



Using VNS 3

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Foreword

Congratulations! You have just purchased the most sophisticated terrain modeling and animation program available on any platform. With it you will soon be creating images of landscapes that can scarcely be distinguished from photographs. Of course you won't be limited to replicating nature. The infinite realm of surrealism is also at your fingertips.

What's more, VNS is actually a 3-D Geographic Information System (GIS) capable of generating maps and renderings of virtually any kind of geo-referenced spatial data. Use it to study demographics or plan your next trip, perform environmental modeling or design a community infrastructure.

With its integrated key frame animation system, you can use VNS to fly through realistic Earth landscapes or strange alien environments. With the exclusive Terraffectors™ and Effects you can alter the landscape to visualize natural and man-made changes. Populate the terrain with trees, buildings and other structures using the extensive animated Image Objects and enhanced 3D Object support. Control the Rules-Of-Nature™ Ecosystems for automatic, natural ecosystem growth, or override the rules for specific landscaping. Add fine detail with the powerful Texture Engine. Complete your environment with water, skies, atmospheres, clouds, sun, moon and stars. At render-time, your images can be manipulated with the built-in PostProcess functionality, to add custom effects, or even perform compositing!

Many years of programming and nature study have gone into the development of Visual Nature Studio. Every effort has been made to create a flexible yet user-friendly product. As with any program of this complexity, the learning curve may appear formidably steep when looking up at it from the bottom. If you already have some familiarity with conventional 3-D animation or understand the rudiments of ecology you are already well on the way to mastering this software.

If this is your first introduction to terrain animation have no fear. A mountain is scaled one foot at a time. We will take you step by step to the top. The accompanying tutorials should go a long way to helping you take those first steps, and along the way you will not only learn about modeling terrain but also some of the basic rules nature applies in designing her landscapes (and most people agree: She does a very realistic job).

If you have used Visual Nature Studio in the past, you should be amazed and extremely pleased by the feature set with which you are now presented. We think that we have produced the best version of VNS yet, and we hope that you will think so too!

Hopefully in the process of learning to use Visual Nature Studio you will gain a greater appreciation for the diversity and beauty that is our home - Planet Earth. Nature's true complexity and design are beyond the comprehension of even our greatest scientists who have accumulated the learning of a hundred generations and more. Fortunately, for our purposes total comprehension is unnecessary. It will suffice to grasp a few fundamentals and to marvel at the rest.

Acknowledgments

There are far too many people who have had some part in the development of this program to thank them all individually. Nevertheless, there are some whose contributions have been far above and beyond the call of duty. Those we shall mention by name as a small token of our endless appreciation.

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Thanks to Fantasy Orchids of Louisville Colorado for providing plant images, and to Paulino Garden Inc. for allowing us to take many photographs of their plants for use in the software.

Our (past and present) Test Pilots and those users who constantly push VNS to the bleeding edge deserve much credit for the program's good behavior. They include James Zack, Marco Gualdrini, Everett Wingert, Scott Cherba, Jeff Nighbert, Kris Briede, Jonathan Rothwell, Katy Appleton, Hans van der Maarel, Drew Stainton, Chris Willis, Jason Gregory and many others. We look forward to seeing more great pictures from these gifted artists.

Thanks to everyone who has purchased VNS and supports its continued development!

Gary R. Huber, Chris "Xenon" Hanson, Mindy Bieging and Frank P. Weed II.

Authors

Visual Nature Studio 3 is the creation of Gary R. Huber, Christopher "Xenon" Hanson and Frank P. Weed II. Version 1 user interface design and development input by Jamie Krutz.

Reference manuals by Adam Hauldren with some production assistance by other 3D Nature staff.

Additional Content by Gary R. Huber, Jamie Krutz, Mindy Bieging, Adrianne Edwards, Chris "Xenon" Hanson, Adam Hauldren, Holly Van Hooser, Dwayne Jensen, and David Catts.

Tutorials by R. Scott Cherba.

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Contact Information

Address

3DNature, LLC
13195 West Chenango Avenue,
Morrison, CO 80465, USA

Web

<http://3DNature.com>
<http://3DNWorld.com>

Email

Sales: *Sales@3DNature.com*
VNS Information: *VNSinfo@3DNature.com*
Tech Support/Bug Reports: *Support@3DNature.com*
To join the International VNS Email Mailing List, send email to:
Subscribe@3DNature.com

Telephone

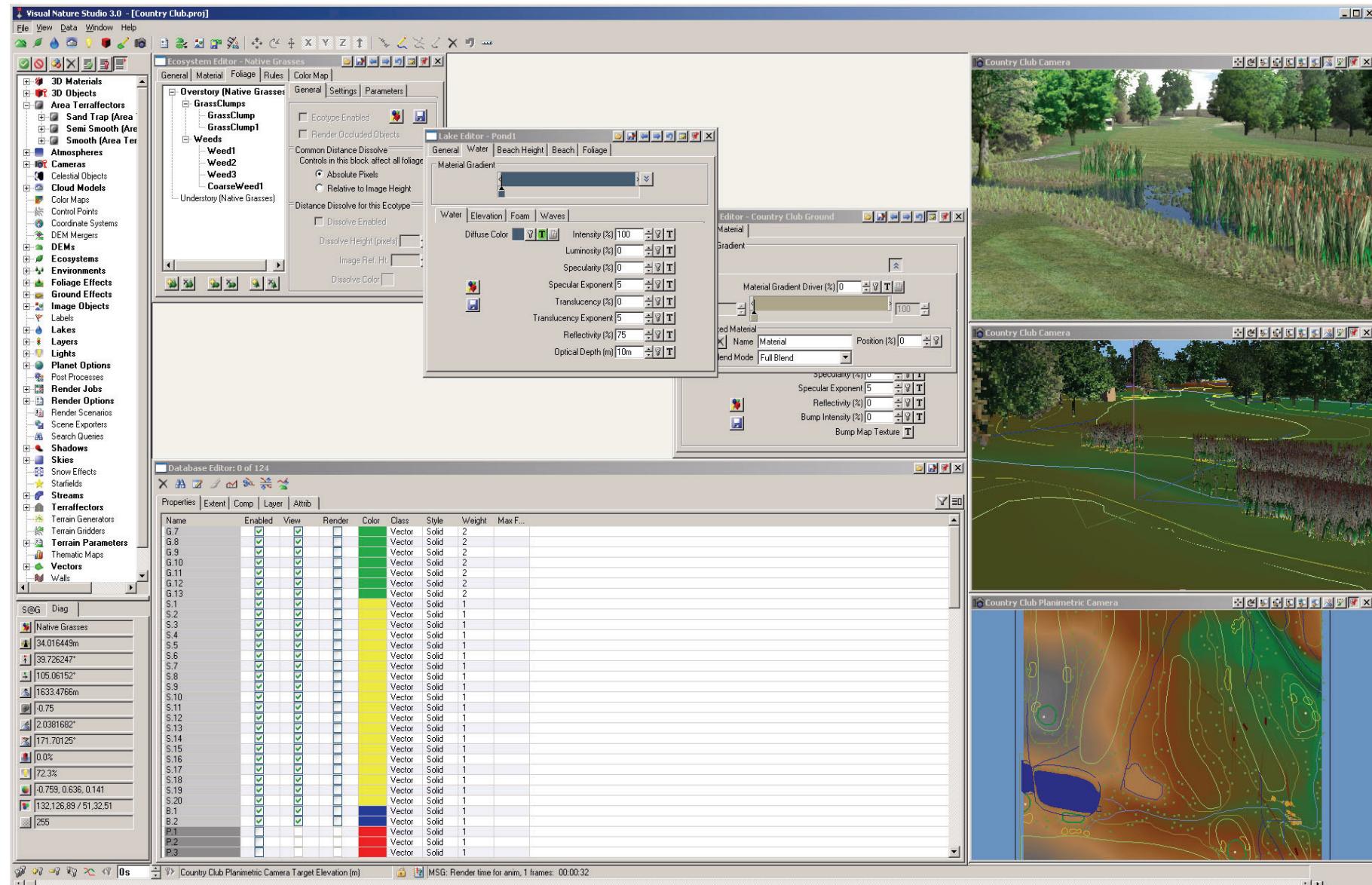
Main: (303) 659-4028
Sales: (303) 659-4028 ext. 1
Tech Support: (303) 659-4028 ext. 2

Fax

Sales: (303) 904-9533

Welcome

Thank you for purchasing Visual Nature Studio. Welcome to a new world of high quality landscape rendering and animation.



Introduction

Welcome to the Visual Nature Studio & Scene Express (SX) Interactive Reference manual.

We created this Interactive Reference manual to cover the function of every menu command, window, icon, button, slider and field in the program (see How to Use This Manual).

Here you can read about the different kinds of files used by VNS, the concepts behind the program, and ways to use it. There are chapters for the entire interface and additional chapters covering a variety of extra topics.

If you read this entire manual you will gain a lot of valuable insight into how VNS works. When you just want to look up information about any VNS feature, follow the links to quickly find relevant information.

Just browsing through this manual might give you ideas for new ways to use Visual Nature Studio.

Registration

Make sure you send in your registration card right away. As a registered user you will be eligible for tech support and be informed of future enhancements and upgrade programs.

Your serial number is unique. It is printed on a sticker attached to your hardware key.

Note: You'll need to know your serial number for technical support and eligibility for future upgrades.

After you install your program you can also see your serial number by selecting the Version command from the Project menu.

Note: It is now possible to register online at:

<http://3dnature.com/registration.php>

Mailing List

There is a free Internet email mailing list dedicated to World Construction Set & Visual Nature Studio. The way this works is that if you send an email message to the mailing list, everyone who is a member will receive your message. As a member of the list you will receive all messages posted to the list. In this way, you can exchange ideas, ask questions and learn from other VNS animators and members of the 3D Nature staff. This is a great place to ask questions as you are learning the program.

Note: Please do not post your serial number on the mailing list. You should only ever email your serial number privately to a 3D Nature employee, and then only when explicitly requested.

The mailing list is FREE. If you would like to join the worldwide community of VNS users online, send an email to:

subscribe@3dnature.com

Make sure you put "Subscribe" in the subject line.

You will receive a message confirming that you have been added to the mailing list. Please save this message. It contains information about how to unsubscribe or change your status on the mailing list.

You can also subscribe by visiting <http://groups.yahoo.com> and searching for the group called WCSML. Once located, you will be able to join the group online.

The mailing list is not the place for bug reports but it is a good place for discussions about VNS techniques and tips, hardware recommendations for running VNS, integration with external 3D and GIS software, etc.

The Mailing list is also not the place for feature suggestions, although we welcome suggestions as to how you think the product could be improved. These should be clearly described and sent privately to:

wishlist@3dnature.com

Once you've subscribed, you can send mail to the general mailing list itself by using this address:

wcsml@yahooroups.com

Tech Support

Whilst the mailing list should be your first point of call for any technical issues you may have with the software, as there are many experienced users there who may be able to address your issues, please be aware that free technical support is available by email.

For technical support, or to report a bug in the software, please email:

support@3dnature.com

For telephone support, please contact 3D Nature Sales who will be happy to discuss the pricing of a telephone support contract.

3DN World

3DN World is 3D Nature's newest website.

It is designed to be a place through which users can exchange Components, find Tutorials, share their work, see the work of others and place Classified advertisements for services & products. On the navigation bar and home page of the site, you will find links to sections specifically oriented around the topic areas detailed above.

You can access 3DN World online at:

<http://3dnworld.com>

New Features

Visual Nature Studio is the leading professional photorealistic terrain modeling, visualization, rendering and animation program. VNS gives you the power to change the world!

With the release of Version 3 of VNS, 3D Nature continues to build on the toolset first seen in Version 1 of the product. Here is a brief overview of the new features in version 3 of the product:

- **Interface enhancements**

The new interface features redesigned icons for more intuitive use. Every graphical button in VNS 3 has been examined and redesigned for maximum clarity, informativeness and appearance. Every Scene-At-A-Glance™ icon intuitively depicts what it represents and each button is informative and clear.

VNS 3's Icon Toolbar has been reworked to only contain the most useful and important controls and make them more prominent and their purpose more obvious. Get to exactly the functions you need without confusion.

Many of the editors and all views have been redesigned to make the use of the program easier for new users. VNS 3 automatically hides the least-commonly used controls in each window to simplify and speed your operation of the software. When you need access to the more advanced settings, they're just a button click away, (via the Show Advanced Features Icon) or you can tell VNS 3 to show all the advanced controls all the time if you like to see them.

Gradients now have a new popup gradient editor that gives you all of the sophisticated control you might need when you want them, but folds up into a small graphical display when not in use. This permits much better layout of editors utilizing gradients, often condensing multiple tabs into a single panel and greatly reducing the amount of mouse and keyboard operation needed.

All common controls that nearly every window or Editor share are now located as buttons in the window titlebar. Load Component From Disk Icon, Save Component To Disk Icon, Undo All Changes in this Window Icon, Show Advanced Features Icon, Toggle Dock Icon, they're all in one convenient place making more room for clearer and better organized editor windows.

Timeline windows are now resizable, making them much more usable, especially on high-resolution displays.

Each View window now has its navigation and View Manipulation controls available right at hand, in a row of buttons on the titlebar of the View window itself.

The Diagnostic Data Window and Info About Point Window have been integrated into the Scene-At-A-Glance™, reducing screen "clutter" and making the program easier to use. Never have to hunt for the window you want or move it out of the way to work with another tool, they're present but unobtrusive. The Drill Down Point Info is now resizable.

All vector-attached components (Ecosystems, Terraffectors, Lakes, etc) now share a common control for displaying and managing their vector linkage. See and manipulate the vectors both hard-linked and soft/query linked to a component in one clean and easy interface and access vector linking controls through a single Vector Links Icon.

- **New Database Editor**

A complete new design for the Database Editor provides a tabular display of all the properties of every database entity in your project, with columns showing the appearance, extents, enabled states, components, layers and attributes. Everything can be edited right in the table view like a spreadsheet, including multi-selection editing. It's resizable too, to make use of as much space as you like. Pop-up panels are available for Attributes and Layers to help drill-down into the properties of the selected object. New filtering controls let you display only the DEMs or Vectors or choose a Layer or even a Search Query to use to determine what you see.

- **Render Speed enhancements**

The program is now optimized for SSE2 & SSE3 capable processors. Whilst this means that there are a range of older CPUs that will no longer run the current version of the program, the optimizations available on these newer CPUs result in faster rendering than ever before!

Typical render speed increases range from 10%-30%, and that is without Fractal Depth reduced through the use of Phong Shading (see below). When Phong Shading is enabled and fractal depth reduced, the speed increases are even more noticeable.

- **Phong Shading option for terrain**

Rendering of terrain models is now performed using Phong Shading by default. This shading method allows for smoothing of surfaces. In most cases, terrain models will no longer need to be rendered at such a high fractal depth as was previously required in order to disguise polygonal artifacts in the terrain. This will result in a noticeable increase in speed of rendering. Phong Shading can be disabled if this is required.

- **New terrain displacement texturing**

Instead of the old one-size-fits-all fractal subdivision roughening, VNS 3 now provides the full power of the Texture Engine to your terrain. Apply different patterns in different places, use geo-referenced textures, whatever you like, to make great natural-looking landforms. This texturing can even be animated! Bump mapping is also available as before to add resolution-independent detailing to terrain.

- **Resolution-independent terraffectors & effect profiles**

No longer are vector-attached and bounded effects limited by a crude raster approximation. No more balancing detail against memory consumption when choosing your effect resolution. VNS 3 has an entirely new vector topology engine for processing effects. Every effect has a perfectly clean, sharp edge right where the vector says it should be, all the time. You don't even need high fractal depth -- VNS 3 will split a big terrain polygon right down the middle if an effect edge crosses it, ensuring high definition. Terraffectors too, like roads and sidewalks and cut walls can now have great sharp transitions right where you want them to be, not just where the terrain mesh permits. Blending of overlapping effects is now done automatically, reducing complexity.

- **Support for wheelmouse zoom**

Scrolling the wheel on wheelmouse devices can now be used to zoom in and out in views.

- **New Terrain Gridder Wizard**

A Terrain Gridder Wizard has been added to the program to help simplify the setup of new DEM Gridder components. Use the new Gridder Wizard to walk through the gridding process step by step, answering each question about your desired result, making gridding an easy process every time.

- **New DEM Merger Wizard**

A DEM Merger Wizard has been added to the program to help simplify the setup of new DEM Merger components. Create simple or multi-resolution merges without having to make and choose Search Queries.

- **GPS Import**

A whole new section of the Import Wizard is dedicated to importing data from GPS/GPX or CSV-like files. Choose your file and VNS 3 will (if necessary) offer you a spreadsheet-like importer to specify which fields you want and what to do with each column. Great for integrating field-survey data.

- **Scenario Improvements**

Simple Scenarios are much easier to create now with an easy on/off control. Advanced animated scenarios are still available, but you don't have to work with the animation controls if you're not using them. And a new "negating" control in the Scenario lets you indicate that some bound items should behave the opposite of the others, allowing you to group the "on" and "off" items of a proposal into one Scenario instead of two.

- **Thematic Maps**

Thematic Maps are now much faster and easier to use. No more rasterization limitations here, every thematic map works hand-in hand with the components and vectors it is associated with to get the exact values straight out of your attributes and onto your landscape with a minimum of fuss. Search Queries are no longer needed, making the Thematic Mapping Process as easy as selecting an attribute.

- **Foliage Editor**

Every foliage-utilizing part of VNS 3 now has the same set of controls for managing Ecotypes, Foliage Groups and Foliage Images all from one page. No more Ecotype editor, no more flipping tabs back and forth between Ecotype, Groups and Items. Everything you need all in one place, and only the controls you need visible when you need them.

- **Walls**

Walls are now much more clever about figuring out complex polygon shapes, able to roof over even extremely complex building shapes and now obeying "island" or "donut" multipart polygon topology.

- **Heading Post Process Event**

Designed to add a configurable graticule at the bottom of a rendered view. See Post Process Editor for more information.

- **Smart Lakes**

With the addition of a new control in the Lake Editor, lakes no longer need to be told what elevation to fill to, they can automatically infer their water level by examining the elevations at the vector containing them.

- **Auto-import of embedded transparency textures in 3DS and OBJ format objects**

Transparency channels in 3D Object material textures will now be recognized and honored. This allows the accurate loading of objects in 3DS and OBJ formats that have PNG textures (or similar) with embedded alpha channels to be loaded without any processing of the texture images and material editing in VNS.

- **New “Alpha Only” option in image texture elements**

This feature allows for the automatic extraction of embedded alpha channel information from images, when necessary, without the laborious process of loading a second copy into the Image Object library and applying a Color Control attribute to it to achieve the same thing.

- **Gridder Densification**

Improve the output of your contour-line gridding with the automatic Densification feature, which makes VNS 3's gridder see lines as lines, not just a collection of points, improving the tessellation of contour line datasets and making better looking output.

How to Use This Manual

Visual Nature Studio (VNS) is a powerful and feature packed program. This manual will help you get the most out of it. In addition, we've supplied you with a set of video tutorials to help you to get straight into using the product.

This manual will help you with installation and getting to know VNS. It is a gold mine of information, tips and answers to common questions. The Interactive Reference manual describes every window, button, field and gadget in the entire program.

How you use these manuals will depend on your comfort level with geography, computers, and 3-D modeling. Read on for some advice.

Geography Novice

VNS is not just a landscape animation program; it's a Geographic Information System (GIS). VNS is based on a spherical or ellipsoidal planet using latitude and longitude coordinates.

If you haven't studied geography or need to brush up, start by reading Appendix A: A Lesson In Geography. It is important that you understand the concepts of geographic (latitude and longitude) referencing of planetary location.

The Ecosystem chapter in the Interactive Reference Manual also includes information on basic ecological concepts that you may find helpful for creating realistic landscapes.

There are many good books on geography and ecology that you can find in bookstores and libraries which may also help you understand the driving forces behind biodiversity and ecological distributions.

Computer Novice

If you are just getting started with your computer, you'll want to start by reading your computer's manuals to learn how to interact with programs. VNS uses standard mouse, window, button and field operations common to most operating systems.

The VNS manuals assume you know how to operate your computer.

Computer Veteran

If you are a computer veteran, but new at 3D animation and landscape generation, you'll want to go through the Interactive Reference Manual and tutorials for a full understanding of the power of VNS.

3D Veteran

If you are a 3D animation veteran, you can probably get away with reading the introductory chapters in this manual and, then use the video tutorials and the information provided in the Interactive Reference Manual whenever you have additional questions about program operation.

How to Open the Interactive Reference Manual

The easiest way to see the Interactive Reference Manual, select the Interactive Reference Manual command from the Help menu or use the Help key (F1) on your keyboard.

If you want to instantly jump to the page that describes a particular window in VNS, select the window in VNS and hit the Help key.

Navigation Commands

Use the commands specific to your PDF viewing software to navigate to the next page, previous page, or bookmarks (Table of Contents page). You can also use the Search or Find functions in the viewing software to look for references to particular words or phrases.

Video Tutorials

Starting your VNS adventure could not be simpler! The video tutorials are all in HTML & Quicktime format and have been installed to the VNS Help folder when you installed the product. You can select a tutorial from the Tutorials section of the splash screen and it will load into your default web browser.

Problems With Terminology

Terminology can be a problem when trying to reach across disciplinary lines to communicate complex ideas. Whether you are a graphic designer, video animator, geographer, cartographer, land use planner, natural resource manager (or some other kind of '-er'!), you're familiar with a particular way of describing what you do. Unfortunately, words that mean one thing to you may mean something entirely different to someone else. When we couldn't find a satisfactory word to capture a particular meaning we became guilty of our own language perversion. An example is the word "ecosystem." In VNS, an ecosystem is a combination of overstory and understory foliage and textures applied to the terrain. In most cases a VNS ecosystem will be designed to mimic a certain type of land cover such as forest, tundra or rock. Probably the closest thing ecologists have to approaching our meaning is the term "ecological land unit." That simply doesn't fit well in a window title bar or make much sense to anyone other than an ecologist.

Another example is the word "vector." To mathematicians the word means a quantity with magnitude and direction. To graphic artists it is an object in a drawing defined mathematically. To those in the Geographic Information business it is a line that represents something that can be mapped on the ground.

While the meanings overlap to some extent the word will be troublesome to some of our readers. We use an extension of the Geographers' definition which includes points as well as lines. After all a point is a degenerate line, and a straight line is an arc of a circle of infinite radius, right?

We apologize ahead of time for any misunderstandings or inconvenience our use of the language may cause. Please bear with us as we attempt to bridge the linguistic abyss separating our diverse audience.

A Note To Explorers

Best of luck on your new adventure. The world is at your fingertips: Explore it all, and don't forget to take pictures!

If all our work has been successful we will be rewarded by your enjoyment of this program. Feel free to contact us at any time regarding organizational improvements that would enhance the usefulness of the software.

We'd love to see the amazing images and animations you create with VNS. If you would like to be considered for the user gallery feature on our web site, or have us feature your work in VNS demo tapes, posters, magazine ads and other materials, (with full credit, of course), please contact us (see Contact Information).

Installation

VNS includes a box with a DVD, a printed reference sheet for shortcut key mappings, a registration card, your software license agreement and a hardware key. The DVD contain the program files, Interactive Reference Manual files, demo Projects, example images, training files, and support files.

System Requirements

VNS 3 is available for Intel Pentium/AMD Athlon computers that support the SSE2 instruction set (or better). Your computer will also require a DVD Rom Drive.

VNS has been tested with Microsoft Windows XP and Windows Vista on 32 and 64 bit platforms. Due to specific function calls made in the code, VNS will not run on earlier versions of Windows.

In the following sections we will discuss the minimum and recommended specs for running VNS 3.

Hard Drive Space

VNS itself needs 15 megabytes of space on any hard drive partition and an additional 1 Gigabyte (Gb) for supporting data storage.

Any pictures and animations you create will need additional space. A single frame for a video animation in IFF-ILBM format occupies between 500 Kilobytes and 1 Megabyte, and Targa, PICT and BMP files can be even larger. A single print resolution image (4000 lines) can be over 30Mb. Several hundred megabytes of extra hard drive space should be considered a minimum for animation work.

Memory

A minimum of 512b of RAM is recommended to run your operating system and VNS.

Note: VNS can render images in segments, tiles, or with Pixel Fragment Rendering and/or diagnostic buffers disabled if you need to conserve memory.

Use of advanced features like volumetric cloud maps; shadow maps; high resolution Image Objects; and 3D Objects may require a lot more RAM. Power users typically have at least several Gigabytes of RAM on their systems plus virtual memory.

Display

VNS requires a display card with true color (16/24/32 bit) displays of at least 1024 x 768 that is OpenGL capable.

Recommended Specifications

Although VNS 3 will run on a machine with the minimum specifications listed above, we recommend that, as with most large graphical rendering products, you run the program on a machine with a considerably higher specification.

Our recommended minimums for optimum performance, given entry level machine specifications, would be the following:

2 GHz clock speed CPU or better

1Gb Ram or more

Several Gb of Disk space or more

An accelerated OpenGL Video Card

The specification of the machine on which you run VNS, will of course depend upon the complexity of projects that you are visualizing.

The DVD Package

Inside the VNS box you will find a clear plastic package with the license agreement visible inside. This package contains a DVD but don't open it yet.

Do not break the seal on the package unless the registration card, DVD, license agreement and hardware key are all inside the package. Once the package is open the software is non-returnable!

Note: Upgrade copies will not have a hardware key included.

Please take time to read the fine print on the license agreement. It contains the terms by which you agree to use this program and is a legally binding agreement. We have invested years of our lives and a lot of money to make this program available to you. We hope you profit from it and expect you to abide by our conditions for its distribution and use.

Please be aware that you have purchased the right to use Visual Nature Studio with the hardware key on one computer. You cannot lend or allow anyone else to copy the program. If you sell the program to someone else you must not retain any copies. A written authorization from you, the registered owner, will allow 3D Nature to transfer registration to a new owner.

Should you need to run VNS on more than one computer, please contact us for information on multiple seat licensing.

Note: You can legally use the VNS render engine on multiple computers and there is no limit to the number of render engine copies that can be run simultaneously.

Once the DVD package is opened you can remove the DVD with the program, content and associated training files. You will also find a registration card with your personal serial number. **Send in your registration card right away to be eligible for support and upgrades or register online.**

Note: Registration online can be performed at: <http://www.3DNature.com/registration.php>

Your serial number is also on the inside front cover of this manual, and on your hardware key.

Installation

In this section you'll learn how to install the hardware key, the program and associated files.

The Hardware Key

Before you install VNS, make sure you plug the hardware key into a USB port on your computer.

It is highly recommended that you turn off your computer before plugging in your hardware key, and that you ground yourself to prevent static electricity discharge as you are plugging in the hardware key. While relatively robust, USB hardware keys are still sensitive to damage and should always be handled with care.

Installing the Hardware Key Driver

You should no longer have to worry about manual installation of the hardware key driver files. This step will now be performed automatically for you during product installation.

Installing VNS with the Program Installer

You must install VNS in order to run it. Installation is easy:

1) Double click the Install icon on your DVD.

You'll see the Visual Nature Studio Installer window.

Use the "Install Demo Projects, Content and Support Files" checkbox to tell the installer to copy those files to your hard drive.

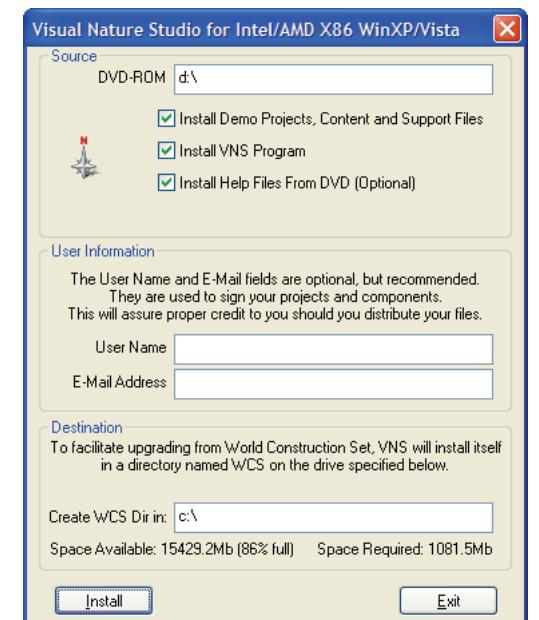
Use the "Install VNS Program" checkbox to tell the installer to install Visual Nature Studio onto your hard drive. Make sure this is checked.

Use the "Install Help Files From DVD (optional)" checkbox to tell the installer that you want a local copy of the VNS 3 Interactive Reference Manual & Tutorial Files (HTML pages but not Quicktime movies) loaded onto your local hard disk. Without this box selected, you will be prompted to provide the VNS 3 DVD whenever you hit F1 for help.

2) Enter your name and email address.

They will be added to Component files whenever you save pre-made Component files using the Signature window.

Components let you save pieces of your best work that you can reuse later or share with others. For example, you can save a Lake, Terraffected road, Atmosphere and much more.



Your name is permanently attached to give you credit. Your email address allows others to know how to contact you for contract work or to ask questions.

3) Enter the destination directory in the “Create WCS Dir in” field.

The installer will fill in the field with the path to your hard disk partition with the most free space. Feel free to change it to wherever you like. The installer will create a “WCS” directory in the destination directory you specify during the installation process.

If you tell the installer to put the WCS directory in a partition that does not have enough room, the installer will not let you install WCS. Make sure the destination directory has enough room for the installation (see “System Requirements” above). The installer shows the space available at the bottom of its screen.

4) Once you have set all the above choices, click the Install button to install VNS.

Note: If the Install button is unavailable, then it means that the destination drive does not have sufficient free disk space to allow installation of the components selected.

The program will be available in the WCS directory you just installed, and an icon will be added to your start menu.

Keep Your DVD Handy

If you decide not to install all the content when you install VNS, keep the DVD handy so you can load what you need onto your hard drive later.

Importing Older Projects

Visual Nature Studio is backward compatible with previous version of the product: VNS 3 will load VNS projects created with earlier versions of the product. VNS 3 is, however, at least in part compatible with the WCS project file format and should be able to load most WCS projects directly.

VNS 3 will also read WCS files created by WCS 2, WCS 3 and WCS 4. When you open them, the following screen will appear to remind you that there are some differences in the way in which VNS3 handles project data:

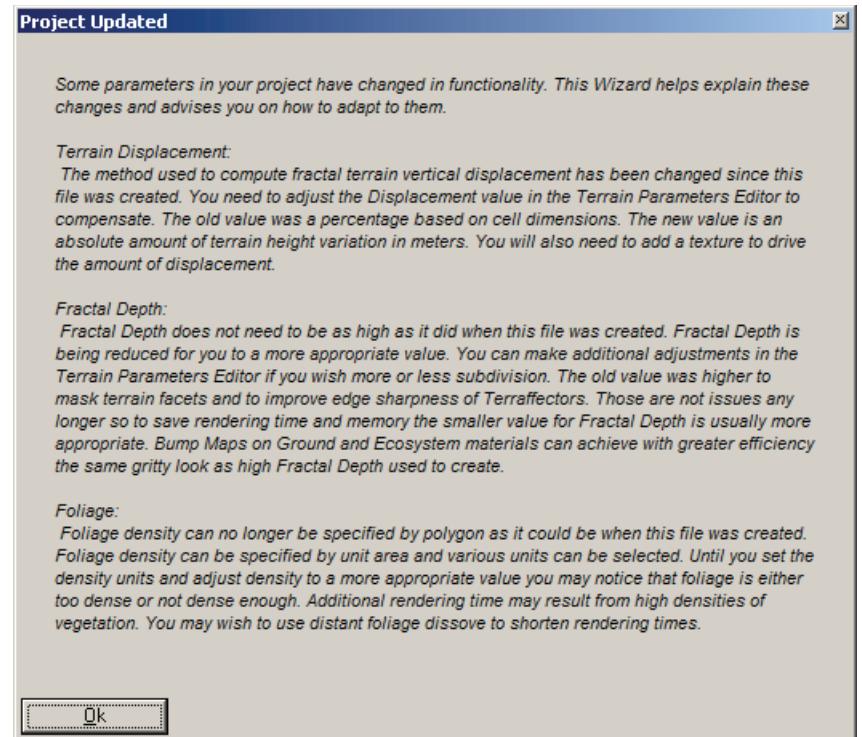
Not everything will import exactly the same. You may have to adjust aspects of the project after you import it. Some things, like cloud models, will render differently.

Note: Due to additions to the file format, earlier versions of WCS will not read VNS 3 files.

After you load a project into VNS 3 you can save it under a new name so you don't overwrite your original version of the project.

Be aware that depending upon which version of the product range the imported project was originally created in, there may be other areas in which the rendering may differ. These include:

- **Ecotype foliage placement - May be different due to changes in random number generation.**
- **Shadows - Due to changes in shadow map creation and evaluation you'll need to regenerate all shadow maps, including those for Shadow Effects, Clouds and 3D Objects.**
- **3D Objects - May be aligned differently, so you may need to reset rotations.**



Using Old Ecotype, Foliage Group and Material Files

VNS no longer uses the old ".etp" Ecotype files, ".wmt" Material files or ".fgp" Foliage Group files from WCS 4. If you have some of these files that you still want to use, you can load them into VNS 3 through the relevant editor. You can then save this information as Components for VNS 3 from the Component Signature window. Be aware that due to the changes made between versions 4 and 6 of WCS, your ecotype files may need some modification to render exactly as they did in version 4 or before.

Older WCS DEM Files

If you have any WCS DEM files created before WCS 3, you should know that the WCS DEM file format was improved with WCS 3. The vertical resolution was enhanced and Relative Elevation Model data became embedded in the DEM file. You no longer need separate REM files.

You should use the Import Wizard to re-import any pre-WCS 3 versions of WCS DEM files you may have. This will translate them to the newer format. VNS uses the Relative Elevation (RelEl) data to help determine where Ecosystems will be placed on the landscape according to the WCS Rules-of-Nature™.

If you render an old Project with separate REM files VNS 3 will still find them and work. If you render an old Project without separate REM files and without re-importing the DEM files to embed new RelEl data into the DEM, VNS 3 will calculate the RelEl data each time you render. This will add significantly to your rendering time. To avoid that, re-import your DEM data with the Import Wizard and VNS will resave it with the RelEl data embedded in it.

Older File Structures

For greater flexibility, WCS 5 stored its common Image and 3D Objects in a new file structure based on the WCSContent Master Path. VNS 3 follows this convention. However Projects from older versions of WCS will be looking for this content material in a path starting with "WCSProjects:EcoModels". To alleviate problems finding these files, VNS 3 will automatically search for images in the most likely possible directories.

VNS will first look in the last directory from which you selected an image. VNS will then look through the WCSContent directory and all the directories within that path. If the missing file has not yet been found VNS will look through the WCSProjects:EcoModels path, if it exists, and all directories within that path.

If the file still has not been found VNS will ask you to locate the file yourself via a file requester. VNS will then remember that directory as the last one from which you selected an image and the first to search in case another file is missing.

VNS will post a message to the status log when it goes on such a search, and the message will tell you if the image is found or not.

This search mechanism lets you move content files around with relative impunity if you don't mind extra time for searching when a project opens. Once a project is loaded and VNS has found all its files you can save the project again. This will make the Project remember the new paths. VNS won't have to go through the search process again for that Project unless you change your file arrangement again. In addition, you can change the format of a particular image file (for example, converting a texture from TGA to JPEG to save disk space) and VNS will load the most appropriate available file if the original can not be found. In order for this to work the new file must have the same base filename (ignoring extension) as the missing file.

Image Loading and Saving

Visual Nature Studio supports a variety of image formats. These formats are supported wherever VNS loads or saves Image Objects, including the File Output page of the Render Options Editor; the Image Object Library; the Matrix Popup Menus; the Image Viewer and every Editor that works with Image Objects. When saving images, if there is no explicit way to indicate a file format you can always force a particular file format by adding the appropriate extension to the file name in the file requester.

VNS supports the following image formats for loading and saving:

- **8-bit gray scale IFF (.iff)**
- **24-bit Color IFF (.iff)**
- **24-bit Color Targa (.tga)**
- **32-bit Color Targa with Alpha Channel (.tga)**
- **24-bit Color PICT (.pct)**
- **32-bit Color PICT with Alpha Channel (.pct)**
- **24-bit Color BMP (.bmp)**
- **24-bit Raw**
- **24-bit Raw Interleaved**
- **8-bit Z Buffer Gray IFF (.iff)**
- **24-bit Color JPEG (.jpg)**

Note: Do not use low quality JPEG images for foliage, Celestial Objects or Color Maps used to place Ecosystems. JPEG compression artifacts may cause a fringe to appear when the image is rendered in VNS. JPEG artifacts may also be noticeable in animations so you may want to avoid rendering animations in JPEG format.

- **24-bit Color TIFF (.tif)**
- **Indexed Color TIFF (.tif)**

Note: Indexed TIFFs are converted to 24-bit during loading.

- **24-bit Color PNG (.png)**
- **Indexed Color PNG (.tif)**

Note: Indexed PNGs are converted to 24-bit during loading.

VNS also supports these georeferenced image formats:

- **JPEG with associated World and optional PRJ files**

VNS will recognize a same named World File (.JGW) and .PRJ file with the JPEG file if they exist in the same directory.

- **BMP with associated World and optional PRJ files**

VNS will recognize a same-named World File (.BPW) and .PRJ file with the BMP file if they exist in the same directory.

- **TIFF with associated World and optional PRJ files**

VNS will recognize same-named World File (.TFW) and .PRJ file with the TIFF file if they exist in the same directory.

- **ER Mapper ECW**
- **GeoTIFF**

Georeferenced images are especially useful for draping onto the terrain as Color Maps. VNS will try to load them and set the Coordinate System and bounds automatically. However not all possible coordinate systems, datums and ellipsoids will necessarily map correctly between VNS and other software. Be sure you check the results.

Note: Be aware that even if VNS appears to have loaded something from your georeferenced file, you must double-check the results to be absolutely sure all the data has been loaded correctly. Failing to check the results may lead to alignment problems.

Visual Nature Studio lets you use Image Objects for foliage, Color Maps, textures, Celestial Objects and backgrounds. You can also import them as terrain or Control Points with the Import Wizard. Image Objects can be single images or image sequences. Image sequences are a series of numbered image files in any of the above image formats, typically with numbers after the base name and before the extension. Image sequences are used for animation frames.

In addition to saving image sequences of animations in the above formats, VNS also supports these direct animation formats:

- **AVI**
- **Quicktime**

Format Descriptions

AVI

VNS supports the AVI format for saving animations, but not for loading. When you render an animation as an AVI file, VNS will ask which CODEC you want to use based on the CODECs you have available on your system.

Quicktime

VNS supports the Quicktime format for saving animations, but not for loading. When you render an animation as an Quicktime file, VNS will ask which CODEC you want to use based on the CODECs you have available on your system.

IFF

IFF (Interchange File Format) as an image file format uses interleaved bit mapping (ILBM) and run length encoding for efficient compression with no loss of quality. It was arrived at with the cooperation of several companies developing for the Amiga and has since gained support on multiple platforms.

BMP

BMP (Bitmap Image) is a simple, uncompressed image format created for Microsoft Windows. BMP images can be georeferenced via a separate file, called a World File. A World file contains pixel scale information and the location of the northwest pixel in real world coordinates. Files with accompanying World files may also have an optional PRJ file. A PRJ file specifies a coordinate system (geographic, UTM, Mercator, etc.) and the datum and ellipsoid to use for the coordinates found the associated World File.

Targa

Targa is an image format first created for the Targa series of proprietary graphics cards. It is supported by many graphics

programs.

PICT

PICT is the standard image format for the Macintosh.

JPEG

JPEG (Joint Photographic Experts Group) is a format that allows massive compression. We do not recommend using JPEG images for foliage or Celestial Objects because the compression artifacting could cause fringing. We do not recommend using JPEG images for Ecosystem Matching Color Maps because compression artifacting could cause fringing around Ecosystems. JPEG artifacts may also be noticeable in animations so you may want to avoid rendering animations in JPEG format. JPEG images are useful for texture images if you need to conserve disk space. JPEG images can be georeferenced via a separate file, called a World File. A World file contains pixel scale information and the location of the northwest pixel in real world coordinates. Files with accompanying World files may also have an optional PRJ file. A PRJ file specifies a coordinate system (geographic, UTM, Mercator, etc.) and the datum and ellipsoid to use for the coordinates found the associated World File.

PNG

PNG (Portable Network Graphics) is a flexible format created for use on the internet.

TIFF

TIFF (Tagged Image File Format) is common in publishing. VNS can load LZW images with compression but can't use LZW compression when saving. TIFF images can be georeferenced via a separate file, called a World File, or within the image file itself. A World file contains pixel scale information and the location of the northwest pixel in real world coordinates. When georeferencing information is present in the TIFF image file itself, the file is called a GeoTIFF. Files with accompanying World files may also have an optional PRJ file. A PRJ file specifies a coordinate system (geographic, UTM, Mercator, etc.) and the datum and ellipsoid to use for the coordinates found the associated World File.

ER Mapper ECW

ECW (Extreme Compression by Wavelets) is a georeferenced file format used in GIS applications. Most commonly created as output from ERMapper.

Instant Gratification

A Sneak Preview

To give you an idea of what VNS can do we've included example VNS Projects and Tutorial files on your DVD. We hope you enjoy your sneak preview. You can see many more images and animations on our web sites:

<http://www.3DNature.com>

<http://www.3DNWorld.com>

Demo Projects

We have included a variety of animation Projects that use many of the extensive features in VNS. You will find the demo Projects in a directory called "Demos" inside your WCSProjects directory. The WCSProjects directory will be installed on your hard drive when you install VNS.

The previous chapter told you how to install VNS. After you've installed VNS and read the Getting Started chapter, open and render some of the demo Projects:

- 1) Double-click the  VNS icon to start VNS. For MS Windows you can also select VNS from the Start Menu.

Visual Nature Studio will open.

VNS should know where your Master directories are. However, if for some reason VNS does not see where your "WCSProjects:", "WCSContent:" and "WCSFrames:" directories are a dialog window will open. VNS will ask for the paths to these Master directories.

It's very important that VNS know where these directories are on your system. Without them it will not be able to find other files that it needs when the program is running.

Note: This is the only time VNS will need you to tell it where those directories are, unless you delete your VNS .prefs file, rearrange your hard drive or move your VNS directories to another computer.

Select the Open command in the Project menu.

When VNS knows where your Master directories are, you'll see a standard file requester titled "Open Project".

- 2) Using this file requester, locate and select a Project file.

Open one of the demo projects in the Demos directory inside your WCSProjects directory that was created when you installed VNS.

Look for a file with a “.proj” suffix.

3) Double click this file, or click OK in the file requester to load the project.

If all goes well, VNS will notify you, in the Status display on the lower right, that the Project file was loaded.

You can then use VNS to render the demo project:

1) Open the Render Control window by clicking the  Render Control icon in the Icon toolbar.

Click the Edit button to the right of the Options line. This will open the Render Options window where you can see and control what VNS is about to render.

2) Click the “Go” button at the bottom of the Render Control window.

The Project will begin rendering. The Render Control window will show information about the rendering process.

To see the image as it's rendering click the Show Rendering checkbox on the Render Control Window (however for fastest rendering you'll normally keep this “Rendering in Progress” window closed, and the program window minimized).

For more about the Render Control window see the tutorials in this manual or the Render Editor section of the Interactive Reference manual.

To abort the rendering, click the Stop button in the Render Control window.

That's it, you're up and running!

Note: Unusual system fonts may cause interface elements to overlap under Microsoft Windows. If that happens, try a different system font if your display card driver supports multiple fonts. Any control you have will be via the Font Size drop box on the Settings page of the Windows Display Properties window accessible from the Control Panel.

Look at the demo Projects again after you've done the tutorials. Explore the Parameters and Effects we used to create these photorealistic animations and you'll recognize some of the techniques we used.

Tutorial Files

VNS has a new redesigned splash screen, allowing centralized access to New and Existing projects, Tips and Tutorial files.

You can use this interface to browse the installed tutorials, read short abstracts on each, and see the level of user at which the tutorial is aimed.

Selecting a tutorial and clicking on its thumbnail will load the tutorial into your default web browser. If this is the first time you have ever used Visual Nature Studio, we highly recommend that you work your way through all the provided tutorial files before attempting your own projects. Since there are dependencies in the later tutorials that require you have completed the earlier ones, it is not recommended

that you skip the introductory tutorials in favor of a more challenging one, or you will find yourself reaching a stage where you are being prompted for a file or files which you have yet to create!

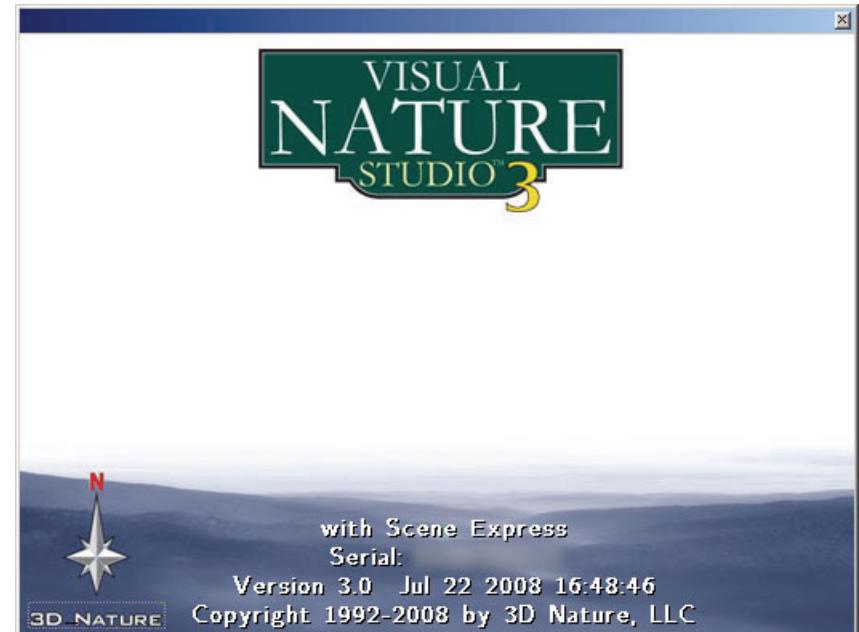
Let's look at the first tutorial right now:

- 1) Double-click the  VNS icon to start VNS. For MS Windows you can also select VNS from the Start Menu.**

Visual Nature Studio will open, and the splash screen will appear with version information. If VNS is already open, then call up the tutorials page of the splash screen by choosing Tutorials from the Help menu, and proceeding directly to step 3.

- 2) Click on the image to make it disappear.**

The image will disappear of its own accord after a few seconds even if you do not click on it.



3) Click the Tutorials button on the left hand side of the interface

The tutorials interface should appear.

4) Select the tutorial named “Project Basics”

A thumbnail should appear for it, along with a short abstract giving you an overview of the content and aims of the tutorial.

5) Click on the thumbnail

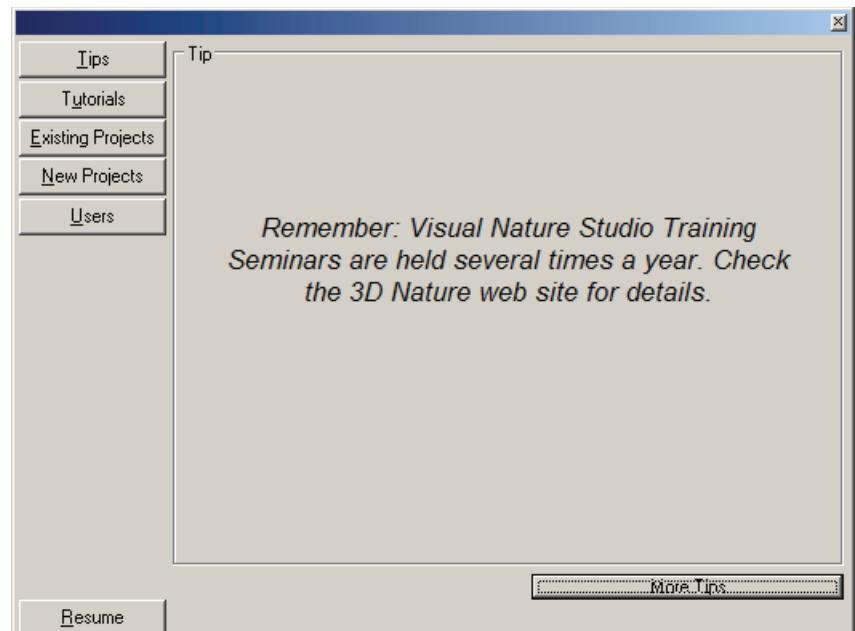
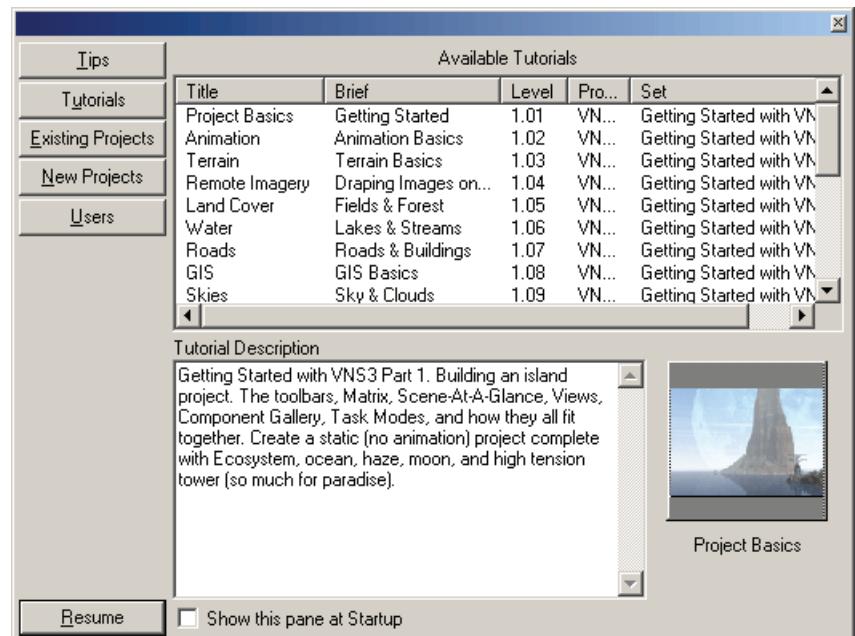
Your default web browser should run, and automatically load the tutorial file. With VNS still open, work your way through this first tutorial to learn the basics of the program’s operation.

The tutorials are all written in HTML, and information about the format and metadata tags supported can be found in Appendix D: “HTML tutorial format”. Any tutorials written to confirm to the correct requirements and installed to the correct location will appear in the tutorial list in this startup screen.

Hopefully, the ease with which tutorials can be created, distributed and installed will encourage more people to share their ideas and tips with the rest of the VNS community.

Tips

Clicking the “More Tips” button will proceed through the Tips list one at a time. Sometimes this screen will (as in the diagram) display a message saying that the program has not been updated for a while. Clicking the “More Info” button at this point will automatically redirect you to the 3D Nature web site, and provide your update details to the web server ready to download any free interim updates that may be available.



Existing Projects

The Existing Projects screen is similar to the Tutorials screen.

The Existing Projects screen (see above) is very similar to the Projects section of the Component Gallery. By default it will display the last 6 projects opened, but you can use the up and down arrows to scroll through successive groups of projects.



New Projects

The New Projects section is similar to the old WCS 4 Project Wizard, allowing quick and easy creation of basic project types with all essential parameters setup already for you. This will allow you to very quickly create the basis of a new project, and just make changes to the structure created for you, rather than having to have the knowledge to create everything from scratch.

Upon selecting the New Projects button to the left of the Splash Screen interface, you will be presented with a page consisting of some of the basic elements used to make up a VNS scene. These are Terrain, Ground, Environment, Sky and Clouds. VNS 3 takes advantage of component files to provide you with a quick way of getting a project "up and running".

Let's try this now:

- 1) Double-click the  VNS icon to start VNS. For MS Windows you can also select VNS from the Start Menu.

Visual Nature Studio will open, and the splash screen will appear with version information. If VNS is already open, then call up the Tutorials page of the splash screen by choosing Tutorials from the Help menu, and proceeding directly to step 3.

- 2) Click on the image to make it disappear.

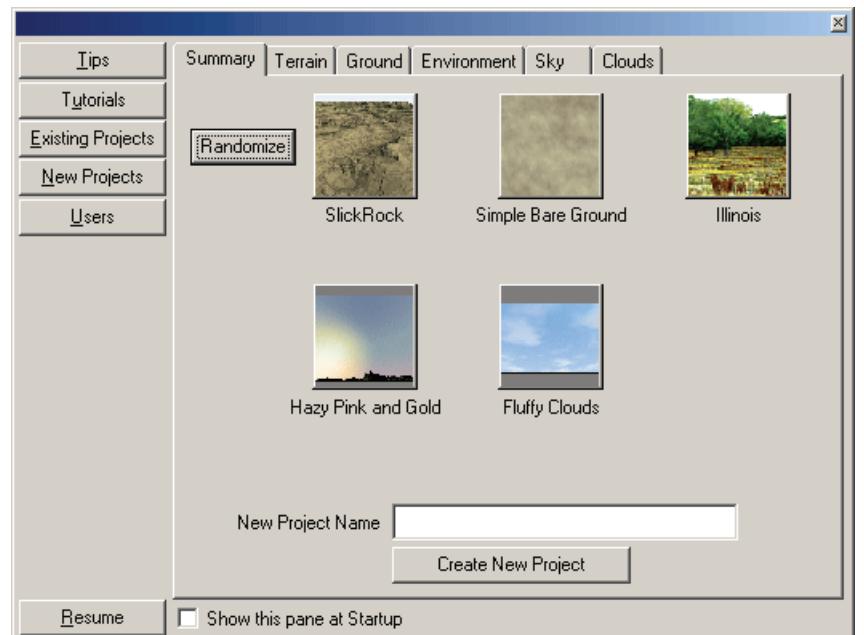
The image will disappear of its own accord after a few seconds even if you do not click on it.

- 3) Click the New Projects button on the left hand side of the interface

The New Projects Interface will appear.

Each of the tabbed windows effectively allows you access to the component gallery for that particular component type. The Randomize button will allow VNS to randomly select 1 of each type of component for you. Try this now, and you will see that some of the combinations it comes up with are interesting, to say the least!

If you want to use the selections that VNS 3 has made for you, proceed to step 10, otherwise, let's work our way through the 5 component types and see how we can manually select components through this interface.



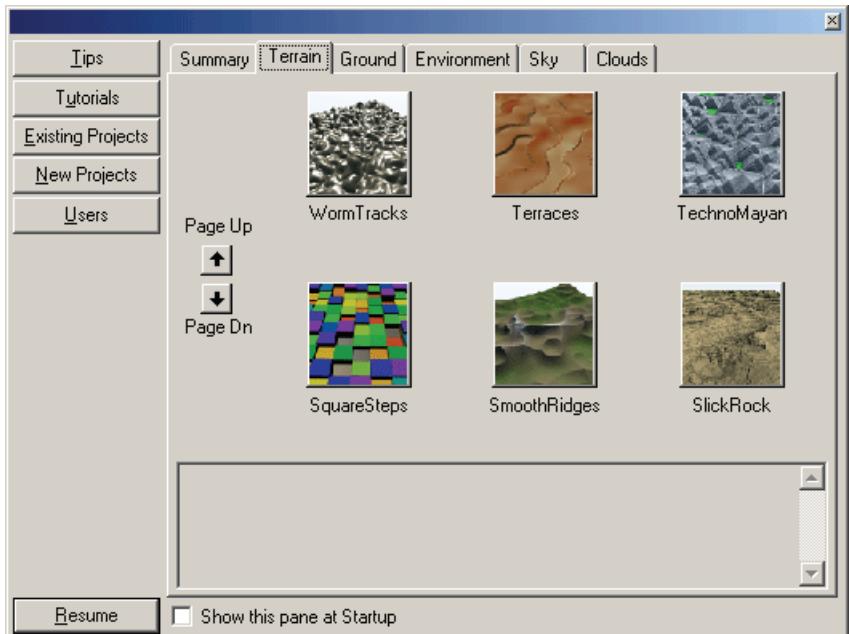
4) Click on the Terrain tab

The following interface should appear, and (quickly or otherwise, depending upon the number of Terrain Generator components stored on your hard drive) should load the first 6 component thumbnails:

Click on any of the thumbnails and switch back to the Summary tab, and you will see that the selected Terrain Generator component has been selected as the chosen terrain model in the New Project interface.

Clicking on the Page Up button will scroll up one page of components, whilst clicking the Page Down button will scroll down one page of components.

You have access to all terrain generator component files stored in your WCSContent path.

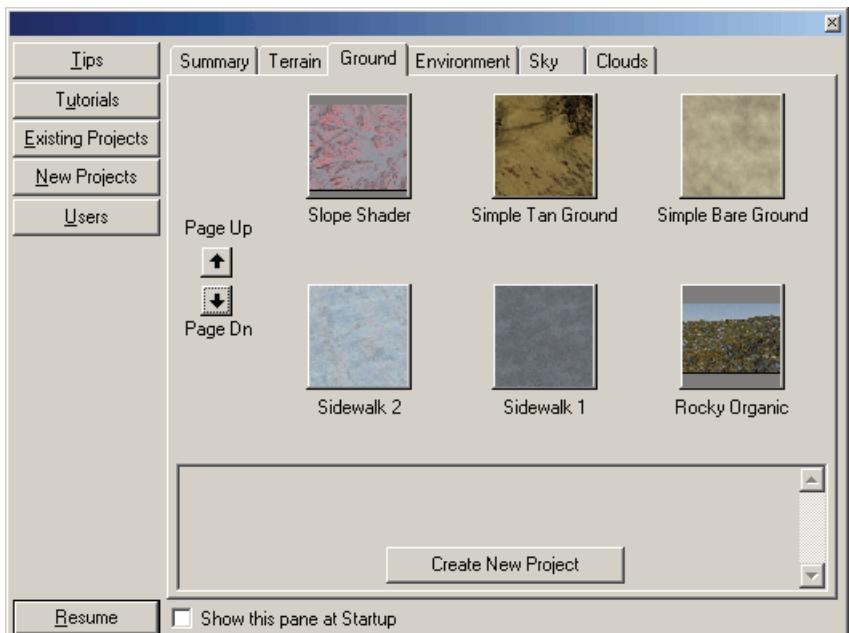


5) Select the Terrain component called "Distant Range"

6) Click on the Ground tab

As with the Terrain tab, once the Ground Effect components that you have saved have been loaded, the following interface will appear.

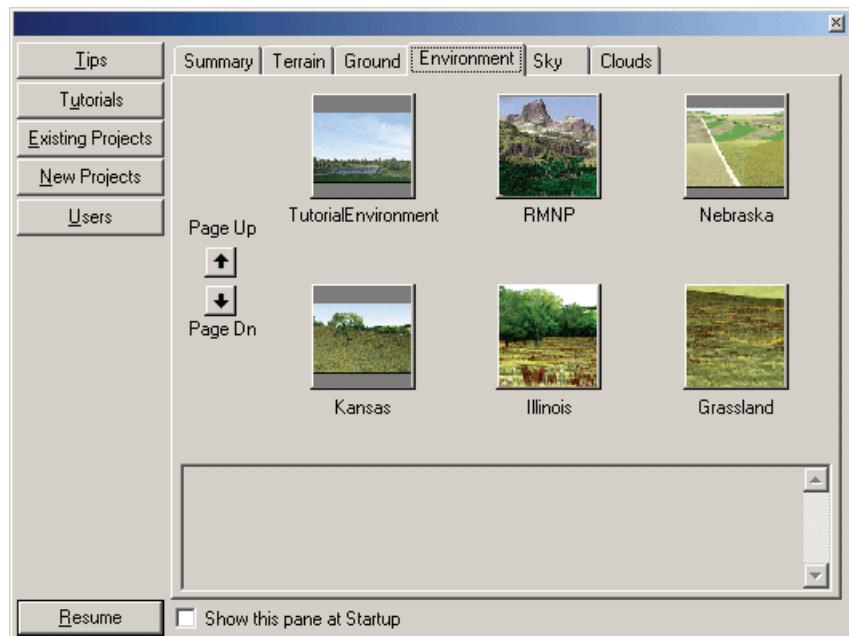
The controls for this screen are as before, with the Terrain components. What you are seeing is a representation of all the Ground Effect components in your component library. Select the component named "Rocky Organic"



7) Click on the Environment tab

Again, a now familiar interface will appear, this time with a selection of Environments (collections of ecosystems).

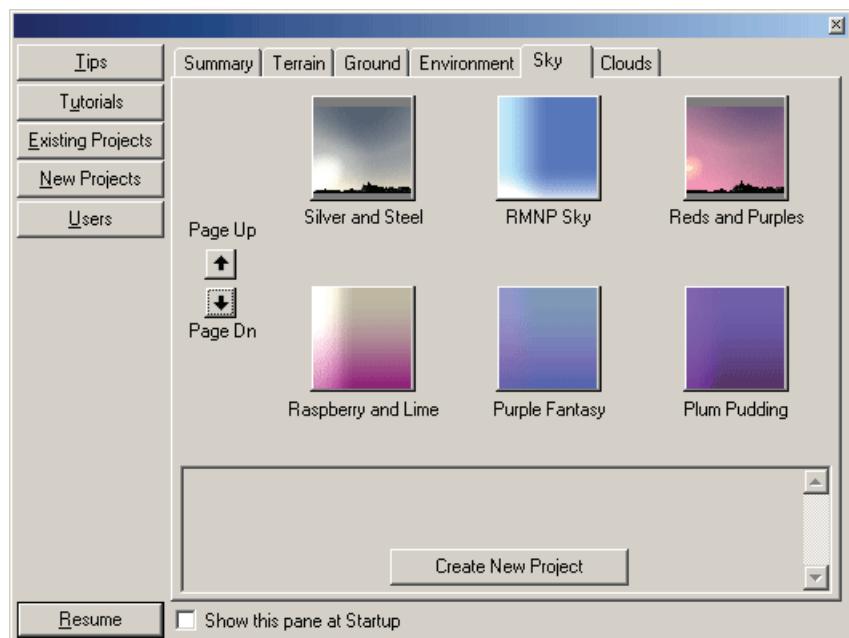
Scroll through the installed environments until you find one called "Generic Environment" and select it by clicking on its thumbnail.



8) Click on the Sky tab

The sky interface should appear and (as before) list all the installed sky components in the form of graphical thumbnails.

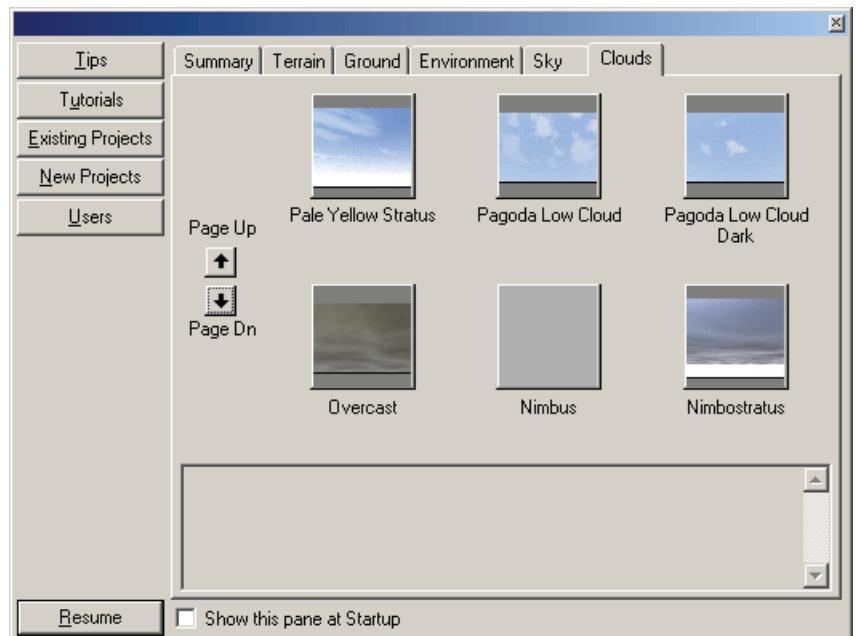
Select the one named "RMNP Sky"



9) Click on the Clouds tab

This will bring up the list of installed Clouds components.

Click on the one called "Fluffy Clouds" - you may have to use the Page up and Page down arrows to find it.



10) Enter a name for your new project

Suggestion is "InstantGrat"

11) Click the Create New Project button

VNS will create the necessary folder, create the terrain model(s), and run through a series of processes to load foliage objects, sky colors and cloud distributions. You may be asked if you would like the ecosystems' elevation lines to be scaled to your new terrain - answer Yes. You may also be asked if you wish the cloud model's bounds to be scaled to your new terrain model - also answer Yes to this question.

Once VNS has processed all data, a new perspective camera view should initialize in one of the matrix cells.

You have created your first VNS project, and should be able to quickly generate a rendered view!

12) Position your camera

Select the new View window that has been created for you, and make sure its title bar is active. Press and hold the space bar and while holding it, click on the Move button  on the main toolbar. While continuing to hold down the space bar, move the camera interactively in the view (left mouse button allows movement in front/back/left/right directions, right mouse button allows movement up/down). Do this until you find a viewpoint that pleases you. By simply lowering my camera the following view was gained.



13) Render a preview

Hit F9 and depending upon the speed of your computer, within a minute or two a rendered preview should be finished and you should receive a status message giving you render time for that frame. Click at various points within the rendered image and see what sort of diagnostic data you can read from the diagnostic window at the bottom of the Scene-at-a-Glance.



Congratulations! You have just created your first ever VNS 3 project from scratch. It was pretty easy, right? This method can be used to create the basis of a scene which can then be further modified using the other tools within the product (Atmospherics, water etc). Working your way systematically through the provided Tutorials is the best way to gain a better understanding of these other features.

Users

The users page is where you configure VNS to work in multiple user mode. VNS is capable of remembering the settings of many users, and storing each in a separate .prefs file. What this means to the user is that they can share a machine with other users, without having to spend time resetting their view prefs, matrix layout, and resume file every time they return to the machine.

Another application of this mode is to set up a number of “users” to represent a number of different areas of business application. For example, you might have a “user” called “Civil Engineering”, one called “Land Planning”, one called “Architecture”. Each could access different content and have different settings to the others, specific to your needs.

To enable multi-user mode:

1) select the checkbox marked “Multiple User Mode”

The dropdown list should be activated.

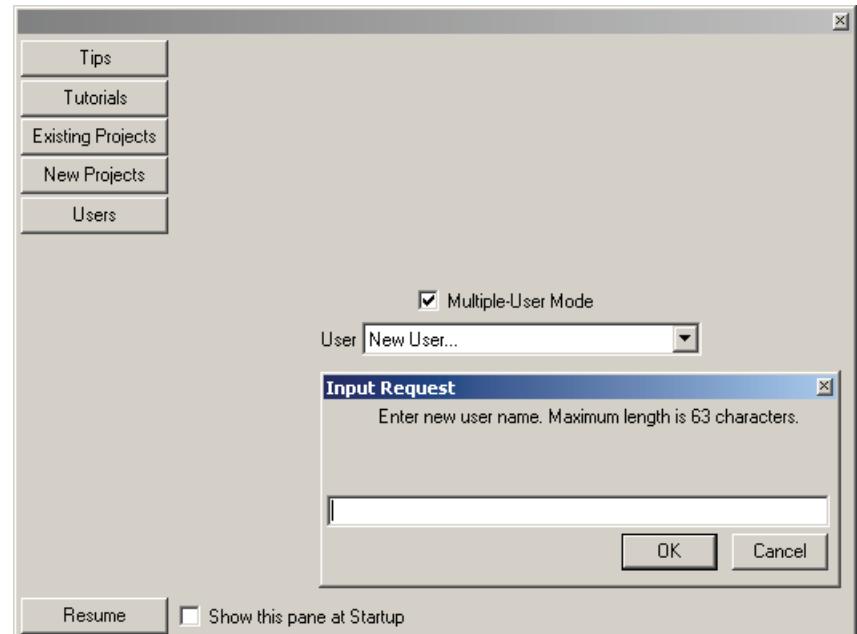
2) Select “New User...” from the list

A dialog will appear in which you can enter a new user name. This must be no more than 63 characters in length.

The new user prefs file will be a copy of the existing VNS.prefs file in your application folder. Each new user created in this way will have a new prefs file created for them with a filename <Username>.prefs, where <Username> is the name you entered in step 2.

To delete a user from the list, select Remove Current User from the File menu. The next time you run VNS, or select the Users page of the startup screen, the deleted user will no longer be available from the dropdown list.

Note: Deleting a user's prefs in this way will delete all settings they may have had, including the Resume file for the project they were last working on. VNS will warn you that this operation is can not be undone before it allows you to proceed.



Overview

VNS lets you create vast and detailed animated simulations of real-world locations or imaginary places. How can one program do so much? Read these sections for insights into the magic:

How VNS Works

Here's how VNS works.

VNS starts with a Digital Elevation Model (DEM). A DEM file is a table of elevation points taken across a landscape at regular intervals, via satellite, aerial photography or by surveyors on the ground.

Note: You can create your own DEM files using the Terrain Generator or Terrain Gridder in VNS; or by importing gray scale pictures from a paint program, DXF points from a CAD program, tables of numbers created in a spreadsheet or data from GIS software like ArcInfo, ArcView, or ERDAS Imagine.

The data looks something like this:

```
2314 2315 2318 2325 2340 2354 2362 2365 2361 2352  
2316 2319 2323 2330 2348 2357 2363 2365 2365 2360  
2317 2324 2323 2332 2350 2358 2365 2364 2365 2361  
etc.
```

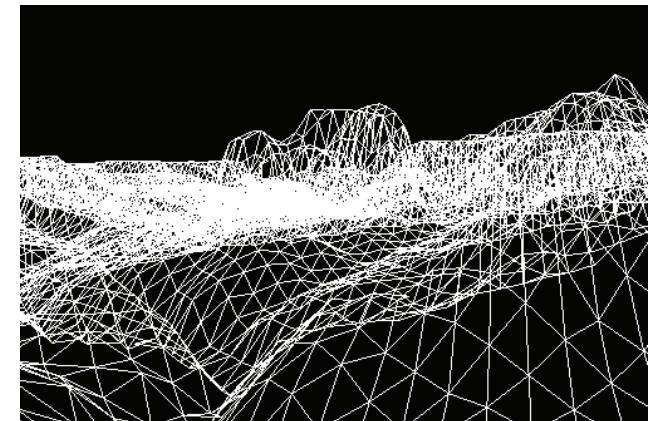
Often the data is geographically referenced. That means it comes from real places on the planet. With Visual Nature Studio you can maintain the true location, because VNS always uses real spherical or ellipsoidal terrain positioned on the globe using actual latitude and longitude coordinates (see Appendix A: A Lesson In Geography).

Note: You can render any amount of terrain, even the entire planet.

VNS takes that DEM data and recreates the shape of the original landscape by connecting the elevation points into polygons, like this:

VNS lets you add detail to the polygons and roughen them to make the terrain look more natural. VNS lets you do this with Fractal Depth and Displacement controls. Then VNS applies foliage and ground texturing to that landscape using groups of Ground Effects, Ecosystems, and groups of Ecosystems called Environments. Where Ecosystems grow can be controlled by Rules-Of-Nature™. You control the rules.

The Ecosystems can include things like dirt textures, rock textures, strata, grass, shrubs, deciduous trees, conifer trees, palm trees, cacti and even 3D Objects such as boulders. You can also have separate Ground texturing with satellite imagery, strata, photographic texturing of dirt, rock or fallen leaves, procedural textures to simulate ground detail or other texturing.



VNS simulates sunlight to shade the terrain and foliage, and creates a gradient sky. VNS even lets you apply atmospheric effects like haze, fog and sunbeams; add multiple levels of clouds to the sky; and animate the sun, moon and stars.

You can import or digitize Vectors to show things like rivers or political boundaries. Vectors are geographically referenced points connected by straight-line segments.

You can apply Terraffectors™ to Vectors to change the shape of the terrain. Terraffectors™ can also alter the foliage and texturing.

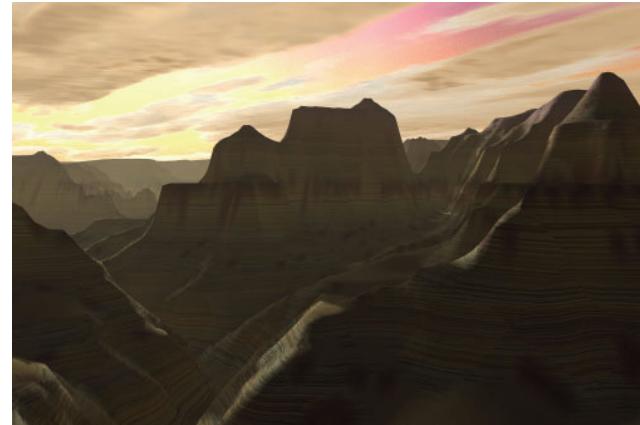
You can use Vectors to place individual trees or entire forests that override the Rules-Of-Nature. Trees can be 3D Objects, 3D-shaded Image Objects or animated Image Object sequences. You can also use Vectors to place roads, lakes, streams, snow, areas where shadows are cast, and individual 3D Objects.

You can use bitmapped pictures, called “Color Maps,” to override the Rules-Of-Nature or project pictures directly onto the landscape.

You can even add multiple Cameras and multiple Lights, and start rendering with multiple resolutions and cameras with the click of a single button.

All of this power and flexibility is accessed through a simple interactive interface. You can even load pre-built Components, including skies, clouds, lakes, starfields, Ecosystems and much more to quickly build a new project from scratch.

To keep things simple, much of the information VNS uses to create an image or animation is stored in a single Project file. To keep things flexible and efficient, some information is stored in external files where it can be used by more than one Project or even by other programs. Each Project has its own directory to store external files. VNS lets you manipulate its Parameters to completely change the look of a landscape. You can animate hundreds of Parameters to create landscapes that change over time. You also control how VNS renders images, including image size, number of frames, field rendering, antialiasing and more.



How VNS Renders

As you've seen, Visual Nature Studio recreates the surface of the planet based on the DEM data. To add realism to your data, VNS can increase the resolution using a combination of *Fractal Depth* and *Displacement*.

To render more efficiently VNS gives you level-of-detail control with *Variable Fractal Depth* for still images, and *Fractal Depth Maps* for animations.

Let's look at how this works.

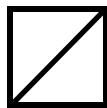
Increasing Detail with Fractal Depth

The Maximum Fractal Depth Parameter lets you increase the detail in your terrain.

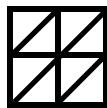
VNS lets you subdivide the polygons in the terrain to increase the apparent detail of the terrain. You can do this with the Fractal Depth Parameter.

Fractal Depth goes from zero to seven. A level of zero leaves the terrain data unchanged. A level of one subdivides each polygon into four polygons. A level of two subdivides each level one polygon into four more polygons, and so on. Each step in Fractal Depth adds four times the last step's resolution.

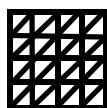
A single cell of terrain data is a rectangle drawn around four terrain elevation points. If you looked at it from directly overhead it would look like this:



That's at a Fractal Depth of zero. As you see VNS uses two triangular polygons to fill the cell.



With a Fractal Depth of one the same area is covered by four times the polygons:



With a Fractal Depth of two the same area is covered by four times the polygons as a Fractal Depth of one, and sixteen times more polygons than a Fractal Depth of zero:

As you can see, the number of polygons increases quickly as you raise the Fractal Depth.

So far all these new polygons are lined up in the plane of the original polygon. If you looked at the original polygon on edge you would not see any change. In order to use the new polygons to add noticeable detail to the terrain you must somehow move the new polygon vertices out of the plane of the original polygon. VNS lets you do this via the *Vertical Displacement* Parameter.

Increasing Roughness with Vertical Displacement

Vertical Displacement moves polygon vertices up or down to add natural irregularity to the terrain. This moves the vertices of the new polygons out of the plane of the original polygon.

You can control the amount of displacement with the Vertical Displacement Parameter. You can tell VNS the maximum distance that the new terrain points should be offset. This value will have no visible effect unless you also apply a texture to drive the displacement. The amount of texture detail will be directly related to the distance between terrain points after fractal subdivision. If you require high-detail displacement effects on your terrain model, but are unwilling to raise the terrain resolution sufficiently high, then you can simulate the effect of displacement by using bump mapping.

Efficient Rendering with Level-Of-Detail Control

By increasing Fractal Depth you increase the number of polygons, the level-of-detail, over the entire terrain. More polygons take longer to render.

That's why VNS gives you control over level-of-detail so you can increase detail only where it matters: near the Camera.

VNS has several ways of deciding what can and can't be seen: *Variable Fractal Depth* and *Fractal Depth Maps*. Both methods control the level-of-detail based on the distance from the Camera. That way VNS won't have to waste time rendering extra detail where the Camera can't see it.

A general rule of thumb is that for still images you should use Variable Fractal Depth, and for animations you should use Fractal Depth Maps.

Variable Fractal Depth

When you use Variable Fractal Depth VNS uses the full level of Fractal Depth near the Camera. As the terrain gets further from the Camera VNS renders with lower Fractal Depth. Lower Fractal Depth means fewer polygons. Fewer polygons means faster rendering.

The end result is high detail with reasonable rendering times for still images. VNS puts the detail up close where you can see it, with lower detail in the distance where it's not noticeable.

VNS won't waste rendering time creating high detail where you can't see it.

Fractal Depth Maps

Using Fractal Depth Maps is similar to using Variable Fractal Depth, except instead of just considering one frame, VNS considers your entire animation. When you create Fractal Depth Maps VNS looks to see which polygons will be close to the Camera along the entire Camera path.

VNS then creates a series of Fractal Depth Maps which define this information, and when you come to render your animation, will use the information stored in the Depth Maps to determine the level of detail to use.

VNS uses the full level of Fractal Depth near the Camera path. As the terrain gets further from the Camera path VNS renders with lower Fractal Depth. Once again, lower Fractal Depth means fewer polygons. Fewer polygons means faster rendering.

This gives you high detail with reasonable rendering times for animations. VNS puts the detail up close where you can see it throughout your animation, with lower detail in the distance where it's not noticeable. Again, VNS won't waste rendering time creating high detail where you can't see it.

If you change the Camera or Target paths; any of the Terrain Parameters; or any Terraffector you will need to re-create the Fractal Depth Maps. Otherwise they will no longer accurately reflect which polygons are closer to the Camera path. Out of date Fractal Depth Maps can cause holes in the terrain and other rendering anomalies.

Note: Fractal Depth maps are required for any image or animation where accurate foliage shadows are required. While Variable Fractal Depth may work in some situations, Fractal Depth Maps are the preferred and recommended way of ensuring accurate foliage shadows.

Effect of Fractal Depth on Foliage

You can choose to have tree density tied to polygon density (Per Polygon). If you do, changing Fractal Depth will change the density of your trees. This is because changing Fractal Depth changes the density of your polygons.

Unless you use the Per Unit Area option, don't be surprised when you see fewer trees at a lower Fractal Depth than at a higher Fractal Depth.

Note: Polygon density will not affect any trees you place with Foliage Effects or with ecosystems using the "Per Unit Area" density options.

Polygon-based Density

Polygon-based density means your foliage will be denser where the polygons are denser. When you use either level-of-detail option (Variable Fractal Depth or Fractal Depth Maps) for still images or animations, the trees will be more dense nearer the Camera. This is because with Variable Fractal Depth and Fractal Depth Maps the polygons are more numerous nearer the Camera.

Having your trees vary in density with the polygon density generally means faster rendering when using either level-of-detail option. This is because VNS will render fewer trees off in the distance where you might not be able to see them anyway.

Per Unit Area Density

If you don't want your trees to change density as polygon density changes, you can use the Per Unit Area Density option. You can choose this for each Ecosystem's Overstory and Understory in the Ecosystem Editor. You'll learn more about Ecosystems later. Right now, just know that you have the option to have a constant density for your trees.

Having your tree density stay the same has several advantages. If you decide to change the Fractal Depth for your Project the trees will not change in density. The Per Unit Area Density option is particularly useful for foresters who need to set a consistent tree density per area unit.

Per Unit Area Density may also be useful for scenes where the camera is high enough that you would be able to notice trees falling off with polygon-based density, such as high flying aircraft perspectives or scenes of the entire planet.

To keep Per Unit Area Density from greatly increasing rendering time you can enable the Image Object Distance Dissolve option. When you do, VNS will render a color or texture in the distance instead of spending time rendering trees that won't be big enough to have detail anyway.

The combination of Per Unit Area Density and Distance Dissolve can give you foliage that is independent of the polygon density, yet still renders in a reasonable amount of time.

File Flexibility

VNS lets you handle a wide variety of files in an amazingly flexible manner. Here are things you should know about files to make your life easier:

File Types

You can import and export terrain data, vector data, control point data, Image Objects, 3D Objects, reusable Components, ZBuffer files and external scene files.

VNS also uses its own Project files, Fractal Depth Map files and some optional files.

Project Files

VNS loads and saves its own Project files. Project files include all the details of the scene but not all the data. Some data is stored outside of your Project file so it can be shared by other Projects and because including it could make Project file sizes unmanageable.

You can create or clone a Project with the New Project window. You can save a Project file with the Save or Save-As commands in the File menu. VNS Project files have an extension of ".proj". VNS stores some additional preferences in a "VNS.prefs" file when you close the Program.

The Project file includes Components and their settings, the Database, the interface arrangement and preferences data. The Database includes Vector data and the names of DEM files. A VNS Project file also keeps track of where to find other files you might be using for the Project.

There are a number of names and paths stored in the Project file. In fact for every file that VNS needs to either read or write (with the exception of DEM names), there is a name and path stored in the Project file.

Ideally, all of the paths used by the Project should start with a Master Path. This makes it easy to change the locations of files, which would happen if you run the project on another machine or across the network. By changing the Master Paths VNS can still find all the files for the Project without having to change all the individual paths to each file within the Project (see "Master Paths - Finding Projects and Components" below).

The Project file includes paths that start with Master Paths to find Image Object files for foliage, Celestial Objects, Color Maps and textures; 3D Object files; cached tree files; cached shadow map files; Fractal Depth Map files; and other files needed by the Project.

Project files contain a list of directories in which to search for DEM files. Since VNS uses flexible DEM paths, it needs to know where to look for the DEMs that shape the landscape. The DEM Directories List can be as long as you like, allowing you to store DEMs anywhere on your system or across a network. It lets you reorganize your disks with a minimum of hassle.

With many 3D programs it's easy to move an important file and have your project lose track of it. In VNS, If you reorganize your DEM directories you can simply update the Directory List. If you move any of the files that are referenced by a Master Path, you can simply

change the Master Path. You can edit a Project's Master Paths in the Preferences window on the Paths page. You can edit the DEM Directories List in the Preferences window on the DEM Directories page.

Note: Whenever you load a different Project, the Master Paths are kept from the previous project. If you are jumping between projects that use different Master Paths, make sure you set the Master Paths to the correct paths or the Project will not find the DEMs, trees and other files it needs. We recommend that you use the same Master paths for all of your Projects.

Terrain Files

VNS uses terrain data in the form of a height field, sometimes called a Digital Elevation Model (DEM). It's a series of regular elevation measurements taken in a grid across the land. From these elevation points, VNS can recreate the shape of the terrain within your computer.

Here are the DEM file formats you can import with the Import Wizard:

- **Arc ASCII Array**
- **Arc Grid**
- **Arc Export Grid**
- **ASCII Array**
- **Binary Array**
- **Bryce v2, v3, v4, v5**
- **DTED**
- **DXF**
- **GTOPO30**
- **Images (BMP, IFF, PICT, Targa, JPEG, PNG, TIFF, ECW)**
- **MicroDEM DEM**
- **NTF DEM (Landform Panorama and Landform Profile)**
- **NED BIL (National Elevation Dataset)**
- **NED Grid-Float**
- **USGS SDTS DEM**
- **STM (Simple Terrain Model)**
- **Terragen Terrain**
- **USGS ASCII DEMs**
- **VistaPro v3, v4**
- **WCS/VNS DEM**

VNS will convert all of these into the high-resolution WCS DEM format. This is the format VNS uses to render terrain.

Vector Data

Vector data consists of points (vertices) connected by lines to create shapes. These shapes have specific positions on the terrain and each vertex has an elevation. VNS can handle Vectors from one to 32000 vertices. VNS lets you use Vectors to indicate boundaries or areas directly, or to control more realistic elements such as foliage, lakes, streams, Terraffector™ roads and much more.

Here are the Vector file formats you can import with the Import Wizard:

- **DXF**
- **Arc Shape file**
- **USGS ASCII DLG**
- **USGS SDTS DLG**

ArcView Shape files can be in UTM or Lat/Lon coordinates. DXF files (used by many CAD programs) can be in latitude and longitude, UTM coordinates or arbitrary units like feet or meters, or any supported VNS coordinate system.

You can import ArcView Shape files with embedded attribute data. This is useful for assigning Components (such as Ecosystems) to these Vectors after you import them.

VNS saves Vector data in the Project Database, which is saved in the Project file. You can save the Database separately using the Save DB button in the Database window.

Control Point Data

Here are the Control Point file formats you can import with the Import Wizard:

- **Arc ASCII DEM**
- **ASCII Array**
- **Bryce v2, v3, v4, v5**
- **Binary Array**
- **DTED**
- **DXF**
- **Images (BMP, IFF, PICT, Targa, JPEG, PNG, TIFF, ECW)**
- **NED BIL (National Elevation Dataset)**
- **NED Grid-Float**
- **STM (Simple Terrain Model)**
- **Terragen Terrain**
- **VistaPro v3, v4**
- **WCS DEM**
- **WCS XYZ**
- **XYZ**

Control Points are elevation sample points. VNS can use them to generate new DEMs with the Terrain Gridder. You can import the above file types and regrid them into VNS DEMs. VNS saves Control Point data in the Project Database, which is saved in the Project file. You can save the Database separately using the Save DB button in the Database window.

Image Objects

Image Objects are images or image sequences. They can be in IFF (.iff), BMP (.bmp), Targa (.tga), Pict (.pct), JPEG (.jpg), PNG (.png), ERMapper ECW (.ecw) or TIFF (.tif) formats. Image sequences are a series of numbered image files in any of these formats, typically with numbers after the base name and before the extension.

VNS lets you use Image Objects for foliage, Color Maps, textures, Celestial Objects and backgrounds. VNS includes two libraries of Image Objects in the Foliage and Texture directories. As foliage, VNS 3D-shades images based on the lighting to create a three-dimensional look. Color Maps are images you can drape onto the terrain, such as satellite photographs.

Textures can be combinations of images and computer-generated patterns (called procedural textures). You can use pictures of dirt, rock, concrete, metal, plastic or whatever you like for terrain and 3D object texturing. Textures can also be used to displace the terrain within Area Terraffectors, tint foliage, create animated water surfaces, control foliage distribution and more.

Celestial Objects can include pictures of the sun, moon, stars, satellites, comets or whatever image you want to put into the sky.

Here are the Image file formats you can import with the Image Object Editor:

- **IFF**
- **Targa**
- **BMP**
- **PICT**
- **JPEG**
- **ECW**
- **PNG**
- **TIFF**

Image Object files can be named anything you like. An extension is not required for VNS. However, certain paint and image processing software may be looking for the appropriate extensions to indicate the type of file format ".iff", ".bmp", ".tga", ".pct", ".jpg", ".png", ".ecw" or ".tif".

Foliage

Foliage images are pictures of trees and other plants that have their backgrounds replaced with a completely black color with red, green and blue values of zero. During rendering, VNS will make the black background transparent and shade the tree based on the direction of the light to make it appear to be three-dimensional.

VNS includes a library of foliage images. You can create your own foliage images from any picture or image sequence. Using Image Sequences lets you have animated foliage. For example, you could record a time-lapse of a flower blooming and then use that image sequence to create an entire meadow of flowers blooming in VNS.

Textures

Textures are pictures of the ground, brick, stone or other surfaces that you can project onto the terrain or 3D Objects using the Texture Editor. The Texture Editor lets you combine and layer Image Object textures with procedural textures created mathematically, for the ultimate in texture flexibility.

By using an image sequence you can have animated textures. Procedural textures also have animatable parameters. Animated textures can let you show evolving displaced terrain using Area Terraffectors; moving patterns on the landscape using Ecosystems and Ground Effects; moving water and waterfalls using Lakes and Streams; animated cloud patterns using Cloud Models; and much more.

Color Maps

Color Maps are pictures you drape onto the terrain. You can use them for two purposes:

1) Tint the terrain.

For example, you could superimpose a satellite photograph over the DEM data of the same area. You could paint a picture of a fantasy landscape and superimpose it onto the 3D structure of a DEM. You could tint an area to show the boundaries of a national park, a county, or a watershed area.

2) Specify exact Ecosystems for specific areas of a landscape.

Note: In some cases it may be easier to do this with Ecosystems attached to Vectors. Use the method that works best for each situation.

For example you could make a grove of Aspen trees grow in a specific place, simulate a burned hillside by making it bare ground, or create a ski map by making the ski runs have bare snow instead of trees.

By using an animated Image Object you can animate Color Maps. This opens up exciting possibilities for simulating fire, lava flows, glaciers, illustrating animal migrations and even showing Ecosystems moving over time.

To make a Color Map, create an image in a Paint program, use any existing image or image sequence or generate a Color Map from VNS. You can edit Color Map images into any paint program that supports 24 bit IFF, Targa, BMP, PICT, JPEG, PNG, ECW or TIFF image files. Some programs have a feature known as "transparent layer overlay". Using this feature you can put a Color Map image in the background and use it as a guide as you paint a new version of the Color Map image in the foreground. Or you can paint directly on the guide image and stencil out the terrain data when you are done.

You can set up a Color Map for rendering in the Image Object Library, where you can also add georeferencing information to the image or view the georeferenced information already embedded in it. You can import a Color Map into VNS using the Image Object Library or directly from a Color Map editor. In the Image Object Library you can tell VNS the area it should cover on your landscape, and associate it with Ecosystems if you desire.

If you decide to use a Color Map to specify the placement of one or more Ecosystems, you'll need to select which Color Map colors or ranges will control each Ecosystem. To make an Ecosystem available for use by a Color Map you must also select the Match Ecosystems to Colors checkbox in the Ecosystem Editor.

Once you've created a Color Map, you can render with it by enabling Color Maps in the Render Options Editor. Do this for the Render Options used by an enabled Render Job.

3D Objects

3D Objects are shapes you can import and render. For example, you can use 3D Objects to add buildings, vehicles, animals and more.

VNS Can import the following 3D Object types: LightWave 3D, 3D Studio, DXF, Wavefront OBJ

VNS 3D Object geometry files have the extension “.w3o” or “.w3d”.

When you import a 3D Object in LightWave, 3D Studio, DXF, or Wavefront OBJ format VNS translates the geometry and resaves it in the WCS “.w3o” file format. VNS saves the “.w3o” in the same directory as the 3D Object you imported. The original input file is never changed by VNS. A “.w3o” file stores only the geometry of the object. By saving a “.w3o” file, VNS only has to translate data into the WCS geometry format once. VNS will use the “.w3o” file during rendering. This saves a lot of rendering time because VNS won’t have to translate the geometry every time you render. Any Material texturing you add to an object within VNS is stored in the VNS Project file. That way the same object can be used with different material characteristics in different Projects. If you want to save a 3D Object with texturing for reuse in other Projects, you can save it as a 3D Object Component from the Component Signature Window. VNS saves 3D Object Components as “.w3d” files. By default VNS saves Object Components in the 3DObject directory inside the Components directory. This is the directory the Component Gallery normally shows when you select the 3D Object tab to load 3D Object Components into other Projects.

Component Files

Components are reusable project pieces you can use to quickly build a Project. You can choose from the following Component types:

- **3D Objects**
- **3D Materials**
- **Area Terraffectors**
- **Atmospheres**
- **Cameras**
- **Celestial Objects**
- **Cloud Models**
- **Color Maps**
- **Coordinate Systems**
- **DEM Mergers**
- **Ecosystems**
- **Ecotypes**
- **Environments**
- **Foliage Effects**
- **Foliage Groups**
- **Ground Effects**
- **Lakes**
- **Lights**
- **Planet Options**
- **Post Processes**
- **Projects**
- **Render Jobs**
- **Render Options**
- **Render Scenarios**
- **Search Queries**
- **Shadows**
- **Skies**
- **Snow Effects**
- **Starfields**
- **Strata**
- **Streams**
- **Terraffectors**
- **Terrain Generators**
- **Terrain Gridders**
- **Terrain Parameters**
- **Textures**
- **Thematic Maps**
- **Walls**
- **Wave Models**

The Component Gallery lets you choose pre-built Components from these categories to add to your Project. The Component Signature window lets you save your own Components for future reuse in other Projects.

ZBuffer Files

ZBuffer files store the distance of every rendered pixel from the Camera. You can use them in other programs for 3D compositing.

Here are the ZBuffer formats you can export:

- **WCS ZBUF**
- **RLA**
- **Binary Arrays of Floating Point Values**

VNS now understands RLA and RPF files such as can be produced by recent versions of Lightwave, 3DSMax and 3DSViz. These can be used in conjunction with the new Post Process compositing to integrate externally rendered frames with your VNS creations.

Scene Files

Scene files are similar to the VNS Project file but resaved in a format used by external 3D programs.

Here are the Scene File formats you can import and export with the Scene Import and Export windows:

- **LightWave**
- **3D Studio**

You can also choose to export the terrain data in downsampled form for use as a reference object within the external 3D program.

Fractal Depth Map Files

Fractal Depth Maps let you render animations efficiently. Fractal Depth Maps vary the level-of-detail in your terrain so that any terrain that will be close to the Camera's path during your animation will have higher detail than terrain that is always further away. This gives you a detailed look without having to waste time rendering that level of detail across the entire landscape, where it wouldn't be seen anyway.

You must generate Fractal Depth Map files using the Create Fractal Maps button in the Terrain Parameter Editor. VNS will store the Fractal Depth Map files in the Project's Directory.

Important: Whenever you change any Parameter that affects the shape of the terrain or a Camera Target path, you must regenerate the Fractal Depth Maps. Otherwise the Fractal Depth Maps will no longer be accurate and you might see holes or artifacts in your terrain.

If you see holes or artifacts in the terrain and you're using Fractal Depth Maps, regenerate the Fractal Depth Maps.

Important: Fractal Depth Maps take into account all Cameras in your Project that are part of an enabled Render Job. If you aren't using a particular Camera and it's part of a Render Job, make sure you disable the Render Job before generating Fractal Depth Maps. Otherwise VNS will add unnecessary detail to the terrain for that Camera, which will waste rendering time.

Fractal Depth Map files have the extension “.frd”.

Other Optional Files

When you select the Load Fast command on the Image Object Editor’s Image page, VNS will save pre-calculated Image Object Files to your hard drive the first time you render. After that, VNS can load the files instead of having to recalculate them. This saves rendering time. The pre-calculated Image Object files are saved in the same directory as the Image Object’s base image file and have the extension “.wfl”. Once generated, they can be used by any Project. This only works for still images, not image sequences.

When you select the Use File command on the Shadow Editor, 3D Model Editor or Cloud Model Editor, VNS will save pre-calculated Shadow Map Files to your hard drive the first time you render. After that, VNS can load the files instead of having to recalculate them. This saves rendering time. The pre-calculated Shadow Map files have the extension “.wsm” and are saved in the Project’s Default Directory.

The VNS Directory Structure

In order to create realistic images and animations, Visual Nature Studio needs access to a lot of different files.

First, VNS has to be able to find and load your Project files and find their associated directories. Second, VNS needs to be able to find any DEM files. Third, VNS needs to find any trees, textures and 3D Objects used by a Project, plus any other Components you may want to add later. Finally, VNS needs to know where to save the images you render.

The standard VNS directory structure looks like this:

WCS

WCSPublic (set with the “WCSPublic:” Master Path)

Demos

Your Project Directories

WCSScripts (set with the “WCSScripts:” Master Path)

Your Rendered Frame Directories

Components (set with the “WCSComponents:” Master Path)

3DObject

Animal

Aviation

Building

Farm

General

Golf

Home

Industrial

Plant

RoadAndBridge

Rock

Transportation

Tree
Urban
Vehicle

Image
Color Map
Color Swatches
Foliage
Animals
Buildings
Cactus
Conifer
Crop
Deciduous
Flower
Fungus
Grass
Manmade
Ornamental
Palm
People
Rocks
Shrub
SmallPlant
SnowCoveredTrees
StumpAndSnag
Tropical
WaterPlant

Sky

Texture
Bark
Brick
Cobble
Dirt
Foliage
Grass
Gravel
Ground
GroundCover
Leaf
Mud
Pavement
Sand
Sign
Stone
Urban
Water
Wood

Landcover
Light
Render
Sky
Terrain
Texture
Vector
Water

Help
Interactive Reference Manual (PDF)

VNS will automatically set up this directory structure when you install the program

How does VNS find all its files? It does so using Master Paths, the DEM Directories List (see below) and a standard directory structure. Using these tools, you can move the WCSProjects, WCSFrames and WCSContent directories anywhere on your system or network and VNS will still be able to find the files it needs.

Master Paths - Finding Projects and Components

Master Paths are “aliases”. They represent three specific places on your hard drive where VNS looks for files. They are:

- **WCSProjects**
- **WCSContent**
- **WCSFrames**

The WCSProjects Master Path tells VNS where to look for Project files and any other files in the Project’s directory. The WCSContent Master Path tells VNS where to look for re-usable Component files and external files such as Image Object foliage and 3D Objects. The WCSFrames Master Path tells VNS where to save rendered images.

Using Master Paths lets you create Projects that can be easily moved to other computers or across a network. Master Paths make network rendering simple. Master Paths also make it easy for multiple VNS animators to share resources and collaborate across a network. To move a Project to a different computer, all you have to do is change the Master Paths.

You can change the Master Paths on the Paths page of the Preferences window.

It is extremely important that they be set up correctly. If not, your installation may not work.

When you install VNS with the VNS installer, the installer will set these paths for you automatically. If VNS ever has trouble finding these paths it will ask you to enter them again. If these paths are not valid VNS will not run.

Note: To learn more about setting Master Paths, see the Paths page of the Preferences Window.

Finding DEMs

Digital Elevation Model (DEM) files are the foundation of your images. They are the raw data that VNS uses to create landscape shapes (see the Overview chapter, “How VNS Works” section).

VNS has its own DEM file format. VNS DEM files have the extension “.elev”.

With the Project’s Database you can combine many DEM files together to create your terrain. Different Projects can use the same DEM files. You can interact with the DEMs and Vector Objects in the Project using the Database window.

Project files do NOT contain any DEMs, they just know which files to use. There are three huge advantages to this:

- 1) Because they do not contain the actual DEM file data, Project files don't have to be very big, and you won't waste disk space by saving DEM files more than once.**
- 2) Because the Project keeps a Directory List to know where to look for DEM files, VNS can load each DEM as needed, rather than having them all loaded at once.**

This lets you render huge landscapes without requiring the huge amounts of computer memory it would take to load all the data at once. Because of the way this works, you can render any number of DEM files, up to and including the entire Earth, with essentially the same amount of RAM!

- 3) You can build a library of DEM files on multiple hard drives that can even be attached to multiple computers across a network.**

This lets you build a DEM library as big as the number of hard drives you can connect to your computer or network.

DEM Directories List

How does VNS find terrain (DEM) files? It looks for them using a list of paths called the “DEM Directories List”. You’ll find this on the DEM Directories page of the Preferences Window:

VNS does not store DEMs with the Project. Instead, VNS saves the names of DEMs in the Project’s Database, and remembers the path where the actual DEMs are stored in the DEM Directories List.

You can save DEM files wherever you want. One common place is your Project’s directory. Alternatively you can store your DEMs in a central location on a network so multiple VNS users can access them.

If you create or import data to be used as a DEM, VNS will save the new DEM to the Project’s directory, and add the name to the Database so it knows where to find them. VNS always adds the Project’s directory to the DEM Directories List when the project is created.

Any time you add a DEM file that is stored outside the Project’s Directory VNS will add its path to the DEM Directories List.

VNS finds DEMs when you load a Project by looking through the directories listed in the DEM Directory List. The DEM Directories List lets you keep your DEMs anywhere on the network. As long as the path is in the DEM Directories List, VNS will be able to find and load the DEMs when needed.

Since the Database and DEM Directories List are saved with the Project, you must save the Project after you create, import or add DEMs so VNS will know where to look for the new DEMs the next time you load the Project.

If the paths to the DEMs are not in the DEM Directories list, VNS will not be able to find and use the DEMs. VNS will post a message to the Status Log reporting that a DEM was not found.

Note: If you remove a DEM in the Database window VNS will give you the choice of removing the link from the current Project or actually deleting the DEM files from your hard drive. Be careful you don't delete a DEM that may be needed by another Project.

Saving

As you work with a Project, make sure you save it periodically using the Save command in the File menu.

Note: The keyboard shortcut Control+s makes this easy to do.

It's a good idea to save any changes to disk immediately if you feel they are worth preserving. That way you won't forget and quit the program without saving them. If you don't save the Project, any changes you made will be lost the next time you load a different Project.

Resuming

VNS saves a special backup Resume Project every time you save or quit. The Resume Project is saved as "VNS.prefs". This is also where VNS saves your non-project-specific preferences.

If you quit the program without saving, you can use the Open Resume File button on the Version window the next time you start VNS. This will open the Resume version of the Project you were in when you quit, in the state it was when you quit, even if you didn't save the Project itself!

Notice that VNS saves this Resume version of the Project whenever you quit. If you made changes to the Project after you last saved the Project and before you quit VNS, the Resume version of your last Project will be more current than actual saved version of the Project.

Note: Despite the fact that this functionality is included within the product, it should never be used as an alternative to regular saving of your project data. Should VNS crash for any reason, the prefs file will not be updated and you will only be able to resume to the version of the project created the last time VNS was exited cleanly.

Saving External Files

VNS will save external files automatically whenever you create a DEM, save a Component, render with shadow caching, render with Load Fast turned on or import a 3d object.

Saving Vectors

If you create or import Vectors, they will be added only to the Project in memory. You must save the Project to disk if you want VNS to remember those Vectors the next time you open that Project. When you create a new Vector you will need to save the Project if it is something you wish to keep.

Data Safety

Files may be read and written many times during a VNS session. It's a good idea to make back up copies of critical data so that as you work you don't risk accidentally destroying data you need.

You can quickly backup a project by copying a Project file and its associated directory.

If the Project is using files from another directory, (for example, a DEM that's also used by another Project and is located in the other Project's directory or some central DEM directory) you may want to back up those files also.

Note: See your Computer's reference manual for instructions if you don't know how to copy files.

It's also a very, very good idea to back up your work periodically so that if your hard drive fails you don't lose your work. You can back up your work to optical media (CD or DVD) or by using other methods like tape drives, removable hard drives, etc.

Viewing Pictures

When you generate pictures, you can view them with any program that can display 24 bit pictures, including VNS itself. VNS currently renders images in IFF-ILBM, Targa, BMP, PICT, JPEG, PNG, ECW and TIFF formats.

The View Image submenu in the View menu runs the Image Viewer and lets you load and view images within VNS.

Tip: You can sample color values from pictures using the "Sample Color from Image" section of the Color Editor. For example, this makes it possible to get the exact grass color from a photograph and apply it to grass Image Objects within VNS.

Viewing Animations

VNS can render full color image sequences, AVI movies and Quicktime movies.

For real-time playback of full color image sequences, add-on hardware from companies like Matrox, NewTek and others may fulfill your requirements.

Typically, computer playback requires certain compromises, including small frame sizes, fewer frames-per-second and a lot of data compression. Fitting detailed animations within the bandwidth limitations of the Internet, or optical media such as CD-ROMs and DVDs, often involves some loss of quality.

For film production you can output high resolution frames to a film recorder.

Note: If you choose in VNS to render to an animation file such as Quicktime, and for any reason your computer ceases to operate during rendering (power cut, blown fuse, system crash etc.) the output file may be corrupted and unplayable. For broadcast productions, 3D Nature recommends you render to image sequences and compile them into an animation format after rendering.

3D Nature does not specifically endorse any of the available playback products, but we suggest you evaluate them to see if they fit your needs.

Main Menus

There are five Global menus that appear at the top of the VNS screen.

- **File Menu**
- **View Menu**
- **Data Menu**
- **Window Menu**
- **Help Menu**

Use the File menu to open and save Projects, save a Project in Component form, import and export a variety of data, manage your user list (in multiple user mode) and set Preferences.

Use the View menu to open the Database Editor, Image Object Library, Component Library, Component Gallery, Authorization Window, Status Log and Image Viewing Commands.

Use the Data menu to open the Terrain Gridder Editor, Terrain Generator, DEM Interpolator, Planet Options Editor and Numeric Entry command.

Use the Window menu to control the layout of The Matrix, select any currently open window and close all windows.

Use the Help menu to open the Interactive Reference Manual, access the built-in Tutorials interface, go to the 3D Nature web site, go the updates page on the 3D Nature web site, open the VNS Version Window and open the VNS Credits Window.

File Menu

The File menu gives you access to these commands:

- **New Ctl+N**
- **Open Ctl+O**
- **Save Ctl+S**
- **Save-As Ctl+A**
- **Save As Template**
- **Sign and Save (Component Signature Window)**
- **Import Wizard Ctl+I**
- **Import Scene Ctl+Shift+I**
- **Export Scene Ctl+Shift+X**
- **Scene Express Ctl+Shift+E**
- **Open Resume File Alt+0**
- **Recent Files Alt+1-6**
- **Preferences Submenu Ctl+P**
- **Select User**
- **Remove Current User**

- **Template Manager**
- **Quit Ctl+Q**

New

Use the New command to create a new VNS Project or clone an existing Project. When you choose the New command you'll see the New Project Window. There you can create a new Project from scratch or clone an existing Project.

Open

Use the Open command to open an existing VNS Project file. The Project will open along with any Project Settings that were selected in the Preferences Window the last time the Project was saved.

The Project name will appear in the title bar at the top of the VNS window.

Save

Use the Save command to save a VNS Project file under the current Project name. You can load any saved Project file into VNS in the future using the Open command.

Note: Changes you make as you work are not permanent until you save the Project.

When you save a project, VNS also saves a special Project file called the "Resume File." As long as you've saved your project at least once since opening it, choosing the Open Resume File command (see below) is a handy way of reverting your project to the state it was in when you last saved.

Note: When you start the program, VNS opens the Version Window, which gives you the option of opening the Resume file. This is a quick way of getting back to the state you were in when you last saved a Project or quit the program.

Save-As

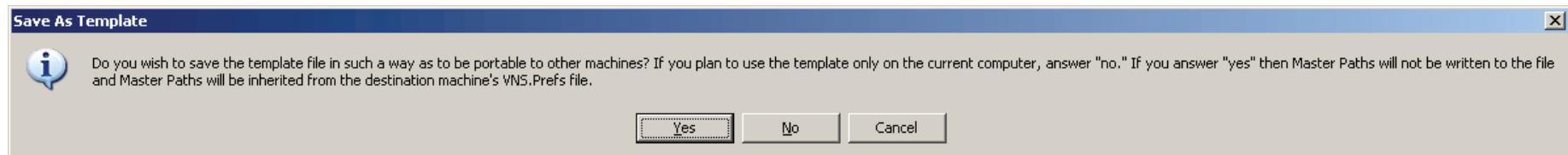
Use the Save As command to save a VNS Project file under a new name. A standard file requester will appear. Enter the name and path for the new file or select an old file to be overwritten.

When you save a project, VNS also saves a special Project file called the "Resume File." As long as you've saved your project at least once since opening it, choosing the Open Resume File command (see below) is a handy way of reverting your project to the state it was in when you last saved.

Note: When you start the program, VNS opens the Version Window, which gives you the option of opening the Resume file. This is a quick way of getting back to the state you were in when you last saved a Project or quit the program.

Save As Template

Use the Save As Template command to save a VNS Project file under a new name as a Template. The following message box will appear:



After you choose yes or no as appropriate to your circumstances, a standard file requester will appear. Enter the name and path for the new file or select an old file to be overwritten.

Import Wizard

Select the Import Wizard command when you want to import any DEM, vector or control point data. VNS will open the Import Wizard.

Import Scene

Use the Import Scene command to open the Scene Import Window. There you can import a scene file from an external 3D program.

VNS supports external 3D programs with scene import, scene export, reference object export, and Z-Buffer plug-ins for 3D compositing as well as Post Process compositing that does not require any plugins. This lets you combine the photorealistic terrain rendering of VNS with 3D objects from popular 3D programs.

Currently supported programs include LightWave 3D, 3D Studio MAX and 3D Studio VIZ.

Export Scene

Use the Export Scene command to open the Scene Export Window. There you can export a VNS Project as a scene file for an external 3D program.

VNS supports external 3D programs with scene import, scene export, reference object export, Z-Buffer plug-ins, and a Composite Post Process event. The last two features lets you combine the photorealistic terrain rendering of VNS with 3D objects from popular 3D programs. The plugins allow compositing to be performed within your external 3D Application, while the Post Process event allows compositing to be performed from within VNS 3 using RLA or RPF output from another program.

Currently supported programs include LightWave 3D 3D Studio MAX and 3D Studio VIZ.

Scene Express

Use the Scene Express command to open the Export Control Window. From there you can edit existing export formats stored in components created by the Scene Exporter Editor and control the process used by Scene Express to export the content to the selected formats.

Open Resume File

Select the Open Resume File command to open the special file called the Resume File." This file is saved every time you save your project, and when you quit VNS by selecting the Quit command.

Note: When you start the program, VNS opens the Version Window, which gives you the option of opening the Resume file.

As long as you've saved your project at least once since opening it, choosing the Open Resume File command is a handy way of reverting your project to the state it was in when you last saved.

Recent Files

For quick access, VNS keeps track of the last six Project files you've opened. You'll see the names of these files listed in the File menu. Select the name of any of these recent files to open them. This can be faster than using the Open command and file requester (see above).

Preferences Submenu

Select any of the commands in the Preferences sub-menu to open the Preferences Window. It will open to the page corresponding to the command you selected. You can change to any of the pages once the Preferences window is open.

The pages in the Preferences window let you adjust your choices for the following settings:

- **General Ctl+P**
- **Matrix Layout Ctl+- (Control+Minus Symbol)**
- **Project**
- **Interaction**
- **Units Ctl+= (Control+Equal Symbol)**
- **Paths Ctl+E**
- **DEM Directories Ctl+D**

Select User

Choose the Select User command in the File menu to open the Version Window where you can select a new user name from the User drop box.

Remove Current User

When you are using the Multiple-User Mode, you can choose the Remove Current User command in the File menu to delete the current user.

VNS will warn you that this is a permanent operation. Click "Yes" in the dialog to remove the current user account. Click "No" to abort the operation.

Note: You can enable the Multiple-User Mode from the Version Window.

Template Manager

Select the Template Manager command to open the Template Manager. There you can see and edit the list of available Template Projects.

Quit

Use the Quit command to close Visual Nature Studio.

Whenever you Quit or Save, VNS will also save your current Project into a special "Resume" file. The next time you open VNS you can load that Resume file by clicking the Resume button in the Version Window.

The Project, windows and window positions will load and you will be right where you were when you quit. This also works from the Version command in the Help Menu.

Note: There is another way to automatically load a project when you start VNS. If you turn on the "Load Project" checkbox on the Preferences window's General page and then save a Project, the next time you open VNS, the last saved version of that Project will be opened automatically (see Preferences Window).

View Menu

The View menu gives you access to these commands:

- **Database Editor Alt+D**
- **Image Object Library Alt+J**
- **Component Library Alt+L**
- **Component Gallery Alt+M**
- **Status Log Alt+G**
- **View Image Submenu**

Database Editor

Select the Database Editor command to open the Database Editor. The Database Editor lets you control the DEMs, Vector Objects and Effects in your Project.

Image Object Library

Select the Image Object Library command to open the Image Object Library.

There you can create Image Objects to use as trees for Ecosystems (see Ecosystem Editor) and Foliage Effects (see Foliage Effect Editor), and as textures in the Texture Editor (see Texture Editor) to apply to 3D Objects (see 3D Object Editor), Ground Effects (see Ground Effect Editor), Lakes (see Lake Editor) and Ecosystems.

Component Library

Select the Component Library command to open the Component Library. There you can create Components and apply them to Vector Objects in the Database.

Component Gallery

Select the Component Gallery command to open the Component Gallery. You can also open the Component Gallery by clicking the Component Gallery icon in the Icon Toolbar.

The Component Gallery lets you load pre-built effects into your Project.

Status Log

Select the Status Log command to pop up the Status Log. It will appear in the lower right corner of the screen. This is the same as clicking the Status Log icon in the Animation Toolbar. You can also use the keyboard shortcut Alt+G to pop up the Status Log.

The Status Log shows you messages about recent VNS activity. You can see when files have been loaded or saved, watch what VNS is doing as it renders, and see error messages if something should go wrong.

The Status Log Message Area in the Animation Toolbar shows the last Status Log message.

View Image Submenu

The View Image submenu commands let you look at image on your system or network or see the last image you rendered.

Tip: You can sample colors from images using the Color Editor. This makes it easy to use actual colors from nature photographs to color your VNS foliage, textures, skies etc. The addition of the Color Swatch feature in the Color Editor has made this even simpler to achieve.

From Disk alt +]

Choose the From Disk command to view any compatible image on your system or network. VNS will open a file requester. Use it to select an image to view and click the Open button in the file requester. VNS will open a window to display the image.

When you're done viewing the image, close the window using the standard close gadget in the window border as used by your operating system.

VNS can view images in a variety of formats (see Image Loading and Saving).

Last Rendered alt + [

Choose the Last Rendered command to view the image you last rendered. This includes renderings you create as a preview render from a View (see Common Controls) or as a final render from the Render Control Window.

Data Menu

The Data menu gives you access to these commands:

- **Terrain Gridder**
- **Terrain Generator Alt+F**
- **DEM Interpolator Alt+P**
- **Path-Vector Transfer Window Alt+H**
- **Numeric Entry (Numeric Input Window) Alt+. (Alt plus period)**
- **Scene Express Utilities Submenu**

Terrain Gridder

Select the Terrain Gridder command to open the Terrain Gridder Editor. With the Terrain Gridder, you can grid DEM data from Control Points or Vectors.

Terrain Generator

Select the Terrain Generator command to open the Terrain Generator. There you can generate terrain never before seen in nature.

DEM Interpolator

Select the DEM Interpolator command to open the DEM Interpolator, where you can interpolate existing VNS format DEMs to higher resolution.

Path-Vector Transfer Window

Select the Path-Vector Transfer command to open the Path-Vector Transfer Window where you can copy Motion Path or Vector information to another Motion Path or Vector.

Numeric Entry

Select the Numeric Entry command to open the Numeric Input Window, where you can enter a value for the Active Item if it is a parameter. If you're in a hurry and only need to change a single parameter this may be more convenient than opening an Editor and finding the parameter's field.

Scene Express Utilities Submenu

The Scene Express Utilities submenu gives you access to commands and tools relevant to or required by Scene Express.

Sign Natureview File

Natureview files (.nvw) require a digital signature before they will display properly in Nature View Express (the free distributable viewer utility - referred to a NVE from here on). Scene Express automatically signs the NatureView scenefile when created, but since the Nature-

View format is ASCII text based (and very similar to XML), hand editing of these files is supported (and actively encouraged - certain features can only be enabled through manual editing).

Once edited, the file will no longer display properly in NVE, and must be resigned to make it compatible with the viewer. In addition, 3D Objects exported to NVE must be signed by Scene Express before they will display.

Selecting this option will open a file requester allowing you to select the Natureview files (or 3D Object) for NV Signing. Select the file in the requester and click OK. The signing utility will generate a signature which can be copied (Ctrl-V) and pasted (Ctrl-V) into the relevant space in the .nvw project file.

Window Menu

The Window menu gives you access to these commands:

- **Matrix Layout Submenu alt+shift+- (minus sign) and alt+1, 2, 3, 4, 5, 6, 7, 8, 9**
- **Close All**
- **Windows List Submenu**

Matrix Layout Submenu

The Matrix Layout submenu let's you choose a Cell layout for the Matrix. You can choose from a variety of Cell sizes and combinations. Make sure you choose a layout with at least some Cells that are large enough within your screen's resolution to dock Editors. Otherwise, Editors will not be able to dock and will open undocked above the Matrix.

Close All

Select the Close All command if you want to close all the open windows in the program.

Windows List Submenu

The Windows List submenu shows a list of all open windows in the program.

Select a window from the list to activate it and bring it to the front. If the window is hidden behind another window in a Matrix cell, it will come to the front.

Help Menu

The Help menu gives you access to these commands:

- **Interactive Reference Manual F1**
- **Tutorials**
- **Online Updates**
- **Online Registration**

- **VNS Version**
- **VNS Credits**

Interactive Reference Manual

The Interactive Reference Manual command allows you to open this interactive Interactive Reference Manual (see How to Use This Manual).

Follow the links throughout the manual to learn what all the windows, commands, fields, buttons, sliders, and other interface elements do.

A quick way to open the Interactive Reference Manual is to hit the Help/F1 key on your keyboard. VNS will open the Interactive Reference Manual to the page that discusses the currently selected VNS window. That makes it easy to get more information about any VNS window.

The Interactive Reference manual requires PDF viewing software. Because it is a PDF (Portable Document Format) file, it is platform-independent and can be viewed on any computer or hardware capable of reading PDFs.

Tutorials

Selecting this menu item will open the Visual Nature Studio Version Window, but with the focus on the tutorials page. This screen allows centralized access to the installed HTML tutorials supplied with the product, and to any supplemental tutorials distributed in the future by 3D Nature or independent developers and users.

Since the manual no longer contains any procedures (with the exception of the “Instant Gratification” section), it is highly recommended that if unfamiliar with the product, you work your way through all supplied tutorial material before attempting any of your own project work.

The International Mailing List is also a good place to share ideas and ask questions.

3D Nature Homepage

Click the 3D Nature Homepage command to open your system’s Internet browser to our home page. Here you will find exciting news, images, animations, tutorials and other information about Visual Nature Studio.

Note: Your computer must be connected and logged in to the Internet for this to work.

Online Updates

Click the Online Updates command to open your system’s Internet browser to the update page of our web site. Here you will find the latest versions of Visual Nature Studio, which may include free updates and paid upgrades.

It’s a good idea to check here periodically to see if new versions of Visual Nature Studio are available.

Note: Your computer must be connected and logged in to the Internet for this to work.

Online Registration

Select the Online Registration command to register VNS via the Internet.

Note: Your computer must be connected and logged in to the Internet for this to work.

VNS Version

Use the VNS Version command to open the Visual Nature Studio Version Window.

This is the window that appears when the program is started. You should have this window in front of you when you contact 3D Nature for technical support. It contains the program version and revision numbers as well as your own personalized serial number. Without these we can't give you much help.

Note: This is an alternative way to gain access to the Tips, Tutorials and other screens that have now been incorporated into this window.

VNS Credits

Use the VNS Credits command to open the Visual Nature Studio Credits Window. Here you'll see the names of the dedicated terrain fanatics who create VNS for your visualizing and animating pleasure.

Matrix Popup Menus

Right click on the title bar of any window to see the Matrix popup menus. The Matrix popup menus give you access to these commands:

- **Help**
- **Advanced Features**
- **Dock**
- **View Submenu**
- **Open View Preferences ?**
- **Edit View's Camera**
- **Realtime Options Submenu**
- **Make Quick Sequence**
- **Render Options Submenu**
- **Select Option Set**
- **Render a Preview F9**
- **Show Preview F8**
- **Save Displayed Image F7**
- **Joystick Submenu**
- **Close Window Ctrl-F4**

Help

The Help command opens the Interactive Reference manual to whichever page is relevant to the window from which you opened it. This is the same behavior as if you had hit the Help/F1 key.

Advanced Features

This option is only enabled for Editors and allows you to enable all the advanced features in that particular editor. This can also be achieved through use of the Enable Advanced Features Icon (see Title Bar Icons)

Dock

You can select the Dock command to dock the window into the Matrix. If the window is already docked into The Matrix, you can deselect the Dock command to allow the window to float above the Matrix.

View Submenu

The View submenu lets you use the cell to view editors or any existing Camera. You can also use it to create new Perspective, Overhead or Planimetric Cameras.

Editors

Select the Editors command if you want to use the Matrix Cell to display Editor windows.

Existing Cameras

VNS will show all the existing Cameras in your Project by name. Select a Camera to show what it sees in the View.

New Perspective Camera

Select the New Perspective Camera command to create a new Camera with the Camera Type set to Targeted. This is useful for providing a perspective view of the terrain. You can change the Camera Type on the General page of the Camera Editor if you wish.

New Overhead Camera

Select the New Perspective Camera command to create a new Camera with the Camera Type set to Overhead. This is useful for providing a view from above the terrain looking straight down. You can change the Camera Type on the Camera Editor's General Page if you wish.

New Planimetric Camera

Select the New Planimetric Camera command to create a new Camera with the Camera Type set to Planimetric. This is useful for providing a view from above the terrain looking down, with the terrain viewed in a flat projection. You can change the Camera Type on the Camera Editor's General Page if you wish.

Open View Preferences

Select the Open View Preferences command to open the View Preferences Window.

Edit View's Camera

Select the Edit View's Camera command to open the Camera Editor for the Camera being used by the View.

Realtime Options Submenu

Use the commands in the Realtime Options submenu to select what you see in the View in real time. The real time previews use OpenGL for fast, 3D shaded and textured views that can be similar to final rendered images.

To see fully detailed rendered image previews, use the Render Options commands (see below).

View Window Enabled Command

Select the View Window Enabled command when you want the OpenGL realtime View to react to changes you make. Deselect the View Window Enabled command when you want to freeze the OpenGL realtime View in its current state, ignoring changes you make to your scene.

It can be useful to temporarily disable a View to speed up the refreshing of one or more other Views you may be using. Don't forget to re-enable the View when you want it to show the current state of your Project.

Terrain

The Terrain submenu lets you choose what terrain-related items to see in Realtime Views. These include:

Control Points

Select the Control Points command to see Control Points in the Realtime View. You'll see Control Points shown as dots if there is just one point, or connected lines if there are multiple points.

Control Points are editable with the Vector editing tools.

Reference Grid

Select the Reference Grid command to see the Reference Grid in the Realtime View. You'll see the Reference Grid shown as a grid subdivided at whatever interval you set in the Grid Unit field, on the General page of the Preferences window. Since it appears beneath the terrain, it may help to make the terrain transparent in OpenGL (see Terrain Transparency below).

The Reference Grid is not available for rendered previews.

Active Object

Select the Active Object command to see the Active Item in the Realtime View. The Active Item is shown in yellow.

DEM Edges

Select the DEM Edges command to see each DEM shown with highlighted edges. This makes it easy to see where each DEM begins and ends.

Terrain

Select the Terrain command to see the Terrain in the Realtime View. You'll see all enabled DEMs shown as a shaded OpenGL shape. You can enable and disable DEMs in the Scene-At-A-Glance or the Database Editor.

Terrain Transparency

Select the Terrain Transparency command to make the terrain have less opacity. You can then see through the terrain to see things that might otherwise be obscured such as distant terrain, Celestial Objects or the Camera's Target if it has one.

Terrain Polygon Edges

Select the Terrain Polygon Edges command if you want to see just the edges of the terrain polygons. This gives the OpenGL display a wireframe look.

Terraffectors

Select the Terraffectors command to see all enabled Vectors that are attached to Terraffectors. You'll see them as Vectors in the Realtime View.

Area Terraffectors

Select the Area Terraffectors command to see all enabled Vectors that are attached to Area Terraffectors. You'll see them as Vectors in the Realtime View.

Terraffector Preview (Common)

Select the Terraffector Preview command to see the effect of Terraffector and Area Terraffector terrain displacement displayed in OpenGL real time Views. This setting is for all Views, hence the "Common" designation.

Terraffector Preview AutoUpdate (Common)

Select the Terraffector Preview AutoUpdate command when you want VNS to refresh OpenGL real time Views after you make a change to any Terraffector or Area Terraffector. This setting is for all Views, hence the "Common" designation.

Land Cover

The Land Cover submenu lets you choose what texturing and foliage items to see in real time previews. These include:

Ground Components

Select the Ground Components command to see all enabled, vector-bounded Ground Effect Components. You'll see them as Vectors in the Realtime View.

Foliage Effects

Select the Foliage Effects command to see all enabled Vectors that are attached to Foliage Effects. You'll see them as Vectors in the Realtime View.

Realtime Foliage Images

Select the RT Foliage Images Checkbox to enable Realtime Foliage in OpenGL views. Deselecting this checkbox will prevent all realtime foliage from displaying in the OpenGL view.

Vector Ecosystems

Select the Vector Ecosystems command to see all enabled Vectors that are attached to Ecosystems. You'll see them as Vectors in the Realtime View, unless the necessary Realtime Foliage Files exist and are enabled.

Color Maps

Select the Color Maps command to see all enabled Color Maps as semi-transparent rectangles indicating the boundaries of the Color Maps (see Color Map Editor). This is most useful in Planimetric Views for seeing the areas covered by the Color Maps.

Note: Depending on how they are configured, you can see some Color Maps draped onto the terrain if you enable the Ecosystem Map command in the Overlay submenu (see below).

Snow

Select the Snow command to see all enabled, vector-bounded Snow Effects. You'll see them as Vectors in the Realtime View.

Realtime Foliage File

Select the Realtime Foliage File command to see Realtime Foliage displayed in OpenGL. This command relates only to foliage in Ecotypes; Foliage Effects do not require generation of a Realtime Foliage file to display in OpenGL. To display the foliage objects in Ecotypes, you must first create a realtime foliage file. You can do this by selecting the Create Realtime Foliage File command from the Realtime Options Popup Menu.

Deselecting this command will hide all realtime foliage from displaying in the OpenGL view, with the exception of enabled Foliage Effects with their Preview checkboxes selected.

Realtime Foliage File Preferences

Select the Realtime Foliage File Preferences to open the Realtime Foliage File Preferences Window. You can use this window to determine the minimum and maximum sizes of foliage that will be considered for inclusion in the realtime foliage file, and the name of such file or files. You can also use the settings in this window to control the display of realtime foliage files.

Water

The Water submenu lets you choose what water-related items to see in real time previews. These include:

Lakes

Select the Lakes command to see all enabled Vectors that are attached to Lakes. You'll see them as Vectors in the Realtime View.

Streams

Select the Streams command to see all enabled Vectors that are attached to Streams. You'll see them as Vectors in the Realtime View.

Wave Models

Select the Wave Models command to see all enabled Vectors that are attached to Wave Models and the source of any enabled wave models. You'll see them as Vectors and small blue "W" symbols in the Realtime View.

Sky Features

The Sky Features submenu lets you choose what sky-related items to see in real time previews. These include:

Skies

Select the Skies Command to Enable or disable display of sky color in the background of the selected viewport.

Atmosphere

Select the Atmosphere command to see Haze in the Realtime View.

OpenGL can only approximate linear Haze. To accurately see any other kinds of Atmospheres you'll need to do a preview rendering by selecting the Render Preview command.

Cloud Models

Select the Cloud Models command to see Cloud Model bounds, Cloud Waves and any enabled Vectors that are attached to Cloud Models.

Celestial Objects

Select the Celestial Objects command to see all enabled Vectors that are attached to Celestial Objects. You'll see them as colored OpenGL globes.

Light & Shadow

The Light & Shadow submenu lets you choose which light-related items to see in real time previews. These include

Lights

Select the Lights command to see all enabled Lights as OpenGL shapes. Each type of Light will have a different shape.

Omni-directional lights will appear as small spheres. Spotlights will appear as cones with the cone indicating the Spotlight Cone Angle. Parallel Lights will appear as cylinders. Spotlights and Parallel Lights will point in the direction the Lights are aimed.

Terrain Shadows

Select the Terrain Shadows command to see all enabled Vectors that are attached to Shadow Components. You'll see them as Vectors in the Realtime View.

3D Objects

The 3D Object command lets you see 3D objects as boxes or shaded colored shapes in real time previews. Select it to see 3D objects. Deselect it to hide 3D objects.

For each 3D Object you can select one of the Preview radio buttons on the General page of the 3D Object Editor. Select the Off radio button if you don't want to see the Object. Hiding a 3D Object will speed up the OpenGL display. Select the Box radio button if you want to

see the Object but don't need to see its actual shape. Box is very fast for the OpenGL display to render. Select the Detail radio button if you want to see the shape of the Object. Detailed 3D Objects take the longest to display.

It's useful to hide 3D objects when you want the real time preview to update faster and you are working on something other than 3D objects.

Note: To see a 3D object it must be enabled. You can enable a 3D object from the 3D Object Editor as described above. You can enable or disable all 3D objects on the Enabled 1 page of the Render Options Editor or with Render Scenarios (see Render Scenario Editor).

Walls

The Walls command allows you to decide whether or not your wish to view Walls in real time Open GL views. Select it to see any Wall components that are enabled and attached to controlling vectors. Deselect it to hide any enabled, attached Wall components.

Walls will be displayed in the base diffuse color of the materials defined in the panel and roof interfaces of the Wall Editor

Plain Vectors

The Plain Vector command lets you choose whether to see unattached vectors in real time previews. Select it to see any Vectors that are not attached to any other Components. Deselect it to hide any Vectors that aren't attached to any other Components.

Each Vector will be shown in the color it is set to in the Database Editor or Vector Editor.

This command applies to vectors that are set to be visible in a View. You can set this in the Database Editor or the Vector Editor.

Camera

The Camera submenu lets you choose which camera-related items to see in real time previews. These include:

Cameras

The Cameras command lets you choose whether to see Cameras in real time previews. Select it to see Cameras. Deselect it to hide Cameras.

You will see any Cameras that are within the view area. Cameras are shown as semi-transparent red rectangular shapes with spreading triangles depicting their Horizontal Field of View.

Note: You will never see the Camera that is actually creating the view itself.

Targets

The Targets command lets you choose whether to see Camera Targets in real time previews. Select it to see Targets. Deselect it to hide Targets.

You will see any Targets that are within the view area for all targeted Cameras that are enabled. Targets are shown as bright green 3D crosses.

Image Boundaries

Depending on the size of the View window, a View may show extra image area that won't get rendered. The Image Boundaries command lets you choose whether to see crop lines to show the portion of the View that will actually be rendered. The crop lines will show the actual aspect of the image based on the Width and Height fields on the Size & Range page of the Render Options Editor.

Preview rendering will honor the crop lines and render only the area of the View that is based on the image size you specify in the Render Options. The aspect will be the same but the image size will be limited to fit within the View.

Using the Image Boundaries saves preview rendering time and gives you a more accurate idea of your actual image area. We recommend leaving the Image Boundaries enabled.

Safe Title Area

When outputting for video or broadcast media such as television, one must take into account the fact that objects at the edges of the screen may get lost and/or distorted in the "overscan" area. Modern flat-screen televisions have nearly removed this problem, but still suffer to a slight degree with picture quality to the edges of the screen

Hence, a standard was developed by which an animator could determine that what he had output on his computer would look the same on a television screen.

This standard defined two areas of the screen - the Safe Title Area and Safe Action Area.

The Safe Title Area is the area in which any Titles will not suffer cropping due to overscan areas of the Television screen falling behind fascia elements or distortion due to screen curvature. This is set to the industry standard of 80% of the screen width.

Selecting this command will display this region in OpenGL so you can more accurately position and animate components within your scene.

Safe Action Area

As with the Safe Title Area, the Safe Action Area was defined as that area within which no cropping would occur due to overscan, but in which a small amount of distortion might occur due to screen curvature. This is set to the industry standard of 90% of the screen width. When animating for output to broadcast media, one should always attempt to maintain the focus of the on-screen action in the Safe Action Area.

Selecting this command will display this region in OpenGL so you can more accurately position and animate components within your scene.

Overlay

The Overlay submenu lets you choose how the terrain is displayed in real time previews. The overlay options available include:

Contours

Select the Contours command to see lines drawn at specific elevations in the manner of a contour map. Each contour line represents an elevation. You can adjust the elevation spacing of the lines in the Contour/Gradient Interval field, on the Overlay/Gradient page of the View Preferences Window.

Contours work best if you zoom into the map using the Horizontal Field of View or View Width field on the Lens page of the Camera Editor for the View's Camera.

In a contour map the lines get closer together where slopes are steeper and farther apart where slopes are more gentle. A series of curves in adjacent lines can indicate the location of a ridge or valley. This can be useful, for example, if you're digitizing a stream and want the stream to follow a valley.

Slope Map

Select the Slope Map command to see a grayscale gradient depicting slope. Darker shades indicate flatter terrain. Lighter shades indicate steeper terrain.

Relative Elevation Map

Select the Relative Elevation Map command to see a visual depiction of the Relative Elevation data for your DEMs. This can give you an idea of the convexity or concavity of the terrain. VNS uses this information when placing Ecosystems using the Rules of Nature™. You can edit the Rules-of-Nature™ for each Ecosystem in the Ecosystem Editor.

Fractal Map

Use the Fractal Map command if you want to see what the Fractal Maps look like. Use it after you've generated Fractal Maps. The View will show the Fractal Maps that correspond to the enabled DEM files, if any Fractal Maps exist.

Note: To create Fractal Maps for your enabled DEMs, select the Create Fractal Maps command in the Terrain Parameter Editor.

Lighter colors indicate areas of your scene that are close to the Camera path and will be rendered at higher fractal depths. Darker shades are farther from the Camera path and will be rendered at lower fractal depths.

Areas of your scene that will not be rendered will be drawn in black. This makes it easy to see what areas will be rendered and what areas will not be rendered because they are out of the viewing area or if you are using Backface Culling.

Note: Backface Culling means VNS doesn't render polygons that face away from the Camera. You can enable or disable Backface Culling from the Terrain Parameter Editor.

If there are areas of very light color it indicates that higher Fractal Depth settings would be advantageous for best quality renderings. Consider increasing the Fractal Depth value. You can increase the Fractal Depth setting on the Fractals page of the Render Settings Editor.

Increasing Fractal Depth will increase rendering times, so only increase it as much as is needed to create the level of rendering quality your Project requires. When you change the Fractal Depth value you do not have to create new Fractal Depth Maps.

If you change Parameters that affect the Camera, Target, Terrain or Render parameters, you will need to create new Fractal Depth Maps. Or you may want to regenerate new Fractal Depth Maps with a different maximum pixel size or frame step. Whenever you generate new Fractal Depth Maps you can use the Fractal Map command again to view the new version of the Fractal Maps in the View.

Ecosystem Map

Select the Ecosystem Map command to see Ecosystems mapped onto the terrain in the selected Realtime OpenGL View. VNS will show their Diffuse Colors. This can give you a quick idea of where each Ecosystem will appear.

VNS will show any Ecosystems applied with Environments or Color Maps.

If you have a Color Map enabled, set to “Color by Polygon” but not set to match Ecosystems to any colors, VNS will show the actual colors of the color map in the Realtime OpenGL View. This lets you see draped images in the OpenGL View.

Note: The Ecosystem map command will not show vector-bounded Ecosystems. You can see the vectors controlling vector-bounded Ecosystems by selecting the Vector Ecosystems command in the Vegetation submenu.

If you add or change the Ecosystems in the project the Ecosystems visible in the OpenGL View may no longer be current. You can regenerate the Ecosystem Map overlay by clicking the Regen button on the Overlay/Gradient page of the View Preferences Window.

Gradient

The Gradient submenu lets you choose how the terrain is displayed in real time previews. The gradient options available include:

Gray Elevation

Select the Gray Elevation command to see the terrain shaded with gray based on its elevation. The grey palette is a standard grey scale gradient. Lighter shades are higher in elevation than darker shades.

Earth Tone Elevation

Select the Earth Tone Elevation command to see the terrain shaded with earth-like colors based on its elevation. The earth palette uses gradients of natural-looking colors to indicate elevation. This creates a natural-looking preview that is useful for slope analysis.

Rainbow Elevation

Select the Rainbow Elevation command to see the terrain shaded with colors based on its elevation. The Rainbow color palette uses gradients of bright colors to indicate elevation. This is useful for slope analysis and to make features more pronounced.

Gradient Repeat

Select the Gradient Repeat command to see the terrain shaded with repeating gradients based on your selection of Gray Elevation, Earth Tone, Elevation or Rainbow Elevation (see above). Gradient Repeat uses a repeating gradient to represent elevations. The result is a pseudo-contour map with contour interval specified in the Contour/Gradient Interval field on the Overlay/Gradient page of the View Preferences window.

Lighter shades represent higher elevations within each dark to light gradient band.

Cursor

Select the Cursor command to enable the crosshairs that show where you last clicked in the OpenGL realtime View. Deselect the Cursor command to hide the crosshairs.

Create Realtime Foliage File

Selecting the Create Realtime Foliage File command will tell the program to create realtime foliage files based on the settings you entered into the Realtime Foliage File Preferences Window.

Load Realtime Foliage File

Selecting the Load Realtime Foliage File command will tell the program to load the realtime foliage files from the project folder, and display them (according to the display settings in the Realtime Foliage File Preferences Window), should the Realtime Display of foliage be enabled for that view.

Copy Render Opt

Select the Copy Render Opt command if you want the Realtime OpenGL View to show the same Components as you will see if you do a preview rendering in the View.

VNS will copy the settings from the Render Options submenu into the Realtime Options submenu in the Matrix popup menus. These are the same settings you see in the View Preferences under the Realtime and Render headings. VNS will only copy those settings which exist in both Realtime Options and Render Options.

Make Quick Sequence

Select the Make Quick Sequence command to generate an OpenGL animation as a series of numbered frames in BMP format. VNS will open a file requester. Navigate to the directory where you want to save the animation. Enter a base name for the animation and click the OK button in the file requester.

VNS will step through the animation and save the OpenGL display from the View window as a frame sequence on your hard drive. You can then view the animation in any external program that can convert frame sequences to quicktime, AVI, MPEG movies or use video playback hardware such as NewTek's VT[5] to view the animation as a video.

This is a quick way to test the motions in your animation.

Render Options Submenu

Use the Render Options commands to select what you see in the View when you do a preview render using the "Render a Preview" command in the Matrix popup menus or Render Preview icon in the Icon toolbar.

After you do a preview rendering you can see a real time OpenGL preview in the View again by deselecting the Show Preview command in the Matrix popup menus (see below).

Terrain

The Terrain submenu lets you choose what terrain-related items to see in rendered previews. These include:

Terrain

Select the Terrain command to see the Terrain in the rendered View. You'll see all enabled DEMs shown as a rendered shape, colored by any Ground Effects, Ecosystems, Snow Effects and Color Maps used to texture the terrain in your Project. You can enable and disable DEMs in the Scene-At-A-Glance or the Database Editor.

Note: You must select terrain to see other terrain-dependent objects such as Image Objects, Lakes, Streams, Terraffectors, etc. If you deselect the Terrain checkbox your preview renderings will show only enabled 3D Object and sky features.

Terraffectors

Select the Terraffectors command to see all enabled Terraffectors. Depending on how you set them up, you'll see them as displaced and textured terrain in the rendered View.

Area Terraffectors

Select the Area Terraffectors command to see all enabled Area Terraffectors. You'll see them as displaced terrain in the rendered View.

Land Cover

The Land Cover submenu lets you choose what texturing and foliage items to see in rendered previews. These include:

Other Foliage

Select the Other Foliage command to see foliage from Ecotypes. Ecotypes appear in Ecosystems used in Environments, Color Maps and Terraffectors or attached to Vectors, and to foliage on Lake and Stream Beaches.

Foliage Effects

Select the Foliage Effects command to see all enabled Foliage Effects. You'll see them as Image Objects or 3D Objects in the rendered View. Objects will appear at every vertex of attached Vectors.

Vector Ecosystems

Select the Vector Ecosystems command to see all enabled Ecosystems that are attached to enabled Vectors. You'll see them as areas of Image and 3D Object foliage in the rendered View. In order to see any Ecotype foliage you'll also need to select the Other Foliage checkbox.

Color Maps

Select the Color Maps command to see all enabled Color Maps rendered onto the terrain.

Snow

Select the Snow command to see all enabled Snow Effects rendered onto the terrain.

Water

The Water submenu lets you choose what water-related items to see in rendered previews. These include:

- **Lakes**
- **Streams**
- **Wave Models**
- **Reflections**

Lakes

Select the Lakes command to see all enabled Lakes. You'll see them as flat water surfaces in the rendered View. Lakes appear within their controlling Vectors.

Streams

Select the Streams command to see all enabled Streams. You'll see them as water surfaces in the rendered View. Streams appear along their controlling Vectors and follow the Vector elevation.

Wave Models

Select the Wave Models command to see all enabled Wave Models. You'll see them as displacement on Lakes and Streams in the rendered View.

Reflections

Select the Reflections command to see any reflections in Lakes and Streams. You can set the amount of reflection separately for each body of water in the Lake and Stream Editors.

Sky Features

The Sky Features submenu lets you choose what sky-related items to see in rendered previews. These include:

Skies

Select the Skies command to see enabled Sky colors in your rendered View.

Atmosphere

Select the Atmosphere command to see enabled Atmospheres for haze, fog or volumetric effects in the rendered View.

Cloud Models

Select the Cloud Models command to see any enabled Cloud Model clouds in the rendered View.

Volumetrics

Select the Volumetrics command to see any enabled Volumetric effects in the rendered View.

Celestial Objects

Select the Celestial Objects command to see all enabled Celestial Objects in the rendered View.

Starfields

Select the Starfields command to see all enabled Starfields in the rendered View.

Light and Shadow

The Light & Shadow submenu lets you choose what light-related items to see in real time previews. These include

Cloud Shadows

Select the Cloud Shadows command to see all enabled Cloud Shadows in rendered previews. In order to see shadows on the terrain you must also have an enabled Shadow Component to receive them.

Terrain Shadows

Select the Terrain Shadows command to see all enabled Shadow Components in rendered previews. Shadow Components can receive shadows from clouds, 3D Objects, Image Objects and terrain. Shadow Components can also cast shadows from Image Objects and terrain.

3D Object Shadows

Select the 3D Object Shadows command to see all enabled 3D Object Shadows in rendered previews. In order to see shadows on the terrain you must also have an enabled Shadow Component to receive them.

Lights

Select the Lights command to see the light from all enabled Lights in rendered previews. If lights are categorically disabled here, the terrain and everything else rendered will be shaded as if it had 100% white ambient light from all directions, effectively disabling all lighting/shading.

3D Objects

The 3D Object command lets you see 3D objects as colored, textured shapes in rendered previews. Select it to see 3D objects. Deselect it to hide 3D objects.

It's useful to hide 3D objects when you want the rendered preview to update faster and you are working on something other than 3D objects.

Note: To see a 3D object it must be enabled. You can enable a 3D object from the 3D Object Editor as described above.

Walls

The Walls command lets you see vector controlled wall effects in rendered previews.

Plain Vectors

The Plain Vector command lets you choose whether to see Vectors that are enabled for rendering in your preview renders. Select it to see any Vectors that are enabled for rendering. Deselect it to disable Vector rendering.

Each Vector will be shown in the color it is set to in the Database Editor or Vector Editor.

This command applies to vectors that are set to be visible in rendered Views. You can set this in the Database Editor or the Vector Editor.

Camera

The Camera submenu lets you choose what Camera-related items to see in preview renderings and whether to render diagnostic data:

Depth of Field

The Depth of Field command lets you choose whether to see areas of the scene in and out of focus, as set on the Lens page of the Camera Editor, in your preview renders. Select it to enable Depth of Field rendering if Depth of Field is enabled in the Camera Editor. Deselect it to disable Depth of Field rendering.

Depth of Field takes extra rendering time. You can save preview rendering time by temporarily disabling it when you are working on other aspects of your scene.

There is also a Depth of Field Post process, which delivers almost the same quality but can be interactively previewed and adjusted.

Multi-pass Antialiasing/Motion Blur

The Multi-pass Antialiasing/Motion Blur command lets you choose whether to see Multi-pass Antialiasing and Motion Blur, as set on the Lens page of the Camera Editor, in your preview renders. Select it to enable Multi-pass Antialiasing and Motion Blur rendering if they are enabled in the Camera Editor. Deselect it to disable Multi-pass Antialiasing and Motion Blur rendering.

Multi-pass Antialiasing takes extra rendering time. You can save preview rendering time by temporarily disabling it when you are working on other aspects of your scene.

Note: Motion Blur doesn't take much additional time beyond what multi-pass AA adds, but it depends on Multi-pass Antialiasing to work.

Render Diagnostic Data

Select the Render Diagnostic Data command if you want VNS to generate the complete set of data used by the Diagnostic Data Window when you render. You can then click on the rendered View and read a variety of useful information in the Diagnostic Data window about the point where you clicked.

Rendering Diagnostic Data uses extra memory but doesn't take significant extra time. Normally you'll want to leave this command selected, unless memory is in great demand such as in high-resolution images with reflections using Pixel Fragment rendering.

Constrain Render Area

Select the Constrain Render Area command to enable limited region rendering for preview renders. Deselect it to allow normal preview rendering. Constrained rendering lets you render only an area you want to see without waiting for the whole image to render. This can save a lot of time as you are setting up a scene.

The keyboard shortcut is F6.

Note: This will take precedence over the Image Boundaries, which you set in the Camera submenu in the Realtime Options submenu (see above). Image Boundaries also affect preview rendering. When you use the Relative to Image Height option (see Common Distance Dissolve Section) VNS will take into account whatever constrained preview rendering size you use if you are using the Constrain Render Area option. Image height will be calculated using the pixel height of the constrained render area, not the pixel height of the View.

Set Render Area

Select the Set Render Area command when you want to specify the area for the Constrain Render Area command (see above). The keyboard shortcut is F5.

Note: You can also use the Toggle Constrained Render (F5) Icon in the View toolbar.

After you select the Set Render Area command, VNS will show a requester where you can select the last constrain render area, create a new constrain render area or cancel the operation. Follow the directions in the requester.

If you select OK in the requester, you can then click twice in the View to set the corner points for the constrain render area. After the first click, VNS will show a yellow rectangle as you move the mouse.

After the second click, VNS will automatically select the Constrain Render Area command so that the next time you render a preview VNS will only render the constrained area. If you want to render the entire image, deselect the Constrain Render Area command (see above) or icon.

Copy Realtime Opt

Select the Copy Realtime command if you want the preview rendering in a View to show the same Components as the Realtime OpenGL options.

VNS will copy the settings from the Realtime Options submenu into the Render Options submenu in the Matrix popup menus. These are the same settings you see in the View Preferences under the Realtime and Render headings. VNS will only copy those settings which exist in both Realtime Options and Render Options.

Select Option Set

The Select Option Set submenu lets you choose a set of Render Options for the View.

The set of Render Options determines what gets rendered in a View's preview rendering or in final renderings using a Render Job. By editing the Render Options you can temporarily disable things you aren't working with to save preview rendering time as you create your Project.

When you open a View VNS will search for a Render Options named something resembling 'Preview Options' to use. If there is no set of Render Options named something resembling "Preview Options" VNS will create a set of render options named "Preview Options." By changing the Preview Options you can change what gets rendered in the View without changing the Render Options you are using for final rendering.

The Select Option Set submenu lets you use any set of Render Options in your Project for the View. This lets you switch the View to show the same set of Render Options as you are using for final rendering, if you wish.

You can give any View a unique set of Render Options by creating a new set of Render Options in the Scene-At-A-Glance, making the View the active window and then selecting your new set of Render Options from the Select Option Set drop box.

You can edit a View's Render Options from the Render Options Editor, the Render Options submenu of the Matrix popup menus or the View Preferences window's Render column. You can open the Render Options Editor using the Edit Render Options button on the View Preference's General page, or by double clicking the Set of Render Options you want to edit in the Scene-At-A-Glance.

Render a Preview

Select the Render a Preview command to tell VNS to create a preview rendering in the current View. VNS will include the Components enabled in the View's Render Options.

If the View is selected you can use the handy F9 keyboard shortcut. This is also the same as clicking the Render Preview icon in the Icon toolbar.

Show Preview

The Show Preview command lets you see or discard your last preview rendering. After you do a preview rendering, it will be checked.

You can then deselect it to revert the View back to a realtime OpenGL display. VNS will ask if you want to preserve diagnostic data. If you discard it you can no longer show the last preview rendering. If you keep it you can switch back to rendered image at any time by re-selecting the Show Preview command.

Switching back to the last preview rendering allows you to once again click on the rendering in the View to get diagnostic data from the rendered image.

If you haven't yet rendered a preview in the View, the Show Preview command is disabled.

The keyboard shortcut key for this command is F8.

Save Displayed Image

Select the Save Displayed Image command if you want to save the contents of the View as an image file. This works for both OpenGL and preview renderings.

VNS will open a file requester where you can enter a name for the file. By default, VNS will save OpenGL captures in BMP format, and rendered images in PNG format. If you'd like to save in another format, add an extension for another file format (see Image Loading and Saving).

Note: Every time you do a preview rendering, the rendered view is automatically saved as "VNSLastRender.png" in the WCSFrames: directory.

Joystick Submenu

The Joystick submenu gives you access to the Joystick interactive mode commands. These allow you to interact with VNS using a joystick connected to your computer. These options work particularly well for demonstrations of project files, with a well-implemented realtime foliage file.

There are two joystick modes: "Drive" and "MultiAxis." You can select them with the Joystick submenu commands.

- **Drive command j**
- **MultiAxis command J**

For faster enabling you can use the 'j' key (lower case) to enable Drive mode and shift- J (upper case) to enable MultiAxis mode. To use a joystick:

1) Connect a joystick to your first joystick port.

2) Select a View.

3) Select one of the Joystick commands.

The controls will auto-center when you enable joystick control. The position of the joystick at that point will be considered the 'neutral' or 'rest' position.

4) You can use the escape key or Joystick Button 1 to exit Joystick Control Mode.

Joystick mode is not modal. It doesn't make other windows and controls unavailable. However, because Joystick Control Mode is a very intensive process, it may be best to avoid doing other program operations while using the Joystick.

Select the "Interactive Elevation Follow Terrain" option in the Camera Editor (General Page, General Features section) if you would like the camera to follow terrain variations as you "fly".

Drive Command

Select the Drive command to fly the View's Camera using a joystick. To use Drive mode:

- 1) Move the joystick forward or back to move the active View's Camera forward or backward.**
- 2) Move the joystick left or right to rotate the active View left or right.**

MultiAxis Command

Select the MultiAxis command if you want to move or rotate either the View's Camera or any Interactive-capable Active Item with the joystick.

You can choose to control movement by selecting the Move Mode icon in the Icon toolbar. You can choose to control rotation by selecting the Rotate Mode icon in the toolbar. You can also switch between moving or rotating with the right mouse button.

If you select the Manipulate View's Camera icon in the View toolbar, the joystick will move or rotate the View's Camera.

If you deselect the Manipulate View's Camera icon the joystick will move or rotate the Active Item if the Active Item is something that can be moved or rotated.

Close Window

Select the Close Window command to close the currently selected window. The keyboard shortcut key for this command is Ctrl-F4.

Icon Toolbar

At the top of the screen is the Icon Toolbar. It has four sections:

- **Task Mode Icons**
- **Window Icons**
- **Interactive Icons**
- **Vector Icons**

Task Mode Icons

VNS lets you work in Free Form Mode or any of eight Task Modes. In Free Form Mode VNS will not attempt to hide any of the tools that you see. This gives you access to everything but can sometimes feel cluttered or difficult to manage.

To make it easier to concentrate on specific tasks, VNS lets you use eight Task Modes. This works two ways:

- 1) **Task Modes filter the Scene-At-A-Glance to show only those items which relate to a particular task.**
- 2) **Task Modes can determine what you see in The Matrix.**

To select Free Form Mode, deselect all Task Mode icons. In Free-Form mode VNS will show all of the Project's items in the Scene-At-A-Glance and the Matrix will show all open Editors. To enter a Task Mode, select one of the Task Mode icons. There are eight Task Mode icons:

-  **Terrain Task Mode**
-  **Land Cover Task Mode**
-  **Water Task Mode**
-  **Sky Task Mode**
-  **Light Task Mode**
-  **3D Object Task Mode**
-  **Vector Task Mode**
-  **Render Task Mode**

Each Task Mode lets you work with a subset of the program. This lets you concentrate on specific tasks with less clutter and distraction.

Terrain Task Mode

Use the Terrain Task Mode when you want to work with the project's terrain data. The Scene-At-A-Glance will show you items that let you create and modify the terrain itself.

Click the Terrain Task Mode icon to show the following items in the Scene-At-A-Glance:

-  **Area Terraffectors (See Area Terraffector Editor)**
-  **Control Points (See Database Editor & Vector Editor)**
-  **Coordinate Systems (See Coordinate System Editor)**
-  **DEM Mergers (See DEM Merger & DEM Merger Wizard)**
-  **DEMs (See DEM Editor & DEM Painter Window)**
-  **Layers (See Database Editor)**
-  **Planet Options (See Planet Options Editor)**
-  **Terraffectors (See Terraffector Editor)**
-  **Terrain Generators (See Terrain Generator)**
-  **Terrain Gridders (See Terrain Gridder Editor & Terrain Gridder Wizard)**
-  **Terrain Parameters (See Terrain Parameter Editor)**

Land Cover Task Mode

Use the Land Cover Task Mode when you want to work with foliage and texturing applied to the terrain. The Scene-At-A-Glance will show you items that let you apply and modify foliage and texturing.

Click the Land Cover Task Mode icon to show the following items in the Scene-At-A-Glance:

-  **Color Maps (See Color Map Editor)**
-  **Ecosystems (See Ecosystem Editor)**
-  **Environments (See Environment Editor)**
-  **Foliage Effects (See Foliage Effect Editor)**
-  **Ground Effects (See Ground Effect Editor)**
-  **Image Objects (See Image Object Library)**
-  **Snow Effects (See Snow Effect Editor)**
-  **Thematic Maps (See Thematic Map Editor)**

Water Task Mode

Use the Water Task Mode when you want to work with water applied to the terrain. The Scene-At-A-Glance will show you items that let you apply and modify oceans lakes and streams.

Click the Water Task Mode icon to show the following items in the Scene-At-A-Glance:

-  **Lakes (See Lake Editor)**
-  **Streams (See Stream Editor)**
-  **Wave Models (See Wave Model Editor)**

Sky Task Mode

Use the Sky Task Mode when you want to work with the air, sky and surrounding space. The Scene-At-A-Glance will show you items that let you apply and modify properties of the atmosphere, the look of the Sky, Celestial Objects and Starfields.

Click the Sky Task Mode icon to show the following items in the Scene-At-A-Glance:

-  **Atmospheres (See Atmosphere Editor)**
-  **Celestial Objects (See Celestial Object Editor)**
-  **Clouds (See Cloud Model Editor)**
-  **Skies (See Sky Editor)**
-  **Starfields (See Starfield Editor)**

Light Task Mode

Use the Light Task Mode when you want to work with the lighting applied to the scene. The Scene-At-A-Glance will show you items that let you apply and modify lights and shadows.

Click the Light Task Mode icon to show the following items in the Scene-At-A-Glance:

-  **Lights (See Light Editor)**
-  **Shadows (See Shadow Editor)**

3D Object Task Mode

Use the 3D Object Task Mode when you want to work with imported 3D objects and vector-extruded Walls. The Scene-At-A-Glance will show you items that let you import and modify 3D objects such as buildings, bridges, vehicles and foliage.

Note: You can also import 3D objects to use within Ecosystems and Foliage Effects. Controls to do so are in the Ecosystem Editor and Foliage Effect Editor, which are visible in the Land Cover or Free Form modes.

Click the 3D Object Task Mode icon to show the following items in the Scene-At-A-Glance:

-  **3D Object Materials (See 3D Material Editor)**
-  **3D Objects (See 3D Object Editor)**
-  **Walls (See Wall Editor)**

Vector Task Mode

Use the Vector Task Mode when you want to work with all the Vectors in your Project. The Scene-At-A-Glance will show you the Vectors. You can use Vectors as rendered lines on the terrain or as invisible anchors and boundaries that let you control the placement of Components such as Terraffectors, Area Terraffectors, Ecosystems, Foliage, Cloud Models, Lakes, Streams, and Shadowed areas.

Note: You can also see any vectors controlling the placement of Components by clicking the plus symbol next to any Component in the Scene-At-A-Glance.

Click the Vector Task Mode icon to show the following item in the Scene-At-A-Glance:

-  **Coordinate Systems (See Coordinate System Editor)**
-  **Layers (See Database Editor)**
-  **Search Queries (See Search Query Editor)**
-  **Vectors (See Vector Editor)**

Render Task Mode

Use the Render Task Mode when you want to work with items that control what will be rendered. The Scene-At-A-Glance will show you items that let you apply and modify Cameras, Render Options and Render Jobs.

To render a picture or animation, you need at least one Render Job with a Camera and a set of Render Options. VNS automatically creates a Render Job with an attached Camera and set of Render Options when you create a new Project.

Click the Render Task Mode icon to show the following items in the Scene-At-A-Glance:

-  **Cameras (See Camera Editor)**
-  **Post Processes (See Post Process Editor)**
-  **Render Jobs (See Render Job Editor)**
-  **Render Options (See Render Options Editor)**
-  **Render Scenarios (See Render Scenario Editor)**
-  **Scene Exporters (See Scene Exporter Editor)**

Window Icons

There are five Window icons:

-  **Preferences**
-  **Database Editor**
-  **Image Object Library**
-  **Import Wizard**
-  **Render Control**

Click an icon to open its associated window.

Preferences

Click the Preferences icon to open the Preferences Window. The Preferences Window lets you see and manage all the settings central to the use of the program. These include Matrix Layouts, Project-specific Preferences, Path and Unit settings and Advanced Config Options.

Database Editor

Click the Database Editor icon to open the Database Editor. The Database Editor lets you see and manage all the DEMs, Vectors or Control Points used by your Project.

DEM^s are files which VNS uses to create the shape of the terrain.

Vectors are positions, anything from a single point to a complex series of points connected by line segments. You can use Vectors to indicate the location of things like roads, streams, lakes and political boundaries.

By attaching Components to Vectors, you can use Vectors to position a single tree, a row of trees, a realistic road, an area containing an Ecosystem, an area digging out a lake bed, and much more.

Control Points are collections of points. They are primarily useful for importing into VNS and gridding into terrain.

Image Object Library

Click the Image Object Library icon to open the Image Object Library. The Image Object Library lets you see and manage all the images and image sequences, called "Image Objects," in your Project.

You can use Image Objects as foliage, Celestial Objects, 3D object textures and terrain textures.

Import Wizard

Click the Import Wizard icon to open the Import Wizard. The Import Wizard will load DEM, Vector and Control Point data into VNS.

The Import Wizard will take you step-by-step through the loading process. It will automatically attempt to identify the file format of any supported data file and help you successfully import it into your Project.

Render Control

Click the Render Control icon to open the Render Control Window. The Render Control Window lets you render finished images and image sequences.

Interactive Icons

The Interactive icons let you interact with Cameras, the Active Item, Vectors and Control Points in the View windows.

VNS gives you the following Interactive icons:

-  **Move Mode Icon**
-  **Rotate Mode Icon**
-  **Scale/Zoom Mode Icon**
-  **Enable X, Y and Z**
-  **Enable Heading, Pitch and Bank**
-  **Enable Elevation Axis**

Move Mode Icon

Select the Move Mode icon when you want to move a View's Camera or the Active Item.

When the Spacebar is held down, you can move the Views Camera by dragging the mouse in the View, otherwise you can move the Active Item.

Note: You can alt-click an item in a View to make it the Active Item. You can also select the Active Item in the Scene-At-A-Glance or by changing the value for the item in an Editor.

Drag the mouse in the View and VNS will move the Camera or Active Item. You can drag with the left and right mouse buttons. Movement will behave with the interactive style you set on the Interaction page of the Preferences Window. VNS will let you move the item along the enabled axes. You can enable and disable axes with the Enable X, Enable Y and Enable Z icons.

Rotate Mode Icon

Select the Rotate Mode icon when you want to rotate a View's Camera or the Active Item.

When the Spacebar is held down, you can rotate the Views Camera by dragging the mouse in the View, otherwise you can rotate the Active Item.

Note: You can alt-click an item in a View to make it the Active Item. You can also select the Active Item in the Scene-At-A-Glance or by changing the value for the item in an Editor.

Drag the mouse in the View and VNS will rotate the Camera or Active Item. The left mouse button lets you change heading and pitch. The right mouse button lets you control banking. VNS will let you rotate the item around the enabled axes. You can enable and disable axes with the Enable Heading, Enable Pitch and Enable Bearing (bank) icons.

Scale/Zoom Mode Icon

Select the Scale/Zoom Mode icon when you want to zoom a View's Camera or scale the Active Item.

When the Spacebar is held down, you can zoom the Views Camera by dragging the mouse in the View, otherwise you can scale the Active Item.

Note: You can alt-click an item in a View to make it the Active Item. You can also select the Active Item in the Scene-At-A-Glance or by changing the value for the item in an Editor.

Drag the mouse in the View and VNS will zoom or the scale Active Item. You can zoom a Camera by dragging forward or back with the left mouse button. If your mouse is suitably equipped, you can also use the scroll wheel to zoom in a view.

You can scale an item with the left and right mouse buttons. The left mouse button generally lets you scale width and length. The right mouse button generally lets you scale height.

Note: Not all items can be scaled. Items that can be scaled include 3D Objects, Celestial Objects, Vectors, Control Points, and Cloud Models.

VNS will let you scale the Active Item along the enabled axes. You can enable and disable axes with the Enable X, Enable Y and Enable Z icons.

X Y Z Enable X, Y and Z

You can enable and disable axes with the Enable X, Enable Y and Enable Z icons.

When you select the Move icon, VNS will let you move the Camera or Active Item along the enabled axes. Movement will behave with the interactive style you set on the Interaction page of the Preferences Window.

When you select the Scale/Zoom icon, VNS will let you scale the Active Item along the enabled axes.

H P B Enable Heading, Pitch and Bank

You can enable and disable axes with the Enable Heading, Enable Pitch and Enable Bank icons.

When you select the Rotate icon, VNS will let you rotate the Active Item around the enabled axes.

↑ Enable Elevation Axis

The Enable Elevation Axis icon only matters when you select the “Move Relative to Camera Image Plane” interactive style on the Interaction page of the Preferences Window.

Select the Enable Elevation Axis icon to allow elevation changes in the Camera or Active Item when you move them interactively.

Vector Icons

The Create icons let you Create& Edit Vectors, and measure within the View windows.

VNS gives you the following Vector icons:

-  **Select>Show Points**
-  **Create**
-  **Replace Vector or Control Points**
-  **Append Vector or Control Points**
-  **Delete Vector or Control Points**
-  **Undo Last Vector Edit**
-  **Measure Distance**

Select>Show Points

When the Active Item is a Vector, select the Select>Show Points icon to show all the vertices in the Vector. You can then interactively edit any vertex or group of vertices. By selecting the Move, Rotate or Scale/Zoom icons you can then move, rotate or scale the selected vertices by dragging in a View.

You can click any vertex to select it and deselect all other vertices. You can Shift-click to select or deselect vertices in the Vector without deselecting other vertices.

Deselect the Select>Show Points icon when you want to interactively edit the entire Vector. By selecting the Move, Rotate or Scale/Zoom icons you can then move, rotate or scale the entire Vector by dragging in a View.

Create

Click the Create icon when you want to create a new Vector or a new Component and an attached Vector in one step. VNS will open the Create Palette Window ready to create a new item based on the Active Item.

This works when the Active Item is a Vector or is a Component that can be attached to a Vector. In the latter case, after you digitize the Vector VNS will automatically create and attach a Component of the same type to the Vector.

Replace Vector or Control Points

Click the Replace Vector or Control Points icon when you want to re-digitize an existing Vector or set of Control Points. VNS will open the Create Palette set up to re-digitize the Active Item.

This icon is only available if you first select an existing Vector or set of Control Points.

Append Vector or Control Points

Click the Append Vector or Control Points icon when you want to add more vertices to the end of an existing Vector or set of Control Points. VNS will open the Create Palette set up to re-digitize the Active Item.

This icon is only available if you first select an existing Vector or set of Control Points.

Delete Vector or Control Points

Click the Delete Vector or Control Points icon when you want to delete an existing Vector or set of Control Points. VNS will delete the Vector or set of Control Points.

This icon is only available if you first select an existing Vector or set of Control Points.

Undo Last Vector Edit

Click the Undo Last Vector Edit icon if you want to throw away your last Vector or Control Points edit.

Measure Distance

The Measure Distance icon lets you measure a distance between two points.

To do so, click the Measure Distance icon. Then click twice in any View.

VNS will open a dialog with the linear and great circle distances between the points you clicked. Linear distances do not take the curvature of the earth into account. Great circle distances include the curvature of the earth.

Click the OK button to close the dialog window.

Animation Toolbar

The Animation toolbar puts all the Animation controls in one convenient place at the bottom of the screen

Key Frame Group Toggle Icon

Select the Key Frame Group Toggle icon when you want VNS to key frame members of a group together.

Some of the Interactive Objects have multiple key-fivable Parameters. For example, the Camera and target each have three separately key-fivable channels: Latitude, Longitude and Altitude.

Sometimes you may want to create a key frame for all channels at the same time. VNS lets you do this by enabling Group Mode. Select the Key frame Group Toggle icon to enable Group Mode. Deselect it to disable Group Mode.

When you enable Group Mode and create or update a key frame for an Interactive Object with multiple Parameters, VNS will automatically create or update a key frame for each of them.

Disable Group Mode when you want to create or update a key frame for just one Parameter in a group. An example would be if you want to key frame Camera Altitude without affecting Camera Longitude or Camera Latitude.

Add Key Frame Icon

Click the Add Key Frame(s) icon to create a key frame at the current frame for the Active Item. If Group Mode is enabled (see above) and the parameter is a member of a group, all the parameters in the group will get a key frame at the current frame. Clicking this icon will open a requester allowing you to enter a time different to the current time, if you should wish to create a key at another point with the current settings.

Note: By default, keyframes are created using the currently selected Time units on the Units page of the Preferences Window (either Seconds or Frames). Keyframes can be added the other unit to that selected (ie: Frames if Seconds is selected, or Seconds if Frames is selected), by appending an f or s after the keyframe number.

Example: Your Time Unit preferences are set to Seconds. You wish to create a key at frame 13. In the add key requester that appears after clicking the add keyframe icon, you would enter 13f. VNS will then automatically convert that setting to the currently selected units and add a key at that point.

Remove Key Frame Icon

Click the Remove Key Frame(s) icon to open the Scale/Delete Key Frames Window. There you can delete any combination of key frames for the Active Item.

Scale Key Frames Icon

Click the Scale Key Frames icon to open the Scale/Delete Key Frames Window. There you can change the values of multiple key frames in one step.

Open TimeLine for Active Item Icon

Click the Open TimeLine for Active Item icon to open a Timeline Editor for the Active Item. There you can edit the key frames for the Active Item in graph form. You can also visually add or delete key frames there.

Go To Previous Key Frame Icon

Click the Go To Previous Key Frame icon to go to the previous key frame for the Active Item.

Current Time Field

The Current Time field is useful if you are creating an animation. It shows the current time of your animation. It also lets you change the time. All of the VNS Edit and View windows display information and imagery which reflect the parameters for the Current Time.

The time is displayed in either seconds or frames. You can specify the units on the Units page of the Preferences Window, from the Time drop box.

You can type a new time into the Current Time field and hit the Enter key to go to a different time in your animation. If you type a number, VNS will interpret that in the selected units. If you type a number and specify the units VNS will calculate that into the selected units.

For example, if you have specified seconds, you can type a number plus an "f" and hit enter. VNS will then go to that frame and display what that frame number would be in seconds. If you have specified frames as the time units, you can type a number plus an "s" and hit enter. VNS will then go to that time and display the frame that appears at that time.

Note: The frame number may include decimals to hit the exact time.

When you drag the Time Slider to select a different frame, the Current Time field will change to reflect the new time you choose.

Time Increment Icons

These icons allow you to step through the timeline in increments of 1 frame. The Current Time Field will update accordingly in the units chosen on the Units page of the Preferences Window.

Go To Next Key Frame Icon

Click the Go To Next Key Frame icon to go to the next key frame for the Current Parameter.

Active Item Display and Progress Display

The next area of the Animation Toolbar is the Active Item display and Progress display. It shows either the Active Item or a Progress display when VNS is calculating something.

Active Item Display

Whenever you select an item in the Scene-At-A-Glance or in a View, or change a parameter in an Editor, the item will become the Active Item in the Animation Toolbar.

VNS lets you manipulate the Active Item in Views if the item is an interactive object. If the Active Item is animatable, VNS lets you create a key frame for the item using the controls in the Animation Toolbar.

You can select items by clicking them in the Scene-At-A-Glance. You can select items interactively by alt-clicking an item in one of the Views. You can select a View's Camera as the Active Item by selecting the Manipulate View's Camera icon and making the View the active window. You can also select items by changing a parameter in one of the Editors.

Note: To prevent the Active Item from changing, select the Lock Active Item icon to the right of the Active Item display (see below).

For example you can click and drag the Camera in a View and a member of the Camera Group will become the Active Item. You can immediately click the Create Key Frame icon to create a key frame for the new Camera position. In this example, VNS will make a key frame either for the Camera parameter that is the Active Item or for all Camera Group members, depending on the state of the Key Frame Group Toggle icon (see above).

Progress Display

When VNS is calculating an operation, you will see a description of the operation and a progress bar. When the progress bar reaches the right edge of the display area the operation is finished.



Lock Active Item Icon

Normally VNS will change the Active Item to reflect what you are doing (see Active Item Display above). To prevent the Active Item from changing, select the Lock Active Item icon. This is useful when you know you want to manipulate a particular item no matter what else you may be doing in VNS.

Make sure you deselect the Lock Active Item icon when you are finished with the item. Then the Active Item can once again change to reflect what you are doing in VNS.



Status Log Icon & Message Area

Use the Status Log icon to pop up the Status Log. This is the same as selecting the Status Log command in the View menu. You can also use the keyboard shortcut: Alt+G.

The Status Log shows you messages about recent VNS activity. You can see when files have been loaded or saved, watch what VNS is doing as it renders, and see error messages if something should go wrong.

The Message Area to the right of the Status Log icon shows the last Status Log message.

Clear Status Log Icon

This icon can be found on the upper left of the Status Log message area when open. Use the Clear Log Icon allows you to clear all stored messages from the log.

Time Slider

Drag the Time slider to move to a different time in your animation.

You can also click the arrow icon on the left to rewind and the arrow icon on the right to fast forward through the animation.

The Current Time field will always show you where you are in the animation.

Play Animation Icon

The Play Animation icon is to the right of the Time Slider. Select the Play Animation icon to start playback of your animation in all open Views.

Click it and VNS will play back a preview of your animation in all open Views using the current Realtime settings.

Depending upon the complexity of your scene, playback may skip frames to try and achieve the playback speed selected on the Project page of the Preferences Window. If you require smoother or more accurate playback, reduce the max polygons setting in the View Preferences Window, and consider changing the display mode of 3D Objects and realtime foliage.

Deselect the Play Animation icon to stop playback.

Scene-At-A-Glance

The Scene-At-A-Glance (hereafter sometimes abbreviated to S@G) lets you see and interact with all the Components and parameters in your scene. It includes:

- **Upper and Lower Lists**
- **Control Icons**
- **Display Icons**

Note: The Scene-At-A-Glance also responds to the current Task mode. You can select a Task mode using the Task mode icons in the Icon Toolbar.

Lists

The Scene-At-A-Glance includes two list sections, an upper list and a lower list. The lists show Components and parameters as items and sub-items.

You can drag and drop one item onto another item to copy parameters. Having two lists makes it easy to drag and drop items that may be far apart from each other in a single list.

Any item in the list that has sub-items will have a plus sign next to it in the list. Click the plus sign to expand the list and show the sub-items. Sub-items with a plus sign have further sub-items. Click the plus sign to further expand the list.

When an item is expanded to show sub-items there will be a minus sign next to it. You can click the minus sign to collapse the list and hide the sub-items.

Double click an item in the list to edit it. VNS will open the appropriate editor.

To enable, disable, add, clone or remove an item, select the item and use the appropriate Control Icons or Matrix Popup Menus for the item.

Upper List

The upper list shows the items which belong to the selected Task Mode (see Icon Toolbar).

To make your scene easier to work with you can restrict what you see in the upper list. You can do so by selecting a Task mode icon, and by choosing Show Icons (see below). If no Task Mode or Show icon is selected, you will see all the items in the Project.

Lower List

The lower list is not affected by Task modes or Show Icons. It always lets you see all the items in your project.

Having a second view makes it easier to drag and drop items which are far apart in the list.

Vectors and Components

The Scene-At-A-Glance shows any controlling Vectors as sub-items of the Component they control. This makes it easy to see and select any Vector Object(s) in the list that are being used to apply a particular Component.

The Scene-At-A-Glance also shows any Components as sub-items of the Vectors controlling them. This makes it easy to see and select any the Host Components applied by a particular vector.

For example, if your project uses a single Area Terraffector to create sandtraps in a golf course, and you apply that Component with a dozen different Vectors to create a dozen different sandtraps, each of those Vectors will be listed under the name of the sandtrap Area Terraffector in the Area Terraffectors section of the Scene-At-A-Glance.

In this example you would also see the name of the sandtrap Terraffector listed under each Vector in the Vectors section of the Scene-At-A-Glance, along with any other Component each Vector controls.

Note: You can also see Vector-Component relationships in the Component Library and Database Editor.

Mouse Controls

Vertically Resizing the Lists

Drag the divider up or down between the lists to expand one list and shrink the other.

Double-click the divider between the lists to expand the top list hide the bottom list. The divider will still be at the bottom of the top list. Double-click it again to return the divider to its former position.

Selecting an Item

Click an item in the list to select it. Then you can use the Control icons above the Scene-At-A-Glance to enable, disable, add/clone or remove the item, respectively (see below).

Expanding a Category

Click a Plus (+) symbol to expand an item in the list. This lets you see any sub-items of the selected item.

Sub-items can be Components within a category of Components; parameters for a Component; Components attached to a Vector; or Vectors attached to a Component.

Double-clicking

Double-click an item in the list to open the appropriate Editor for that item.

Drag and Drop

Drag and drop is the process of clicking on one item and holding down the mouse button, then dragging the item over another item and letting up on the mouse button. You can drag items within either list or between the upper and lower lists in the Scene-At-A-Glance.

Drag and drop lets you copy parameter values between like items, or attach one item to another.

To copy parameter values, drag one item in the list onto the same type of item elsewhere in the list. VNS will copy the source item's parameters to the destination item. This works with items of the same type; for example, from one Ecosystem to another.

To attach one item to another, drop one item onto another item of a different type.

For example you can drag a Wave Model onto a Lake and VNS will attach the Wave Model to the Lake. If you drag a Wave Model onto another Wave Model, VNS will copy the parameters from the source Wave Model to the destination Wave Model.

If the source item can be a member of the destination item, as with waves for lakes, you can drag and drop the item and VNS will do the appropriate thing. If VNS can't figure out what you want, VNS will put up a dialog asking for clarification.

If there is too much ambiguity about your intentions or if the selected source item can't be copied to the destination item, the cursor will become a slash to indicate you can't drop the source item over a particular destination item.

Scene-At-A-Glance Popup Menus

Right-click an item to see appropriate popup menu commands for the item. Possible commands include:

- **Enable**
- **Disable**
- **Edit**
- **Create Vector or Path**
- **Edit Numeric**
- **Add**
- **Clone**
- **Copy**
- **Paste**
- **Add Component from Gallery**
- **Load Component from File**
- **Sign and Save Component**
- **Delete**

If you click on a category, the command may apply to all members of the category. If you click on an individual item the command may apply only to that item. Don't worry, the wording of the actual commands when you right-click makes this very clear.

Note: The Scene-At-A-Glance popup menus are there for convenience. You can accomplish the same operations by using the icons above the Scene-At-A-Glance to enable, disable, add, clone and delete; double-clicking items to open their editors; dragging and dropping items to copy parameters between them; using the icons on the right side of editor windows to load and save Components; and using the data menu's Numeric Entry command to edit a specific Parameter numerically.

Control Icons

Enable Icon

The Enable icon lets you turn on disabled items so they will render. Select an item in the upper or lower list. Then click the Enable icon to turn on the item. Enabled items will render.

This works for individual items or all members of an item category depending on what you have selected in the S@G. If you have selected an entire category of items in the S@G, VNS will enable all members of the category. If you have selected a single item VNS will enable that item.

Note: You have further control over what will and will not render using the Render Options Editor (see Render Options Editor).

Disable Icon

Click the Disable icon to turn off the currently selected item in the S@G. Disabled items will not render.

This works for individual effects and all members of an item category depending on what you have selected in the S@G. If you have selected an entire category of items in the S@G, VNS will disable all members of the category. If you have selected a single item VNS will disable that item.

Note: You have further control over what will and will not render using the Render Options Editor.

Add or Clone Selected Item icon

The Add or Clone Selected Item icon works differently depending on what item is selected.

If you've selected a category heading, VNS will create a new member of that category with all values set to default values.

If you've selected an existing member of a category, VNS will create a clone of that member and add a number after the name. If there's already a number at the end of the name, VNS will increment the number.

Remove icon

Click the Remove icon to remove the selected item from the list.

Expand Scene-At-A-Glance Icon

Click the Expand Scene-At-A-Glance icon to make the Scene-At-A-Glance wider by overlapping the Matrix area (see The Matrix).

Click it again to shrink the Scene-At-A-Glance to its normal size.

You can drag the right edge of the Scene-At-A-Glance with the mouse. VNS will remember the size you last dragged and the Expand Scene-At-A-Glance icon will alternate between that size and the normal size.

Display Icons

The Show icons let you filter the list based on items that are enabled or animated.

Note: You can select these in any combination. For example if you want to see only enabled items that are animated you can select the Show Only Enabled Items and Show Only Animated Items icons together.

Show Only Enabled Items

Select the Show Only Enabled Items icon to filter all items in the list which are not enabled.

Note: You can enable and disable items with the Enable and Disable icons (see above).

You can combine this with any Task Mode (see above) to show only the enabled items which are part of the Task Mode.

Show Only Animated Items

Select the Show Only Animated Items icon to filter all items in the list which are not animated.

Note: You can animate an item's parameters by adding key frames.

You can combine this with any Task Mode (see above) to show only the animated items which are part of the Task Mode.

The Matrix

What is the Matrix?

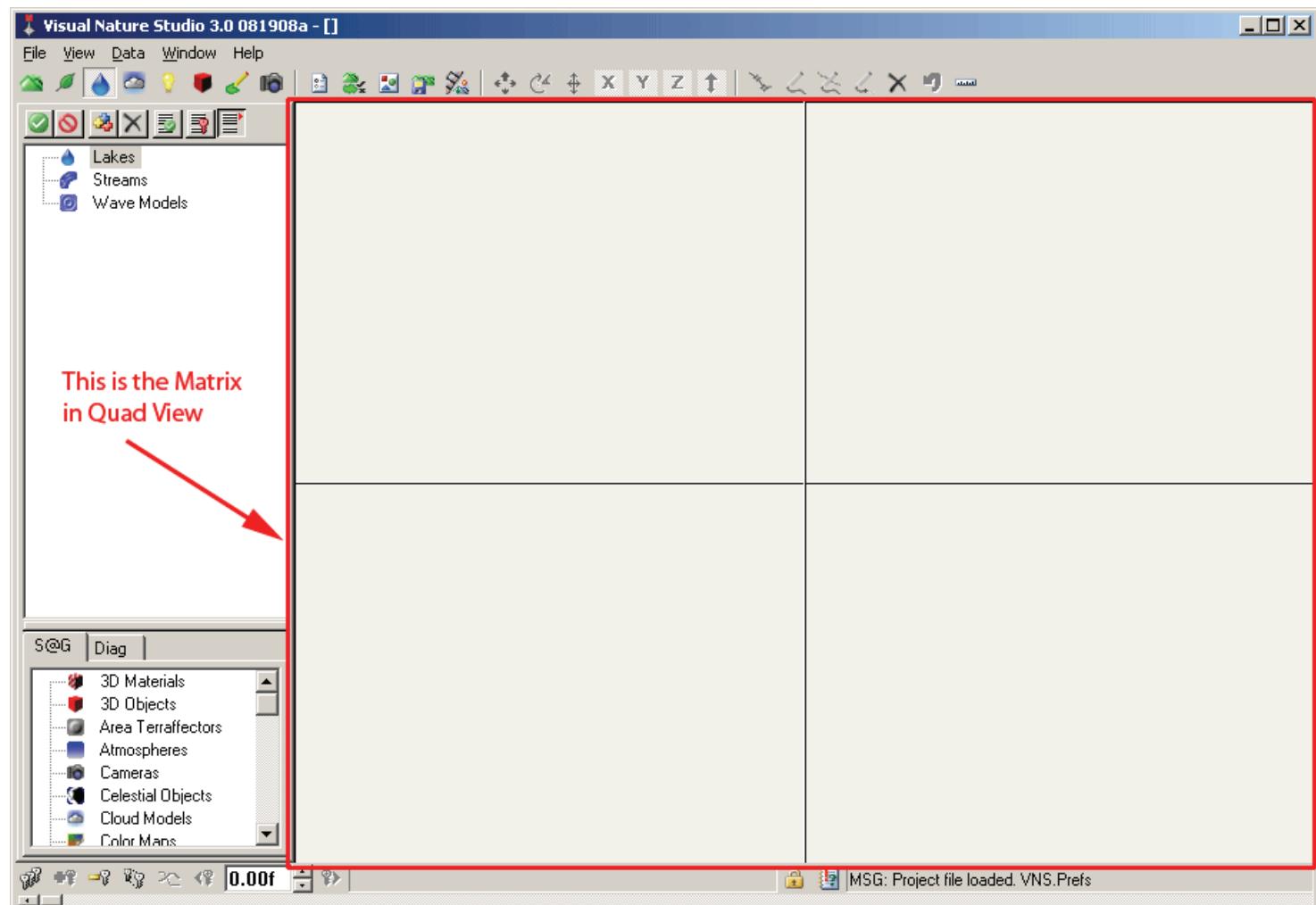
The VNS Matrix takes up most of the screen. It sits to the right of the Scene-At-A-Glance.

The Matrix organizes your work space into cells. You can choose the number and arrangement of cells from the Matrix page of the Preferences Window or the Layout sub-menu in the Windows menu (see Window Menu).

You can have combinations of Views, Editors and other windows within the Matrix. You can dock Editors or Views to attach them to the Matrix or undock them to allow them to float freely. They are docked by default.

Views can appear in cells of any shape or size. Editors are all the same size and will only dock into cells that are as large or larger than they are.

Other windows are of varying sizes and will normally not be docked. You can dock them if you wish. They will only dock into cells that are as large or larger than they are.



You can have more than one Editor in a cell. To switch between stacked Editors, click the "View Next Window in Stack" icon in an Editor window, or select the Cycle command from the Matrix Popup Menus.

Views

Views let you see what a Camera sees. You can set up Cameras to show perspective and overhead views, with or without a target.

Views give you fully shaded "real-time" OpenGL interaction with your scene for fast feedback as you work. OpenGL can even show Vectors, Lights, Cameras, 3D Objects, Wave Sources, Cloud Models, Sky, the effects of lighting and haze; and display Ecosystem distributions, contours, slope, relative elevation, Fractal Depth and several elevation-related shadings.

You can control what each View displays with the commands in the Matrix Popup Menus and View Preferences Window. You can access the Matrix popup menus by right-clicking the title bar of a View.

Each View is associated with a Camera (see Camera Editor). A View always shows you what a VNS Camera sees. You can use any Camera type to create perspective, overhead or planimetric Views.

You can create multiple Cameras. Any View can show the output of any Camera. You can have multiple Views open in the Matrix at the same time. You can do interactive operations, such as creating and editing Vectors, across multiple views.

You can render preview images directly into a View. You can do final rendering with any Camera by including it in a Render Job.

By default Views live in cells of the Matrix. These cells can be any size. Alternatively, you can undock Views to float above the Matrix and resize them to whatever size you wish.

View Icons

The View icons let you interact with Views and their Cameras. You can move, rotate and zoom the View's camera, or return it to a default position, zoom within a specified area, zoom way out to see Lights and Celestial Objects, toggle between the last two zoom positions, start or dismiss a preview render, and dock the view.

VNS gives you the following View icons, which are present in the title bar of every opened view:

-  **Move The View**
-  **Rotate The View**
-  **Zoom The View**
-  **Default Camera Position (Floating)**
-  **Zoom Box**
-  **Zoom Way Out**
-  **Restore Zoom**
-  **Perform (F9)/Dismiss (F8) Preview Render**
-  **Toggle Constrained Render (F5)**
-  **Toggle Dock**

Move The View

With this icon selected, drag the mouse in the View and VNS will move the Camera associated with that view. You can drag with the left and right mouse buttons.

Dragging with the left mouse button pressed will move the camera in the horizontal plane (X & Y), and dragging with the right mouse button pressed will move the camera in the vertical plane (Z). Movement will behave with the interactive style you set on the Interaction page of the Preferences Window.

VNS will let you move the item along the enabled axes. You can enable and disable axes with the Enable X, Enable Y and Enable Z icons.

Rotate The View

With this icon selected, drag the mouse in the View and VNS will rotate the Camera associated with that view. You can drag with the left and right mouse buttons.

Dragging with the left mouse button pressed will rotate the camera in Heading and Pitch, and dragging with the right mouse button pressed will rotate the camera in Bank.

VNS will let you rotate the item along the enabled axes. You can enable and disable axes with the Enable H, Enable P and Enable B icons.

Zoom The View

With this icon selected, drag the mouse in the View and VNS will zoom the Camera associated with that view. You can drag with the left mouse button only.

Dragging down will zoom out, and dragging up will zoom in.

For Planimetric Cameras, zooming changes the View Width. For all other Camera types, zooming changes the Horizontal Field of View.

Note: You can perform the above three tasks interactively by pressing and holding the space bar, and using the Move, Rotate and Zoom icons on the toolbar to choose the mode in which you want to interact with the camera. While the spacebar is held down, all movement, rotating and zooming performed in that view will be applied to the view's camera, not to the currently selected active item.

Default Camera Position (Floating)

Click the Default Camera Position icon to cause the View's Camera to "float." This is great for putting a Camera into a starting position where it can see the terrain.

Note: This is the same as selecting the Floating checkbox on the General page of the Camera Editor.

You can also make a Camera float by clicking the "Default Camera Position (Floating)" icon in the Icon Toolbar.

Note: As soon as you change the Camera's position in any way, VNS will deselect the Floating checkbox automatically.

When you click the Default Camera Positioning icon, VNS will position the Camera where it can see the terrain. If you add more terrain, the Camera will move to keep the terrain in view.

Making a Camera float will delete any key frames the Camera may have. If the Camera has key frames, VNS will ask you before deleting the key frames and floating the Camera.

Zoom Box

The Zoom Box icon lets you zoom into a specified area of a View. Click the Zoom Box icon, and then click twice in a View to specify the corners of the area you want to see. VNS will create a yellow box after the first click so you can see the area the zoom will include. When you click the second time VNS will adjust the View's Camera to show the new area.

For Planimetric Cameras, zooming changes the View Width. For all other Camera types, zooming changes the Horizontal Field of View.

Zoom Way Out

The Zoom Way Out icon lets you zoom the selected View so you can see the entire planet.

Note: If you have data for only a small part of the planet there may be very little to see when you zoom way out.

For a View with Planimetric Camera, zooming way out lets you see Lights and Celestial Objects and easily position them above a different part of the planet than you are actually rendering.

For Planimetric Cameras, zooming changes the View Width. For all other Camera types, zooming changes the Horizontal Field of View.

Restore Zoom

Click the Restore Zoom icon to switch to the previous zoom level for the selected View. This makes it easy to toggle between several zoom levels. For example, you can click the Zoom Way Out icon (see above) to adjust a light, and then click the Restore Zoom icon to return to a closer zoom level.

For Planimetric Cameras, zooming changes the View Width. For all other Camera types, zooming changes the Horizontal Field of View.

If you select a rendered preview and click the restore zoom button, VNS will restore the View to the zoom conditions you used when you created the preview.

Perform (F9)/Dismiss (F8) Preview Render

Click the View/Refresh Realtime icon lets you accomplish one of two things depending on the state of the selected View:

If the View is showing an OpenGL realtime preview, click the Perform/Dismiss Preview Render icon to tell VNS to create a Preview Rendering within the selected View. VNS will include the Components enabled in the View's Preview Render Options.

Note: This is the same as selecting the "Render a Preview" command (F9) in the Matrix Popup Menus.

If the View is showing a preview render, you can click the Perform/Dismiss Render icon to let the View show an OpenGL realtime preview again.

VNS will give you the choice of keeping the rendered buffers around or deleting them. If you keep them around you can switch back to the preview rendering by selecting the Show Preview command in the Matrix popup menus (F8). If you delete the buffers you will save memory.

Toggle Constrained Render (F5)

The Constrain Render icon lets you tell VNS to use a smaller region in a View when rendering a preview. Select the Constrain Render icon and VNS will ask you to set a Constrain Render region.

Click twice in any View to set the region, which VNS will show as an outlined area.

Deselect the Constrain Render icon to turn off constrained rendering and allow the entire View to show a preview rendering.

Note: You can also enable and disable constrained rendering using the Constrain Render Area and Set Render Area commands in the Render Options submenu, which is in the Matrix popup menus. The keyboard shortcuts are F4 and F5, respectively.

Toggle Dock

The Toggle Dock Icon forces VNS to lock the current view to a Matrix Cell. Deselect this icon if you want the current view to float and be resizable.

Editors

Editors let you change parameter values. All Editors are the same size. By default, they open in the Matrix. VNS provides you with the following Editors:

3D Material Editor	Foliage Effect Editor	Scene Exporter Editor**
3D Object Editor	Foliage Effect Editor - Forestry Edition**	Shadow Editor
Area Terraffector Editor	Ground Effect Editor	Sky Editor
Atmosphere Editor	Label Editor	Snow Effect Editor
Camera Editor	Lake Editor	Starfield Editor
Celestial Object Editor	Lake Editor - Forestry Edition**	Stream Editor
Cloud Model Editor	Light Editor	Stream Editor - Forestry Edition**
Color Map Editor	Material Strata Editor	Terraffector Editor
Coordinate System Editor	Planet Options Editor	Terrain Generator
DEM Editor	Post Process Editor	Terrain Gridder Editor
DEM Merger	Render Job Editor	Terrain Parameter Editor
Ecosystem Editor	Render Options Editor	Thematic Map Editor
Ecosystem Editor - Forestry Edition**	Render Scenario Editor	Wall Editor
Environment Editor	Search Queries	Wave Model Editor

* in versions of VNS authorized with the Scene Express add-on

** in versions of VNS authorized with the Forestry Edition add-on

Editors have these things in common:

- **Multiple Pages**
- **Matrix Popup Menus**
- **Title Bar Icons**
- **Common Controls**

Multiple Pages

Editors are organized into multiple pages. You can view each page by selecting its tab at the top of the Editor window.

Each page gives you a logically grouped subset of the Editor's controls.

Matrix Popup Menus

Right-click on the title bar of any Editor window to see the Matrix Popup Menus.

The commands available for Editors are the same as listed previously (see Matrix Popup Menus)

Title Bar Icons

These icons always apply to entire Component. If you see other load buttons within an editor they will apply to a subset of the Component.

Load Component From Disk Icon

The Load Component from Disk icon lets you import pre-built pieces of Projects, such as skies, clouds, ecosystems and more using a standard file requester instead of the Component Gallery. You can use it to import a Component appropriate for the Editor you're in.

For the 3D Object Editor, this icon lets you add a 3D Object to the Project.

Save Component To Disk Icon

Click the Save Component to Disk icon when you want to store what you're editing as a Component.

VNS will open the Component Signature Window. There you can add notes and information about the Component and save it to your hard drive.

You can import Components into your Projects using the Component Gallery.

Previous/Next Icons

You can only have one Editor of a given type open at a time. The Previous and Next arrow icons on each Editor let you cycle through all existing objects or effects that can be edited by that editor.

VNS resets the Editor's Undo state (see below) when you cycle the Editor.

Undo All Changes in this Window Icon

The "Undo All Changes in this Window" icon lets you deliberately throw away all the changes you made since you last opened the Editor. Use this as a way to undo changes when experimenting.

To reset the Undo state, close the window and reopen it. Now you can make new changes in the window, and click the “Undo All Changes in this Window” icon if you decide you don’t want those new changes.

Show Advanced Features Icon

To streamline the interface and reduce immediate complexity in the editors, some editors have certain features hidden by default. Clicking this icon will enable these features and allow you to access every parameter available through the editor interface.

You should find that you have access to most of the required functionality of the program without having to enable this icon. Unless you need a control that is hidden by default, you will leave it disabled to

All screengrabs of editor interfaces in this manual were made with this icon enabled where present.

Toggle Dock Icon

The Toggle Dock Icon forces VNS to lock the current editor to a Matrix Cell. Deselect this icon if you want the current editor to float.

Common Controls

In addition to the icons on the title bars of Editor windows, you’ll see similar controls in different Editors for Animation, Texturing, Thematic Mapping, Strata, Vector Linking and Bump Mapping.

Note: If you hold your mouse above any icon, you’ll see a popup label that tells you what the icon does.

Animation Operations Icon

Any field for a parameter you can animate will have an adjacent Animation Operations icon. Click it to see a menu of Animation Operations commands.

You can choose actions from the command menu such as creating, deleting, graphically editing in the TimeLine Editor, scaling, copying, pasting and selecting the parameter as the Active Item. The icon’s command menu will only show you the commands which are actually available. For example, you won’t see a delete command if key frames have not yet been created for the parameter.

Note: By default, keyframes are created using the currently selected Time units on the Units page of the Preferences Window (either Seconds or Frames). Keyframes can be added the other unit to that selected (ie: Frames if Seconds is selected, or Seconds if Frames is selected), by appending an f or s after the keyframe number.

Example: Your Time Unit preferences are set to Seconds. You wish to create a key at frame 13. In the add key requester that appears after clicking the add keyframe icon, you would enter 13f. VNS will then automatically convert that setting to the currently selected units and add a key at that point.

The icon changes to a green background to indicate that keyframes exist .

Note: You can edit key frames with the Timeline Editor.

Texture Operations Icon

Any field for a parameter you can control with textures will have an adjacent Texture Operations icon. Click it to see a menu of Texture Operations commands.

You can choose actions from the command menu such as creating, enabling, editing, disabling and deleting a texture for the parameter and selecting the parameter as the Active Item. The icon's command menu will only show you the commands which are actually available. For example, you won't see a disable command if a texture has not yet been created for the parameter.

The icon changes to a green background to indicate that a texture exists . If the texture is disabled a circle with a red stripe through it appears .

Note: You can edit a Texture with the Texture Editor.

Thematic Map Operations Icon

Any field for a parameter you can control with a Thematic Map will have an adjacent Thematic Operations icon. Click it to see a menu of Thematic Operations commands.

You can choose actions from the command menu such as creating, enabling, editing, disabling and removing a Thematic Map for the parameter, and selecting the parameter as the Active Item. The icon's command menu will only show you the commands which are actually available. For example, you won't see a disable command if a Thematic Map has not yet been created for the parameter.

The icon colors brighten, and the background changes to green to indicate that a thematic map exists . If the Thematic Map is disabled a circle with a red stripe through it appears .

Note: You can edit a Thematic Map with the Thematic Map Editor.

Strata Operations Icon

Materials that can include Strata will have an adjacent Strata Operations icon. Click it to see a menu of Strata Operations commands.

You can choose actions from the command menu such as creating, enabling, editing, copying, pasting, disabling and removing Strata for the Material, and selecting the Material's Strata as the Active Item. The icon's command menu will only show you the commands which are actually available. For example, you won't see a disable command if Strata has not yet been created for the Material.

The icons change to a yellow background to indicate that Strata exist . If the Strata are disabled a circle with a red stripe through it appears .

Note: You can edit Strata with the Material Strata Editor.

Vector Links Icon

Components that can be attached to vectors will have a Vector Links Icon in their editor. Click it to see a menu of Vector Linkage commands.

You can choose actions from the command menu such as creating a new or selecting an existing Search Query to associate with the component, Edit or Free an attached query, hard-link the component to the vectors selected by a particular query, attach a component to the vectors selected in the database editor, select the linked vectors in the database editor, and enable or disable the linked vectors. The icon's command menu will only show you the commands which are actually available. For example, commands relating to editing search queries will be greyed out unless there is a search query associated with the component.

When the component is attached to a vector via a search query, the icon will turn blue 

When the component is hard-linked to a vector or vectors, the icon will turn green 

When the component is both hard-linked to a vector or vectors and attached using a search query, the icon will be half blue and half green 

You can attach Vectors to Components in a number of different ways:

- **by dragging and dropping vectors onto components, or components onto vectors in the Scene-At-A-Glance**
- **by selecting Vectors in the Database Editor, selecting a component in the Component Library, and clicking the Attach button in the Component Library**
- **by clicking the Vector Links button and selecting Hard Link to Query Vectors button to make Dynamic Links into Hard Links**
- **by selecting Vectors in the Database Editor, and then clicking the Vector Links button and selecting Hard Link to Selected vectors**

For more information on editing vectors, see Vector Editor.

For more information on creating and using Search Queries, see Search Query Editor.

For more information on viewing and selecting vectors in the Database Editor, see Database Editor.

For more information on using the Component Library, see Component Library.

Bump Mapping Controls

Bump mapping lets you simulate detailed relief shadowing without requiring dense geometry. Shadowing is calculated by using textures to vary the apparent surface normal across each polygon. Bump mapping is great for irregular rocky surfaces, mud cracks and much, much more

When looking down on a flat polygon it will appear to have the detail of many more polygons than really exist. When looking at the same polygon on edge it will be obvious that there is no real raised texture on its surface. But for many applications the lack of additional geometry is not obvious, while the additional apparent detail can add a lot to your renderings.

Bump mapping renders much faster than adding dense geometry (additional polygon subdivision by increasing Maximum Fractal Depth) but can create a similar detailed look.

You'll find identical Bump Map controls in the following Component Editors:

- **3D Material Editor, Properties Page, Selected Material Section**
- **Ecosystem Editor, Material Page, Selected Material Section**
- **Ground Effect Editor, Material Page, Selected Material Section**
- **Snow Effect Editor, Material Page, Selected Material Section**
- **Lake Editor and Stream Editor, Beach Page, Selected Material Section**
- **Lake Editor and Stream Editor, Water page, Waves sub-page**

For example, at the bottom of the editor pictured to the right, you can see the Bump Map controls of the Ecosystem Editor, in the Selected Material Ground Overlay section.

Note: There are unique Bump Map controls in the Material Strata Editor.

Using Bump Mapping

To use bump mapping, set the Bump Intensity to a value of 100 percent and click the T icon next to "Bump Map Texture" to open the Texture Editor. Create the texture you want to use.

In the Texture Editor's Values section, low values create areas that appear lower while high values create areas that appear higher. In other words, lighter areas of the bump map texture appear to be higher than the dark areas. The actual height of the polygons is unaltered, but bump mapping creates a useful illusion of displaced detail.

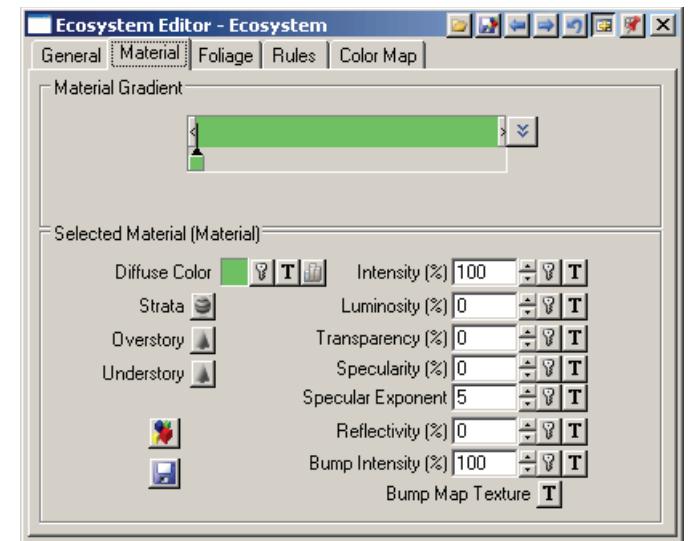
A useful technique is to use the same texture for a Diffuse Color and a Bump Map. That way the detail in the Diffuse Color texture will have matching apparent displacement from the Bump Map.

You can reduce the effect of bump mapping by reducing the Bump Intensity percentage, and increase the effect by increasing the Bump Intensity percentage.

Bump Intensity Percentage Field

The Bump Intensity Percentage field lets you control the amount of bump mapping. 100 percent is full bump mapping and 0 percent is no bump mapping. You can exaggerate the bump mapping by entering a value larger than 100. The allowed values range from -1000% to 1000%. By using negative bump amounts, the values in your texture will be reversed, and where there was the appearance of high areas before, there will now be the appearance of depressions in the surface and vice versa.

You can control the amount of bump mapping with a texture. For example, you can use a Texture with a Dynamic Parameter of Z Distance to fade the Bump Map in the distance where it makes no sense to add detail, so distant bump mapping doesn't needlessly slow down rendering or create distant aliasing artifacts.



Bump Map Texture Controls

The Bump Map Texture Controls give you access to the Texture Editor to create a Bump Map. Click the T icon and select the Create Texture popup command to open the Texture Editor where you can create the texture to use for the Bump Map.

3D Material Editor

The 3D Material Editor lets you change the parameters for any 3D Object material. To open it, double-click a Material on Materials page of the 3D Object Editor, select a Material there and click the Edit Material Properties button or double click a 3D Material in the Component Library.

You can apply, edit or delete Texture Editor textures, using the T icons, Edit buttons and Delete buttons to the right (see Texture Operations Icon). Using these controls you can replace many of the Material's Parameters with separate texture patterns. This gives you great flexibility to create realistic Materials.

You can also animate many of the Material Parameters (see Animation Operations Icon).

General Page

Name field

The name field lets you see the name for the current material. For a 3D Object, a material is a collection of polygons in the Object. You may change the name if you wish.

If you are going to use several 3D Objects which have a material with the same name, and you don't want them to use the same material parameter values, it's a good idea to change the name of one of the materials. That way they will become different materials that can have different parameter settings.

Once a material exists in VNS, it will not be changed by importing another object that has a material with the same name. The new object's material will instead adopt the parameter settings of the existing, same-named material.

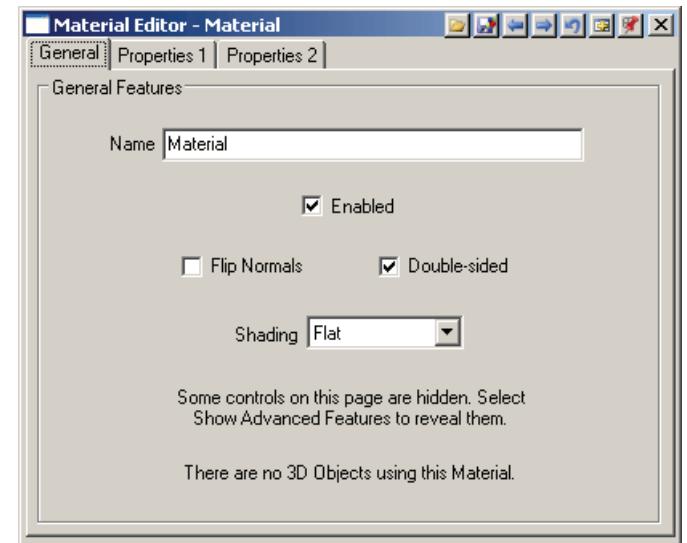
If you want to import another Object that has materials with the same name as those within an existing 3D Object, but you want the imported Object to keep its own material Parameters, you can rename the existing materials before importing the new Object. That way each Object will have its own materials with unique material Parameter values.

Enabled checkbox

The Enabled checkbox lets you enable or disable the Material for rendering. If you disable the Material, any polygons which use the Material will not be rendered.

Flip Normals checkbox

3D Objects are often constructed so that their polygons are only visible from one side, the direction of the "surface normals." This is usually the outside surface of the object. From the other side, the polygons are invisible. Usually the invisible side is on the inside of an object where it doesn't matter.



If polygons get “flipped” accidentally, the invisible side may be facing the camera. The effect is that the polygon disappears. If you have double-sided polygons, the effect would be that you’d see inverted shading, where a lit polygon would appear dark or an unlit polygon would appear light.

Select the Flip Normals checkbox to reverse the direction of surface normals on the polygons which use the current material. Try this if the polygons seem to be invisible or the shading seems reversed when you render the 3D Object.

If some polygons are invisible when Flip Normals is unchecked, and others are invisible when Flip Normals is checked, you can probably fix the problem by selecting the Double Sided checkbox.

Double-sided checkbox

Select the Double-sided checkbox to render single-sided polygons as if they were double-sided. This lets you see the polygons from both sides.

Selecting Double-sided checkbox will greatly increase rendering time. Use it only if you need to see both sides of the polygons in the object. One use is if the Object has inconsistent surface normals that cause holes in the object.

Shading drop box

The Shading drop box lets you select between the following Shading options:

Invisible

Select Invisible when you want the polygons assigned to the current Material to not be rendered. For example you can use it for clear windows.

Flat

Select Flat when you want the polygons assigned to the current Material to be rendered as visible polygons.

Phong

Phong is usually the best option when you want the polygons assigned to the current Material to be rendered with shading that hides the polygonal edges, and creates smooth shading across polygon boundaries that are less than the Smoothing Angle.

Phong shading interpolates the surface normals from one corner to the other. This can create more of a gradient effect across polygons pointed at the sun.

Smoothing Angle field

The Smoothing Angle field lets you set the highest angle VNS will attempt to smooth when using Phong shading between adjacent polygons. Angles higher than the Smoothing Angle can show polygonal breaks in the shading.

The Smoothing Angle field only applies to Materials where Phong shading is selected.

Number of Objects display field

The Number of Objects display field shows how many 3D Objects are using the current Material.

Properties 1 Page

Diffuse Color well

The Diffuse Color Well shows the color for the current material.

Click the Color Well to open the Color Editor, where you can edit the color.

VNS will use the color you select to shade the polygons that use the current material. The behavior of the shading depends on the shading style chosen in the Shading drop box on the General page, and the settings of the Diffuse Intensity, Luminosity, Reflectivity, Specularity and Transparency fields.

Diffuse Intensity Field and Buttons

The diffuse intensity of a material is a measure of how much of the diffuse color of a surface is returned to the camera. Reducing this value to 0% will result in a black surface (i.e.: 0 color) and setting it to 100% will result in the pure diffuse color as set in the Diffuse Color Well.

This attribute is useful for simulating dirt (try driving this field with a Fractal Noise texture element), streaks, moisture (drive Diffuse Intensity with a Dynamic parameter of Water Level or Elevation to simulate moist surfaces at the edges of lakes and streams etc.)

The maximum value for this parameter is 10000%.

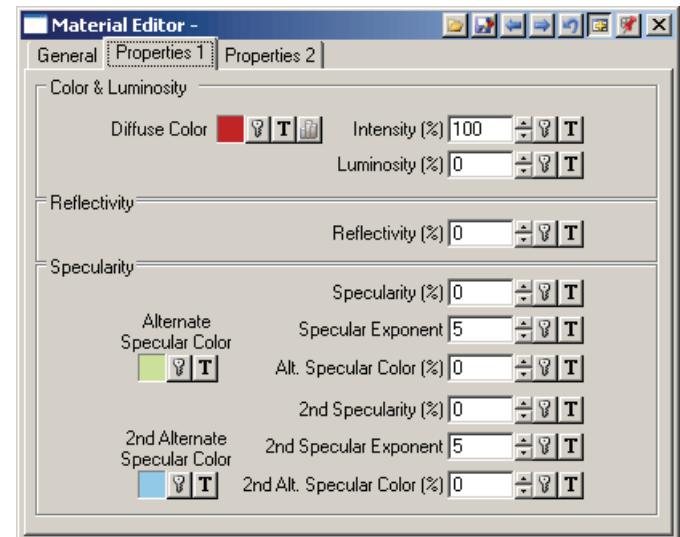
Luminosity Percentage Field and Buttons

Luminosity affects how the Material is shaded by the Sun Light. You can adjust it to create 3D-shaded Objects, flat-shaded Objects or anything in-between.

With zero percent luminosity, the Material will be fully shaded by the Sun Light. This produces a 3D look. In deeply shadowed areas, the Material's color will be a darker shade of itself based on the Ambient Light Intensity and Color. Where fully lit by the Sun Light, the color will be what you chose in the 3D Object Material Editor's Color drop box, modulated by the Sun Light Intensity and Color.

By raising the luminosity, you can lighten the shaded areas. This can be useful to do if the surfaces that use the Material seem too dark. Raising the luminosity a little bit decreases the shading contrast for the Material.

With 100 percent luminosity, the Material will ignore the Sun Light completely. This produces a flat, unshaded look. The Material will always be the color you chose in the 3D Object Material Editor's Color drop box. This can be useful for Materials used on surfaces for neon lights, blue screen areas that will be replaced with other imagery later using a chromakeyer, or flat, paper-cutout-style animations used by certain cartoon shows.



You can also subtract light by using negative luminosity to make the object tend toward the Ambient Light color. With 100 percent negative luminosity, the Material will ignore the sun. The Material will be flat-shaded with the Ambient color.

Reflectivity Field

3D materials can now Reflect their surroundings and other 3D Objects, as well as parts of their own geometry.

Set this value to an amount greater than 0% to see reflections on these surfaces.

The maximum value for this parameter is 10000%.

Specularity Fields and Buttons

Specularity is the amount of shininess for a material.

Use the Specularity Percentage field to adjust the shininess of the material. Zero percent means no specular highlight, while 10000 percent is maximum shininess.

Use the Specular Exponent field to adjust the size of the shiny spot. The useful range is from 1 to 200. Higher numbers will produce a smaller spot, with less feathering at its edge.

Alternate Specularity Fields

The Alternate Specular Color, Color % and Specularity % Values can be used to control how much of the original white highlight is replaced by a colored highlight. For example, setting Specularity % to 100, then setting Alternate Specular color to Green, and Alternate Specularity % to 100 will result in a green highlight, not a white one. With an Alternate Specularity % value of 50%, the highlight would be a pale green (50% white, 50% green). The Specular Exponent field for this parameter is taken from the Specular Exponent value.

2nd Alternate Specularity Fields

The 2nd Alternate Specular Color, Color %, Specularity %, and Specular Exponent Values can be used to create a second specular bloom on the surface. This is an excellent way of simulating high-lacquered surfaces (such as highly polished car bodywork). By using a different color and specular exponent, one can simulate the effect caused by a hotspot on a polished varnish (high specular exponent, no color) and an underlying paint layer (lower specular exponent and a colored highlight)

Properties 2 Page

Transparency Percentage Field and Buttons

Use the Transparency field to adjust how much you can see through the 3D Object. Zero percent creates a solid object. One hundred percent creates an invisible object. Any value in between creates various levels of transparency.

Translucency Fields and Buttons

Translucency is the amount of light transmission for a material. This is particularly effective for the bright glow of backlit leaves. For example, translucency is great for the leaves of aspen trees.

In nature there are solid materials, like tree branches, and translucent materials, like leaves. The side of a tree branch that is away from the sun will be in shadow. The side of a leaf that's away from the sun will still be lit due to the translucency of the leaf. That translucency is brightest the more one side of the leaf faces the sun, and the closer the leaf is to a line between you and the sun. As you move around a tree, the leaves that show translucency change based on your position, their position and angle, and the sun's position.

To simulate this complex and beautiful play of light, VNS gives you several Translucency Parameters. These Parameters lets you control the amount of perceived light transmission for a material. As you can see from the above example, Translucency is particularly effective for simulating the bright glow of back-lit leaves, like those on aspen trees. Translucency is spectacular when showing the bright colors of fall foliage. It's also useful for simulating the light transmission of glass and plastic.

To see Translucency, the material must be between the Camera and the SunLight. You can adjust the amount of light transmission, and the angle from the sun within which the material will show the effect.

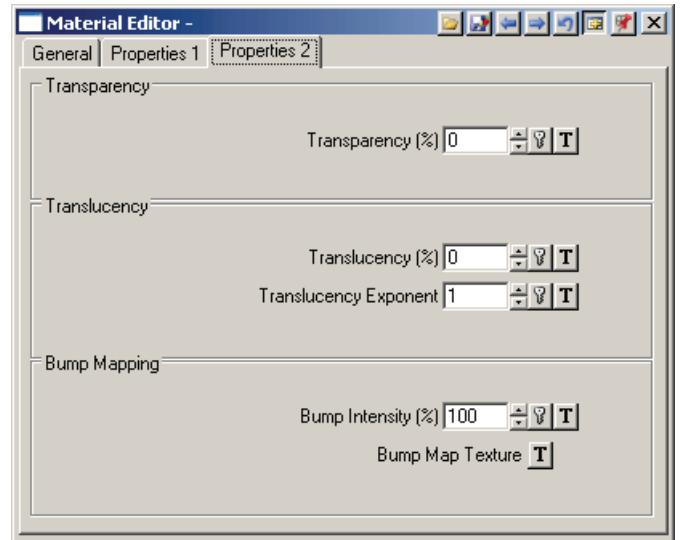
During rendering there are several things that affect translucency. VNS will make translucent materials brighter when the polygons they are on are directly facing the SunLight. In other words, if the polygons are perpendicular to a line between the 3D Object and the SunLight. VNS will also make translucent materials brighter when the polygons they are on are most directly between the Camera and SunLight.

The Translucent effect is less bright for materials on polygons who's faces are angled away from the SunLight and for materials that are farther from the direct line between the Camera and SunLight. You can adjust the amount of light transmission, and the angle from the sun within which the material will show the effect.

Translucency Percentage Field

Use the Translucency Percentage field to adjust the light transmission of the material. Zero percent means no extra highlighting, while 100 percent is maximum transmission. For even brighter glows you can enter a value that is more than 100%. In that case VNS will actually increase the Value of the material's color to further increase brightness.

Note: Value is one of the Parameters you can manually adjust on the Color Editor.



Translucency Exponent Field

Use the Translucency Exponent field to adjust the cone of the light transmission. This is a measure of how far the material can be off axis from a line extending from the Camera to the SunLight. The useful range is from 1 to infinity. Higher numbers will produce a smaller cone, with less feathering at its edge. The larger the cone (smaller numbers) the larger the area the material can be in and still be affected by translucency.

Bump Intensity Percentage Field and Bump Map Icon

Bump mapping lets you simulate detailed relief shadowing without requiring dense geometry. For more about using bump mapping throughout VNS, see Bump Mapping Controls.

Using Textures with 3D Object Materials

For each 3D Object Material you can apply separate textures to control these different parameters:

- **Diffuse Color**
- **Diffuse Color Intensity %**
- **Luminosity %**
- **Reflectivity %**
- **Specular Color**
- **Specularity %**
- **Specular exponent**
- **Alternate Specular Color**
- **Alternate Specular Color %**
- **2nd Specular Color**
- **2nd Specularity %**
- **2nd Specular Color %**
- **2nd Specular Exponent**
- **Transparency %**
- **Translucency %**
- **Translucency exponent**
- **Bump Intensity %**
- **Bump Map**

Each of these parameters has a button on the right side of the 3D Object Material Editor. Click on the Texture Operations Icon to access a menu of controls for creating, modifying and deleting material textures.

Saving and Loading Materials

Use the Save Component To Disk Icon to open the Component Signature Window. From there you can save the current Material as a reusable Component.

VNS will save a file with all the parameter values in the 3D Object Material Editor, along with all the parameter values in the Texture Editor for each texture used by the Material. VNS will also save all the colors used by the Material.

You can use the Load Component From Disk Icon or the Component Gallery to load any Material file you may have on your hard drive. VNS will then replace all the parameter values in the 3D Object Material Editor, along with all the parameter values in the Texture Editor for each texture used by the Material.

The simplest way to use textures with 3D objects is to load pre-built material Components from your hard drive. VNS comes with a selection of pre-built materials.

3D Object Editor

The 3D Object Editor lets you adjust the parameters for a 3D Object.

The 3D Object Editor lets you place a 3D Object on the terrain at a single geographic position and at the vertices of one or more attached Vectors. For each 3D Object you can animate object position, size, rotation and received shadow intensity.

Note: You can also include 3D Objects as part of an Ecosystem's Ecotype (see Ecosystem Editor) or within a Foliage Effect (see Foliage Effect Editor).

You can randomize object scale, rotation and position and even randomize the positions of each vertex in each iteration of an object to create object variations automatically. For example you could use a single boulder object attached to a Vector and use the randomization controls to automatically produce a different boulder variation at each Vector vertex.

Dynamic linking lets you attach Vectors to the 3D Object using the Search Query Editor.

You can orient objects to follow changes in the Vector. For example this makes it easy to align houses to face the road in subdivisions with curved roads, and to align telephone poles along curved roads.

Note: You can specify and animate 3D Object Material parameters using the 3D Material Editor.

Render 3D trees, buildings, vehicles, structures, signs, characters and other 3D objects within VNS, without requiring an external 3D program. You can preview 3D Objects in Views using OpenGL.

VNS will render enabled 3D objects even if the terrain is disabled for rendering.

Hint: If you want faster preview rendering of 3D Objects, temporarily disable terrain for the Render Options you are using for Preview Rendering. Don't forget to enable the terrain again when you're done.

Note: For more extensive 3D object rendering and animation, VNS integrates with external 3D programs, including LightWave 3D, Inspire 3D, 3D Studio MAX, and 3D Studio VIZ. You can pre-render shadows in VNS with the Shadows Only checkbox (see below).

3D Object Formats

VNS can import 3D Objects in these formats:

- **WCS/VNS (.w3d .w3o)**
- **Alias Wavefront OBJ (.obj)**
- **DXF (.dxf)**
- **LightWave 3D (.lwo)**
- **3D Studio (.3ds)**

Note: You can also import already textured VNS 3D Objects from other VNS Projects by using the Component Library.

You can create 3D Objects with any modeling program that can save in those formats. You can also import VNS objects, complete with VNS materials.

VNS supports UV mapping for 3DS, LWO and OBJ format objects. VNS also support Per Pixel coloration in the form of RGBA Vertex Color Maps for objects created in those programs that can create such color map data.

Geometry

When you import a 3D Object, VNS will create and save a ".w3o" object to hold the geometry in a pre-translated, fast loading format for efficient rendering. VNS saves this file in the same directory as the original object.

Once VNS has written the ".w3o" file, VNS no longer needs the original 3D object file.

Note: If you change the original object, you'll need to re-import it so VNS can update the ".w3o" file.

If you want to save a 3D Object with texturing for reuse in other Projects, you can save it as a 3D Object Component from the Component Signature window. VNS saves 3D Object Components as ".w3d" files. By default VNS saves Object Components in the 3DObject directory inside the Components directory. This is the directory the Component Gallery normally shows when you select the 3D Object tab to load 3D Object Components into other Projects.

There are no polygon or vertex limitations in VNS, other than available memory. Objects with fewer polygons will render faster.

Note: LightWave 5 and 3D Studio formats do have polygon limitations, so objects created in those programs will be constrained to those limits. Lightwave 6.x and 7.x format models do not have this limitation.

Multipart 3DS and LWO objects are both supported in VNS 3. There is no longer any need to collapse these objects into single meshes in order to have VNS load them accurately.

3D Object Materials

VNS supports multiple materials within an object. A material is a texture applied to groups of polygons within the object. Some programs may refer to this as a "surface." For example, a car object may have a body material, a bumper material, a tire material and a glass material.

When you import a 3D Object, VNS will create materials with colors based on those in the original object. The VNS materials are saved with the Project. If you wish you can save a 3D Object with Materials separately as a Component.

You can see the Materials for the current 3D Object in the 3D Object Editor's Materials section. You can see the 3D Object materials for the entire Project in the Scene-At-A-Glance or the Component Library. You can edit the Parameters for any 3D Object Material with the 3D Material Editor.

If you re-import the original object, the VNS materials won't change unless you first delete them in VNS before you re-import the original object. You can delete them in the Scene-At-A-Glance or Component Library.

For each material, you can edit polygon surface normal direction, single or double-sided rendering, shading, smoothing angle, color, luminosity, transparency, specularity and translucency using the Material Editor. Most of these Parameters can also be controlled by textures, and animated.

Tips for Fastest 3D Object Rendering

In the 3D Object Editor, set the Render Quality as low as you can for fastest rendering. On the other hand, set it as high as it needs to be to produce acceptable antialiasing.

In the 3D Material Editor rendering will be fastest for a material if you turn off the Double Sided checkbox, and use Flat Shading. On the other hand, use Phong Shading when you want a smooth look, and use double sided polygons when you need polygons to render on both sides.

Adding a 3D Object

You can add a 3D Object by selecting the 3D Objects category in the Scene-At-A-Glance and clicking the Add or Clone Selected Item icon, or by right clicking on the 3D Object category and choosing Add Component from Gallery from the popup menu.

VNS will open the 3D Object Editor where you can import an object and set its Parameters (see below). VNS will also open the Component Gallery in case you want to import a pre-made 3D Object Component.

Alternatively you can right click on the 3D Object category and choosing Add Component of this Type, in which case VNS will add a component and open the 3D Object Editor without opening the Component Gallery.

Note: If the object is found to be offset from its local origin (either because it was intentionally modelled this way, or due to bad modeling) VNS will give you the option of resetting its origin. If you did not model the object intentionally with an offset origin, it is recommended that you allow VNS to perform this change, as transformations (scale, rotate, move) will be far more predictable, as will positioning by Ctrl-clicking in a view.

Removing a 3D Object

You can remove a 3D Object by selecting the 3D Object in the Scene-At-A-Glance and clicking the Remove the Selected Item icon.

You can also remove a 3D Object by selecting it in the Component Library and clicking the Remove Effect button. The object's Materials will go away when you delete a 3D object, unless something else is also using the material.

Placing 3D Objects

You can place 3D Objects with or without an attached Vector.

Placing a 3D Object without a Vector

To render a 3D Object without an attached Vector you can enable the object's geographic instance. To do so, select the "Render a Geographic Instance" checkbox in the Position section on the Size & Position page of the 3D Object Editor.

Note: When you first create a 3D Object, the Geographic Instance is enabled by default and VNS will ask if you want the object's Geographic Instance to be centered in the current DEM bounds.

You can edit the position of the Geographic Instance in the Geographic Position section on the Size & Position page.

If the 3D Object is the Active Item, you can control-click in a View to interactively place the geographic instance. You can also use the Move Mode to drag the geographic instance; the Rotate Mode to rotate the geographic instance; and the Scale/Zoom Mode to resize the interactive instance interactively in a View.

The geographic instance is available whether or not you have also attached the 3D Object to one or more Vectors.

Placing 3D Objects with Vectors

You can place a 3D Object with Vectors by creating a new 3D Object and Vector with the Create Palette Window; by dragging and dropping a Vector onto a 3D Object or vice versa in the Scene-At-A-Glance; or by applying a 3D Object to a Vector using the Component Library and Database Editor.

To place a 3D Object using an existing vector or vectors, see Vector Links Icon. To place a 3D Object and at the same time create a new vector, select the object in the Scene-At-A-Glance, and use the Create Palette Window to digitize a new vector.

Note: You may apply no more than one 3D Object Component to a single Vector Object, but you can apply other types of Effects to the same Vector Object. You can apply multiple 3D Objects along a Vector with a Foliage Effect, and within a Vector with an Ecosystem's Eco-type.

If you apply a 3D Object to a Vector Object with a single vertex, VNS will place one copy of the 3D Object at that vertex. This lets you place a single tree, building, bridge or vehicle wherever you want.

If you apply a 3D Object to a Vector Object that has more than one vertex, VNS will place a copy of the 3D Object at each vertex. This lets you place a row of identical objects such as Greek columns, fence posts or bushes.

You can use the Randomize options to create variations of the object by randomizing size, position and shape for each iteration of the object.

Editing 3D Object Parameters

You can import a 3D Object and edit its parameters with the 3D Object Editor.

To open the 3D Object Editor, double click the 3D Object in the Scene-At-A-Glance. VNS will open the 3D Object Editor ready to edit the current 3D Object.

General Page

General Features Section

Name Field

The Name field lets you edit the name of the current 3D Object. It will initially be named "3D Object," with a number appended if there is already a 3D Object named 3D Object.

You can change the name if you wish. For example, if the object is a white building, you might call it "White Building".

Load Object From Disk Icon

Click the Load Object from disk icon to import a 3D object in VNS, LightWave 3D, 3D Studio, Alias/Wavefront OBJ, or DXF formats. VNS will open a file requester where you can select any 3D objects in these formats.

For VNS objects, you can load either ".w3o" or ".w3d" objects.

VNS will maintain the named polygons, color, smooth or flat shading state, smoothing angle, luminosity, specularity, transparency, and the double or single sided state from the imported 3D Object. When you load an Object that doesn't have these texturing choices set, VNS defaults to flat shading with the Sun Light color, double sided polygons, a smoothing angle of 45, and zero luminosity, transparency and specularity.

VNS will use or preserve any UV coordinates created in other programs, but not other mapping types. Procedural texturing will not be converted from native object format to VNS texturing, however, you can add multiple channels of image-based and procedural texturing within VNS.

For 3D Studio and DXF files VNS will now load multiple objects from one file.

When you import a 3D Object in LightWave, OBJ, 3DS or DXF format, VNS will save a copy of the object in VNS format with a ".w3o" extension. The copy will be saved in the directory from which you loaded the original object. This saves significant rendering time since VNS only has to translate the original object when you import it. After that, VNS will use the ".w3o" object instead.

VNS can then load the already translated VNS version of the object during rendering, rather than having to retranslate the object for each frame.

VNS also protects the original object from changes you may make in materials for the current Project. Materials are saved in the Project file. That way the same VNS 3D Object can have different material values in different Projects.

Note: If you change the original 3D Object in an external 3D program, you will need to reload the Object into VNS. However, if you do reload the object, VNS will not update any of the material Parameters. If you need to have the materials updated, delete them in VNS before you re-import the Object.



Enabled Checkbox

The Enabled checkbox lets you enable or disable the 3D Object for rendering.

Disabling an object can be useful to speed up rendering if you are doing test renders to check some other aspect of your scene and don't need to see the 3D Object. Make sure you remember to enable it for the final rendering if you want to see the object.

Note: To see the 3D Object in your rendering, it must be visible to the Camera you selected for the Render Job you are using (see Render Job Editor), and 3D Objects must be enabled in the Render Options you are using (see Render Options Editor).

Shadows Only Checkbox

Select the Shadows Only checkbox when you want VNS to render shadows for 3D Objects but not the 3D Objects themselves. This can be useful for making shadows for objects you will later be rendering with an external 3D program like LightWave 3D, Inspire 3D, 3D Studio MAX and 3D Studio VIZ.

Render a Geographic Instance Checkbox

Select the Render a Geographic Instance checkbox when you want VNS to render an instance of the object at the location specified in the Geographic Position section of the Size and Position page (see below). This instance of the object is independent of any Vector. It can exist whether or not you also have a Vector attached to the 3D Object.

Note: If you have one or more Vectors attached to the 3D Object, VNS will also place instances of the 3D Object at each Vector vertex.

Preview Radio Buttons

The Preview radio buttons let you choose how VNS will display the current 3D Object when you have 3D Objects enabled for Views.

Select appropriate settings for each of your 3D Objects as you work. That way you can enjoy 3D Object visualization in Views with a minimum impact on your system's OpenGL display speed.

Off

Select the Off radio button to disable display of the current 3D Object in Views. Do this for objects you don't need to see, in order to speed up OpenGL previews in Views.

Box

Select the Box radio button to display the current 3D Object as a 3D box in OpenGL Views. The box encloses the space containing the 3D Object. Do this for objects when you don't need to see the full, detailed object. Often, a box is sufficient for positioning objects, and it will refresh very quickly in Views.

Detail

Select the Detail radio button to display the current 3D Object as a shaded 3D Object in OpenGL Views. This gives you the most accurate preview. Complex objects may slow down the refresh rate in Views, so use the Detail setting only when you need it.

Note: 3D Objects are not affected by the Maximum Polygons setting in the View Preferences Window.

Vital Statistics Section

Vertices Display Field

The Vertices display field shows the number of vertices in the current 3D Object. The more vertices there are, the longer it will take to render. VNS does not impose a limit to the number of vertices an object may have, other than the limit imposed by the available memory on your system.

Polygons Display Field

The Polygons display field shows the number of polygons in the current 3D Object. The more polygons there are, the longer it will take to render. VNS does not impose a limit to the number of polygons an object may have, other than the limit imposed by the available memory on your system.

Materials Display Field

The Materials display field shows how many materials there are in the current 3D Object. A material is a texture applied to groups of polygons within the object. For example, a car object may have a body material, a bumper material, a tire material and a glass material. You can see a list of the materials in the Materials Section (see below) You can edit the properties of each material using the 3D Material Editor.

Vector Placement Section

By attaching Vectors to Components you can control where Components appear. In addition to a single instance at a geographic position, 3D Objects can appear at Vector vertices. Vectors can be dynamically linked with Search Queries or hard linked.

Vector Links Button

This control allows you to perform various tasks relating to the association of vectors with components. To learn how to use it, see Vector Links Icon.

Attached Hard-Linked Vectors Display

The Hard-Linked Vectors display tells you if there are any Vectors hard-linked to the Component, and if so, how many. It will also display vectors attached by Search queries and list the names of the search query or queries in use.

Materials Page

The Materials page lets you see a list of the materials used in the current 3D Object. A material is a texture applied to groups of polygons within the object. For example, a car object may have a body material, a bumper material, a tire material and a glass material.

Materials List

The Materials list shows a list of all the materials used in the current 3D Object. Click any item in the list to select it. Double click any item in the list to open the 3D Material Editor, where you can change and animate the Parameters for the current material.

Selected Material Color Well and Texture

The Color well shows the diffuse color of the selected material. Click the Color well to open the Color Editor where you can edit that color.

The diffuse color of a material can be controlled by the Selected Material color, a texture applied to the diffuse color or a combination of both.

Since the color can also be controlled by a texture, there is a display below the Color Well showing whether the color is influenced by a texture. Depending on the opacity of the texture, the color in the Color Well may or may not contribute to the material's actual color.

If the color is controlled by a texture, click the Edit Material Properties button (see below) to open the 3D Material Editor. From there you can open the Texture Editor for the Diffuse Color and edit the texture used for the color.

Edit Material Properties Button

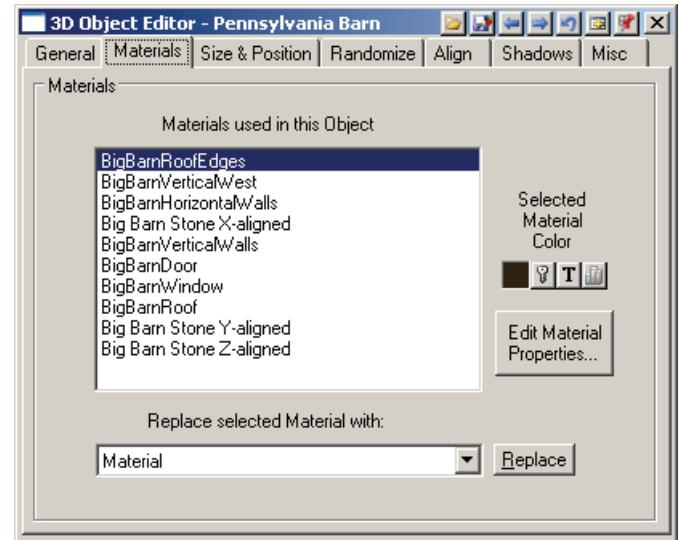
Click the Edit Material Properties button to open the 3D Material Editor with the Properties page displayed. There you can edit all the properties of the Material.

Replace Material Drop Box and Button

You can replace any material in the current 3D Object with any other material in the Project.

You can create a new material by selecting "3D Object Materials" in the Component Library's Current Project Effects list and clicking the Create New Effect button. Alternatively you can double click "3D Object Materials" in the list. Materials are also added to the Project when you load a 3D Object that has materials which don't already exist in the Project.

To replace the current material with another existing material, select the material you want to replace in the Materials list. Then select a new material from the drop box. Finally, click the Replace button.



Size & Position Page

Position Section

The Position section lets you control the position of the geographic instance. The 3D Object will have a geographic instance if the Render a Geographic Instance checkbox is selected on the General page.

If the 3D Object is the Active Item, you can control-click in a View to interactively place the geographic instance. You can also use the Move Mode to drag the geographic instance in a View. These operations will change the values in the Latitude, Longitude and Elevation fields.

Note: The geographic instance is available whether or not you have also attached the 3D Object to one or more Vectors.

Latitude Field and Buttons

Enter a latitude position into the Latitude field to change the latitude of the geographic instance of the 3D Object. You can animate it using the Add Key Frame icon or the Timeline Editor, which you can open by clicking the Timeline icon. If Geographic Instance is not enabled, this field and its associated controls will be unavailable.

Longitude Field and Buttons

Enter a longitude position into the Longitude field to change the longitude of the geographic instance of the 3D Object. You can animate it using the Add Key Frame icon or the Timeline Editor, which you can open by clicking the Timeline icon. If Geographic Instance is not enabled, this field and its associated controls will be unavailable.

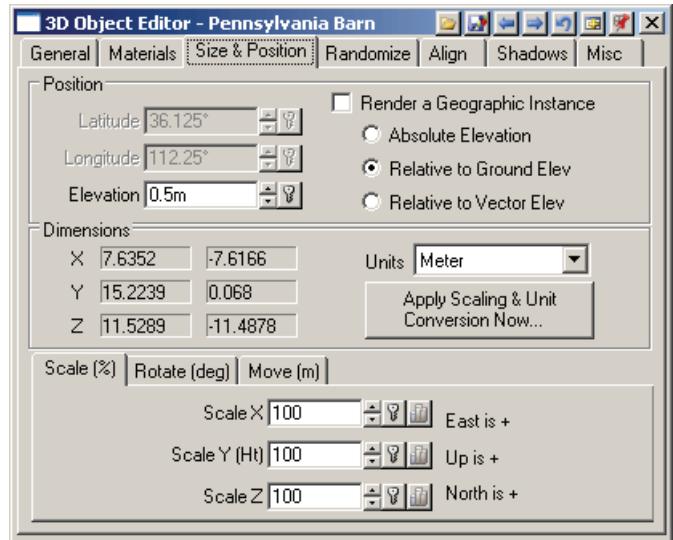
Elevation Field and Buttons

Elevation is the distance above or below sea level, the terrain or the Vector, depending on the selection you make with the Elevation radio buttons.

Note: Sea Level is the surface of the Project Coordinate System's Ellipsoid, which is an elevation of zero. You can see the Project's Coordinate System in the Planet Options Editor.

Enter an Elevation in the Elevation field to change the elevation of the geographic instance of the 3D Object. You can animate it using the Add Key Frame icon or the Timeline Editor, which you can open by clicking the Timeline icon. The elevation you enter will be a distance in meters above the reference you select with the Elevation radio buttons.

Elevation has the same effect as the Move Y field in the Move section (see below). You can animate both Elevation and Y values. VNS adds them together.



Elevation Radio Buttons

Select a reference for the elevation using the Elevation radio buttons. The elevation in the Elevation field is a distance in meters above or below the reference you select. This applies to the geographic instance and to any Vector-placed instances of the 3D Object.

Absolute Elevation

Select this to enter an elevation above sea level.

Note: Sea Level is the surface of the Project Coordinate System's Ellipsoid, which is an elevation of zero. You can see the Project's Coordinate System in the Planet Options Editor.

Relative to Ground Elev

Select this to enter an elevation above the terrain.

Relative to Vector Elev

Select this to enter an elevation above the host Vector Object.

Dimensions Section

X, Y and Z Display Fields

The X, Y and Z Dimensions display fields show the limits of a bounding box enclosing the current 3D Object. You'll see the maximum and minimum X range, the maximum and minimum Y range and the maximum and minimum Z range. The values are in meters.

These fields take into account any size changes you make using the Scale fields (see below). If the object you import was originally created in units other than meters, it's a good idea to use the Units drop box and Apply Scaling & Unit Conversion Now button to rescale the object within VNS (see below).

Units Drop Box

Set the Units drop box to the units that were used when the object was created.

For example, if you import an object that was created in inches, VNS will render it as if each inch was a meter and it will be too big. Using the Units drop box lets you shrink it back down to the size it was designed to be.

Note: Many objects created in 3D Studio MAX are in inches, and thus must be scaled by 2.5406%. The Units drop box makes this conversion simple.

Click the "Apply Scaling & Unit Conversion Now" button to make the conversion permanent (see below).

Apply Scaling & Unit Conversion Now Button

The "Apply Scaling & Unit Conversion Now" button lets you convert your 3D Object to meters. If your object is already in meters you don't need to use this button.

If your object is not in meters, it's a good idea to select the units it was actually created in with the Units drop box (see above). Then click this button to convert the object to meters. This will increase rendering speed and make texture sizes correct.

Click this button to convert the unit you selected in the Units drop box into meters and resave the object. VNS will then set the Units drop box to meters.

Doing this makes rendering quicker. Otherwise VNS has to do this conversion every time you render.

Doing this will change the XYZ display fields to 100% which saves another step in rendering.

Doing this also keeps textures from scaling along with the object.

Scale, Rotate, Move Section

Click the Scale, Rotate or Move buttons to access the Scale, Rotate or Move fields, respectively.

You can animate all of these values using the Add Key Frame icon next to each field; using the Timeline Editor accessible from the Timeline icons next to each field; or by using the controls in the Animation toolbar. Animating scaling lets the 3D object squash or stretch along any or all axes. Animating rotation lets the 3D object spin on any or all axes. Animating position lets the 3D object move along any or all axes.

You can also associate these values with Thematic Maps so as to automate the scaling/rotation/movement of large numbers of vector-attached objects. An example might be the rotation of hundreds of house models in a project visualizing a proposed residential development.

Scale Fields

The Scaling section lets you change or animate the size of the current 3D Object. Changes you make here are reflected in the Dimensions section (see above).

The X axis runs east to west. A positive X axis is to the east. The Y axis runs vertically. A positive Y axis is up. The Z axis runs north to south. A positive Z axis is to the north.

Enter a number in the X Field to scale the 3D Object along the X axis. Enter a number in the Y Field to scale the 3D Object along the Y axis. Enter a number in the Z Field to scale the 3D Object along the Z axis.

If the 3D Object is the Active Item, you can use the Scale/Zoom Mode to interactively size the geographic instance a View. This will change the values in the Scale fields.

Rotate Fields

The Rotation fields let you change or animate the rotation of the current 3D Object. A value of zero in any field means no rotation for that axis.

The X axis runs east to west. A positive X axis is to the east. The Y axis runs vertically. A positive Y axis is up. The Z axis runs north to south. A positive Z axis is to the north.

Enter a number in the X Field to rotate the 3D Object around the X axis. Enter a number in the Y Field to rotate the 3D Object around the Y axis. Enter a number in the Z Field to rotate the 3D Object around the Z axis.

If the 3D Object is the Active Item, you can use the Rotate Mode to interactively rotate the geographic instance a View. This will change the values in the Rotate fields.

Move Fields

The Move fields let you change or animate the position of the current 3D Object. A value of zero in any field means no change from the object's original position along that axis.

The X axis runs east to west. A positive X axis is to the east. The Y axis runs vertically. A positive Y axis is up. The Z axis runs north to south. A positive Z axis is to the north.

Enter a number in the X Field to scale the 3D Object along the X axis. Enter a number in the Y Field to scale the 3D Object along the Y axis. Enter a number in the Z Field to scale the 3D Object along the Z axis.

Randomize Page

The Randomize page lets you randomly vary object scale, rotation and position. You can also randomize vertex position within an object. Using textures to control vertex position gives you displacement mapping - the ability to change object shape to create variations of the object.

When you randomize object scale, VNS multiplies the scale values on the Size & Position page. When you randomize object rotation or position, VNS adds the rotation or position values to those on the Size and Position Page.

Randomizing will change a single object but it is particularly useful when you are using the object to populate multiple points on an attached Vector, multiple points on a Foliage Effect Vector or multiple instances within an Ecosystem's Ecotype. When the object is used multiple times, each instance will be different. This lets you use a single object to automatically create a variety of similar but different objects.

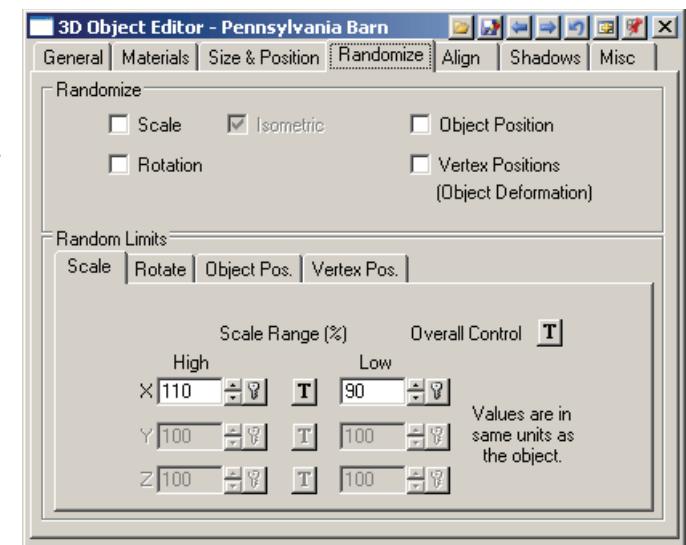
Randomizing the shape of objects may be useful for creating a variety of natural features such as rocks, hoodoos, stalactites and stalagmites from a few original objects. Randomizing object size and rotation may be useful for creating variations of buildings, creatures and foliage.

Randomize Section

The Randomize section lets you choose to randomize Scale, Rotation or Object Position or Vertex Positions.

Scale Checkbox

Click the Scale checkbox to randomize the size of the object. You can set the scale range for each axis with the controls in the Random Limits section (see below).



If you want the entire object to scale evenly on all axes so the shape remains the same, select the Isometric checkbox (see below). If you don't want the axes to scale evenly, deselect the Isometric checkbox.

Isometric Checkbox

The Isometric checkbox is available if you select the Scale checkbox (see above).

When you select both of these checkboxes VNS will scale all axes proportionally to keep same object shape. You control the range of scaling using the X fields in the Detail section.

This only affects scaling. It does not affect rotation or position.

Rotation Checkbox

Click the Rotation checkbox to randomize the orientation of the object. You can set the rotation range for each axis with the controls in the Random Limits section (see below).

Object Position Checkbox

Click the Object Position checkbox to randomize the placement of the object. You can set the distance range for each axis with the controls in the Random Limits section (see below).

Vertex Positions Checkbox

Click the Vertex Positions checkbox to randomize the position of the 3D Object's vertices. This will deform the shape of the object to give you variations of the object.

Note: This does not affect Vector vertices.

You can set the position range for each axis with the controls in the Random Limits section (see below).

Random Limits Section

Show Buttons

The Show buttons let you select whether the Random Limits section shows controls for scaling, rotation, object position or vertex position variations.

To see the Scale controls in the Random Limits section, select the Scale button. You can then adjust the allowed range of scaling by percentage of the original size along each axis. When you select the Scale checkbox in the Randomize section VNS will resize the object randomly within the percentages you enter. If you select the Isometric checkbox, VNS will resize all axes proportionally.

To see the Rotation controls in the Random Limits section, select the Rotate button. You can then adjust the range of rotation along each axis. When you select the Rotation checkbox in the Randomize section VNS will rotate the object randomly within the ranges you enter.

To see the Object Position controls in the Detail section, select the Object Pos. button. You can then adjust the range of position offset along each axis. When you select the Object Position checkbox in the Randomize section VNS will move the object randomly within the distance ranges you enter.

To see the Vertex Position controls in the Detail section, select the Vertex Pos. button. You can then adjust the range of position offset for the 3D Object's vertices along each axis. When you select the Vertex Position checkbox in the Randomize section VNS will move the object's vertices randomly within the distance ranges you enter.

Overall Control Texture Controls

The Overall Control texture controls let you control all axes in concert by using a texture. The texture gives you a percentage value from zero to 100 percent. VNS multiplies the low to high range by that percentage on each axis. All axes will vary by the same proportion within the separate ranges you set. You can use a separate texture for Scaling, Rotation, Object Positioning and Vertex Positioning.

For example, you can create objects of different rotations or scales at different elevations by use a Dynamic Parameter of Elevation in the Texture Editor for the Overall Control. This would let you create a boulder field with big boulders in low spots and small boulders in high spots. You could even have flat boulders at higher elevations and round ones (more likely to have rolled down the hill) at lower elevations.

Using a texture to control vertex position gives you the ability to use displacement mapping to deform objects.

High and Low Scale X, Y and Z Fields

Click the Scale button to set the range of random size changes for each axis.

Set the value of the High field for each axis to specify the largest percentage value VNS will use when randomizing the size of the object along that axis. Set the Value of the Low field for each axis to specify the smallest percentage value VNS will use when randomizing the size of the object along that axis.

You can also control these ranges with textures.

When you randomize the scale, VNS uses these random percentages to multiply the scale values on the Size & Position page.

If you select the Isometric Scale checkbox, all axes will resize proportionally, controlled by the range you enter into the High and Low fields for the X axis.

High and Low Rotation X, Y and Z Fields

Click the Rotation button to set the range of random orientation changes for each axis.

Set the value of the High field for each axis to specify the largest value VNS will use when randomizing the orientation of the object along that axis. Set the Value of the Low field for each axis to specify the smallest value VNS will use when randomizing the orientation of the object along that axis.

You can also control these ranges with textures.

When you randomize the rotation, VNS adds random rotation values to those on the Size and Position Page.

High and Low Object Position X, Y and Z Fields

Click the Object Position button to set the range of random object position changes for each axis.

Set the value of the High field for each axis to specify the largest value VNS will use when randomizing the placement of the object along that axis. Set the Value of the Low field for each axis to specify the smallest value VNS will use when randomizing the placement of the object along that axis. Normally objects are positioned with their origin point placed on a Vector vertex. You can offset the object on the Size and Position page. VNS will randomize the position of the object from there. When you randomize the object position, VNS adds random position values to those on the Size and Position Page.

High and Low Vertex Position X, Y and Z Fields

Click the Vertex Position button to set the range of random vertex position changes for each axis.

Set the value of the High field for each axis to specify the largest value VNS will use when randomizing the placement of the object's vertices along that axis. Set the Value of the Low field for each axis to specify the smallest value VNS will use when randomizing the placement of the object's vertices along that axis.

You can also control these ranges with textures to do texture-based displacement.

Note: these displacements are in the Object's units. So if your object has been modelled in inches, then your defined displacement values will be in inches also.

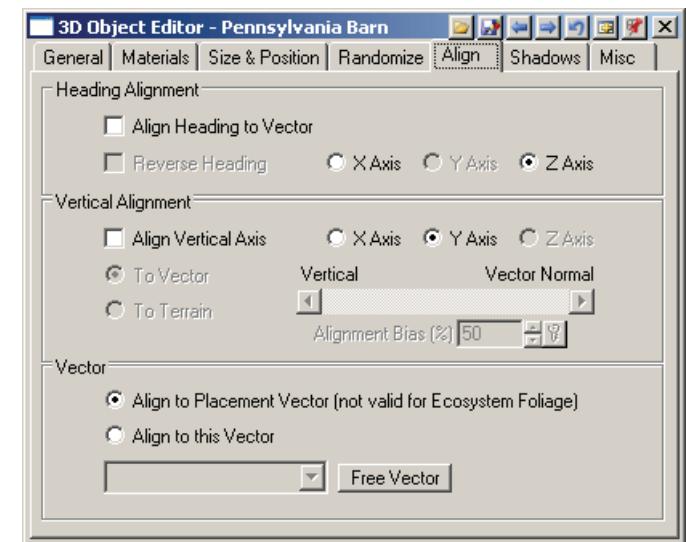
Align Page

The Align page lets you orient objects to a vector, by heading, vertically or both. For example you may want houses along a curved street to have different orientations to face the street. You may want fence posts to tilt as they go up a hill.

To align the object to a vector by heading, select the Align Heading to Vector checkbox. To align the object vertically, select the Align Vertical Axis checkbox.

Alignment happens before any other rotation. Then VNS looks at any changes you make on the Size and Position page and the Randomize page. Once an object's axes have been aligned, it's as if you changed the way the object was modeled before you imported it. Any other orientation changes and randomizations will be applied to those modified axes. That way you can set the alignment on the Align page and further rotate the object directly on the Size & Position page and randomly on the Randomize page.

You can't align the same axis both vertically and by heading (an object can't face two ways at once). The axis radio buttons will ghost to show what combinations are available as you select them.



Heading Alignment Section

The Heading Alignment section lets you align the object's heading to the Vector along your choice of object axis.

You can't align the same axis both vertically and by heading (an object can't face two ways at once). The axis radio buttons will ghost to show what combinations are available.

Align Heading to Vector Checkbox

Select the Align Heading to Vector checkbox to cause the object to rotate so that the object axis you select is aligned along the Vector. As the Vector changes direction, the orientation of the object will also change. The orientation of the object at a vertex is the average direction of the Vector's connecting line segments.

You can choose the axis to align by selecting the X Axis, Y Axis or Z Axis radio button on the right.

You can choose which Vector the object aligns with by using the controls in the Vector section (see below).

Reverse Heading Checkbox

Select the Reverse Heading checkbox to cause the object to rotate so that the object axis you select is aligned 180 degrees opposite the direction of the Vector.

This is only available if the Align Heading to Vector checkbox is selected (see above).

Heading Axis Radio Buttons

The Heading Axis radio buttons let you choose the object axis for alignment with the Vector.

X Axis

Select this radio button to make the positive X Axis of the object align toward the increasing direction of the Vector's vertices. The vertices increase in the order the Vector was digitized.

Y Axis

Select this radio button to make the positive Y Axis of the object align toward the increasing direction of the vector.

Z Axis

Select the radio button to make the positive Z Axis of the object align toward the increasing direction of the vector.

You can't align the same axis both vertically and by heading (an object can't face two ways at once). The axis radio buttons in the Heading Alignment and Vertical Alignment sections will ghost to show what combinations are available.

Vertical Alignment Section

The Vertical Alignment section lets you control the tilting of objects as the Vector changes its vertical angle (for example, going up and down hills).

The tilt of the object at a vertex is the average of the tilt of two lines going up at 90 degrees from each of the adjacent Vector line segments, modified by the Alignment Bias percentage (see below).

Align Vertical Axis Checkbox

Select the Align Vertical Axis checkbox to cause the object to rotate so that the object axis you select is aligned to follow changes in the Vector or the underlying terrain. Choose which using the To Vector or To Terrain radio buttons (see below).

You can choose which axis to align by selecting the X Axis, Y Axis or Z Axis radio button on the right.

You can choose which Vector the object aligns with by using the controls in the Vector section (see below).

To Vector and To Terrain Radio Buttons

Choose the To Vector radio button if you want the object tilt to be perpendicular to the Vector's vertical angle. As the Vector changes vertical angle, the tilt of the object will also change. The tilt of the object at a vertex is perpendicular to the average vertical angle of the Vector's connecting line segments, modified by the Alignment Bias percentage (see below).

Choose the To Terrain radio button if you want the object tilt to be perpendicular to the underlying terrain's vertical angle. As the terrain changes vertical angle, the tilt of the object will also change. The tilt of the object is perpendicular to the vertical angle of the terrain, modified by the Alignment Bias percentage (see below).

Vertical Axis Radio Buttons

The Vertical Axis radio buttons let you choose the object axis for vertical alignment perpendicular to the Vector or terrain.

X Axis

Select this radio button to make the positive X Axis of the object align toward the increasing direction of the Vector's vertices. The vertices increase in the order the Vector was digitized.

Y Axis

Select this radio button to make the positive Y Axis of the object align toward the increasing direction of the vector.

Z Axis

Select the radio button to make the positive Z Axis of the object align toward the increasing direction of the vector.

You can't align the same axis both vertically and by heading (an object can't face two ways at once). The axis radio buttons in the Heading Alignment and Vertical Alignment sections will ghost to show what combinations are available.

Vertical vs. Normal Slider

The Vertical vs. Terrain or Vector Normal slider lets you set the value in the Alignment Bias field. Slide it to the left to cause the Vertical Alignment to have less effect. Slide it to the right to cause the Vertical Alignment to have more effect.

Alignment Bias Field

The Alignment Bias field lets you control how much Vertical Alignment is used. A percentage of zero means no Vertical Alignment. A percentage of 100 means full Vertical Alignment. In between values mix the Terrain or Vector Normal with unchanged vertical alignment to determine how much the object will tilt as the terrain or Vector's vertical angle changes.

You can type a number or adjust the value with the Vertical vs. Normal slider (see above).

Vector Section

If you're using the 3D Object alone or as part of a Foliage Effect's Ecotype, you have a choice. You can align it with the Vector attached to the 3D Object or Foliage Effect or you can specify another Vector for alignment.

If you're using the 3D Object within an Ecosystem's Ecotype, you MUST select a Vector from the Align to this Vector drop box or it will have no Vector with which to align and alignment settings will be ignored.

Align to Placement Vector Radio Button

Select the Align to Placement Vector radio button to align your 3D object using the Vector to which the object is attached. This works for 3D Objects used in a 3D Object Component or Foliage Effect's Ecotype.

This does not work with 3D objects used in an Ecosystem's Ecotype. If you want to use alignment with 3D Objects in an Ecosystem's Ecotype you MUST select the Align to this Vector radio button (see below) and select a Vector in the associated drop box. Otherwise all alignment will be ignored.

Align to this Vector Radio Button and Drop Box

Select the Align to this Vector radio button to align your 3D object using a Vector specified in the drop box. To specify the Vector for alignment, select a Vector from the drop box.

This works for 3D Objects used in a 3D Object Component or Foliage Effect's Ecotype.

Note: This does not work for 3D Objects used in an Ecosystem's Ecotype.

Free Vector Button

Click the Free Vector button if you no longer want the object to align with the Vector shown in the Alignment drop box. If there is no Vector shown in the Alignment drop box the Free Vector button does nothing.

Note: You must free a vector if you want to attach it as a placement vector to the 3D Object or to a Foliage Effect using the 3D Object. Otherwise VNS will warn you that you can't attach the Vector.

Shadows Page

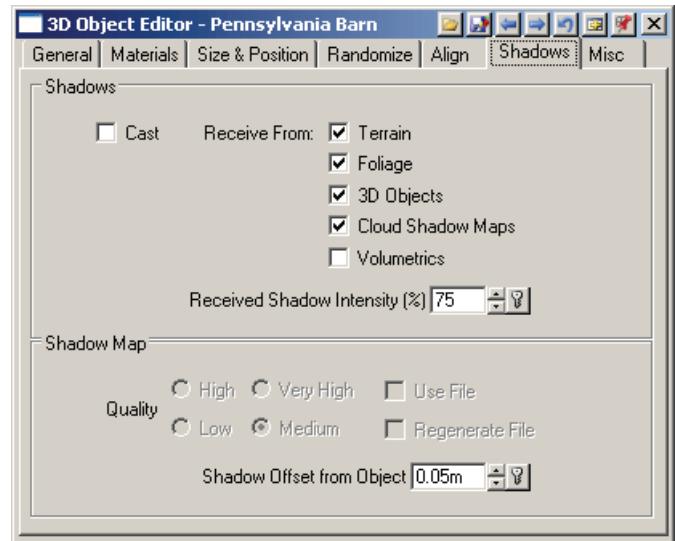
Shadows Section

VNS gives you a lot of control over how shadows interact with 3D Objects. You can adjust the intensity of shadows received by 3D Objects with the Received Shadow Intensity field in the Illumination section (see above).

You can choose to have the 3D Object cast shadows onto other 3D Objects, onto the terrain, and onto itself. You can also choose to have the 3D Object receive shadows from other 3D Objects, Image Objects and the terrain.

For faster rendering, you can tell VNS to save a 3D Object's shadow information to your hard drive.

You can select from four shadow quality settings to balance rendering speed and quality.



Cast Checkbox

Select the Cast checkbox to allow the 3D Object to cast shadows onto other 3D Objects and the terrain.

You must also have a Shadow Component created and applied to the area around the 3D Object for the object to cast shadows.

Receive Checkboxes

Select the required Receive checkbox(es) to allow the 3D Object to receive shadows cast by other 3D Objects, Image Object foliage, Volumetrics and terrain features.

Note: For other 3D Objects to cast a shadow onto the current 3D Object, you must also select the Cast Checkbox for the other 3D Objects (see above).

Received Shadow Intensity Percentage Field and Buttons

The Received Shadow Intensity field lets you adjust the intensity of shadows cast onto the object. 100 percent is normal shadowing. You can use smaller values to lighten the shadows, or larger values to darken the shadows.

Note: To see shadows on a 3D Object, you must select the Receive checkbox for 3D Objects. The scene must also be lit by the SunLight such that shadows would be cast on the Object.

Shadow Map

Quality Radio Buttons

VNS gives you four different shadow quality choices for 3D Objects. Select the Very High radio button for the highest resolution 3D Object shadows. Select the High radio button for high resolution shadow maps. Select the Medium radio button for medium resolution 3D Object shadows that render faster. Select the Low radio button for the lowest resolution shadows which render the fastest.

The width of the maps associated with the above settings are as follows: Low: 512 pixels, Medium: 1024 pixels, High: 2048 pixels, Very High: 4096 pixels. The height of the map will be determined by the angle of the sunlight and the area that the shadow map affect.

For fastest rendering, choose the lowest setting that gives you sufficient shadow resolution.

Use File Checkbox

Select the Use File checkbox to tell VNS to save the 3D Object's shadow information to your hard drive. That way it only has to be calculated once. During subsequent renderings VNS will load the shadow information, which is faster than calculating it.

Don't select the Use File checkbox if you are animating the light source(s) or the 3DObject and you want the shadows to remain accurate during the animation. In that case VNS will need to recalculate the shadows for each frame of the animation.

Regenerate File Checkbox

If you change something about your Project that affects the 3D Object's shadowing, and you have the Use File checkbox selected, VNS won't recreate the shadow information to match your other changes.

To force VNS to recreate the shadow information, select the Regenerate File checkbox before you render. Then VNS will recalculate the shadow information and save new shadow information to your hard drive.

Shadow Offset from Object Field and Buttons

The Shadow Offset from Object field lets you fix splotchy shadow artifacting. You may see this problem in certain situations, such as with objects that have large polygons at near right angles to the sun.

Note: You may see this problem if the if both the Cast and Receive checkboxes are selected (see above).

You can fix splotchy shadowing by adjusting the amount of Z offset VNS applies to the object's shadow map. If you don't see splotchy shadows on the object itself, you don't have to change the value in this field.

What the Offset field does is move the base of the shadow away from the object. The useful range is typically from .05 meters (5 centimeters) to 1 meter, although very large objects may benefit from values larger than 1 meter. The default value of .05 should be sufficient for most uses. Make the value higher if you see splotchy looking shadows on the 3D object.

Note: If your units are set to something other than Meters, VNS will show the .05 meter default in your chosen units.

If you make it too high, you may see places where the shadow becomes disassociated from the object casting the shadow. For instance a tree casting a shadow on the ground will have a light patch between the tree base and the start of its shadow. In that case, decrease the value in the Offset field.

Misc Page

Render Quality Radio Buttons

Use the Render Quality radio buttons to select the amount of antialiasing VNS applies to the current 3D Object during rendering. VNS offers four steps of quality, ranging from Normal to Highest. Each of these settings corresponds to a certain number of antialiasing passes: 1, 5, 9 and 17 respectively.

Normal Render Quality will render the fastest, but be most likely to show jagged edges. Highest Render Quality will render the slowest, but will create the smoothest edges. High and Very High Render Quality are in between in both render speed and antialiasing effectiveness.

Start with Low Render Quality for fastest rendering. If any edges of the current 3D Object look too jagged when rendered, select the next highest Render Quality. Repeat if necessary until the object looks acceptable.

Animation imposes stricter standards on acceptable quality. Something that looks OK as a still may not look acceptable when animated. It's a good idea to render a test animation to see if the Render Quality is sufficient before you do your final rendering.

Note: You can save time by disabling other Components from the View Preferences Window or Render Options Editor before you render 3D Object tests - just don't forget to turn the other Components back on.

Pixel Fragment Radio Buttons

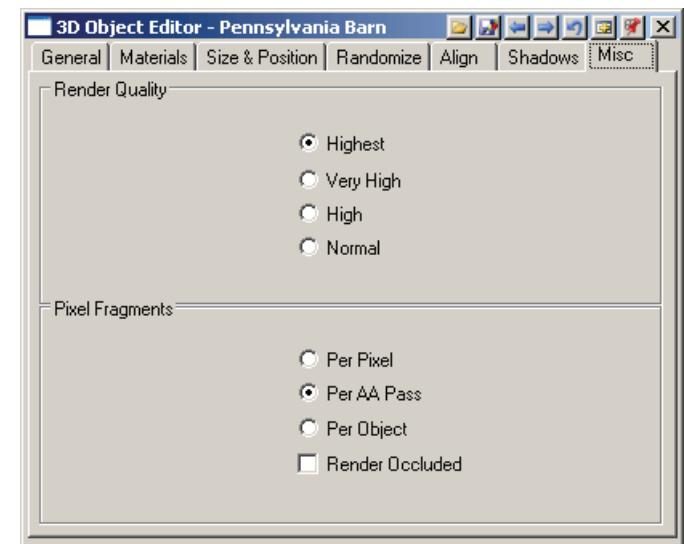
The three radio buttons, and checkbox that make up this area of the editor, control the way in which VNS considers 3D Objects when rendering them when Pixel Fragment Rendering is enabled (See Render Options Editor, Misc. page).

Per Pixel

This option provides the best quality under all circumstances, with the trade-off being that it can require more memory, and render slower than the other methods.

Per AA Pass

This option provides the best quality under circumstances where there are no separate objects within other transparent objects (for example, a model of a man inside a plate-glass building where the man is a separate object to the building). This option takes less memory and is faster to render than the Per Pixel option.



Per Object

This option should only be used for objects that do not intersect other 3D objects or the terrain. This option renders fastest and with the lowest memory requirements, but may result in reduced render quality in some cases.

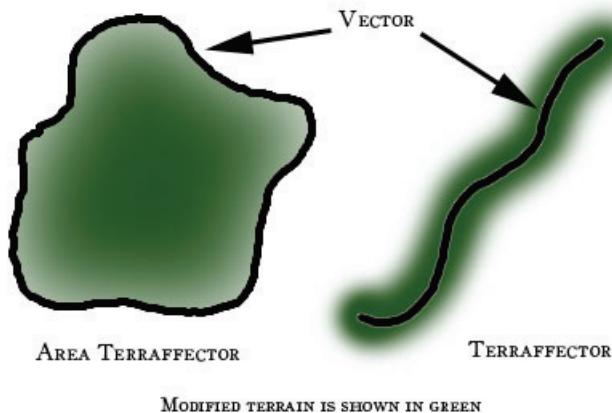
Render Occluded

Enabling this checkbox will force VNS to render those faces of the object not visible to the camera. This will allow those faces to reflect in water and other reflective surfaces, in circumstances where the reflection of the surface would be visible, even when the surface itself is not. This will require slightly more memory and will increase rendertimes, but will result in much more accurate reflections, when the High Quality reflection type is chosen (see Render Options Editor, Enabled 1 page).

Area Terraffector Editor

The Area Terraffector Editor lets you control Area Terraffectors. It gives you common controls that affect all Area Terraffectors you may have in a Project, along with a set of controls that apply to a single Area Terraffector.

What is an Area Terraffector?



An Area Terraffector is a Component that can change the shape of the terrain bounded by a host Vector Object. You can shape the terrain inside the Vector with an Edge Feathering Profile. This makes it easy to dig a lake bed or other depression, or create a hill or mountain.

Area Terraffectors are area Effects that work inside the region bounded by a Vector Object. If you want to change the terrain along a Vector rather than inside a Vector, try using a Terraffector instead (see Terraffector Editor).

Area Terraffectors will change the geometry of the underlying DEM at render time. Area Terraffectors do not change the geometry of the DEM files themselves. This non-destructive behavior lets you experiment freely with Area Terraffectors without risking the integrity of the actual DEM data.

Vectors to which you apply Area Terraffectors may overlap. You can apply the same Area Terraffector to any number of Vector Objects.

Editing an Existing Area Terraffector

To open the Area Terraffector Editor, double-click the Area Terraffectors heading or any existing Area Terraffector in the Scene-At-A-Glance.

You can also select an Area Terraffector's name in the Component Library in the Current Project Effects list, and then click the Edit button.

Another way to open the Area Terraffector Editor is to double click an Area Terraffector name in either the Component Library's Current Project Components list or the Components list on the Comp page of the Database Editor.

The Area Terraffector Editor will open, ready to edit the selected Area Terraffector. You can edit other Area Terraffectors by using the You can import Components into your Projects using the Component Gallery..

Creating a New Area Terraffector

If there are no Area Terraffectors in your Project, you can create a new one by double-clicking in the Scene-At-A-Glance. The Area Terraffector Editor will open, ready to edit the new Area Terraffector.

You can always create a new Area Terraffector by selecting the Area Terraffectors category in the Scene-At-A-Glance and clicking the "Add or Clone Selected Item" icon. The Area Terraffector Editor will open, ready to edit the new Area Terraffector. The Component Gallery will also open in case you want to select a pre-made Area Terraffector.

You can create a new Area Terraffector with an attached Vector by selecting the Area Terraffectors category in the Scene-At-A-Glance and clicking the "Create" icon to open the Create Palette Window. Then digitize the Vector in a View and VNS will create a new Area Terraffector and attached Vector. The Area Terraffector Editor will open, ready to edit the new Area Terraffector. The Component Gallery will also open in case you want to select a pre-made Area Terraffector.

You can also create a new Area Terraffector by selecting "Area Terraffectors" in the Component Library in the Current Project Components list and clicking the Create New Component button. You can optionally double click "Area Terraffectors" in the Component Library in the Current Project Components list to create a new Area Terraffector. The Area Terraffector Editor will open, ready to edit the new Area Terraffector.

Cloning or Adding Vectors to an Area Terraffector

You can clone an Area Terraffector by selecting an existing Area Terraffector in the Scene-At-A-Glance and clicking the "Add or Clone Selected Item" icon. VNS will create a new Area Terraffector that is a copy of the one you first selected. The Area Terraffector Editor will open, ready to edit the new Area Terraffector. The Component Gallery will also open in case you want to select a pre-made Area Terraffector.

You can create another Vector and add it to an existing Area Terraffector by selecting the Area Terraffector in the Scene-At-A-Glance and clicking the "Create" icon to open the Create Palette Window. Then digitize the Vector in a View. VNS will add the Vector to the Area Terraffector. The Component Gallery will also open in case you want to select a pre-made Area Terraffector.

Edge Feathering Profile

You can control the effect of the Area Terraffector with an Edge Feathering Profile. Click the Edit Profile button on the Area Terraffector Editor's General page to open the Edge Feathering Profile Editor. There you can edit the Edge Feathering Profile.

VNS will project the Edge Feathering Profile from the Vector inward when it calculates the Area Terraffector during rendering.

You will not see the Area Terraffector in a View unless you render a Preview.

It's easy to change your mind. At any time you can edit the Profile, change to a different Profile, choose a different Area Terraffector for the Vector Object, edit the Vector Object, apply the Area Terraffector to a different Vector Object, or make other changes.

Note: To specify an Ecosystem in the same area covered by an Area Terraffector, create an Ecosystem and apply it to the same Vector as the Area Terraffector.

General Page

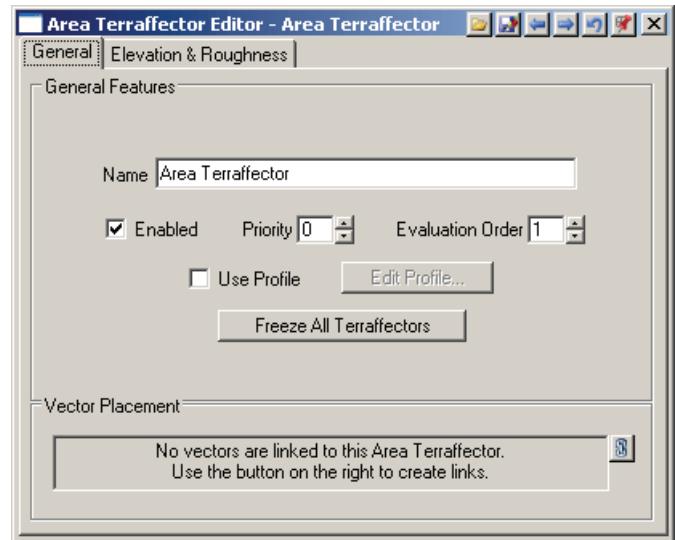
General Features Section

Name Field

Use the Name field to name the current Area Terraffector.

Make sure you don't use the same name for more than one Area Terraffector in the Project.

If you select an existing Area Terraffector and click the Create New Effect button to create a new Area Terraffector, VNS will name the new Area Terraffector with the same name, but with a number appended to the end. If there was already a number at the end of the name of the original Area Terraffector, VNS will increment the number. This ensures that the new Area Terraffector will have a different name. However since you can edit the names it is still possible for you to make two Area Terraffectors with the same name if you really try. This could cause the wrong Effect to be rendered.



Enabled Checkbox

The Enabled checkbox lets you enable or disable the Area Terraffector for rendering.

Disabling an Area Terraffector can be useful to speed up rendering if you are doing test renders to check some other aspect of your scene and don't need to see the Area Terraffector. Make sure you remember to enable it for the final rendering if you want to see the Area Terraffector.

Note: To see the Area Terraffector in your rendering, it must be visible to the Camera you selected for the Render Job you are using (see Render Job Editor), and Area Terraffectors must be enabled in the Render Options you are using (see Render Options Editor).

Priority Field

The Priority field and buttons let you specify the rendering priority of an Area Terraffector when it overlaps another Area Terraffector.

The Area Terraffector with the highest priority will be rendered when Area Terraffectors overlap. VNS will only consider Area Terraffectors of the highest priority found at any location. VNS will not average results between Area Terraffectors of different priorities.

Render priority only matters where Area Terraffectors of the same class overlap. In that case, the highest priority Area Terraffector's values will be used regardless of the Compare method (see above). The Compare method only matters between effects of the same priority.

Evaluation Order Field

Use the Evaluation Order field to tell VNS what order to render Area Terraffectors that are at the same priority. This only matters where Area Terraffectors of the same priority overlap.

If you were a contractor, what do you build first? Suppose you're building an Area Terraffector hill with a smaller Area Terraffector hill on the first hill. You would want to tell VNS to evaluate the second hill after the first hill. Then suppose you want to level a building site with a third Area Terraffector at an absolute elevation, with a profile. The levelling Area Terraffector should be evaluated last.

Use Profile Checkbox

Click the Use Profile checkbox when you want to vary the amount of elevation change imposed by the Area Terraffector. You can vary the Elevation with an Edge Feathering Profile (see Edge Feathering Profile Editor).

This is only available if you've attached one or more Vectors to the Area Terraffector.

Without an Edge Feathering Profile, the terrain will change instantly from the elevations of the surrounding terrain to the elevation change imposed by the Area Terraffector, creating steep cliffs around the Area Terraffector.

With an Edge Feathering Profile, the terrain can change gradually from the elevations of the surrounding terrain to the elevation change imposed by the Area Terraffector. This lets you have gradual slopes around an Area Terraffector depression or on the sides of an Area Terraffector hill.

Edge Feathering Profiles control the amount of the Area Terraffector's Elevation used to affect the terrain. Edge Feathering Profiles are applied inward from the edge of the Vector object.

You can select any Profile to control the gradient by using the Select Edge Feathering Profile button (see below).

VNS creates a default 10m wide splined profile regardless of the effect resolution. For more control, create your own Edge Feathering Profile.

Gradient Fills add to rendering time and take additional memory to render.

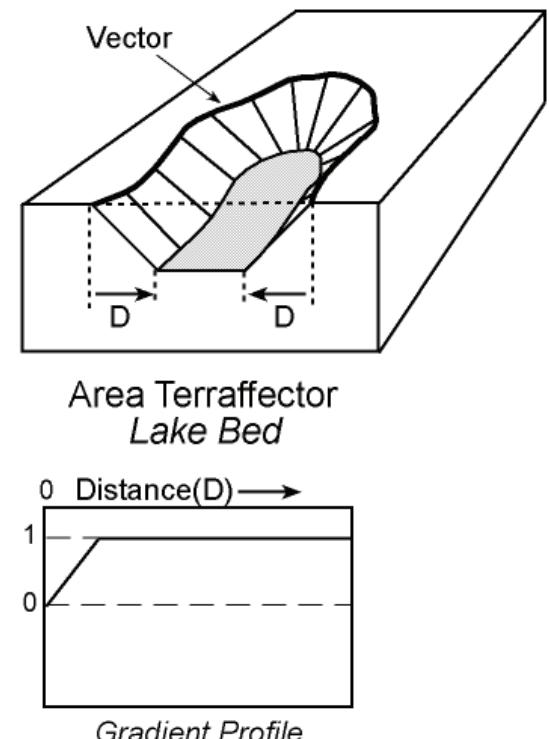
Note: Area Terraffectors will ignore any Ecosystem settings selected within a Profile. These settings are only for linear Terraffectors. To specify an Ecosystem in the same area covered by an Area Terraffector, create an Ecosystem (see Ecosystem Editor) and apply it to the same vector as the Area Terraffector.

Edit Profile Button

Click the Edit Profile button to open the Edge Feathering Profile Editor. There you can alter the Edge Feathering Profile to change the intensity of the Area Terraffector from the edge of the vector inward.

Freeze All Button

Clicking this button will bring up a requester asking for a DEM prefix. Since "freezing" Terraffectors into your terrain model will edit the underlying terrain mesh, entering a prefix when prompted (the default is FRZ) will save the new DEMs to new filenames. Leaving the requester blank will cause your original DEMs to be overwritten.



Once confirmed, VNS will “embed” all enabled Terraffectors into the terrain model.

Vector Placement Section

By attaching Vectors to Components you can control where Components appear. Area Terraffectors appear within controlling Vectors. Vectors can be dynamically linked with Search Queries or hard linked.

Vector Links Button

This control allows you to perform various tasks relating to the association of vectors with components. To learn how to use it, see Vector Links Icon.

Attached Hard-Linked Vectors Display

The Hard-Linked Vectors display tells you if there are any Vectors hard-linked to the Component, and if so, how many. It will also display vectors attached by Search queries and list the names of the search query or queries in use.

Elevation & Roughness Page

Elevation Controls

Relative and Absolute Radio Buttons

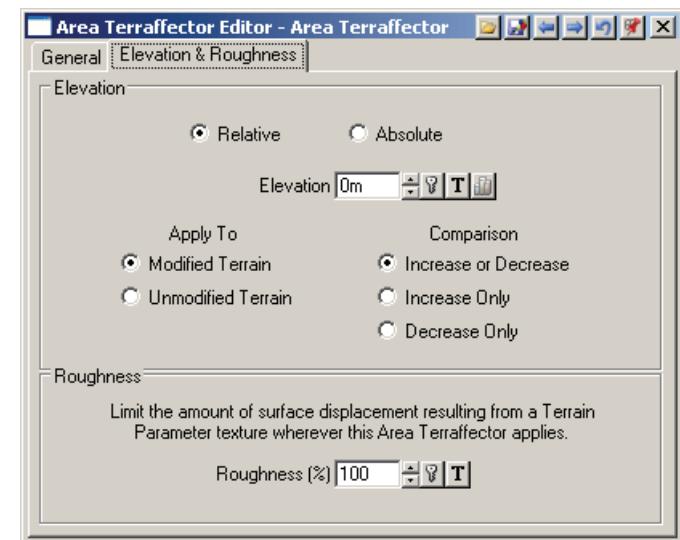
Choose the Relative radio button to make the Area Terraffector’s elevation change an offset of the existing terrain’s elevation. Choose the Absolute radio button if you want to set the Area Terraffector’s elevation change at a specific elevation relative to sea level.

Note: Sea Level is the surface of the Project Coordinate System's Ellipsoid, which is an elevation of zero. You can see the Project's Coordinate System in the Planet Options Editor.

In either case, the Edge Feathering Profile Editor lets you merge the Area Terraffector into the surrounding terrain.

The values in the Edge Feathering Profile Editor are a multiplier. The normal range is from zero to 100%. 100% times the elevation in the Elevation field of the Area Terraffector Editor results in the Elevation remaining unchanged, while profile values below 100% will reduce the Elevation value. A profile elevation of zero percent means the Area Terraffector’s Elevation will have no affect on the terrain. By creating an Edge Feathering Profile that goes from zero percent to 100%, you can merge the Area Terraffector smoothly into the surrounding terrain.

Note: Values in the Edge Feathering Profile’s graph that are larger than 100% will create elevations larger than the value in the Elevation field (see below).



Relative Radio Button

Choose Relative to set the Elevation of the Terraffector relative to the underlying terrain. This allows the surface of the Area Terraffector to change as an offset of the original terrain surface, maintaining the terrain shape but at an offset elevation.

You can set the Elevation above or below the original terrain elevation using the Elevation field (see below). Use a positive number in the Elevation field to raise the terrain compared to its original elevation. Use a negative number in the Elevation field to make the terrain lower.

Absolute Radio Button

Choose the Absolute radio button to force an exact Elevation no matter what the underlying terrain elevation may be. You can set the Elevation above or below sea level in the Elevation field (see below).

Note: Sea Level is the surface of the Project Coordinate System's Ellipsoid, which is an elevation of zero. You can see the Project's Coordinate System in the Planet Options Editor.

If you're in Absolute mode, the Profile values in the Edge Feathering Profile Editor also lets you merge the Area Terraffector's elevation into the surrounding terrain.

Elevation Field and Buttons

The Elevation field lets you set the elevation of the surface of the Area Terraffector. Enter a number above sea level if the Effect is in Absolute mode, or on either side of the underlying terrain elevation if the Effect is in Relative mode.

Note: Sea Level is the surface of the Project Coordinate System's Ellipsoid, which is an elevation of zero. You can see the Project's Coordinate System in the Planet Options Editor.

You can use an Edge Feathering Profile (see Edge Feathering Profile Editor) to change the elevation from the Vector inward. This lets you smoothly merge the elevation changes into the surrounding terrain.

Elevation Texture Icons

The Elevation Texture icons let you use displacement texturing on the terrain. Click the T icon to add a texture and open the Texture Editor.

You can use the shape of a texture to alter and even animate the shape of the terrain. Wherever there is a value of zero within the texture, there will be no elevation change from the Area Terraffector. A value of 100 within the texture will apply the full elevation change from the Elevation field into the Area Terraffector. Texture values between zero and 100 will apply partial amounts of the value in the Elevation field to the terrain within the Area Terraffector.

You can use any sort of texture, including animated textures, bitmapped textures, or even animated bitmap textures, to displace the terrain within an area terraffector.

In order to use a texture effectively, you must first set up the Area Terraffector to raise or lower your terrain. Then you can apply the texture to alter where, and how much, your Area Terraffector actually changes the elevations of the terrain.

Apply To Radio Buttons

The Apply To radio buttons let you choose whether the Area Terraffector will make its elevation changes to the DEM alone or if it will take other Area Terraffectors into account.

The Apply To radio buttons only matter for Area Terraffectors that have a Relative Elevation Type. They have no effect if the Elevation Type is Absolute.

The height of terrain in the region of a Relative Area Terraffector is determined by evaluating the Terraffector's Edge Feathering Profile and adding it to the terrain elevation.

Unmodified Terrain

Use the Unmodified Terrain radio button to tell VNS to add the Area Terraffector's Edge Feathering Profile elevations to the original unmodified terrain, ignoring other Area Terraffectors.

Modified Terrain

Use the Modified Terrain radio button to tell VNS to add the Area Terraffector's Edge Feathering Profile elevations to the elevations resulting from any Area Terraffectors applied before it.

Note: If you want your current Area Terraffector to affect other Area Terraffectors applied before it, make sure you set the order of evaluation appropriately (see the Evaluation Order field above). Linear Terraffectors are always applied after Area Terraffectors.

Comparison Radio Buttons

An Area Terraffector can raise the terrain, lower the terrain or both.

Increase Only

Select the "Increase Only" radio button if you want VNS to apply the Area Terraffector only where it will raise the terrain. VNS will ignore the Area Terraffector where it would have otherwise lowered the terrain. This is great for hills and mountains.

Decrease Only

Select the "Decrease Only" radio button if you want VNS to apply the Area Terraffector only where it will lower the terrain. VNS will ignore the Area Terraffector where it would have otherwise raised the terrain. This is great for lake beds or pit mines.

Increase or Decrease

Select the "Increase or Decrease" radio button if you want VNS to apply the Area Terraffector. This is great for craters with raised rims and levelled building sites that dig into hillsides and fill out on the downhill side.

Roughness Controls

Roughness Percentage Field and Buttons

Use the Roughness Percentage field to specify a percentage of the Vertical Displacement from the Project. VNS will use this percentage of Vertical Displacement within the Area Terraffector.

Note: You can set the amount of Vertical Displacement for the Project with the Terrain Parameter Editor.

The range is from zero to 500 percent, with zero being no Vertical Displacement and 100% being the full amount of Vertical Displacement as used by the Project. Any value over 100% will increase the amount of Vertical Displacement, with 500% being five times the Vertical Displacement you set for the Project.

A Roughness percentage of 100 will apply all the Vertical Displacement from the Project into the Area Terraffector. This will cause the terrain to have the same roughness within the Area Terraffector as the terrain does outside of the Area Terraffector.

You can smooth the terrain within the Area Terraffector by using a value of less than 100 percent. For example, you can use a lower value when you are creating a smooth parking lot surrounded by rougher terrain.

You can roughen the terrain within the Area Terraffector by using a value of greater than 100 percent, up to 500 percent. For example, you can use a high number to make a rough landslide area on the side of a mountain.

Roughness Percentage Texture Icons

The Roughness Percentage Texture icons let you add or subtract Vertical Displacement within the Area Terraffector using a texture.

By using a texture to control the roughness percentage, you can vary the roughness within a single Area Terraffector. You can use any sort of texture, including procedural textures, Image Object textures or even animated textures to alter the amount of roughness within an area terraffector.

Evaluate After Fractals Checkbox

Select the Evaluate After Fractals checkbox when you want the Area Terraffector to work with the fractally subdivided terrain rather than the terrain as originally sampled. VNS subdivides the terrain when you use Fractal Displacement shading.

It's a good idea to select Evaluate After Fractals if your Area Terraffector is small, for example if it only encompasses the area of a few original terrain cells. By using the fractally subdivided terrain instead of the original terrain resolution, the Area Terraffector's Edge Feathering Profile will have more terrain detail to work with. Without using Evaluate After Fractals, a small Area Terraffector's Edge Feathering Profile may make little or no difference due to the lack of resolution.

The Area Terraffector can use just a percentage of the Project's Fractal Displacement to create an area of smoother terrain. You can use the Roughness Parameter (see below) to set the amount of Fractal Displacement used within the Area Terraffector.

You can use an Area Terraffector to affect only the terrain smoothness by setting the Elevation field to zero and selecting the Relative radio button (see above).

Atmosphere Editor

The Atmosphere Editor gives you controls for the Atmosphere and Ambient Light. The Atmosphere is a simulation of the effect of particles in the air such as haze, fog, dust, smoke and smog.

VNS offers five types of atmospheres:

- **Linear**
- **Slow Increase**
- **Fast Increase**
- **Exponential**
- **Volumetric**

The first four are fast-rendering ways to simulate some of the effects of a real atmosphere. They also let you control cloud haze separately from haze on the ground. They do not react to shadows.

A Volumetric Atmosphere takes longer to render but is designed to more realistically depict an actual atmosphere by more accurately simulating the behavior of particles in the air. Volumetric Atmospheres can receive shadows for realistic crepuscular ray effects.

All the above atmosphere types apart from volumetric can also be set as “Filter Atmospheres” on the Haze and Fog page of the editor.

Linear

A Linear Atmosphere works by shading the objects in your scene with Haze and Fog colors. VNS varies the color between the real color of objects in the scene and the Haze and Fog colors.

Note: You can drag colors in the Scene-At-A-Glance to copy them from one to the other.

Haze is an atmospheric effect that colors distant objects more the farther away they are from the Camera. It is most noticeable horizontally unless the Camera is at a tremendous height. You can control where VNS starts mixing in the Haze color, where the Haze color is at its full intensity and what the start and end intensities will be for the Haze color. Haze is applied based on a distance from the Camera.

Fog is a vertical atmospheric effect that colors objects based on elevation. You can control where VNS starts mixing in the Fog color, where the Fog color is at its full intensity and what the start and end intensities will be for the Fog color.

You can control and enable and disable Haze, Cloud Haze and Fog separately.

Slow Increase and Fast Increase

Slow Increase and Fast Increase are similar to Linear, except that the Haze color is applied with different curves. Slow Increase will give you less coloration at the start of Haze and more coloration farther away. At the halfway point there will be less than 50% of Haze shading. Fast Increase gives you a denser effect closer to the Camera and at the halfway point there will be more than 50% of Haze shading.

Fog is always linear.

Exponential

Exponential haze is similar in falloff characteristics to Volumetric haze (see below) but without the rendering overhead. It renders about as fast as Linear, Slow Increase or Fast Increase and gives you the same controls for Haze, Cloud Haze and Fog.

Exponential haze does not react to shadows so it does not provide true volumetric effects. Use it where you want a fast-rendering haze effect similar to volumetric haze but without the ability to react to shadows.

Volumetric

Volumetric Atmospheres, while slower to render, do a more faithful job of reproducing most of the visible effects of a realistic atmosphere within a scene. These include distance cuing, change of color and saturation of objects as they recede in the distance, and simulating actual atmospheric particles that scatter light.

You can control the particles in the Atmosphere by creating and editing Atmospheric Constituents. Each Constituent is a different set of parameters.

You can use preset Constituents or build your own from scratch. You can rename Constituents and edit their properties.

VNS lets you load and save individual Atmospheric constituents as Components. This makes it easy to use them in other Projects. Atmospheric Components have an ".atc" extension.

Ambient Light

Ambient Light illuminates shadowed areas. In nature, ambient light comes from the sky or is bounced from the ground. To simulate this, VNS gives you two sources of ambient light. It's like having thousands of lights on the ground and thousands of lights in the sky.

The color you see in the color wells is the product of the color and intensity values in the Color Editor. VNS adds Ambient lighting to any light cast by Lights (see Light Editor) to shade each object in your scene.

Warning, too much light could blow out colors toward white, causing desaturation of the original object color. In general, use subtle amounts of ambient light. Sunny days have more direct light, while cloudy days are mostly ambient light.

General Page

Common Atmosphere and Cloud Volumetric Controls

The Common Atmosphere Controls let you change the Volumetric Sampling Quality and Tolerance. This applies to all Atmospheres and Cloud Models in your Project that are set to Volumetric in the General Features section (see below).

Note: The Common Atmosphere Controls do not have any affect for Atmospheres that use Linear, Slow Increase or Fast Increase Atmosphere types (see below), or for clouds that use the layered or Non-Volumetric settings Cloud Model Editor.

Volumetric Sample Quality Field and Sampling Tolerance Field

The Volumetric Sample Quality multipliers and Tolerance field let you control the interval VNS uses to sample volumetric levels in any volumetric Atmospheres.

Note: You can cast shadows into volumetric Atmospheres from Cloud Models (see Cloud Model Editor), terrain and foliage (see Shadow Editor) or 3D objects (see 3D Object Editor).

You can select a Volumetric Sample Quality by clicking on the corresponding radio button. If Normal (1x) is selected, VNS will sample every pixel. If 4x is selected, VNS will sample every other pixel, this continues upto 25x, for which VNS will sample every 5th pixel.

The higher the value, the faster VNS can render volumetrics, with a corresponding reduction in accuracy. In many cases, this reduction in accuracy will not be noticeable, and in some cases can even improve the appearance of the final render.

If you notice square or blocky artifacts in your volumetrics when rendered, reduce this setting.

The Sampling Tolerance field allows you a finer level of control over the Sampling Rate selected with the radio buttons. Values in this field can range from 0 to 100, with a value of 0 being the most accurate, and time consuming, and a value of 100 being least accurate, but faster to render.

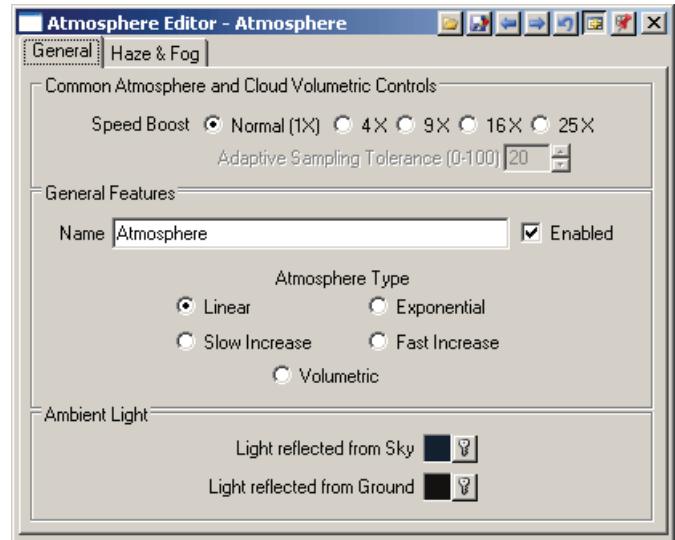
For the most accurate, but slow rendering volumetrics, you should select Normal (1x) with a Tolerance of 0. For the fastest volumetrics, but with the least accuracy you should select 25x with a Tolerance of 100. The latter setting is good for previewing global distribution and shading of volumetrics but in most cases will not be sufficiently high quality for final renders.

Note: As you add Atmospheric Constituents to a volumetric Atmosphere, they may cause a general darkening of your scene. You may need to increase light intensity to brighten the scene. You can increase Light intensity for any Light by clicking the Light Color & Intensity color well on the Light Editor's Color & Shadow page to open the Color Editor. You can set the Intensity field at the bottom of the Color Editor to a maximum of 1000%.

General Features

Name Field

Enter a name for the Atmosphere. For example, if you are creating a component to simulate smoky air, you might call it simply "Smoke".



By default VNS will name new Atmospheres “Atmosphere”, and add a number after the name if there is more than one Atmosphere named “Atmosphere”.

Enabled Checkbox

The Enabled checkbox lets you enable or disable the Atmosphere for rendering.

Disabling an Atmosphere can be useful to speed up rendering if you are doing test renders to check some other aspect of your scene and don't need to see the Atmosphere. Make sure you remember to enable it for the final rendering if you want to see the Atmosphere.

Note: To see the Atmosphere in your rendering, Atmospheres must be enabled in the Render Options you are using (see Render Options Editor). If you have more than one Atmosphere, VNS will add them together.

Atmosphere Type Radio Buttons

VNS lets you choose between four fast-rendering Atmosphere types and a more comprehensive Volumetric choice. After you make your choice you'll find further controls on the Haze & Fog page (see below).

Note: No matter what choice you make, the OpenGL Realtime previews always show a Linear Haze. To see the actual effects of the other choices you will need to render a preview.

After you select an Atmosphere type you can specify the Atmosphere's properties on the Haze & Fog page. The first four types share the same controls for Haze, Cloud Haze and Fog. Volumetric Atmospheres use a different approach with a different set of properties on the Haze and Fog page.

Linear

A Linear Atmosphere gives you a constant change in Haze and Fog density. It does not react to shadows.

Slow Increase

A Slow Increase Atmosphere makes the Haze and Fog get denser slower so you don't see the effect until you look farther away.

Fast Increase

A Fast Increase Atmosphere makes the Haze and Fog get denser quicker so you see the density increase closer to the Camera.

Exponential

An Exponential Atmosphere is similar in density falloff characteristics to a Volumetric Atmosphere (see below) but without the rendering overhead. It has the same controls as Linear, Slow Increase and Fast Increase. It does not react to shadows.

Volumetric

Select the Volumetric radio button if you want to use a Volumetric Atmosphere. A Volumetric Atmosphere is an entirely different, more realistic way of creating the effect of both fog and haze. Volumetric Atmospheres can show the effect of light and shadows.

Note: You have to enable shadows for the Lights (see Light Editor), Cloud Models (see Cloud Model Editor) and 3D Objects (see 3D Object Editor), and add Shadow Components (see Shadow Editor) for Image Object shadows and terrain shadowing when you want VNS to create shadows that will affect a Volumetric Atmosphere.

When you select the Volumetric radio button you will get a different set of controls on the Haze & Fog page (see below).

Ambient Light

Ambient light reflects from the sky and ground onto all parts of the scene. You can separately control ambient light reflected from the sky and reflected from the ground. Use this as a way to light shadowed areas. With both sky and ground ambient colors you can add an illusion of radiosity.

Note: Adjusting received shadow intensity is another way to reduce contrast in a scene without raising the ambient light everywhere. Shadow intensity can be adjusted in the Shadow, Cloud Model and 3D Object Editors.

If you add a lot of ambient light to a scene to brighten shadows, you should also cut back the direct light from your main sun light. Ambient lighting adds together with your main sun Light in sunlit areas just as in the real world.

No matter how much light you apply to a pure black surface it will always be pure black. Areas that are dark because of a dark Material will remain relatively dark. Specular Material surfaces will pick up more of the ambient light colors than dull surfaces. Specular Materials will also reflect some direct light regard-less of how dark the Material itself is. Adding specularity to dark Materials is a good way to keep them from appearing too flat.

Note: Typically you will have a single Atmosphere in your Project, but if you have more VNS will add the ambient lighting from each.

Light Reflected from Sky Color Well

Click the "Light Reflected from Sky" color well to adjust the color and intensity of the Sky Ambient Light.

VNS will open the Color Editor and you can adjust the color and intensity. By default it is a blue color and a fairly low intensity. If you make it pure black (or colored, but at 0 intensity) it will have no effect.

Light Reflected from Ground Color Well

Click the "Light Reflected from Ground" color well to adjust the color and intensity of the Ground Ambient Light.

VNS will open the Color Editor and you can adjust the color and intensity. By default it is a sandy gray color and an even lower intensity than the Sky Ambient Light. If you make it pure black (or colored, but at 0 intensity) it will have no effect.

Haze & Fog Page

The Haze & Fog page lets you control Haze and Fog parameters. If you selected Linear, Fast Increase or Slow Increase on the General page you'll get the Haze section and the Fog section. If you selected Volumetric on the General page you'll get the Atmospheric Constituents controls.

Haze Section

These controls only appear if you select Linear, Fast Increase, Slow Increase or Exponential on the General page (see above).

Enabled Checkbox

Select the Enabled checkbox to turn Haze on. Deselect it to turn Haze off. You can control the range of the Haze using the Start Distance and Range fields (see below).

Haze will apply to the terrain and clouds unless you select the Separate Cloud Haze checkbox in the Cloud Haze section (see below). If you select the Separate Cloud Haze checkbox, clouds will get their own Cloud Haze controls and the Haze controls here will only affect the terrain and objects on the terrain.

Act as Filter Checkbox

Selecting this checkbox will enable Filter Haze for any non-volumetric atmosphere. Filter Haze colorizes the scene based on distance just as normal haze does, but it does it by filtering out the complementary color to that selected in the Haze Color Well, rather than adding that color to the scene.

To use this feature most effectively, copy your atmosphere and rename it. Enable Filter Haze, and set the intensity of ambient light levels for the Filter Haze atmosphere to 0. Failure to do this will result in your scene receiving (at least) twice as much ambient light as before.

When enabled, this setting affects both normal Haze and Separate Cloud Haze, if enabled.

Haze Color Well

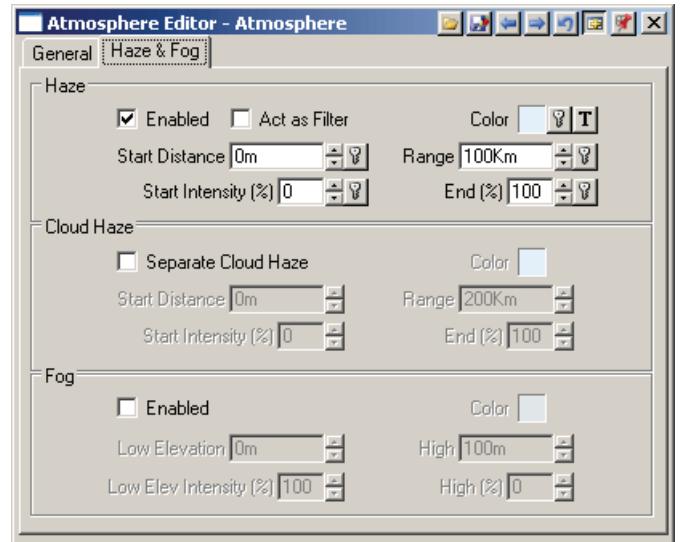
The Haze color well displays the color of the Haze effect. Click it to open the Color Editor where you can modify the Haze color.

Start Distance Field

Maximum: 1,000,000 kilometers

Minimum: -1,000,000 kilometers

Start Distance and Range are the members of the Haze Group. Together with the intensity controls they define how haze effects the objects in your image.



Haze is a simulation of the dust, smoke and water particles present in the earth's atmosphere. These particles tint objects in the distance. Heavy haze can even totally obscure far away objects.

Start Distance is the distance from the Camera at which haze begins to color objects using the Haze Start Intensity value. Objects closer than this distance will not be effected by haze.

Beyond the Start Distance, objects will get more and more colored by the haze color as they get farther away from the Camera.

Range Field

Maximum: 1,000,000 kilometers

Minimum: -1,000,000 kilometers

Start Distance and Range are the members of the Haze Group. Together they define how haze effects the objects in your image.

Range is the distance from the Camera beyond the Start Distance at which objects are colored with the End Intensity If End Intensity is 100 percent, objects will completely disappear into the haze color.

Start and End Intensity Fields

Start Intensity is the percentage of Haze at the Start distance. By default this is zero. You can increase this to make the Haze thicker faster.

End Intensity is the percentage of Haze at the end of the Haze Range. By default this is 100. You can decrease this to make the Haze never fully obscure distant objects.

Cloud Haze Section

These controls only appear if you select Linear, Fast Increase, Slow Increase or Exponential on the General page (see above).

Separate Cloud Haze Checkbox

Select the Separate Cloud Haze checkbox to enable separate Haze controls for clouds. This is useful for finer artistic control over the look of your skies.

Deselect the Separate Cloud Haze checkbox to use the settings from the Haze section (see above) for clouds.

You can control the range of the Cloud Haze using the Start Distance and Range fields (see below).

Cloud Haze Color Well

The Cloud Haze color well displays the color of the Cloud Haze effect. Click it to open the Color Editor where you can modify the Haze color.

Start Distance Field

Maximum: 1,000,000 kilometers

Minimum: -1,000,000 kilometers

Start Distance and Range are the members of the Cloud Haze Group. Together with the intensity controls they define how haze effects the objects in your image.

Haze is a simulation of the dust, smoke and water particles present in the earth's atmosphere. These particles tint objects in the distance. Heavy haze can even totally obscure far away objects.

Start Distance is the distance from the Camera at which haze begins to color the clouds using the Start Intensity value. Objects closer than this distance will not be effected by haze.

Beyond the Start Distance, clouds will get more and more colored by the Cloud Haze color as they get farther away from the Camera.

Range Field

Maximum: 1,000,000 kilometers

Minimum: -1,000,000 kilometers

Start Distance and Range are the members of the Cloud Haze Group. Together they define how haze effects clouds in your image.

Range is the distance from the Camera beyond the Start Distance at which objects are colored with the End Intensity If End Intensity is 100 percent, objects will completely disappear into the haze color.

You can interactively change the Haze Range numerically in the Atmosphere Editor or interactively in a View.

Start and End Intensity Fields

Start Intensity is the percentage of Haze at the Start distance. By default this is zero. You can increase this to make the Haze thicker faster.

End Intensity is the percentage of Haze at the end of the Haze Range. By default this is 100. You can decrease this to make the Haze never fully obscure distant objects.

Fog Section

These controls only appear if you select Linear, Fast Increase or Slow Increase on the General page (see above).

Enabled Checkbox

Select the Enabled checkbox to turn Fog on. Deselect it to turn Fog off. You can control the range of the Fog using the Low Fog and High Fog fields (see below).

Fog Color Well

The Fog color well displays the color of the Fog effect. Click it to open the Color Editor where you can modify the Fog color.

Low and High Fog Elevation Field and Buttons

Maximum: 1,000,000 meters

Minimum: -1,000,000 meters

Like Haze, Fog will tint elements of an image toward a color. However it works with elevation rather than distance.

Low Elevation is the elevation above sea level beyond which the fog effect begins. From there to the High Elevation, objects will be increasingly colored by the Fog color. This lets you simulate things like mountain peaks disappearing into fog. If the Camera is looking down from above, you can simulate valleys disappearing into fog.

Note: Sea Level is the surface of the Project Coordinate System's Ellipsoid, which is an elevation of zero. You can see the Project's Coordinate System in the Planet Options Editor.

Low Elevation and High Elevation Intensity Fields

Low Elevation Intensity is the percentage of Fog at the Low Elevation. By default this is 100.

High Elevation Intensity is the percentage of Fog at the High Elevation. By default this is zero.

The default values are great for filling valleys with Fog with the Camera looking down from above. If you want the tops of mountains to disappear into the Fog with the Camera looking up from below, set Low Elevation Intensity to zero and High Elevation Intensity to 100.

You can increase the value closest to zero to make the Fog thicker faster, and decrease the value closest to 100 to keep the Fog from completely obscuring objects.

Atmospheric Constituents Controls

These controls only appear if you select Volumetric on the General page (see above).

Atmospheric Constituents List

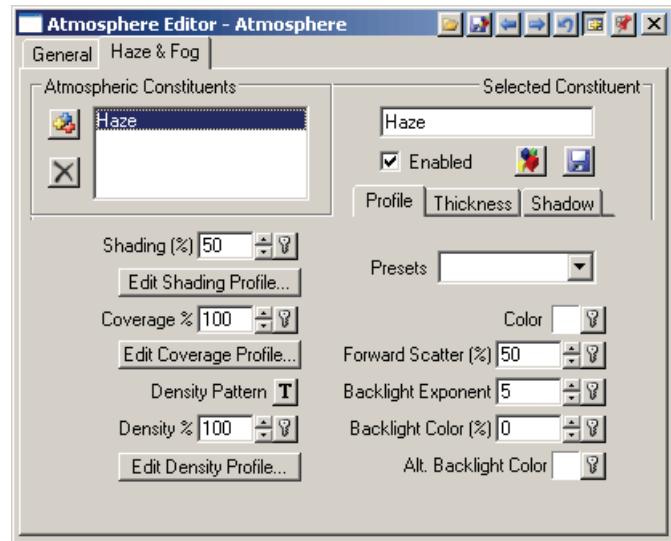
The Atmospheric Constituents list lets you see all the Constituents that make up the Volumetric Atmosphere. Each Constituent is a set of particles that color distant objects and can react to light.

You can have multiple Constituents in an Atmosphere. For example, you can combine Air and Fog.

The more Constituents you use, the longer your rendering times will be.

To add a new Constituent, click the Add Constituent icon. To remove a Constituent, select it in the list and click the Remove Constituent icon.

Note: If Volumetric Atmospheres have been enabled, this list will always contain at least one atmospheric Constituent. Deleting the last Constituent from the list will result in a default Haze Constituent being inserted to replace it. As you add Atmospheric Constituents to a volumetric Atmosphere, they may cause a general darkening of your scene. You may need to increase light intensity to brighten the scene. You can increase Light intensity for any Light by clicking the Light Color & Intensity color well on the Light Editor's Color & Shadow page to open the Color Editor. You can set the Intensity field at the bottom of the Color Editor to a maximum of 1000%.



Load and Save Atmospheric Constituent Icons

Use the Save Atmospheric Constituent to Disk icon to open the Component Signature window. There you can save an individual Atmospheric Constituent for use in other Projects.

Use the Load Atmospheric Constituent icon to open the Component Gallery where you can select from pre-saved Constituent Components and add them to the Atmosphere.

Name Field

Use the Name field to name the selected Constituent.

Enabled Checkbox

Use the Enabled Checkbox to enable or disable the selected Constituent.

Selected Constituents Controls

These controls only appear if you select Volumetric on the General page. They let you set the properties of the Constituent you select in the Atmospheric Constituents List (see above). There are three pages of parameters for Volumetric Atmospheres: Profile, Thickness and Shadow.

Profile Sub-Page

Shading Percentage Field

The Shading percentage field lets you adjust the shading variation in the atmospheric component based on the position of Lights. VNS combines the output of Lights with that of the Color Gradient on the Color page to create the final atmospheric effect.

Increase the Shading percentage to get more variation of shading in the clouds from Lights. A value of zero means the Cloud Model will not change shading in response to Lights. 100% is the maximum shading variation based on Lights.

For Volumetric shadows the Shading value limits the amount of shading the shadows produce.

Edit Shading Profile Button

Clicking this button will open the Edit Shading Profile Editor, allowing you to use a gradient to control shading of the cloud model vertically from the Base of Profile Elevation for a distance equal to the Thickness Above Base value.

Coverage Percentage Field

The Coverage percentage field lets you adjust the amount of atmospheric constituent that will appear in the defined volume of space.

Set it to 100% to allow all the coverage that you see in the Texture Editor for the Density Pattern. Set it lower to reduce the cloud coverage. You can animate the Coverage percentage to create increasing or decreasing cloud coverage over time.

You'll never have more coverage than what you see in the texture editor. Set the Coverage percentage to 100% to get as much Density as you set up for the Density Pattern in the Texture Editor, as long as the Density percentage is also at 100% (see below).

This value is not exact and the actual amount of coverage depends as much on the Density Pattern texture definition as the coverage % value set.

Edit Coverage Profile Button

Clicking this button will open the Edit Coverage Profile Editor, allowing you to access a gradient controlling coverage of the Atmosphere vertically through its volume from the Base of Profile Elevation for a distance equal to the Thickness Above Base value.

Density Pattern Controls

The Density Pattern controls let you access the Texture Editor where you can use textures to control local density within the Atmospheric constituent. This pattern controls the size, shape, placement and edge definition of the atmospheric constituent as well as its evolution.

You can edit the Density Pattern texture by clicking the Edit button.

You can use other texture Elements if you wish, including the Planar Image Element which lets you use any Image Object to control the Density Pattern. Image Objects are images or image sequences.

If the pattern changes over time or has velocity applied on the Z axis the cloud will appear to evolve shape. The Density Pattern is the main key to creating texture within your atmospheric constituents to simulate particle movement.

Density Percentage Field

Controls the transparency of the cloud mass. It works in combination with the Optical Depth, increasing Optical Depth as the density decreases and vice versa. Densities greater than 100% are permissible. Lights will affect atmospheric constituents when the Shading percentage is above zero (see above).

Set the Density to 100% if you want the clouds to be like the Density that you see in the Texture Editor for the Density Pattern (the center color is shown as white in the Texture Editor). Set the Density percentage higher to increase the apparent thickness or lower to reduce the apparent thickness. You can animate the Density percentage to create increasing or decreasing apparent cloud density over time.

Set the Density percentage to 100% and the Coverage percentage to 100% if you want the to have the exact Density and Coverage you see in the Texture Editor for the Density Pattern.

Edit Density Profile Button

Clicking this button will open the Edit Density Profile Editor, allowing you to control the density gradient vertically within the atmospheric constituent from the Base of Profile Elevation for a distance equal to the Thickness Above Base value.

Presets Drop Box

Use the Presets drop box to select preset properties for the selected Constituent. There are presets for a number of different types of Atmospheric Constituents including choices for air, haze, fog, smog, dust and smoke.

Color Well

The Constituent color well displays the color of the selected Atmospheric Constituent. Click it to open the Color Editor where you can modify the color this Constituent will contribute to your Volumetric Atmosphere.

Select the Color you want the constituent's particles to scatter. For realism, set it to some shade of blue that matches the basic color of the sky. The inverse of the particle color will be the color the terrain 3D Objects and Image Objects become tinted by the constituent.

The amount of air that light travels through affects the amount of the particle color reflected from the sky. A thin atmosphere goes more toward black, while a thicker atmosphere will have a more intense version of the color. A thin atmosphere adds less of the inverse color onto objects, while a thick atmosphere adds more inverse color to objects.

Because the sun at noon has less atmosphere to pass through, the atmosphere adds less of the inverse color to objects. Morning and evening light passes through more atmosphere and so more of the inverse color is added to objects and even parts of the sky. A sunset is more dramatically colored with large particles, but even smaller particles have some effect.

Forward Scatter % Field

Allows greater illumination of atmospheric constituent when backlit. Simulates the scattering of light due to particulate matter in the atmosphere. Values of 10% to 100% have shown to be useful in different situations. High Forward Scatter values may cause excessive color washout especially when the atmospheric constituent is backlit. Either accept it as the same phenomenon that would occur using a real camera and film or use a post process event to adjust exposure so the true colors can be seen.

Backlight Exponent Field

Works like Translucency Exponent in 3D Object materials. Adds an additional quantity of backlighting proportional to the Forward Scatter % and the cosine of the angle between the view ray and the ray from atmospheric constituent to light. Higher values of exponent restrict the backlight effect to areas closer to the light. Lower values (less than 1 is allowable) create broader areas of effect. Values of 5-50 have been tried and also look realistic.

Backlight Color % Field

determines the mixture of backlight color between the light's color and the Alternate Backlight Color. A value of 0 means use only the light's color and a value of 100 means use only the Alternate Backlight Color. The mixture only applies to the area within the cone defined by the Backlight Exponent.

Alt. Backlight Color Well

An alternate color for use in backlighting. It replaces the light's color according to the ratio specified by the Backlight Color %. It is only applied within the cone defined by the Backlight Exponent and its amount is also affected by the Forward Scatter %.

Thickness Sub-Page

Before Reflections Checkbox

Causes the volumetric atmospheric constituent to be rendered before reflections so they will reflect. Use this setting for sky constituents.

After Reflections Checkbox

Causes the volumetric atmospheric constituent to be rendered after reflections so they will not reflect and will replace reflective material as appropriate. Use this setting for fog over water.

Optical Depth

Determines the distance you can see into a volumetric atmospheric constituent. It is the visibility threshold beyond which an object will be completely obscured by the atmospheric constituent if the cloud density is a constant 100%. In practice the Optical Depth is modulated by the cloud Density, Density Pattern and Coverage. This value will be set automatically based on the preset constituent selected. Atmospheric constituents with higher Density or lower Optical Depth seem more solid, have more well-defined shadow boundaries and tend to render a bit faster because of the higher light extinction rate and fewer samples along a ray required to fully sample the volume.

Minimum Sample Spacing

Controls the speed of rendering volumetric atmospheric constituent and volumetric atmospheric constituent shadows. A smaller number may result in slower rendering times by allowing over-sampling of the cloud volume. The value should be lower than or equal to the Maximum Sample Spacing.

Maximum Sample Spacing

Controls the render quality of volumetric atmospheric constituent and volumetric atmospheric constituent shadows. Higher numbers may result in cloud under-sampling and a coarse grainy look or even holes in the atmospheric constituent where there shouldn't be any. Under-sampling may also result in poor shadow sampling indicated by missing or incomplete shadow and light rays within the atmospheric mass. It should always be equal or greater than the Minimum Sample Spacing so that both can perform their respective duties. The correct Maximum Spacing can only be determined by trial and error. The only penalty of having the value too low will be poor rendering speed. Start with a value of 100 and increase it until the atmospheric constituent becomes grainy. If it is grainy at 100 or the atmospheric constituent has missing parts or poor shadow definition, lower it until it looks good. Then set the Minimum Spacing to a value less than or equal to the Maximum. The Minimum value is less critical than the maximum value and is in fact only of real use for very thin atmospheric constituents.

Base Of Profile Elevation Field

Controls the absolute elevation above sea level at which the atmospheric constituent is considered to have its base elevation. This is the lowest point at which the atmospheric constituent will be considered to have an effect.

Thickness Above Base Field

Controls the distance above the base elevation to which the atmospheric constituent stretches in a vertical sense. This height is the distance over which the Edit Coverage Profile Editor, Edit Density Profile Editor, and Edit Shading Profile Editor work.

Shadows Sub-Page

Cast Shadows Checkbox

Enabling shadow casting will allow this atmospheric constituent to cast shadows on other elements in the scene providing that the necessary shadow receive checkboxes have been enabled on those objects and shadow maps generated where necessary.

Receive Checkboxes

Select one or more of the following checkboxes to allow the cloud model to receive shadows from that object class.

Terrain

Receive shadows generated by terrain that is covered by a Shadow Effect (see Shadow Editor.)

Foliage

Receive shadows generated by foliage that is covered by a Shadow Effect (see Shadow Editor.)

3D Objects

Receive shadows from 3D Objects that cast shadows.

Cloud Shadow Maps

Receive shadows from clouds that have either Cast Shadow Map or Cast Combination shadow types selected.

Volumetrics

Receive shadows from clouds that have either Cast Volumetric or Cast Combination shadow types selected and from Volumetric Atmospheres that have Cast Shadows turned on. Normally a cloud will have only Receive From Volumetrics OR Receive From Cloud Shadow Maps selected, not both. In order to generate volumetric self-shadows the cloud must have Receive From Volumetrics enabled and either Cast Volumetric or Cast Combination shadow types selected. This procedure is slow but generates by far the most realistic cloud shading. The amount of shadow that can be generated is limited by the Shading % value and Shading Profile on the Aerial Attributes tab.

Consider Light Falloff, Spotlight cone & Earth Umbra

To save time if there are not lights with falloff, spotlights or lights beyond the horizon, turn this checkbox off. If any of the above conditions are not met turn this checkbox on. Extra computations will be required in that event to correctly illuminate the cloud.

Received Shadow Intensity

Controls the amount of shading that can be generated from Terrain, Foliage, 3D Object and Light Falloff, Spotlight Cones and Earth Umbra.

Camera Editor

VNS lets you use multiple Cameras. To open the Camera Editor for a Camera, double-click the Camera's name in the Scene-At-A-Glance.

The Camera Editor lets you edit all the Camera, Lens, Camera Path and Target Path Parameters in one place.

You'll see Key Frame and TimeLine icons next to the fields of every animatable Parameter.

Note: To use the Camera in your rendering, it must be selected for the Render Job you are using (see Render Job Editor).

General Page

The controls on the General page let you name the Camera, set it to be "floating," and keep it at the same elevation when you move it interactively in a View.

General Features Section

Name Field

Enter a name for the Camera. For example, if it's an overhead Camera, you might call it simply "Overhead Camera".

By default VNS will name new Cameras "Camera", and add a number after the name if there is more than one Camera named "Camera".

Floating Checkbox

Click the Floating Checkbox to cause the Camera to float. VNS will position the Camera where it can see the terrain. If you add more terrain, the Camera will move to keep the terrain in view.

You can also make a Camera float by clicking the "Default Camera Position (Floating)" icon in the Icon Toolbar.

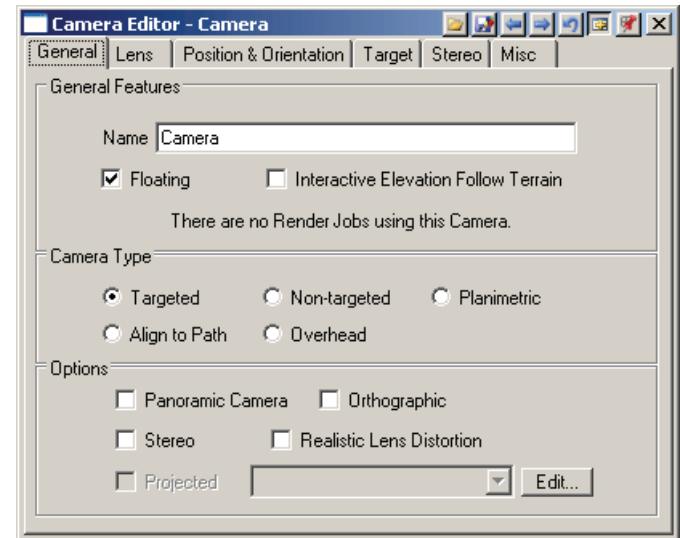
Making a Camera float will delete any key frames the Camera may have. If the Camera has key frames, VNS will ask you before deleting the key frames and floating the Camera.

As soon as you change the Camera's position in any way, VNS will deselect the Floating checkbox automatically.

Interactive Elevation Follow Terrain Checkbox

Select the Interactive Elevation Follow Terrain checkbox if you want the Camera to stay at the same elevation about the terrain when you move it interactively in a View.

This will not affect the Camera's elevation if you change the Camera position numerically within the Camera Editor.



Number of Render Jobs Message

The Number of Render Jobs message shows whether the Camera is being used by any Render Jobs. Cameras can be used for rendering or just to provide another View perspective.

Cameras belonging to enabled Render Jobs will be taken into consideration when VNS calculates Fractal Depth Maps. Don't attach a Camera to a Render Job unless you really need to use the Camera to render. You can attach a Camera to a Render Job in the Render Job Editor.

Camera Type Section

Camera Type Radio Buttons

Choose a Camera Type by selecting one of the Camera Type radio buttons.

Targeted

Select the Targeted radio button if you want the Camera to point at a target. A Targeted Camera is always linked to a Target or any 3D Object. You can alter heading and pitch on the Position & Orientation page (see below). When heading and pitch are set to zero, the Camera will point at the Target.

The Target appears as three crossed bars in OpenGL Realtime Views. You can position the Target numerically or select a 3D Object as the Target on the Target page (see below).

Non-targeted

Select the Non-targeted radio button if you want the Camera to point based only on the heading, pitch and bank controls.

A non-targeted Camera has no Target. You can control its orientation with the heading, pitch and bank controls on the Position and Orientation page (see below).

Align to Path

Select the Align to Path radio button when you want the Camera to look ahead along a motion path. This is great for fly-through animations to create airplane or helicopter perspectives. VNS will automatically align the Camera's orientation along a tangent of its motion path.

You can also animate heading, pitch and bank separately on the Position and Orientation page (see below).

Select the Align to Path radio button if you want the Camera axis to be aligned to the Camera Motion Path. This lets the Camera look down its own path instead of looking at the Target.

Overhead

Select the Overhead Camera radio button to point the Camera at the earth's center. The Camera will point straight down with the top of the Camera to the north.

This gives you a map-like overhead perspective of the terrain useful to use in a View as an overview of your terrain. It is also useful for rendering whole-earth perspectives.

Note: If you don't want north to be at the top of the picture you can change the rotation of the Camera with the Bank Parameter.

Planimetric

Select the Planimetric Camera radio button when you want an overhead View with a flat projection. The Longitude of all coordinates will be compressed based on latitude of the camera. You can set the scale with the Horizontal Field of View field on the Lens page.

Planimetric is the only Camera Type that lets you position Components interactively outside of DEM boundaries. This is great for positioning Lights, Celestial Objects and Cloud Model boundaries.

Options Section

Panoramic Camera Checkbox

The Panoramic Camera checkbox is available for Targeted, Non-targeted and Align to Path Camera Types. It lets you render a 360 degree image constructed of multiple panels. This is great for wide panoramic images as well as interactive formats such as Quicktime VR.

You can use the Horizontal Field of View field on the Lens page to tell VNS how many degrees each panel covers. For example, if you set the Field of View to 60 degrees, VNS will create six panels. If the Field of View doesn't divide evenly into 360 degrees, VNS will use the next smallest Field of View that does divide evenly.

You can't have a Field of View equal or larger than 180 degrees. VNS will always use at least three panels. VNS will automatically stitch the panels together to create a final image.

You can use third party programs such as Quicktime to create interactive "VR-style" animations out of panoramic renderings.

Note: When you render a Panoramic Camera, any elapsed time and time estimates VNS displays are for the current panel only, not the complete panoramic render.

Orthographic Checkbox

The Orthographic checkbox is available for all Camera Types except Planimetric. It turns off perspective.

This could be useful for rendering architectural plans. Since objects don't change size due to perspective, if you know the scale you can measure sizes directly on the rendering. All 3D objects, trees and terrain will be rendered without perspective.

Stereo Checkbox

Select the Stereo checkbox to make the Camera able to render two images for every frame, from different perspectives. It's like using two perfectly synchronized Cameras.

By creating two images and viewing them separately with each eye with a stereo viewer (or by looking at them side by side and crossing your eyes if you're really talented) you can simulate an added appearance of 3 dimensional depth.

You can adjust the stereo controls on the Stereo page (see below).

Realistic Lens Distortion Checkbox

The Realistic Lens Distortion checkbox lets VNS attempt to mimic the light bending that happens in a real lens. Straight lines become curves, most noticeable along the edges of image. This can affect the terrain, horizon line, 3D Objects and Image Objects.

Note: A 3D object won't become curved unless it has more than one polygon side along the edge. The amount of curving is restricted by the polygon detail in the object. 2D foliage images sizes will be affected, but trunk and branch lines will not be made more curvy. Using Realistic Lens Distortion may make it difficult to match VNS renderings with those of external 3D programs.

Projected Checkbox

The Projected checkbox tells VNS to render your output in a selected coordinate system.

Note: This checkbox can only be enabled for Planimetric Cameras.

This function is especially useful for preparing cartographic output for atlases and the like, which are often presented using a Lambert projection. When enabled, the following controls will be made available:

Coordinate System Dropdown List

Select the coordinate system to which you want to project your rendered output. Due to the nature of some coordinate systems, not all will give the rendered output that you expect, necessarily. For example, no special clipping is performed on vectors or polygons that cross into the forbidden zones of certain projections, like Interrupted Goode Homolosine, or tail around the planet. Camera View Width is the key to controlling how much of the projection is seen.

Edit Button

Clicking this button will open the Coordinate System Editor for the Coordinate System selected for projected output.

Lens Page

The Lens page lets you set the Lens and Aperture controls, the Depth of Field controls, and the Shutter controls.

Lens & Aperture Controls

Horizontal Field of View or View Width Field

The Horizontal Field of View or View Width field lets you zoom the Camera's "optics" in or out like a zoom lens on a real camera. It will be the Horizontal Field of View or View Width field, depending on the Camera Type you select on the General page. It will be View Width only for the Planimetric or Orthographic Camera Types.

The Horizontal Field of View provides the illusion of closeness and distance without changing the spatial relationship of objects in the image. You can animate the Horizontal Field of View to create the effect of a zoom lens changing focal length to zoom in or out. The maximum value is 179.9 degrees and the minimum value is .0001 degree.

The View Width Field lets you specify how wide the Planimetric Camera will display in the Distance units you set on the Units page of the Preferences Window.

For Cameras with the Panoramic Camera checkbox selected (see above), VNS lets you render a 360 degree image constructed of multiple panels. The Horizontal Field of View field lets you tell VNS how many degrees each panel covers. For example, if you set the Field of View to 60 degrees, VNS will create six panels. If Field of View doesn't divide evenly into 360 degrees, VNS will use the next smallest Field of View that does divide evenly. You can't have a Field of View equal or larger than 180 degrees. VNS will always use at least three panels. VNS will automatically stitch the panels together to create a final image.

Depth of Field

Depth of field means a range of distance from the camera that is in focus, with the rest of the scene losing focus. Using Depth of field simulates the way a camera really works.

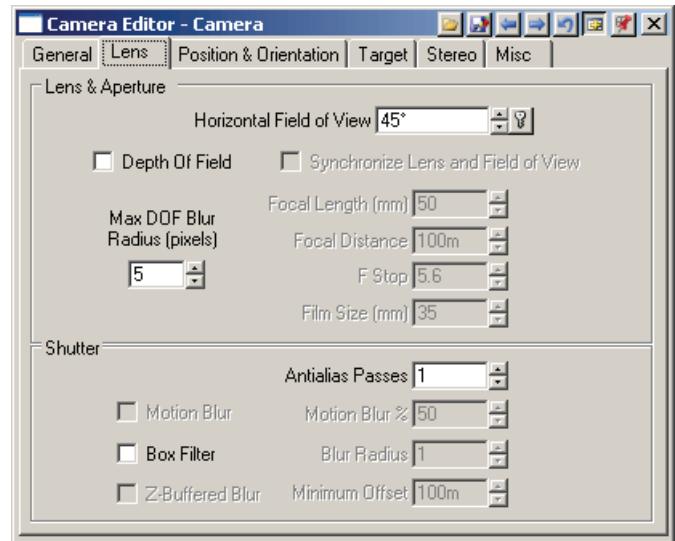
VNS lets you create subtle or dramatic depth of field effects.

By focusing on a particular part of a scene, you can draw attention to it. Depth of field can make your images and animations look more realistic or artistic. For example, you can bring attention to a flower by focusing on it, while the foreground and background are blurred.

VNS simulates the way a real camera creates depth of field. You can set the Film Width, F Stop, Lens Focal Length and Focal Distance to create the depth of field produced by any type of camera! You can also tell VNS how much to blur the blurred areas by using the Max Blur Radius field.

To use depth of field:

- 1) Select the Depth of Field checkbox



- 2) Set the Focal Distance field to the distance from the Camera you want to be in sharpest focus, in meters.**
- 3) Set one or more of the Focal Length, F Stop and Film Width fields to produce the amount of depth of field you desire. You can create a narrow area of focus or a deep area of focus.**
- 4) Set the Max Blur Radius to specify the maximum amount of blurring you want to see in the defocused areas.**

You can animate all of these parameters for dramatic effects, including film-style rack focus effects where you change from focusing on one area to focusing on another!

Depth Of Field Checkbox

Select the Depth of Field checkbox when you want to render with a depth of field effect.

When you select the Depth of Field checkbox, you can tell VNS where the scene should be in focus and where the focus should fall off into a natural lens blur, using the controls listed below. The areas of focus and blur happen along a line directly ahead of the Camera.

When you deselect the Depth of Field checkbox, the entire scene will be in focus. The Depth of Field controls described below will be disabled.

Synchronize Lens and Field of View Checkbox

Select the Synchronize Lens and Field of View checkbox for a temporary linkage between the Horizontal Field of View field and the Depth of Field's Focal Length field. The linkage will go away when you close the Camera Editor.

The Focal Length field only sets focal length for the Depth of Field calculation. The Horizontal Field of View field lets you actually zoom the Camera's lens by changing the width of its horizontal view, which is another way to affect the focal length of the Camera lens.

By selecting the Synchronize Lens and Field of View checkbox, any changes you make in either field will also change the other field. VNS will calculate the Field of View for any Focal Length change you make, and vice versa. This matches the Depth of Field calculations to the real focal length of the Camera's lens as set with the Horizontal Field of View.

This also lets you set the Horizontal Field of View by entering a Focal Length value, which may be convenient if you're an experienced photographer.

Max DOF Blur Radius Field

Useful range: typically 5 to 10 pixels.

The Max DOF Blur Radius field lets you set the maximum amount that blurred areas will be blurred, in pixels.

You can use it to limit the amount of blurring to save rendering time. Start with 5 pixels, and if that's not enough, make it higher. If your rendering looks too blurred, set it lower.

Using more than a 10 pixels blur radius makes little difference except to increase rendering time.

You can animate Max Blur Radius to go from a small amount of blurring to a large amount of blurring, or vice versa.

Focal Length Field and Buttons

Maximum: 1000mm

Min: 5mm

The Focal Length field lets you change the amount of depth of field for the camera. It simulates the depth of field you would get from a real camera lens of the same focal length.

Note: Focal length is the length from the diaphragm or iris to the film plane. The Focal Length field does not actually change the lens itself! It only changes the way depth of field is calculated. To zoom the lens, use the Horizontal View Arc parameter (see above).

For a shallower area of focus and more areas that are blurred, use a higher value. For a deeper area of focus with less areas that are blurred, use a lower value.

As an example, for a 35mm film width (see below), 50mm is a normal focal length lens. Values higher than 50 will create less depth of field than normal (with less area in focus and more area blurred). Values below this will create more depth of field than normal (with more area in focus and less area blurred).

You can animate the Focal Length field to go from a shallower depth of field to a deeper depth of field, or vice versa.

Focal Distance Field and Buttons

The Focal Distance field lets you set the distance from the Camera at which the scene will be in the sharpest focus. The distance is in the units you set in the Distance field on the Units page of the Preferences Window. Areas in front or behind that distance will fall off into a blur.

A good way to set this field is to do a preview rendering in a View and then click on the area you want to be in focus. The Diagnostic Data Window will show the distance from the Camera to that point.

You can animate Focal Distance to create film-style rack focus effects. This lets you change from focusing on one area to focusing on another.

F Stop Field and Buttons

Maximum: 100

Minimum: 1

The F Stop field lets you change the amount of depth of field for the camera. It simulates a change in f-stop for the camera.

Note: The F Stop field does not actually change the lens itself! It only changes the way depth of field is calculated. To darken or lighten the exposure, you can control Lights with the Light Editor and Ambient Light with the Atmosphere Editor. There is also an Exposure Event for use in the Post Process Editor

The larger the f-stop, the greater the depth of field. For a shallower area of focus and more areas that are blurred, use a lower value. For a deeper area of focus with less areas that are blurred, use a higher value.

You can animate the F Stop field to go from a shallower depth of field to a deeper depth of field, or vice versa.

Film Size Field and Buttons

Maximum: 1000mm

Min: 5mm

The Film Size field lets you simulate the effect of different sizes of film. All other things being equal, a larger film width will give you more depth of field and a smaller film width will give you less depth of field. The default is 35mm, just like a standard 35mm camera.

Note: The Film Size field does not actually change the image resolution! It only changes the way depth of field is calculated. You can change image resolution from the Render Options Editor.

You can animate the Film Size field to go from a shallower depth of field to a deeper depth of field, or vice versa.

Shutter Controls

VNS supports several kinds of antialiasing and blurring, including motion blur, multi-pass antialiasing, and box filtering.

Antialias Passes Field and Buttons

Enter a number in the Antialias Passes field to enable multi-pass antialiasing. Multi-pass antialiasing further smooths jagged edges and reduces high contrasts between adjacent pixels. It can be especially useful when rendering highly detailed animations. If you see any unrealistic pixel flashing during motion, multi-pass antialiasing is designed to get rid of it.

Note: The implementation of Pixel Fragment Rendering in VNS 3 has improved antialiasing quality. Multiple antialiasing passes should no longer be necessary in most cases. However, multiple antialiasing passes are still required if you want to use Motion Blur (see Motion Blur Percent Field below).

VNS always does internal antialiasing during rendering. A setting of 1 adds no extra multi-pass antialiasing. A setting of two or more will add multi-pass antialiasing. Higher numbers will do more antialiasing, lower numbers will do less. While for technical reasons 5, 9 and 17 are the most optimal numbers to use, it's unlikely you will need that much. Most often, a setting of 1 (no extra passes), 2 (one extra rendering pass) or 3 (two extra rendering passes) will be sufficient.

Note that multi-pass antialiasing will multiply rendering time by the number you enter. VNS already does other types of internal antialiasing, so only use multi-pass antialiasing if it's really necessary for your scene. For efficient rendering use the lowest number that produces the look you need.

No additional memory is used by multi-pass antialiasing.

Motion Blur Checkbox

Select the Motion Blur checkbox if you want moving areas of your picture to blur. Without Motion Blur animations will look like they were shot with a camera using a higher shutter speed. With Motion Blur animations will look like they were shot with a camera using a slower shutter speed.

The smoothness of the motion blur will be determined by the number you enter in the Antialias Passes field. The higher the number, the smoother the blur.

While increasing the number of Antialias Passes does multiply the time it takes to render, selecting Motion Blur does not increase rendering time any further.

No additional memory is used by motion blur.

Motion Blur Percent Field and Buttons

Enter a number between 0 and 100. This is the percent of difference between frames that becomes blurred. It is like setting the exposure length on a camera. The larger the number the longer the "shutter" remains open and the more blur occurs. A value of zero will have no blurring effect. A value of 100 will create a continuous blur. Values larger than 100 will cause frames' images to overlap in time.

If you want Motion Blur you must also set the number of antialias passes to greater than one (see Antialiasing Passes Field below). The faster the camera motion and the smoother you want the blur, the more passes you will need. There is no optimal number; it depends on your camera motion and scene. The down side is that additional passes result in additional rendering time (see below), so you will probably want to use the fewest antialiasing passes that produce an acceptable result.

Box Filter Checkbox

Select the Box Filter checkbox to enable the center weighted box filter (similar to Gaussian blur). You can set the amount of blurring in the Blur Radius field.

Expect only very slightly longer rendering time with Box Filter on. The larger the number in the Filter Strength field the more it will add to rendering time. Box Filtering does not require any additional Memory use.

You can also use the Box Filter along with the Z-Buffered Blur option to blur only areas that are not adjacent in space (such as ridges against the sky) even though the pixels representing them are adjacent from the Camera's perspective. This can help add additional antialiasing to your scene with very little rendering cost.

Note: VNS automatically antialiases the horizon against clouds.

Blur Radius Field

The Blur Radius field lets you set the amount of blurring created by the Box Filter (see above). The higher the number, the more blurring will be done. An amount of 1 is usually enough to soften things, while 10 will give you a mushy effect.

Z-Buffered Blur Checkbox

Select the Z-Buffered Blur checkbox to restrict the Box Filter's blurring to blur only elements that are more than a certain distance away from each other in a straight line from the Camera. For example, this lets you give extra antialiasing to trees against distant hills.

Box Blur with Z-Buffered Blur selected will barely affect rendering time and will not take additional memory use.

Minimum Offset Field and Buttons

Use the Minimum Offset field to set the minimum Z offset distance beyond which adjacent pixels will be blurred together when the Box Filter and Z-Buffered Blur checkboxes are both enabled (see above).

Position & Orientation Page

You can position the Camera on the planet in latitude, longitude and elevation; control ease-in and ease-out; and rotate the Camera's heading, pitch and bank. For more about latitude and longitude see Appendix A: A Lesson In Geography.

Note: You can also place the Camera interactively by selecting it as the Active Item and Control-Clicking in any View.

Position Controls

Latitude Field and Buttons

You can enter a value into the Latitude field to change the Camera's north/south position. The maximum value is 90.0 degrees (north pole). The minimum value is -90.0 degrees (south pole).

Camera Latitude is how far the Camera is north or south of the equator. It's measured in degrees and is compatible with the latitude markings on standard maps and globes.

Camera Altitude, Camera Latitude and Camera Longitude together define the Camera's position in 3D space. They are all members of the Camera Group. When you change the Camera Latitude without changing the Camera Altitude, the Camera will naturally move at a fixed orbital distance from the earth rather than shooting out into space.

Longitude Field and Buttons

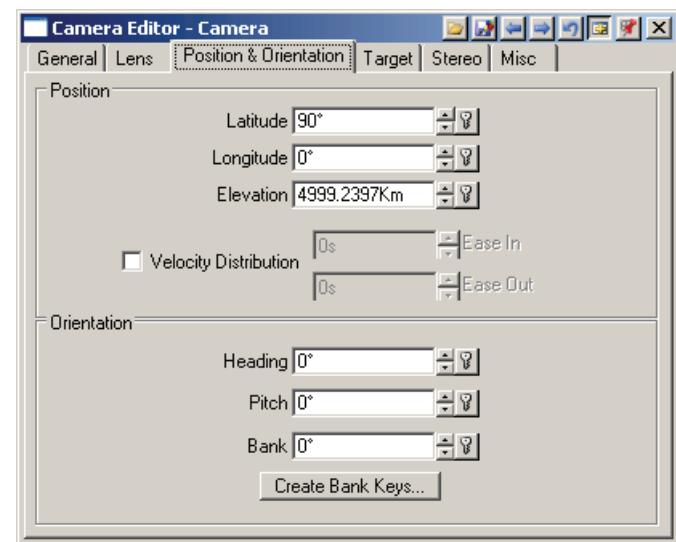
You can enter a value into the Longitude field to change the Camera's north/south position. The maximum value is 1,000,000 degrees and the minimum value is -1,000,000 degrees (more than several thousand orbits in the positive or negative directions).

Camera Longitude is how far the Camera is east or west of the prime meridian, which passes through Greenwich, England. It's measured in degrees and is compatible with the longitude markings on standard maps and globes.

By default, VNS uses a positive longitude as west of the meridian and negative longitude as east. This is due to the fact that much of the high quality DEM data available is for the Western hemisphere. You can change this on the Units page of the Preferences Window if you wish.

VNS supports continuous longitudinal motion up to 1,000,000 degrees (approximately 2,777 complete orbits) in both positive and negative directions. Longitude position may be expressed as either positive or negative ($-5^\circ = 355^\circ$) based on the 360° full circle.

Note: You can rotate the planet directly with the Rotation field in the Planet Options Editor.



Camera Altitude, Camera Latitude and Camera Longitude together define the Camera's position in 3-D space. They are all members of the Camera Group. When you change the Camera Longitude without changing the Camera Altitude, the Camera will naturally move at a fixed orbital distance from the earth rather than shooting out into space.

Elevation Field and Buttons

Maximum: 1,000,000 kilometers

Minimum: -6,362.683195 kilometers (the center of the earth)

The Elevation field lets you set the height of the Camera. It's measured in the elevation units you select on the Units page of the Preferences Window, above or below sea level.

Note: The elevations in DEM files are also relative to sea level. Sea Level is the surface of the Project Coordinate System's Ellipsoid, which is an elevation of zero. You can see the Project's Coordinate System in the Planet Options Editor.

Camera Elevation, Camera Latitude and Camera Longitude together define the Camera's position in 3-D space. They are all members of the Camera Group.

Velocity Distribution Checkbox

Use the Velocity Distribution checkbox to specify whether the Camera's Motion Paths will have velocity smoothing applied.

When using key framed Motion Paths it is sometimes impossible to obtain perfectly smooth velocity. Velocity Distribution causes all frames to be adjusted by a small amount along the path to even out the velocity over the entire animation. You may specify an "Ease In" or "Ease Out" value to ramp the velocity at either end. The Velocity Distribution feature operates on both Camera and Target Paths.

The velocity graphs that appear with latitude, longitude and altitude graphs in the TimeLine window will show the distributed values.

Since Velocity Distribution overrides normal velocity behavior, it can be confusing if you forget that you've turned it on and are trying to edit Camera position. It's a good idea to disable Velocity Distribution until your Motion Paths are as smooth as you can make them. The effects of Velocity Distribution are not shown in Realtime Views, only in finished renderings.

Ease In Field

Use the Ease In field to set the length of the velocity ramp at the beginning of an animation if "Velocity Distribution" is enabled (see above).

The value can be either a number of frames or seconds, depending on your choice on the Units page of the Preferences Window. The sum of Ease In and Ease Out must not exceed the length of the complete animation from frame 1 to the final key frame.

Note: When Velocity Distribution is enabled you cannot use the key frame Tension control to ease into or out of a motion.

Ease Out Field

Use the Ease Out field to set the length of the velocity ramp at the end of an animation if "Velocity Distribution" is enabled (see above).

The value can be either a number of frames or seconds, depending on your choice on the Units page of the Preferences Window. The sum of Ease In and Ease Out must not exceed the length of the complete animation from frame 1 to the final key frame.

Note: When Velocity Distribution is enabled you cannot use the key frame Tension control to ease into or out of a motion.

Orientation Controls

Heading Field and Buttons

Enter a degree value into the Heading field to point the Camera left or right. The default value is zero which is straight ahead.

Negative values will point the Camera to the left. Positive values will point the Camera to the right. 360 degrees in either direction is all the way around and the same as zero.

Pitch Field and Buttons

Enter a value into the Pitch field to point the Camera up or down. The default value is zero which is straight ahead.

Negative values will point the Camera up. Positive values will point the Camera down. 360 degrees in either direction is all the way around and the same as zero.

Bank Field and Buttons

Enter a value into the Bank field to tilt the Camera left or right. You can use it for turn banking during Camera motion, or to simulate tipping the axis of a rotating earth. 360° provides one complete roll.

The default value is zero which is no tilt. Negative values will tilt the Camera to the right. Positive values will tilt the Camera to the left. 360 degrees in either direction is all the way around and the same as zero.

Maximum banking is 1,000,000 degrees and minimum banking is -1,000,000 degrees for multiple Camera rolls.

Note: You can let VNS create Bank key frames automatically by clicking the Create Bank Keys button (see below).

Create Bank Keys Button

The Create Bank Keys button lets you create Bank key frames from the Camera Motion Path. VNS will create the key frames automatically. The amount of banking is a function of path curvature and the Banking Parameter (see below).

When you click the Create Bank Keys button, if Bank Keys already exist you will be asked if you wish to overwrite them. You will then be asked to supply the frame interval at which you want VNS to make Bank key frames. The default is "K" which stands for "existing key frames."

Accepting the default will create a Bank key frame at every frame where there is already a Camera Latitude or Camera Longitude key frame. Otherwise you can specify a frame interval which can be as small as one (1) which will create a Bank key at every frame. We suggest a minimum of 20 frames for the interval.

The rest of the process is automatic. If less than two key frames exist for either Camera Latitude or Longitude, the operation will fail and no Bank Keys will be created.

Target Page

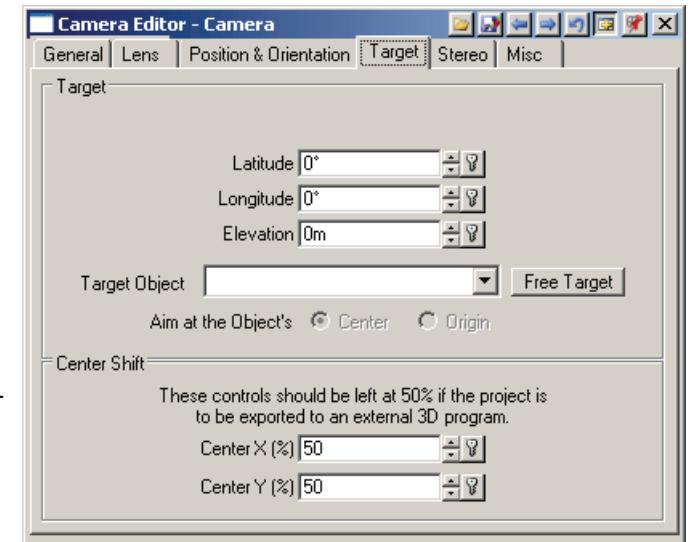
For Targeted Cameras you can position the Camera's Target on the planet in latitude, longitude and elevation or replace the Target with a 3D Object. You can also adjust the Center Shift controls on this page. For more about latitude and longitude see Appendix A: A Lesson In Geography.

Target Controls

A Targeted Camera's Target is the point at which the Camera is aimed when Heading and Pitch are both set at zero.

Note: If you selected a 3D Object from the Target Object drop box (see below), the Camera will use the 3D Object as its target instead.

Target Elevation, Target Latitude and Target Longitude together define the Target's position in 3-D space. They are all members of the Target Group. If the Key Frame Group Toggle icon is selected on the Animation toolbar, creating a key frame for any member of the group will create a key frame for all members of the group.



Targeted Camera Message

The Targeted Camera Message says "This section is disabled unless you select "Targeted" as the Camera Type on the General page."

What this means is you can't adjust the Target controls in this section unless the Camera is actually a Targeted Camera. You can set that on the General page (see above), using the Targeted checkbox.

Latitude Field and Buttons

You can enter a value into the Latitude field to change the Target's north/south position. The maximum value is 90.0 degrees (north pole). The minimum value is -90.0 degrees (south pole).

Target Latitude is how far the Camera is north or south of the equator. It's measured in degrees and is compatible with the latitude markings on standard maps and globes.

Target Elevation, Target Latitude and Target Longitude together define the Target's position in 3D space. They are all members of the Target Group. When you change the Target Latitude without changing the Target Altitude, the Target will naturally move at a fixed orbital distance from the earth rather than shooting out into space.

Longitude Field and Buttons

You can enter a value into the Longitude field to change the Target's north/south position. The maximum value is 1,000,000 degrees and the minimum value is -1,000,000 degrees (more than several thousand orbits in the positive or negative directions).

Target Longitude is how far the Target is east or west of the prime meridian, which passes through Greenwich, England. It's measured in degrees and is compatible with the longitude markings on standard maps and globes.

By default, VNS uses a positive longitude as west of the meridian and negative longitude as east. This is due to the fact that much of the high quality DEM data available is for the Western hemisphere. You can change this on the Units page of the Preferences Window if you wish.

VNS supports continuous longitudinal motion up to 1,000,000 degrees (approximately 2,777 complete orbits) in both positive and negative directions. For additional rotational control see "Earth:Rotation" below. Longitude position may be expressed as either positive or negative (-5° = 355°) based on the 360° full circle.

Target Elevation, Target Latitude and Target Longitude together define the Target's position in 3-D space. They are all members of the Focus Group. When you change the Target Longitude without changing the Target Altitude, the Target will naturally move at a fixed orbital distance from the earth rather than shooting out into space.

Elevation Field and Buttons

Maximum: 1,000,000 Kilometers

Minimum: -6,362.683195 Kilometers (the center of the earth)

Target Elevation is the height of the Target. It's measured in kilometers above or below sea level.

Note: The elevations in DEM files are also relative to sea level. Sea Level is the surface of the Project Coordinate System's Ellipsoid, which is an elevation of zero. You can see the Project's Coordinate System in the Planet Options Editor.

Target Object Drop Box

You can use any 3D Object in the Project as the Camera's Target if you wish. To do so, select a 3D Object from the Target Object drop box. This is great when you need to fly the Camera around an object, such as a building or bridge.

Free Target Button

If you have selected a 3D Object as the Target and would rather not use a 3D Object, click the Free Target button. VNS will then give the Camera a normal Target.

Aim at the Object's Center or Origin Radio Buttons

If you are using a 3D Object as the Camera's Target, select one of these radio buttons to determine where the Camera will aim when its heading and pitch are both set to zero degrees.

The Center radio button causes the Camera to aim at the center of the 3D Object's bounds. This is the center of the volume of space that is within the outermost extremities of the object.

The Origin radio button causes the Camera to aim at the 3D Object's origin point. Most 3D Models created for use in VNS should have their origin point set to the center of the object's base.

Center Shift Controls

External 3D Program Message

There is a message at the top of the Center Shift section stating that the Center X and Center Y controls must be set to 50% if you intend to export the project to an external 3D program. This is because other 3D programs lack this feature, and values other than 50% could cause problems between the VNS Camera and the camera in an external 3D program.

Center X and Y Percentage Fields

Center X and Center Y let you step back from the normal three dimensional universe of VNS and scroll around over the potential two dimensional bitmap that VNS will render. This is a unique VNS feature that you may find useful for adjusting the framing of a landscape without having to change any Camera or Target key frames.

You can also use Center X and Center Y to change the position of the planet in the frame when doing full planet renderings.

VNS can render any section of a landscape at any resolution up to 32,767 pixels square. When you render an image, VNS renders only the part of the landscape that is visible to the Camera. If you think of that image as part of a larger potential image, then you can think about using Center X to scroll left or right and Center Y to scroll up and down by a set number of pixels across the potential image.

This gives you the same kind of control as a photographer who is printing a negative and can control which part of the negative is actually projected onto the photographic paper. It's also similar to the controls available on a microfilm reader to let you scroll around on the microfilm to choose which area to view, or the camera on an animation stand.

Center X and Y each default to a value of 50%. setting them to the middle of the rendered image.

Note: Center X and Center Y must be centered at 50% if you are working with an external 3D program and you want things to line up. This is because other 3D programs lack the Center Shift feature.

Stereo Page

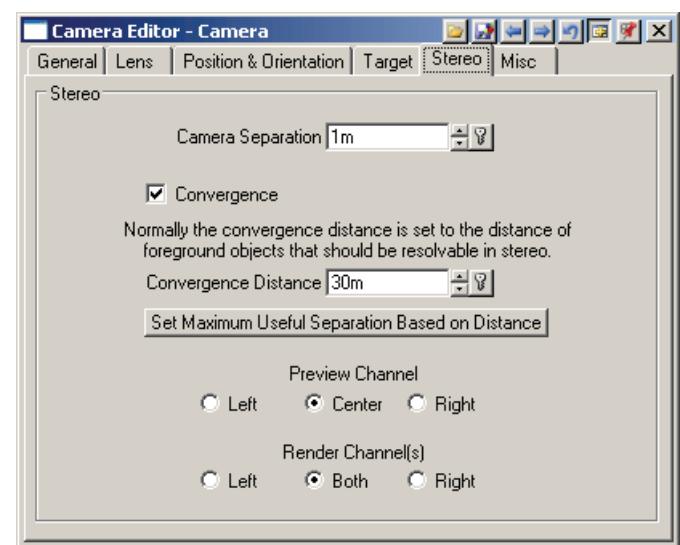
If you select the Stereo checkbox in the Options section on the General page, the Camera will be able to render from two Camera positions for each frame.

You can preview from either position or an average between the two positions. You can render either or both perspectives.

Given a convergence distance, VNS can calculate the maximum Camera separation for you. It may require some experimentation to choose the exact Camera separation that works best for your scene.

Camera Separation Field

Enter the distance you want between the two Camera positions. You can do this automatically with the "Set Maximum Useful Separation Based on Distance" button (see below) or calculate it manually.



To calculate it yourself you can use this formula for the maximum Camera separation in meters: (distance to foreground area of interest in meters) / (lens focal length in millimeters).

To find the distance to the foreground area of interest open the Diagnostic Data window and click something you'd like people to look at in the foreground of the Camera's View. You can then read the distance to that spot in the Diagnostic Data window's Distance field.

To find the focal length of your lens, go to the Lens page, enable the Depth of Field checkbox, enable the Synchronize Lens and Field of View check box and VNS will display the focal length in the Focal Length field (see Lens Page above).

You can use a smaller value for separation than what you obtain from the above formula but if you use larger values it may be difficult to resolve the stereo image.

To set Camera Separation to the same as typical human eyes, set it to 63.5mm.

Convergence Checkbox

Select the Convergence checkbox if you want the two Camera positions to aim at a point between them at particular distance ahead of the Camera. Deselect it if you want the two perspectives to both point straight ahead.

Selecting the Convergence checkbox will make the stereo effect more pronounced at the Convergence Distance. We recommend using convergence for your stereo images.

Convergence Distance Field

Enter the distance where you want the two Camera Positions to cross in front of the Camera. This should be where an object of interest appears in the foreground of your image. The stereo effect will look most pronounced at this position.

Set Maximum Useful Separation Based on Distance Button

Click the "Set Maximum Useful Separation Based on Distance" button and VNS will fill in the Camera Separation field for you based on the Convergence Distance you set.

Preview Channel Radio Buttons

The Preview Channel Radio Buttons let you select what you see in the Camera's View. Select the Left radio button to see the left Camera Position in the Camera's View. Select the Right radio button to see the right Camera Position in the Camera's View. Select the Center radio button to see a position between the two Camera Positions in the Camera's View.

Render Channel Radio Buttons

Select the Both radio button to tell VNS to render both Camera positions. Do this when you want to render two images per frame to create stereo images.

Select the Left radio button to tell VNS to render only the left Camera position. This is useful if you only want to render one image for testing.

Select the Right radio button to tell VNS to render only the right Camera position. This is useful if you only want to render one image for testing.

Miscellaneous Page

The Miscellaneous page lets you add a background image, choose field rendering and use several optimizations.

Background Image Controls

Enable Checkbox

The Enable checkbox determines if a Background image will be added during rendering.

You may use any Image Object (see Image Object Library). An Image Object can be an image or series of images (for animations) over which VNS will render. When you render, VNS will scale the Image Object to fit the image size you are rendering.

You can use background images to add images or animations of real clouds. You can also use them in combination with Z-Buffers to provide foreground details or animated objects.

VNS will antialias the Background Image Object into the final rendering, behind the sky.

Note: If you don't want a VNS sky, you can disable any Skies in your Project with the Sky Editor. More sophisticated 3D Z-Buffered compositing is available through the Composite Post Process Event (See Post Process Editor)

Image Object Drop Box

Select a background image from the Image Object drop box.

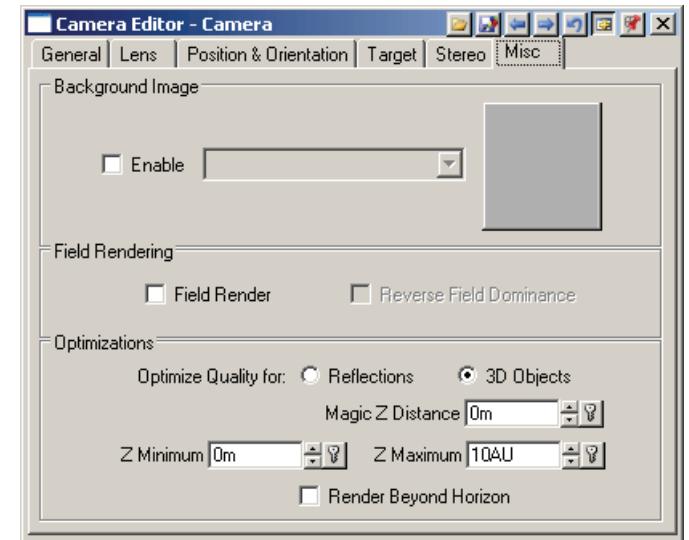
If the image you want to use is not listed, select "New Image Object" at the top of the list. VNS will open a file requester where you can select the image you want to use.

Image Object Thumbnail

The Image Object thumbnail shows a small version of the Image Object you are using as a background image. You can double-click it to see the full-size image.

Edit Image Object Button

Click the Edit Image Object button to open the Image Object Library, ready to edit the Image Object you are using for the background image.



Width, Height and Colors Display Fields

These display fields show the width and height in pixels, and the number of 8-bit color bands in the background Image Object.

Field Rendering Controls

Field Render Checkbox

Use the Field Render checkbox to choose whether or not to enable field rendering. This is only important if you're rendering animations for video.

Field Rendering makes smoother looking motion. It improves the appearance of even very slow moving animations. If you see "ghosting" at high-contrast edges in your images when the camera moves, Field Rendering will give you a significant improvement in your animation quality.

Unfortunately Field Rendering takes twice as long to render since VNS must interpolate every other field and render it separately. This is a feature for the discriminating professional!

Note: When you select Field Rendering, VNS will need to save the first field of each frame temporarily until it is combined into the final frame. These are stored with special names in the directory designated as the Temp Path. Set this directory on the Images page of the Settings Editor. These temporary files will automatically be deleted after the second field is rendered and the images are combined.

Technical Explanation

Every frame of video consists of two fields interlaced together. Each field is half the vertical resolution of the frame.

Your television draws its picture one dot at a time scanning rapidly from left to right to create a line. It draws all the odd numbered lines first, then it starts at the top again and draws all the even numbered lines. The first set of lines is field one, and the second set of lines is field two. Together all the odd numbered lines in field one and all the even numbered lines in field two make up one frame.

This all happens very fast to give you the illusion of watching smooth motion.

If you select field rendering, VNS will create a separate image for each field of video. This gives you 60 images per second if you're rendering images for NTSC video, or 50 images per second for PAL video.

If you don't select field rendering, VNS will create a separate image for each frame of video. This gives you 30 images per second for NTSC video or 25 for PAL video.

NTSC video is the video standard used in North America and Japan, among other countries. PAL is the video standard used in much of Europe and in Australia, among other countries.

Note: For output to film do not use Field Rendering! Film is projected in a very different way than video. Field Rendering would create a ghosting effect if used in film work.

Reverse Field Dominance Checkbox

If you select the Field Render checkbox, the Reverse Field Dominance checkbox will be enabled.

Note: Field dominance only matters if you are field rendering, and you should only be field rendering if you are creating animation for NTSC, PAL or any other kind of video output that uses field rendered video.

Here you can choose the field dominance that your video editing or playback hardware requires. With the box unchecked, the first line in the video frame will be from field 1. With the box checked, the first line in the video frame will be from field 2.

There is some dispute about which field should have it's first line at the top of a field rendered image. If your animation output looks sawtoothed or ragged, then you may need to change the field dominance. Once you decide which setting works best with your equipment, it's best to keep the setting and never change it.

When editing video it's best if all the video is using the same field dominance.

Optimizations Controls

These controls allow you to change several aspects of the way VNS renders.

Optimize Quality Radio Buttons

The Optimize Quality radio buttons change how partially transparent foreground pixels are handled in the VNS Z-buffer. The default selection is the Reflections radio button. The only reason to change this is If you have foreground foliage obscuring 3D Objects that are going to be composited in LightWave or MAX using one of the included Z-Buffer plugins.

If you don't have foreground foliage obscuring 3D Objects that are going to be composited in LightWave or MAX, select the Reflections radio button. If your Project has 3D objects that are rendered in VNS and no 3D Objects being rendered and composited using LightWave or MAX, select the Reflections radio button.

If you do have foreground foliage obscuring 3D Objects that are going to be composited in LightWave or MAX, select the 3D Objects radio button. You also should set the Magic Z Distance (see below) to the distance of the 3D objects.

Magic Z Distance Field and Buttons

The Magic Z Distance Parameter determines how VNS treats antialiasing of trees against distant objects. Trees that are closer than this distance will be antialiased in one way. Trees farther than this distance will be antialiased in a different way.

If you don't have foreground foliage obscuring 3D Objects that are going to be composited in LightWave or MAX, Magic Z Distance doesn't matter.

If you do have foreground foliage obscuring 3D Objects that are going to be composited in LightWave or MAX, in most cases the default value should be fine. But there are several cases where you might see a halo appearing around trees.

If you are doing Z-Buffer compositing and see a halo appearing around the edges of trees when in front of composited objects, set this value to a distance beyond your composited objects.

If you have a scene where you have trees in front of reflective water, you may see a halo around the edges of the near trees where they are silhouetted against the water. In this case set the Magic Z Distance beyond the foreground trees but in front of any trees on the far side of the water.

If need be you can animate the Magic Z Distance Parameter to keep tree antialiasing correct throughout an animation.

A good way to determine the appropriate Magic Z Distance is by using the Diagnostic Data Window to find the Z value (distance) of elements in your scene.

Z Minimum

The Z Minimum Parameter lets you set a minimum distance for rendered objects. All objects that lie closer than the Z Minimum distance to the Camera, including parts of DEMs, will not be rendered.

This is useful for creating cutaway views of the terrain model. You can set it anywhere from zero to 1,000,000 kilometers. Normally it is set at zero.

Z Maximum

The Z Maximum Parameter lets you set a maximum distance for rendered objects. All objects that lie farther than the Z Maximum distance from the Camera, including parts of DEMs, will not be rendered.

This is useful for limiting the distant view of the terrain model. You can set it anywhere from zero to approximately 10 to the 38th power meters. The default value is 1,000,000 kilometers.

Note: By using Z Minimum and Z Maximum together, you can create renderings of distant terrain and of near ground terrain, that can be composited without overlap.

Render Beyond Horizon Checkbox

To make rendering more efficient, VNS determines if entire DEMs will be invisible because they are beyond the horizon. If VNS thinks a DEM will not be visible, VNS won't waste time rendering the DEM.

However, if VNS is wrong about this you may see mountains popping in suddenly. If this happens, turn on the Render Beyond Horizon checkbox to disable VNS's attempt at efficiency.

Celestial Object Editor

The Celestial Object Editor gives you all the controls for putting an image or animation in your sky. For example, you can add an image of the sun or moon to the sky.

If you have more than one Celestial Object each will have its own Celestial Object Editor. You can have as many Celestial Objects as you like, limited only by the amount of memory in your computer.

Overview

The Celestial Object Editor lets you choose an Image Object to become a Celestial Object; animate its size and position in the sky; see the gray replacement color; adjust transparency; enable or disable the Celestial Object for rendering; enable or disable phase; and lock the Celestial Object to a Light.

VNS includes images for the sun and moon. VNS adds them whenever you create a new project, but they are not enabled. To use them, simply enable them and make sure they are within view of the Camera. You can optionally replace them with any Image Objects you want, including animated sequences.

You can also add other Celestial Objects to the sky. For example, you could easily have multiple moons or suns in the sky. This could be useful if you are creating a scene for a planet which has more than one moon or is part of a multi-star solar system.

A Celestial Object can be any image, so if you want to put Santa Claus's sleigh, a flying saucer, the international space station or a passing jet in the sky, you can.

You can position and animate the image numerically within the Celestial Object Editor, and interactively in conjunction with Views. This lets you animate sunrises, moonrises, or even a passing spaceship. You'll see Key Frame and TimeLine icons next to the fields of every animatable Parameter.

Note: It's important to realize that Celestial Objects are images and they do not cast light. If you want to make it look like a Celestial Object is casting light, you can lock the position of a Celestial Object with that of an actual Light (see the Position page below).

Celestial Objects can show phase. Phase is shading based on the position of one or more lights. For example, the earth's moon goes through phases such as full, half and quarter, depending on where it is relative to the light from the sun and a person viewing it from the earth. In VNS Celestial Objects can even show phase based on multiple lights, as you might see on a moon in a multiple-star solar system.

Note: Celestial Objects can be obscured if the Sky's colors are too bright (see Sky Editor). They can also be obscured by Cloud Models (see Cloud Model Editor).

General Page

General Features

Name Field

Enter a name for the Celestial Object. For example, if it's an image of the moon, you might call it simply "Moon".

By default VNS will name new Celestial Objects "Celestial" and add a number after the name if there is more than one Celestial Object named "Celestial".

Enabled Checkbox

Select the Enabled checkbox to allow the Celestial Object to appear in your images. In order to be able to see the image in the sky when you render, make sure the image is positioned where the camera can see it, and you have an Image Object selected in the Image Object drop box.

You can most easily position a Celestial Object in the sky by selecting the Celestial Object in the Scene-At-A-Glance to make it the Active Item, and then control-click in the sky within a View. VNS will place the Celestial Object in the sky where you click.

Disabling a Celestial Object can be useful to speed up rendering if you are doing test renders to check some other aspect of your scene and don't need to see the Celestial Object. Make sure you remember to enable it for the final rendering if you want to see the Celestial Object.

Note: To see the Celestial Object in your rendering, it must be visible to the Camera you selected for the Render Job you are using (see Render Job Editor), and Celestial Objects must be enabled in the Render Options you are using (see Render Options Editor).

Show Phase Checkbox

Select the Show Phase checkbox when you want the Celestial Object to be shaded based on Lights in your scene. This makes the most sense if the Celestial Object is a moon and you want it to be less than a full moon, such as a half moon or quarter moon.

When you select this checkbox, the Celestial Object will automatically show phases (waxing and waning) depending on the position of any Lights in your scene.

Deselect the Show Phase checkbox when you want to force the Celestial Object to show a full image no matter where the Light is coming from. For a Celestial Object moon, deselecting this checkbox will always give you a full moon.

You will probably want to deselect this checkbox for non-moon Celestial Objects.

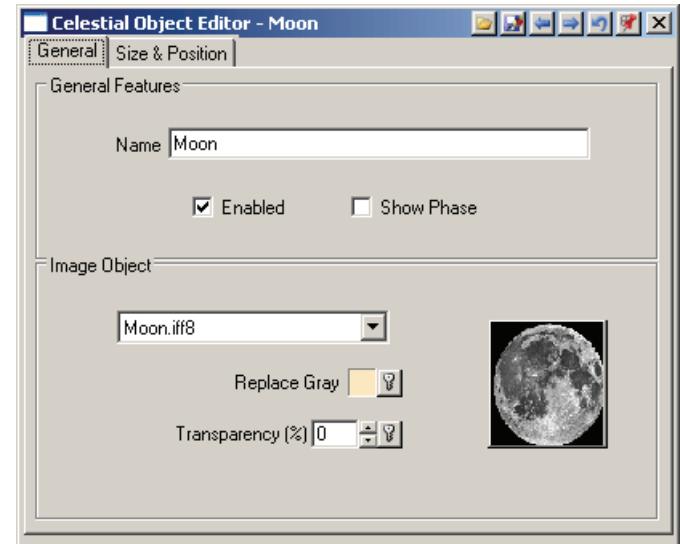


Image Object Controls

Image Object Drop Box

Select an Image Object to use as the Celestial Object.

If the image you want is not listed, select “New Image” and VNS will open a file requester where you can choose a new image to use for your Celestial Object. VNS will also add the image to the Image Object Library.

Image Object Thumbnail

The Image Object thumbnail shows a small version of the Celestial Object image. You can double click it to see a full size preview.

Edit Image Object Button

Click the Edit Image Object button to open the Image Object Library with the Celestial Object’s image selected for editing.

Width, Height and Bands Display Fields

These display fields show the width and height in pixels, and the number of 8-bit bands in the image. A gray scale image will have one band, and a 24-bit color image will have three.

Replace Gray Color Well

The Replace Gray color well shows the color VNS will use for the Image Object if it is a gray scale image, or if it is a color image set to ignore its own color information.

Click the Color well to open the Color Editor, where you can change the Replace Gray color to any color you like.

Note: In order to use this with a color image, you must go to the Image Object Library, Click the Add button in the Color Control section on the left to add a Color Control page on the right, and deselect the Use Color checkbox on the Color Control page.

Transparency Field

Use the Transparency field if you want to be able to see through the Celestial Object. This may be useful if the object is a cloud.

To make the Celestial Object completely opaque, set this field to zero. If you set it to 100 percent, the Celestial Object will be completely transparent and thus invisible, which you probably don’t want. If you just want to disable the Celestial Object, deselect the Enabled checkbox in the General Features section (see above).

Size & Position Page

Size Controls

The Size controls let you determine how large the Celestial Object will be and whether it will show phase based on Lights in your scene.

Size Factor Percentage Field

The Size Factor field lets you enlarge or reduce the size of the Celestial Object. That way you can leave the Radius field set to a standard size and tweak the size artistically with the Size Factor field.

100% will make the Celestial Object the size set by the Radius field. Larger values will enlarge the Celestial Object. Smaller values will shrink the Celestial Object.

Radius Field and Buttons

The Radius field lets you set the size of the Celestial Object in real-world units. The radius is the distance from the center of the Celestial Object to its edge. Enter a number directly or use the Radius Presets drop box (see below) to select a useful value.

Radius Presets

The Radius Presets drop box lets you set the value of the Radius field (see above) based on the size of the sun, moon, various planets or common orbital distances.

Position Controls

Latitude Field and Buttons

The Latitude field shows the latitude of the point on the planet at which the Celestial Object is directly overhead. You can enter a new latitude numerically, or set Celestial Object position interactively by selecting the Celestial Object as the Active Object and control-clicking the sky in a View.

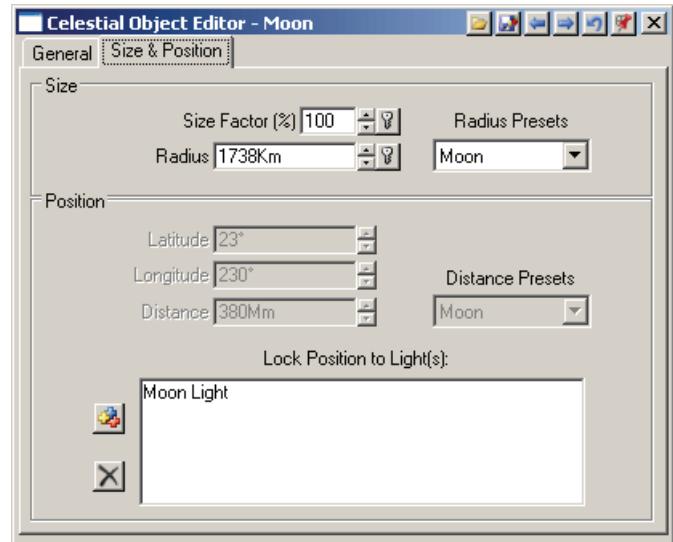
Longitude Field and Buttons

The Longitude field shows the Longitude of the point on the planet at which the Celestial Object is directly overhead. You can enter a new Longitude numerically, or set Celestial Object position interactively by selecting the Celestial Object as the Active Object and control-clicking the sky in a View.

Distance Field and Buttons

The Distance field lets you set the distance of the Celestial Object from the earth. You can set the number directly, or use the Distance Presets drop box (see below) to select a useful value.

Note: The Units are whatever you select in the Height drop box on the Units page of the Preferences Window.



Distance Presets Drop Box

The Distance Presets drop box lets you place the Celestial Object at a set distance from the earth. Selecting an option from the drop box will change the value in the Distance field (see above). Choose the distance to the sun, moon, various planets or common orbital distances.

Lock Position to Light(s) List and Controls

VNS lets you lock a Celestial Object to one or more Lights. This puts the Celestial Object at the same position as the Light. You then control the Celestial Object's position by controlling the position of the Light using its Light Editor.

When the Celestial Object's position is locked to a Light, the Celestial Object will appear where the Light appears. The other Position controls will be disabled and their values will be ignored.

If you lock a Celestial Object to more than one light VNS will duplicate the Celestial object for each light.

The Lock Position to Light(s) list shows any Lights that may be determining the Celestial Object's position.

To add a Light, click the Add Light icon on the left. VNS will open a requester where you can select the Light to add.

To remove a Light, select the Light in the Lock Position to Lights list, then click the Remove Light icon on the left. If you remove all Lights, the Celestial Object will appear directly above the latitude and longitude position shown in the Latitude and Longitude fields above, at a distance shown in the Distance field above.

Cloud Model Editor

The Cloud Model Editor lets you create, edit and animate clouds. You can use multiple Cloud Models to simulate complex multi-layered cloud patterns. Add as many Cloud Models as you like, (limited only by memory). Each Cloud Models can be one of 3 types: Planar (as with all WCS 5 clouds), Multilayer (as with WCS 4 clouds) or Volumetric.

To create a new Cloud Model select the “Cloud Models” category in the Scene-At-A-Glance and click the Add or Clone Selected Item icon. To edit an existing Cloud Model, double-click the name of an existing Cloud Model in the Scene-At-A-Glance.

Multiple cloud models let you mix different types of clouds in the sky. You can animated each cloud model differently or create complex cloud types that combine more than one cloud model.

Multiple cloud models are great for complex skies with high cirrus clouds and lower nimbus or cumulus clouds. You can also create individual roving storm systems. Of course each Cloud Model you use will add to rendering time and memory requirements, so don't use more Cloud Models than you need to achieve the look you want.

You can also control Cloud Shadow Parameters with the Cloud Model Editor.

General Page

General Features

Name Field

Enter a name for the Cloud Model. For example, if it's a set of cirrus clouds, you might call it simply “Cirrus”.

By default VNS will name new Cloud Models “Cloud”, and add a number after the name if there is more than one Cloud Model named “Cloud”.

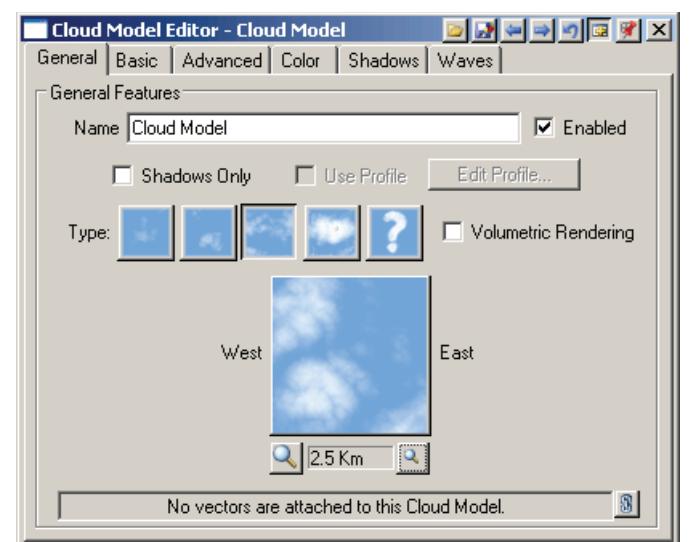
Enabled Checkbox

Select the Enabled checkbox to allow the Cloud Model to appear in your images. In order to be able to see the Cloud Model in the sky when you render, make sure the Cloud Model is positioned where the camera can see it, and you have enough Coverage and Density for the Cloud Model to be visible in the sky.

You can most easily set the position and size of a Cloud Model in the sky by using the Set Bounds in View button and clicking where you want the corners of the Cloud Map in a View (see below).

Deselect the Enabled checkbox when you want to disable the Cloud Model for rendering.

Disabling an object can be useful to speed up rendering if you are doing test renders to check some other aspect of your scene and don't need to see the Cloud Model. Make sure you remember to enable it for the final rendering if you want to see the object.



Note: To see the Cloud Model in your rendering, it must be visible to the Camera you selected for the Render Job you are using (see Render Job Editor), and Cloud Models must be enabled in the Render Options you are using (see Render Options Editor).

Shadows Only Checkbox

Select the Shadows Only checkbox if you want to render cloud shadows but not the clouds themselves. You must also select the Enabled checkbox (see above), and the Cast checkbox on the Shadows page (see below).

Note: To see the Cloud Shadows in your rendering, they must be visible to the Camera you selected for the Render Job you are using (see Render Job Editor), and Cloud Shadows must be enabled in the Render Options you are using (see Render Options Editor). You must also have a Shadow Component set to receive shadows (see Shadow Editor).

Use Profile Checkbox

Click the Use Profile checkbox when you are using one or more Vectors to further restrict cloud coverage in smaller areas inside the Cloud Model's bounds, and you want to feather the edges of the clouds along the Vector(s). This lets you fade in the clouds so they don't end abruptly at the outside edge of the Vector.

Note: You can feather the Clouds at the Cloud Model's bounds using the Feather Bounds checkbox on the Aerial Attributes page.

When you select the Use Profile Checkbox VNS will create a default Edge Feathering Profile. The default Profile varies between no effect at the Vector to the full effect 10 meters toward the middle of the Vector area. You can edit this Profile by clicking the Edit Profile button (see below).

Profiles add to rendering time and take additional memory to render.

Edit Profile Button

Click the Edit Profile button to open the Edge Feathering Profile Editor. There you can alter the Edge Feathering Profile to change the intensity of the Shadow Component from the edge of the Vector inward.

Volumetric Rendering Checkbox

Enables a cloud for volumetric rendering and disables rendering by layers. Volumetric rendering can be quite slow depending on the cloud definition, viewing perspective and shading parameters but it has by far the most potential for realism. Rendering times can be optimized against quality by adjusting sample spacing. A Volumetric cloud that does not receive volumetric shadows will be much faster to render and speed may approach or exceed that of a multi-layer cloud.

Type

This section of the editor contains 5 buttons to allow easy selection of preset cloud types:



Cirrus - Latin for "curl", is the name for high, thin, wispy clouds



Stratus - Latin for "layer", is the name for clouds that blanket the sky



Nimbus - Nimbus, Latin for "rain", are thicker clouds that generate precipitation



Cumulus - Latin for "heap", are separated, flat bottomed cloud masses with more complex top structures



Custom - Used to create your own collection of settings

They are arranged in order from least complex and fastest rendering (Cirrus) to most complex and slowest rendering (Cumulus).

When you select a preset, VNS will alter the texture used by the Density Pattern (see below), as well as the thickness, number of layers, density and coverage. By selecting the Custom cloud type and altering the Density Pattern texture in the Texture Editor, the Coverage and Density percentages and the cloud colors, you can create virtually unlimited variations of these four basic cloud types.

Cloud Thumbnail Preview

The Cloud Thumbnail lets you see an area of sky looking straight up from below.

You can control the amount of sky shown in the Cloud Thumbnail with the Preview Display Width Zoom Buttons.

Preview Display Width Zoom Buttons

Click the Zoom In icon to see less area in the Cloud Thumbnail preview. Click the Zoom Out icon to see more area. The Preview Display Width field shows the width the thumbnail is displaying.

Vector Placement Section

By attaching Vectors to Cloud Models you can control where they appear. Cloud Models appear within controlling Vectors. Vectors can be dynamically linked with Search Queries or hard linked.

Vector Links Button

This control allows you to perform various tasks relating to the association of vectors with components. To learn how to use it, see Vector Links Icon.

Attached Hard-Linked Vectors Display

The Hard-Linked Vectors display tells you if there are any Vectors hard-linked to the Component, and if so, how many. It will also display vectors attached by Search queries and list the names of the search query or queries in use.

If you attach one or more Vectors to a Cloud Model, the clouds will only appear within the Vectors. Otherwise they can appear anywhere within the Cloud Bounds that you set in the Size & Position section of the Cloud Model Editor's General page.

Basic Page

Aerial Attributes Section

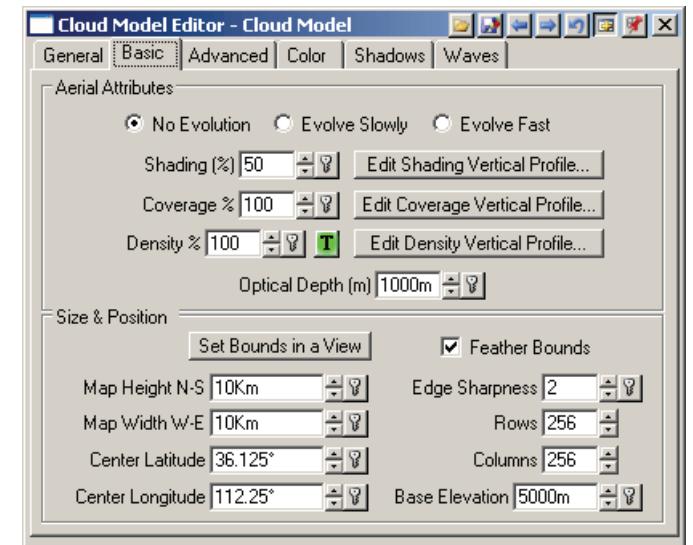
Evolve Radio Buttons

Select either the Fast or Slow Evolve radio buttons to cause the Clouds to evolve.

If the first texture Element in the Texture Editor's Elements list is either Fractal Noise or Turbulence, the Evolve checkbox changes the texture's Z velocity to 15 meters per second for the Slow option or 90 meters per second for the Fast option.

These will be displayed in the Texture Editor using the time and distance units you select on the Units page of the Preferences Window. If you select Frames as the time unit, VNS will use the frame rate you set on the Preferences window's Project page.

You can turn off the Evolve checkbox and control the texture's Z Velocity directly in the Texture Editor if you wish. To open the Texture Editor for the Cloud model, click the Density Pattern Edit button (see below).



Shading Percentage Field

The Shading percentage field lets you adjust the shading variation in the Cloud Model based on the position of Lights. VNS combines the output of Lights with that of the Color Gradient on the Color page to create the final Cloud Model look. Thinner parts of the clouds pick up more shading from Lights that are behind clouds. This gives you realistically lit clouds.

Increase the Shading percentage to get more variation of shading in the clouds from Lights. A value of zero means the Cloud Model will not change shading in response to Lights. 100% is the maximum shading variation based on Lights.

For single or multi-layered clouds the shading amount is varied according to the attitude of the view ray relative to the light position. Backlit clouds receive the highest amount of shading possible. For clouds that receive Volumetric shadows the Shading value limits the amount of shading the shadows produce.

Edit Shading Profile Button

Clicking this button will open the Edit Shading Profile Editor, allowing you to use a gradient to control shading of the cloud model vertically.

Coverage Percentage Field

The Coverage percentage field lets you adjust the amount of clouds covering the sky within the Cloud Map.

Set it to 100% to allow all the coverage that you see in the Texture Editor for the Density Pattern. Set it lower to reduce the cloud coverage. You can animate the Coverage percentage to create increasing or decreasing cloud coverage over time.

You'll never have more coverage than what you see in the texture editor. Set the Coverage percentage to 100% to get as much Density as you set up for the Density Pattern in the Texture Editor, as long as the Density percentage is also at 100% (see below).

This value is not exact and the actual amount of cloud coverage depends as much on the Density Pattern texture definition as the coverage % value set.

Edit Coverage Profile Button

Clicking this button will open the Edit Coverage Profile Editor, allowing you to access a gradient controlling coverage of the cloud model vertically.

Density Percentage Field

Controls the transparency of the cloud mass. For Volumetric clouds it works in combination with the Optical Depth, increasing Optical Depth as the density decreases and vice versa. Densities greater than 100% tend to make solid looking clouds with relatively little fringing. Low densities are useful for fog and wispy clouds. Thickness also affects the translucency of the Cloud Model. Thinner parts of the clouds pass more light when a Light is behind the Cloud Model. Lights will affect cloud shading when the Shading percentage is above zero (see above).

Set the Density to 100% if you want the clouds to be like the Density that you see in the Texture Editor for the Density Pattern (the center color is shown as white in the Texture Editor). Set the Density percentage higher to increase the apparent thickness or lower to reduce the apparent thickness. You can animate the Density percentage to create increasing or decreasing apparent cloud density over time.

Set the Density percentage to 100% and the Coverage percentage to 100% if you want the clouds to have the exact Density and Coverage you see in the Texture Editor for the Density Pattern.

Density Pattern Control

The Density Pattern control let you access the Texture Editor where you can use textures to control the cloud shapes within the Cloud Model. This pattern controls the size, shape, placement and edge definition of the cloud mass as well as its evolution.

When you select a preset from the Cloud Presets on the General page, VNS will set up a Density Pattern texture for you automatically.

You can edit the Density Pattern texture by clicking the Edit button. By default, VNS will use a Turbulence Element with several Remap functions.

You can use other texture Elements if you wish, including the Planar Image Element which lets you use any Image Object to control the Density Pattern. Image Objects are images or image sequences. You can use images of real clouds to control the density of your VNS Cloud Model if you wish.

If the pattern changes over time or has velocity applied on the Z axis the cloud will appear to evolve shape. The Density Pattern is the main key to creating clouds of different types.

Edit Density Profile Button

Clicking this button will open the Edit Density Profile Editor, allowing you to control the density gradient vertically within the cloud.

Optical Depth

Determines the distance you can see into a volumetric or multi-layer cloud model (it has no effect on single layer cloud models). It is the visibility threshold beyond which an object will be completely obscured by the cloud if the cloud density is a constant 100%. In practice the Optical Depth is modulated by the cloud Density, Density Pattern and Coverage. An Optical Depth of 500-1000 meters seems to work well for clouds. Clouds with higher Density or lower Optical Depth seem more solid, have more well-defined shadow boundaries and tend to render a bit faster because of the higher light extinction rate and fewer samples along a ray required to fully sample the volume.

Size and Position Controls

Use these controls to control the area, resolution and location of the Cloud Model. You can enter values numerically or set the area and position interactively in a View after clicking the Set Bounds in a View button.

Set Bounds in a View Button

The Set Bounds in a View button lets you specify the Cloud Map area and position for the Cloud Model by clicking in one or more Views.

To do so, click the Set Bounds in a View button and then click two corner positions in any View. VNS will automatically fill in the Map Height, Map Width, Center Latitude and Center Longitude fields.

Note: If you are working with a relatively small terrain area you may need to position your Cloud Map beyond the area covered by terrain. The only type of View that lets you do that is a View using a Planimetric Camera.

Map Height

The Map Width field lets you control the distance from the South edge to North edge of the Cloud Model.

Increase Map Height and Map Width (see below) to make the Cloud Model cover more area, decrease them to make the Cloud Model cover less area.

When you create a new Cloud Model, VNS will set the Map Height to 10 Km. You can change this to whatever height looks best for your Project.

Map Width

The Map Width field lets you control the distance from the East edge to West edge of the Cloud Model.

Increase Map Height (see above) and Map Width to make the Cloud Model cover more area, decrease them to make the Cloud Model cover less area.

When you create a new Cloud Model, VNS will set the Map Width to 10 Km. You can change this to whatever width looks best for your Project.

Center Latitude

The Center Latitude field lets you control the Latitudinal position of the Cloud Model's center.

When you create a new Cloud Model, VNS will set the Center Latitude to zero degrees. This is not likely to be correct for your Project so be sure you change it to a latitude value that will be in view of your camera.

Center Longitude

The Center Longitude field lets you control the Longitudinal position of the Cloud Model's center.

When you create a new Cloud Model, VNS will set the Center Longitude to zero degrees. This is not likely to be correct for your Project so be sure you change it to a longitude value that will be in view of your camera.

Feather Bounds Checkbox

The Feather Bounds Checkbox lets the edge of the Cloud Model taper off naturally so you don't see a hard edge to the cloud area. Use the Sharpness field (see below) to adjust the amount of feathering for the current Cloud Model.

Each Cloud Model has independent edge feathering. The Feather Bounds Checkbox is deselected by default.

Edge Sharpness Field

The Sharpness fields lets you control the amount of feathering applied to the edge of the Cloud Map when the Feather Edges Checkbox is enabled (see above). This will round the edges of the Cloud Map and make the clouds taper off naturally.

The units are arbitrary. The minimum value is 1 which will give you the most feathering (the least sharpness). The maximum is unlimited, but a value of 10 will give you a very sharp edged cloud map, almost as if the Feather Edges Checkbox is disabled. Try values from 1 to 5. The higher the number, the less feathering will occur.

The default value is 2.

Map Rows (N-S) and Columns (E-W)

The Rows and Columns let you control the polygon resolution of the Cloud Map. Rows are the number of polygons along the north/south axis of the map and Columns are the number of polygons along the east/west axis of the map.

Unlike previous versions of VNS, the resolution of the Cloud Map is not that critical to the quality of the clouds themselves, since clouds are now rendered using textures at a sub-polygon resolution.

The Cloud Map resolution affects the resolution of cloud edges inside any Vectors you've attached to the Cloud Model. Rows and Columns resolution also affects the detail of Cloud Waves and edge feathering. If you see artifacts along feathered edges or Cloud Waves try increasing the Rows and Columns.

Higher values will take significantly more memory and add somewhat to rendering time. Keep these values as low as you are able without resulting in artifacting in your cloud model.

Base Elevation

The Base Elevation field lets you control the altitude of the base of the Cloud Model above sea level.

Note: Sea Level is the surface of the Project Coordinate System's Ellipsoid, which is an elevation of zero. You can see the Project's Coordinate System in the Planet Options Editor.

Advanced Page

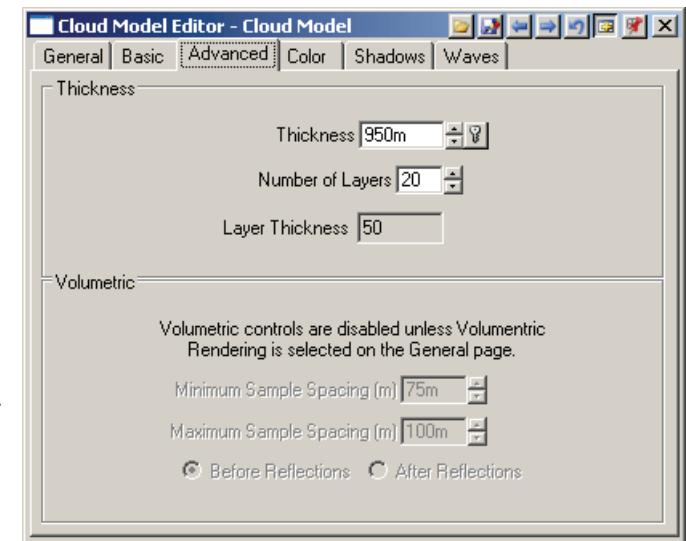
Thickness Controls

Thickness

Determines the maximum height of cloud above the Base Elevation set on the General Tab. It is effective for volumetric and multi-layered clouds and clouds that cast Volumetric or Combination shadows.

Number of Layers

Determines the vertical layer interval for multi-layer, non-volumetric clouds in conjunction with thickness. The number of layers should be adjusted so that the layer thickness does not exceed 50 meters. In some cases even smaller layer thickness may be required to avoid layering artifacts. When the number of layers becomes very large it may be more efficient and give better results to use a volumetric cloud. Volumetric clouds that cast Shadow Map shadows also use the number of layers. By setting the number of layers to 1 in that case Shadow Map drawing will be much faster and may still have acceptable quality.



Volumetric Controls

Minimum Sample Spacing

Controls the speed of rendering volumetric clouds and volumetric cloud shadows. A smaller number may result in slower rendering times by allowing over-sampling of the cloud volume. The value should be lower than or equal to the Maximum Sample Spacing.

Maximum Sample Spacing

Controls the cloud quality of volumetric clouds and volumetric cloud shadows. Higher numbers may result in cloud under-sampling and a coarse grainy look or even holes in the cloud where there shouldn't be any. Under-sampling may also result in poor shadow sampling indicated by missing or incomplete shadow and light rays within the cloud mass. It should always be equal or greater than the Minimum

Sample Spacing so that both can perform their respective duties. The correct Maximum Spacing can only be determined by trial and error. The only penalty of having the value too low will be poor rendering speed. Start with a value of 100 and increase it until the cloud becomes grainy. If it is grainy at 100 or the cloud has missing parts or poor shadow definition, lower it until the cloud looks good. Then set the Minimum Spacing to a value less than or equal to the Maximum. The Minimum value is less critical than the maximum value and is in fact only of real use for very thin clouds or those restricted to very small bounds where over-sampling may become a speed limiter.

Before Reflections Checkbox

Causes the volumetric cloud to be rendered before reflections so they will reflect. Use this setting for sky clouds.

After Reflections Checkbox

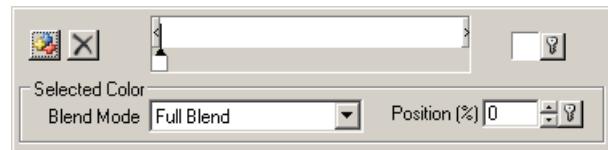
Causes the volumetric cloud to be rendered after reflections so they will not reflect and will replace reflective material as appropriate. Use this setting for fog over water.

Color Page

Color Gradient Controls

The Color Gradient controls let you add, remove and edit the colors in the Cloud Model.

To Access the Gradient, click on the Gradient popdown icon . This will display the Cloud Color Gradient Editor:



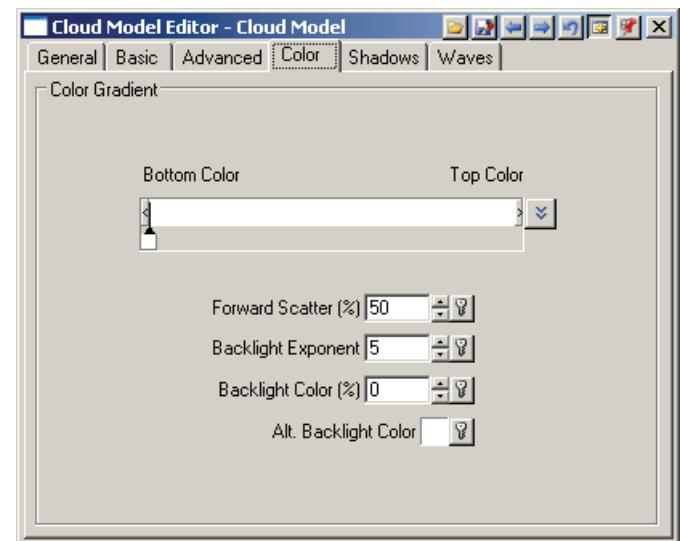
Add Color Icon

Click this button to add a color to the gradient at a specified point. A requester will appear asking you to enter the position (as a %) at which you would like the new color to appear. VNS will insert a color pin at this point on the gradient and assign it a random color. You can then edit the color to that which you require, using the color well to call up the Color Editor.

You can also add a color to the gradient in an arbitrary fashion by left clicking in the gradient bar. The position of the created color pin can then be accurately placed using the Position in Gradient % field.

Remove Color Icon

Click this button to delete the currently selected color pin from the gradient.



Color Gradient

The Color Gradient determines basic cloud material color from bottom to top of cloud. For single-layer, non-volumetric clouds the color is taken from the left of the color bar.

To select a color, click its pin below the gradient. You can change a color's position by dragging its pin left or right or entering a new value in the Position in Gradient field.

Selected Color well

The Selected Color well shows the color of the selected Color Pin in the gradient. Click it to open the Color Editor where you can change the color if you wish. This is the same as double-clicking a Color Pin.

Position in Gradient Percentage Field

The Position in Gradient field shows where the color lies along the gradient as a percentage. A percentage of zero puts the color on the left edge of the gradient, which puts the color on the edges of clouds. A percentage of 100 puts the color on the right edge of the gradient, which puts the color in the middle of clouds.

You can also change a Color's position by dragging its pin left or right along the gradient.

Blend Drop Box

The Blend drop box lets you choose the rate of change between the selected color and the color to its left in the gradient. These are easiest to visualize if you try them and see what they look like in the gradient.

Sharp Edge

Choose "Sharp Edge" if you want an instant change with no gradient.

Soft Edge

Choose "Soft Edge" to create a gradient that turns into the color to the left 1/10 of the way toward that color's pin.

Quarter Blend

Choose "Quarter Blend" to create a gradient that turns into the color to the left 1/4 of the way toward that color's pin.

Half Blend

Choose "Half Blend" to create a gradient that turns into the color to the left 1/2 of the way toward that color's pin.

Full Blend

Choose "Full Blend" to create a smooth gradient that turns into the color to the left at that color's pin.

Fast Increase

Choose “Fast Increase” to create an accelerated gradient that gets closer to the previous color faster, and turns into the color to the left at that color’s pin.

Slow Increase

Choose “Slow Increase” to create an decelerated gradient that gets closer to the previous color slower, and turns into the color to the left at that color’s pin.

S-Curve

Choose “S-Curve” to create a narrower gradient between the pin and the previous color’s pin and leaves more of the original colors along the gradient in between.

Forward Scatter % Field

Allows greater illumination of cloud when backlit. If the cloud is volumetric it also causes greater internal cloud illumination simulating forward scatter and secondary reflection of light within the cloud mass. Values of 10% to 100% have shown to be useful in different situations. When the cloud is backlit even a small amount like 10% adds realism. 50% seems to create realistic clouds from when frontlit or sidelit. High Forward Scatter values may cause excessive color washout especially when the cloud is backlit. Either accept it as the same phenomenon that would occur using a real camera and film or use a post process event to adjust exposure so the true colors can be seen.

Backlight Exponent Field

Works like Translucency Exponent in 3D Object materials. Adds an additional quantity of backlighting proportional to the Forward Scatter % and the cosine of the angle between the view ray and the ray from cloud to light. Higher values of exponent restrict the backlight effect to areas closer to the light. Lower values (less than 1 is allowable) create broader areas of effect. Values of 5-50 have been tried and look realistic.

Backlight Color % Field

determines the mixture of backlight color between the light's color and the Alternate Backlight Color. A value of 0 means use only the light's color and a value of 100 means use only the Alternate Backlight Color. The mixture only applies to the area within the cone defined by the Backlight Exponent.

Alt. Backlight Color Well

An alternate color for use in backlighting. It replaces the light's color according to the ratio specified by the Backlight Color %. It is only applied within the cone defined by the Backlight Exponent and its amount is also affected by the Forward Scatter %.

Shadows Page

The Shadows page lets you control shadows cast by and onto the Cloud Model.

Shadows Controls

Cast Checkbox

Selecting the Cast checkbox enables cloud to cast shadows on either itself or other objects. In order to cast shadows onto the terrain you will also need a Shadow Component set up to receive shadows (see Shadow Editor).

Note: This must be enabled in order for a volumetric cloud to self-shadow.

Receive Checkboxes

Select the required Receive checkbox(es) if you want the Cloud Model to receive shadows cast by other scene elements.

Received Shadow Intensity Field

The Received Shadow Intensity field lets you adjust how dark shadows cast onto the Cloud Model will appear. This field is disabled unless you select at least one Receive checkbox (see above).

Shadow Map Controls

Cast Checkbox

Enabling shadow casting will activate a series of radio buttons and checkboxes related to shadow type and effect.

Shadow Maps Checkbox

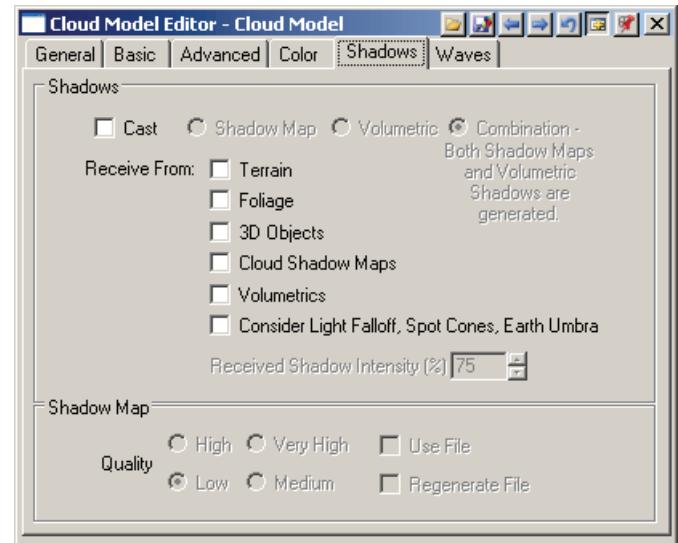
Only Shadow Maps are created by this cloud, Volumetric shadows from this cloud are not possible. Shadow Map controls become active. A Shadow Map cannot be used effectively to self-shadow a cloud but can be useful for shading other clouds or the ground. In most cases it will be faster to have ground and 3D objects receive shadows from clouds in the form of Shadow Maps. An exception would be if you have thick multi-layer clouds that are animated. The time taken to regenerate Shadow Maps may exceed the time required to do volumetric shading.

Volumetric Checkbox

Only Volumetric shadows are generated by this cloud. Only objects with the Receive From: Volumetrics will be shaded by this cloud. Shadow Map controls are inactive.

Combination Checkbox

Both Shadow Map and Volumetric shadows are generated by this cloud. Depending on which type of shadows are set to be received by an object either or both types of shadows may be received from this cloud



Receive Checkboxes

Select one or more of the following checkboxes to allow the cloud model to receive shadows from that object class.

Terrain

Receive shadows generated by terrain that is covered by a Shadow Effect (see Shadow Editor)

Foliage

Receive shadows generated by foliage that is covered by a Shadow Effect (see Shadow Editor)

3D Objects

Receive shadows from 3D Objects that cast shadows.

Cloud Shadow Maps

Receive shadows from clouds that have either Cast Shadow Map or Cast Combination shadow types selected.

Volumetrics

Receive shadows from clouds that have either Cast Volumetric or Cast Combination shadow types selected and from Volumetric Atmospheres that have Cast Shadows turned on. Normally a cloud will have only Receive From Volumetrics OR Receive From Cloud Shadow Maps selected, not both. In order to generate volumetric self-shadows the cloud must have Receive From Volumetrics enabled and either Cast Volumetric or Cast Combination shadow types selected. This procedure is slow but generates by far the most realistic cloud shading. The amount of shadow that can be generated is limited by the Shading % value and Shading Profile on the Aerial Attributes tab.

Consider Light Falloff, Spotlight cone & Earth Umbra

To save time if there are not lights with falloff, spotlights or lights beyond the horizon, turn this checkbox off. If any of the above conditions are not met turn this checkbox on. Extra computations will be required in that event to correctly illuminate the cloud.

Received Shadow Intensity

Controls the amount of shading that can be generated from shadow maps for Terrain, Foliage, 3D Object and Light Falloff, Spotlight Cones and Earth Umbra. It does not affect Volumetric shading.

Quality Radio Buttons

Choose Low, Medium, High or Very High quality. Use the lowest setting that looks convincing.

The width of the maps associated with the above settings are as follows: Low: 512 pixels, Medium: 1024 pixels, High: 2048 pixels, Very High: 4096 pixels. The height of the map will be determined by the angle of the sunlight and the area that the shadow map affect.

Use File Checkbox

Select the Use File checkbox if you want VNS to cache the shadow map to your hard drive (by default, in the Project folder). If the clouds or lights are not moving this will save time. VNS will only have to calculate the shadow map the first time you render. After that VNS can quickly reload the shadow map from your hard drive. File is not used if any parameter of the cloud is animated which would cause the cloud pattern or density to change over time.

Regenerate File Checkbox

Select the Regenerate File checkbox if you are using the Use File checkbox (see above) and you've changed the clouds or lighting. The next time you render VNS will regenerate the shadow map for the Cloud Model save it to your hard drive. The new shadow map will take your changes into account. Changes in light positions will automatically cause the shadow map to be regenerated.

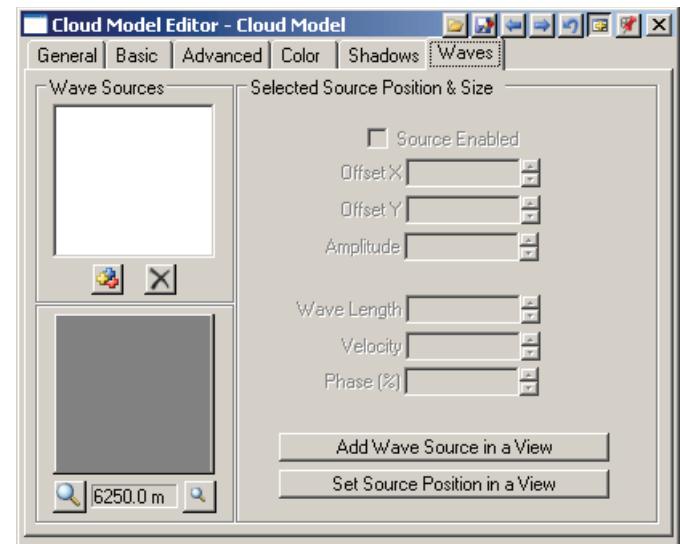
Waves Page

The Waves page lets you add, remove and adjust Cloud Waves. Cloud Waves let you modulate the Cloud Model with animated wave patterns, much like real clouds. This gives your clouds another source of patterns and evolution.

Cloud Waves are optional.

The Waves thumbnail on the lower left will show a preview of the wave pattern. The thumbnails on the Aerial Attributes and Color pages will not show the result of Cloud Waves. To see the final result of Cloud Waves in your Cloud Model, render a preview in a View.

Note: For faster rendering you can disable terrain on the Enabled 1 page of the View's Render Options.



Wave Sources List

On the left side of the Wave Editor window is the Wave Sources list. Here you'll see a number for each Wave Source you create. For convenient comparison, the numbers in the list are the Amplitude of each of the Wave Sources in the list.

You can make any wave the Active Wave Source by clicking its Amplitude in the Waves list. The Parameter values for the Active Wave Source are shown on the right.

Add Source Icon

Click the Add Source icon to add a Wave Source with a click of the mouse. After you add one or more Wave Sources you can edit its parameters with the controls on the right.

By using the Add button you can very quickly create realistic waves. It doesn't take very many Wave Sources to create convincing wave patterns in the clouds.

Note: You can also add Wave Sources interactively with the Add Wave Source in a View button (see below).

The Cloud Wave thumbnail in the lower left shows you the wave pattern you are creating.

Remove Source Icon

Use the Remove icon to remove the Active Wave Source (the one selected in the Wave Sources list). You can remove any wave by selecting it in the Wave Sources list and then clicking the Remove Source icon.

Selected Source Position and Size Controls

These controls let you change the parameters of the Wave Source selected in the Wave Sources list on the left. You enable or disable each Wave Source, and edit the offsets, amplitude, wavelength, velocity and phase for each Wave Source.

Source Enabled Checkbox

The Enabled checkbox lets you enable or disable the selected Wave Source for rendering.

Disabling a Wave Source can be useful to see what the Cloud Model will look like without the Wave Source. Make sure you remember to enable it for the final rendering if you want to see the Wave Source.

Offset X Field

The Offset X field lets you position the Wave Source east or west relative to the Center Longitude you set on the General page. The units are in the Distance units you set on the Units page of the Preferences Window.

A value of zero is at the Center Longitude.

Offset Y Field

The Offset Y field lets you position the Wave Source north or south relative to the Center Latitude you set on the General page. The units are in the Distance units you set on the Units page of the Preferences Window.

A value of zero is at the Center Latitude.

Amplitude Field

The Amplitude field lets you adjust the height of the waves in the Height units you set on the Units page of the Preferences Window.

Amplitude Texture Controls

The Amplitude Texture controls let you control the wave amplitude with a texture. Click the T icon to add a texture and open the Texture Editor. Once you've created a texture, the T icon lets you enable or disable the texture. Click the Edit icon to reopen the Texture Editor if you need to re-edit the texture. Click the Remove Texture icon if you want to eliminate the texture completely.

Wave Length Field

The Wave Length field lets you adjust the wavelength of the Wave Source in the Distance unit you set on the Units page of the Preferences Window.

Velocity Field

The Velocity field lets you adjust the speed of the waves in the units you set on the Units page of the Preferences Window.

Phase Percentage Field

The Phase Percentage field lets you adjust the phase of the Wave Source.

Phase Texture Controls

The Phase Texture controls let you control the Wave Source's phase with a texture. Click the T icon to add a texture and open the Texture Editor. Once you've created a texture, the T icon lets you enable or disable the texture. Click the Edit icon to reopen the Texture Editor if you need to re-edit the texture. Click the Remove Texture icon if you want to eliminate the texture completely.

By using a Dynamic Parameter Element of Water Depth in the Texture Editor, you can delay the phase of a Wave Source as the water depth decreases. This makes waves tend to wrap naturally around the shoreline.

Add Wave Sources in a View Button

Use the Map Add button to add Wave Sources visually, by clicking where you want them directly in a View. This lets you precisely place each Wave Source. If you need to add Wave Sources where there is no terrain, use a View with a Planimetric Camera.

Color Map Editor

The Color Map Editor lets you drape Color Maps onto the terrain. A Color Map can be any Image Object (see Image Object Library). You can use a Color Map two ways:

1) To tint areas of the terrain.

For example, you can drape a satellite image onto the terrain or tint areas within a political boundary such as a country or state.

2) To specify, via unique colors or color ranges, where particular Ecosystems should appear on the landscape.

For example, you can use a satellite image to control where VNS places Ecosystems.

Wherever black exists on the image, the terrain will not be affected. Wherever a color exists on the image, the corresponding area of the terrain can be tinted with that color or you can specify that a particular Ecosystem appear, thus overriding the Rules-of-Nature™ that normally determine Ecosystem placement.

By tinting areas you can indicate such things as parks, protected forest areas, or lakes; or even project a picture onto the terrain. By specifying Ecosystems you can place such things as forests, orchards, ski runs, clearings, or any other precise landscaping.

A Color Map is any Image Object in a format supported by VNS (see Image Object Library). You can create Color Map images in any paint program. You can use Satellite imagery or aerial photographs.

VNS lets you use multiple Color Maps and size them or overlap them as needed.

Note: You may find it more convenient to place Ecosystems (see Ecosystem Editor) or Foliage Effects (see Foliage Effect Editor) with Vectors instead of using Color Maps to place Ecosystems. You can also use the Texture Engine to drape high resolution imagery onto the terrain via a Ground Effect, Ecosystem, Snow Effect or Lake.

Overlapping Color Maps

You can have as many overlapping color maps as you want. All color maps can be of any size or resolution.

If you want a Color Map to be the same size as the area covered by one or more DEMs, select that DEM in the Database Editor and use the "Snap to Selected DEMs" button on the Image Object Library's GeoReference page for the Color Map's Image Object. You can snap to any number of DEMs. VNS will choose the smallest rectangular bounds that encompasses all selected DEMs.

Each color map can have its own behavior. Some can match to ecosystems, some can be colored by pixel, some can provide luminous colored polygons, etc. The order that they are considered for rendering is their priority settings found on the General page of the Color Map editor. Higher priority Color Maps are considered first.

VNS will examine each Color Map that encompasses a point on the landscape within its bounds. It will stop the evaluation when a Color Map is found that is either "Color by Pixel" or has a color at the point in question. If neither event occurs in the first Color Map it will move down the priority list to the next Color Map and try again. If it goes through the list and never finds one of these circumstances then it will go on and apply Rules of Nature™ ecosystems.

Ecosystem Matching

If a Color Map is found to have color at a point and Ecosystem Matching is enabled then VNS will search the list of ecosystems matched to that particular color map. It will examine the color or color range, depending on the ecosystem's match color setting and if a match-up is found will further screen the ecosystem based on terrain slope and relative elevation. If the point falls within the ecosystem's limit requirements on those two counts then the match will be complete and VNS will exit the search loop, return and draw the ecosystem.

If an ecosystem color match is found but the slope or relative elevation don't fit then VNS will continue to search other color maps and eventually apply Environment Ecosystems if no other match-ups are found.

If no color match is found to any ecosystem then the color of the color map will be used to color the terrain. If Luminous colors is chosen for the Color Map then no shading will be applied, either shadows nor any other lighting considerations. The colors will be rendered just as seen in the color map with the addition of haze if present.

Render Priority

Here is the priority with which VNS renders foliage: Foliage Effects are always visible, then Beach Ecosystems, then Terraffector Ecosystems, then Ecosystems placed with Vectors, then color mapped Ecosystems, and finally Environment Ecosystems.

Within each method of placing foliage you can set the priority in the appropriate Editor. For example, if you have two Color Maps which overlap and you want one to take precedence, set it's priority higher using the Priority field on the General page of the Color Map Editor (see below).

How to Use a Color Map

Here's how to use a Color Map:

- 1) Create a new Color Map by selecting Color Maps in the Scene-At-A-Glance and clicking the Add or Clone Selected Items icon at the top.**

VNS will open the Color Map Editor.

The Enable checkbox will be selected on the General page. You can deselect it later if you want to disable the Color Map for any reason.

- 2) Select an Image Object in the Image Object section on the General page.**

Select an Image Object from the Image Object drop box.

If you want to import a new image that is not currently used in your Project, select the "New Image Object" option. VNS will open a file requester where you can navigate to the image you'd like to import.

- 3) Set the Position of the Image Object on the terrain using the controls on the Image Object Library's Geo Reference page (see Image Object Library).**

There you can select a Coordinate System and set the registration coordinates for the Image Object. If you imported a georefer-

enced image format, VNS will fill the registration information in for you.

4) If you'd like the Color Map to control Ecosystem placement, select the Color By Polygon option on the General page and use the controls on the Ecosystem Matching page.

You can choose any Ecosystems which are available to be Color Mapped. You can set an Ecosystem to be available for Color Mapping by selecting the "Match Ecosystem to Colors" checkbox on the Gradient & Color Map page of the Ecosystem Editor.

This will cause the Ecosystem to appear on the landscape in a position corresponding to the position of pixels of that color or range used on your Color Map.

How to See Color Maps in Real Time OpenGL Views

If you want to see the Ecosystems or colors from Color Maps, select the Ecosystem Map command in the Realtime Options submenu's Overlay submenu in the Matrix Popup Menus. Alternatively, select the Ecosystem Map checkbox on the Overlay/Gradient page of the View Preferences Window.

VNS will then show Ecosystems mapped onto the terrain in the selected Realtime OpenGL View, along with any Ecosystems belonging to Environments. VNS will show Diffuse Colors from Ecosystem Materials. This can give you a quick idea of where each Ecosystem or Color Map color will appear.

If you have a Color Map enabled and set to "Color by Polygon" on the General page but not set to match Ecosystems to any colors on the Ecosystems page, VNS will show the actual colors of the color map in the Realtime OpenGL View. This lets you see draped images in the OpenGL View.

If you change the Color Map and want to refresh the View, click the Regen button on the Overlay/Gradient page of the View Preferences window.

General Page

General Features

Name Field

Enter a name for the Color Map. For example, if it is used to drape a satellite image onto the terrain, you might call it simply "Satellite".

By default VNS will name new Color Maps "Cmap", and add a number after the name if there is more than one Color Map named "Cmap".

Enabled Checkbox

The Enabled checkbox lets you enable or disable the Color Map for rendering.

Disabling a Color Map can be useful when you have several Color Maps representing different conditions. In that case you may want to render the different images with different Color Maps. Make sure you remember to enable a Color Map for the final rendering if you want to see it in your images.

Note: To see the Color Map in your rendering, it must be visible to the Camera you selected for the Render Job you are using (see Render Job Editor), and Color Maps must be enabled in the Render Options you are using (see Render Options Editor).

Priority Field

The Priority field lets you set the rendering priority of the Color Map. If you have more than one Color Map and they overlap, VNS will render the one with the highest priority in the overlapped area.

Drape Image On Terrain Radio Button

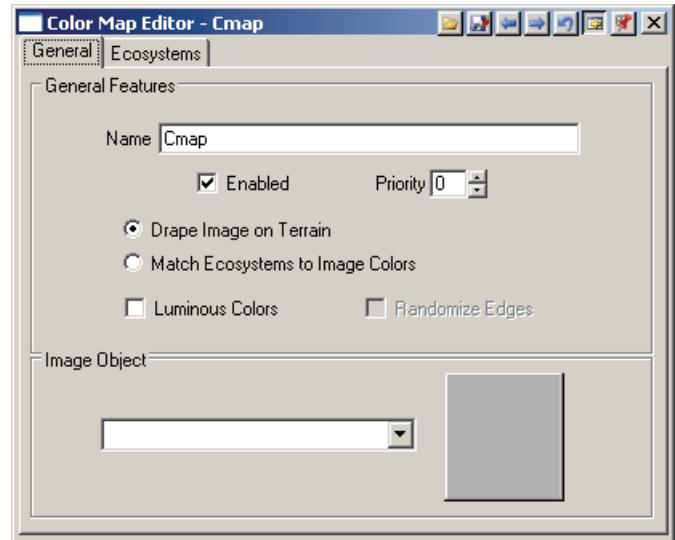
Select the Drape Image On Terrain radio button when you want to place an image on the terrain and you don't need to control Ecosystems with the Color Map. This is great for draping satellite imagery onto the terrain.

Note: This is identical to what you would get if you created a project with one Ecosystem everywhere and applied a texture onto the Ecosystem's Material Ground Overlay's Diffuse Color, using a planar image Component of the same source picture positioned with latitude/longitude bounds.

This option will give you a nicely antialiased, high resolution image drape. Because it colors every pixel in the final image, the Color Map's resolution will be higher than if you select the Match Ecosystems To Colors radio button.

If you select this option, the Color Map will not be able to control Ecosystem placement. If you need to place Ecosystems with a Color Map, select the Match Ecosystems To Colors radio button (see below).

Note: If you select the Color by Pixel option, you will not be able to use the Randomize Edges option (see below).



Color by Polygon Radio Button

Select the Match Ecosystems To Colors radio button when you want to control Ecosystems with the Color Map. This is great for using satellite imagery, to control where Ecosystems appear.

Since the Match Ecosystems To Colors option applies the Color Map at the resolution of the underlying terrain model (ie: on a per-polygon basis) you can jitter the map a bit so as to have softer pixel boundaries. To do so turn on the Randomize Edges checkbox (see below).

Luminous Colors Checkbox

Enable the Luminous Colors checkbox when you want to make Color Map colors render without shading from Lights.

Normally colors are shaded according to where Lights are and how they illuminate the scene. Using this option, colors from a Color Map are applied directly to the terrain without shading. This may be useful for creating bodies of molten lava, a glowing forest fire, a watery mirage in the desert or other effects where you want to specify a precise color pattern for the terrain and not have a Light's position affect it.

Note: Haze and Fog will still be applied when Luminous Colors is enabled. Also, if colors match a particular Ecosystem using the Color Matching feature described above, any trees in the Ecosystem will still be shaded by Lights.

Randomize Edges Checkbox

Use the Random Edges checkbox to specify whether color boundaries in Color Maps are softened. If you are applying Ecosystems with Color Maps this can mingle the Ecosystems at the edges of Color Mapped areas for a more natural look.

Points along a color border are chosen to fall into the color on one side or the other based on a random number. This is particularly effective at fractal depth levels of one or higher (see Terrain Parameter Editor).

Image Object Controls

Image Object Drop Box

Select an Image Object to use as the Color Map.

If the image you want is not listed, select "New Image" and VNS will open a file requester where you can choose a new image to use for your Color Map. VNS will also add the image to the Image Object Library, where you can see and adjust the Image Object's Coordinate System and registration coordinates.

Image Object Thumbnail

The Image Object thumbnail shows a small version of your Color Map image if there is one. You can double click the thumbnail to see a full sized image

Ecosystems Page

The Ecosystems page lets you map Ecosystems to the colors in your Color Map image. This is available if you select the Color by Polygon option on the General page. Colors that have no matching Ecosystem will tint the terrain polygons.

An RGB 0,0,0 black color in a color map will never be matched or used for tinting but will always be treated as transparent.

Note: To apply an Ecosystem with a Color Map, you must first select the Ecosystem's "Match Ecosystem to Colors" checkbox on the Color Map page of the Ecosystem Editor.

Sharing Ecosystems among Multiple Color Maps

If you have more than one Color Map in your Project, each Color Map can have a different set of matched Ecosystems. Any Ecosystem can be used by more than one Color Map.

Each Ecosystem has its own distinct matched color or color range which will be used in any the Color Maps using the Ecosystem. If you need to apply an Ecosystem with a different color or color range from different Color Maps you will need to duplicate the Ecosystem and modify the match color or range.

If you disable an Ecosystem, VNS will not apply it with a Color Map. It will be ignored. By disabling an otherwise matched ecosystem you can make its polygons draw in color mapped colors.

Ecosystem Matching Controls

The Ecosystem matching controls let you use colors in your Color Map image to specify where Ecosystems appear on the terrain. For any color that isn't matched to an Ecosystem VNS will tint the terrain polygons with the Color Map color.

Color by Polygon message

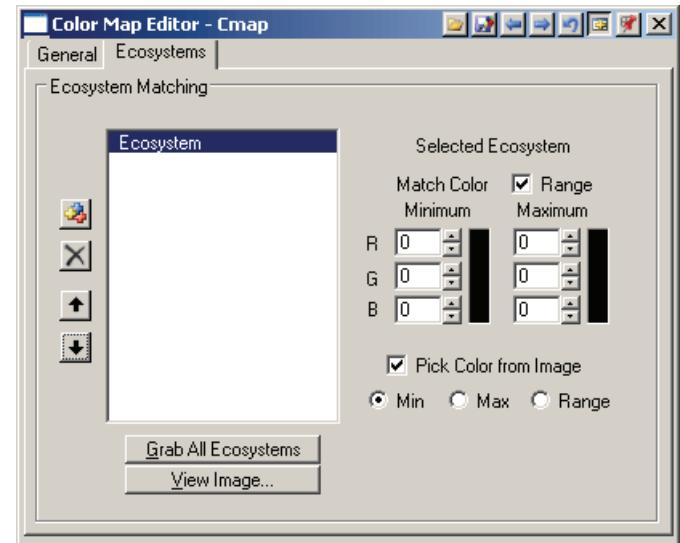
The Color by Polygon message is a reminder that in order to specify Ecosystems with a Color Map you must first select the Color by Polygon radio button on the General page.

Match Ecosystems to Colors Checkbox

You can tell VNS to put a particular Ecosystem wherever you put a particular color in a corresponding place on a Color Map. The color itself does not need to be shown, it's just used to indicate to VNS where to put the Ecosystem. You could use this to put a grove of aspen trees in a particular place, or to spell your name in evergreen trees.

Use the Match Ecosystems to Colors checkbox to tell VNS to use colors in the Color Map to place Ecosystems.

You can then add Ecosystems to the list (see below). Then use the RGB fields for each Ecosystem to define the color or color range that will place the Ecosystem on the landscape based on where the color or color range appears in the Color Map.



Note: To make this work, you must have a Color Map. You must also select the Enabled checkbox on the General page.

Ecosystem List, Icons and Buttons

The Ecosystem list shows the Ecosystems the Color Map can place onto the terrain.

To make an Ecosystem available to appear in this list, you must first select the Ecosystem's "Match Ecosystem to Colors" checkbox on the Color Map page of the Ecosystem Editor.

If you later turn off that checkbox the Ecosystem will appear grayed in the Color Map Editor's Ecosystems list. The same thing will happen if you disable the Ecosystem by deselecting the Enabled checkbox on the General page of the Ecosystem Editor.

Add Ecosystem Icon

Click the Add Ecosystem Icon to add one or more Ecosystems to the list. VNS will open a window where you can select one or more Ecosystems. Click to select. Shift-click or control-click to select more than one.

Note: To make an Ecosystem available to appear in this window, you must first select the Ecosystem's "Match Ecosystem to Colors" checkbox on the Color Map page of the Ecosystem Editor.

Remove Ecosystem Icon

Select an Ecosystem you want to remove from the Color Map in the Color Map Editor's Ecosystem list. Then click the Remove Ecosystem icon to remove it.

VNS will ask you if you want to remove the Ecosystem from the Color Map.

Raise and Lower Ecosystem Rendering Priority Icons

Select an Ecosystem and click the Raise or Lower Ecosystem Rendering Priority icons to move it higher or lower in the list.

The order of entries in the list is important if more than one Ecosystem is mapped to part of the same color range.

If you are using color ranges for Ecosystems you can have overlapping ranges of matched colors. VNS evaluates the Ecosystems for match criteria from the top of the list down. The first Ecosystem that matches a color will appear on the terrain wherever that Color Map's color does. Any other Ecosystem lower in the list which is also set to appear on that color will not appear.

If you wanted to have a "catch-all" ecosystem for a color map you can put it at the bottom of the list and set its match color range from 0 to 255 for red, green and blue. Then it will appear wherever there is a color in the Color Map that is not assigned to any other Ecosystem.

Grab All button

Click the Grab All button to grab all Ecosystems that have their Match Ecosystem to Colors checkbox selected. This is a quick way to see all the Ecosystems that have their "Match Ecosystem to Colors" checkbox selected on the Color Map page of the Ecosystem Editor.

You can then remove any Ecosystems you don't really want to use in the Color Map by selecting them and clicking the Remove Ecosystem icon (see above).

View Image Button

Click the View Image button to open the Color Map Image Object into a window. This makes it easy to set Match Colors for Ecosystems by using the Pick Color from Image checkbox (see below).

Selected Ecosystem Match Color Controls

Use the Match Color controls to edit the color or color range where each Ecosystem will appear based on the colors in your Color Map.

RGB Fields and Range Checkbox

Use the R (Red), G (Green) and B (Blue) fields to specify a color or color range for the selected Ecosystem.

If the Range checkbox is not selected, use the Match Color Values fields stacked in the middle of the window to specify a single color.

If the Range checkbox is selected, use the Match Color Minimum and Maximum fields to specify a minimum color and a maximum color in the range. VNS will apply the Ecosystem wherever any color within the range appears in your Color Map.

For each field you can enter a number from 0 to 255. Don't use pure black (RGB 0,0,0) because that is the one color in the Color Map that does not affect the terrain.

Tip: A useful technique is to take a satellite photo and color map the ecosystems on top of the picture, using the colors of the actual trees to control where VNS puts similar trees.

When VNS finds a match between the three color components in the Color Map and the components set for one of the Ecosystems the Ecosystem will be rendered at that spot.

When an Ecosystem match is not found, the terrain will be tinted the Color Map color. The exception is the color black (RGB 0,0,0) which makes the Color Map completely transparent. VNS ignores the Color Map anywhere its color is RGB 0,0,0.

Pick Color from Image Checkbox

Select the Pick Color from Image checkbox if you want to set the RGB fields by clicking in the Color Map itself. This is a fast way to set the RGB fields.

You can open the Color Map by clicking the View Image button. Then click the Pick Color from Image checkbox and you can choose the Value, Maximum or Range mode from the radio buttons below.

Value (Val) Radio Button

Select the Value radio button and then click in the Color Map window. VNS will enter the color you click into the Match Color Values RGB fields. Use this when the Range checkbox is deselected.

Maximum (Max) Radio Button

Select the Value radio button and then click or drag in the Color Map window. VNS will enter the maximum color value you clicked or dragged over into the Match Color Values RGB fields. Use this when the Range checkbox is deselected.

Range Radio Button

Select the Range radio button and then click or drag in the Color Map window. VNS will enter the minimum color value you clicked or dragged over into the Minimum RGB fields, and the maximum color value you clicked or dragged over into the Maximum RGB fields. Use this when the Range checkbox is selected.

Coordinate System Editor

The Coordinate System Editor lets you edit Coordinate Systems. A Coordinate System lets you configure a Projection System, which includes a Projection Method and a Datum. A Datum includes an Ellipsoid.

Note: This documentation cannot cover every possible coordinate system variation or substitute for an education in Geodesy or Cartography, however there is more information for those interested, in Appendix A: A Lesson In Geography.

Coordinate Systems

VNS lets you combine DEM, Vector, Control Point and Image Object data created in multiple Coordinate Systems. When you import the data with the Import Wizard or Image Object Library, VNS will look at any available metadata and attempt to figure out the Coordinate System for the data. If VNS can't figure out the Coordinate System you will be asked to choose a Coordinate System.

VNS will attach the resulting Coordinate System to the data. You can see or change the Coordinate System for any Vector or set of Control Points from the Vector Editor; for any DEM from the DEM Editor; and for any Image Object from the Image Object Library. You can also drag and drop Coordinate Systems onto DEMs, Vectors, Control Points or Image Objects in the Scene-At-A-Glance.

Note: Be very careful as you use these tools. They are meant to help you line up data created with differing projection systems, but it's easy to get into trouble if you don't know what you're doing. For example, if you take a geographic set of data and tell VNS it's projected in UTM the data will move to an unexpected location. If you have a DEM that's a whole degree square and you tell VNS it's in UTM, it will go from 100km square to less than a meter square. Check with your data source if you are not sure of the proper Coordinate System for the data.

When you're importing DEM data with a Coordinate System, VNS will ask if you want that to be the default Coordinate System. That way you can view the data in its native Coordinate System within VNS. If you want to see what the data looks like in a different projection, you can change the default Coordinate System in the Planet Options Editor. VNS normally displays data in latitude and longitude, using the Datum from the data's Coordinate System. If your DEM is in one projection and Vectors in another, you may find it useful to switch the default Coordinate System occasionally.

Note: In the Preferences Window, the "Display Lat/Lon As Geographic or as Projected" button on the Units page determines how coordinates are displayed in various places throughout the program.

You can also create Coordinate Systems in the Scene-At-A-Glance or Component Library, but they won't do anything until you attach them to a DEM, Vector, set of Control Points or Image Object.

When you render, VNS uses the Ellipsoid and Datum from the Planet Options Coordinate System. Renderings and Views use geographic coordinates. The Coordinate Systems your DEM, Vector, Control Point and Image Object data is in gets converted to the Coordinate System of the Planet Options, except VNS ignores the Projection Method and always uses geographic coordinates on an elliptical earth.

For any DEMs, Vectors, sets of Control Points or Image Objects that don't have an attached Coordinate System, they are assumed to be geographic in the Datum and Ellipsoid of the default Coordinate System. You can set the default Coordinate System in the Planet Options Editor. If there is no default Coordinate System selected in the Planet Options Editor, the default Coordinate System is assumed to be Geographic-WGS84.

General Page

Open Component Gallery and Save Component to Disk Icon

Lets you save the entire Coordinate System as a reusable Component.

You can also save the Projection Method, Geodetic Datum and Ellipsoid as separate Components using similar Component icons on the Method, Datum and Ellipsoid pages, respectively (see above).

Click the Open Component Gallery icon on the right side of the Coordinate System Editor to see the Component Gallery, ready to load one of any pre-made Coordinate Systems you may have created.

You can create and export your own pre-built Coordinate System Components from the Coordinate System Editor by setting up the Coordinate System the way you want it and then clicking the Save Component to Disk icon on the right side of the Coordinate System Editor. VNS will open the Component Signature Window where you can fill in the information, choose a representative image for the Component's thumbnail and save the Component in the Component Gallery.

This makes it easy to create and store different kinds of Coordinate Systems you may need. You can later reuse the Coordinate System in another Project.

General Features Section

The General Features section lets you edit the Coordinate System's name and see if it is attached to any Database Objects or Image Objects.

Name Field

By default the Name field shows name of the Coordinate System's Projection system, as selected in the System drop box, in System page's Projection System section.

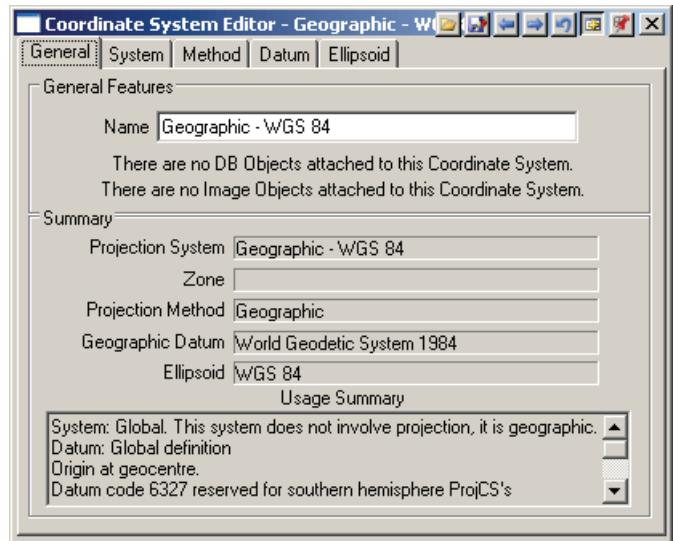
You can change or add to the name if you wish. If you select a new Projection System on the System page, VNS will update the Name field with the name of the new Projection System.

Database Object Attachment Message

The Database Object Attachment message shows the number of database objects (DEMs, sets of Control Points or Vectors) attached to the Coordinate System you're editing.

Image Object Attachment Message

The Image Object Attachment message shows the number of Image Objects attached to the Coordinate System you're editing.



Summary Section

The Summary section shows all the important properties of the Coordinate System at a glance. You can edit these properties on other pages of the Coordinate System Editor (see below).

Projection System Display Field

The Projection System display field shows the name of the Projection System used by the Coordinate System. You can change the Projection System on the System page (see below).

Zone Display Field

The Zone display field shows the name of the Zone used by the Coordinate System. You can change the Zone on the System page (see below).

Projection Method Display Field

The Projection Method display field shows the name of the Projection Method used by the Coordinate System. You can change the Projection Method on the Method page (see below).

Geographic Datum Display Field

The Geographic Datum display field shows the name of the Geographic Datum used by the Coordinate System. You can change the Geographic Datum on the Datum page (see below).

Ellipsoid Display Field

The Ellipsoid display field shows the name of the Ellipsoid used by the Coordinate System. You can change the Ellipsoid on the Ellipsoid page (see below).

Usage Summary Display Field

The Usage Summary display field shows all the Usage Notes for System, Method, Datum and Ellipsoid in one handy place. You can also read them individually on the editor's other pages.

System Page

You can use the System page to see, and possibly alter, the Coordinate System's Projection System.

Projection System Section

The Projection System section lets you see and change a preset Projection System for the Coordinate System.

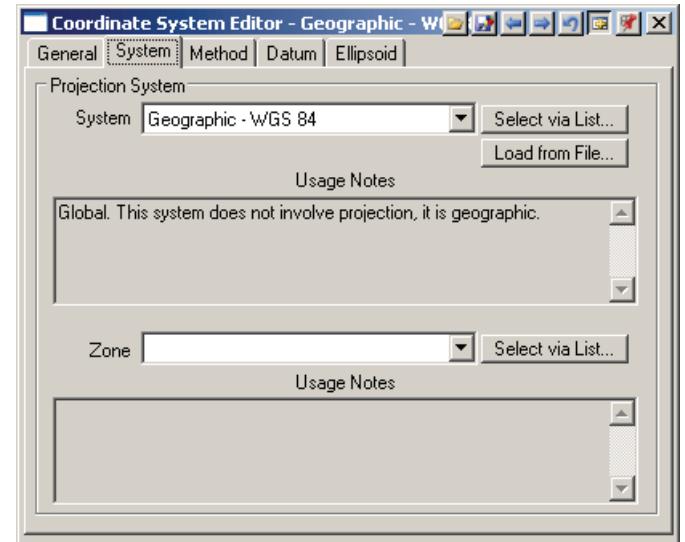
Note: Using an inappropriate Projection System can cause attached data to appear distorted and in the wrong location.

Some of the Projection Systems also have Zones. Selecting a Zone automatically enters appropriate values into the Method fields on the Method page (see below).

System Drop Box

The System drop box lets you see the Projection System used by the Coordinate System. If appropriate, you can choose a different Projection System from a list of presets:

- **Custom**
- **WCS Back-compatible Sphere**
- **Geographic - NAD 27**
- **Geographic - NAD 83**
- **Geographic - ED 50**
- **Geographic - WGS 84**
- **UTM - NAD 27 (has zones)**
- **UTM - NAD 83 (has zones)**
- **UTM - ED 50 (has zones)**
- **UTM - WGS 84 (has zones)**
- **US State Plane - NAD 27 (has zones)**
- **US State Plane - NAD 83 (has zones)**
- **Surveyed Cartesian - NAD 27 (has zones)**
- **Surveyed Cartesian - NAD 83 (has zones)**
- **Surveyed Cartesian - ED 50**
- **Surveyed Cartesian - WGS 84**
- **Gauss-Kruger - 500k Eastings (has zones)**
- **Gauss-Kruger - Incremental Eastings (has zones)**
- **Gauss-Boaga (has zones)**
- **UK National Grid**
- **Universal Polar Stereographic (has zones)**



System Select via List Button

Click the Select Via List button to see the available Projection Systems in a separate window. There you can click the name of a Projection System and click the Apply button to select it for the Coordinate System. This is the same as selecting a preset Projection System in the System drop box (see above).

Usage Notes Display Field

The Usage Notes display field may include useful information about the Projection System selected in the System drop box (see above).

Zone Drop Box

If the selected Projection System has available Zone information (see above), you can see the selected Zone in the Zone drop box. You can select a different Zone if appropriate.

Selecting a Zone automatically enters appropriate values into the Method fields on the Method page (see below).

Zone Select via List Button

If the selected Projection System has available Zone information (see above), the Zone Usage Notes display field may include useful information about the Projection System Zone selected in the Zone drop box (see above).

Method Page

The Method page lets you configure the Coordinate System's Projection Method.

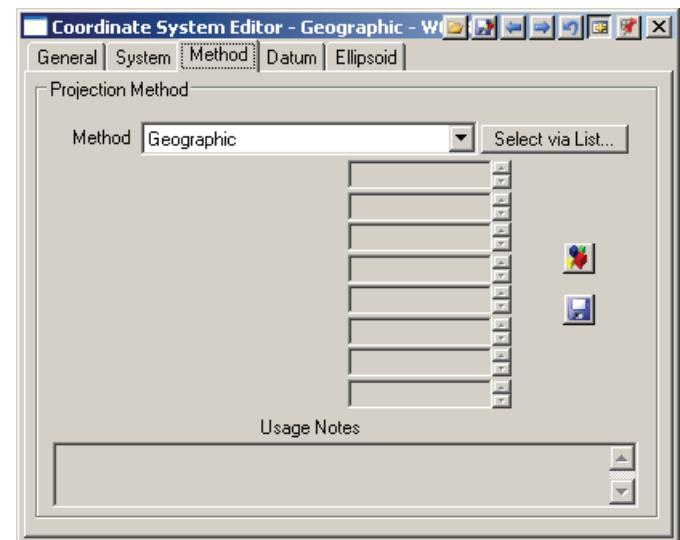
Projection Method Section

Note: Using an inappropriate Projection Method can cause attached data to appear distorted and in the wrong location.

Method Drop Box

The Method drop box lets you see the Projection Method used by the Coordinate System. The appropriate, you can choose a different Projection Method from a list of presets:

- **Albers Conical Equal Area**
- **Azimuthal Equidistant**
- **Equidistant Conic, A**
- **Equidistant Conic, B**
- **Equirectangular**
- **General Vertical Near-side Perspective**
- **Geographic**
- **Gnomonic**
- **Hammer**



- **Hotine Oblique Mercator, A**
- **Hotine Oblique Mercator, B**
- **Interrupted Goode Homolosine**
- **Interrupted Mollweide**
- **Lambert Azimuthal Equal Area**
- **Lambert conformal Conic**
- **Mercator**
- **Miller Cylindrical**
- **Modified Stereographic Conformal**
- **Mollweide**
- **Oblated Equal Area**
- **Orthographic**
- **Polar Stereographic**
- **Polyconic**
- **Robinson**
- **Sinusoidal**
- **Space Oblique Mercator, A**
- **Space Oblique Mercator, B**
- **Stereographic**
- **Transverse Mercator**
- **Van der Grinten**
- **Wagner IV**
- **Wagner VII**

Method Select via List Button

Click the Method Select Via List button to see the available Projection Methods in a separate window. There you can click the name of a Projection Method and click the Apply button to select it for the Coordinate System. This is the same as selecting a preset Projection Method in the Method drop box (see above).

Usage Notes Display Field

The Usage Notes display field may include useful information about the Projection Method selected in the Method drop box (see above).

Parameter Value Fields

VNS will show the appropriate parameter value fields and values for the Projection Method selected in the Method drop box (see above). You can alter the values as appropriate.

Note: Using inappropriate values can cause attached data to appear distorted and in the wrong location.

Load Projection Method and Save Projection Method to Disk Icons

Click the Load Projection Method icon to see the Component Gallery, ready to load one of any pre-made Projection Methods you may have created.

You can create and export your own pre-built Projection Method Components from the Coordinate System Editor by setting up the Projection Method the way you want it and then clicking the Save Projection Method to Disk icon. VNS will open the Component Signature Window where you can fill in the information, choose a representative image for the Component's thumbnail and save the Component in the Component Gallery.

This makes it easy to create and store different kinds of Projection Methods you may need. You can later reuse the Projection Method in another Project.

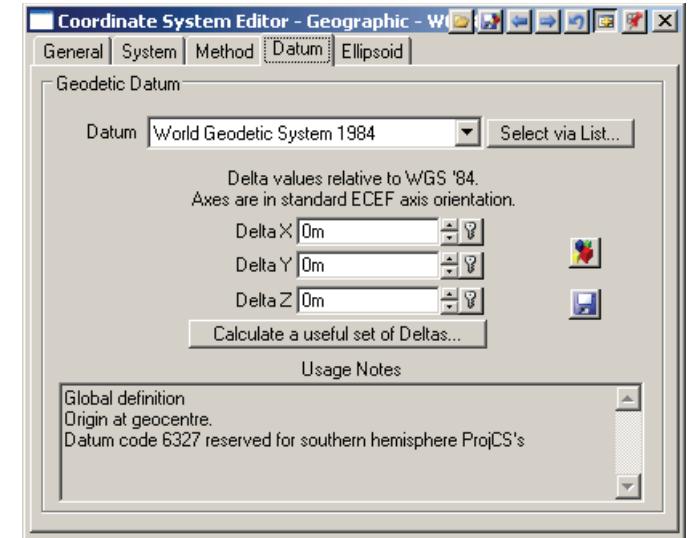
Datum Page

A "datum" is a mathematical reference, an assumed value used for calculations.

A "Geographic Datum" is a point or network of points with a known location. For GIS and cartography purposes, a Datum is comprised of at least one point with known latitude and longitude positions relative to the shape of the planet (an ellipsoid). From this reference it is possible to calculate the relative position of other points on the planet.

A Datum is only valid with one Ellipsoid (see below). If you use the wrong Ellipsoid, the Datum is no longer accurate.

Note: If you choose a pre-set Datum VNS will automatically supply the appropriate Ellipsoid. Using an inappropriate Datum can cause attached data to appear distorted and in the wrong location.



Geodetic Datum Section

Datum Drop Box

The Datum drop box lets you see the Datum used by the Coordinate System. If appropriate, you can choose a different Datum from a list of presets.

- **Custom**
- **WCS Back-compatible Sphere**
- **Abidjan 1987**
- **Adindan - Burkina-Faso**
- **Adindan - Cameroon**
- **Adindan - Ethiopia**
- **Adindan - Mali**
- **Adindan - Mean**
- **Adindan - Senegal**
- **Adindan - Sudan**
- **Adindan - Somalia**
- **Agadez**
- **Ain el Abd 1970 - Bahrain**
- **Ain el Abd 1970 - Saudi Arabia**
- **American Samoa**

- **Amersfoort**
- **Ancienne Triangulation Francaise (Paris)**
- **Anguilla 1957**
- **Anna 1 Astro 1965**
- **Antigua 1943**
- **Aratu**
- **Arc 1950 - Botswana**
- **Arc 1950 - Burundi**
- **Arc 1950 - Lesotho**
- **Arc 1950 - Malawi**
- **Arc 1950 - Mean**
- **Arc 1950 - Swaziland**
- **Arc 1950 - Zaire**
- **Arc 1950 - Zambia**
- **Arc 1950 - Zimbabwe**
- **Arc 1960 - Kenya**
- **Arc 1960 - Mean**
- **Arc 1960 - Tanzania**
- **Ascension Island 1958**
- **Hundreds more**

Note: For a full list, see the Datum Drop box or click the Select Via List button.

Datum Select via List Button

Click the Datum Select Via List button to see the available Datums in a separate window. There you can click the name of a Datum and click the Apply button to select it for the Coordinate System. This is the same as selecting a preset Datum in the Datum drop box (see above).

Delta X, Y, Z Fields and Calculation Button

The Delta X, Y and Z fields are used to align Datums. It works by shifting the center of the Datum so that at the point of the Datum's definition the Ellipsoidal surfaces are coincident. This does not result in the ellipsoids being co-centric but rather the areas on the surface near the datum's defining point become aligned with reasonable closeness.

The Delta values provided for each preset Datum shift the Datum to WGS 84 which is considered the reference Datum. To transform from one datum to another we first shift to WGS 84 and then to the destination Datum so there are two sets of transformation delta values applied, one additive and one subtractive.

Note: The transformation values VNS provides are from NIMA.

The notes section will tell you if a Datum doesn't have preset Delta values. You can provide your own Delta values or use the "Calculate a Useful Set of Values" button to let VNS calculate a reasonable set. This calculation does not take into account all the factors that could apply, so it may not give the same results as the values provided for those Datums that have preset Delta values. The calculated values can be a good starting point when trying to align one datum with another, but additional "tweaking" of delta values may be required.

Usage Notes Display Field

The Usage Notes display field may include useful information about the Datum selected in the Datum drop box (see above).

Load Geodetic Datum and Save Geodetic Datum to Disk Icons

Click the Load Geodetic Datum icon to see the Component Gallery, ready to load one of any pre-made Datums you may have created.

You can create and export your own pre-built Datum Components from the Coordinate System Editor by setting up the Datum the way you want it and then clicking the Save Geodetic Datum to Disk icon. VNS will open the Component Signature Window where you can fill in the information, choose a representative image for the Component's thumbnail and save the Component in the Component Gallery.

This makes it easy to create and store different kinds of Datums you may need. You can later reuse the Datum in another Project.

Ellipsoid Page

The Earth is not quite an exact sphere. Due to distortions in shape from gravity and spin, it is an ellipsoid, although with a slightly irregular surface. Since it's flattened at the top and bottom it is an oblate ellipsoid. Since it's almost a sphere, it's also a spheroid.

The Ellipsoid page lets you specify the shape of the planet for your Project. Different standards groups at different times have deemed different ellipsoids to be the most accurate representation of the Earth's irregular surface. You can choose from shapes used as standards by different organizations around the world or create your own ellipsoid numerically.

Ellipsoid Section

If you are doing a project where the exact shape matters, you will need to know which ellipsoid is appropriate for your data. If you don't know which ellipsoid is appropriate for your data, VNS also provides the "WCS Back-compatible Sphere" ellipsoid which is a true sphere and may be close enough. It's designed to be compatible with projects created in World Construction Set.

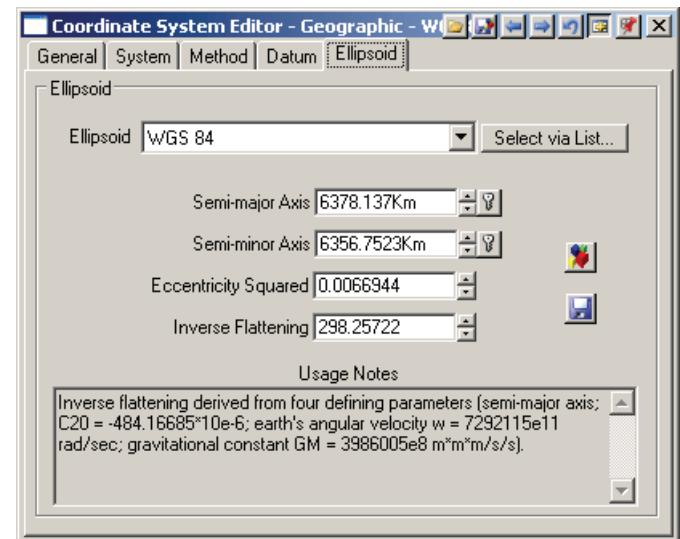
If you are visualizing planets other than Earth, the "WCS Back-compatible Sphere" may be a good place to start. You can also enter values directly into the fields below to create your own ellipsoid.

Ellipsoid Drop Box

When you select a Coordinate System, select a Coordinate Method or select a Datum, VNS will generally add the Ellipsoid appropriate to the Datum, automatically.

The Ellipsoid drop box lets you see the Ellipsoid used by the Coordinate System. If appropriate, you can choose a different Ellipsoid from a list of presets. Selecting a preset Ellipsoid will fill in the proper values for that Ellipsoid in the fields below. The presets available include:

- **Custom**



- WCS back-compatible Sphere
- GRS 1980
- WGS 84
- Airy 1830
- Modified Airy 1849
- Australian National
- Average Terrestrial System 1977
- Bessel 1841
- Bessel 1841 (Namibia)
- Modified Bessel
- Clarke 1858
- Clarke 1866
- Clarke 1866 (Michigan)
- Clarke 1880 (Arc)
- Clarke 1880 (Benoit)
- Clarke 1880 (IGN)
- Clarke 1880 (RGS)
- Clarke 1880 (SGA)
- Everest (India 1830)
- Everest (India 1956)
- Everest (Malaysia & Singapore)
- Everest (Malaysia 1969)
- Everest (Pakistan)
- Everest (Sabah Sarawak)
- Everest 1830 (1962 Definition)
- Everest 1830 (1975 Definition)
- Fischer 1960 (Mercury)
- Modified Fischer 1960
- Fischer 1968
- GRS 1967
- GRS 1980
- Helmert 1906
- Hough 1960
- Indonesian 1974
- International 1924
- Krassovsky 1940
- NWL 9D
- Plessis 1817
- South American 1969
- Sphere
- Sphere of Radius 6370997 meters
- Struve
- Struve 1860
- War Office
- WGS 60

- **WGS 66**
- **WGS 72**
- **WGS 84**

Note: Under some projection systems, ESRI's Arc/Info software generates data on a sphere rather than an ellipsoid. The "Sphere of Radius 6370997 meters" is the standard radius used for "Spheroid Sphere" by Arc/Info.

Ellipsoid Select via List Button

Click the Ellipsoid Select Via List button to see the available Ellipsoid in a separate window. There you can click the name of an Ellipsoid and click the Apply button to select it for the Coordinate System. This is the same as selecting a preset Ellipsoid in the Ellipsoid drop box (see above).

Semi-major Axis Field

The Semi-major Axis is the distance from the top of the planet to the bottom, through the poles.

Semi-minor Axis field

The Semi-minor Axis is the distance from one side of the planet to the opposite site, measuring from opposite points on the equator.

Adjusting the Semi-minor Axis value automatically changes the Eccentricity and Inverse Flattening values.

Eccentricity Field

Eccentricity is how much the Ellipsoid's ellipse differs from a circle. The ellipse is a shape that is spun around the poles to produce the Ellipsoid. The closer the ellipse is to a circle, the smaller the eccentricity.

Adjusting Eccentricity automatically changes the Semi-minor Axis and Inverse Flattening values.

Inverse Flattening Field

The Inverse Flattening field changes the Ellipsoid radius as a ratio of the Semi-major Axis to the Semi-minor Axis.

If you have a known value for flattening, you can divide it into 1 to get the inverse flattening value VNS requires. VNS displays just the denominator (for example, a flattening value of 1/297 is the same as an Inverse Flattening of 297).

Adjusting Inverse Flattening automatically changes the Semi-minor Axis and Eccentricity values.

Usage Notes Display Field

The Usage Notes display field may include useful information about the Ellipsoid selected in the Ellipsoid drop box (see above).

Load Ellipsoid Icon and Save Ellipsoid to Disk Icons

Click the Load Ellipsoid icon to see the Component Gallery, ready to load one of any pre-made Ellipsoids you may have created.

You can create and export your own pre-built Ellipsoid Components from the Coordinate System Editor by setting up the Ellipsoid the way you want it and then clicking the Save Ellipsoid to Disk icon. VNS will open the Component Signature Window where you can fill in the information, choose a representative image for the Component's thumbnail and save the Component in the Component Gallery.

This makes it easy to create and store different kinds of Ellipsoids you may need. You can later reuse the Ellipsoid in another Project.

DEM Editor

The DEM Editor lets you edit any DEM numerically. To open it, double click the DEM you want to edit in the Scene-At-A-Glance. You can then change the DEM's elevation values on the Elevations page and adjust the Coordinate System and position on the File page. The DEM Painter module can be accessed from either page. Any changes you make take effect only when you save the DEM over the original DEM.

Note: Be aware that if the DEM is used in other Projects the changes will also be noticeable in those other projects. If you don't want that to happen, use a copy of the DEM file in the current Project and make changes to the copy.

Elevations Page

The Elevations page lets you edit the actual elevation values in a digital elevation model (DEM).

DEM Elevations Table

The DEM Elevations Table displays the rows and columns of the DEM with the elevation values in fields available for editing. Elevations are shown in meters.

You can navigate through the DEM by dragging the sliders on the bottom and right sides. The Row and Column (Col) display fields on the upper left show where you are in the file.

If you click in View and drag the mouse around, the DEM Editor will try and center the DEM Elevations Table on the mouse's location. This makes it easy to find the positions for the elevations you want to edit. Interactive navigation works as long as you are editing the DEM which is at the mouse's location.

A screenshot of the DEM Editor software window titled "DEM Editor - LoResTiled.cs". The window has tabs for "Elevations" and "File", with "Elevations" selected. The main area is a grid titled "DEM Elevations" with a subtitle "Elevation of DEM vertices in meters". The grid shows a 10x5 table of elevation values. The first row and column are labeled with numerical values. A "Paint" button is located in the top-left corner of the grid area. The window has standard Windows-style controls at the top and scroll bars on the right and bottom.

Row\Col	1	2	3	4	5
1	228.59005	249.74488	269.47369	283.76077	295.37219
	242.57695	271.86602	301.23712	330.92120	361.00012
	250.77093	280.49182	314.59011	365.39300	410.82244
	257.11077	284.79809	322.05041	395.80355	455.58578
	237.44670	259.43106	288.92990	347.10458	395.63870
	217.55868	233.71473	254.72271	294.24597	329.67318
	250.41873	266.28427	287.84622	331.14611	372.08990
	270.08801	292.61926	320.75543	370.28051	415.60156
	234.08792	292.64230	352.76016	418.84426	463.73419
	223.92569	308.63763	388.33633	448.90402	478.20449

Row Display Field

The Row Display Field shows the number of the data row that is at the top of the DEM Elevations Table.

Column Display Field

The Column Display Field shows the number of the data column that is at the left edge of the DEM Elevations Table.

File Page

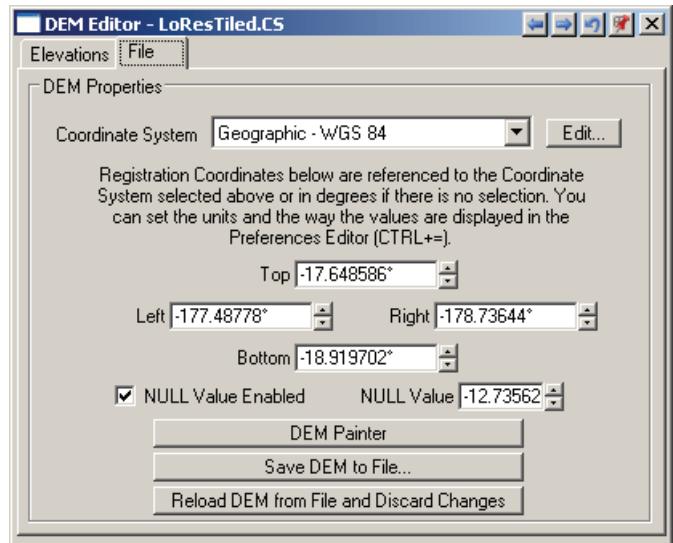
The File page lets you select a Coordinate System and specify the Registration Coordinates of the DEM.

Note: When you import terrain data that is georeferenced, it will already have these parameters set by the Import Wizard.

DEM Properties Section

The DEM Properties section lets you see and select a Coordinate System for the DEM and adjust the DEM's Registration Coordinates. You can enable null value recognition and edit the null value.

The Registration Coordinates (Top, Left, Right and Bottom) are referenced to the Coordinate System or are in degrees if there is no selection. You can set how the Registration Coordinates are displayed on the Units page of the Preferences Window.



Coordinate System Drop Box

Where possible, VNS will create and select the proper Coordinate System for you when you import DEM data. The Coordinate System drop box lets you select a different Coordinate System for the DEM should that be necessary.

Note: Be careful, using an inappropriate Coordinate System for a DEM may cause it to appear at the wrong place on the planet, and at the wrong size and shape.

If there is no Coordinate System showing in the drop box, the DEM will use the Coordinate System selected in the Planet Options Editor for the Project. If there is no Coordinate System showing in the Planet Options Editor, the Project will use Geographic-WGS84.

If a non-geographic Coordinate System is selected in the Planet Options Editor, VNS will consider it geographic for rendering and only use its datum and ellipsoid in geographic form. In that case, if there is no Coordinate System showing in the DEM Editor's drop box, the DEM Editor will also use the Project's datum and ellipsoid but consider it geographic and show the DEM Registration Coordinates as geographic.

Coordinate System Edit Button

Click the Coordinate System Edit button to edit the selected Coordinate System with the Coordinate System Editor.

Top Field

The Top field generally lets you enter the Northern boundary where the DEM is positioned on the planet using the selected Coordinate System. However depending on the projection, the Top edge may not necessarily be toward the North.

Left Field

The Left field generally lets you enter the Western boundary where the DEM is positioned on the planet using the selected Coordinate System. However depending on the projection, the Left edge may not necessarily be toward the West.

Right Field

The Right field generally lets you enter the Eastern boundary where the DEM is positioned on the planet using the selected Coordinate System. However depending on the projection, the Right edge may not necessarily be toward the East.

Bottom Field

The Bottom field generally lets you enter the Southern boundary where the DEM is positioned on the planet using the selected Coordinate System. However depending on the projection, the Bottom edge may not necessarily be toward the South.

DEM Painter Button

Clicking this button will Open the DEM Painter Window.

Null Value Enabled Checkbox and Null Value Field

Select the Null Value Enabled checkbox if you want VNS to recognize an elevation value as a null value. Null values are ignored.

If the Null Value Enabled checkbox is selected you can change the null value in the Null Value field.

Save DEM to File Button

When you're done editing the DEM, click the Save DEM to File button to save your altered DEM.

VNS will warn you that you will be overwriting the DEM's file on your hard drive to include your changes, and that this will affect any other Project using this DEM. Click OK to save over the original DEM file. Click cancel to abort.

Reload DEM from File and Discard Changes Button

Click the Reload DEM from File and Discard Changes button if you want to abort your edit and return to the original DEM.

DEM Merger

The DEM Merger allows you to achieve one or more of four things:

Firstly, it can be used to merge two or more terrain models that exist in different Coordinate Systems (for example, DEM data that spans two different UTM zones).

It can be used to fill void or NULL areas in a high quality dataset with available (lower quality) data from another dataset of the same area (for example, high quality SRTM data “patched” with lower quality USGS data of the same area)

It can also be used to seamlessly merge multiple datasets of differing resolutions. For example, you may have 4.7m data for the primary site, but only have 93m data for the surrounding terrain. Using a DEM Merger in Multires mode will allow you to create a new “merged” dataset where the primary site is an exact multiple of the res of the surrounding terrain (eg: 100m and 5m). This allows VNS to “stitch” the edges of the DEMs to create a seamless terrain model.

The DEM Merger requires that you reproject all datasets involved in the merge process to a common Coordinate system. As such, it’s fourth and final function is to reproject data.

General Page

Name Field

In this field you may enter a name for the DEM Merger. This allows you to uniquely identify multiple DEM Merger components in your project.

Merged DEM Bounds Section

Merged Coordsys Dropdown List

Click on the dropdown list to select a pre-defined Coordinate System. If you have not already defined a common Coordinate System into which to project your merged DEM data, you can select “New Coordinate System...” which will open the Coordinate System Editor allowing you to edit a new Coordinate System.

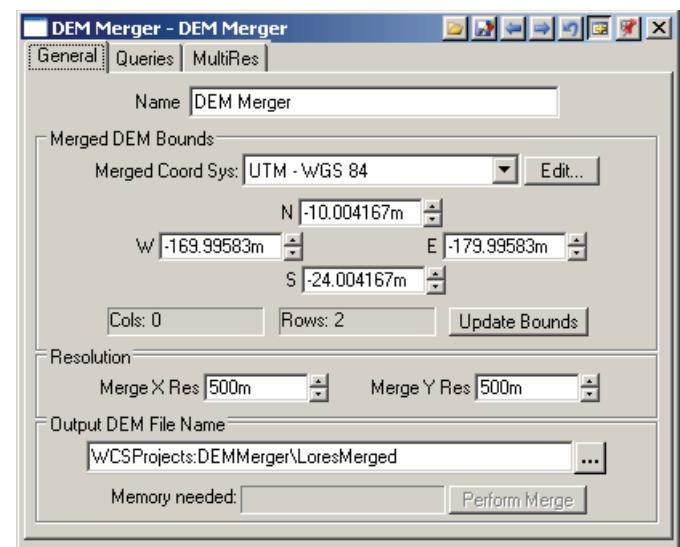
All merged terrain must share a common Coordinate System, and this should also be selected as the Coordinate System used in the Planet Options Editor.

Merged Coordsys Edit Button

Click this button to open the Coordinate System Editor for the currently selected Coordinate System.

North (N) Field

This field displays the northern bound of the merged dataset.



West (W) Field

This field displays the western bound of the merged dataset.

South (S) Field

This field displays the southern bound of the merged dataset.

East (E) Field

This field displays the eastern bound of the merged dataset.

Columns Display

This field displays the number of columns in the merged dataset.

Rows Display

This field displays the number of rows in the merged dataset.

Update Bounds Button

Click this button to update the values in the bounds to reflect the bounds of all DEMs involved in the merge process. All enabled DEMs will contribute to the automatic calculation of these bounds. Use the database editor to temporarily disable any that you do not wish to be taken into consideration.

Resolution Section

Merge X Res Field

This field defines the E-W output resolution of your merged DEM.

Merge Y Res Field

This field defines the N-S output resolution of your merged DEM.

Output DEM File Name Section

DEM Filename Field

Enter a path and filename for your merged dataset into this field.

DEM File Browse Button

Click this button to open a standard file requester, which will allow you to interactively select a location and filename for the merged output file.

Memory Needed Display

This field displays the amount of physical memory required to perform the merge.

Perform Merge Button

Click this button to start the merge process. Depending upon the size of datasets to be merged, and the speed and amount of memory on your system, this may take some time.

Queries Page

The Queries page allows you to define which Search Queries are going to contribute towards the Merge process. Search queries are used by the DEM Merger to select DEMs in the correct order for the required merge.

Search Queries Controls

Search Query List

The Search Query List shows all the Search Queries used in the DEM Merge process. For simple merges, one search query which selects all DEMs is all that is required, as all DEM data in the project will appear in the merged and reprojected output.

For multires merges, and merges involving incomplete datasets, the order of the Search Queries in the list is very important. DEM data is included in the merged output in the order in which their related search queries appear in this list. For example, you have SRTM data which is high detail, but contains void areas, and USGS data which has no voids but is less accurate. Setting up 2 search queries (one called SRTM, one called USGS) would allow you to select SRTM and USGS datasets independently of each other, and placing the SRTM search query first in the DEM Merger Search Query list, will force VNS to select SRTM data where possible, and only insert USGS data where no SRTM data exists (ie: the void areas).

Note: For Multires Merges, the Hires DEM is created from the first Search Query only.

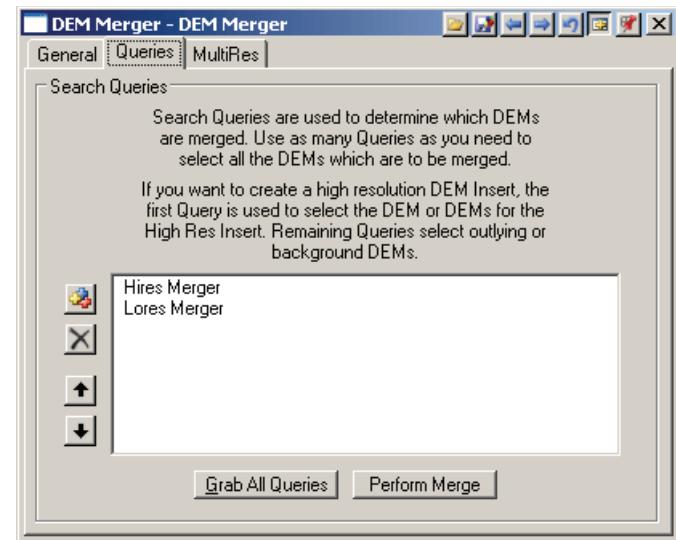
Add Search Query Icon

Click the Add Search Query icon to open a window with a list of Search Queries in your Project. Select one or more Search Queries by clicking, shift-clicking or control-clicking. Click the Add Items button to add the Search Queries to the DEM Merger.

Click the Cancel button if you want to close the window without adding any Search Queries to the DEM Merger.

Remove Search Query Icon

Select an Search Query in the Search Queries list and click the Remove Search Query icon to remove it from the DEM Merger.



Raise Search Query Priority

Select an Search Query in the Search Queries list and click the Raise Search Query Priority to make it higher in the Search Queries list.

Lower Search Query Priority

Select an Search Query in the Search Queries list and click the Lower Search Query Priority to make it lower in the Search Query list.

Grab All Button

Click the Grab All button to add all the Project's Search Queries to the Search Query list.

Perform Merge Button

Click this button to start the merge process. Depending upon the size of datasets to be merged, and the speed and amount of memory on your system, this may take some time.

Multires Page

The Multires Page is only relevant in circumstances where you wish to use the DEM Merger to merge multiple datasets of differing resolution.

High Resolution DEM Insert Section

High Res Insert Checkbox

Enable this checkbox to enable multires merging of DEM data. Until this is done the multires controls will be grayed-out and inaccessible.

Divider

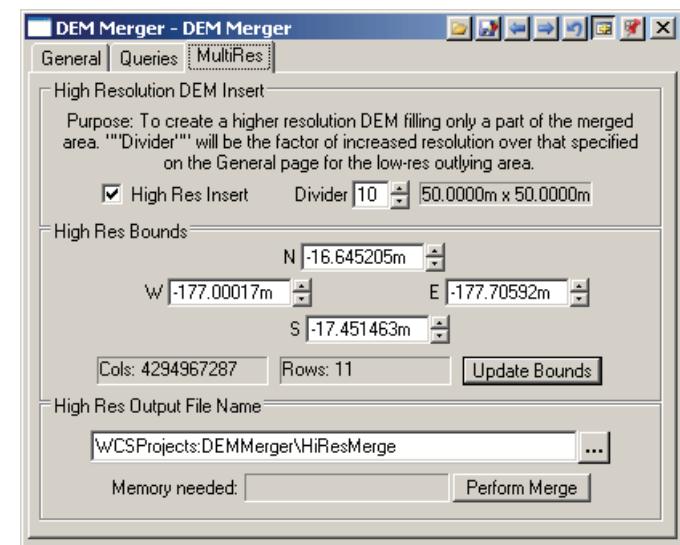
This field defines your Hires DEM resolution as a factor of the Lores DEM resolution.

Into this field, enter a whole number factor of the resolution entered on the General Page, under Merge X Res and Merge Y res. For example, if your Merge X and Merge Y values are 100m, and your divider is 10, you will generate a Lores DEM at 100m resolution and a Hires DEM at 10m resolution. Because the Hires resolutions is a factor of the Lores resolution, VNS is able to "stitch" the cell edges of the terrain tiles together, even though they are of differing resolutions.

High Res Bounds Section

North (N) Field

This field displays the northern bound of the merged dataset.



West (W) Field

This field displays the western bound of the merged dataset.

South (S) Field

This field displays the southern bound of the merged dataset.

East (E) Field

This field displays the eastern bound of the merged dataset.

Columns Display

This field displays the number of columns in the merged dataset.

Rows Display

This field displays the number of rows in the merged dataset.

Update Bounds Button

Click this button to update the values in the bounds to reflect the bounds of all DEMs involved in the merge process. All enabled DEMs will contribute to the automatic calculation of these bounds. Use the database editor to temporarily disable any that you do not wish to be taken into consideration.

High Res Output Filename Section

Hires Filename Field

Enter a path and filename for your Hires merged dataset into this field.

Hires File Browse Button

Click this button to open a standard file requester, which will allow you to interactively select a location and filename for the Hires output file.

Memory Needed Display

This field displays the amount of physical memory required to perform the multires merge.

Perform Merge Button

Click this button to start the merge process. Depending upon the size of datasets to be merged, and the speed and amount of memory on your system, this may take some time.

Ecosystem Editor

To open the Ecosystem Editor for an existing Ecosystem, double-click the name of the Ecosystem in the Scene-At-A-Glance.

The Ecosystem Editor lets you add areas of foliage and texturing to your terrain. You can control where the Ecosystem appears with an Environment; with one or more Vectors; with one or more Color Maps; or with one or more Terraffectors.

Rules of Nature™ let you restrict an Ecosystem to specific areas within an Environment based on elevation, relative elevation and slope.

Note: To add individual trees or other specific landscaping, use Foliage Effects (see Foliage Effect Editor).

To better simulate nature, each Ecosystem gives you three levels of control. The Overstory Ecotype and Understory Ecotype let you grow foliage such as trees, bushes and grass. The Ground Overlay lets you add texturing to the terrain such as rock or dirt.

The Overstory usually represents the tallest trees. The Understory includes shorter foliage. You can control the foliage mix for the Overstory and Understory separately.

The Ground can be a simple color or a combination of image and procedural textures. Ground also includes strata, which simulates the exposure of multiple layers of rocks laid down over millions of years.

You can make any Ecosystem's Ground Overlay transparent using the transparency field and texture controls on the Material page. Where an Ecosystem is transparent you will be able to see the global Ground Effect (see Ground Effect Editor).

Creating Ecosystems

To create a new Ecosystem, select the "Ecosystems" category in the Scene-At-A-Glance and click the Add or Clone Selected Item icon. This makes it easy to create a variety of Ecosystems which you can later combine in an Environment, apply with a Terraffector, apply with a Color Map or attach directly to a Vector.

You can create a new Ecosystem and place it on the terrain by attaching it to a Vector all in one step (see "Placing Ecosystems" below).

To clone an existing Ecosystem, select the Ecosystem in the Scene-At-A-Glance and click the Add or Clone Selected Item icon. This makes it easy to create a new Ecosystem based on the settings in an existing Ecosystem within your project.

To load pre-made Ecosystems, select the icon for the Component Gallery in the Icon Toolbar. In the Component Gallery click the Ecosystems tab. Then select any Ecosystem thumbnail you'd like to load.

Placing Ecosystems

You can apply Ecosystems to your terrain in four ways:

- **As part of an Environment (see Environment Editor)**
- **With a Color Map (see Color Map Editor)**
- **Within a Vector area**
- **Along a Terraffector (see Terraffector Editor)**

What happens if Ecosystems applied with these methods overlap? Terraffectors will always take precedence over the other methods. Vector Areas take precedence over Color Maps and Environments. Color Maps take precedence over Environments.

Note: To add individual trees or other specific landscaping, use Foliage Effects (see Foliage Effect Editor). Foliage Effects always take precedence over Ecosystems, Ground Effects, Snow Effects, Lakes and Streams.

Placing an Ecosystem as Part of an Environment

Environments let you combine multiple Ecosystems based on their Rules-of-Nature™. This is an excellent way to quickly populate your entire terrain with realistic foliage growing in complex combinations.

Environments can be global or restricted within a vector area.

To apply an Ecosystem as part of an Environment, select it on the Ecosystems page of the Environment Editor.

Placing an Ecosystem With a Color Map

Color Maps let you apply Ecosystems based on the colors in an image. One use of this is to use the colors in a satellite image to control where actual foliage grows on your terrain. When you place an Ecosystem within a Color Map, VNS will ignore all the Rules-of-Nature™ for the Ecosystem except the Minimum and Maximum Relative Elevation & Slope settings (see The Hard-Linked Vectors display tells you if there are any Vectors hard-linked to the Component, and if so, how many. It will also display vectors attached by Search queries and list the names of the search query or queries in use.).

Placing an Ecosystem Within a Vector

To place an Ecosystem within a Vector Area, you can either draw the Ecosystem and Vector directly in a View or attach the Ecosystem to an existing vector.

Note: You can have different Ecosystems attached to different Vectors. You can have the same Ecosystem attached to more than one Vector. But you cannot have more than one Ecosystem attached to the same Vector.

When you place an Ecosystem within a Vector, VNS will ignore all the Rules-of-Nature™ for the Ecosystem except the Minimum and Maximum Relative Elevation & Slope settings (see The Hard-Linked Vectors display tells you if there are any Vectors hard-linked to the Component, and if so, how many. It will also display vectors attached by Search queries and list the names of the search query or queries in use.).

To draw an Ecosystem directly:

- **Select the Ecosystems category in the Scene-At-A-Glance.**
- **Click the Create icon in the Icon toolbar.**

VNS will open the Create Palette Window. You can change the properties of the Vector in the Create Palette before you digitize the Vector, if you wish.

- **Digitize a Vector in a View.**

Left click to draw points in the manner you selected in the Create Palette.

Right-click when you're done. VNS will ask for a name. Then VNS will create the Vector and Ecosystem and attach them to each other automatically.

To attach an Ecosystem to an existing Vector see Vector Links Icon.

You will see the Ecosystem listed on the Database Editor's Comp page when you select the Vector in the Objects list.

If you have different Ecosystems applied to different Vectors which overlap, VNS will use the Ecosystem with the highest priority (see Priority Field below). If the Ecosystems have the same priority, VNS will choose an Ecosystem to render in the overlap area.

You can also dynamically link Vectors using Search Queries (see Search Query Editor).

Placing an Ecosystem Along a Terraffector

To apply an Ecosystem along a Terraffector, click the Edit Cross-section Profile button on the general page of the Terraffector Editor.

Then select a spline knot in the profile graph, and select an Ecosystem from the Ecosystem Drop box (see Cross-Section Profile Editor).

When you place an Ecosystem along a Terraffector, VNS will ignore all the Rules-of-Nature™ for the Ecosystem (see The Hard-Linked Vectors display tells you if there are any Vectors hard-linked to the Component, and if so, how many. It will also display vectors attached by Search queries and list the names of the search query or queries in use.).

General Page

Common Ecosystem Controls

Vector Polygon Rendering Enabled

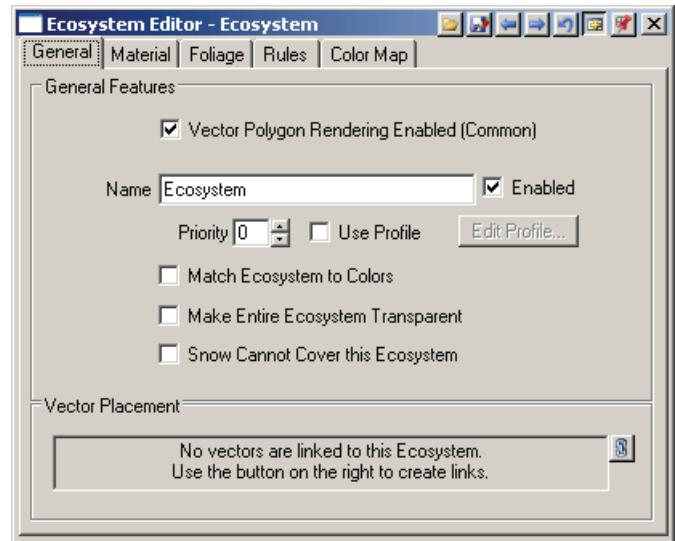
Deselecting this checkbox disables the rendering of all vector-bounded ecosystems.

General Features

Name Field

Enter a name for the Ecosystem. For example, if it is a rain forest Ecosystem, you might call it "Rain Forest".

By default VNS will name new Ecosystems "Ecosystem", and add a number after the name if there is more than one Ecosystem named "Ecosystem".



Enabled Checkbox

The Enabled checkbox lets you enable or disable the Ecosystem for rendering.

Disabling an Ecosystem can be useful to see what the scene would look like without that particular Ecosystem. Make sure you remember to enable it for the final rendering if you want to see the Ecosystem.

Note: To see the Ecosystem in your rendering, it must be attached to a Terraffector, Vector, Environment or Color Map. It must also be visible to the Camera you selected for the Render Job you are using (see Render Job Editor).

If the Ecosystem is applied with a Terraffector, then "Terraffectors" and "Other Foliage" must be enabled in the Render Options you are using (see Render Options Editor) and the Terraffector itself must be enabled (see Terraffector Editor).

If the Ecosystem is applied with a Color Map, then "Color Maps" must be enabled in the Render Options you are using (see Render Options Editor) and the Color Map itself must be enabled (see Color Map Editor).

If the Ecosystem is attached to a vector, then "Vector Ecosystems" must be selected in the Render Options you are using, and the Vector must be enabled in the Database Editor.

Priority Field

The Priority field lets you specify the rendering priority of the Component relative to other Components of the same category. A Component with a higher priority will be rendered before a Component in the same category that has a lower priority.

Render priority only matters where Components of the same category overlap. VNS will use the values from the highest-priority Component.

If there are overlapping Components of the same category that are each set to the same priority, VNS will mix them equally.

Use Profile Checkbox

Click the Use Profile checkbox when you want to control the amount of a Vector-bounded Ecosystem based on a gradient from the edge of the Vector Object's area toward the middle. This lets you fade the Ecosystem so it doesn't end abruptly at the outside edge of the Vector.

This is valid only with Ecosystems attached to Vectors.

When you first create a Vector-bounded Ecosystem VNS will create a default Edge Feathering Profile. The default Profile varies between no effect at the edge to the full effect 10 meters toward the middle of the Vector area. You can edit this Profile by clicking the Edit Profile button (see below).

Profiles add to rendering time and take additional memory to render.

Edit Profile Button

Click the Edit Profile button to open the Edge Feathering Profile Editor. There you can alter the Edge Feathering Profile to change the intensity of the Ecosystem from the edge of the vector inward.

This is valid only with Ecosystems attached to Vectors.

Match Ecosystem to Colors Checkbox

Select the Match Ecosystem to Colors checkbox when you want this Ecosystem to appear wherever a particular color or range of colors appears on a Color Map projected onto the terrain (see Color Map Editor).

Make Entire Ecosystem Transparent Checkbox

Select this checkbox to make the polygons that are textured with the Ecosystem completely invisible.

Snow Cannot Cover This Ecosystem Checkbox

Select this checkbox to keep snow from covering the Ecosystem. This is great for an Ecosystem that you are using for a Terraffector road, such as an asphalt Ecosystem. In that case, using this checkbox will plow the road.

Vector Placement Section

By attaching Vectors to Ecosystems you can control where they appear. Vectors can be dynamically linked with Search Queries or hard linked.

Vector Links Button

This control allows you to perform various tasks relating to the association of vectors with components. To learn how to use it, see Vector Links Icon.

Attached Hard-Linked Vectors Display

The Hard-Linked Vectors display tells you if there are any Vectors hard-linked to the Component, and if so, how many. It will also display vectors attached by Search queries and list the names of the search query or queries in use.

Material Page

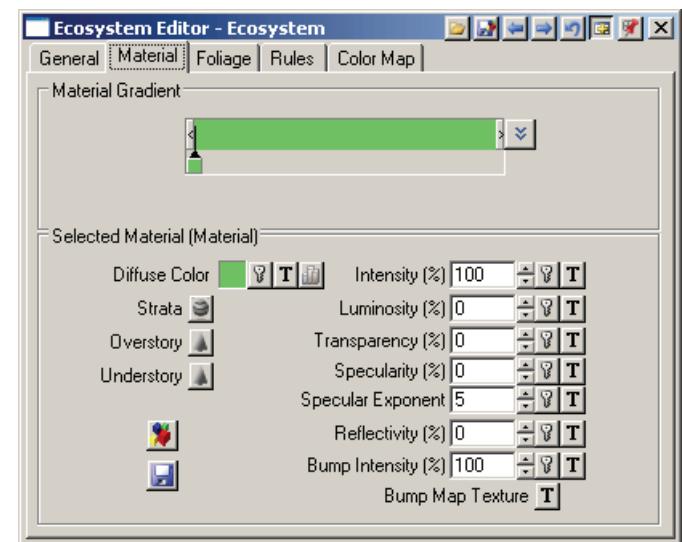
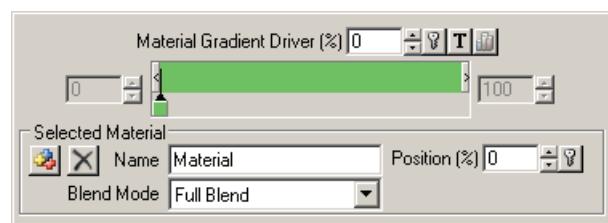
Material Gradient Section

Material Gradient and Driver

The Material Gradient controls let you add, remove and edit the materials to the Ecosystem.

Each material in an ecosystem comprises a set of properties (color, reflectivity, transparency etc), Strata, and foliage contained in Overstory and understory ecotypes.

To Access the Gradient, click on the Gradient popdown icon . This will display the Material Gradient Editor:



Material Gradient Driver Percentage Controls

The Material Gradient Driver field lets you pick a Material for the Ecosystem based on a position along the Material Gradient (see below).

Enter a percentage from zero to 100 where zero is the left edge of the gradient and 100 is the right edge. VNS will use the Material at the gradient position you specify. If there is no Material represented at that position, VNS will create a blend between the nearest two Materials.

You can animate the Material Gradient Driver percentage to change Materials over time. This is great for climate change animations where you could animate through a variety of Materials such as from a desert to a rain forest.

By clicking the Texture Control icon you can control the Material Gradient Driver percentage with the Texture Editor. This lets you use all the Materials in the Gradient. Textures can range in gray values from black to white, with black representing 0% on the Gradient and white representing 100% on the gradient.

For example, if you use a fractal noise Element in the texture that ranges from black to white, VNS will cover the Ecosystem's area with Materials in a fractal noise pattern ranging from the left-most Material in the Gradient to the right-most Material in the Gradient.

Another example: You could use a Dynamic Parameter of Elevation in the Texture Editor and set its Input Low field to the lowest elevation in your terrain and the Input Height field to the highest Elevation in your terrain. Then VNS will arrange the Materials in the Ecosystem's Material Gradient so that the Materials on the left side of the gradient will grow on the lower elevations and the Materials on the right side of the Gradient will grow on the higher elevations.

You can also drive the selection of ecosystem materials using a Thematic Map. For example, you could have an attribute in your controlling vectors that assigned a numeric value based on ecosystem, and by careful organization of your ecosystem materials on the gradient, use this attribute to populate all your vectors with one ecosystem, while each displayed a different material at rendertime.

Material Gradient

The Material Gradient shows a colored bar with one or more colored pins beneath it. The bar is a place to create Materials. Click it to create a new Material.

When you click the Gradient to create a new Material, VNS will give the new Material a random Diffuse Color. You can change the color by using the Diffuse Color Well to open the Color Editor.

VNS represents each Material with a pin that is colored with the Diffuse Color of the Material. Click any pin to select a Material.

Material Gradient Range Fields

The Material Gradient Range fields are on either side of the Material Gradient. They show the range of the value that controls the gradient.

If there's no texture enabled for the Material Gradient Driver, the range of the gradient is zero to 100 percent.

If there is a texture enabled for the Material Gradient Driver, then there are two cases:

1) The first Texture Element is a Dynamic Parameter.

In this case, the Range fields show the range of input values for the Dynamic Parameter you have selected. For example if Elevation is the Dynamic Parameter and the Elevation range in the texture editor (Input Low and Input High) is zero to 1000 meters, then in the Range fields you'll see zero on the left and 1000 on the right.

You can directly edit those texture values in the Ecosystem Editor's Range fields. This is handy because you don't have to reopen the Texture Editor if you want to edit these values.

2) The first Texture Element is not a Dynamic Parameter.

In this case, the Range fields are zero to 100 percent (representing values of 0 to 1 in the controlling texture, or black to white), and are non-editable.

Add Material Icon

Click the Add Material icon to add a new Material. VNS will ask for the position in the Gradient. Enter a position and click the OK button.

Alternatively you can click directly in the Gradient in a spot where no other Material exists.

VNS will create a new Material and give it a random Diffuse Color. The Material will be represented in the Gradient with a pin in the color of its Diffuse Color.

Remove Material Icon

Click the Remove Material icon if you want to delete the selected Material.

Material Name

The Material Name field lets you edit the Material's name. After you create a Material it will have a default name of "Material." It's a good idea to enter a unique name in the Material Name field to identify how you will use the Material. For example "sand," "forest" or "fall foliage."

Position in Gradient Field

The Position in Gradient field shows the percentage along the Gradient for the selected Material. You can move the Material's pin to the left by decreasing this number or to the right by increasing this number. You can also drag the pin along the Gradient with the mouse.

Blend Mode Drop Box

The Blend drop box lets you choose the rate of change between the selected Material and the Material to its left in the gradient.

These are easiest to visualize if you try them and see what they look like in the gradient. You can see how VNS blends Materials between the pins by how it blends the Diffuse Colors along the Gradient.

You can change the blending by selecting different blend types from the Blend Drop Box. If you have more than one material in the gradient, use the following choices to decide how the gradient blends the materials together.

Sharp Edge

Choose "Sharp Edge" if you want an instant change with no gradient.

Soft Edge

Choose "Soft Edge" to create a gradient that turns into the color to the left 1/10 of the way toward that color's pin.

Quarter Blend

Choose "Quarter Blend" to create a gradient that turns into the color to the left 1/4 of the way toward that color's pin.

Half Blend

Choose "Half Blend" to create a gradient that turns into the color to the left 1/2 of the way toward that color's pin.

Full Blend

Choose “Full Blend” to create a smooth gradient that turns into the color to the left at that color’s pin.

Fast Increase

Choose “Fast Increase” to create an accelerated gradient that gets closer to the previous color faster, and turns into the color to the left at that color’s pin.

Slow Increase

Choose “Slow Increase” to create an decelerated gradient that gets closer to the previous color slower, and turns into the color to the left at that color’s pin.

S-Curve

Choose “S-Curve” to create a narrower gradient between the pin and the previous color’s pin and leaves more of the original colors along the gradient in between.

Selected Material Section

Diffuse Color Well and buttons

The Ground Effect's Diffuse Color (or texture) always appears wherever the Selected Material's Ground Overlay appears, unless you set the transparency of the Material to 100%. Click the Diffuse Color well to edit the Diffuse Color in the Color Editor.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's Diffuse Color with texture patterns.

When you use a texture, the Colors in the texture will replace the Diffuse Color, unless you use less than 100% Opacity in the Texture Editor, in which case the texture and the Diffuse Color will be mixed.

Strata Icon

Click the Strata icon to open the Material Strata Editor. There you can add Strata texturing to the Material.

Overstory and Understory Ecotype Controls

Ecotypes let you add foliage to the Ecosystem.

There are two Ecotypes, an Overstory and an Understory. In nature, the Overstory represents taller trees while the Understory represents shorter foliage. You can add appropriate foliage to the Overstory Ecotype and Understory Ecotype to simulate this in VNS.

To create an Overstory or Understory, click the Overstory or Understory Ecotype Operations icon to see the Ecotype Operations commands. If there is no Ecotype yet created (icon has a gray background), select the Create Ecotype command. If there is an existing Ecotype (icon has a green background), select the Edit Ecotype command.

If you want to disable an Ecotype, click its Ecotype Operations icon and select the Disable Ecotype command. The icon will show a red diagonal stripe to indicate that there is an Ecotype but it's disabled. This is the same as deselecting the Ecotype Enabled checkbox on the General page of the Ecotype Editor for the Ecotype. VNS will ignore disabled Ecotypes for rendering.

If you want to enable a disabled Ecotype, click its Ecotype Operations icon and select the Enable Ecotype command. The icon will no longer show a red diagonal stripe. This is the same as selecting the Ecotype Enabled checkbox on the General page of the Ecotype Editor for the Ecotype.

If you want to delete an Ecotype, click its Ecotype Operations icon and select the Remove Ecotype command. Because this is destructive, VNS will ask you to confirm this choice. Click OK to remove the Ecotype forever.

If you want to copy an Ecotype, click its Ecotype Operations icon and select the Copy Ecotype command. If you want to paste an Ecotype, click the Ecotype Operations icon for the destination Ecotype and select the Paste Ecotype command.

If you want to make an Ecotype the Active Item, click its Ecotype Operations icon and select the Activate Ecotype command. VNS will make it the Active Item.

These tasks can also be performed using the relevant controls on the Foliage page.

Load and Save Material Icons

Clicking the relevant icon will either open the Component Gallery or the Component Signature Window, allowing you to load or save ecosystem materials as required.

Diffuse Intensity Field and Buttons

The diffuse intensity of a material is a measure of how much of the diffuse color of a surface is returned to the camera. Reducing this value to 0% will result in a black surface (i.e.: 0 color) and setting it to 100% will result in the pure diffuse color as set in the Diffuse Color Well.

You can animate the value over time, and also drive its intensity with a texture.

This attribute is useful for simulating dirt (try driving this field with a Fractal Noise texture element), streaks, moisture (drive Diffuse Intensity with a Dynamic parameter of Water Level or Elevation to simulate moist surfaces at the edges of lakes and streams etc.)

The maximum value for this parameter is 10000%.

Luminosity Percentage Field and Buttons

Luminosity affects how the Material is shaded by Lights (see Light Editor). You can adjust it to create 3D-shaded Objects, flat-shaded Objects or anything in-between.

With zero percent luminosity, the Material will be fully shaded by Lights. This produces a 3D look. In deeply shadowed areas, the Material's color will be a darker shade of itself based on the Ambient Light Intensity and Color. Where fully lit by Lights, the color will be the Diffuse Color or texture (see above) modulated by the Intensity and Color of any Lights.

By raising the luminosity, you can lighten the shaded areas. This can be useful to do if the terrain that uses the Material seems too dark. Raising the luminosity a little bit decreases the shading contrast for the Material.

With 100 percent luminosity, the Material will ignore Lights completely. This produces a flat, unshaded look. The Material will always be the Diffuse Color or texture. This can be useful for Materials used to create the flat, paper-cutout-style animations used by certain cartoon shows.

You can also subtract light by using negative luminosity to make the object tend toward the Ambient Light colors. With 100 percent negative luminosity, the Material will ignore Lights. The Material will be flat-shaded with the Ambient colors.

You can animate the Luminosity percentage to simulate lighting changes. This lets you animate the effect of nearby lightning or explosions.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's luminosity with a texture pattern. This can be useful for creating the look of glowing lava.

When you use a texture, a white value in the texture will equal the amount of luminosity you set in the Luminosity percentage field. A black value in the texture will equal zero luminosity. Gray values will be in-between.

Transparency Percentage Field and Buttons

Use the Transparency field to adjust how much you can see through the Ground Overlay. Zero percent will cover the terrain with opaque Ground Overlay. One hundred percent makes the Ground Overlay invisible, and you will instead see a Ground Effect on the terrain polygons. Anything in-between will mix the Ground Overlay with the Ground Effect.

Note: There is always at least one global Ground Effect in any VNS Project.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's transparency with a texture pattern to make some areas more transparent than others.

When you use a texture, a white value in the texture will equal the amount of Transparency you set in the Transparency percentage field. A black value in the texture will equal zero Transparency. Gray values will be in-between.

Specularity Percentage Field and Buttons

Specularity is the amount of shininess for a material.

Use the Specularity Percentage field to adjust the shininess of the material. Zero percent means no specular highlight, while 100 percent is maximum shininess.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's specularity value with texture patterns.

When you use a texture, a white value in the texture will equal the amount of Specularity you set in the Specularity percentage field. A black value in the texture will equal zero Specularity. Gray values will be in-between.

Specular Exponent Field and Buttons

Use the Specular Exponent field to adjust the size of the shiny spot. The useful range is from 1 to infinity. Higher numbers will produce a smaller spot, with less feathering at its edge.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's specular exponent value with texture patterns.

When you use a texture, a white value in the texture will equal the amount of Specular Exponent you set in the Specular Exponent field. A black value in the texture will equal zero Specular Exponent. Gray values will be in-between.

Reflectivity Field and Buttons

Terrain materials can now reflect their surroundings, as well as parts of their own geometry. This is ideal for simulating surfaces such as snowfields, or mirages.

Set this value to an amount greater than 0% to see reflections on these surfaces.

You can animate the value over time, and also drive its intensity with a texture.

The maximum value for this parameter is 10000%.

Bump Intensity Percentage Field and Bump Map Icon

Bump mapping lets you simulate detailed relief shadowing without requiring dense geometry. For more about using bump mapping, see Bump Mapping Controls.

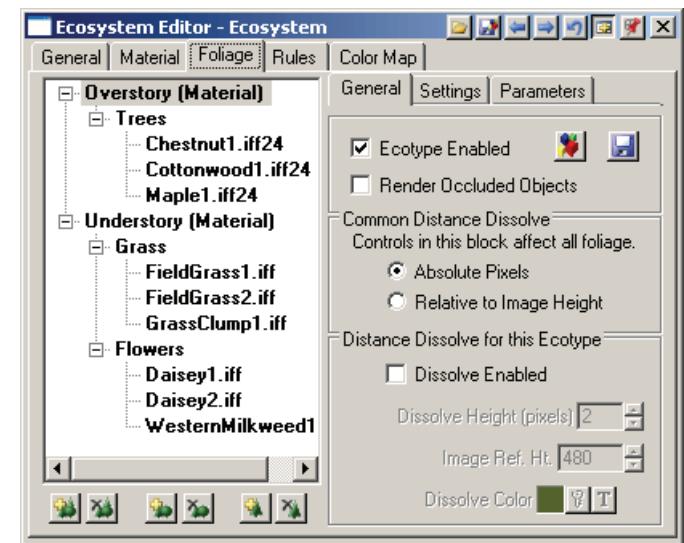
Foliage Page

To create Ecotypes in VNS, perform the following:

- Add one or more Ecotypes using the controls on the Material Page, or directly to an existing (and selected) Material using the Ecotype Control Icon underneath the Foliage List on the Foliage Page.
- Add one or more Foliage Groups to each Ecotype using the Foliage Group Control Icon underneath the Foliage List on the Foliage Page.
- Add one or more Foliage Objects to each Group using the Foliage Object Control Icon underneath the Foliage List on the Foliage Page.
- Adjust the properties for each Foliage Object, Group and Ecotype on the parameters pages that appear when the appropriate item is selected in the Foliage List page.

You can specify height and density for each Foliage Object, Foliage Group and the entire Ecotype. You can even use textures to control height and density to create natural-looking foliage clumping based on procedural textures, images and dynamic parameters.

The way the controls interact depends on the choices you make on the General page. There you can configure the Ecotype to behave according to your needs.



Foliage Objects can be Image Objects or 3D Objects. Image Objects can be still images or animated sequences (see the Image Object Library section). Typically they will be images or animations of trees and other foliage, but they can be any images or animations of anything you like. If you have an animation of a dancing munchkin and want an entire forest of dancing munchkins, you can create that effect using Image Objects and the Ecotype Editor.

Using Pre-made Components

Click the Load Component From Disk Icon to see the Component Gallery, ready to load a pre-made Ecotype. Ecotypes are multiple groups of Foliage Objects with the Ecotype, Group and Object controls already set up. You can select from any previously created Ecotype files. Double-click the thumbnail image to load the Ecotype Component. VNS will reset the parameters of the Ecotype to those of the Component you selected.

You can create and export your own pre-built Ecotype Components from the Ecotype Editor by setting up the Ecotype the way you want it and then clicking the Save Component To Disk Icon. VNS will open the Component Signature Window where you can fill in the information, choose a representative image for the Component's thumbnail and save the Component in the Component Gallery.

For example, this makes it easy to create different kinds of forests with complex foliage mixes. You can later reuse the Ecotype another Project and have an instant complex forest.

Material Foliage List

This list will show the foliage associated with the currently selected Ecosystem Material. The selected Material name will be in brackets behind the Overstory and understory foliage types.

Note: Overstory and understory vegetation are simply logical groupings. There is no reason why they can not contain similar species, or why one can exist while the other doesn't.

Enabled Items in the list will be displayed in Bold text. Disabled Items will still be displayed, but not emboldened.

At the bottom of the Material Foliage List, there are the following Control Icons:



Add Ecotype

Click the Add Ecotype icon if you want to add a new Ecotype to the Material.

Note: An Ecotype must exist in the Material in order for there to be Foliage groups, and therefore Foliage Objects in that Material.



Remove Ecotype

Click the Remove Ecotype icon if you want to delete an Ecotype. VNS will remove the Ecotype from the Material, along with all associated Foliage groups and Foliage Objects in those Groups.

If the Ecotype existed when you last opened the Ecosystem Editor, you can undo the removal by clicking the Undo All Changes in this Window icon. Otherwise the Ecotype will be gone forever.

Add Foliage Group

Click the Add Foliage Group icon if you want to add a new Foliage Group to the Ecotype. VNS will ask for a name.

Note: You have to add at least one Foliage Group to an Ecotype before you can add Foliage Objects on the Objects page (see below).

Remove Foliage Group

Click the Remove Foliage Group icon if you want to delete a Foliage Group. VNS will remove the Foliage Group from the Ecotype.

If the Foliage Group existed when you last opened the Ecosystem Editor, you can undo the removal by clicking the Undo All Changes in this Window icon. Otherwise the Foliage Group will be gone forever.

Add Foliage Object

Click the Add Foliage Object icon to Create a new, blank entry in the Foliage Objects list.

Then choose either the Image Object or 3D Object radio button in the Selected Object section (see below). Finally, select an object from the drop box in the Image Object section or 3D Object section (see below).

Remove Foliage Object

If you want to remove a Foliage Object from the selected Foliage Group, select it in the Foliage Objects list and click the Remove Foliage Object icon.

VNS will ask if you want to remove the object. Click OK and VNS will remove it from the Foliage Group.

General Sub-Page

Ecotype Enabled Checkbox

The Enabled checkbox lets you enable or disable the Ecotype for rendering.

Note: You can also enable and disable an Ecotype from its Ecotype Operations icon on the Ecosystem, Lake or Stream Editor, wherever you first created the Ecotype. Select the icon's Disable Ecotype command to disable the Ecotype. The icon will be displayed with a red diagonal stripe to indicate that it's disabled. Select the icon's Enable Ecotype command to enable the Ecotype. The Ecotype will be enabled and the red stripe will disappear.

Disabling an Ecotype can be useful to speed up rendering if you are doing test renders to check some other aspect of your scene and don't need to see the Ecotype's foliage. Make sure you remember to enable it for the final rendering if you want to see the foliage.

Note: To see the Ecotype in your rendering, it must be part of an Ecosystem or Beach that is visible to the Camera you selected for the Render Job you are using (see Render Job Editor), and Other Foliage must be enabled in the Render Options you are using (see Render Options Editor).

Render Items Occluded By This Ecotype's Image Objects Checkbox

Selecting this checkbox will force VNS to render those elements of the scene obscured by this foliage effect. This will allow reflections to accurately represent terrain and foliage that has been hidden from the camera by this foliage effect. Select this checkbox if you are experiencing "holes" in reflections of terrain and foliage objects near to a Foliage Effect.

Common Distance Dissolve Section

The Common Distance Dissolve section lets you specify whether VNS will calculate Distance Dissolve Height based on an absolute pixel height or as a pixel height relative to a specified image size. This applies to all the Ecotypes and Foliage Effects in your Project (see also Foliage Effect Editor).

Distance Dissolve Height is the height at which VNS will stop rendering foliage Image Objects and instead render a color or texture. You can enable Distance Dissolve in the Image Object Distance Dissolve section (see below). There you can specify a pixel height for Image Objects at which VNS stops trying to render foliage and instead renders a simple color or a texture.

For example, if a tree is so far away that its height is below the Distance Dissolve Height in pixels, it will no longer be rendered and VNS will instead render the color or texture you specify. This can make rendering much, much faster because VNS can calculate a color or texture much faster than a combination of foliage. Rendering the actual trees and plants far in the distance may take a long time for little or no visual benefit.

The default choice is Absolute Pixels. The default value for Distance Dissolve Height is 2 pixels. This means that VNS will replace a foliage object with a color or texture whenever the foliage object is shorter than two pixels in your rendered image. This makes a lot of sense because you can't see a complete tree in two pixels anyway, so there's not much point wasting the rendering time in the attempt.

You can enable Distance Dissolve in the Image Object Distance Dissolve section (see below).

Absolute Pixels Radio Button

Select the Absolute Pixels radio button to choose a specific height in pixels below which VNS will no longer render an Image Object. VNS will instead replace the Image Object with the color or texture you specify in the Image Object Distance Dissolve section (see below).

By default, the Absolute Pixels radio button is selected.

Relative to Image Height Radio Button

Select the Relative to Image Height radio button to relate the minimum pixel height at which VNS will render Image Objects to the size of your rendered images. This will let you see a more consistent rendering no matter what size image you render. Image Object foliage will then appear in the same areas and be dissolved to a color or texture in the same areas at any image size.

When you use the Relative to Image Height option, VNS will automatically change the Distance Dissolve Height based on the size of your rendering. VNS does this by using the Image Reference Height you specify in the Image Object Distance Dissolve section (see below).

You may want to select this option in order for preview renderings in Views to give you a more accurate visual indication of where plants will actually be rendered in your final renderings. Views are typically rendered at a different resolution than your final renderings and may show different results if you use the Absolute Pixels option (see above).

If you are rendering the same scene for a poster and for a video animation, using the Relative to Image Height option will make the foliage dissolve away in the same places in both scenes.

Be careful with this option, it may add to rendering time when you render at lower resolutions than what is in the Image Reference Height field (see below). This is because as you decrease the size of the rendered image, VNS will correspondingly decrease the Distance Dissolve Height. You may then end up with VNS wasting time rendering Image Object foliage even for Image Objects that would be less than a single pixel in height.

Note: When you use the Relative to Image Height option VNS will take into account whatever constrained preview rendering size you use if you have selected the Constrain Render Area icon (see Constrain Render Area). Image height will be calculated using the pixel height of the constrained render area, not the pixel height of the View.

Distance Dissolve for this Ecotype Section

You can reduce rendering times by enabling Distance Dissolve and adjusting the Dissolve Height. Then Image Object foliage will transition to a fast-rendering color or a texture in the distance.

If you are using the Absolute Pixels option then the Dissolve Height is an absolute value in pixels (see the Common Distance Dissolve section above). This gives you the more efficient rendering.

If you are using the Relative to Image Height option then the Dissolve Height will be scaled depending on the resolution of your rendering (see the Common Distance Dissolve section above). This allows the most consistency between renderings at different resolutions, including preview renderings in a View.

Dissolve Enabled Checkbox

Select the Dissolve Enable checkbox to enable Distance Dissolve. Deselect it to disable Distance Dissolve.

Dissolve Height Field

Dissolve Height lets you control how small the rendered foliage can get in the distance before VNS replaces it with a color or texture.

If the Absolute Pixels radio button is selected in the Common Distance Dissolve section (see above), then this value will apply no matter what resolution you render your images.

If the Relative to Image Height radio button is selected in the Common Distance Dissolve section (see above), then this value will apply only for images that are rendered at the vertical resolution you enter into the Image Reference Height field (see below). VNS will scale the Dissolve Height for images rendered at a different horizontal resolution than specified in the Image Reference Height field. This allows Image Objects to change to a color or texture at the same place on the terrain no matter what resolution you render.

Image Reference Height Field

The “Image Ref. Ht.” field is only available when you select the “Relative to Image Height” radio button in the Common Distance Dissolve section (see above).

Use the Image Reference Height field to specify the rendered image height in pixels at which the actual Dissolve Height value is used. This lets you control the amount of up or down Dissolve Height scaling that will occur when you render images at different resolutions. The

specified Dissolve Height will always be multiplied by the rendered image height (in pixels) divided by the Image Reference Height (in pixels).

The default Image Reference Height value is 480 pixels. You may want to set it to match the resolution of your preview renderings or your final image renderings.

Example

Let's look at how this works. Suppose you use an Image Reference Height of 480 pixels. If you render an image with a height of 480 pixels and you have an Ecotype that uses a Dissolve Height of 2 pixels, then any rendered images that are 480 pixels high will really have a Dissolve Height of 2 pixels for that Ecotype. $2 \times 480 / 480 = 2$

But if you render a preview image at half that resolution, 240 pixels, VNS will scale the Dissolve Height down by 50% and that Ecotype will have an actual Dissolve Height of 1 pixel in that rendered image. $2 \times 240 / 480 = 1$

If you render a poster with an image height of 1920 pixels, the actual Dissolve Height for the Ecotype in that image will become 8 pixels. $2 * 1920 / 480 = 8$.

The end result is that the Ecotype will dissolve out to a color or texture at the same place on the terrain in all three examples. This would not have been true if you were using the Absolute Pixels option in the Common Distance Dissolve section (see above).

Note: You can set the rendered image height with the Height field on the Size and Range page of the Render Options Editor.

The Image Reference Height is always the same for all Ecotypes and Foliage Effects. When you change it for one Ecotype or Foliage Effect you are changing it for all Ecotypes and Foliage Effects.

Note: All Ecotypes and Foliage Effects are also affected when you select either the Absolute Pixels radio button or the Relative to Image Height radio button in the Common Distance Dissolve section (see above).

However, the Dissolve Height is unique to each Ecosystem or Foliage Effect.

Dissolve Color Controls

Click the Dissolve Color well to open the Color Editor. There you can edit the color VNS will render on the terrain in the distance.

If you'd rather use a texture, click the Texture icon to open the Texture Editor. There you can create a more complex pattern to represent your distant foliage. Textures will take longer to render than a simple color.

Settings Sub-Page

Absolute Size Radio Buttons

Select the "Absolute Size is in Ecotype" radio button if you want to control the actual size of the Ecotype's foliage using the Maximum Size field, on the Parameters page in the Ecotype Size section. You can then set the size of each Foliage Group as a percentage of the Ecotype's Maximum Size.

Select the “Absolute Size is in Foliage Group” radio button if you want to set the actual size of each Foliage Group directly instead of setting each group as a percentage of the Ecotype Size. VNS will disable the Ecotype Size controls and you can directly set a Group Size and Group Minimum Size for each Foliage Group on the Groups page.

Note: In both cases, the size of each Foliage Object is a percentage of the size of the Foliage Group to which it belongs. You can set the size percentage for each Foliage Object.

However you choose to control the absolute size, you’ll set it in the units you selected in the Height field on the Units page of the Preferences Window.

Second Size Radio Buttons

The “Second Size is” radio buttons let you configure how the Ecotype Editor lets you control a second size for the Ecotype’s foliage.

Second Size is in Absolute Minimum radio button

Select the Second Size is in Absolute Minimum (Min) radio button if you want to be able to set a secondary Size as a specific, using the units you selected in the Height field on the Units page of the Preferences Window.

If you’ve selected the “Absolute Size is in Ecotype” radio button (see above), you can then control a minimum size for all Foliage Groups using the Minimum Size percentage field on the Parameters page.

If you’ve selected the “Absolute Size is in Foliage Group” radio button (see above), you can then control a minimum size for separately for each Foliage Group using the Group Minimum Size field on the Parameters page for a selected Foliage Group. This controls the minimum size separately for each Group.

Second Size is Minimum Percentage Radio Button

Select the Second Size is in Minimum (Min) percentage radio button if you want to be able to set the secondary size as a percentage of the absolute size.

If you’ve selected the “Absolute Size is in Ecotype” radio button (see above), you can then control a minimum size for all Foliage Groups using the Minimum Size Percentage field on the Parameters page. The minimum size of the Ecotype’s foliage will be a percentage of the value you entered into the Maximum Size field. VNS will vary the size of the foliage between these two sizes. You can further control the size of each Foliage Group by adjusting the Group Size percentage field on the Parameters page for each Foliage Group.

If you’ve selected the “Absolute Size is in Foliage Group” radio button (see above), you can instead control a minimum size for separately for each Foliage Group using the Group Minimum size field on the parameters page for a selected Foliage Group. This controls the minimum size separately for each Group.

Second Size is Plus or Minus a Percentage Radio Button

Select the Second Size is +/- percentage radio button if you want to be able to set the secondary size as a percentage range above and below the absolute size.

If you’ve selected the “Absolute Size is in Ecotype” radio button (see above), you can then control a range of size for all Foliage Groups using the Size Range Plus/Minus Percentage field on the Parameters page. The Ecotype’s foliage will range in size as a percentage above or below the value you entered into the Maximum Size field. VNS will vary the size of the foliage within this percentage range. You can

further control the size of each Foliage Group by adjusting the Group Size percentage field on the Parameters page for each Foliage Group.

If you've selected the "Absolute Size is in Foliage Group" radio button (see above), you can instead control a range of size separately for each Foliage Group using the Group Size Range Plus/Minus Percentage field on the Parameters page for a selected Foliage Group. This controls the size range separately for each Group.

Absolute Density Radio Buttons

Select the "Absolute Density is in Ecotype" radio button if you want to specify the overall density of the Ecotype's foliage for the entire Ecotype using the Density field in the Ecotype Density section on the Ecotype page. You can then set the density of each Foliage Group as a percentage of the Ecotype's overall Density.

Select the "Absolute Density is in Foliage Group" radio button if you want to specify the density of each Foliage Group directly instead of setting each group as a percentage of the Ecotype Density. VNS will disable the Density field on the Ecotype page and you can directly set a Group Density for each Foliage Group using the Group Density field on the Groups page instead.

Note: In both cases, the density of each Foliage Object is a percentage of the density of the Foliage Group to which it belongs. You can set the density percentage for each Foliage Object on the Objects page.

Density Radio Buttons

The Ecotype page's Density Field and the Group page's Group Density field work differently depending on whether you select the "Density is per Polygon" or "Density is per Unit Area" radio button.

VNS lets you choose whether to have the Ecotype's foliage density be linked to the polygon density for more efficient rendering or be a constant across the terrain. Polygon density is increased near the Camera when you render with Variable or Fractal Maps options on the Terrain Parameter Editor.

Density per Polygon Radio Button

With the "Density is per Polygon" radio button selected, the Density or Group Density field lets you specify the percentage of polygons that will be covered with the Ecotype. Enter an integer value between 0 and 100 percent or use the arrow buttons to change the value. A value of zero will cause no trees or textures to be rendered for the given Ecotype. A value of 100 will cause a tree or texture to be applied at all polygon sites where the Ecotype appears.

With Density per Polygon the density of the foliage is directly related to the polygon density. The more polygons you have, the more foliage you will have. Anything that affects the polygon density will also affect the tree density. This includes things like Fractal Depth, Variable Fractal Depth and Fractal Depth Maps.

You can increase the polygons available during rendering by increasing the Fractal Depth in the Terrain Parameter Editor. The foliage density will be different when you render at lower or higher Fractal Depth settings. To see how it all works out you'll have to render an image.

If you use Variable Fractal Depth, the foliage density will be higher nearer the Camera. If you use Fractal Depth Maps, the foliage density will be higher along the Camera path.

In many cases the varying tree density is not noticeable, and using Density per Polygon may render faster. But if you notice uneven tree density; if you want to be able to change fractal depth without changing the tree density; or if you see distant trees disappearing during an animation, use Density per Unit Area instead (see below).

When changing from Density per Polygon to Density per Unit Area, you will generally need to increase the density field between 5 to 10 times its previous value to get a similar look as the non-fixed scene. Use your judgment based on what you want it to look like.

Density per Unit Area Radio Button

Select the “Density is per Unit Area” radio button when you want the tree density to be unrelated to the polygon density. With the “Density is per Unit Area” radio button selected, the number of trees won’t change when you raise or lower the fractal depth. The distribution of trees on the landscape will be consistent even if you are using variable fractal depth or fractal depth maps.

The Density you set in the Density or Group Density field is the actual number of foliage stems per unit. You can select the kind of unit from the Area Units drop box (see below). To save rendering time, enter the lowest Density value that gives you the look you want. To see the result, render an image.

To make Density per Unit Area foliage render more efficiently, use the controls in the Image Object Distance Dissolve section to dissolve distant foliage to a color or texture (see below).

Increase the Density or Group Density value if you want to see more trees from the Ecotype. If it’s an Overstory Ecotype, lower values can leave more bare spots where the Understory Ecotype will show through.

Area Units Drop Box

If you select the “Density is in Unit Area” radio button you can use the Area Units drop box to select the units for area density. Choose between stems per Hectare, Acre, Square Meter or Square Foot.

Parameters Sub-Page

The Ecotype Size section’s fields are available if you select the Absolute Size is in Ecotype radio button on the General Sub-Page (see above).

Note: These fields let you adjust foliage sizes for the entire Ecotype. You can further adjust foliage sizes for each of the Ecotype’s Foliage Groups and for individual Foliage Objects by selecting the relevant Group or Object and using the context sensitive controls which appear (see below). You can also adjust Foliage sizes for all the foliage from all Ecosystems used within an Environment. To do so, use the Foliage Height Factor field on the Foliage and Gradients page of the Environment Editor.

Maximum Height Field

Use the Maximum Height field to specify the upper limit for how large you’d like the foliage in the Active Ecosystem to appear.

Enter a value for the Maximum Height field in the units you selected for height on the Units page of the Preferences Window.

Controlling Height with a Texture

If you want to control foliage height with a texture, click the Texture Operations Icon next to the field for the variable you want to control, which in this case is Maximum Height.

Select the Create Texture command from the Texture Operations Icon's commands and VNS will create a new texture and open the Texture Editor. There you can edit your texture to control the variable. Wherever the Texture is white, you'll have the full height using the value you set in the Maximum Height field. Wherever the texture is gray you'll have less height and where it is black you'll have zero height. This is a good way to make naturally varied foliage heights.

Controlling Height with a Thematic Map

If you want to control foliage height with a Thematic Map, click the Thematic Map Operations Icon next to the field for the variable you want to control, which in this case is Maximum Height.

Select the Create Thematic Map command from the Thematic Map Operations Icon's commands and VNS will create a new Thematic Map and open the Thematic Map Editor. There you can select one or more Vector attributes to control the variable. In this case the height value will be inherited from the Vector attribute you select. The attribute value comes from the Ecosystem's attached Vector. This is a good way to let your GIS data control actual foliage height in VNS.

Second Size Field

The second Size field lets you control Minimum Size, Minimum Size Percentage or Size Range +/- Percentage depending on your Second Size radio button selection on the General page (see above).

If you select the Second Size is in Absolute Min (Minimum) on the Settings sub-page, the second Size field will be labelled "Minimum Height." Enter the height you want for the shortest foliage in the Ecotype. When you render, VNS will place trees with a random mix of heights from the Minimum Height you specified in the Minimum Height field up to the Maximum Height you specified in the Maximum Height field (see above).

Note: The Minimum Height field uses the units you selected for height on the Units page of the Preferences Window.

If you select the Second Size is in Min (Minimum) Percentage on the Settings sub-page, the second size field will be labelled "Minimum Height Percentage." Enter the height you want for the shortest foliage in the Ecotype as a percentage of the Maximum Height field. When you render, VNS will place trees with a random mix of heights from the Minimum Height percentage you specified in the Minimum Height Percentage field up to the Maximum Height you specified in the Maximum Height field (see above).

If you select the Second Size is in Min (Minimum) Percentage on the General page, the second Height field will be labelled "Height Range (+/-)." Enter the height you want for the shortest foliage in the Ecotype as a percentage above and below the value in the Maximum Height field. When you render, VNS will place trees with a random mix of heights ranging above and below the value you specified in the Maximum Height field (see above).

Ecotype Density Section

The Ecotype Density section is available if you select the Absolute Density is in Ecotype radio button on the General page (see above). You can then set the density of each Foliage Group on the Groups page as a percentage of the Ecotype's overall density, and for individual Foliage Objects on the Objects page as a percentage of the Group's density.

VNS lets you choose whether to have the foliage density be linked to the polygon density for more efficient rendering or be a constant across the terrain. Polygon density is increased near the Camera when you render with Variable or Fractal Maps options on the Terrain Parameter Editor.

The Ecotype page's Density Field works differently depending on whether you select the "Density is per Polygon" or "Density is per Unit Area" radio button on the General page.

If the Density is per Unit Area radio button selected on the General page, the Density you set in the Density field is the actual number of foliage stems per unit. You can select the kind of unit from the Area Units drop box on the General page. To save rendering time, enter the lowest Density value that gives you the look you want.

To see the result, render a final image from the Render Control Window.

Note: Preview renderings may not show densities accurately if your View is significantly smaller than the final rendered image size you set in the set of Render Options you're using in the Render Job. This is especially true if you are using Image Object Distance Dissolve (see below) with Common Distance Dissolve set to Absolute Pixels.

If the Density is per Polygon radio button selected on the General page, the Density field lets you specify the percentage of polygons that will be covered with the Ecotype. Enter an integer value between 0 and 100 percent or use the arrow buttons to change the value. A value of zero will cause no trees or textures to be rendered for the given Ecotype. A value of 100 will cause a tree or texture to be applied at all polygon sites where the Ecotype appears.

Note: With Density is per Polygon radio button selected, the more polygons you have, the more trees you will have. You can increase the polygons available during rendering by increasing the Fractal Depth in the Terrain Parameter Editor. To see how it all works out you'll have to render an image.

Increase the Density value if you want to see more trees from the Ecotype. If the Ecotype is an Overstory, lower values will leave more bare spots where the Understory Ecosystem can show through.

Controlling Density with a Texture

If you want to control density with a texture, click the Texture Operations icon next to the field for the variable you want to control, which in this case is Ecotype Density.

Select the Create Texture command from the Texture Operations icon's commands and VNS will create a new texture and open the Texture Editor. There you can edit your texture to control the variable. Wherever the Texture is white, you'll have the full density using the value you set in the Density field. Wherever the texture is gray you'll have less density and where it is black you'll have no density. This is a good way to make naturally clumpy groups of foliage.

Controlling Density with a Thematic Map

If you want to control density with a Thematic Map, click the Thematic Map Operations icon next to the field for the variable you want to control, which in this case is Ecotype Density.

Select the Create Thematic Map command from the Thematic Map Operations Icon's commands and VNS will create a new Thematic Map and open the Thematic Map Editor. There you can select one or more Vector attributes to control the variable. In this case the density

value will be inherited from the Vector attribute you select. The attribute value comes from the Ecosystem's attached Vector. This is a good way to let your GIS data control actual foliage density in VNS.

Foliage Group Controls

The following controls appear when the selected item in the Material Foliage List is a Foliage group:

Load Foliage Group Icon

Click the Load Foliage Group icon to open the Component Gallery where you can load a Foliage Group Component.

Save Foliage Group Icon

Click the Save Foliage Group icon to open the Component Signature Window where you can save the selected Foliage Group as a Component for use in other Projects.

Name Field

Whenever you create a Foliage Group VNS asks you for a name. You can change the name of a Foliage Group by selecting it in the Foliage Group list and changing it in the Name field.

Group Enabled Checkbox

Select the Group Enabled checkbox to make the Group available for rendering. Deselect it if you want to disable the Group for rendering.

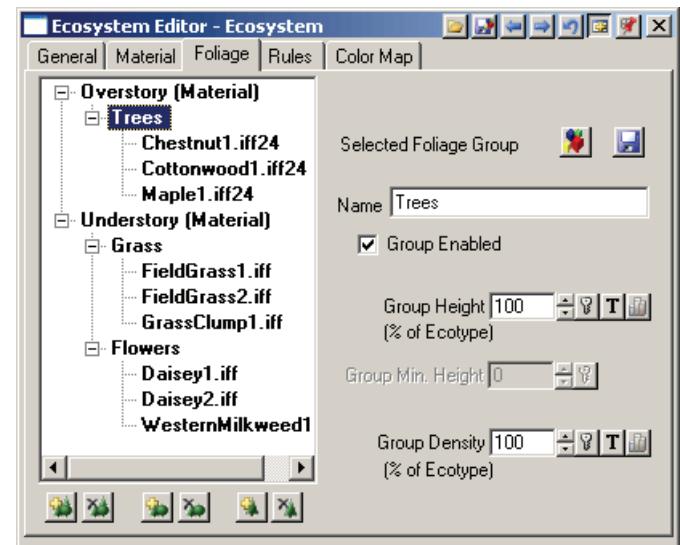
Group Size Controls

Each Foliage Group has its own height specification. This determines how tall the Foliage Objects in the Group are compared to other Foliage Groups in the Ecotype. You can also adjust the height of each Foliage Object in the Group on the Objects page (see below). This gives you tremendous flexibility to customize an Ecotype.

Note: If you don't care for subtleties, just select the "Absolute Height is in Ecotype" radio button on the General page, leave all the heights set to 100% on the Groups and Objects pages and modify the values on the Ecotype page to get the right look.

If you selected the "Absolute Height is in Ecotype" radio button on the General page, you'll control the actual height of the Ecotype's foliage using the Maximum Height field on the Ecotype page in the Ecotype Height section. You can then set the height of each Foliage Group here with the Group Height field as a percentage of the Ecotype's Maximum Height.

If you selected the "Absolute Height is in Foliage Group" radio button on the General page, you'll control the actual height of each Foliage Group directly instead of setting each group as a percentage of the Ecotype Height. VNS will disable the Ecotype Height controls and you can directly set a Group Height and a Secondary height for each Foliage Group on the Groups page.



Second Height Field

The second Height field lets you control Minimum Height, Minimum Height Percentage or Height Range +/- Percentage depending on your Second Height radio button selection on the General page (see above).

If you select the Second Height is in Absolute Min (Minimum) on the General page, the second Height field will be labelled "Group Minimum Height." Enter the height you want for the shortest foliage in the Foliage Group. When you render, VNS will place trees with a random mix of heights from the Group Minimum Height you specified in the Minimum Height field up to the Maximum Height you specified in the Group Height field (see above).

Note: The Group Minimum Height field uses the units you selected for height on the Units page of the Preferences Window.

If you select the Second Height is in Min (Minimum) Percentage on the General page, the second Height field will be labelled "Group Min (Minimum) Height Percentage." Enter the height you want for the shortest foliage in the Foliage Group as a percentage of the Group Height field. When you render, VNS will place trees with a random mix of heights from the Group Minimum Height percentage you specified in the Group Min Height Percentage field up to the Maximum Height you specified in the Group Height field (see above).

If you select the Second Height is in Min (Minimum) Percentage on the General page, the second Height field will be labelled "Group Ht (Height) Range (+/-)." Enter the height you want for the shortest foliage in the Foliage Group as a percentage above and below the value in the Group Height field. When you render, VNS will place trees with a random mix of heights ranging above and below the value you specified in the Group Height field (see above).

If you wish you can control the group's height with a Thematic Map or a texture.

Group Density Percentage Controls

Each Foliage Group has its own density specification. This determines how often the object is repeated compared to other Foliage Objects in the Ecotype. You can also adjust the density of each Foliage Object in the Group on the Objects page (see below).

This gives you tremendous flexibility to customize an Ecotype.

Note: If you don't care for subtleties, just select the "Absolute Height is in Ecotype" radio button on the General page, leave all the heights set to 100% on the Groups and Objects pages and tweak the values on the Ecotype page to get the right look.

If you select the Absolute Density is in Foliage Group radio button on the General page (see above) you can then set the absolute density of each Foliage Group on the Groups page.

If you select the Absolute Density is in Ecotype radio button on the General page you can then set the density of each Foliage Group as a percentage of the Ecotype's overall density.

In either case you can set the density of individual Foliage Objects on the Objects page as a percentage of the Group's density.

VNS lets you choose whether to have the foliage density be linked to the polygon density for more efficient rendering or be a constant across the terrain. Polygon density is increased near the Camera when you render with Variable or Fractal Maps options on the Terrain Parameter Editor.

The Group page's Group Density field works differently depending on whether you select the "Density is per Polygon" or "Density is per Unit Area" radio button on the General page.

If the Density is per Unit Area radio button selected on the General page, the Density you set in the Group Density field is the actual number of foliage stems per unit. You can select the kind of unit from the Area Units drop box on the General page. To save rendering time, enter the lowest Density value that gives you the look you want.

To see the result, render a final image from the Render Control Window.

Note: Preview renderings may not show densities accurately if your View is significantly smaller than the final rendered image size you set in the set of Render Options you're using in the Render Job. This is especially true if you are using Image Object Distance Dissolve (see below) with Common Distance Dissolve set to Absolute Pixels.

If the Density is per Polygon radio button selected on the General page, the Group Density field lets you specify the percentage of polygons that will be covered with the Ecotype. Enter an integer value between 0 and 100 percent or use the arrow buttons to change the value. A value of zero will cause no trees or textures to be rendered for the given Ecotype. A value of 100 will cause a tree or texture to be applied at all polygon sites where the Ecotype appears.

Note: With Density is per Polygon radio button selected, the more polygons you have, the more trees you will have. You can increase the polygons available during rendering by increasing the Fractal Depth in the Terrain Parameter Editor. To see how it all works out you'll have to render an image.

Increase the Group Density value if you want to see more trees from the Ecotype. If the Ecotype is an Overstory, lower values will leave more bare spots where the Understory Ecosystem can show through.

If you wish you can control the group's density with a Thematic Map or a texture.

Foliage Object Controls

Image Object or 3D Object Radio Buttons

These radio buttons let you select whether the selected Foliage Object should be an Image Object or a 3D Object.

If you select the Image Object radio button, VNS will show the Image Object section at the bottom of the Objects page (see below). There you can select an Image Object and adjust its properties.

If you select the 3D Object radio button, VNS will show the 3D Object section at the bottom of the Objects page (see below). There you can select a 3D Object and adjust its properties.

Enabled Checkbox

The Enabled checkbox lets you enable or disable the selected Foliage Object for rendering. Disabled Foliage Objects are shown in gray in the Foliage Objects list.

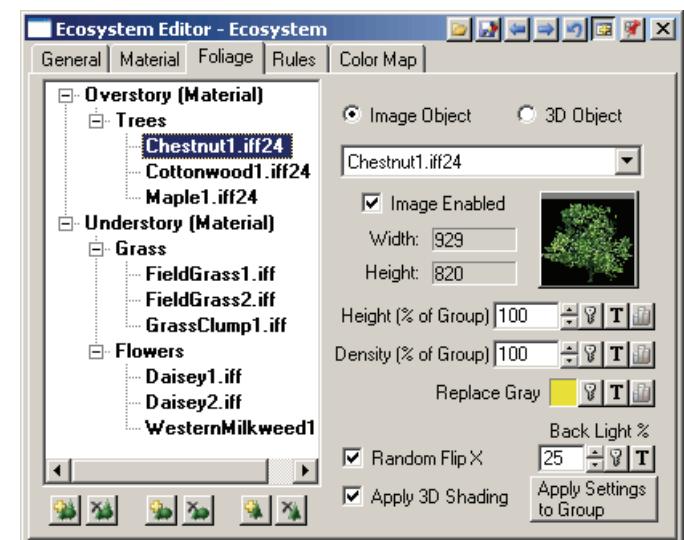


Image Object Options

Image Object Drop Box

Select an Image Object in the Image Object drop box. VNS will replace the selected Foliage Object in the Foliage Objects list (see above) with the Image Object you choose.

If you want to load a new Image Object, select “New Image Object.” VNS will open a file requester where you can select a new Image Object. Image Objects can be images or image sequences in any supported format (see Image Loading and Saving).

Width, Height and Image Bands Display Fields

The Width, Height and Image Bands display fields show the pixel dimensions and number of 8-bit image bands of the Selected Image Object.

Thumbnail

The Thumbnail shows a small version of the selected Image Object. You can double-click it if you want to see the full version.

Random Flip X Checkbox

Select the Random Flip X checkbox to have VNS randomly reverse the Image Object from left-to-right during rendering. This will give you more variety in the foliage since the selected Image Object will appear in different places in normal and reversed versions.

Apply 3D Shading Checkbox

Select the Apply 3D Shading checkbox to tell VNS to shade the Image Object based on the direction of the light. This will give foliage a more 3-dimensional appearance.

Replace Gray Color Controls

By using unique colors for a Group of images or even individual Foliage Objects you can create a scene of nearly unlimited color variety. You can animate colors to create a kaleidoscopic landscape. Change the color of maple trees first, then the birches followed by the oaks and leave the conifers green, and voila - New England in October.

Each Image Object has its own color specifications. The color for each image can come from the Image Object itself or from a color. If it comes from a color, you can animate that color. You can edit the colors for the selected Image Object by clicking the Replace Gray color well to open the Color Editor.

Note: This only works for gray scale images, or images that have been set to gray scale in the Image Object Library. If the Image Object contains a color image and it has not been changed to gray scale in the Image Object Library, the Replace Gray color well will be disabled.

You can change the Gray Replacement Color for a gray-scale Image Object independently at any time or leave it with the color it inherited when you added the Image Object.

Note: Gray Scale Images require 1/3 the amount of memory that 24 bit color images require when rendering.

Height Percentage Controls

Each Foliage Object has its own height specifications. These determine how tall the object is compared to other objects in the Ecotype.

The Height Percentage field for the currently selected Foliage Object is a percentage of the number entered in the Group Height field for the Foliage Group on the Groups page (see above).

If you wish you can control the object's height with a Thematic Map or a texture.

Density Percentage Controls

Each Foliage Object has its own density specifications. These determine how often the object is repeated compared to other Foliage Objects in the Ecotype.

Density of coverage for a Foliage Object is based on its Density within its group (set with the Density Percentage field for the selected Foliage Object), the group's Density in the Ecotype (set with the Group Density field on Group page for the selected Group).

If you wish you can control the object's density with a Thematic Map or a texture.

Back Light Percentage Field

The Back Light Percentage field lets you allow light to shine through backlit Image Object foliage. The default value is 25%. You can set it higher than 100%.

Use the Back Light Percentage when the Camera is looking into the light and the foliage looks too dark. It allows light to be transmitted through the leaves. This will brighten the foliage and increase color saturation. The result can be much more realistic small vegetation when the vegetation is backlit.

You can adjust the Back Light Percentage individually for any Foliage Object by selecting it in the Foliage Objects list and changing the value in the Back Light Percentage field. You can increase the Back Light percentage to brighten objects that are between the Camera and a light. Decrease it if you want a silhouette effect.

Apply to Group Button

Click the Apply to Group button if you want to set the Back Light Percentage of all members of the Group to be the same as the value in the Back Light Percentage field (see above). This is much faster than setting the Back Light Percentage individually for each member of the Group.

If the Back Light Percentage for the current Foliage Object has key frames, they will also be copied to the other members of the Group.

3D Object Options

Rotate X, Y and Z Checkboxes and Fields

The Rotation controls let you add random rotation to the current 3D Object. Select a checkbox and enter a value and VNS will randomly rotate the object along that axis every time it places it on a Vector vertex, within the rotation limit you set.

The X axis runs east to west. A positive X axis is to the east. The Y axis runs vertically. A positive Y axis is up. The Z axis runs north to south. A positive Z axis is to the north.

Enter a number in the X Field to rotate the 3D Object around the X axis. Enter a number in the Y Field to rotate the 3D Object around the Y axis. Enter a number in the Z Field to rotate the 3D Object around the Z axis.

A value of zero in any field means no rotation for that axis.

Polygons, Vertices and Materials Display Fields

The Vertices display field shows the number of vertices in the current 3D Object. The more vertices there are, the longer it will take to render. VNS does not impose a limit to the number of vertices an object may have, other than the limit imposed by the available memory on your system.

The Polygons display field shows the number of polygons in the current 3D Object. The more polygons there are, the longer it will take to render. VNS does not impose a limit to the number of polygons an object may have, other than the limit imposed by the available memory on your system.

The Materials display field shows how many materials there are in the current 3D Object. A Material is a texture applied to groups of polygons within the object. For example, a car object may have a body Material, a bumper Material, a tire Material and a glass Material. You can edit the properties of each Material using the 3D Material Editor.

Height Percentage Controls

Each Foliage Object has its own height specifications. These determine how tall the object is compared to other objects in the Ecotype.

The Height Percentage field for the currently selected Foliage Object is a percentage of the number entered in the Group Height field for the Foliage Group on the Groups page (see above).

If you wish you can control the object's height with a Thematic Map or a texture.

Density Percentage Controls

Each Foliage Object has its own density specifications. These determine how often the object is repeated compared to other Foliage Objects in the Ecotype.

Density of coverage for a Foliage Object is based on its Density within its group (set with the Density Percentage field for the selected Foliage Object), the group's Density in the Ecotype (set with the Group Density field on Group page for the selected Group).

If you wish you can control the object's density with a Thematic Map or a texture.

Rules of Nature Page

Click the Rules Page tab to see the Rules-of-Nature™ Page. Here you can adjust all the Ecosystem Parameters that can affect where the Ecosystem grows on the terrain.

All of the Rules-of-Nature™ apply when the Ecosystem is part of an Environment (see Environment Editor).

Only the Maximum and Minimum Slope and Relative Elevation limits are applied to Vector-bounded Ecosystems and Color-mapped Ecosystems.

Ecosystems used within Terraffectors are not affected by the Rules-of-Nature™.

Parameter Fields

The Parameter fields and Value Slider (see below) let you change the Ecosystem Parameters. By changing these Parameters you can control the Rules-of-Nature™ that determine where VNS grows the Ecosystem on the terrain. You can type numbers directly into the fields, click the arrow buttons or use the Value Slider to change the values.

The Rules-of-Nature™ Parameters include Vertical Limits and Lateral Limits.

Vertical Limits

- **Elevation Line**
- **Elevation Skew**
- **Elevation Skew Azimuth**
- **Relative Elevation Effect**

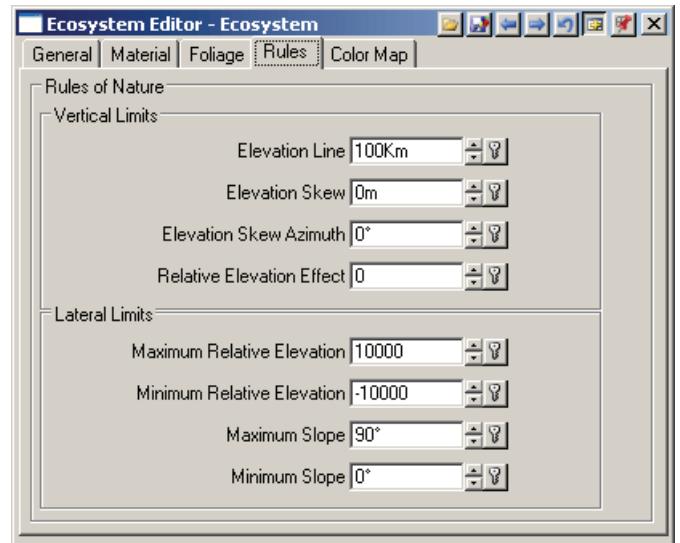
Lateral Limits

- **Maximum Relative Elevation**
- **Minimum Relative Elevation**
- **Maximum Slope**
- **Minimum Slope**

Radio Buttons and Value Slider

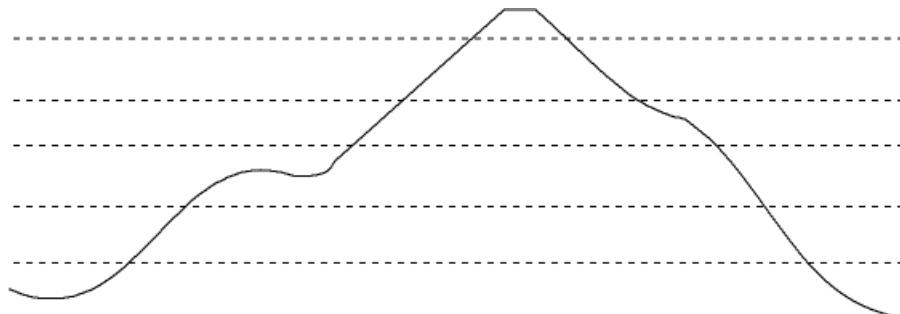
Rules-of-Nature™ fields have radio buttons which activate the Value Slider on the right. When you select a radio button you can use the slider to control the value for the adjacent field.

The scroll bar range is a "reasonable" or useful range for each Parameter, although there may be times you might want to manually enter a higher or lower number. For Elevation Line, the slider range is from the lowest to highest elevation of the enabled DEMs.



Vertical Limits

Elevation Line Field and Buttons



You can set the upper limit for an Ecosystem in the Elevation Line field.

The Elevation Line is the average upper limit for the Ecosystem.

If the Elevation Line were the only Parameter, Ecosystems would be distributed like the layers of a cake on the hillside with each one occupying a well-defined elevation range. But the Elevation Line only represents the average upper limit.

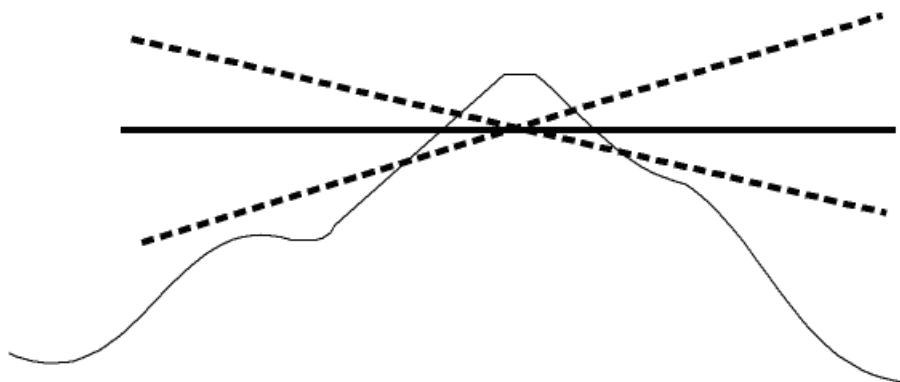
For rock and ground ecosystems elevation is not a factor, so you will probably want to set the value to the maximum setting of 32,000 meters. That way VNS can use those Ecosystems at any elevation.

The limit at any given site will vary depending on local factors which you can alter using the rest of the Parameter variables (see below). They are designed to break up this even-layered distribution and to create a natural patchy appearance that embodies valid ecological principles.

Ecological Explanation

As elevation increases conditions become more harsh. Temperature drops, growing season shortens, desiccating wind exposure increases, solar radiation becomes more intense and soils tend to become poorer. Every plant species has an upper limit to its range beyond which it cannot survive or reproduce.

Elevation Skew Field and Buttons



Elevation Skew works to lower the Elevation Line on one side of a hill relative to the other side of the hill. It's useful for simulating the drying effects of prevailing winds or the effect of sun falling more on one side of a hill than the other.

Note: You can tell VNS what direction to use when dividing hills into two sides by using the Elevation Skew Azimuth parameter (see below). This lets you simulate sun or prevailing wind direction.

Since Elevation Skew is a slope-based parameter, it also has the effect of breaking up the transition between Ecosystems based on the changing slope values typically found on irregular hillsides. This lets you add a natural looking irregularity to the land cover.

You can use any values but most Ecosystems look best with numbers from -500 to +500.

Technical Explanation

Elevation Skew is a measure of the effect of slope azimuth on the upper limit of an Ecosystem. In other words, it changes the Elevation Line of an Ecosystem based on the direction of the slope.

The Elevation Line will be lowered in the direction of the Skew Azimuth (see below) by an amount proportional to the slope and Elevation Skew. The value is in units of meters and referenced to a 45° slope. In other words, on a 45 degree slope, if the Elevation skew value is 200 then the Elevation Line will be raised or lowered 200 meters. On lesser slopes the change will be proportionately less.

Ecological Explanation

One of the factors that breaks up the layered arrangement of Ecosystems is the azimuth or direction of the terrain slope. In the northern hemisphere, southern slopes receive more hours of sunlight especially in the winter. This makes them somewhat warmer on average than north-facing slopes. They also tend to be drier and have more months free of snow.

These are important factors to plants which can not sprout until the snow has cleared. The drier conditions on the other hand mean more months of drought and certain moisture-loving species cannot thrive here.

Elevation Skew Azimuth Field and Buttons

Elevation Skew Azimuth lets you specify the direction of the Elevation Skew (see above). Together, Elevation Skew and Elevation Skew Azimuth let you add irregularity to the land cover. You can use values from -360 to +360. In nature values of -90 to +90 are typical.

The value for a given species of plant depends on the complex interaction of a host of factors such as prevailing wind direction, wind strength, latitude, solar intensity at different times of the day and the specific temperature and moisture requirements of the plant species. For non-living Ecosystems such as snow, the controlling variables are prevailing wind direction, wind strength, and sun intensity.

In the simplest case, where you just want to simulate the effect of the sun on an Ecosystem, set the Elevation Skew to the same direction as the Sun Light. This will raise the Elevation Line on the sunny sides of hills for plants that like the sun and don't mind drier conditions, and lower the Elevation Line on the shady side of hills where those same plants are less likely to grow. Or you can set Elevation Skew opposite the direction of the Sun Light to lower the Elevation Line on the sunny sides of hills and raise the elevation line on the shady sides of hills. This is great for plants that don't like dryness and can live better on the shady side of the hills with less sun.

Technical Explanation

The direction in which the Elevation Skew has the greatest effect is the Elevation Skew Azimuth. If the Elevation Skew is positive the Elevation Line is lowered, if negative, it is raised in the Skew Azimuth direction. At 180° from the Skew Azimuth the effect will be of the same magnitude, only reversed. This value is measured in degrees clockwise from north so north is 0°, east is 90°, etc.

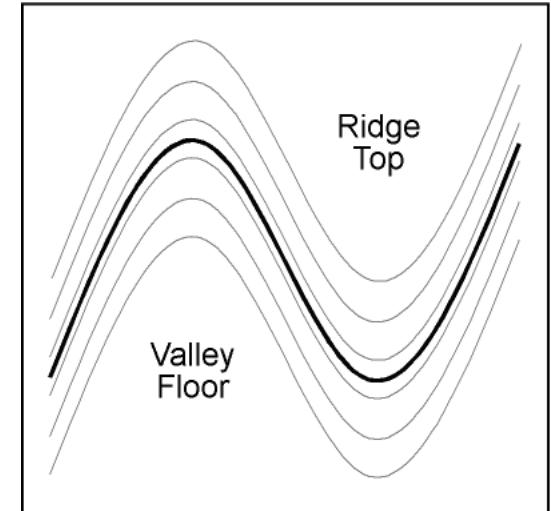
Ecological Explanation

In the Rocky Mountains our winter winds prevail from the west. Snow is blown off ridges and accumulates in basins on the east side. Sun melts more snow on southern slopes, where its force is more intense, than northern so the cumulative effect is to deepen snow on the northeast sides of mountains. Here snow frequently lays until late summer when it is long gone from other slopes. We can simulate that effect by setting the Skew Azimuth to 45° (northeast) and the Elevation Skew to 200 (a moderate value).

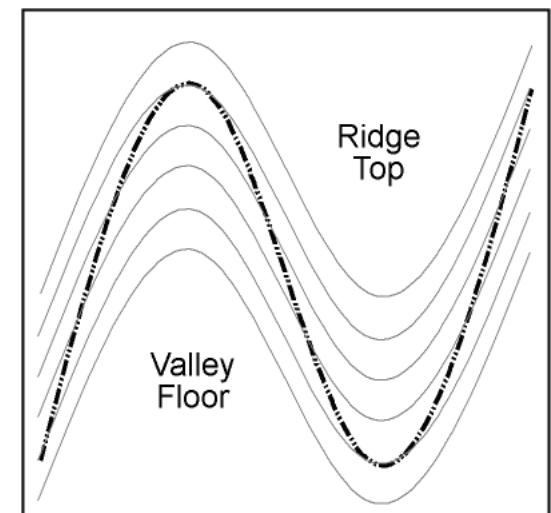
Relative Elevation Field and Buttons

One of the most powerful tools available to us in the quest for realism is the Relative Elevation Effect. VNS knows if slopes are convex or concave. By using a positive Relative Elevation Effect value, you can push an Ecosystem up valleys. By using a negative Relative Elevation Effect value, you can push an Ecosystem onto ridges.

To see how this works, the diagram to the right is a segment of a contour map. Each band represents a different elevation. On the left is a valley (concave terrain shape), with the lowest part of the valley at the bottom and the terrain rising up the valley to the top. This is a typical drainage. On the right is a ridge (convex terrain shape), with the terrain ascending in elevation up the ridge from bottom to top. The heavy line is the elevation line of the Ecosystem, which follows the contours to stay at the same elevation.



With a positive Relative Elevation Effect, VNS will distort the Ecosystem's Elevation Line so that the Ecosystem can grow higher in valleys, but lower on ridges. So use a positive Relative Elevation effect for riparian Ecosystems which tend to follow a drainage and generally require more water and shelter.



With a negative Relative Elevation Effect, VNS will distort the Ecosystem's Elevation Line so that the Ecosystem can grow higher on ridges, but lower in valleys. So use a negative Relative Elevation for an Ecosystem of ridge-dwelling plants, plants that need less water and can stand more exposure.

The greater the Relative Elevation value (either positive or negative), the stronger the effect. Values from +10 to -10 generally work well.

Snow is a little different because snow lives above the Elevation Line rather than below it, like other Ecosystems. The Elevation Line still behaves the same, but the snow appears above it rather than below it. To make snow fill valleys, use a positive Relative Elevation Effect value. A value of +5 works well for snow, causing it to fill in the valleys on a mountain side.

Ecological Explanation

In nature concave areas collect water, convex areas shed it. Concave areas have deeper soils with higher water tables even to the point of being saturated or hydric. These extremely wet areas have been termed wetlands and are of vital importance to flood control, water quality preservation and wildlife (not just mosquitoes).

Convex terrain drains quickly and soils tend to be droughty. They are often coarser in texture which aids in the rapid removal of soil moisture. Wind exposure is higher which desiccates the site and any plants that grow on it. Convex sites are favored by some species of plants and shunned by others.

Complicating things are the temperature effects. Valleys are like pipelines that transport air masses up and down mountains. At night cold air from the surrounding peaks drains down into the valleys. They are often ten or more degrees cooler at night than surrounding slopes. During the day they trap hot air which flows up from lower elevations.

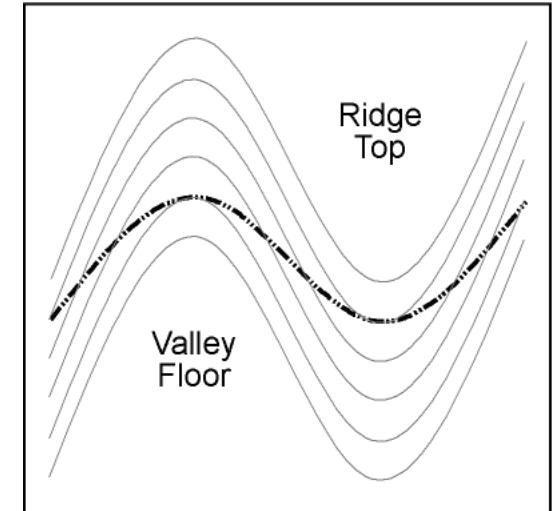
The end result is that some Elevation Lines are lowered in valleys and others are raised. We can take advantage of this divergent behavior by creating some Ecosystems that exhibit each. It will add realistic complication and diversity to our images whether or not we truly understand the principles behind it. Small dips and bumps of Relative Elevation values in the terrain model will produce isolated clumps of one Ecosystem or another. These are equivalent to micro-climate zones found on real hillsides. They are the main reason that timber line is seldom truly a line.

Lateral Limits

Maximum and Minimum Relative Elevation Fields and Buttons

Some Ecosystems may be limited exclusively to concave or convex terrain. You can set Maximum and Minimum Relative Elevation values to limit an Ecosystem's growth so it occurs only within these types of terrain areas.

Limit the Maximum Relative Elevation to keep an Ecosystem off of ridges. Limit Minimum Relative Elevation to keep an Ecosystem out of valleys. To see what values are appropriate, do a preview rendering and click in the View. You'll see the Relative Elevation value for the point you clicked displayed in the Diagnostics Data window. You can copy and paste the value from the Diagnostics Data window into the Max or Min Relative Elevation fields.



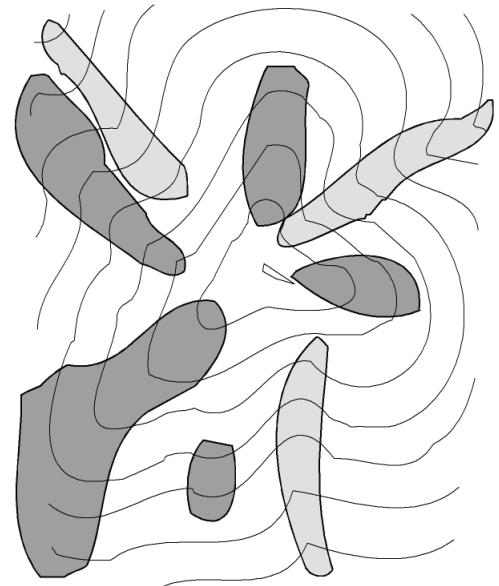
Find the Relative Elevation values of areas where you want the current Ecosystem to grow. Enter the highest value you find into the Maximum Relative Elevation field, and the lowest value you find into the Minimum Relative Elevation field.

Relative Elevations assume a statistically normal distribution about the mean value of zero. That is to say most values are near zero and very few values are at the extremes of the range. For DEMs we have encountered, values range from -250 to +250.

Because of this natural variation, Relative Elevation doesn't just make the Elevation Line wobble across terrain as you saw above, it also breaks Ecosystems into patches. This is because the Relative Elevation values can vary dramatically across the terrain. This variation tends to chop up linear bands of ecosystems into natural Ecosystem patches.

We have found upper limits of -20 or -30 for a deciduous Ecosystem can add interesting and realistic patches of color among the darker greens of a conifer forest. In the Rockies those patches might represent aspen or shrub willows at middle and higher elevations.

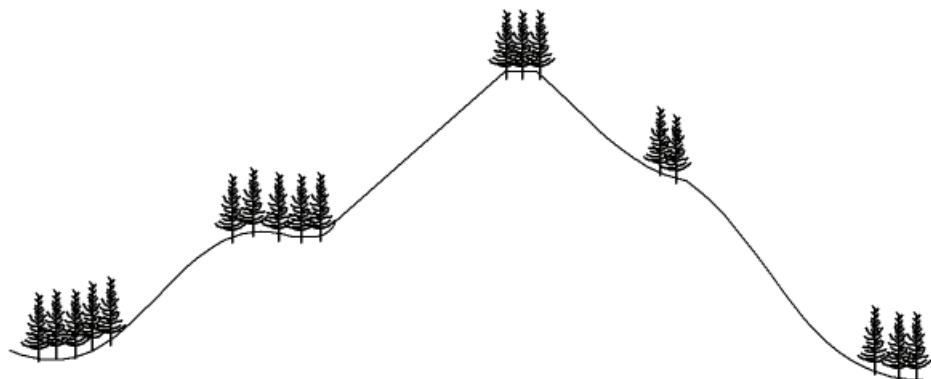
Any Ecosystem you want to be able to appear anywhere should have a wide open relative elevation range (-1000 to +1000).



Maximum Slope

Set the Maximum Slope to the steepest amount of slope in degrees that you want the current Ecosystem to grow on. VNS will keep the Ecosystem from appearing on any terrain that is steeper than this value. This is probably the easiest Parameter to visualize.

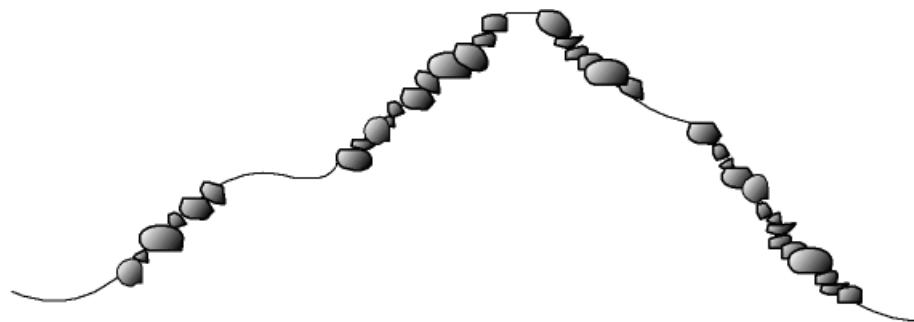
Everyone knows that trees do not grow on the face of a cliff. Setting the Maximum Slope for vegetation Ecosystems to 30 or 35 degrees will work well. Rock should have a maximum slope of 90°.



Any Ecosystem you want to be able to appear on any slope should have a wide open slope range (0 degrees minimum to 90 degrees maximum).

Minimum Slope

Set the Minimum Slope to the least amount of slope in degrees that you want the current Ecosystem to grow on. VNS will keep the Ecosystem from appearing on any terrain that is less steep than this value.



We have used Minimum Slope on occasion where we wish to have some way to discriminate between two Ecosystems that otherwise have identical or similar Sub-Parameters. We also use it to limit rock to slopes greater than 35°.

Any Ecosystem you want to be able to appear on any slope should have a wide open slope range (0 degrees minimum to 90 degrees maximum).

Material Name Field

The Material Name field is above the Material list. After you create a Material it will have a default name of "Material." It's a good idea to enter a unique name in the Material Name field to identify how you will use the Material. For example "sand," "forest" or "fall foliage."

This is the same as the Selected Material Name field on the Material & Foliage page (see below).

Gradient Materials List

The Gradient Materials list shows all the Materials in the Ecosystem.

Click a Material in the list to select it. This will also select its pin below the Gradient. You can then change its Position in Gradient percentage, remove it by clicking the Remove Material icon, rename it in the Material Name field, or go to the Material & Foliage page (see below) and edit any of its properties.

This is the same as the Gradient Materials List on the Material & Foliage page (see below).

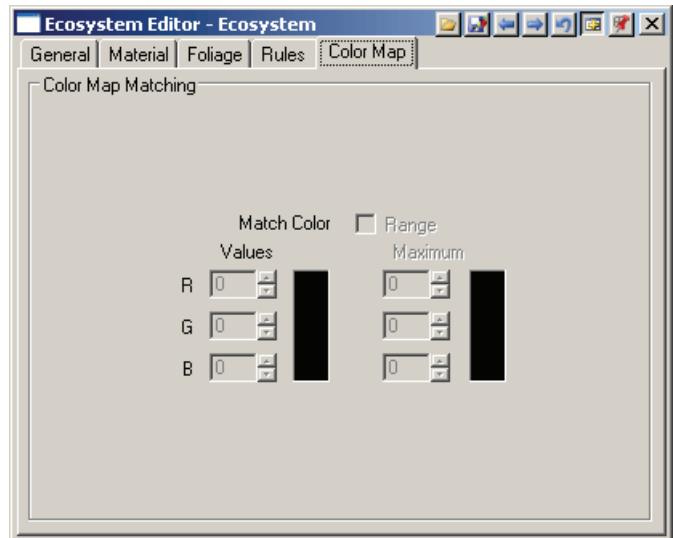
Color Map Page

Color Map Matching Controls

The Color Map Matching controls let you tell VNS to place the Ecosystem on the terrain wherever a single color or range of colors appears on a Color Map projected onto the terrain (see Color Map Editor).

One use of this is to use the colors in a satellite image to control where actual foliage grows on your terrain.

To apply an Ecosystem as part of a Color Map, set the controls on the Color Map page (see below). Then select the Ecosystem on the Ecosystems & Miscellaneous page of the Color Map Editor.



Match Color Range Checkbox

Select the Match Color Range checkbox when you want the Ecosystem to appear wherever a range of colors appears on a Color Map projected onto the terrain (see Color Map Editor). You can specify the color range using the Minimum and Maximum fields (see below).

Deselect the Match Color Range checkbox when you want the Ecosystem to appear wherever a single color appears on a Color Map projected onto the terrain. You can specify the color using the Values fields (see below).

Values Fields and Color Bar

If the Match Color Range checkbox is not selected, the Value RGB Fields let you set the single color for Color Mapping.

If the Match Color Range checkbox is selected, the name of the fields changes to "Minimum." These RGB fields then let you set the lower limit for a range of colors. You can set the upper limit in the Maximum RGB fields (see below).

Set the amount of Red in the R field, the amount of Green in the G field and the amount of Blue in the B field.

This only works if the Match Ecosystems to Colors checkbox is selected (see above).

The adjacent color bar lets you see the color you set with the RGB fields.

Maximum Fields and Color Bar

The Maximum Fields let you set the upper limit for a range of colors.

This only works if the Match Ecosystems to Colors checkbox is selected and the Match Color Range checkbox is selected (see above).

Set the amount of Red in the R field, the amount of Green in the G field and the amount of Blue in the B field. The adjacent color bar displays the color you set with the RGB fields.

Ecosystem Editor - Forestry Edition

If you are not running the Forestry Edition you will need to refer to the section relating to the regular version of the Ecosystem Editor.

To open the Ecosystem Editor for an existing Ecosystem, double-click the name of the Ecosystem in the Scene-At-A-Glance.

The Ecosystem Editor lets you add areas of foliage and texturing to your terrain. You can control where the Ecosystem appears with an Environment; with one or more Vectors; with one or more Color Maps; or with one or more Terraffectors.

Rules of Nature™ let you restrict an Ecosystem to specific areas within an Environment based on elevation, relative elevation and slope.

Note: To add individual trees or other specific landscaping, use Foliage Effects (see Foliage Effect Editor).

To better simulate nature, each Ecosystem gives you three levels of control. The Overstory Ecotype and Understory Ecotype let you grow foliage such as trees, bushes and grass. The Ground Overlay lets you add texturing to the terrain such as rock or dirt.

The Overstory usually represents the tallest trees. The Understory includes shorter foliage. You can control the foliage mix for the Overstory and Understory separately.

The Ground can be a simple color or a combination of image and procedural textures. Ground also includes strata, which simulates the exposure of multiple layers of rocks laid down over millions of years.

You can make any Ecosystem's Ground Overlay transparent using the transparency field and texture controls on the Material page. Where an Ecosystem is transparent you will be able to see the global Ground Effect (see Ground Effect Editor).

Creating Ecosystems

To create a new Ecosystem, select the "Ecosystems" category in the Scene-At-A-Glance and click the Add or Clone Selected Item icon. This makes it easy to create a variety of Ecosystems which you can later combine in an Environment, apply with a Terraffector, apply with a Color Map or attach directly to a Vector.

You can create a new Ecosystem and place it on the terrain by attaching it to a Vector all in one step (see "Placing Ecosystems" below).

To clone an existing Ecosystem, select the Ecosystem in the Scene-At-A-Glance and click the Add or Clone Selected Item icon. This makes it easy to create a new Ecosystem based on the settings in an existing Ecosystem within your project.

To load pre-made Ecosystems, select the icon for the Component Gallery in the Icon Toolbar. In the Component Gallery click the Ecosystems tab. Then select any Ecosystem thumbnail you'd like to load.

Placing Ecosystems

You can apply Ecosystems to your terrain in four ways:

- **As part of an Environment (see Environment Editor)**
- **With a Color Map (see Color Map Editor)**
- **Within a Vector area**
- **Along a Terraffector (see Terraffector Editor)**

What happens if Ecosystems applied with these methods overlap? Terraffectors will always take precedence over the other methods. Vector Areas take precedence over Color Maps and Environments. Color Maps take precedence over Environments.

Note: To add individual trees or other specific landscaping, use Foliage Effects (see Foliage Effect Editor). Foliage Effects always take precedence over Ecosystems, Ground Effects, Snow Effects, Lakes and Streams.

Placing an Ecosystem as Part of an Environment

Environments let you combine multiple Ecosystems based on their Rules-of-Nature™. This is an excellent way to quickly populate your entire terrain with realistic foliage growing in complex combinations.

Environments can be global or restricted within a vector area.

To apply an Ecosystem as part of an Environment, select it on the Ecosystems page of the Environment Editor.

Placing an Ecosystem With a Color Map

Color Maps let you apply Ecosystems based on the colors in an image. One use of this is to use the colors in a satellite image to control where actual foliage grows on your terrain. When you place an Ecosystem within a Color Map, VNS will ignore all the Rules-of-Nature™ for the Ecosystem except the Minimum and Maximum Relative Elevation & Slope settings (see The Hard-Linked Vectors display tells you if there are any Vectors hard-linked to the Component, and if so, how many. It will also display vectors attached by Search queries and list the names of the search query or queries in use.).

Placing an Ecosystem Within a Vector

To place an Ecosystem within a Vector Area, you can either draw the Ecosystem and Vector directly in a View or attach the Ecosystem to an existing vector.

Note: You can have different Ecosystems attached to different Vectors. You can have the same Ecosystem attached to more than one Vector. But you cannot have more than one Ecosystem attached to the same Vector.

When you place an Ecosystem within a Vector, VNS will ignore all the Rules-of-Nature™ for the Ecosystem except the Minimum and Maximum Relative Elevation & Slope settings (see The Hard-Linked Vectors display tells you if there are any Vectors hard-linked to the Component, and if so, how many. It will also display vectors attached by Search queries and list the names of the search query or queries in use.).

To draw an Ecosystem directly:

- **Select the Ecosystems category in the Scene-At-A-Glance.**
- **Click the Create icon in the Icon toolbar.**

VNS will open the Create Palette Window. You can change the properties of the Vector in the Create Palette before you digitize the Vector, if you wish.

- **Digitize a Vector in a View.**

Left click to draw points in the manner you selected in the Create Palette.

Right-click when you're done. VNS will ask for a name. Then VNS will create the Vector and Ecosystem and attach them to each other automatically.

To attach an Ecosystem to an existing Vector see Vector Links Icon.

You will see the Ecosystem listed on the Database Editor's Comp page when you select the Vector in the Objects list.

If you have different Ecosystems applied to different Vectors which overlap, VNS will use the Ecosystem with the highest priority (see Priority Field below). If the Ecosystems have the same priority, VNS will choose an Ecosystem to render in the overlap area.

You can also dynamically link Vectors using Search Queries (see Search Query Editor).

Placing an Ecosystem Along a Terraffector

To apply an Ecosystem along a Terraffector, click the Edit Cross-section Profile button on the general page of the Terraffector Editor.

Then select a spline knot in the profile graph, and select an Ecosystem from the Ecosystem Drop box (see Cross-Section Profile Editor).

When you place an Ecosystem along a Terraffector, VNS will ignore all the Rules-of-Nature™ for the Ecosystem (see The Hard-Linked Vectors display tells you if there are any Vectors hard-linked to the Component, and if so, how many. It will also display vectors attached by Search queries and list the names of the search query or queries in use.).

General Page

Common Ecosystem Controls

Vector Polygon Rendering Enabled

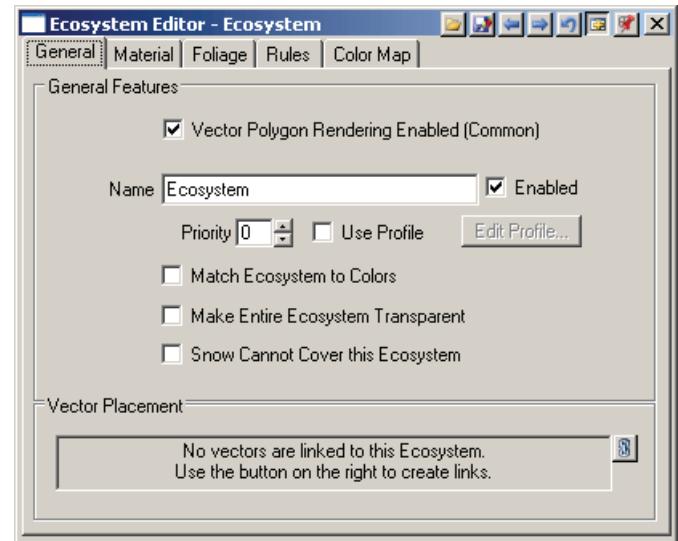
Deselecting this checkbox disables the rendering of all vector-bounded ecosystems.

General Features

Name Field

Enter a name for the Ecosystem. For example, if it is a rain forest Ecosystem, you might call it "Rain Forest".

By default VNS will name new Ecosystems "Ecosystem", and add a number after the name if there is more than one Ecosystem named "Ecosystem".



Enabled Checkbox

The Enabled checkbox lets you enable or disable the Ecosystem for rendering.

Disabling an Ecosystem can be useful to see what the scene would look like without that particular Ecosystem. Make sure you remember to enable it for the final rendering if you want to see the Ecosystem.

Note: To see the Ecosystem in your rendering, it must be attached to a Terraffector, Vector, Environment or Color Map. It must also be visible to the Camera you selected for the Render Job you are using (see Render Job Editor).

If the Ecosystem is applied with a Terraffector, then "Terraffectors" and "Other Foliage" must be enabled in the Render Options you are using (see Render Options Editor) and the Terraffector itself must be enabled (see Terraffector Editor).

If the Ecosystem is applied with a Color Map, then "Color Maps" must be enabled in the Render Options you are using (see Render Options Editor) and the Color Map itself must be enabled (see Color Map Editor).

If the Ecosystem is attached to a vector, then "Vector Ecosystems" must be selected in the Render Options you are using, and the Vector must be enabled in the Database Editor.

Priority Field

The Priority field lets you specify the rendering priority of the Component relative to other Components of the same category. A Component with a higher priority will be rendered before a Component in the same category that has a lower priority.

Render priority only matters where Components of the same category overlap. VNS will use the values from the highest-priority Component.

If there are overlapping Components of the same category that are each set to the same priority, VNS will mix them equally.

Use Profile Checkbox

Click the Use Profile checkbox when you want to control the amount of a Vector-bounded Ecosystem based on a gradient from the edge of the Vector Object's area toward the middle. This lets you fade the Ecosystem so it doesn't end abruptly at the outside edge of the Vector.

This is valid only with Ecosystems attached to Vectors.

When you first create a Vector-bounded Ecosystem VNS will create a default Edge Feathering Profile. The default Profile varies between no effect at the edge to the full effect 10 meters toward the middle of the Vector area. You can edit this Profile by clicking the Edit Profile button (see below).

Profiles add to rendering time and take additional memory to render.

Edit Profile Button

Click the Edit Profile button to open the Edge Feathering Profile Editor. There you can alter the Edge Feathering Profile to change the intensity of the Ecosystem from the edge of the vector inward.

This is valid only with Ecosystems attached to Vectors.

Match Ecosystem to Colors Checkbox

Select the Match Ecosystem to Colors checkbox when you want this Ecosystem to appear wherever a particular color or range of colors appears on a Color Map projected onto the terrain (see Color Map Editor).

Make Entire Ecosystem Transparent Checkbox

Select this checkbox to make the polygons that are textured with the Ecosystem completely invisible.

Snow Cannot Cover This Ecosystem Checkbox

Select this checkbox to keep snow from covering the Ecosystem. This is great for an Ecosystem that you are using for a Terraffector road, such as an asphalt Ecosystem. In that case, using this checkbox will plow the road.

Vector Placement Section

By attaching Vectors to Ecosystems you can control where they appear. Vectors can be dynamically linked with Search Queries or hard linked.

Vector Links Button

This control allows you to perform various tasks relating to the association of vectors with components. To learn how to use it, see Vector Links Icon.

Attached Hard-Linked Vectors Display

The Hard-Linked Vectors display tells you if there are any Vectors hard-linked to the Component, and if so, how many. It will also display vectors attached by Search queries and list the names of the search query or queries in use.

Material Page

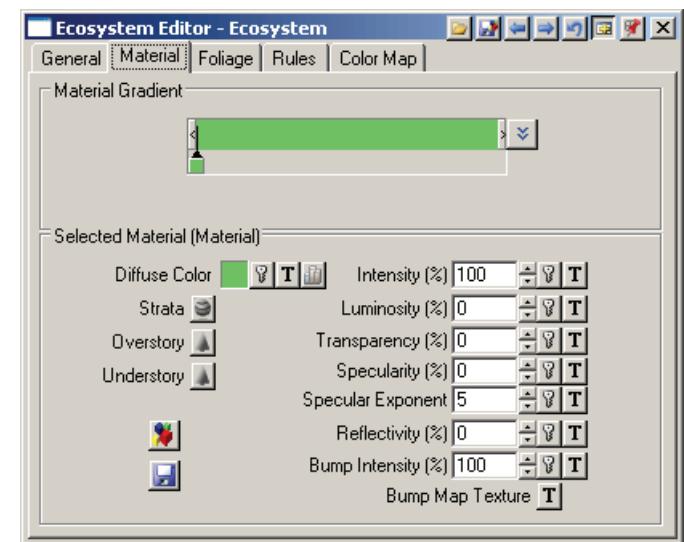
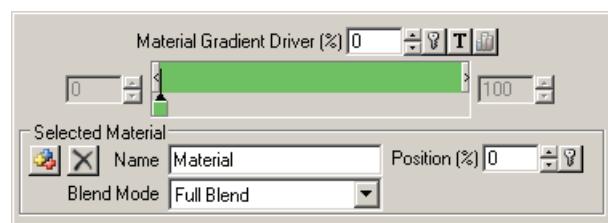
Material Gradient Section

Material Gradient and Driver

The Material Gradient controls let you add, remove and edit the materials to the Ecosystem.

Each material in an ecosystem comprises a set of properties (color, reflectivity, transparency etc), Strata, and foliage contained in Overstory and understory ecotypes.

To Access the Gradient, click on the Gradient popdown icon . This will display the Material Gradient Editor:



Material Gradient Driver Percentage Controls

The Material Gradient Driver field lets you pick a Material for the Ecosystem based on a position along the Material Gradient (see below).

Enter a percentage from zero to 100 where zero is the left edge of the gradient and 100 is the right edge. VNS will use the Material at the gradient position you specify. If there is no Material represented at that position, VNS will create a blend between the nearest two Materials.

You can animate the Material Gradient Driver percentage to change Materials over time. This is great for climate change animations where you could animate through a variety of Materials such as from a desert to a rain forest.

By clicking the Texture Control icon you can control the Material Gradient Driver percentage with the Texture Editor. This lets you use all the Materials in the Gradient. Textures can range in gray values from black to white, with black representing 0% on the Gradient and white representing 100% on the gradient.

For example, if you use a fractal noise Element in the texture that ranges from black to white, VNS will cover the Ecosystem's area with Materials in a fractal noise pattern ranging from the left-most Material in the Gradient to the right-most Material in the Gradient.

Another example: You could use a Dynamic Parameter of Elevation in the Texture Editor and set its Input Low field to the lowest elevation in your terrain and the Input Height field to the highest Elevation in your terrain. Then VNS will arrange the Materials in the Ecosystem's Material Gradient so that the Materials on the left side of the gradient will grow on the lower elevations and the Materials on the right side of the Gradient will grow on the higher elevations.

You can also drive the selection of ecosystem materials using a Thematic Map. For example, you could have an attribute in your controlling vectors that assigned a numeric value based on ecosystem, and by careful organization of your ecosystem materials on the gradient, use this attribute to populate all your vectors with one ecosystem, while each displayed a different material at rendertime.

Material Gradient

The Material Gradient shows a colored bar with one or more colored pins beneath it. The bar is a place to create Materials. Click it to create a new Material.

When you click the Gradient to create a new Material, VNS will give the new Material a random Diffuse Color. You can change the color by using the Diffuse Color Well to open the Color Editor.

VNS represents each Material with a pin that is colored with the Diffuse Color of the Material. Click any pin to select a Material.

Material Gradient Range Fields

The Material Gradient Range fields are on either side of the Material Gradient. They show the range of the value that controls the gradient.

If there's no texture enabled for the Material Gradient Driver, the range of the gradient is zero to 100 percent.

If there is a texture enabled for the Material Gradient Driver, then there are two cases:

1) The first Texture Element is a Dynamic Parameter.

In this case, the Range fields show the range of input values for the Dynamic Parameter you have selected. For example if Elevation is the Dynamic Parameter and the Elevation range in the texture editor (Input Low and Input High) is zero to 1000 meters, then in the Range fields you'll see zero on the left and 1000 on the right.

You can directly edit those texture values in the Ecosystem Editor's Range fields. This is handy because you don't have to reopen the Texture Editor if you want to edit these values.

2) The first Texture Element is not a Dynamic Parameter.

In this case, the Range fields are zero to 100 percent (representing values of 0 to 1 in the controlling texture, or black to white), and are non-editable.

Add Material Icon

Click the Add Material icon to add a new Material. VNS will ask for the position in the Gradient. Enter a position and click the OK button.

Alternatively you can click directly in the Gradient in a spot where no other Material exists.

VNS will create a new Material and give it a random Diffuse Color. The Material will be represented in the Gradient with a pin in the color of its Diffuse Color.

Remove Material Icon

Click the Remove Material icon if you want to delete the selected Material.

Material Name

The Material Name field lets you edit the Material's name. After you create a Material it will have a default name of "Material." It's a good idea to enter a unique name in the Material Name field to identify how you will use the Material. For example "sand," "forest" or "fall foliage."

Position in Gradient Field

The Position in Gradient field shows the percentage along the Gradient for the selected Material. You can move the Material's pin to the left by decreasing this number or to the right by increasing this number. You can also drag the pin along the Gradient with the mouse.

Blend Mode Drop Box

The Blend drop box lets you choose the rate of change between the selected Material and the Material to its left in the gradient.

These are easiest to visualize if you try them and see what they look like in the gradient. You can see how VNS blends Materials between the pins by how it blends the Diffuse Colors along the Gradient.

You can change the blending by selecting different blend types from the Blend Drop Box. If you have more than one material in the gradient, use the following choices to decide how the gradient blends the materials together.

Sharp Edge

Choose "Sharp Edge" if you want an instant change with no gradient.

Soft Edge

Choose "Soft Edge" to create a gradient that turns into the color to the left 1/10 of the way toward that color's pin.

Quarter Blend

Choose "Quarter Blend" to create a gradient that turns into the color to the left 1/4 of the way toward that color's pin.

Half Blend

Choose "Half Blend" to create a gradient that turns into the color to the left 1/2 of the way toward that color's pin.

Full Blend

Choose “Full Blend” to create a smooth gradient that turns into the color to the left at that color’s pin.

Fast Increase

Choose “Fast Increase” to create an accelerated gradient that gets closer to the previous color faster, and turns into the color to the left at that color’s pin.

Slow Increase

Choose “Slow Increase” to create an decelerated gradient that gets closer to the previous color slower, and turns into the color to the left at that color’s pin.

S-Curve

Choose “S-Curve” to create a narrower gradient between the pin and the previous color’s pin and leaves more of the original colors along the gradient in between.

Selected Material Section

Diffuse Color Well and buttons

The Ground Effect's Diffuse Color (or texture) always appears wherever the Selected Material's Ground Overlay appears, unless you set the transparency of the Material to 100%. Click the Diffuse Color well to edit the Diffuse Color in the Color Editor.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's Diffuse Color with texture patterns.

When you use a texture, the Colors in the texture will replace the Diffuse Color, unless you use less than 100% Opacity in the Texture Editor, in which case the texture and the Diffuse Color will be mixed.

Strata Icon

Click the Strata icon to open the Material Strata Editor. There you can add Strata texturing to the Material.

Overstory and Understory Ecotype Controls

Ecotypes let you add foliage to the Ecosystem.

There are two Ecotypes, an Overstory and an Understory. In nature, the Overstory represents taller trees while the Understory represents shorter foliage. You can add appropriate foliage to the Overstory Ecotype and Understory Ecotype to simulate this in VNS.

To create an Overstory or Understory, click the Overstory or Understory Ecotype Operations icon to see the Ecotype Operations commands. If there is no Ecotype yet created (icon has a gray background), select the Create Ecotype command. If there is an existing Ecotype (icon has a green background), select the Edit Ecotype command.

If you want to disable an Ecotype, click its Ecotype Operations icon and select the Disable Ecotype command. The icon will show a red diagonal stripe to indicate that there is an Ecotype but it's disabled. This is the same as deselecting the Ecotype Enabled checkbox on the General page of the Ecotype Editor for the Ecotype. VNS will ignore disabled Ecotypes for rendering.

If you want to enable a disabled Ecotype, click its Ecotype Operations icon and select the Enable Ecotype command. The icon will no longer show a red diagonal stripe. This is the same as selecting the Ecotype Enabled checkbox on the General page of the Ecotype Editor for the Ecotype.

If you want to delete an Ecotype, click its Ecotype Operations icon and select the Remove Ecotype command. Because this is destructive, VNS will ask you to confirm this choice. Click OK to remove the Ecotype forever.

If you want to copy an Ecotype, click its Ecotype Operations icon and select the Copy Ecotype command. If you want to paste an Ecotype, click the Ecotype Operations icon for the destination Ecotype and select the Paste Ecotype command.

If you want to make an Ecotype the Active Item, click its Ecotype Operations icon and select the Activate Ecotype command. VNS will make it the Active Item.

These tasks can also be performed using the relevant controls on the Foliage page.

Load and Save Material Icons

Clicking the relevant icon will either open the Component Gallery or the Component Signature Window, allowing you to load or save ecosystem materials as required.

Diffuse Intensity Field and Buttons

The diffuse intensity of a material is a measure of how much of the diffuse color of a surface is returned to the camera. Reducing this value to 0% will result in a black surface (i.e.: 0 color) and setting it to 100% will result in the pure diffuse color as set in the Diffuse Color Well.

You can animate the value over time, and also drive its intensity with a texture.

This attribute is useful for simulating dirt (try driving this field with a Fractal Noise texture element), streaks, moisture (drive Diffuse Intensity with a Dynamic parameter of Water Level or Elevation to simulate moist surfaces at the edges of lakes and streams etc.)

The maximum value for this parameter is 10000%.

Luminosity Percentage Field and Buttons

Luminosity affects how the Material is shaded by Lights (see Light Editor). You can adjust it to create 3D-shaded Objects, flat-shaded Objects or anything in-between.

With zero percent luminosity, the Material will be fully shaded by Lights. This produces a 3D look. In deeply shadowed areas, the Material's color will be a darker shade of itself based on the Ambient Light Intensity and Color. Where fully lit by Lights, the color will be the Diffuse Color or texture (see above) modulated by the Intensity and Color of any Lights.

By raising the luminosity, you can lighten the shaded areas. This can be useful to do if the terrain that uses the Material seems too dark. Raising the luminosity a little bit decreases the shading contrast for the Material.

With 100 percent luminosity, the Material will ignore Lights completely. This produces a flat, unshaded look. The Material will always be the Diffuse Color or texture. This can be useful for Materials used to create the flat, paper-cutout-style animations used by certain cartoon shows.

You can also subtract light by using negative luminosity to make the object tend toward the Ambient Light colors. With 100 percent negative luminosity, the Material will ignore Lights. The Material will be flat-shaded with the Ambient colors.

You can animate the Luminosity percentage to simulate lighting changes. This lets you animate the effect of nearby lightning or explosions.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's luminosity with a texture pattern. This can be useful for creating the look of glowing lava.

When you use a texture, a white value in the texture will equal the amount of luminosity you set in the Luminosity percentage field. A black value in the texture will equal zero luminosity. Gray values will be in-between.

Transparency Percentage Field and Buttons

Use the Transparency field to adjust how much you can see through the Ground Overlay. Zero percent will cover the terrain with opaque Ground Overlay. One hundred percent makes the Ground Overlay invisible, and you will instead see a Ground Effect on the terrain polygons. Anything in-between will mix the Ground Overlay with the Ground Effect.

Note: There is always at least one global Ground Effect in any VNS Project.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's transparency with a texture pattern to make some areas more transparent than others.

When you use a texture, a white value in the texture will equal the amount of Transparency you set in the Transparency percentage field. A black value in the texture will equal zero Transparency. Gray values will be in-between.

Specularity Percentage Field and Buttons

Specularity is the amount of shininess for a material.

Use the Specularity Percentage field to adjust the shininess of the material. Zero percent means no specular highlight, while 100 percent is maximum shininess.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's specularity value with texture patterns.

When you use a texture, a white value in the texture will equal the amount of Specularity you set in the Specularity percentage field. A black value in the texture will equal zero Specularity. Gray values will be in-between.

Specular Exponent Field and Buttons

Use the Specular Exponent field to adjust the size of the shiny spot. The useful range is from 1 to infinity. Higher numbers will produce a smaller spot, with less feathering at its edge.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's specular exponent value with texture patterns.

When you use a texture, a white value in the texture will equal the amount of Specular Exponent you set in the Specular Exponent field. A black value in the texture will equal zero Specular Exponent. Gray values will be in-between.

Reflectivity Field and Buttons

Terrain materials can now reflect their surroundings, as well as parts of their own geometry. This is ideal for simulating surfaces such as snowfields, or mirages.

Set this value to an amount greater than 0% to see reflections on these surfaces.

You can animate the value over time, and also drive its intensity with a texture.

The maximum value for this parameter is 10000%.

Bump Intensity Percentage Field and Bump Map Icon

Bump mapping lets you simulate detailed relief shadowing without requiring dense geometry. For more about using bump mapping, see Bump Mapping Controls.

Foliage Page

To create Ecotypes in VNS, perform the following:

- Add one or more Ecotypes using the controls on the Material Page, or directly to an existing (and selected) Material using the Ecotype Control Icon underneath the Foliage List on the Foliage Page.
- Add one or more Foliage Groups to each Ecotype using the Foliage Group Control Icon underneath the Foliage List on the Foliage Page.
- Add one or more Foliage Objects to each Group using the Foliage Object Control Icon underneath the Foliage List on the Foliage Page.
- Adjust the properties for each Foliage Object, Group and Ecotype on the parameters pages that appear when the appropriate item is selected in the Foliage List page.

You can specify height and density for each Foliage Object, Foliage Group and the entire Ecotype. You can even use textures to control height and density to create natural-looking foliage clumping based on procedural textures, images and dynamic parameters.

The way the controls interact depends on the choices you make on the General page. There you can configure the Ecotype to behave according to your needs.



Foliage Objects can be Image Objects or 3D Objects. Image Objects can be still images or animated sequences (see the Image Object Library section). Typically they will be images or animations of trees and other foliage, but they can be any images or animations of anything you like. If you have an animation of a dancing munchkin and want an entire forest of dancing munchkins, you can create that effect using Image Objects and the Ecotype Editor.

Using Pre-made Components

Click the Load Component From Disk Icon to see the Component Gallery, ready to load a pre-made Ecotype. Ecotypes are multiple groups of Foliage Objects with the Ecotype, Group and Object controls already set up. You can select from any previously created Ecotype files. Double-click the thumbnail image to load the Ecotype Component. VNS will reset the parameters of the Ecotype to those of the Component you selected.

You can create and export your own pre-built Ecotype Components from the Ecotype Editor by setting up the Ecotype the way you want it and then clicking the Save Component To Disk Icon. VNS will open the Component Signature Window where you can fill in the information, choose a representative image for the Component's thumbnail and save the Component in the Component Gallery.

For example, this makes it easy to create different kinds of forests with complex foliage mixes. You can later reuse the Ecotype another Project and have an instant complex forest.

Material Foliage List

This list will show the foliage associated with the currently selected Ecosystem Material. The selected Material name will be in brackets behind the Overstory and understory foliage types.

Note: Overstory and understory vegetation are simply logical groupings. There is no reason why they can not contain similar species, or why one can exist while the other doesn't.

Enabled Items in the list will be displayed in Bold text. Disabled Items will still be displayed, but not emboldened.

At the bottom of the Material Foliage List, there are the following Control Icons:



Add Ecotype

Click the Add Ecotype icon if you want to add a new Ecotype to the Material.

Note: An Ecotype must exist in the Material in order for there to be Foliage groups, and therefore Foliage Objects in that Material.



Remove Ecotype

Click the Remove Ecotype icon if you want to delete an Ecotype. VNS will remove the Ecotype from the Material, along with all associated Foliage groups and Foliage Objects in those Groups.

If the Ecotype existed when you last opened the Ecosystem Editor, you can undo the removal by clicking the Undo All Changes in this Window icon. Otherwise the Ecotype will be gone forever.

Add Foliage Group

Click the Add Foliage Group icon if you want to add a new Foliage Group to the Ecotype. VNS will ask for a name.

Note: You have to add at least one Foliage Group to an Ecotype before you can add Foliage Objects on the Objects page (see below).

Remove Foliage Group

Click the Remove Foliage Group icon if you want to delete a Foliage Group. VNS will remove the Foliage Group from the Ecotype.

If the Foliage Group existed when you last opened the Ecosystem Editor, you can undo the removal by clicking the Undo All Changes in this Window icon. Otherwise the Foliage Group will be gone forever.

Add Foliage Object

Click the Add Foliage Object icon to Create a new, blank entry in the Foliage Objects list.

Then choose either the Image Object or 3D Object radio button in the Selected Object section (see below). Finally, select an object from the drop box in the Image Object section or 3D Object section (see below).

Remove Foliage Object

If you want to remove a Foliage Object from the selected Foliage Group, select it in the Foliage Objects list and click the Remove Foliage Object icon.

VNS will ask if you want to remove the object. Click OK and VNS will remove it from the Foliage Group.

General Sub-Page

Ecotype Enabled Checkbox

The Enabled checkbox lets you enable or disable the Ecotype for rendering.

Note: You can also enable and disable an Ecotype from its Ecotype Operations icon on the Ecosystem, Lake or Stream Editor, wherever you first created the Ecotype. Select the icon's Disable Ecotype command to disable the Ecotype. The icon will be displayed with a red diagonal stripe to indicate that it's disabled. Select the icon's Enable Ecotype command to enable the Ecotype. The Ecotype will be enabled and the red stripe will disappear.

Disabling an Ecotype can be useful to speed up rendering if you are doing test renders to check some other aspect of your scene and don't need to see the Ecotype's foliage. Make sure you remember to enable it for the final rendering if you want to see the foliage.

Note: To see the Ecotype in your rendering, it must be part of an Ecosystem or Beach that is visible to the Camera you selected for the Render Job you are using (see Render Job Editor), and Other Foliage must be enabled in the Render Options you are using (see Render Options Editor).

Render Items Occluded By This Ecotype's Image Objects Checkbox

Selecting this checkbox will force VNS to render those elements of the scene obscured by this foliage effect. This will allow reflections to accurately represent terrain and foliage that has been hidden from the camera by this foliage effect. Select this checkbox if you are experiencing "holes" in reflections of terrain and foliage objects near to a Foliage Effect.

Common Distance Dissolve Section

The Common Distance Dissolve section lets you specify whether VNS will calculate Distance Dissolve Height based on an absolute pixel height or as a pixel height relative to a specified image size. This applies to all the Ecotypes and Foliage Effects in your Project (see also Foliage Effect Editor).

Distance Dissolve Height is the height at which VNS will stop rendering foliage Image Objects and instead render a color or texture. You can enable Distance Dissolve in the Image Object Distance Dissolve section (see below). There you can specify a pixel height for Image Objects at which VNS stops trying to render foliage and instead renders a simple color or a texture.

For example, if a tree is so far away that its height is below the Distance Dissolve Height in pixels, it will no longer be rendered and VNS will instead render the color or texture you specify. This can make rendering much, much faster because VNS can calculate a color or texture much faster than a combination of foliage. Rendering the actual trees and plants far in the distance may take a long time for little or no visual benefit.

The default choice is Absolute Pixels. The default value for Distance Dissolve Height is 2 pixels. This means that VNS will replace a foliage object with a color or texture whenever the foliage object is shorter than two pixels in your rendered image. This makes a lot of sense because you can't see a complete tree in two pixels anyway, so there's not much point wasting the rendering time in the attempt.

You can enable Distance Dissolve in the Image Object Distance Dissolve section (see below).

Absolute Pixels Radio Button

Select the Absolute Pixels radio button to choose a specific height in pixels below which VNS will no longer render an Image Object. VNS will instead replace the Image Object with the color or texture you specify in the Image Object Distance Dissolve section (see below).

By default, the Absolute Pixels radio button is selected.

Relative to Image Height Radio Button

Select the Relative to Image Height radio button to relate the minimum pixel height at which VNS will render Image Objects to the size of your rendered images. This will let you see a more consistent rendering no matter what size image you render. Image Object foliage will then appear in the same areas and be dissolved to a color or texture in the same areas at any image size.

When you use the Relative to Image Height option, VNS will automatically change the Distance Dissolve Height based on the size of your rendering. VNS does this by using the Image Reference Height you specify in the Image Object Distance Dissolve section (see below).

You may want to select this option in order for preview renderings in Views to give you a more accurate visual indication of where plants will actually be rendered in your final renderings. Views are typically rendered at a different resolution than your final renderings and may show different results if you use the Absolute Pixels option (see above).

If you are rendering the same scene for a poster and for a video animation, using the Relative to Image Height option will make the foliage dissolve away in the same places in both scenes.

Be careful with this option, it may add to rendering time when you render at lower resolutions than what is in the Image Reference Height field (see below). This is because as you decrease the size of the rendered image, VNS will correspondingly decrease the Distance Dissolve Height. You may then end up with VNS wasting time rendering Image Object foliage even for Image Objects that would be less than a single pixel in height.

Note: When you use the Relative to Image Height option VNS will take into account whatever constrained preview rendering size you use if you have selected the Constrain Render Area icon (see Constrain Render Area). Image height will be calculated using the pixel height of the constrained render area, not the pixel height of the View.

Distance Dissolve for this Ecotype Section

You can reduce rendering times by enabling Distance Dissolve and adjusting the Dissolve Height. Then Image Object foliage will transition to a fast-rendering color or a texture in the distance.

If you are using the Absolute Pixels option then the Dissolve Height is an absolute value in pixels (see the Common Distance Dissolve section above). This gives you the more efficient rendering.

If you are using the Relative to Image Height option then the Dissolve Height will be scaled depending on the resolution of your rendering (see the Common Distance Dissolve section above). This allows the most consistency between renderings at different resolutions, including preview renderings in a View.

Dissolve Enabled Checkbox

Select the Dissolve Enable checkbox to enable Distance Dissolve. Deselect it to disable Distance Dissolve.

Dissolve Height Field

Dissolve Height lets you control how small the rendered foliage can get in the distance before VNS replaces it with a color or texture.

If the Absolute Pixels radio button is selected in the Common Distance Dissolve section (see above), then this value will apply no matter what resolution you render your images.

If the Relative to Image Height radio button is selected in the Common Distance Dissolve section (see above), then this value will apply only for images that are rendered at the vertical resolution you enter into the Image Reference Height field (see below). VNS will scale the Dissolve Height for images rendered at a different horizontal resolution than specified in the Image Reference Height field. This allows Image Objects to change to a color or texture at the same place on the terrain no matter what resolution you render.

Image Reference Height Field

The "Image Ref. Ht." field is only available when you select the "Relative to Image Height" radio button in the Common Distance Dissolve section (see above).

Use the Image Reference Height field to specify the rendered image height in pixels at which the actual Dissolve Height value is used. This lets you control the amount of up or down Dissolve Height scaling that will occur when you render images at different resolutions. The

specified Dissolve Height will always be multiplied by the rendered image height (in pixels) divided by the Image Reference Height (in pixels).

The default Image Reference Height value is 480 pixels. You may want to set it to match the resolution of your preview renderings or your final image renderings.

Example

Let's look at how this works. Suppose you use an Image Reference Height of 480 pixels. If you render an image with a height of 480 pixels and you have an Ecotype that uses a Dissolve Height of 2 pixels, then any rendered images that are 480 pixels high will really have a Dissolve Height of 2 pixels for that Ecotype. $2 \times 480 / 480 = 2$

But if you render a preview image at half that resolution, 240 pixels, VNS will scale the Dissolve Height down by 50% and that Ecotype will have an actual Dissolve Height of 1 pixel in that rendered image. $2 \times 240 / 480 = 1$

If you render a poster with an image height of 1920 pixels, the actual Dissolve Height for the Ecotype in that image will become 8 pixels. $2 * 1920 / 480 = 8$.

The end result is that the Ecotype will dissolve out to a color or texture at the same place on the terrain in all three examples. This would not have been true if you were using the Absolute Pixels option in the Common Distance Dissolve section (see above).

Note: You can set the rendered image height with the Height field on the Size and Range page of the Render Options Editor.

The Image Reference Height is always the same for all Ecotypes and Foliage Effects. When you change it for one Ecotype or Foliage Effect you are changing it for all Ecotypes and Foliage Effects.

Note: All Ecotypes and Foliage Effects are also affected when you select either the Absolute Pixels radio button or the Relative to Image Height radio button in the Common Distance Dissolve section (see above).

However, the Dissolve Height is unique to each Ecosystem or Foliage Effect.

Dissolve Color Controls

Click the Dissolve Color well to open the Color Editor. There you can edit the color VNS will render on the terrain in the distance.

If you'd rather use a texture, click the Texture icon to open the Texture Editor. There you can create a more complex pattern to represent your distant foliage. Textures will take longer to render than a simple color.

Settings Sub-Page

Absolute Size Radio Buttons

Select the “Absolute Size is in Ecotype” radio button if you want to control the actual size of the Ecotype’s foliage using the Maximum Size field, on the Parameters page in the Ecotype Size section. You can then set the size of each Foliage Group as a percentage of the Ecotype’s Maximum Size.

Select the “Absolute Size is in Foliage Group” radio button if you want to set the actual size of each Foliage Group directly instead of setting each group as a percentage of the Ecotype Size. VNS will disable the Ecotype Size controls and you can directly set a Group Size and Group Minimum Size for each Foliage Group on the Groups page.

Note: In both cases, the size of each Foliage Object is a percentage of the size of the Foliage Group to which it belongs. You can set the size percentage for each Foliage Object.

However you choose to control the absolute size, you’ll set it in the units you selected in the Height field on the Units page of the Preferences Window.

Second Size Radio Buttons

The “Second Size is” radio buttons let you configure how the Ecotype Editor lets you control a second size for the Ecotype’s foliage.

Second Size is in Absolute Minimum radio button

Select the Second Size is in Absolute Minimum (Min) radio button if you want to be able to set a secondary Size as a specific, using the units you selected in the Height field on the Units page of the Preferences Window, and using the size method chosen in the Size Method section (see below).

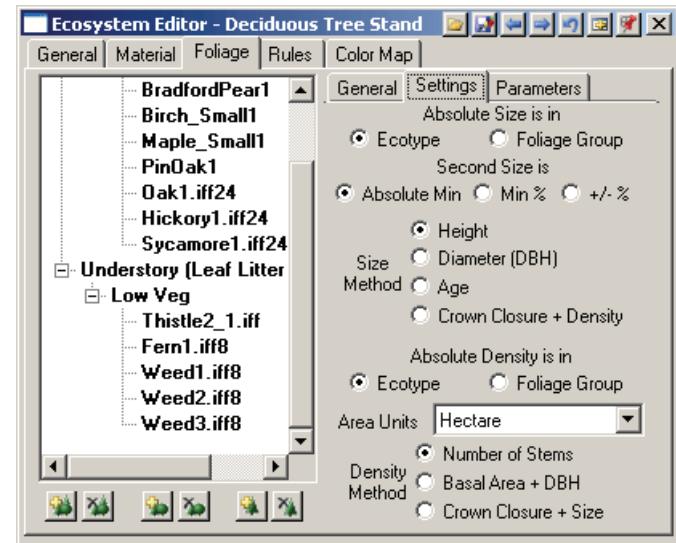
If you’ve selected the “Absolute Size is in Ecotype” radio button (see above), you can then control a minimum size for all Foliage Groups using the Minimum Size percentage field on the Parameters page.

If you’ve selected the “Absolute Size is in Foliage Group” radio button (see above), you can then control a minimum size for separately for each Foliage Group using the Group Minimum Size field on the Parameters page for a selected Foliage Group. This controls the minimum size separately for each Group.

Second Size is Minimum Percentage Radio Button

Select the Second Size is in Minimum (Min) percentage radio button if you want to be able to set the secondary size as a percentage of the absolute size.

If you’ve selected the “Absolute Size is in Ecotype” radio button (see above), you can then control a minimum size for all Foliage Groups using the Minimum Size Percentage field on the Parameters page. The minimum size of the Ecotype’s foliage will be a percentage of the value you entered into the Maximum Size field. VNS will vary the size of the foliage between these two sizes. You can further control the size of each Foliage Group by adjusting the Group Size percentage field on the Parameters page for each Foliage Group.



If you've selected the "Absolute Size is in Foliage Group" radio button (see above), you can instead control a minimum size for separately for each Foliage Group using the Group Minimum size field on the parameters page for a selected Foliage Group. This controls the minimum size separately for each Group.

Second Size is Plus or Minus a Percentage Radio Button

Select the Second Size is +/- percentage radio button if you want to be able to set the secondary size as a percentage range above and below the absolute size.

If you've selected the "Absolute Size is in Ecotype" radio button (see above), you can then control a range of size for all Foliage Groups using the Size Range Plus/Minus Percentage field on the Parameters page. The Ecotype's foliage will range in size as a percentage above or below the value you entered into the Maximum Size field. VNS will vary the size of the foliage within this percentage range. You can further control the size of each Foliage Group by adjusting the Group Size percentage field on the Parameters page for each Foliage Group.

If you've selected the "Absolute Size is in Foliage Group" radio button (see above), you can instead control a range of size separately for each Foliage Group using the Group Size Range Plus/Minus Percentage field on the Parameters page for a selected Foliage Group. This controls the size range separately for each Group.

Size Method Radio Buttons

VNS Forestry Edition offers four methods to specify the desired size of Ecotypes: Height, Diameter (DBH), Age or Crown Closure plus Density. Height is the most straight forward. You simply tell VNS how tall to make the foliage. But sometimes you might have other data that VNS can use to infer foliage heights indirectly. Diameter, age and crown closure are the three additional methods supported for Ecotypes.

If you wish to use either of the alternate methods, diameter or age, you will also need to tell VNS what the relationship is between diameter and height or age and height. You will do that by creating a graph of the relationship. A default graph is provided for your use if you lack real height relationship data.

If you wish to use crown closure your density values will be used in a formula along with the specified crown closure to infer the correct size of foliage to draw. There are some restrictions on the use of crown closure for size calculation which are discussed below.

Height Radio Button

Select the Height Radio Button if you wish to control foliage size directly with height values.

Diameter (DBH) Radio Button

Select the Diameter (DBH) Radio Button if you wish to control foliage size indirectly with diameter values and a diameter/height relationship graph. DBH stands for Diameter at Breast Height, a standard height above the ground for measuring tree diameters. You can use the Diameter (DBH) Size Method even if your tree diameters were measured at some other height from the ground. VNS does not care at which height diameters were measured so long as it is consistent with the DBH/Height graph that is used (see below).

Age Radio Button

Select the Age Radio Button if you wish to control foliage size indirectly with age values and an age/height relationship graph.

Crown Closure plus Density Radio Button

Crown Closure is a measure of the percentage of an area that has foliage directly overhead. The remaining area is open to the sky.

Select the Crown Closure plus Density Radio Button if you wish to control foliage size indirectly with crown closure percentage combined with whatever your density value is. The way this works is VNS first determines the foliage density for an area that is about to be drawn. Then from the density and the average width to height ratio of all the images or 3d objects that represent the Ecotype or Foliage Group (depending on whether the Absolute Size is in the Ecotype or Foliage Group), the size of foliage stems to be drawn for that area is calculated using a standard formula.

Note: Because foliage items are drawn in random positions there may be more overlap between items than would normally occur in nature. Therefore a specification of 100% crown closure will probably result in gaps between foliage items which would not be there if items were evenly spaced throughout the area. When you select Crown Closure plus Density you will not be able to select Crown Closure plus Size for the Density Method (see below) since they are mutually exclusive. Also Absolute Size and Absolute Density will be forced to agree to be in either Ecotype or Foliage Group since it is required that the density be available for use in the size calculation.

Absolute Density Radio Buttons

Select the “Absolute Density is in Ecotype” radio button if you want to specify the overall density of the Ecotype’s foliage for the entire Ecotype using the Density field in the Ecotype Density section on the Ecotype page. You can then set the density of each Foliage Group as a percentage of the Ecotype’s overall Density.

Select the “Absolute Density is in Foliage Group” radio button if you want to specify the density of each Foliage Group directly instead of setting each group as a percentage of the Ecotype Density. VNS will disable the Density field on the Ecotype page and you can directly set a Group Density for each Foliage Group using the Group Density field on the Groups page instead.

Note: In both cases, the density of each Foliage Object is a percentage of the density of the Foliage Group to which it belongs. You can set the density percentage for each Foliage Object on the Objects page.

Density Radio Buttons

The Ecotype page’s Density Field and the Group page’s Group Density field work differently depending on whether you select the “Density is per Polygon” or “Density is per Unit Area” radio button.

VNS lets you choose whether to have the Ecotype’s foliage density be linked to the polygon density for more efficient rendering or be a constant across the terrain. Polygon density is increased near the Camera when you render with Variable or Fractal Maps options on the Terrain Parameter Editor.

When you select Density is per Unit Area the VNS Forestry Edition allows you to choose the format of your density data. You can use actual stems per unit area, basal area or crown closure data to determine density. Which method you choose will affect the appearance of the Ecotype page’s Density Field and the Group page’s Group Density field.

Density per Polygon Radio Button

With the “Density is per Polygon” radio button selected, the Density or Group Density field lets you specify the percentage of polygons that will be covered with the Ecotype. Enter an integer value between 0 and 100 percent or use the arrow buttons to change the value. A value

of zero will cause no trees or textures to be rendered for the given Ecotype. A value of 100 will cause a tree or texture to be applied at all polygon sites where the Ecotype appears.

Note: For forestry work you will almost never use Density is per Polygon for timber ecotypes. For understory vegetation you might prefer to use Density is per Polygon for speedier rendering where the density is not very critical.

With Density per Polygon the density of the foliage is directly related to the polygon density. The more polygons you have, the more foliage you will have. Anything that affects the polygon density will also affect the tree density. This includes things like Fractal Depth, Variable Fractal Depth and Fractal Depth Maps.

You can increase the polygons available during rendering by increasing the Fractal Depth in the Terrain Parameter Editor. The foliage density will be different when you render at lower or higher Fractal Depth settings. To see how it all works out you'll have to render an image.

If you use Variable Fractal Depth, the foliage density will be higher nearer the Camera. If you use Fractal Depth Maps, the foliage density will be higher along the Camera path.

In many cases the varying tree density is not noticeable, and using Density per Polygon may render faster. But if you notice uneven tree density; if you want to be able to change fractal depth without changing the tree density; or if you see distant trees disappearing during an animation, use Density per Unit Area instead (see below).

When changing from Density per Polygon to Density per Unit Area, you will generally need to increase the density field between 5 to 10 times its previous value to get a similar look as the non-fixed scene. Use your judgment based on what you want it to look like.

Density per Unit Area Radio Button

Select the "Density is per Unit Area" radio button when you want the tree density to be unrelated to the polygon density. With the "Density is per Unit Area" radio button selected, the number of trees won't change when you raise or lower the fractal depth. The distribution of trees on the landscape will be consistent even if you are using variable fractal depth or fractal depth maps.

Note: For forestry work you will almost always use Density is per Unit Area for timber ecotypes. For understory vegetation you might prefer to use Density is per Polygon for speedier rendering where the density is not very critical.

When you select Density is per Unit Area the VNS Forestry Edition allows you to choose the format of your density data. You can use actual stems per unit area, basal area or crown closure data to determine density. Which method you choose will affect the appearance of the Ecotype page's Density Field and the Group page's Group Density field. In the paragraphs below the word Density will be used in a generic sense. It can be either stems per unit area, basal area or trunk per unit area or percentage of crown closure.

The Density you set in the Density or Group Density field is the actual number of foliage stems or basal area units per unit of area or the actual percentage of crown closure. You can select the kind of areal unit from the Area Units drop box (see below). To save rendering time, enter the lowest Density value that gives you the look you want. To see the result, render an image.

To make Density per Unit Area foliage render more efficiently, use the controls in the Image Object Distance Dissolve section to dissolve distant foliage to a color or texture (see below).

Increase the Density or Group Density value if you want to see more trees from the Ecotype. If it's an Overstory Ecotype, lower values can leave more bare spots where the Understory Ecotype will show through.

Area Units Drop Box

If you select the “Density is in Unit Area” radio button you can use the Area Units drop box to select the units for area density. Choose between stems per Hectare, Acre, Square Meter or Square Foot.

Density Method Radio Buttons

VNS Forestry Edition offers three methods to specify the desired density per unit area of Ecotype foliage: Number of Stems, Basal Area plus DBH, or Crown Closure plus Size. Number of Stems is the most straight forward. You simply tell VNS how many items of foliage to draw in a unit area of land. But sometimes you might have other data that VNS can use to infer foliage density indirectly. Basal area plus DBH and crown closure plus size are the three additional methods supported for Ecotypes.

If you wish to use crown closure your size values will be used in a formula along with the specified crown closure to infer the correct number of foliage stems per unit area. There are some restrictions on the use of crown closure for density calculation which are discussed below.

Note: Density Method Radio Buttons are disabled unless Density is per Unit Area (see above).

Number of Stems Radio Button

Select the Number of Stems Radio Button if you wish to control foliage density directly with the number of foliage stems per unit area. Be sure to select the appropriate areal unit with the Area Units drop box (see above).

Basal Area plus DBH Radio Button

Basal Area is a measure of the area of tree trunk within some unit of land area. A typical expression would be: 100 square feet of basal area per acre. That would indicate that all the trees in an acre combine to have a cross-sectional area, of 100 square feet. Basal area is usually measured at breast height four and a half feet above the ground. By combining an average diameter, also measured at the same height, with the basal area, an actual number of foliage stems per area of land can be calculated with a simple formula.

Select the Basal Area plus DBH Radio Button if you wish to control foliage density indirectly with basal area and diameter (DBH) values. In the Ecotype Size & Density section of the Ecotype page or the Selected Group section of the Groups page you will need to supply both a diameter and a basal area value. If the Size Method is Diameter (DBH) then that diameter will be used in the density calculation as well as in computing the foliage size. You will also be asked to supply the units for the basal area value. Typical units are square feet and square meters. The basal area units will usually be different than the Area Units selected on the General page because they represent quantities with different orders of magnitude.

Note: You can only have the combination of Basal Area plus DBH for the Density Method and Diameter (DBH) for the Size Method if Absolute Size and Absolute Density are both in either Ecotype or in Foliage Group. Otherwise selections will be greyed out to indicate they are not valid combinations.

Crown Closure plus Size Radio Button

Crown Closure is a measure of the percentage of an area that has foliage directly overhead. The remaining area is open to the sky.

Select the Crown Closure plus Size Radio Button if you wish to control foliage density indirectly with crown closure percentage combined with whatever your size value is. The way this works is VNS first determines the average foliage size for an area that is about to be drawn.

Then from the size and the average width to height ratio of all the images or 3d objects that represent the Ecotype or Foliage Group (depending on whether the Absolute Density is in the Ecotype or Foliage Group), the number of foliage stems to be drawn for that area is calculated using a standard formula.

In forestry practice 100% would be the highest amount of closure that could be achieved by a single layer of forest canopy. In VNS higher percentages are permitted so you can compensate for the overlapping of foliage stems that result from pseudo-random foliage placement. Closure values of 200% or 300% may be necessary to achieve the full coverage of an area without intervening gaps of significant size. Naturally this results in more foliage items being drawn than would really be there for 100% closure.

Note: Because foliage items are drawn in random positions there may be more overlap between items than would normally occur in nature. Therefore a specification of 100% crown closure will probably result in gaps between foliage items which would not be there if items were evenly spaced throughout the area. To compensate for that you may wish to use two or three times the amount of crown closure to achieve the correct look for the foliage density. If you are using a Thematic Map to control crown closure you can set a multiplier value of 2 or 3 in the Thematic Map's Data page to adjust your database values appropriately. When you select Crown Closure plus Size you will not be able to select Crown Closure plus Density for the Size Method (see above) since they are mutually exclusive. Also Absolute Size and Absolute Density will be forced to agree to be in either the Ecotype or Foliage Group since it is required that the size be available for use in the density calculation.

Parameters Sub-Page

The Ecotype Size section's fields are available if you select the Absolute Size is in Ecotype radio button on the Settings Sub-Page (see above).

Note: These fields let you adjust foliage sizes for the entire Ecotype. You can further adjust foliage sizes for each of the Ecotype's Foliage Groups and for individual Foliage Objects by selecting the relevant Group or Object and using the context sensitive controls which appear (see below). You can also adjust Foliage sizes for all the foliage from all Ecosystems used within an Environment. To do so, use the Foliage Height Factor field on the Foliage and Gradients page of the Environment Editor.

Depending on the Size Method you choose on the General Page (see above) you will see different controls in the Size & Density section. All have the same purpose - to let you specify the largest or average size and a second size which may be either a smaller size, a percentage size or a percentage range depending on the Second Size type selected on the General Page.

Maximum Height Field

Use the Maximum Height field to specify the upper limit for how tall you'd like the foliage in this Ecotype to appear. This control only appears if the Size Method is Height and if the Second Size is Absolute Minimum or Second Size is Minimum Percentage on the General Page (see above).

Enter a value for the Maximum Height field in the units you selected for height on the Units page of the Preferences Window.

Mean Height Field

Use the Mean Height field to specify the average for how tall you'd like the foliage in this Ecotype to appear. This control only appears if the Size Method is Height and the Second Size is Plus or Minus Percentage on the General Page (see above).

Enter a value for the Maximum Height field in the units you selected for height on the Units page of the Preferences Window.

Maximum DBH Field

Use the Maximum DBH field to specify the upper limit for how large you'd like the foliage in this Ecotype to appear. This control only appears if the Size Method is Diameter (DBH) and if the Second Size is Absolute Minimum or Second Size is Minimum Percentage on the General Page (see above). DBH stands for Diameter at Breast Height, a standard height above the ground for measuring tree diameters.

Enter a value for the Maximum Diameter field in the units you selected for distance on the Units page of the Preferences Window. Diameter is usually specified as diameter at breast height (DBH) but it does not really matter to VNS how your diameter is measured.

Mean DBH Field

Use the Mean DBH field to specify the average for how large you'd like the foliage in this Ecotype to appear. This control only appears if the Size Method is Diameter (DBH) and the Second Size is Plus or Minus Percentage on the General Page (see above).

Enter a value for the Maximum Diameter field in the units you selected for distance on the Units page of the Preferences Window. Diameter is usually specified as diameter at breast height (DBH) but it does not really matter to VNS how your diameter is measured.

Edit DBH/Height Graph Button

VNS needs to convert the diameters you give it to heights which can be rendered. To do this you must specify a Diameter/Height graph.

The Edit DBH/Height Graph Button only appears if the Size Method is Diameter.

Click the Edit DBH/Height Graph Button to open an editor for the Diameter/Height Graph. Modify the default curve by adjusting points up or down or changing the distance of points in the graph. You can also add or remove points to achieve the diameter/height relationship that describes the foliage in this Ecotype. The same curve will be applied to all Foliage Objects in this Ecotype. If you wish to use a different graph for each Foliage Group then you should select Absolute Size is in Foliage Group on the General Page.

Horizontal units in the graph are the units you selected for distance on the Units page of the Preferences Window. Vertical units in the graph are the units you selected for height on the Units page of the Preferences Window.

Maximum Age Field

Use the Maximum Age field to specify the upper limit for how old you'd like the foliage in this Ecotype to appear. This control only appears if the Size Method is Age and if the Second Size is Absolute Minimum or Second Size is Minimum Percentage on the General Page (see above).

Enter a value for the Maximum Age field in any units you wish. The units do not matter to VNS.

Mean Age Field

Use the Mean Age field to specify the average for how old you'd like the foliage in this Foliage Effect to appear. This control only appears if the Size Method is Age and the Second Size is Plus or Minus Percentage on the General Page (see above).

Enter a value for the Mean Age field in any units you wish. The units do not matter to VNS.

Edit Age/Height Graph Button

VNS needs to convert the ages you give it to heights which can be rendered. To do this you must specify an Age/Height graph.

The Edit Age/Height Graph Button only appears if the Size Method is Age.

Click the Edit Age/Height Graph Button to open an editor for the Age/Height Graph. Modify the default curve by adjusting points up or down or changing the distance of points in the graph. You can also add or remove points to achieve the age/height relationship that describes the foliage in this Ecotype. The same curve will be applied to all Foliage Objects in this Ecotype. If you wish to use a different graph for each Foliage Group then you should select Absolute Size is in Foliage Group on the General Page.

Horizontal units in the graph are dimensionless. Vertical units in the graph are the units you selected for height on the Units page of the Preferences Window.

Maximum Closure Field

Use the Maximum Closure field to specify the upper limit for crown closure of this Ecotype. This control only appears if the Size Method is Crown Closure plus Density and if the Second Size is Absolute Minimum or Second Size is Minimum Percentage on the General Page (see above).

Enter a value for the Maximum Closure field in units of percentage ranging from 0 to 100 or more. VNS allows percentage closure values in excess of the normal 100% to accommodate overlapping between foliage items which reduces the apparent closure.

Mean Closure Field

Use the Mean Closure field to specify the average for crown closure of this Ecotype. This control only appears if the Size Method is Crown Closure plus Density and the Second Size is Plus or Minus Percentage on the General Page (see above).

Enter a value for the Mean Closure field in units of percentage ranging from 0 to 100 or more. VNS allows percentage closure values in excess of the normal 100% to accommodate overlapping between foliage items which reduces the apparent closure.

Controlling Size with a Texture

If you want to control foliage size with a texture, click the Texture Operations icon next to the field for the variable you want to control, which in this case is Maximum Height, DBH, Age or Closure.

Select the Create Texture command from the Texture Operations icon's commands and VNS will create a new texture and open the Texture Editor. There you can edit your texture to control the variable. Wherever the Texture is white, you'll have the full size using the value you set in the field for the controlled variable. Wherever the texture is gray you'll have less size and where it is black you'll have zero height. This is a good way to make naturally varied foliage sizes.

Controlling Size with a Thematic Map

If you want to control foliage size with a Thematic Map, click the Thematic Map Operations icon next to the field for the variable you want to control, which in this case is Maximum Height, DBH, Age or Closure.

Select the Create Thematic Map command from the Thematic Map Operations Icon's commands and VNS will create a new Thematic Map and open the Thematic Map Editor. There you can select one or more Vector attributes to control the variable. In this case the Height, DBH, Age or Closure value will be inherited from the Vector attribute you select. The attribute value comes from the Ecosystem's attached Vector. This is a good way to let your GIS data control actual foliage size in VNS.

The units in which height or diameter should be represented by the Thematic map are meters. The units in which age should be presented do not matter to VNS so long as they are consistent with the Age/Height graph. The units in which crown closure should be presented are percentage normally ranging from 0 to 100 but may be higher if desired. You can use the Data Multiplier field in the Data Input section of the Data page of the Thematic Map Editor to correct for data provided in the wrong units.

Second Size Field

The second size field lets you control Minimum Size, Minimum Size Percentage or Size Range Plus or Minus Percentage depending on your Second Size radio button selection on the General page (see above).

The actual label for the Second Size field will either say Height, DBH, Age or Closure instead of Size, depending on your selection of Size Method on the General page (see above).

If you select the Second Size is Absolute Min (Minimum) on the General page, the second size field will be labelled Minimum Height, Minimum DBH, Minimum Age or Minimum Closure. Enter the appropriate size you want for the smallest foliage in the Ecotype. When you render, VNS will place trees with a random mix of sizes from the minimum size you specified in the Minimum Size field up to the maximum size you specified in the Maximum Size field (see above).

Note: The Minimum Height field uses the units you selected for height on the Units page of the Preferences Window. The Minimum DBH field uses the units you selected for distance there. Minimum Age has no specific units as far as VNS is concerned. Minimum Closure is expressed as a percent normally varying between 0 and 100 but may be higher if desired.

If you select the Second Size is Min (Minimum) Percentage on the General page, the second size field will be labelled Min Height (Percentage of Max), Min DBH (Percentage of Max), Min Age (Percentage of Max) or Min Closure (Percentage of Max). Enter the size you want for the smallest foliage in the Ecotype as a percentage of the Maximum Size field. When you render, VNS will place trees with a random mix of sizes from the Minimum Size percentage you specified in the Min Size (Percentage of Max) field up to the maximum size you specified in the Maximum Size field (see above).

If you select the Second Size is Plus or Minus Percentage on the General page, the second size field will be labelled Height Range (Plus or Minus Percentage), DBH Range (Plus or Minus Percentage), Age Range (plus or minus percentage) or Closure Range (plus or minus percentage). Enter the size you want for the largest and smallest foliage in the Ecotype as a percentage above and below the value in the Mean Size field. When you render, VNS will place trees with a random mix of sizes ranging above and below the value you specified in the Mean Size field (see above).

You can also adjust the size for each Group on the Groups page and for each Foliage Object on the Objects page.

Ecotype Density Section

The Ecotype Size & Density section's density fields are available if you select the Absolute Density is in Ecotype radio button on the General page (see above).

Note: These fields let you adjust foliage densities for the entire Ecotype. You can further adjust foliage densities for each of the Ecotype's image groups on the Groups page, and for individual Foliage Objects on the Objects page (see below).

Depending on the Density Method you choose on the General Page (see above) and whether you choose Density is per Polygon or per Unit Area you will see different controls in the Size & Density page's density fields. All have the same purpose - to let you specify the number of foliage items to be drawn in a given area of land.

VNS lets you choose whether to have the foliage density be linked to the polygon density for more efficient rendering or be a constant across the terrain. Polygon density is increased near the Camera when you render with Variable or Fractal Maps options on the Terrain Parameter Editor.

The Ecotype page's Density Field works differently depending on whether you select the "Density is per Polygon" or "Density is per Unit Area" radio button on the General page.

If the Density is per Unit Area radio button selected on the General page, the Density you set in the Density field is the actual number of foliage stems per unit or the actual basal area per unit or the actual crown closure. You can select the kind of unit from the Area Units drop box on the General page. To save rendering time, enter the lowest Density value that gives you the look you want.

If the Density is per Unit Area and the Area Units is Acre, the Density field will either be labelled Density (Stems per Acre), Basal Area (BA per Acre) or Crown Closure (percentage). These labels correspond with the Density Method selections Number of Stems, Basal Area plus DBH or Crown Closure plus Size, respectively.

Density (Stems per Unit) Field

Use the Density (Stems per Unit) field to specify the actual average number of foliage items to be drawn within a typical area of Unit size. So if you enter 100 and the areal units are acres the result would be approximately 100 foliage items in a one acre parcel of land. For smaller areas, fewer items will be drawn and conversely larger areas will contain more.

Keep in mind that you are telling the average number to draw. There will be some random variation from one unit parcel to another and the items will be placed randomly within the area. There may be some places where items are very close together and other places where they are farther apart leaving natural looking gaps. You can gain more control over the arrangement by using a patterned texture to modify density (see below).

Density (Stems per Unit) field is only visible if the Density Method on the General page is Number of Stems.

Basal Area (BA per Unit) Field

Use the Basal Area (BA per Unit) field to specify the average amount of basal area of trunk to be used in calculating the actual average number of foliage items to be drawn within a typical area of Unit size. Basal Area will be combined with the diameter (DBH) specified for the area to make the calculation. If you have not chosen Diameter (DBH) for your Size Method on the General page, you will need to specify the DBH as well.

Enter a value for the Basal Area (BA per Unit) field in the units you selected for basal area in the Basal Area Units drop box to the right.

Basal Area (BA per Unit) field is only visible if the Density Method on the General page is Basal Area plus DBH.

Basal Area Units Drop Box

Use the Basal Area Units drop box to specify the units that basal area is measured in. This will probably be a different unit from the Area Units on the General page although it doesn't have to be. Be sure to set this correctly as it can have a very large effect on the number of foliage items drawn. Incorrect values can cause extremely high foliage densities and very slow rendering.

Basal Area Units drop box is only visible if the Density Method on the General page is Basal Area plus DBH.

Diameter (DBH) Field

Use the Diameter (DBH) field to specify the average trunk diameter to use in calculating the number of foliage items to draw in a given unit area. Diameter is part of the formula for converting basal area into number of stems. DBH stands for Diameter at Breast Height, a standard height above the ground for measuring tree diameters.

Enter a value for the Diameter (DBH) field in the units you selected for distance on the Units page of the Preferences Window.

Diameter (DBH) field is only visible beneath the Basal Area (BA per Unit) field if the Density Method on the General page is Basal Area plus DBH and the Size Method is not Diameter (DBH). If the Size Method is Diameter (DBH) then the size control DBH values will be used to compute density in conjunction with the basal area (see Ecotype Size Controls above).

Crown Closure (Percentage) Field

Use the Crown Closure (Percentage) field to specify the average amount of crown closure for this Ecotype. Crown Closure is a measure of the percentage of an area that has foliage directly overhead. The remaining area is open to the sky.

Enter a value for the Crown Closure in percentage. The normal range is from 0 to 100 but you may use larger values if you wish to achieve the proper appearance.

Crown Closure (Percentage) field is only visible if the Density Method on the General page is Crown Closure plus Size.

The way crown closure is used is VNS first determines the average foliage size for an area that is about to be drawn. Then from the size and the average width to height ratio of all the images or 3d objects that represent the Ecotype or Foliage Group (depending on whether the Absolute Density is in the Ecotype or Foliage Group), the number of foliage stems to be drawn for that area is calculated using a standard formula.

Note: Because foliage items are drawn in random positions there may be more overlap between items than would normally occur in nature. Therefore a specification of 100% crown closure will probably result in gaps between foliage items which would not be there if items were evenly spaced throughout the area. To compensate for that you may wish to use two or three times the amount of crown closure to achieve the correct look for the foliage density. If you are using a Thematic Map to control crown closure you can set a multiplier value of 2 or 3 in the Thematic Map's Data page to adjust your database values appropriately.

To see the result of your density settings, render a final image from the Render Control Window.

Note: Preview renderings may not show densities accurately if your View is significantly smaller than the final rendered image size you set in the set of Render Options you're using in the Render Job. This is especially true if you are using Image Object Distance Dissolve (see below) with Common Distance Dissolve set to Absolute Pixels.

If the Density is per Polygon radio button selected on the General page, the Density field lets you specify the percentage of polygons that will be covered with the Ecotype. Enter an integer value between 0 and 100 percent or use the arrow buttons to change the value. A value of zero will cause no trees or textures to be rendered for the given Ecotype. A value of 100 will cause a tree or texture to be applied at all polygon sites where the Ecotype appears.

Note: With the Density is per Polygon radio button selected, the more polygons you have, the more trees you will have. You can increase the polygons available during rendering by increasing the Fractal Depth in the Terrain Parameter Editor. To see how it all works out you'll have to render an image.

Increase the Density value if you want to see more trees from the Ecotype. If the Ecotype is an Overstory, lower values will leave more bare spots where the Understory Ecotype can show through.

Controlling Density with a Texture

If you want to control density with a texture, click the Texture Operations Icon next to the field for the variable you want to control, which in this case is Ecotype Density.

Select the Create Texture command from the Texture Operations Icon's commands and VNS will create a new texture and open the Texture Editor. There you can edit your texture to control the variable. Wherever the Texture is white, you'll have the full density using the value you set in the Density field. Wherever the texture is gray you'll have less density and where it is black you'll have no density. This is a good way to make naturally clumpy groups of foliage.

Controlling Density with a Thematic Map

If you want to control density with a Thematic Map, click the Thematic Map Operations Icon next to the field for the variable you want to control, which in this case is Ecotype Density.

Select the Create Thematic Map command from the Thematic Map Operations Icon's commands and VNS will create a new Thematic Map and open the Thematic Map Editor. There you can select one or more Vector attributes to control the variable. In this case the density value will be inherited from the Vector attribute you select. The attribute value comes from the Ecosystem's attached Vector. This is a good way to let your GIS data control actual foliage density in VNS.

Foliage Group Controls

The following controls appear when the selected item in the Material Foliage List is a Foliage group:

Load Foliage Group Icon

Click the Load Foliage Group icon to open the Component Gallery where you can load a Foliage Group Component.

Save Foliage Group Icon

Click the Save Foliage Group icon to open the Component Signature Window where you can save the selected Foliage Group as a Component for use in other Projects.

Name Field

Whenever you create a Foliage Group VNS asks you for a name. You can change the name of a Foliage Group by selecting it in the Foliage Group list and changing it in the Name field.

Group Enabled Checkbox

Select the Group Enabled checkbox to make the Group available for rendering. Deselect it if you want to disable the Group for rendering.

Group Size Controls

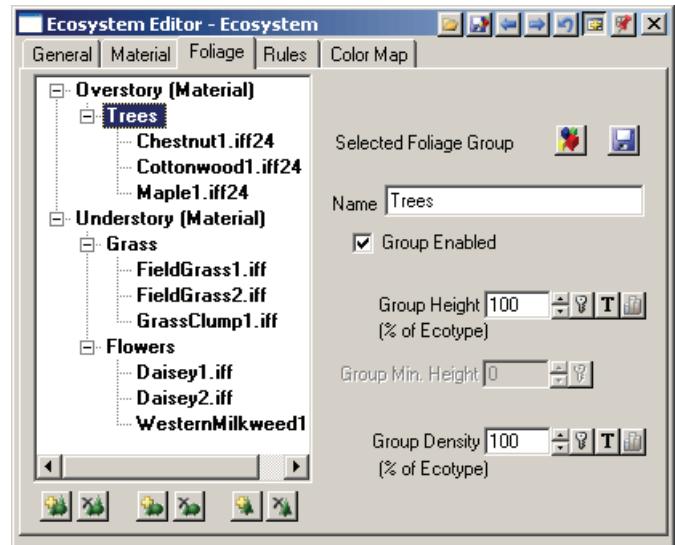
Each Foliage Group has its own size specification. This determines how large the Foliage Objects in the Group are compared to other Foliage Groups in the Ecotype. You can also adjust the relative size of each Foliage Object in the Group on the Parameters sub-page for the selected Foliage Object (see below). This gives you tremendous flexibility to customize an Ecotype.

Note: If you don't care for subtleties, just select the "Absolute Size is in Ecotype" radio button on the General page, leave all the group heights set to 100% on the Parameters sub-page for Foliage Groups and Foliage Objects and modify the values on the Parameters sub-page for the Ecotype to get the right look.

If you selected the "Absolute Size is in Ecotype" radio button on the Settings sub-page, you'll control the actual size of the Foliage Group's foliage using one of the Maximum or Mean Size fields on the Settings sub-page. You can then set the relative size of each Foliage Group here with the Group Height field as a percentage of the Ecotype's Maximum Size.

If you selected the "Absolute Size is in Foliage Group" radio button on the General page, you'll control the actual size of each Foliage Group directly instead of setting each group as a percentage of the Ecotype Size. VNS will disable the Ecotype Size controls and you can directly set a Group Size and a secondary size for each Foliage Group on the Parameters sub-page.

For a more detailed explanation of all the possible configurations you might see in the Group Size section see the section above for Ecotype Size Controls. When you select the "Absolute Size is in Foliage Group" radio button on the General page, all of the controls and options described in Ecotype Size Controls on the Ecotype page will be disabled and will instead appear in the Group Parameter sub-page.



There may also be additional buttons here to allow you to edit a diameter/height graph or an age/height graph depending on the Size Method you have chosen. Each Group can have its own different graph.

Second Size Field

The second Size field lets you control Minimum Size, Minimum Size (Percentage of Max) or Size Range (Plus or Minus Percentage) depending on your Second Size radio button selection on the General page (see above). Exactly what the labels say depends also on the Size Method selected on the Settings sub-page (see above). Second Size Field is only available if Absolute Size is in Foliage Group.

If you select the Second Size is Absolute Min (Minimum) on the Settings sub-page, the second Size field will be labelled Group Minimum Height, Group Minimum DBH, Group Minimum Age or Group Minimum Closure. Enter the size you want for the smallest foliage in the Foliage Group. When you render, VNS will place trees with a random mix of sizes from the Group Minimum Size you specified in the Minimum Size field up to the Maximum Size you specified in the Group Maximum Size field (see above).

Note: The Group Minimum Height field uses the units you selected for height on the Units page of the Preferences Window. the Group Minimum DBH field uses the units you selected for distance on the Units page of the Preferences Window.

If you select the Second Size is Min (Minimum) Percentage on the Settings sub-page, the second Size field will be labelled Group Min Height (Percentage of Max), Group Min DBH (Percentage of Max), Group Min Age (Percentage of Max) or Group Min Closure (Percentage of Max). Enter the size you want for the smallest foliage in the Foliage Group as a percentage of the Group Maximum Size field. When you render, VNS will place trees with a random mix of sizes from the Group Minimum Size percentage you specified in the Group Min Size (Percentage of Max) field up to the Maximum Size you specified in the Group Maximum Size field (see above).

If you select the Second Size is Plus or Minus Percentage on the Settings sub-page, the second Size field will be labelled Group Height Range (Plus or Minus Percentage), Group DBH Range (Plus or Minus Percentage), Group Age Range (Plus or Minus Percentage) or Group Closure Range (Plus or Minus Percentage). Enter the size you want for the largest and smallest foliage in the Foliage Group as a percentage above and below the value in the Group Mean Size field. When you render, VNS will place trees with a random mix of sizes ranging above and below the value you specified in the Group Mean Size field (see above).

If you wish you can control the group's size with a Thematic Map or a texture. See the Ecotype Size Controls section above for more details. Each Foliage Group can have its own size texture or Thematic Map. It can be very useful to drive the size of each group separately from a different database attribute depending on the design of your database. Thematic Maps can be used to adjust group relative percentages too if the Absolute Size is in Ecotype. In that case the Thematic Map should generate values of percentage ranging from 0 to 100. Otherwise Thematic Maps should generate values in meters of height or diameter. Age has no specific units. Closure should generate values of percentage from 0 to 100, or higher if needed.

Group Density Percentage Controls

Each Foliage Group has its own density specification. This determines how often the object is repeated compared to other Foliage Objects in the Ecotype. You can also adjust the density of each Foliage Object in the Group on the Parameters sub-page for the selected Foliage Object (see below). This gives you tremendous flexibility to customize an Ecotype.

Note: If you don't care for subtleties, just select the "Absolute Density is in Ecotype" radio button on the Settings sub-page, leave all the densities set to 100% on the Parameters sub-page for Foliage Groups and Foliage Objects and tweak the values on the Ecotype page to get the right look.

If you select the Absolute Density is in Foliage Group radio button on the Settings sub-page (see above) you can then set the absolute density of each Foliage Group on the Parameters sub-page.

If you select the Absolute Density is in Ecotype radio button on the Settings sub-page you can then set the density of each Foliage Group as a percentage of the Ecotype's overall density.

In either case you can set the density of individual Foliage Objects on the Objects page as a percentage of the Group's density.

VNS lets you choose whether to have the foliage density be linked to the polygon density for more efficient rendering or be a constant across the terrain. Polygon density is increased near the Camera when you render with Variable or Fractal Maps options on the Terrain Parameter Editor. For forestry work you will almost always use Density is per Unit Area for timber ecotypes. For understorey vegetation you might prefer to use Density is per Polygon for speedier rendering where the density is not very critical.

The Parameters sub-page's Group Density fields work differently depending on whether you select the "Density is per Polygon" or "Density is per Unit Area" radio button on the General page.

If you selected the "Absolute Density is in Ecotype" radio button on the Settings sub-page, you'll control the actual density of the Foliage Group's foliage using one of the density fields on the Parameters sub-page. You can then set the relative density of each Foliage Group here with the Group Density field as a percentage of the Ecotype's Density.

If you selected the "Absolute Density is in Foliage Group" radio button on the Settings sub-page, you'll control the actual density of each Foliage Group directly instead of setting each group as a percentage of the Ecotype Density. VNS will disable the Ecotype Density controls and you can directly set a Group Density for each Foliage Group on the Parameters sub-page.

For a more detailed explanation of all the possible configurations you might see in the Group Density section see the section above for Ecotype Density Controls. When you select the "Absolute Density is in Foliage Group" radio button on the Settings sub-page, all of the controls and options described in Ecotype Density Controls on the Ecotype page will be disabled and will instead appear in the Parameters sub-page for the selected Foliage Group. There may also be additional controls here to allow you to select special units such as for basal area.

To see the result of your density settings, render a final image from the Render Control Window.

Note: Preview renderings may not show densities accurately if your View is significantly smaller than the final rendered image size you set in the set of Render Options you're using in the Render Job. This is especially true if you are using Image Object Distance Dissolve (see below) with Common Distance Dissolve set to Absolute Pixels.

If the Density is per Polygon radio button selected on the Settings sub-page, the Group Density field lets you specify the percentage of polygons that will be covered with the Foliage Group. Enter an integer value between 0 and 100 percent or use the arrow buttons to change the value. A value of zero will cause no trees or textures to be rendered for the given Group. A value of 100 will cause a tree or texture to be applied at all polygon sites where the Group appears.

Note: With the Density is per Polygon radio button selected, the more polygons you have, the more trees you will have. You can increase the polygons available during rendering by increasing the Fractal Depth in the Terrain Parameter Editor. To see how it all works out you'll have to render an image.

Increase the Group Density value if you want to see more trees from the Foliage Group. If the Ecotype is an Overstorey, lower values will leave more bare spots where the Understorey Ecotype can show through.

If you wish you can control the group's density with a Thematic Map or a texture. Thematic Maps should generate values of percentage ranging from 0 to 100.

Foliage Object Controls

Image Object or 3D Object Radio Buttons

These radio buttons let you select whether the selected Foliage Object should be an Image Object or a 3D Object.

If you select the Image Object radio button, VNS will show the Image Object section at the bottom of the Objects page (see below). There you can select an Image Object and adjust its properties.

If you select the 3D Object radio button, VNS will show the 3D Object section at the bottom of the Objects page (see below). There you can select a 3D Object and adjust its properties.

Enabled Checkbox

The Enabled checkbox lets you enable or disable the selected Foliage Object for rendering. Disabled Foliage Objects are shown in gray in the Foliage Objects list.

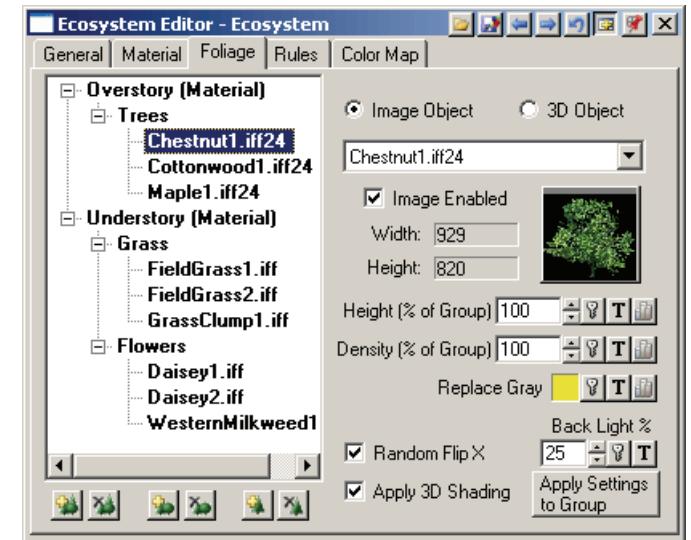


Image Object Options

Image Object Drop Box

Select an Image Object in the Image Object drop box. VNS will replace the selected Foliage Object in the Foliage Objects list (see above) with the Image Object you choose.

If you want to load a new Image Object, select "New Image Object." VNS will open a file requester where you can select a new Image Object. Image Objects can be images or image sequences in any supported format (see Image Loading and Saving).

Width, Height and Image Bands Display Fields

The Width, Height and Image Bands display fields show the pixel dimensions and number of 8-bit image bands of the Selected Image Object.

Thumbnail

The Thumbnail shows a small version of the selected Image Object. You can double-click it if you want to see the full version.

Random Flip X Checkbox

Select the Random Flip X checkbox to have VNS randomly reverse the Image Object from left-to-right during rendering. This will give you more variety in the foliage since the selected Image Object will appear in different places in normal and reversed versions.

Apply 3D Shading Checkbox

Select the Apply 3D Shading checkbox to tell VNS to shade the Image Object based on the direction of the light. This will give foliage a more 3-dimensional appearance.

Replace Gray Color Controls

By using unique colors for a Group of images or even individual Foliage Objects you can create a scene of nearly unlimited color variety. You can animate colors to create a kaleidoscopic landscape. Change the color of maple trees first, then the birches followed by the oaks and leave the conifers green, and voila - New England in October.

Each Image Object has its own color specifications. The color for each image can come from the Image Object itself or from a color. If it comes from a color, you can animate that color. You can edit the colors for the selected Image Object by clicking the Replace Gray color well to open the Color Editor.

Note: This only works for gray scale images, or images that have been set to gray scale in the Image Object Library. If the Image Object contains a color image and it has not been changed to gray scale in the Image Object Library, the Replace Gray color well will be disabled.

You can change the Gray Replacement Color for a gray-scale Image Object independently at any time or leave it with the color it inherited when you added the Image Object.

Note: Gray Scale Images require 1/3 the amount of memory that 24 bit color images require when rendering.

Height Percentage Controls

Each Foliage Object has its own height specifications. These determine how tall the object is compared to other objects in the Ecotype.

The Height Percentage field for the currently selected Foliage Object is a percentage of the number entered in the Group Height field for the Foliage Group on the Groups page (see above).

If you wish you can control the object's height with a Thematic Map or a texture.

Density Percentage Controls

Each Foliage Object has its own density specifications. These determine how often the object is repeated compared to other Foliage Objects in the Ecotype.

Density of coverage for a Foliage Object is based on its Density within its group (set with the Density Percentage field for the selected Foliage Object), the group's Density in the Ecotype (set with the Group Density field on Group page for the selected Group).

If you wish you can control the object's density with a Thematic Map or a texture.

Back Light Percentage Field

The Back Light Percentage field lets you allow light to shine through backlit Image Object foliage. The default value is 25%. You can set it higher than 100%.

Use the Back Light Percentage when the Camera is looking into the light and the foliage looks too dark. It allows light to be transmitted through the leaves. This will brighten the foliage and increase color saturation. The result can be much more realistic small vegetation when the vegetation is backlit.

You can adjust the Back Light Percentage individually for any Foliage Object by selecting it in the Foliage Objects list and changing the value in the Back Light Percentage field. You can increase the Back Light percentage to brighten objects that are between the Camera and a light. Decrease it if you want a silhouette effect.

Apply to Group Button

Click the Apply to Group button if you want to set the Back Light Percentage of all members of the Group to be the same as the value in the Back Light Percentage field (see above). This is much faster than setting the Back Light Percentage individually for each member of the Group.

If the Back Light Percentage for the current Foliage Object has key frames, they will also be copied to the other members of the Group.

3D Object Options

Rotate X, Y and Z Checkboxes and Fields

The Rotation controls let you add random rotation to the current 3D Object. Select a checkbox and enter a value and VNS will randomly rotate the object along that axis every time it places it on a Vector vertex, within the rotation limit you set.

The X axis runs east to west. A positive X axis is to the east. The Y axis runs vertically. A positive Y axis is up. The Z axis runs north to south. A positive Z axis is to the north.

Enter a number in the X Field to rotate the 3D Object around the X axis. Enter a number in the Y Field to rotate the 3D Object around the Y axis. Enter a number in the Z Field to rotate the 3D Object around the Z axis.

A value of zero in any field means no rotation for that axis.

Polygons, Vertices and Materials Display Fields

The Vertices display field shows the number of vertices in the current 3D Object. The more vertices there are, the longer it will take to render. VNS does not impose a limit to the number of vertices an object may have, other than the limit imposed by the available memory on your system.

The Polygons display field shows the number of polygons in the current 3D Object. The more polygons there are, the longer it will take to render. VNS does not impose a limit to the number of polygons an object may have, other than the limit imposed by the available memory on your system.

The Materials display field shows how many materials there are in the current 3D Object. A Material is a texture applied to groups of polygons within the object. For example, a car object may have a body Material, a bumper Material, a tire Material and a glass Material. You can edit the properties of each Material using the 3D Material Editor.

Height Percentage Controls

Each Foliage Object has its own height specifications. These determine how tall the object is compared to other objects in the Ecotype.

The Height Percentage field for the currently selected Foliage Object is a percentage of the number entered in the Group Height field for the Foliage Group on the Groups page (see above).

If you wish you can control the object's height with a Thematic Map or a texture.

Density Percentage Controls

Each Foliage Object has its own density specifications. These determine how often the object is repeated compared to other Foliage Objects in the Ecotype.

Density of coverage for a Foliage Object is based on its Density within its group (set with the Density Percentage field for the selected Foliage Object), the group's Density in the Ecotype (set with the Group Density field on Group page for the selected Group).

If you wish you can control the object's density with a Thematic Map or a texture.

Rules of Nature Page

Click the Rules Page tab to see the Rules-of-Nature™ Page. Here you can adjust all the Ecosystem Parameters that can affect where the Ecosystem grows on the terrain.

All of the Rules-of-Nature™ apply when the Ecosystem is part of an Environment (see Environment Editor).

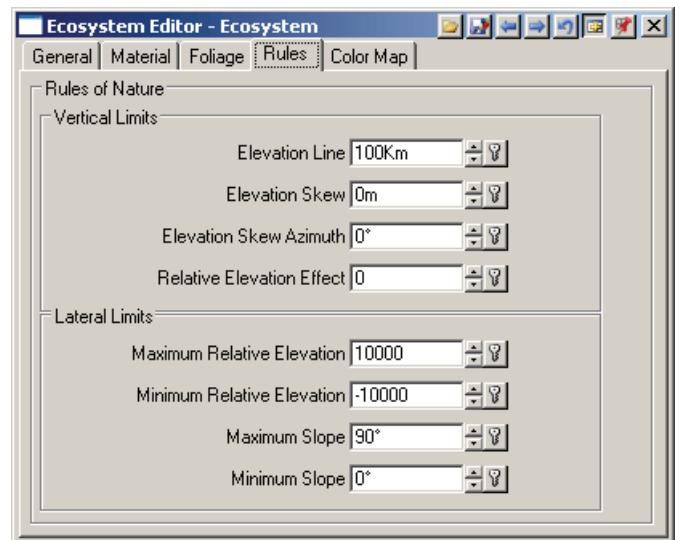
Only the Maximum and Minimum Slope and Relative Elevation limits are applied to Vector-bounded Ecosystems and Color-mapped Ecosystems.

Ecosystems used within Terraffectors are not affected by the Rules-of-Nature™.

Parameter Fields

The Parameter fields and Value Slider (see below) let you change the Ecosystem Parameters. By changing these Parameters you can control the Rules-of-Nature™ that determine where VNS grows the Ecosystem on the terrain. You can type numbers directly into the fields, click the arrow buttons or use the Value Slider to change the values.

The Rules-of-Nature™ Parameters include Vertical Limits and Lateral Limits.



Vertical Limits

- **Elevation Line**
- **Elevation Skew**
- **Elevation Skew Azimuth**
- **Relative Elevation Effect**

Lateral Limits

- **Maximum Relative Elevation**
- **Minimum Relative Elevation**
- **Maximum Slope**
- **Minimum Slope**

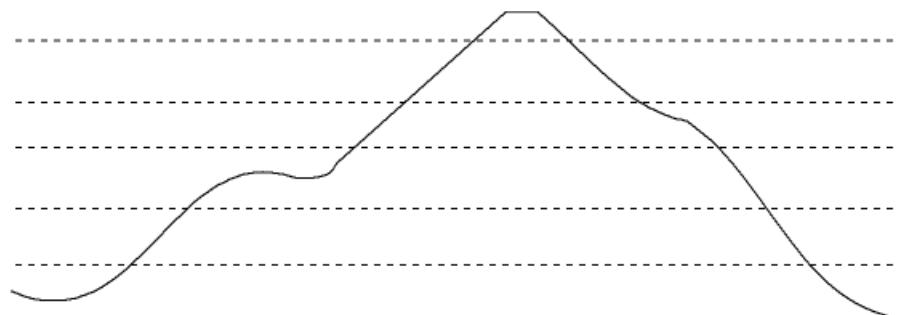
Radio Buttons and Value Slider

Rules-of-Nature™ fields have radio buttons which activate the Value Slider on the right. When you select a radio button you can use the slider to control the value for the adjacent field.

The scroll bar range is a "reasonable" or useful range for each Parameter, although there may be times you might want to manually enter a higher or lower number. For Elevation Line, the slider range is from the lowest to highest elevation of the enabled DEMs.

Vertical Limits

Elevation Line Field and Buttons



You can set the upper limit for an Ecosystem in the Elevation Line field.

The Elevation Line is the average upper limit for the Ecosystem.

If the Elevation Line were the only Parameter, Ecosystems would be distributed like the layers of a cake on the hillside with each one occupying a well-defined elevation range. But the Elevation Line only represents the average upper limit.

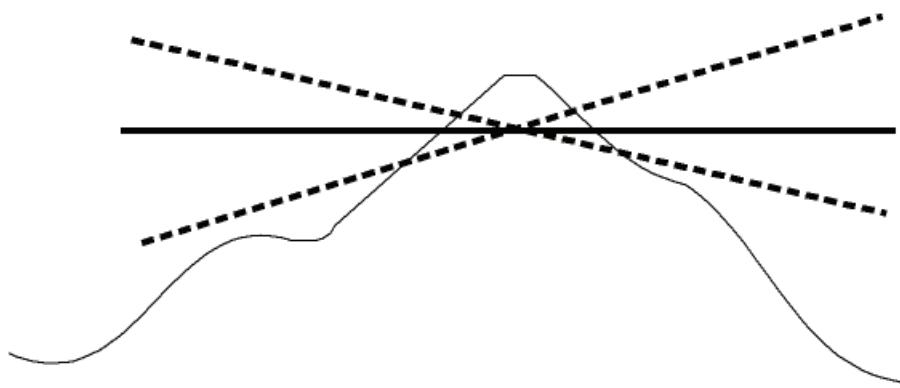
For rock and ground ecosystems elevation is not a factor, so you will probably want to set the value to the maximum setting of 32,000 meters. That way VNS can use those Ecosystems at any elevation.

The limit at any given site will vary depending on local factors which you can alter using the rest of the Parameter variables (see below). They are designed to break up this even-layered distribution and to create a natural patchy appearance that embodies valid ecological principles.

Ecological Explanation

As elevation increases conditions become more harsh. Temperature drops, growing season shortens, desiccating wind exposure increases, solar radiation becomes more intense and soils tend to become poorer. Every plant species has an upper limit to its range beyond which it cannot survive or reproduce.

Elevation Skew Field and Buttons



Elevation Skew works to lower the Elevation Line on one side of a hill relative to the other side of the hill. It's useful for simulating the drying effects of prevailing winds or the effect of sun falling more on one side of a hill than the other.

Note: You can tell VNS what direction to use when dividing hills into two sides by using the Elevation Skew Azimuth parameter (see below). This lets you simulate sun or prevailing wind direction.

Since Elevation Skew is a slope-based parameter, it also has the effect of breaking up the transition between Ecosystems based on the changing slope values typically found on irregular hillsides. This lets you add a natural looking irregularity to the land cover.

You can use any values but most Ecosystems look best with numbers from -500 to +500.

Technical Explanation

Elevation Skew is a measure of the effect of slope azimuth on the upper limit of an Ecosystem. In other words, it changes the Elevation Line of an Ecosystem based on the direction of the slope.

The Elevation Line will be lowered in the direction of the Skew Azimuth (see below) by an amount proportional to the slope and Elevation Skew. The value is in units of meters and referenced to a 45° slope. In other words, on a 45 degree slope, if the Elevation skew value is 200 then the Elevation Line will be raised or lowered 200 meters. On lesser slopes the change will be proportionately less.

Ecological Explanation

One of the factors that breaks up the layered arrangement of Ecosystems is the azimuth or direction of the terrain slope. In the northern hemisphere, southern slopes receive more hours of sunlight especially in the winter. This makes them somewhat warmer on average than north-facing slopes. They also tend to be drier and have more months free of snow.

These are important factors to plants which can not sprout until the snow has cleared. The drier conditions on the other hand mean more months of drought and certain moisture-loving species cannot thrive here.

Elevation Skew Azimuth Field and Buttons

Elevation Skew Azimuth lets you specify the direction of the Elevation Skew (see above). Together, Elevation Skew and Elevation Skew Azimuth let you add irregularity to the land cover. You can use values from -360 to +360. In nature values of -90 to +90 are typical.

The value for a given species of plant depends on the complex interaction of a host of factors such as prevailing wind direction, wind strength, latitude, solar intensity at different times of the day and the specific temperature and moisture requirements of the plant species. For non-living Ecosystems such as snow, the controlling variables are prevailing wind direction, wind strength, and sun intensity.

In the simplest case, where you just want to simulate the effect of the sun on an Ecosystem, set the Elevation Skew to the same direction as the Sun Light. This will raise the Elevation Line on the sunny sides of hills for plants that like the sun and don't mind drier conditions, and lower the Elevation Line on the shady side of hills where those same plants are less likely to grow. Or you can set Elevation Skew opposite the direction of the Sun Light to lower the Elevation Line on the sunny sides of hills and raise the elevation line on the shady sides of hills. This is great for plants that don't like dryness and can live better on the shady side of the hills with less sun.

Technical Explanation

The direction in which the Elevation Skew has the greatest effect is the Elevation Skew Azimuth. If the Elevation Skew is positive the Elevation Line is lowered, if negative, it is raised in the Skew Azimuth direction. At 180° from the Skew Azimuth the effect will be of the same magnitude, only reversed. This value is measured in degrees clockwise from north so north is 0° , east is 90° , etc.

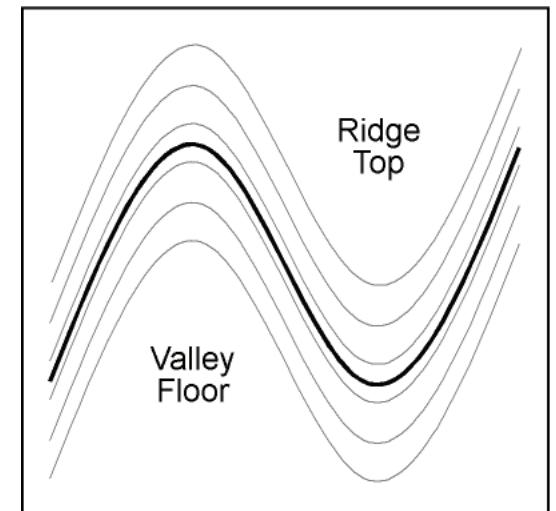
Ecological Explanation

In the Rocky Mountains our winter winds prevail from the west. Snow is blown off ridges and accumulates in basins on the east side. Sun melts more snow on southern slopes, where its force is more intense, than northern so the cumulative effect is to deepen snow on the northeast sides of mountains. Here snow frequently lays until late summer when it is long gone from other slopes. We can simulate that effect by setting the Skew Azimuth to 45° (northeast) and the Elevation Skew to 200 (a moderate value).

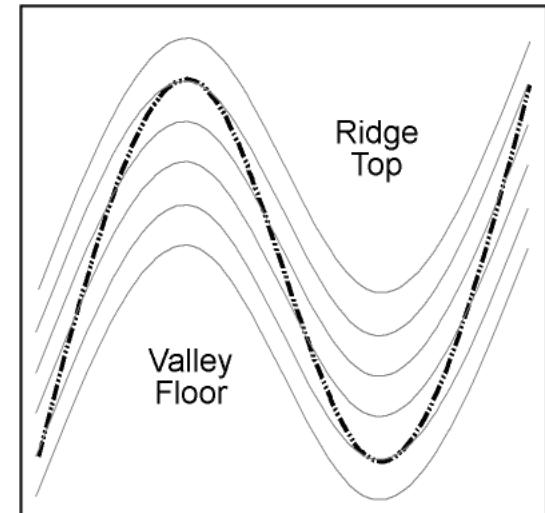
Relative Elevation Field and Buttons

One of the most powerful tools available to us in the quest for realism is the Relative Elevation Effect. VNS knows if slopes are convex or concave. By using a positive Relative Elevation Effect value, you can push an Ecosystem up valleys. By using a negative Relative Elevation Effect value, you can push an Ecosystem onto ridges.

To see how this works, the diagram to the right is a segment of a contour map. Each band represents a different elevation. On the left is a valley (concave terrain shape), with the lowest part of the valley at the bottom and the terrain rising up the valley to the top. This is a typical drainage. On the right is a ridge (convex terrain shape), with the terrain ascending in elevation up the ridge from bottom to top. The heavy line is the elevation line of the Ecosystem, which follows the contours to stay at the same elevation.



With a positive Relative Elevation Effect, VNS will distort the Ecosystem's Elevation Line so that the Ecosystem can grow higher in valleys, but lower on ridges. So use a positive Relative Elevation effect for riparian Ecosystems which tend to follow a drainage and generally require more water and shelter.



With a negative Relative Elevation Effect, VNS will distort the Ecosystem's Elevation Line so that the Ecosystem can grow higher on ridges, but lower in valleys. So use a negative Relative Elevation for an Ecosystem of ridge-dwelling plants, plants that need less water and can stand more exposure.

The greater the Relative Elevation value (either positive or negative), the stronger the effect. Values from +10 to -10 generally work well.

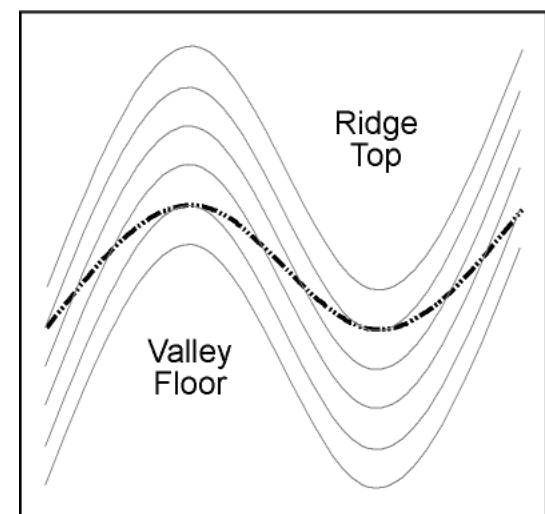
Snow is a little different because snow lives above the Elevation Line rather than below it, like other Ecosystems. The Elevation Line still behaves the same, but the snow appears above it rather than below it. To make snow fill valleys, use a positive Relative Elevation Effect value. A value of +5 works well for snow, causing it to fill in the valleys on a mountain side.

Ecological Explanation

In nature concave areas collect water, convex areas shed it. Concave areas have deeper soils with higher water tables even to the point of being saturated or hydric. These extremely wet areas have been termed wetlands and are of vital importance to flood control, water quality preservation and wildlife (not just mosquitoes).

Convex terrain drains quickly and soils tend to be droughty. They are often coarser in texture which aids in the rapid removal of soil moisture. Wind exposure is higher which desiccates the site and any plants that grow on it. Convex sites are favored by some species of plants and shunned by others.

Complicating things are the temperature effects. Valleys are like pipelines that transport air masses up and down mountains. At night cold air from the surrounding peaks drains down into the valleys. They are often ten or more degrees cooler at night than surrounding slopes. During the day they trap hot air which flows up from lower elevations.



The end result is that some Elevation Lines are lowered in valleys and others are raised. We can take advantage of this divergent behavior by creating some Ecosystems that exhibit each. It will add realistic complication and diversity to our images whether or not we truly understand the principles behind it. Small dips and bumps of Relative Elevation values in the terrain model will produce isolated clumps of one Ecosystem or another. These are equivalent to micro-climate zones found on real hillsides. They are the main reason that timber line is seldom truly a line.

Lateral Limits

Maximum and Minimum Relative Elevation Fields and Buttons

Some Ecosystems may be limited exclusively to concave or convex terrain. You can set Maximum and Minimum Relative Elevation values to limit an Ecosystem's growth so it occurs only within these types of terrain areas.

Limit the Maximum Relative Elevation to keep an Ecosystem off of ridges. Limit Minimum Relative Elevation to keep an Ecosystem out of valleys. To see what values are appropriate, do a preview rendering and click in the View. You'll see the Relative Elevation value for the point you clicked displayed in the Diagnostics Data window. You can copy and paste the value from the Diagnostics Data window into the Max or Min Relative Elevation fields.

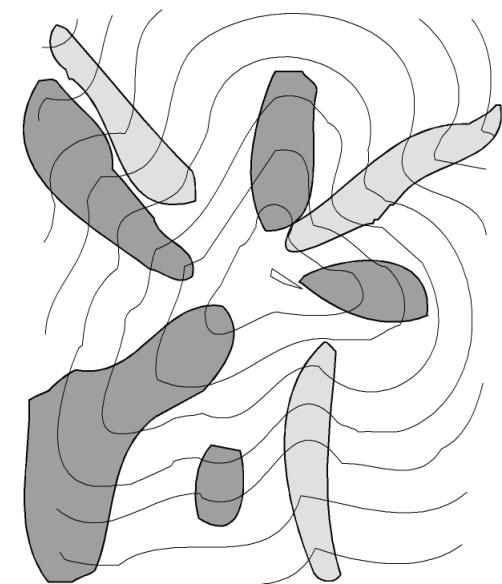
Find the Relative Elevation values of areas where you want the current Ecosystem to grow. Enter the highest value you find into the Maximum Relative Elevation field, and the lowest value you find into the Minimum Relative Elevation field.

Relative Elevations assume a statistically normal distribution about the mean value of zero. That is to say most values are near zero and very few values are at the extremes of the range. For DEMs we have encountered, values range from -250 to +250.

Because of this natural variation, Relative Elevation doesn't just make the Elevation Line wobble across terrain as you saw above, it also breaks Ecosystems into patches. This is because the Relative Elevation values can vary dramatically across the terrain. This variation tends to chop up linear bands of ecosystems into natural Ecosystem patches.

We have found upper limits of -20 or -30 for a deciduous Ecosystem can add interesting and realistic patches of color among the darker greens of a conifer forest. In the Rockies those patches might represent aspen or shrub willows at middle and higher elevations.

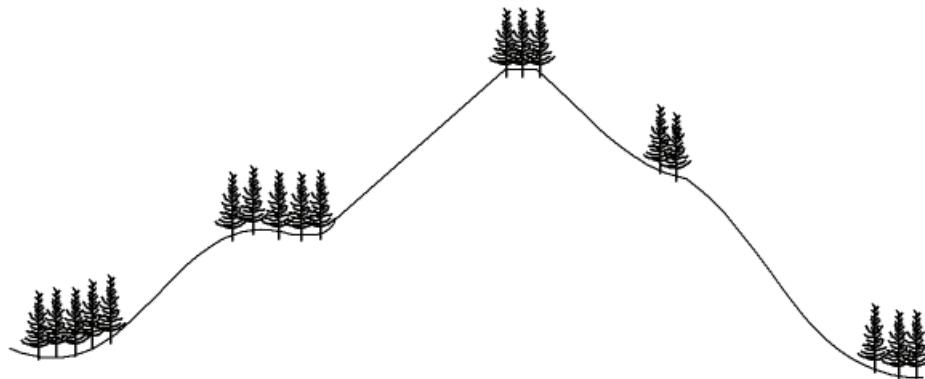
Any Ecosystem you want to be able to appear anywhere should have a wide open relative elevation range (-1000 to +1000).



Maximum Slope

Set the Maximum Slope to the steepest amount of slope in degrees that you want the current Ecosystem to grow on. VNS will keep the Ecosystem from appearing on any terrain that is steeper than this value. This is probably the easiest Parameter to visualize.

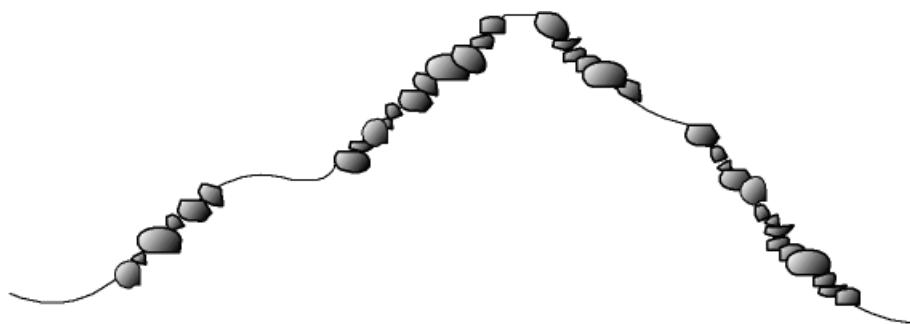
Everyone knows that trees do not grow on the face of a cliff. Setting the Maximum Slope for vegetation Ecosystems to 30 or 35 degrees will work well. Rock should have a maximum slope of 90°.



Any Ecosystem you want to be able to appear on any slope should have a wide open slope range (0 degrees minimum to 90 degrees maximum).

Minimum Slope

Set the Minimum Slope to the least amount of slope in degrees that you want the current Ecosystem to grow on. VNS will keep the Ecosystem from appearing on any terrain that is less steep than this value.



We have used Minimum Slope on occasion where we wish to have some way to discriminate between two Ecosystems that otherwise have identical or similar Sub-Parameters. We also use it to limit rock to slopes greater than 35°.

Any Ecosystem you want to be able to appear on any slope should have a wide open slope range (0 degrees minimum to 90 degrees maximum).

Material Name Field

The Material Name field is above the Material list. After you create a Material it will have a default name of "Material." It's a good idea to enter a unique name in the Material Name field to identify how you will use the Material. For example "sand," "forest" or "fall foliage."

This is the same as the Selected Material Name field on the Material & Foliage page (see below).

Gradient Materials List

The Gradient Materials list shows all the Materials in the Ecosystem.

Click a Material in the list to select it. This will also select its pin below the Gradient. You can then change its Position in Gradient percentage, remove it by clicking the Remove Material icon, rename it in the Material Name field, or go to the Material & Foliage page (see below) and edit any of its properties.

This is the same as the Gradient Materials List on the Material & Foliage page (see below).

Color Map Page

Color Map Matching Controls

The Color Map Matching controls let you tell VNS to place the Ecosystem on the terrain wherever a single color or range of colors appears on a Color Map projected onto the terrain (see Color Map Editor).

One use of this is to use the colors in a satellite image to control where actual foliage grows on your terrain.

To apply an Ecosystem as part of a Color Map, set the controls on the Color Map page (see below). Then select the Ecosystem on the Ecosystems & Miscellaneous page of the Color Map Editor.

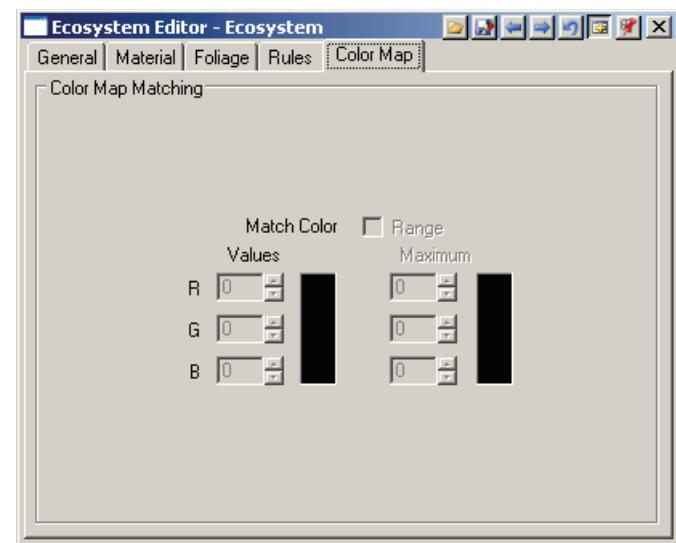
Match Color Range Checkbox

Select the Match Color Range checkbox when you want the Ecosystem to appear wherever a range of colors appears on a Color Map projected onto the terrain (see Color Map Editor). You can specify the color range using the Minimum and Maximum fields (see below).

Deselect the Match Color Range checkbox when you want the Ecosystem to appear wherever a single color appears on a Color Map projected onto the terrain. You can specify the color using the Values fields (see below).

Values Fields and Color Bar

If the Match Color Range checkbox is not selected, the Value RGB Fields let you set the single color for Color Mapping.



If the Match Color Range checkbox is selected, the name of the fields changes to "Minimum." These RGB fields then let you set the lower limit for a range of colors. You can set the upper limit in the Maximum RGB fields (see below).

Set the amount of Red in the R field, the amount of Green in the G field and the amount of Blue in the B field.

This only works if the Match Ecosystems to Colors checkbox is selected (see above).

The adjacent color bar lets you see the color you set with the RGB fields.

Maximum Fields and Color Bar

The Maximum Fields let you set the upper limit for a range of colors.

This only works if the Match Ecosystems to Colors checkbox is selected and the Match Color Range checkbox is selected (see above).

Set the amount of Red in the R field, the amount of Green in the G field and the amount of Blue in the B field. The adjacent color bar displays the color you set with the RGB fields.

Environment Editor

The Environment Editor lets you combine Ecosystems. VNS will place them on the terrain according to their Rules-of-Nature™. This makes it easy to place a lot of foliage in natural arrangements across the entire terrain or in limited regions.

An Environment that is not attached to a Vector will appear everywhere. VNS gives you a unattached global Environment whenever you create a new Project.

By attaching an Environment to a Vector you can limit it to a specific region. This is great for creating areas of different climate characteristics. For example, you could have one Environment for western Oregon by the Pacific ocean where there is a lot of rain and completely different Environment for eastern Oregon where the climate is much drier.

Where Environments overlap VNS will render them by priority. If they are at the same priority, VNS will mix them equally.

Using Pre-made Components

Click the Open Component Gallery icon to see the Component Gallery, ready to load a pre-made Environments. Environments are combinations of multiple Ecosystems. You can select from any previously created Environment files. Double-click the thumbnail image to load the Environment Component. VNS will reset the parameters of the Environment to those of the Component you selected and load any Ecosystems it requires.

You can create and export your own pre-built Environment Components from the Environment Editor by setting up the Environment the way you want it and then clicking the Sign or Save Component to Disk icon. VNS will open the Component Signature Window where you can fill in the information, choose a representative image for the Component's thumbnail and save the Component in the Component Gallery.

For example, this makes it easy to create different kinds of Ecosystem combinations for different climates. You can later reuse the Environment in another Project.

General Page

General Features Section

Name Field

Enter a name for the Environment. For example, if it is a desert Environment, you might call it simply "Desert".

By default VNS will name new Environments "Environment", and add a number after the name if there is more than one Environment named "Environment".

Enabled Checkbox

The Enabled checkbox lets you enable or disable the Environment for rendering.

Disabling an Environment can be useful if you are trying other Environments to see what they look like. For example, you might have different Environments to visualize different climates in the same area. Make sure you remember to enable the Environment for the final rendering if you want to see the Environment.

Note: To see the Environment in your rendering, it must be visible to the Camera you selected for the Render Job you are using (see Render Job Editor). To see any foliage applied by Ecosystem Ecotypes within the Environment, "Other Foliage" must be enabled in the Render Options you are using (see Render Options Editor).

Priority Field

The Priority field lets you specify the rendering priority of the Component relative to other Components of the same category. A Component with a higher priority will be rendered before a Component in the same category that has a lower priority.

Render priority only matters where Components of the same category overlap. VNS will use the values from the highest-priority Component.

If there are overlapping Components of the same category that are each set to the same priority, VNS will mix them equally.

Use Profile Checkbox

Click the Use Profile checkbox when you want to control the amount of a Vector-bounded Environment based on a gradient from the edge of the Vector Object's area toward the middle. This lets you fade the Environment so it doesn't end abruptly at the outside edge of the Vector.

This only applies to Vector-bounded Environments.

When you first create a Vector-bounded Environment VNS will create a default Edge Feathering Profile. The default Profile varies between no effect at the edge to the full effect 10 meters toward the middle of the Vector area. You can edit this Profile by clicking the Edit Profile button (see below).



Profiles add to rendering time and take additional memory to render.

Edit Profile Button

Click the Edit Profile button to open the Edge Feathering Profile Editor. There you can alter the Edge Feathering Profile to change the intensity of the Environment from the edge of the vector inward.

This only applies to Vector-bounded Environments.

Vector Placement Section

By attaching Vectors to Ecosystems you can control where they appear. Vectors can be dynamically linked with Search Queries or hard linked.

Vector Links Button

This control allows you to perform various tasks relating to the association of vectors with components. To learn how to use it, see Vector Links Icon.

Attached Hard-Linked Vectors Display

The Hard-Linked Vectors display tells you if there are any Vectors hard-linked to the Component, and if so, how many. It will also display vectors attached by Search queries and list the names of the search query or queries in use.

Ecosystems Page

The Ecosystems page lets you choose the Ecosystems to include in the Environment. VNS will combine them based on the order in the Ecosystems list, and their Rules-of-Nature™ which you can set on the Rules page of the Ecosystem Editor.

Ecosystems Controls

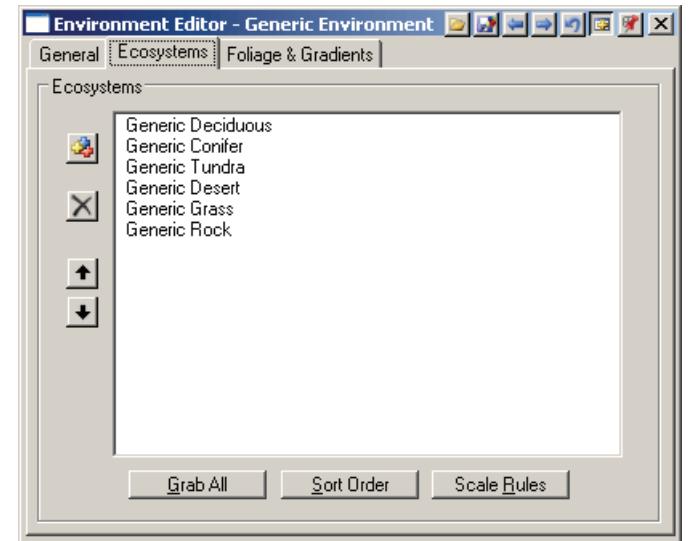
Ecosystem List

The Ecosystem List shows all the Ecosystems in the Environment.

The order of the Ecosystems in the list is very important. For every terrain polygon covered by the Environment, VNS evaluates the Ecosystems starting at the top of the list and working toward the bottom. As soon as VNS finds an Ecosystem whose Rules-of-Nature™ qualify it for the polygon, VNS uses that Ecosystem and ignores any Ecosystems below it in the list.

Add Ecosystem Icon

Click the Add Ecosystem icon to open a window with a list of Ecosystems in your Project. Select one or more Ecosystems by clicking, shift-clicking or control-clicking. Click the Add Items button to add the Ecosystems to the Environment.



Click the Cancel button if you want to close the window without adding any Ecosystems to the Environment.

Remove Ecosystem Icon

Select an Ecosystem in the Ecosystems list and click the Remove Ecosystem icon to remove it from the Environment.

Raise Ecosystem Rendering Priority

Select an Ecosystem in the Ecosystems list and click the Raise Ecosystem Rendering Priority to make it higher in the Ecosystems list. The higher in the list, the more likely VNS will choose it to render (see Ecosystem List above).

Lower Ecosystem Rendering Priority

Select an Ecosystem in the Ecosystems list and click the Lower Ecosystem Rendering Priority to make it lower in the Ecosystems list. The lower in the list, the less likely VNS will choose it to render (see Ecosystem List above).

Grab All Button

Click the Grab All button to add all the Project's Ecosystems to the Ecosystems list.

Sort Order Button

Click the Sort Order button to have VNS guess at the proper order for the Ecosystems in the list.

Scale Rules Button

Click the Scale Rules button to adjust the Elevation Lines of all the Ecosystems in the list proportionally to fit the actual range of elevations available in your Project's terrain.

If this doesn't do what you want, click the Undo All Changes in This Window icon to return the Ecosystem Elevation Lines to the state they were in when you last opened the Environment Editor.

Note: You will lose the ability to undo if you close the Environment Editor.

Foliage & Gradients Page

The Foliage and Gradients page lets you control overall height, intensity, blending and latitude changes for all the foliage in the Environment.

Foliage Controls

Foliage Height Factor Percentage Field

The Foliage Height Factor percentage field lets you multiply the Maximum Heights of all the Ecotypes in the Ecosystems that are members of the Environment. You can use this to make all the foliage taller or shorter. If you animate this parameter you can create growing foliage for all of the Ecotypes at once.

Distant Foliage Intensity Field

Use the Distant Foliage Intensity setting to alter how VNS draws distant foliage. If the antialiasing is thinning out the distant foliage too much, increase the Distant Foliage Intensity setting to thicken the distant foliage. The useful range is 1 to 500. The default setting is 50.

Foliage Blending Field

Image Object foliage always rotates to face the camera. The Foliage Blending field lets you counteract the flipping of closely spaced Image Object trees where the images may overlap and change order as the camera moves. It works by blending adjacent trees.

If you see Image Object trees changing their order during an animation, with a tree suddenly popping in front of another tree, the first thing to try is to reduce the density of the foliage in the appropriate Ecotype. Use the Density field on the Foliage page of the Ecosystem Editor. You can also set the density of groups of trees on the Groups page or individual trees on the Objects page. It's important to make sure you don't have trees growing unnaturally close together.

If reducing the Ecosystem's density doesn't fix the problem, try increasing the Foliage Blending value. As you increase this value, trees that are close to each other will be blended.

If the trees begin to look too soft, reduce the value in the Foliage Blending field.

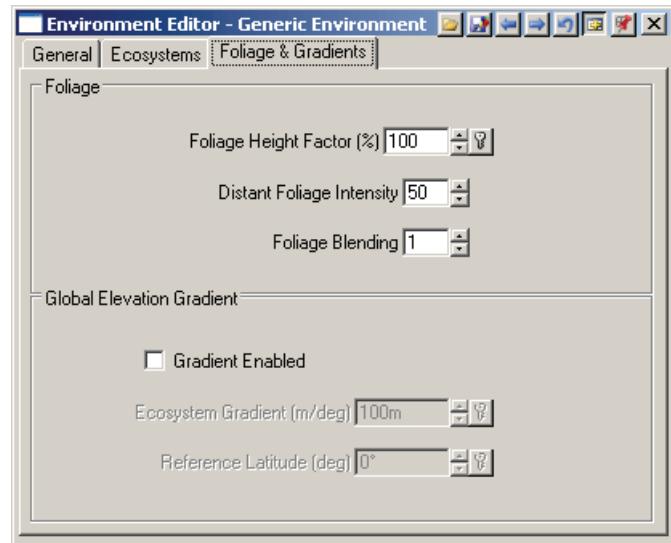
The useful range is from 1 to 10, with 1 being the default value.

Note: Foliage Blending will not affect 3D Object trees. 3D Object trees will never have a flipping problem to begin with.

Global Elevation Gradient Controls

Use these controls when you're rendering all or most of a planet and you want to show the effect latitude has on Ecosystems. As you move further from the equator, climates get generally colder. This is similar to moving up the side of a mountain.

In the Ecosystem Editor window you can change the Elevation Line value for each Ecosystem to tell VNS at what altitude the foliage in that Ecosystem can be expected to grow.



Since changes in latitude have similar effect on vegetation as changes in altitude, VNS can simulate the changes in climate with changing latitude by changing the Elevation Line value of each Ecosystem during rendering based on latitude.

VNS lets you apply latitude-based changes to the Elevation Line of each Ecosystem with the Global Gradients controls.

Gradient Enabled Checkbox

The Gradients Enabled checkbox determines whether an elevation gradient is applied to Ecosystem values based on the DEM latitude, relative to a reference latitude.

This is generally used to represent cooler temperatures toward the poles. The gradients are applied symmetrically to the equator. The effect is that the farther north you go the lower the Ecosystem elevations become.

You can control the severity of this effect with the Ecosystem fields.

Ecosystem Gradient Field

Use the Ecosystem field to set the equivalence of latitude degrees to elevation (in meters) for the Ecosystems in the Environment.

A gradient can be applied to Ecosystems based on latitude to simulate cooler environments toward the poles (see above). Typical values are close to 100.0 meters/degree. Increasing it lowers all Ecosystem Lines more dramatically toward the poles.

Reference Latitude Field

Use the Reference Latitude field to set the Latitude at which Ecosystem Elevation Lines will not vary when you use a Global Elevation Gradient. VNS will vary the Elevation Lines of Ecosystems at latitudes above or below this reference latitude position.

If you're starting a planet from scratch, zero, which is the equator, is a good choice.

If you've already set up a scene at some latitude and decide to add more DEMs and expand the scene, you might want to enter the latitude of the area you started. That way, their Ecosystem Elevation Line Parameters will not be changed by the Global Elevation Gradient.

Foliage Effect Editor

The Foliage Effect Editor lets you control each Foliage Effect in your Project. The controls apply to the Foliage Effect shown in the Editor's title bar.

Note: You can select a different Foliage Effect to edit by double clicking the name of another Foliage Effect in the Scene-At-A-Glance or by clicking the You can import Components into your Projects using the Component Gallery.

Foliage Effects are only rendered if their underlying DEM is rendered. You can specify whether they will appear at an absolute elevation or an elevation relative to either the terrain or Vector elevation.

What is a Foliage Effect?

A Foliage Effect lets you place Image Objects or 3D Objects onto the terrain. You can place a single object or rows of objects as defined by the points of a Vector Object. The Foliage Effect will appear even if other foliage has been placed via Ecotypes.

Image Objects can be still images or animated sequences (see Image Object Library). Typically they will be images or animations of trees and other foliage, but they can be any images or animations of anything you like. If you have an animation of a dancing munchkin and want an entire forest of dancing munchkins, you can create that effect using Image Objects and the Foliage Effect Editor.

3D Objects can be trees, flowers, fence posts, power poles, buildings or anything you like.

Foliage Effects are useful for things like placing an individual tree or bush; creating an orderly orchard; adding telephone poles to the side of a road; adding floating signs over a building site, a town or a point of interest; or adding fence posts to the edge of a field. Since Image Objects can be animations, you can even use a Foliage Effect to put things like buildings with blinking lights, animated characters, lightning, explosions or falling rain or snow into your scene.

You can also use a Foliage Effect to place trees or water plants into a stream or lake.

Using Pre-made Components

Click the Load Component From Disk Icon in the Foliage Effect Editor to see the Component Gallery, ready to load a pre-made Foliage Effect. VNS will reset the parameters of the Ecotype to those of the Component you selected.

You can create and export your own pre-built Foliage Effect Components from the Foliage Effect Editor by setting up the Foliage Effect the way you want it and then clicking the Save Component To Disk Icon. VNS will open the Component Signature Window where you can fill in the information, choose a representative image for the Component's thumbnail and save the Component in the Component Gallery.

You can later reuse the Foliage Effect in other Projects.

Note: You can also save and load Foliage Groups as Components.

General Page

General Features Section

Each Foliage Effect is configurable to act in different ways depending on your needs. The General features section lets you choose the Absolute Height, Second Height and Density behaviors you need.

Name Field

Use the Name field to edit the name of the current Foliage Effect.

Enabled Checkbox

The Enabled checkbox lets you enable or disable the Foliage Effect for rendering.

Disabling an object can be useful to speed up rendering if you are doing test renders to check some other aspect of your scene and don't need to see the Foliage Effect. Make sure you remember to enable it for the final rendering if you want to see the Foliage Effect's objects.

Note: To see the Foliage Effect in your rendering, it must be visible to the Camera you selected for the Render Job you are using (see Render Job Editor), and Foliage Effects must be enabled in the Render Options you are using (see Render Options Editor).

Preview Enabled Checkbox

Select this checkbox to enable the display of this foliage effect in realtime views. In order for the foliage effect to show up, you must have also enabled either Realtime Foliage Images from the View's Realtime Popup menu, or have selected the checkbox marked RT Foliage Images in the View Preferences Window. Deselecting this checkbox allows you to disable the display of Foliage Effects on a per-component basis.

Base Elevation Section

Base Elevation Field and Buttons

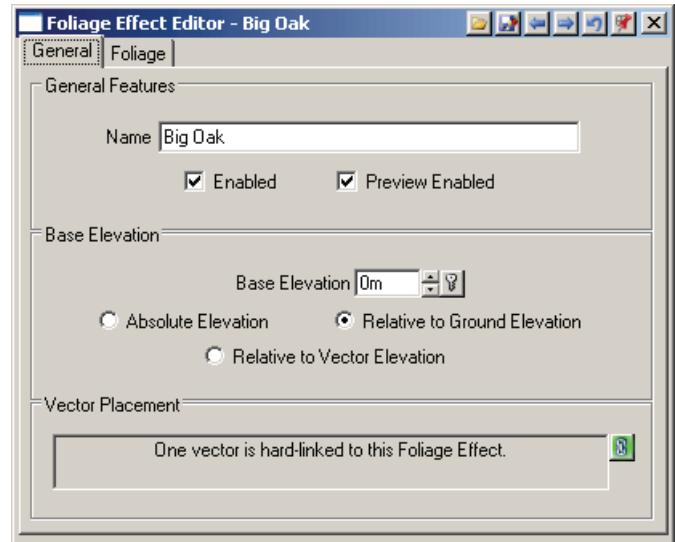
The Base Elevation is an offset from ground elevation if you chose the Relative to Ground radio button; an offset from the Vector elevation if you chose the Relative to Vector radio button, or the actual elevation in meters if you chose the Absolute radio button.

Base Elevation Radio Buttons

The Base Elevation Radio buttons let you choose how the Base Elevation works.

Absolute Elevation Radio Button

Choose the Absolute Elevation radio button to make the Base Elevation (see above) be the actual elevation of the base of the Scaled Images in meters above sea level.



Note: Sea Level is the surface of the Project Coordinate System's Ellipsoid, which is an elevation of zero. You can see the Project's Coordinate System in the Planet Options Editor.

Relative to Ground Elevation Radio Button

Choose the Relative to Ground radio button to make the Base Elevation be an offset in meters from the elevation of the terrain.

Note: If the Foliage Effect's Vector is above NULL value terrain the Foliage Effect will be rendered at the NULL elevation.

Relative to Vector Elevation Radio Button

Choose the Relative to Vector radio button to make the Base Elevation be an offset in meters from the elevation of the Vector to which the Foliage Effect is applied.

Vector Placement Section

By attaching Vectors to Foliage Effects you control where they appear. Vectors can be dynamically linked with Search Queries or hard linked.

Vector Links Button

This control allows you to perform various tasks relating to the association of vectors with components. To learn how to use it, see Vector Links Icon.

Attached Hard-Linked Vectors Display

The Hard-Linked Vectors display tells you if there are any Vectors hard-linked to the Component, and if so, how many. It will also display vectors attached by Search queries and list the names of the search query or queries in use.

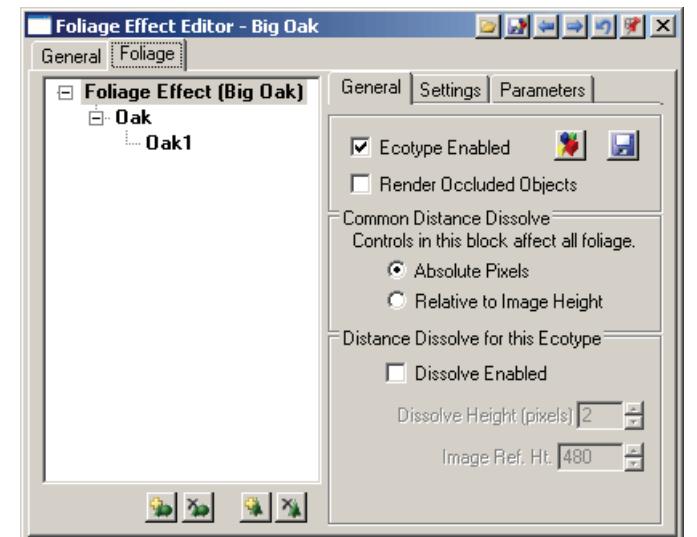
Foliage Page

To create Foliage Effects in VNS, perform the following:

- Add one or more Foliage Groups to the Foliage Effect using the Foliage Group Control Icon underneath the Foliage List on the Foliage Page.**
- Add one or more Foliage Objects to each Group using the Foliage Object Control Icon underneath the Foliage List on the Foliage Page.**
- Adjust the properties for each Foliage Object & Group on the parameters pages that appear when the appropriate item is selected in the Foliage List page.**

You can specify height for each Foliage Object & Foliage Group. You can even use textures to control height to create natural-looking foliage clumping based on procedural textures, images and dynamic parameters.

The way the controls interact depends on the choices you make on the Settings sub-page. There you can configure the Ecotype to behave according to your needs.



Foliage Objects can be Image Objects or 3D Objects. Image Objects can be still images or animated sequences (see the Image Object Library section). Typically they will be images or animations of trees and other foliage, but they can be any images or animations of anything you like. If you have an animation of a dancing munchkin and want a line of dancing munchkins, you can create that effect using Image Objects and the Foliage Effect Editor.

Using Pre-made Components

Click the Load Component From Disk Icon to see the Component Gallery, ready to load a pre-made Foliage Effects. Foliage Effects are multiple groups of Foliage Objects with their Group and Object controls already set up. You can select from any previously created Foliage Effect files. Double-click the thumbnail image to load the Foliage Effect Component. VNS will reset the parameters of the Foliage Effect to those of the Component you selected.

You can create and export your own pre-built Foliage Effect Components from the Foliage Effect Editor by setting up the Foliage Effect the way you want it and then clicking the Save Component To Disk Icon. VNS will open the Component Signature Window where you can fill in the information, choose a representative image for the Component's thumbnail and save the Component in the Component Gallery.

For example, this makes it easy to create different kinds of hedges with complex foliage mixes. You can later reuse the Foliage Effect another Project and have an instant complex hedge.

Material Foliage List

This list will show the foliage associated with the currently selected Foliage Effect. The selected Foliage Effect name will be in brackets behind the words "Foliage Effect" at the top of the list.

Enabled Items in the list will be displayed in Bold text. Disabled Items will still be displayed, but not emboldened.

At the bottom of the Material Foliage List, there are the following Control Icons:



Add Foliage Group

Click the Add Foliage Group icon if you want to add a new Foliage Group to the Foliage Effect. VNS will ask for a name.

Note: You have to add at least one Foliage Group to an Foliage Effect before you can add Foliage Objects on the Objects page (see below).



Remove Foliage Group

Click the Remove Foliage Group icon if you want to delete a Foliage Group. VNS will remove the Foliage Group from the Foliage Effect.

If the Foliage Group existed when you last opened the Foliage Effect Editor, you can undo the removal by clicking the Undo All Changes in this Window icon. Otherwise the Foliage Group will be gone forever.



Add Foliage Object

Click the Add Foliage Object icon to Create a new, blank entry in the Foliage Objects list.

Then choose either the Image Object or 3D Object radio button in the Selected Object section (see below). Finally, select an object from the drop box in the Image Object section or 3D Object section (see below).



Remove Foliage Object

If you want to remove a Foliage Object from the selected Foliage Group, select it in the Foliage Objects list and click the Remove Foliage Object icon.

VNS will ask if you want to remove the object. Click OK and VNS will remove it from the Foliage Group.

General Sub-Page

Ecotype Enabled Checkbox

The Enabled checkbox lets you enable or disable the Ecotype for rendering.

Note: You can also enable and disable an Ecotype from its Ecotype Operations icon on the Ecosystem, Lake or Stream Editor, wherever you first created the Ecotype. Select the icon's Disable Ecotype command to disable the Ecotype. The icon will be displayed with a red diagonal stripe to indicate that it's disabled. Select the icon's Enable Ecotype command to enable the Ecotype. The Ecotype will be enabled and the red stripe will disappear.

Disabling an Ecotype can be useful to speed up rendering if you are doing test renders to check some other aspect of your scene and don't need to see the Ecotype's foliage. Make sure you remember to enable it for the final rendering if you want to see the foliage.

Note: To see the Ecotype in your rendering, it must be part of an Ecosystem or Beach that is visible to the Camera you selected for the Render Job you are using (see Render Job Editor), and Other Foliage must be enabled in the Render Options you are using (see Render Options Editor).

Render Occluded Objects Checkbox

Selecting this checkbox will force VNS to render those elements of the scene obscured by this foliage effect. This will allow reflections to accurately represent terrain and foliage that has been hidden from the camera by this foliage effect. Select this checkbox if you are experiencing "holes" in reflections of terrain and foliage objects near to a Foliage Effect.

Common Distance Dissolve Section

The Common Distance Dissolve section lets you specify whether VNS will calculate Distance Dissolve Height based on an absolute pixel height or as a pixel height relative to a specified image size. This applies to all the Ecotypes and Foliage Effects in your Project (see also Foliage Effect Editor).

Distance Dissolve Height is the height at which VNS will stop rendering foliage Image Objects and instead render a color or texture. You can enable Distance Dissolve in the Image Object Distance Dissolve section (see below). There you can specify a pixel height for Image Objects at which VNS stops trying to render foliage and instead renders a simple color or a texture.

For example, if a tree is so far away that its height is below the Distance Dissolve Height in pixels, it will no longer be rendered and VNS will instead render the color or texture you specify. This can make rendering much, much faster because VNS can calculate a color or

texture much faster than a combination of foliage. Rendering the actual trees and plants far in the distance may take a long time for little or no visual benefit.

The default choice is Absolute Pixels. The default value for Distance Dissolve Height is 2 pixels. This means that VNS will replace a foliage object with a color or texture whenever the foliage object is shorter than two pixels in your rendered image. This makes a lot of sense because you can't see a complete tree in two pixels anyway, so there's not much point wasting the rendering time in the attempt.

You can enable Distance Dissolve in the Image Object Distance Dissolve section (see below).

Absolute Pixels Radio Button

Select the Absolute Pixels radio button to choose a specific height in pixels below which VNS will no longer render an Image Object. VNS will instead replace the Image Object with the color or texture you specify in the Image Object Distance Dissolve section (see below).

By default, the Absolute Pixels radio button is selected.

Relative to Image Height Radio Button

Select the Relative to Image Height radio button to relate the minimum pixel height at which VNS will render Image Objects to the size of your rendered images. This will let you see a more consistent rendering no matter what size image you render. Image Object foliage will then appear in the same areas and be dissolved to a color or texture in the same areas at any image size.

When you use the Relative to Image Height option, VNS will automatically change the Distance Dissolve Height based on the size of your rendering. VNS does this by using the Image Reference Height you specify in the Image Object Distance Dissolve section (see below).

You may want to select this option in order for preview renderings in Views to give you a more accurate visual indication of where plants will actually be rendered in your final renderings. Views are typically rendered at a different resolution than your final renderings and may show different results if you use the Absolute Pixels option (see above).

If you are rendering the same scene for a poster and for a video animation, using the Relative to Image Height option will make the foliage dissolve away in the same places in both scenes.

Be careful with this option, it may add to rendering time when you render at lower resolutions than what is in the Image Reference Height field (see below). This is because as you decrease the size of the rendered image, VNS will correspondingly decrease the Distance Dissolve Height. You may then end up with VNS wasting time rendering Image Object foliage even for Image Objects that would be less than a single pixel in height.

Note: When you use the Relative to Image Height option VNS will take into account whatever constrained preview rendering size you use if you have selected the Constrain Render Area icon (see Constrain Render Area). Image height will be calculated using the pixel height of the constrained render area, not the pixel height of the View.

Distance Dissolve for this Ecotype Section

You can reduce rendering times by enabling Distance Dissolve and adjusting the Dissolve Height. Then Image Object foliage will transition to a fast-rendering color or a texture in the distance.

If you are using the Absolute Pixels option then the Dissolve Height is an absolute value in pixels (see the Common Distance Dissolve section above). This gives you the more efficient rendering.

If you are using the Relative to Image Height option then the Dissolve Height will be scaled depending on the resolution of your rendering (see the Common Distance Dissolve section above). This allows the most consistency between renderings at different resolutions, including preview renderings in a View.

Dissolve Enabled Checkbox

Select the Dissolve Enable checkbox to enable Distance Dissolve. Deselect it to disable Distance Dissolve.

Dissolve Height Field

Dissolve Height lets you control how small the rendered foliage can get in the distance before VNS replaces it with a color or texture.

If the Absolute Pixels radio button is selected in the Common Distance Dissolve section (see above), then this value will apply no matter what resolution you render your images.

If the Relative to Image Height radio button is selected in the Common Distance Dissolve section (see above), then this value will apply only for images that are rendered at the vertical resolution you enter into the Image Reference Height field (see below). VNS will scale the Dissolve Height for images rendered at a different horizontal resolution than specified in the Image Reference Height field. This allows Image Objects to change to a color or texture at the same place on the terrain no matter what resolution you render.

Image Reference Height Field

The "Image Ref. Ht." field is only available when you select the "Relative to Image Height" radio button in the Common Distance Dissolve section (see above).

Use the Image Reference Height field to specify the rendered image height in pixels at which the actual Dissolve Height value is used. This lets you control the amount of up or down Dissolve Height scaling that will occur when you render images at different resolutions. The specified Dissolve Height will always be multiplied by the rendered image height (in pixels) divided by the Image Reference Height (in pixels).

The default Image Reference Height value is 480 pixels. You may want to set it to match the resolution of your preview renderings or your final image renderings.

Example

Let's look at how this works. Suppose you use an Image Reference Height of 480 pixels. If you render an image with a height of 480 pixels and you have an Ecotype that uses a Dissolve Height of 2 pixels, then any rendered images that are 480 pixels high will really have a Dissolve Height of 2 pixels for that Ecotype. $2 \times 480 / 480 = 2$

But if you render a preview image at half that resolution, 240 pixels, VNS will scale the Dissolve Height down by 50% and that Ecotype will have an actual Dissolve Height of 1 pixel in that rendered image. $2 \times 240 / 480 = 1$

If you render a poster with an image height of 1920 pixels, the actual Dissolve Height for the Ecotype in that image will become 8 pixels. $2 \times 1920 / 480 = 8$.

The end result is that the Ecotype will dissolve out to a color or texture at the same place on the terrain in all three examples. This would not have been true if you were using the Absolute Pixels option in the Common Distance Dissolve section (see above).

Note: You can set the rendered image height with the Height field on the Size and Range page of the Render Options Editor.

The Image Reference Height is always the same for all Ecotypes and Foliage Effects. When you change it for one Ecotype or Foliage Effect you are changing it for all Ecotypes and Foliage Effects.

Note: All Ecotypes and Foliage Effects are also affected when you select either the Absolute Pixels radio button or the Relative to Image Height radio button in the Common Distance Dissolve section (see above).

However, the Dissolve Height is unique to each Ecosystem or Foliage Effect.

Dissolve Color Controls

Click the Dissolve Color well to open the Color Editor. There you can edit the color VNS will render on the terrain in the distance.

If you'd rather use a texture, click the Texture icon to open the Texture Editor. There you can create a more complex pattern to represent your distant foliage. Textures will take longer to render than a simple color.

Settings Sub-Page

Absolute Size Radio Buttons

Select the "Absolute Size is in Ecotype" radio button if you want to control the actual size of the Ecotype's foliage using the Maximum Size field, on the Parameters page in the Ecotype Size section. You can then set the size of each Foliage Group as a percentage of the Ecotype's Maximum Size.

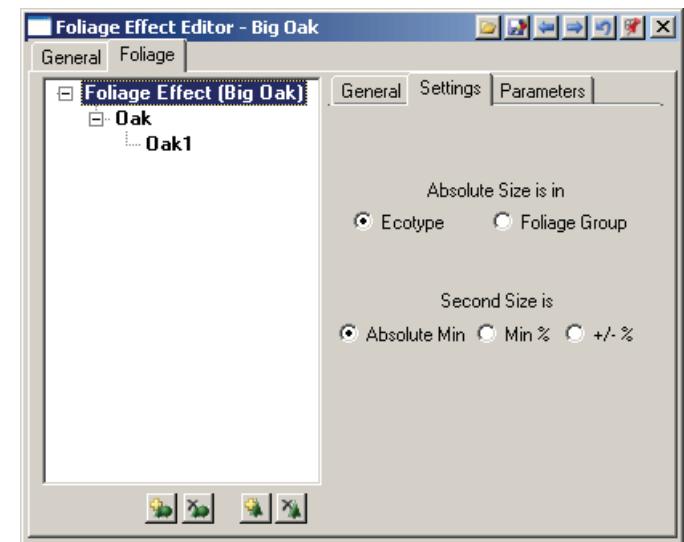
Select the "Absolute Size is in Foliage Group" radio button if you want to set the actual size of each Foliage Group directly instead of setting each group as a percentage of the Ecotype Size. VNS will disable the Ecotype Size controls and you can directly set a Group Size and Group Minimum Size for each Foliage Group on the Groups page.

Note: In both cases, the size of each Foliage Object is a percentage of the size of the Foliage Group to which it belongs. You can set the size percentage for each Foliage Object.

However you choose to control the absolute size, you'll set it in the units you selected in the Height field on the Units page of the Preferences Window.

Second Size Radio Buttons

The "Second Size is" radio buttons let you configure how the Ecotype Editor lets you control a second size for the Ecotype's foliage.



Second Size is in Absolute Minimum radio button

Select the Second Size is in Absolute Minimum (Min) radio button if you want to be able to set a secondary Size as a specific, using the units you selected in the Height field on the Units page of the Preferences Window.

If you've selected the "Absolute Size is in Ecotype" radio button (see above), you can then control a minimum size for all Foliage Groups using the Minimum Size percentage field on the Parameters page.

If you've selected the "Absolute Size is in Foliage Group" radio button (see above), you can then control a minimum size for separately for each Foliage Group using the Group Minimum Size field on the Parameters page for a selected Foliage Group. This controls the minimum size separately for each Group.

Second Size is Minimum Percentage Radio Button

Select the Second Size is in Minimum (Min) percentage radio button if you want to be able to set the secondary size as a percentage of the absolute size.

If you've selected the "Absolute Size is in Ecotype" radio button (see above), you can then control a minimum size for all Foliage Groups using the Minimum Size Percentage field on the Parameters page. The minimum size of the Ecotype's foliage will be a percentage of the value you entered into the Maximum Size field. VNS will vary the size of the foliage between these two sizes. You can further control the size of each Foliage Group by adjusting the Group Size percentage field on the Parameters page for each Foliage Group.

If you've selected the "Absolute Size is in Foliage Group" radio button (see above), you can instead control a minimum size for separately for each Foliage Group using the Group Minimum size field on the parameters page for a selected Foliage Group. This controls the minimum size separately for each Group.

Second Size is Plus or Minus a Percentage Radio Button

Select the Second Size is +/- percentage radio button if you want to be able to set the secondary size as a percentage range above and below the absolute size.

If you've selected the "Absolute Size is in Ecotype" radio button (see above), you can then control a range of size for all Foliage Groups using the Size Range Plus/Minus Percentage field on the Parameters page. The Ecotype's foliage will range in size as a percentage above or below the value you entered into the Maximum Size field. VNS will vary the size of the foliage within this percentage range. You can further control the size of each Foliage Group by adjusting the Group Size percentage field on the Parameters page for each Foliage Group.

If you've selected the "Absolute Size is in Foliage Group" radio button (see above), you can instead control a range of size separately for each Foliage Group using the Group Size Range Plus/Minus Percentage field on the Parameters page for a selected Foliage Group. This controls the size range separately for each Group.

Parameters Sub-Page

The Ecotype Size section's fields are available if you select the Absolute Size is in Ecotype radio button on the General Sub-Page (see above).

Note: These fields let you adjust foliage sizes for the entire Ecotype. You can further adjust foliage sizes for each of the Ecotype's Foliage Groups and for individual Foliage Objects by selecting the relevant Group or Object and using the context sensitive controls which appear (see below). You can also adjust Foliage sizes for all the foliage from all Ecosystems used within an Environment. To do so, use the Foliage Height Factor field on the Foliage and Gradients page of the Environment Editor.

Maximum Height Field

Use the Maximum Height field to specify the upper limit for how large you'd like the foliage in the Active Ecosystem to appear.

Enter a value for the Maximum Height field in the units you selected for height on the Units page of the Preferences Window.

Controlling Height with a Texture

If you want to control foliage height with a texture, click the Texture Operations Icon next to the field for the variable you want to control, which in this case is Maximum Height.

Select the Create Texture command from the Texture Operations Icon's commands and VNS will create a new texture and open the Texture Editor. There you can edit your texture to control the variable. Wherever the Texture is white, you'll have the full height using the value you set in the Maximum Height field. Wherever the texture is gray you'll have less height and where it is black you'll have zero height. This is a good way to make naturally varied foliage heights.

Controlling Height with a Thematic Map

If you want to control foliage height with a Thematic Map, click the Thematic Map Operations Icon next to the field for the variable you want to control, which in this case is Maximum Height.

Select the Create Thematic Map command from the Thematic Map Operations Icon's commands and VNS will create a new Thematic Map and open the Thematic Map Editor. There you can select one or more Vector attributes to control the variable. In this case the height value will be inherited from the Vector attribute you select. The attribute value comes from the Ecosystem's attached Vector. This is a good way to let your GIS data control actual foliage height in VNS.

Second Size Field

The second Size field lets you control Minimum Size, Minimum Size Percentage or Size Range +/- Percentage depending on your Second Size radio button selection on the General page (see above).

If you select the Second Size is in Absolute Min (Minimum) on the Settings sub-page, the second Size field will be labelled "Minimum Height." Enter the height you want for the shortest foliage in the Ecotype. When you render, VNS will place trees with a random mix of heights from the Minimum Height you specified in the Minimum Height field up to the Maximum Height you specified in the Maximum Height field (see above).

Note: The Minimum Height field uses the units you selected for height on the Units page of the Preferences Window.

If you select the Second Size is in Min (Minimum) Percentage on the Settings sub-page, the second size field will be labelled "Minimum Height Percentage." Enter the height you want for the shortest foliage in the Ecotype as a percentage of the Maximum Height field. When you render, VNS will place trees with a random mix of heights from the Minimum Height percentage you specified in the Minimum Height Percentage field up to the Maximum Height you specified in the Maximum Height field (see above).

If you select the Second Size is in Min (Minimum) Percentage on the General page, the second Height field will be labelled "Height Range (+/-)." Enter the height you want for the shortest foliage in the Ecotype as a percentage above and below the value in the Maximum Height field. When you render, VNS will place trees with a random mix of heights ranging above and below the value you specified in the Maximum Height field (see above).

Foliage Group Controls

The following controls appear when the selected item in the Material Foliage List is a Foliage group:

Load Foliage Group Icon

Click the Load Foliage Group icon to open the Component Gallery where you can load a Foliage Group Component.

Save Foliage Group Icon

Click the Save Foliage Group icon to open the Component Signature Window where you can save the selected Foliage Group as a Component for use in other Projects.

Name Field

Whenever you create a Foliage Group VNS asks you for a name. You can change the name of a Foliage Group by selecting it in the Foliage Group list and changing it in the Name field.

Group Enabled Checkbox

Select the Group Enabled checkbox to make the Group available for rendering. Deselect it if you want to disable the Group for rendering.

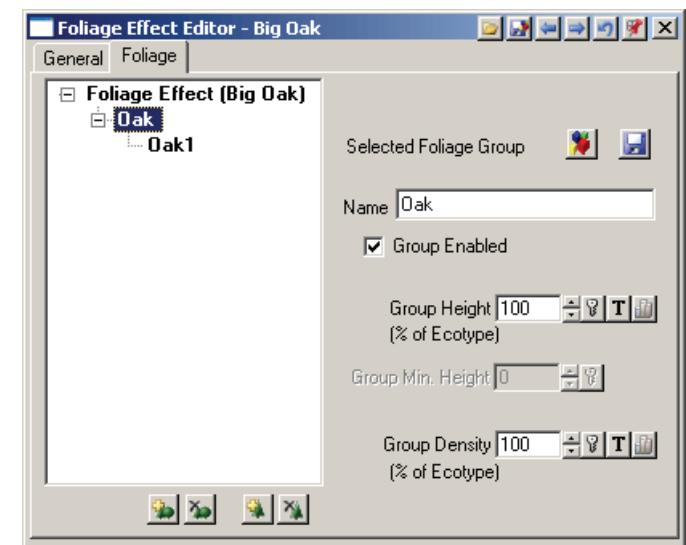
Group Size Controls

Each Foliage Group has its own height specification. This determines how tall the Foliage Objects in the Group are compared to other Foliage Groups in the Ecotype. You can also adjust the height of each Foliage Object in the Group on the Objects page (see below). This gives you tremendous flexibility to customize an Ecotype.

Note: If you don't care for subtleties, just select the "Absolute Height is in Ecotype" radio button on the General page, leave all the heights set to 100% on the Groups and Objects pages and modify the values on the Ecotype page to get the right look.

If you selected the "Absolute Height is in Ecotype" radio button on the General page, you'll control the actual height of the Ecotype's foliage using the Maximum Height field on the Ecotype page in the Ecotype Height section. You can then set the height of each Foliage Group here with the Group Height field as a percentage of the Ecotype's Maximum Height.

If you selected the "Absolute Height is in Foliage Group" radio button on the General page, you'll control the actual height of each Foliage Group directly instead of setting each group as a percentage of the Ecotype Height. VNS will disable the Ecotype Height controls and you can directly set a Group Height and a Secondary height for each Foliage Group on the Groups page.



Second Height Field

The second Height field lets you control Minimum Height, Minimum Height Percentage or Height Range +/- Percentage depending on your Second Height radio button selection on the General page (see above).

If you select the Second Height is in Absolute Min (Minimum) on the General page, the second Height field will be labelled "Group Minimum Height." Enter the height you want for the shortest foliage in the Foliage Group. When you render, VNS will place trees with a random mix of heights from the Group Minimum Height you specified in the Minimum Height field up to the Maximum Height you specified in the Group Height field (see above).

Note: The Group Minimum Height field uses the units you selected for height on the Units page of the Preferences Window.

If you select the Second Height is in Min (Minimum) Percentage on the General page, the second Height field will be labelled "Group Min (Minimum) Height Percentage." Enter the height you want for the shortest foliage in the Foliage Group as a percentage of the Group Height field. When you render, VNS will place trees with a random mix of heights from the Group Minimum Height percentage you specified in the Group Min Height Percentage field up to the Maximum Height you specified in the Group Height field (see above).

If you select the Second Height is in Min (Minimum) Percentage on the General page, the second Height field will be labelled "Group Ht (Height) Range (+/-)." Enter the height you want for the shortest foliage in the Foliage Group as a percentage above and below the value in the Group Height field. When you render, VNS will place trees with a random mix of heights ranging above and below the value you specified in the Group Height field (see above).

If you wish you can control the group's height with a Thematic Map or a texture.

Group Density Percentage Controls

The Foliage Effect places a Foliage Object at each vertex of the host Vector(s). The chances of any particular Foliage Object of appearing along the Vector depends on the density percentage for the Foliage Group it belongs to, and within that group, the density percentage for the Foliage Object itself.

To make the members of a Foliage Group more likely to appear, increase the Group Density percentage. To make the members of a Foliage Group less likely to appear, decrease the Group Density percentage.

If you wish you can control the group's density with a Thematic Map or a texture.

Foliage Object Controls

Image Object or 3D Object Radio Buttons

These radio buttons let you select whether the selected Foliage Object should be an Image Object or a 3D Object.

If you select the Image Object radio button, VNS will show the Image Object section at the bottom of the Objects page (see below). There you can select an Image Object and adjust its properties.

If you select the 3D Object radio button, VNS will show the 3D Object section at the bottom of the Objects page (see below). There you can select a 3D Object and adjust its properties.

Enabled Checkbox

The Enabled checkbox lets you enable or disable the selected Foliage Object for rendering. Disabled Foliage Objects are shown in gray in the Foliage Objects list.

Image Object Options

Image Object Drop Box

Select an Image Object in the Image Object drop box. VNS will replace the selected Foliage Object in the Foliage Objects list (see above) with the Image Object you choose.

If you want to load a new Image Object, select “New Image Object.” VNS will open a file requester where you can select a new Image Object. Image Objects can be images or image sequences in any supported format (see Image Loading and Saving).

Width, Height and Image Bands Display Fields

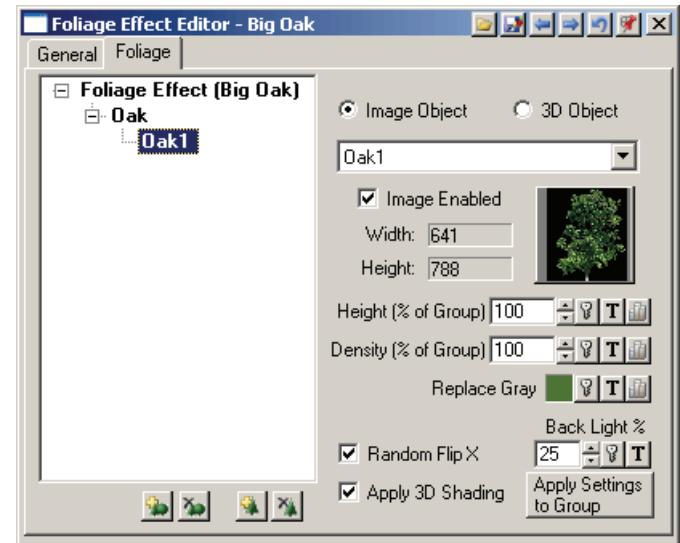
The Width, Height and Image Bands display fields show the pixel dimensions and number of 8-bit image bands of the Selected Image Object.

Thumbnail

The Thumbnail shows a small version of the selected Image Object. You can double-click it if you want to see the full version.

Random Flip X Checkbox

Select the Random Flip X checkbox to have VNS randomly reverse the Image Object from left-to-right during rendering. This will give you more variety in the foliage since the selected Image Object will appear in different places in normal and reversed versions.



Apply 3D Shading Checkbox

Select the Apply 3D Shading checkbox to tell VNS to shade the Image Object based on the direction of the light. This will give foliage a more 3-dimensional appearance.

Replace Gray Color Controls

By using unique colors for a Group of images or even individual Foliage Objects you can create a scene of nearly unlimited color variety. You can animate colors to create a kaleidoscopic landscape. Change the color of maple trees first, then the birches followed by the oaks and leave the conifers green, and voila - New England in October.

Each Image Object has its own color specifications. The color for each image can come from the Image Object itself or from a color. If it comes from a color, you can animate that color. You can edit the colors for the selected Image Object by clicking the Replace Gray color well to open the Color Editor.

Note: This only works for gray scale images, or images that have been set to gray scale in the Image Object Library. If the Image Object contains a color image and it has not been changed to gray scale in the Image Object Library, the Replace Gray color well will be disabled.

You can change the Gray Replacement Color for a gray-scale Image Object independently at any time or leave it with the color it inherited when you added the Image Object.

Note: Gray Scale Images require 1/3 the amount of memory that 24 bit color images require when rendering.

Height Percentage Controls

Each Foliage Object has its own height specifications. These determine how tall the object is compared to other objects in the Ecotype.

The Height Percentage field for the currently selected Foliage Object is a percentage of the number entered in the Group Height field for the Foliage Group on the Groups page (see above).

If you wish you can control the object's height with a Thematic Map or a texture.

Density Percentage Controls

The Foliage Effect places a Foliage Object at each vertex of the host Vector(s). The chances of any particular Foliage Object of appearing along the Vector depends on the density percentage for the Foliage Group it belongs to, and within that group, the density percentage for the Foliage Object itself.

To make a Foliage Object more likely to appear, increase the Density percentage. To make a Foliage Object less likely to appear, decrease the Density percentage.

If you wish you can control the object's density with a Thematic Map or a texture.

Back Light Percentage Field

The Back Light Percentage field lets you allow light to shine through backlit Image Object foliage. The default value is 25%. You can set it higher than 100%.

Use the Back Light Percentage when the Camera is looking into the light and the foliage looks too dark. It allows light to be transmitted through the leaves. This will brighten the foliage and increase color saturation. The result can be much more realistic small vegetation when the vegetation is backlit.

You can adjust the Back Light Percentage individually for any Foliage Object by selecting it in the Foliage Objects list and changing the value in the Back Light Percentage field. You can increase the Back Light percentage to brighten objects that are between the Camera and a light. Decrease it if you want a silhouette effect.

Apply to Group Button

Click the Apply to Group button if you want to set the Back Light Percentage of all members of the Group to be the same as the value in the Back Light Percentage field (see above). This is much faster than setting the Back Light Percentage individually for each member of the Group.

If the Back Light Percentage for the current Foliage Object has key frames, they will also be copied to the other members of the Group.

3D Object Options

Rotate X, Y and Z Checkboxes and Fields

The Rotation controls let you add random rotation to the current 3D Object. Select a checkbox and enter a value and VNS will randomly rotate the object along that axis every time it places it on a Vector vertex, within the rotation limit you set.

The X axis runs east to west. A positive X axis is to the east. The Y axis runs vertically. A positive Y axis is up. The Z axis runs north to south. A positive Z axis is to the north.

Enter a number in the X Field to rotate the 3D Object around the X axis. Enter a number in the Y Field to rotate the 3D Object around the Y axis. Enter a number in the Z Field to rotate the 3D Object around the Z axis.

A value of zero in any field means no rotation for that axis.

Polygons, Vertices and Materials Display Fields

The Vertices display field shows the number of vertices in the current 3D Object. The more vertices there are, the longer it will take to render. VNS does not impose a limit to the number of vertices an object may have, other than the limit imposed by the available memory on your system.

The Polygons display field shows the number of polygons in the current 3D Object. The more polygons there are, the longer it will take to render. VNS does not impose a limit to the number of polygons an object may have, other than the limit imposed by the available memory on your system.

The Materials display field shows how many materials there are in the current 3D Object. A Material is a texture applied to groups of polygons within the object. For example, a car object may have a body Material, a bumper Material, a tire Material and a glass Material. You can edit the properties of each Material using the 3D Material Editor.

Height Percentage Controls

Each Foliage Object has its own height specifications. These determine how tall the object is compared to other objects in the Ecotype.

The Height Percentage field for the currently selected Foliage Object is a percentage of the number entered in the Group Height field for the Foliage Group on the Groups page (see above).

Density Percentage Controls

The Foliage Effect places a Foliage Object at each vertex of the host Vector(s). The chances of any particular Foliage Object of appearing along the Vector depends on the density percentage for the Foliage Group it belongs to, and within that group, the density percentage for the Foliage Object itself.

To make a Foliage Object more likely to appear, increase the Density percentage. To make a Foliage Object less likely to appear, decrease the Density percentage.

If you wish you can control the object's density with a Thematic Map or a texture.

Foliage Effect Editor - Forestry Edition

If you are not running the Forestry Edition you will need to refer to the section relating to the regular version of the Foliage Effect Editor.

The Foliage Effect Editor lets you control each Foliage Effect in your Project. The controls apply to the Foliage Effect shown in the Editor's title bar.

Note: You can select a different Foliage Effect to edit by double clicking the name of another Foliage Effect in the Scene-At-A-Glance or by clicking the You can import Components into your Projects using the Component Gallery..

Foliage Effects are only rendered if their underlying DEM is rendered. You can specify whether they will appear at an absolute elevation or an elevation relative to either the terrain or Vector elevation.

What is a Foliage Effect?

A Foliage Effect lets you place Image Objects or 3D Objects onto the terrain. You can place a single object or rows of objects as defined by the points of a Vector Object. The Foliage Effect will appear even if other foliage has been placed via Ecotypes.

Image Objects can be still images or animated sequences (see Image Object Library). Typically they will be images or animations of trees and other foliage, but they can be any images or animations of anything you like. If you have an animation of a dancing munchkin and want an entire forest of dancing munchkins, you can create that effect using Image Objects and the Foliage Effect Editor.

3D Objects can be trees, flowers, fence posts, power poles, buildings or anything you like.

Foliage Effects are useful for things like placing an individual tree or bush; creating an orderly orchard; adding telephone poles to the side of a road; adding floating signs over a building site, a town or a point of interest; or adding fence posts to the edge of a field. Since Image Objects can be animations, you can even use a Foliage Effect to put things like buildings with blinking lights, animated characters, lightning, explosions or falling rain or snow into your scene.

You can also use a Foliage Effect to place trees or water plants into a stream or lake.

Using Pre-made Components

Click the Load Component From Disk Icon in the Foliage Effect Editor to see the Component Gallery, ready to load a pre-made Foliage Effect. VNS will reset the parameters of the Ecotype to those of the Component you selected.

You can create and export your own pre-built Foliage Effect Components from the Foliage Effect Editor by setting up the Foliage Effect the way you want it and then clicking the Save Component To Disk Icon. VNS will open the Component Signature Window where you can fill in the information, choose a representative image for the Component's thumbnail and save the Component in the Component Gallery.

You can later reuse the Foliage Effect in other Projects.

Note: You can also save and load Foliage Groups as Components.

General Page

General Features Section

Each Foliage Effect is configurable to act in different ways depending on your needs. The General features section lets you choose the Absolute Height, Second Height and Density behaviors you need.

Name Field

Use the Name field to edit the name of the current Foliage Effect.

Enabled Checkbox

The Enabled checkbox lets you enable or disable the Foliage Effect for rendering.

Disabling an object can be useful to speed up rendering if you are doing test renders to check some other aspect of your scene and don't need to see the Foliage Effect. Make sure you remember to enable it for the final rendering if you want to see the Foliage Effect's objects.

Note: To see the Foliage Effect in your rendering, it must be visible to the Camera you selected for the Render Job you are using (see Render Job Editor), and Foliage Effects must be enabled in the Render Options you are using (see Render Options Editor).

Preview Enabled Checkbox

Select this checkbox to enable the display of this foliage effect in realtime views. In order for the foliage effect to show up, you must have also enabled either Realtime Foliage Images from the View's Realtime Popup menu, or have selected the checkbox marked RT Foliage Images in the View Preferences Window. Deselecting this checkbox allows you to disable the display of Foliage Effects on a per-component basis.

Base Elevation Section

Base Elevation Field and Buttons

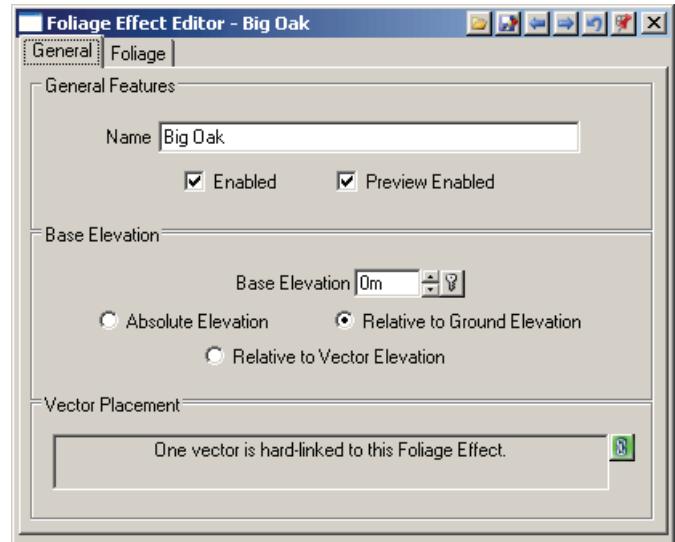
The Base Elevation is an offset from ground elevation if you chose the Relative to Ground radio button; an offset from the Vector elevation if you chose the Relative to Vector radio button, or the actual elevation in meters if you chose the Absolute radio button.

Base Elevation Radio Buttons

The Base Elevation Radio buttons let you choose how the Base Elevation works.

Absolute Elevation Radio Button

Choose the Absolute Elevation radio button to make the Base Elevation (see above) be the actual elevation of the base of the Scaled Images in meters above sea level.



Note: Sea Level is the surface of the Project Coordinate System's Ellipsoid, which is an elevation of zero. You can see the Project's Coordinate System in the Planet Options Editor.

Relative to Ground Elevation Radio Button

Choose the Relative to Ground radio button to make the Base Elevation be an offset in meters from the elevation of the terrain.

Note: If the Foliage Effect's Vector is above NULL value terrain the Foliage Effect will be rendered at the NULL elevation.

Relative to Vector Elevation Radio Button

Choose the Relative to Vector radio button to make the Base Elevation be an offset in meters from the elevation of the Vector to which the Foliage Effect is applied.

Vector Placement Section

By attaching Vectors to Foliage Effects you control where they appear. Vectors can be dynamically linked with Search Queries or hard linked.

Vector Links Button

This control allows you to perform various tasks relating to the association of vectors with components. To learn how to use it, see Vector Links Icon.

Attached Hard-Linked Vectors Display

The Hard-Linked Vectors display tells you if there are any Vectors hard-linked to the Component, and if so, how many. It will also display vectors attached by Search queries and list the names of the search query or queries in use.

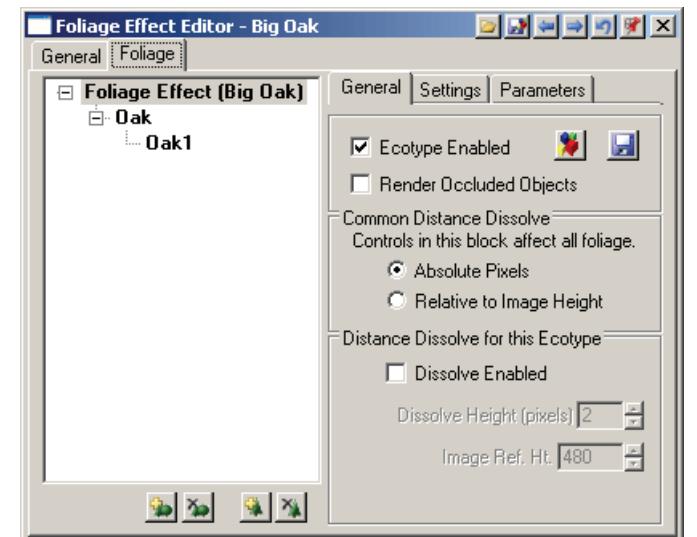
Foliage Page

To create Foliage Effects in VNS, perform the following:

- Add one or more Foliage Groups to the Foliage Effect using the Foliage Group Control Icon underneath the Foliage List on the Foliage Page.**
- Add one or more Foliage Objects to each Group using the Foliage Object Control Icon underneath the Foliage List on the Foliage Page.**
- Adjust the properties for each Foliage Object & Group on the parameters pages that appear when the appropriate item is selected in the Foliage List page.**

You can specify height for each Foliage Object & Foliage Group. You can even use textures to control height to create natural-looking foliage clumping based on procedural textures, images and dynamic parameters.

The way the controls interact depends on the choices you make on the Settings sub-page. There you can configure the Ecotype to behave according to your needs.



Foliage Objects can be Image Objects or 3D Objects. Image Objects can be still images or animated sequences (see the Image Object Library section). Typically they will be images or animations of trees and other foliage, but they can be any images or animations of anything you like. If you have an animation of a dancing munchkin and want a line of dancing munchkins, you can create that effect using Image Objects and the Foliage Effect Editor.

Using Pre-made Components

Click the Load Component From Disk Icon to see the Component Gallery, ready to load a pre-made Foliage Effects. Foliage Effects are multiple groups of Foliage Objects with their Group and Object controls already set up. You can select from any previously created Foliage Effect files. Double-click the thumbnail image to load the Foliage Effect Component. VNS will reset the parameters of the Foliage Effect to those of the Component you selected.

You can create and export your own pre-built Foliage Effect Components from the Foliage Effect Editor by setting up the Foliage Effect the way you want it and then clicking the Save Component To Disk Icon. VNS will open the Component Signature Window where you can fill in the information, choose a representative image for the Component's thumbnail and save the Component in the Component Gallery.

For example, this makes it easy to create different kinds of hedges with complex foliage mixes. You can later reuse the Foliage Effect another Project and have an instant complex hedge.

Material Foliage List

This list will show the foliage associated with the currently selected Foliage Effect. The selected Foliage Effect name will be in brackets behind the words "Foliage Effect" at the top of the list.

Enabled Items in the list will be displayed in Bold text. Disabled Items will still be displayed, but not emboldened.

At the bottom of the Material Foliage List, there are the following Control Icons:



Add Foliage Group

Click the Add Foliage Group icon if you want to add a new Foliage Group to the Foliage Effect. VNS will ask for a name.

Note: You have to add at least one Foliage Group to an Foliage Effect before you can add Foliage Objects on the Objects page (see below).



Remove Foliage Group

Click the Remove Foliage Group icon if you want to delete a Foliage Group. VNS will remove the Foliage Group from the Foliage Effect.

If the Foliage Group existed when you last opened the Foliage Effect Editor, you can undo the removal by clicking the Undo All Changes in this Window icon. Otherwise the Foliage Group will be gone forever.



Add Foliage Object

Click the Add Foliage Object icon to Create a new, blank entry in the Foliage Objects list.

Then choose either the Image Object or 3D Object radio button in the Selected Object section (see below). Finally, select an object from the drop box in the Image Object section or 3D Object section (see below).

Remove Foliage Object

If you want to remove a Foliage Object from the selected Foliage Group, select it in the Foliage Objects list and click the Remove Foliage Object icon.

VNS will ask if you want to remove the object. Click OK and VNS will remove it from the Foliage Group.

General Sub-Page

Ecotype Enabled Checkbox

The Enabled checkbox lets you enable or disable the Ecotype for rendering.

Note: You can also enable and disable an Ecotype from its Ecotype Operations icon on the Ecosystem, Lake or Stream Editor, wherever you first created the Ecotype. Select the icon's Disable Ecotype command to disable the Ecotype. The icon will be displayed with a red diagonal stripe to indicate that it's disabled. Select the icon's Enable Ecotype command to enable the Ecotype. The Ecotype will be enabled and the red stripe will disappear.

Disabling an Ecotype can be useful to speed up rendering if you are doing test renders to check some other aspect of your scene and don't need to see the Ecotype's foliage. Make sure you remember to enable it for the final rendering if you want to see the foliage.

Note: To see the Ecotype in your rendering, it must be part of an Ecosystem or Beach that is visible to the Camera you selected for the Render Job you are using (see Render Job Editor), and Other Foliage must be enabled in the Render Options you are using (see Render Options Editor).

Render Occluded Objects Checkbox

Selecting this checkbox will force VNS to render those elements of the scene obscured by this foliage effect. This will allow reflections to accurately represent terrain and foliage that has been hidden from the camera by this foliage effect. Select this checkbox if you are experiencing "holes" in reflections of terrain and foliage objects near to a Foliage Effect.

Common Distance Dissolve Section

The Common Distance Dissolve section lets you specify whether VNS will calculate Distance Dissolve Height based on an absolute pixel height or as a pixel height relative to a specified image size. This applies to all the Ecotypes and Foliage Effects in your Project (see also Foliage Effect Editor).

Distance Dissolve Height is the height at which VNS will stop rendering foliage Image Objects and instead render a color or texture. You can enable Distance Dissolve in the Image Object Distance Dissolve section (see below). There you can specify a pixel height for Image Objects at which VNS stops trying to render foliage and instead renders a simple color or a texture.

For example, if a tree is so far away that its height is below the Distance Dissolve Height in pixels, it will no longer be rendered and VNS will instead render the color or texture you specify. This can make rendering much, much faster because VNS can calculate a color or

texture much faster than a combination of foliage. Rendering the actual trees and plants far in the distance may take a long time for little or no visual benefit.

The default choice is Absolute Pixels. The default value for Distance Dissolve Height is 2 pixels. This means that VNS will replace a foliage object with a color or texture whenever the foliage object is shorter than two pixels in your rendered image. This makes a lot of sense because you can't see a complete tree in two pixels anyway, so there's not much point wasting the rendering time in the attempt.

You can enable Distance Dissolve in the Image Object Distance Dissolve section (see below).

Absolute Pixels Radio Button

Select the Absolute Pixels radio button to choose a specific height in pixels below which VNS will no longer render an Image Object. VNS will instead replace the Image Object with the color or texture you specify in the Image Object Distance Dissolve section (see below).

By default, the Absolute Pixels radio button is selected.

Relative to Image Height Radio Button

Select the Relative to Image Height radio button to relate the minimum pixel height at which VNS will render Image Objects to the size of your rendered images. This will let you see a more consistent rendering no matter what size image you render. Image Object foliage will then appear in the same areas and be dissolved to a color or texture in the same areas at any image size.

When you use the Relative to Image Height option, VNS will automatically change the Distance Dissolve Height based on the size of your rendering. VNS does this by using the Image Reference Height you specify in the Image Object Distance Dissolve section (see below).

You may want to select this option in order for preview renderings in Views to give you a more accurate visual indication of where plants will actually be rendered in your final renderings. Views are typically rendered at a different resolution than your final renderings and may show different results if you use the Absolute Pixels option (see above).

If you are rendering the same scene for a poster and for a video animation, using the Relative to Image Height option will make the foliage dissolve away in the same places in both scenes.

Be careful with this option, it may add to rendering time when you render at lower resolutions than what is in the Image Reference Height field (see below). This is because as you decrease the size of the rendered image, VNS will correspondingly decrease the Distance Dissolve Height. You may then end up with VNS wasting time rendering Image Object foliage even for Image Objects that would be less than a single pixel in height.

Note: When you use the Relative to Image Height option VNS will take into account whatever constrained preview rendering size you use if you have selected the Constrain Render Area icon (see Constrain Render Area). Image height will be calculated using the pixel height of the constrained render area, not the pixel height of the View.

Distance Dissolve for this Ecotype Section

You can reduce rendering times by enabling Distance Dissolve and adjusting the Dissolve Height. Then Image Object foliage will transition to a fast-rendering color or a texture in the distance.

If you are using the Absolute Pixels option then the Dissolve Height is an absolute value in pixels (see the Common Distance Dissolve section above). This gives you the more efficient rendering.

If you are using the Relative to Image Height option then the Dissolve Height will be scaled depending on the resolution of your rendering (see the Common Distance Dissolve section above). This allows the most consistency between renderings at different resolutions, including preview renderings in a View.

Dissolve Enabled Checkbox

Select the Dissolve Enable checkbox to enable Distance Dissolve. Deselect it to disable Distance Dissolve.

Dissolve Height Field

Dissolve Height lets you control how small the rendered foliage can get in the distance before VNS replaces it with a color or texture.

If the Absolute Pixels radio button is selected in the Common Distance Dissolve section (see above), then this value will apply no matter what resolution you render your images.

If the Relative to Image Height radio button is selected in the Common Distance Dissolve section (see above), then this value will apply only for images that are rendered at the vertical resolution you enter into the Image Reference Height field (see below). VNS will scale the Dissolve Height for images rendered at a different horizontal resolution than specified in the Image Reference Height field. This allows Image Objects to change to a color or texture at the same place on the terrain no matter what resolution you render.

Image Reference Height Field

The "Image Ref. Ht." field is only available when you select the "Relative to Image Height" radio button in the Common Distance Dissolve section (see above).

Use the Image Reference Height field to specify the rendered image height in pixels at which the actual Dissolve Height value is used. This lets you control the amount of up or down Dissolve Height scaling that will occur when you render images at different resolutions. The specified Dissolve Height will always be multiplied by the rendered image height (in pixels) divided by the Image Reference Height (in pixels).

The default Image Reference Height value is 480 pixels. You may want to set it to match the resolution of your preview renderings or your final image renderings.

Example

Let's look at how this works. Suppose you use an Image Reference Height of 480 pixels. If you render an image with a height of 480 pixels and you have an Ecotype that uses a Dissolve Height of 2 pixels, then any rendered images that are 480 pixels high will really have a Dissolve Height of 2 pixels for that Ecotype. $2 \times 480 / 480 = 2$

But if you render a preview image at half that resolution, 240 pixels, VNS will scale the Dissolve Height down by 50% and that Ecotype will have an actual Dissolve Height of 1 pixel in that rendered image. $2 \times 240 / 480 = 1$

If you render a poster with an image height of 1920 pixels, the actual Dissolve Height for the Ecotype in that image will become 8 pixels. $2 \times 1920 / 480 = 8$.

The end result is that the Ecotype will dissolve out to a color or texture at the same place on the terrain in all three examples. This would not have been true if you were using the Absolute Pixels option in the Common Distance Dissolve section (see above).

Note: You can set the rendered image height with the Height field on the Size and Range page of the Render Options Editor.

The Image Reference Height is always the same for all Ecotypes and Foliage Effects. When you change it for one Ecotype or Foliage Effect you are changing it for all Ecotypes and Foliage Effects.

Note: All Ecotypes and Foliage Effects are also affected when you select either the Absolute Pixels radio button or the Relative to Image Height radio button in the Common Distance Dissolve section (see above).

However, the Dissolve Height is unique to each Ecosystem or Foliage Effect.

Dissolve Color Controls

Click the Dissolve Color well to open the Color Editor. There you can edit the color VNS will render on the terrain in the distance.

If you'd rather use a texture, click the Texture icon to open the Texture Editor. There you can create a more complex pattern to represent your distant foliage. Textures will take longer to render than a simple color.

Settings Sub-Page

Absolute Size Radio Buttons

Select the "Absolute Size is in Ecotype" radio button if you want to control the actual size of the Ecotype's foliage using the Maximum Size field, on the Parameters page in the Ecotype Size section. You can then set the size of each Foliage Group as a percentage of the Ecotype's Maximum Size.

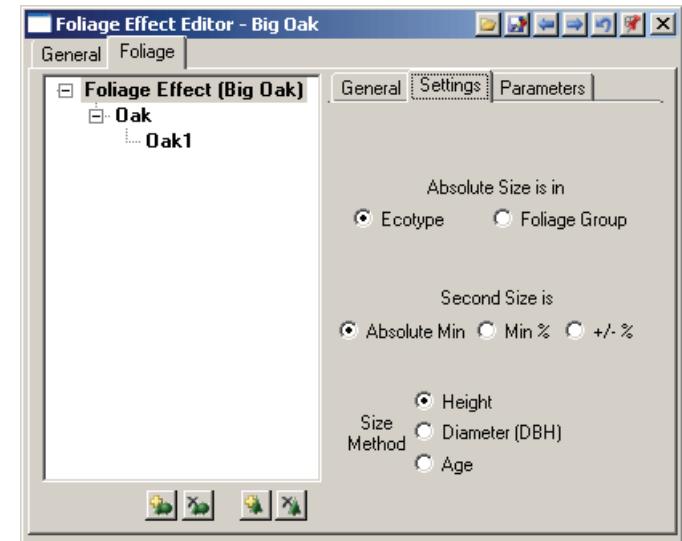
Select the "Absolute Size is in Foliage Group" radio button if you want to set the actual size of each Foliage Group directly instead of setting each group as a percentage of the Ecotype Size. VNS will disable the Ecotype Size controls and you can directly set a Group Size and Group Minimum Size for each Foliage Group on the Groups page.

Note: In both cases, the size of each Foliage Object is a percentage of the size of the Foliage Group to which it belongs. You can set the size percentage for each Foliage Object.

However you choose to control the absolute size, you'll set it in the units you selected in the Height field on the Units page of the Preferences Window.

Second Size Radio Buttons

The "Second Size is" radio buttons let you configure how the Ecotype Editor lets you control a second size for the Ecotype's foliage.



Second Size is in Absolute Minimum radio button

Select the Second Size is in Absolute Minimum (Min) radio button if you want to be able to set a secondary Size as a specific, using the units you selected in the Height field on the Units page of the Preferences Window.

If you've selected the "Absolute Size is in Ecotype" radio button (see above), you can then control a minimum size for all Foliage Groups using the Minimum Size percentage field on the Parameters page.

If you've selected the "Absolute Size is in Foliage Group" radio button (see above), you can then control a minimum size for separately for each Foliage Group using the Group Minimum Size field on the Parameters page for a selected Foliage Group. This controls the minimum size separately for each Group.

Second Size is Minimum Percentage Radio Button

Select the Second Size is in Minimum (Min) percentage radio button if you want to be able to set the secondary size as a percentage of the absolute size.

If you've selected the "Absolute Size is in Ecotype" radio button (see above), you can then control a minimum size for all Foliage Groups using the Minimum Size Percentage field on the Parameters page. The minimum size of the Ecotype's foliage will be a percentage of the value you entered into the Maximum Size field. VNS will vary the size of the foliage between these two sizes. You can further control the size of each Foliage Group by adjusting the Group Size percentage field on the Parameters page for each Foliage Group.

If you've selected the "Absolute Size is in Foliage Group" radio button (see above), you can instead control a minimum size for separately for each Foliage Group using the Group Minimum size field on the parameters page for a selected Foliage Group. This controls the minimum size separately for each Group.

Second Size is Plus or Minus a Percentage Radio Button

Select the Second Size is +/- percentage radio button if you want to be able to set the secondary size as a percentage range above and below the absolute size.

If you've selected the "Absolute Size is in Ecotype" radio button (see above), you can then control a range of size for all Foliage Groups using the Size Range Plus/Minus Percentage field on the Parameters page. The Ecotype's foliage will range in size as a percentage above or below the value you entered into the Maximum Size field. VNS will vary the size of the foliage within this percentage range. You can further control the size of each Foliage Group by adjusting the Group Size percentage field on the Parameters page for each Foliage Group.

If you've selected the "Absolute Size is in Foliage Group" radio button (see above), you can instead control a range of size separately for each Foliage Group using the Group Size Range Plus/Minus Percentage field on the Parameters page for a selected Foliage Group. This controls the size range separately for each Group.

Size Method Radio Buttons

VNS Forestry Edition offers three methods to specify the desired size of Foliage Effects: Height, Diameter or Age. Height is the most straight forward. You simply tell VNS how tall to make the foliage. But sometimes you might have other data that VNS can use to infer foliage heights indirectly. Diameter and age are the two additional methods supported for Foliage Effects. If you wish to use either of the

alternate methods you will also need to tell VNS what the relationship is between diameter and height or age and height. You will do that by creating a graph of the relationship. A default graph is provided for your use if you lack real height relationship data.

Height Radio Button

Select the Height Radio Button if you wish to control foliage size directly with height values.

Age Radio Button

Select the Age Radio Button if you wish to control foliage size indirectly with age values and an age/height relationship graph.

Diameter (DBH) Radio Button

Select the Diameter (DBH) Radio Button if you wish to control foliage size indirectly with diameter values and a diameter/height relationship graph. DBH stands for Diameter at Breast Height, a standard height above the ground for measuring tree diameters. You can use the Diameter (DBH) Size Method even if your tree diameters were measured at some other height from the ground. VNS does not care at which height diameters were measured so long as it is consistent with the DBH/Height graph that is used (see below).

Parameters Sub-Page

The Ecotype Size section's fields are available if you select the Absolute Size is in Ecotype radio button on the General Sub-Page (see above).

Note: These fields let you adjust foliage sizes for the entire Ecotype. You can further adjust foliage sizes for each of the Ecotype's Foliage Groups and for individual Foliage Objects by selecting the relevant Group or Object and using the context sensitive controls which appear (see below). You can also adjust Foliage sizes for all the foliage from all Ecosystems used within an Environment. To do so, use the Foliage Height Factor field on the Foliage and Gradients page of the Environment Editor.

Maximum Height Field

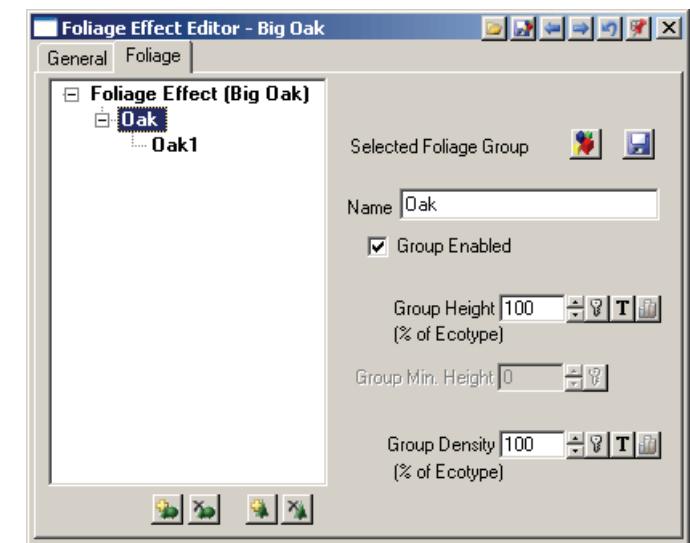
Use the Maximum Height field to specify the upper limit for how large you'd like the foliage in the Active Ecosystem to appear.

Enter a value for the Maximum Height field in the units you selected for height on the Units page of the Preferences Window.

Mean Height Field

Use the Mean Height field to specify the average for how tall you'd like the foliage in this Foliage Effect to appear. This control only appears if the Size Method is Height and the Second Size is Plus or Minus Percentage on the General Page (see above).

Enter a value for the Mean Height field in the units you selected for height on the Units page of the Preferences Window.



Maximum DBH Field

Use the Maximum DBH field to specify the upper limit for how large you'd like the foliage in this Foliage Effect to appear. This control only appears if the Size Method is Diameter (DBH) and if the Second Size is Absolute Minimum or Second Size is Minimum Percentage on the General Page (see above). DBH stands for Diameter at Breast Height, a standard height above the ground for measuring tree diameters.

Enter a value for the Maximum Diameter field in the units you selected for distance on the Units page of the Preferences Window. Diameter is usually specified as diameter at breast height (DBH) but it does not really matter to VNS how your diameter is measured.

Mean DBH Field

Use the Mean DBH field to specify the average for how large you'd like the foliage in this Foliage Effect to appear. This control only appears if the Size Method is Diameter (DBH) and the Second Size is Plus or Minus Percentage on the General Page (see above).

Enter a value for the Mean DBH field in the units you selected for distance on the Units page of the Preferences Window. Diameter is usually specified as diameter at breast height (DBH) but it does not really matter to VNS how your diameter is measured.

Edit DBH/Height Graph Button

VNS needs to convert the diameters you give it to heights which can be rendered. To do this you must specify a Diameter/Height graph.

The Edit DBH/Height Graph Button only appears if the Size Method is Diameter.

Click the Edit DBH/Height Graph Button to open an editor for the Diameter/Height Graph. Modify the default curve by adjusting points up or down or changing the distance of points in the graph. You can also add or remove points to achieve the diameter/height relationship that describes the foliage in this Foliage Effect. The same curve will be applied to all Foliage Objects in this Foliage Effect. If you wish to use a different graph for each Foliage Group then you should select Absolute Size is in Foliage Group on the General Page.

Horizontal & vertical units in the graph are the units you selected for distance on the Units page of the Preferences Window.

Maximum Age Field

Use the Maximum Age field to specify the upper limit for how old you'd like the foliage in this Foliage Effect to appear. This control only appears if the Size Method is Age and if the Second Size is Absolute Minimum or Second Size is Minimum Percentage on the General Page (see above).

Enter a value for the Maximum Age field in any units you wish. The units do not matter to VNS.

Mean Age Field

Use the Mean Age field to specify the average for how old you'd like the foliage in this Foliage Effect to appear. This control only appears if the Size Method is Age and the Second Size is Plus or Minus Percentage on the General Page (see above).

Enter a value for the Mean Age field in any units you wish. The units do not matter to VNS.

Edit Age/Height Graph Button

VNS needs to convert the ages you give it to heights which can be rendered. To do this you must specify an Age/Height graph.

The Edit Age/Height Graph Button only appears if the Size Method is Age.

Click the Edit Age/Height Graph Button to open an editor for the Age/Height Graph. Modify the default curve by adjusting points up or down or changing the distance of points in the graph. You can also add or remove points to achieve the age/height relationship that describes the foliage in this Foliage Effect. The same curve will be applied to all Foliage Objects in this Foliage Effect. If you wish to use a different graph for each Foliage Group then you should select Absolute Size is in Foliage Group on the General Page.

Horizontal units in the graph are dimensionless. Vertical units in the graph are the units you selected for height on the Units page of the Preferences Window.

Controlling Height with a Texture

If you want to control foliage height with a texture, click the Texture Operations Icon next to the field for the variable you want to control, which in this case is Maximum Height.

Select the Create Texture command from the Texture Operations Icon's commands and VNS will create a new texture and open the Texture Editor. There you can edit your texture to control the variable. Wherever the Texture is white, you'll have the full height using the value you set in the Maximum Height field. Wherever the texture is gray you'll have less height and where it is black you'll have zero height. This is a good way to make naturally varied foliage heights.

Controlling Height with a Thematic Map

If you want to control foliage height with a Thematic Map, click the Thematic Map Operations Icon next to the field for the variable you want to control, which in this case is Maximum Height.

Select the Create Thematic Map command from the Thematic Map Operations Icon's commands and VNS will create a new Thematic Map and open the Thematic Map Editor. There you can select one or more Vector attributes to control the variable. In this case the height value will be inherited from the Vector attribute you select. The attribute value comes from the Ecosystem's attached Vector. This is a good way to let your GIS data control actual foliage height in VNS.

Second Size Field

The second Size field lets you control Minimum Size, Minimum Size Percentage or Size Range +/- Percentage depending on your Second Size radio button selection on the General page (see above).

The actual label for the Second Size field will either say Height, DBH or Age instead of Size, depending on your selection of Size Method on the General page (see above).

If you select the Second Size is Absolute Min (Minimum) on the General page, the second size field will be labelled Minimum Height, Minimum DBH or Minimum Age. Enter the appropriate size you want for the smallest foliage in the Foliage Effect. When you render, VNS will place trees with a random mix of sizes from the minimum size you specified in the Minimum Size field up to the maximum size you specified in the Maximum Size field (see above). Note: The Minimum Height field uses the units you selected for height on the Units page of the Preferences Window.

Note: The Minimum Height field uses the units you selected for height on the Units page of the Preferences Window. The Minimum DBH field uses the units you selected for distance there. Minimum Age has no specific units as far as VNS is concerned.

If you select the Second Size is Min (Minimum) Percentage on the General page, the second size field will be labelled Min Height (Percentage of Max), Min DBH (Percentage of Max) or Min Age (Percentage of Max). Enter the size you want for the smallest foliage in the Foliage Effect as a percentage of the Maximum Size field. When you render, VNS will place trees with a random mix of sizes from the Minimum Size percentage you specified in the Min Size (Percentage of Max) field up to the maximum size you specified in the Maximum Size field (see above).

If you select the Second Size is Plus or Minus Percentage on the General page, the second size field will be labelled Height Range (Plus or Minus Percentage), DBH Range (Plus or Minus Percentage) or Age Range (plus or minus percentage). Enter the size you want for the largest and smallest foliage in the Foliage Effect as a percentage above and below the value in the Mean Size field. When you render, VNS will place trees with a random mix of sizes ranging above and below the value you specified in the Mean Size field (see above).

You can also adjust the size for each Group on the Groups page and for each Foliage Object on the Objects page. Foliage Group Controls
The following controls appear when the selected item in the Material Foliage List is a Foliage group:

Load Foliage Group Icon

Click the Load Foliage Group icon to open the Component Gallery where you can load a Foliage Group Component.

Save Foliage Group Icon

Click the Save Foliage Group icon to open the Component Signature Window where you can save the selected Foliage Group as a Component for use in other Projects.

Name Field

Whenever you create a Foliage Group VNS asks you for a name. You can change the name of a Foliage Group by selecting it in the Foliage Group list and changing it in the Name field.

Group Enabled Checkbox

Select the Group Enabled checkbox to make the Group available for rendering. Deselect it if you want to disable the Group for rendering.

Group Size Controls

Each Foliage Group has its own height specification. This determines how tall the Foliage Objects in the Group are compared to other Foliage Groups in the Ecotype. You can also adjust the height of each Foliage Object in the Group on the Objects page (see below). This gives you tremendous flexibility to customize an Ecotype.

Note: If you don't care for subtleties, just select the "Absolute Height is in Ecotype" radio button on the General page, leave all the heights set to 100% on the Groups and Objects pages and modify the values on the Ecotype page to get the right look.

If you selected the “Absolute Height is in Ecotype” radio button on the General page, you’ll control the actual height of the Ecotype’s foliage using the Maximum Height field on the Ecotype page in the Ecotype Height section. You can then set the height of each Foliage Group here with the Group Height field as a percentage of the Ecotype’s Maximum Height.

If you selected the “Absolute Height is in Foliage Group” radio button on the General page, you’ll control the actual height of each Foliage Group directly instead of setting each group as a percentage of the Ecotype Height. VNS will disable the Ecotype Height controls and you can directly set a Group Height and a Secondary height for each Foliage Group on the Groups page.

Second Height Field

The second Height field lets you control Minimum Height, Minimum Height Percentage or Height Range +/- Percentage depending on your Second Height radio button selection on the General page (see above).

If you select the Second Height is in Absolute Min (Minimum) on the General page, the second Height field will be labelled “Group Minimum Height.” Enter the height you want for the shortest foliage in the Foliage Group. When you render, VNS will place trees with a random mix of heights from the Group Minimum Height you specified in the Minimum Height field up to the Maximum Height you specified in the Group Height field (see above).

Note: The Group Minimum Height field uses the units you selected for height on the Units page of the Preferences Window.

If you select the Second Height is in Min (Minimum) Percentage on the General page, the second Height field will be labelled “Group Min (Minimum) Height Percentage.” Enter the height you want for the shortest foliage in the Foliage Group as a percentage of the Group Height field. When you render, VNS will place trees with a random mix of heights from the Group Minimum Height percentage you specified in the Group Min Height Percentage field up to the Maximum Height you specified in the Group Height field (see above).

If you select the Second Height is in Min (Minimum) Percentage on the General page, the second Height field will be labelled “Group Ht (Height) Range (+/-).” Enter the height you want for the shortest foliage in the Foliage Group as a percentage above and below the value in the Group Height field. When you render, VNS will place trees with a random mix of heights ranging above and below the value you specified in the Group Height field (see above).

If you wish you can control the group’s height with a Thematic Map or a texture.

Group Density Percentage Controls

The Foliage Effect places a Foliage Object at each vertex of the host Vector(s). The chances of any particular Foliage Object of appearing along the Vector depends on the density percentage for the Foliage Group it belongs to, and within that group, the density percentage for the Foliage Object itself.

To make the members of a Foliage Group more likely to appear, increase the Group Density percentage. To make the members of a Foliage Group less likely to appear, decrease the Group Density percentage.

If you wish you can control the group’s density with a Thematic Map or a texture.

Foliage Object Controls

Image Object or 3D Object Radio Buttons

These radio buttons let you select whether the selected Foliage Object should be an Image Object or a 3D Object.

If you select the Image Object radio button, VNS will show the Image Object section at the bottom of the Objects page (see below). There you can select an Image Object and adjust its properties.

If you select the 3D Object radio button, VNS will show the 3D Object section at the bottom of the Objects page (see below). There you can select a 3D Object and adjust its properties.

Enabled Checkbox

The Enabled checkbox lets you enable or disable the selected Foliage Object for rendering. Disabled Foliage Objects are shown in gray in the Foliage Objects list.

Image Object Options

Image Object Drop Box

Select an Image Object in the Image Object drop box. VNS will replace the selected Foliage Object in the Foliage Objects list (see above) with the Image Object you choose.

If you want to load a new Image Object, select “New Image Object.” VNS will open a file requester where you can select a new Image Object. Image Objects can be images or image sequences in any supported format (see Image Loading and Saving).

Width, Height and Image Bands Display Fields

The Width, Height and Image Bands display fields show the pixel dimensions and number of 8-bit image bands of the Selected Image Object.

Thumbnail

The Thumbnail shows a small version of the selected Image Object. You can double-click it if you want to see the full version.

Random Flip X Checkbox

Select the Random Flip X checkbox to have VNS randomly reverse the Image Object from left-to-right during rendering. This will give you more variety in the foliage since the selected Image Object will appear in different places in normal and reversed versions.



Apply 3D Shading Checkbox

Select the Apply 3D Shading checkbox to tell VNS to shade the Image Object based on the direction of the light. This will give foliage a more 3-dimensional appearance.

Replace Gray Color Controls

By using unique colors for a Group of images or even individual Foliage Objects you can create a scene of nearly unlimited color variety. You can animate colors to create a kaleidoscopic landscape. Change the color of maple trees first, then the birches followed by the oaks and leave the conifers green, and voila - New England in October.

Each Image Object has its own color specifications. The color for each image can come from the Image Object itself or from a color. If it comes from a color, you can animate that color. You can edit the colors for the selected Image Object by clicking the Replace Gray color well to open the Color Editor.

Note: This only works for gray scale images, or images that have been set to gray scale in the Image Object Library. If the Image Object contains a color image and it has not been changed to gray scale in the Image Object Library, the Replace Gray color well will be disabled.

You can change the Gray Replacement Color for a gray-scale Image Object independently at any time or leave it with the color it inherited when you added the Image Object.

Note: Gray Scale Images require 1/3 the amount of memory that 24 bit color images require when rendering.

Height Percentage Controls

Each Foliage Object has its own height specifications. These determine how tall the object is compared to other objects in the Ecotype.

The Height Percentage field for the currently selected Foliage Object is a percentage of the number entered in the Group Height field for the Foliage Group on the Groups page (see above).

If you wish you can control the object's height with a Thematic Map or a texture.

Density Percentage Controls

The Foliage Effect places a Foliage Object at each vertex of the host Vector(s). The chances of any particular Foliage Object of appearing along the Vector depends on the density percentage for the Foliage Group it belongs to, and within that group, the density percentage for the Foliage Object itself.

To make a Foliage Object more likely to appear, increase the Density percentage. To make a Foliage Object less likely to appear, decrease the Density percentage.

If you wish you can control the object's density with a Thematic Map or a texture.

Back Light Percentage Field

The Back Light Percentage field lets you allow light to shine through backlit Image Object foliage. The default value is 25%. You can set it higher than 100%.

Use the Back Light Percentage when the Camera is looking into the light and the foliage looks too dark. It allows light to be transmitted through the leaves. This will brighten the foliage and increase color saturation. The result can be much more realistic small vegetation when the vegetation is backlit.

You can adjust the Back Light Percentage individually for any Foliage Object by selecting it in the Foliage Objects list and changing the value in the Back Light Percentage field. You can increase the Back Light percentage to brighten objects that are between the Camera and a light. Decrease it if you want a silhouette effect.

Apply to Group Button

Click the Apply to Group button if you want to set the Back Light Percentage of all members of the Group to be the same as the value in the Back Light Percentage field (see above). This is much faster than setting the Back Light Percentage individually for each member of the Group.

If the Back Light Percentage for the current Foliage Object has key frames, they will also be copied to the other members of the Group.

3D Object Options

Rotate X, Y and Z Checkboxes and Fields

The Rotation controls let you add random rotation to the current 3D Object. Select a checkbox and enter a value and VNS will randomly rotate the object along that axis every time it places it on a Vector vertex, within the rotation limit you set.

The X axis runs east to west. A positive X axis is to the east. The Y axis runs vertically. A positive Y axis is up. The Z axis runs north to south. A positive Z axis is to the north.

Enter a number in the X Field to rotate the 3D Object around the X axis. Enter a number in the Y Field to rotate the 3D Object around the Y axis. Enter a number in the Z Field to rotate the 3D Object around the Z axis.

A value of zero in any field means no rotation for that axis.

Polygons, Vertices and Materials Display Fields

The Vertices display field shows the number of vertices in the current 3D Object. The more vertices there are, the longer it will take to render. VNS does not impose a limit to the number of vertices an object may have, other than the limit imposed by the available memory on your system.

The Polygons display field shows the number of polygons in the current 3D Object. The more polygons there are, the longer it will take to render. VNS does not impose a limit to the number of polygons an object may have, other than the limit imposed by the available memory on your system.

The Materials display field shows how many materials there are in the current 3D Object. A Material is a texture applied to groups of polygons within the object. For example, a car object may have a body Material, a bumper Material, a tire Material and a glass Material. You can edit the properties of each Material using the 3D Material Editor.

Height Percentage Controls

Each Foliage Object has its own height specifications. These determine how tall the object is compared to other objects in the Ecotype.

The Height Percentage field for the currently selected Foliage Object is a percentage of the number entered in the Group Height field for the Foliage Group on the Groups page (see above).

Density Percentage Controls

The Foliage Effect places a Foliage Object at each vertex of the host Vector(s). The chances of any particular Foliage Object of appearing along the Vector depends on the density percentage for the Foliage Group it belongs to, and within that group, the density percentage for the Foliage Object itself.

To make a Foliage Object more likely to appear, increase the Density percentage. To make a Foliage Object less likely to appear, decrease the Density percentage.

If you wish you can control the object's density with a Thematic Map or a texture.

Ground Effect Editor

The Ground Effect Editor lets you apply textures to the terrain. There is always at least one Ground Effect in every VNS Project.

General Page

General Features

Name Field

Enter a name for the Ground Effect. For example, if it is a rocky Ground Effect, you might call it "Rock".

By default VNS will name new Ground Effects "Ground", and add a number after the name if there is more than one Ground Effect named "Ground".

Enabled Checkbox

The Enabled checkbox lets you enable or disable the Ground Effect for rendering.

Disabling a Ground Effect can be useful to see what the scene would look like without that particular Ground Effect. Make sure you remember to enable it for the final rendering if you want to see the Ground Effect.

Note: To see the Ground Effect in your rendering, it must be visible to the Camera you selected for the Render Job you are using (see Render Job Editor).

Priority Field

The Priority field lets you specify the rendering priority of the Component relative to other Components of the same category. A Component with a higher priority will be rendered before a Component in the same category that has a lower priority.

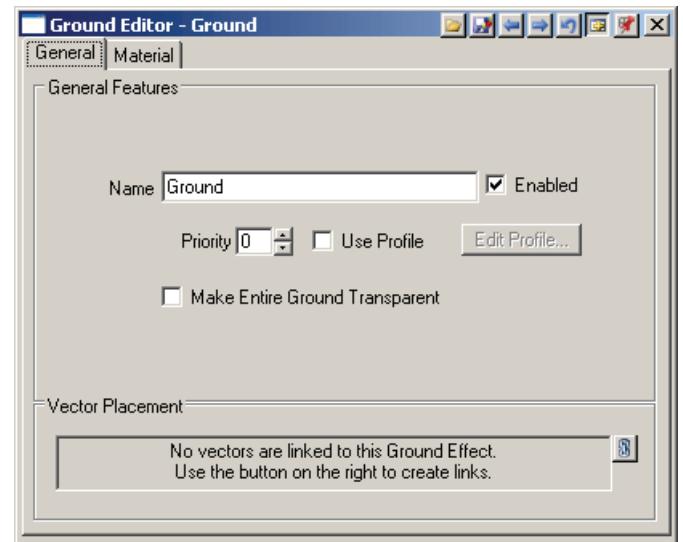
Render priority only matters where Components of the same category overlap. VNS will use the values from the highest-priority Component.

If there are overlapping Components of the same category that are each set to the same priority, VNS will mix them equally.

Use Profile Checkbox

Click the Use Profile checkbox when you want to control the amount of a Vector-bounded Ground Effect based on a gradient from the edge of the Vector Object's area toward the middle. This lets you fade the Ground Effect so it doesn't end abruptly at the outside edge of the Vector.

This is valid only with Ground Effects attached to Vectors.



When you first create a Vector-bounded Ground Effect VNS will create a default Edge Feathering Profile. The default Profile varies between no effect at the edge to the full effect 10 meters toward the middle of the Vector area. You can edit this Profile by clicking the Edit Profile button (see below).

Profiles add to rendering time and take additional memory to render.

Edit Profile Button

Click the Edit Profile button to open the Edge Feathering Profile Editor. There you can alter the Edge Feathering Profile to change the intensity of the Ground Effect from the edge of the vector inward.

This is valid only with Ground Effects attached to Vectors.

Vector Placement Section

By attaching Vectors to Ground Effects you can control where they appear. Vectors can be dynamically linked with Search Queries or hard linked.

Vector Links Button

This control allows you to perform various tasks relating to the association of vectors with components. To learn how to use it, see Vector Links Icon.

Attached Hard-Linked Vectors Display

The Hard-Linked Vectors display tells you if there are any Vectors hard-linked to the Component, and if so, how many. It will also display vectors attached by Search queries and list the names of the search query or queries in use.

Material Page

The Material page lets you add new Materials to the Ground Effect.

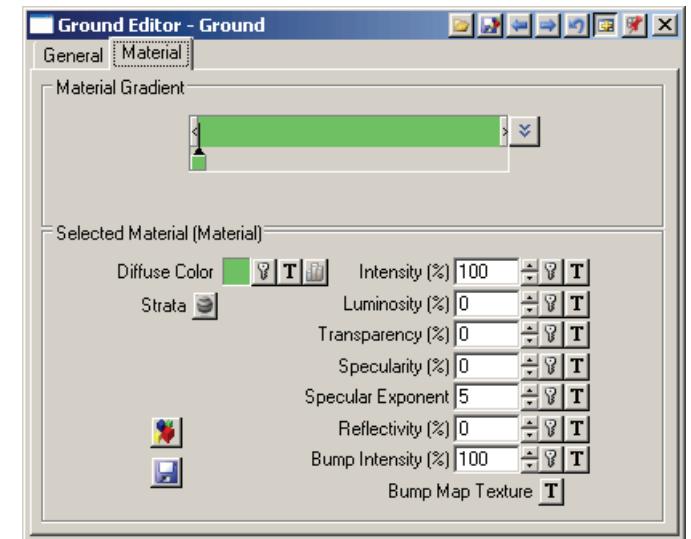
The Material Gradient Driver lets you tell VNS which Material to use. If you select a texture, the Ground Effect can use multiple Materials.

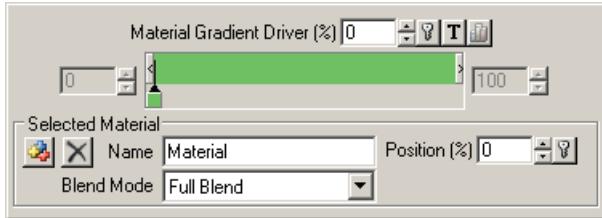
Material Gradient Section

Material Gradient and Driver

The Material Gradient controls let you add, remove and edit the materials to the Ground Effect.

Each material in an Ground Effect comprises a set of properties (color, reflectivity, transparency etc) and Strata. To Access the Gradient, click on the Gradient popdown icon  . This will display the Material Gradient Editor:





Material Gradient Driver Percentage Controls

The Material Gradient Driver field lets you pick a Material for the Ground Effect based on a position along the Material Gradient (see below).

Enter a percentage from zero to 100 where zero is the left edge of the gradient and 100 is the right edge. VNS will use the Material at the gradient position you specify. If there is no Material represented at that position, VNS will create a blend between the nearest two Materials.

You can animate the Material Gradient Driver percentage to change Materials over time. This is great for climate change animations where you could animate through a variety of Materials such as from a desert to a rain forest.

By clicking the Texture Control icon you can control the Material Gradient Driver percentage with the Texture Editor. This lets you use all the Materials in the Gradient. Textures can range in gray values from black to white, with black representing 0% on the Gradient and white representing 100% on the gradient.

For example, if you use a fractal noise Element in the texture that ranges from black to white, VNS will cover the Ground Effect's area with Materials in a fractal noise pattern ranging from the left-most Material in the Gradient to the right-most Material in the Gradient.

Another example: You could use a Dynamic Parameter of Elevation in the Texture Editor and set its Input Low field to the lowest elevation in your terrain and the Input Height field to the highest Elevation in your terrain. Then VNS will arrange the Materials in the Ground Effect's Material Gradient so that the Materials on the left side of the gradient will grow on the lower elevations and the Materials on the right side of the Gradient will grow on the higher elevations.

You can also drive the selection of Ground Effect materials using a Thematic Map. For example, you could have an attribute in your controlling vectors that assigned a numeric value based on Ground Effect, and by careful organization of your Ground Effect materials on the gradient, use this attribute to populate all your vectors with one Ground Effect, while each displayed a different material at render-time.

Material Gradient

The Material Gradient shows a colored bar with one or more colored pins beneath it. The bar is a place to create Materials. Click it to create a new Material.

When you click the Gradient to create a new Material, VNS will give the new Material a random Diffuse Color. You can change the color by using the Diffuse Color Well to open the Color Editor.

VNS represents each Material with a pin that is colored with the Diffuse Color of the Material. Click any pin to select a Material.

Material Gradient Range Fields

The Material Gradient Range fields are on either side of the Material Gradient. They show the range of the value that controls the gradient.

If there's no texture enabled for the Material Gradient Driver, the range of the gradient is zero to 100 percent.

If there is a texture enabled for the Material Gradient Driver, then there are two cases:

1) The first Texture Element is a Dynamic Parameter.

In this case, the Range fields show the range of input values for the Dynamic Parameter you have selected. For example if Elevation is the Dynamic Parameter and the Elevation range in the texture editor (Input Low and Input High) is zero to 1000 meters, then in the Range fields you'll see zero on the left and 1000 on the right.

You can directly edit those texture values in the Ground Effect Editor's Range fields. This is handy because you don't have to reopen the Texture Editor if you want to edit these values.

2) The first Texture Element is not a Dynamic Parameter.

In this case, the Range fields are zero to 100 percent (representing values of 0 to 1 in the controlling texture, or black to white), and are non-editable.

Add Material Icon

Click the Add Material icon to add a new Material. VNS will ask for the position in the Gradient. Enter a position and click the OK button.

Alternatively you can click directly in the Gradient in a spot where no other Material exists.

VNS will create a new Material and give it a random Diffuse Color. The Material will be represented in the Gradient with a pin in the color of its Diffuse Color.

Remove Material Icon

Click the Remove Material icon if you want to delete the selected Material.

Material Name

The Material Name field lets you edit the Material's name. After you create a Material it will have a default name of "Material." It's a good idea to enter a unique name in the Material Name field to identify how you will use the Material. For example "sand," "forest" or "fall foliage."

Position in Gradient Field

The Position in Gradient field shows the percentage along the Gradient for the selected Material. You can move the Material's pin to the left by decreasing this number or to the right by increasing this number. You can also drag the pin along the Gradient with the mouse.

Blend Mode Drop Box

The Blend drop box lets you choose the rate of change between the selected Material and the Material to its left in the gradient.

These are easiest to visualize if you try them and see what they look like in the gradient. You can see how VNS blends Materials between the pins by how it blends the Diffuse Colors along the Gradient.

You can change the blending by selecting different blend types from the Blend Drop Box. If you have more than one material in the gradient, use the following choices to decide how the gradient blends the materials together.

Sharp Edge

Choose “Sharp Edge” if you want an instant change with no gradient.

Soft Edge

Choose “Soft Edge” to create a gradient that turns into the color to the left 1/10 of the way toward that color’s pin.

Quarter Blend

Choose “Quarter Blend” to create a gradient that turns into the color to the left 1/4 of the way toward that color’s pin.

Half Blend

Choose “Half Blend” to create a gradient that turns into the color to the left 1/2 of the way toward that color’s pin.

Full Blend

Choose “Full Blend” to create a smooth gradient that turns into the color to the left at that color’s pin.

Fast Increase

Choose “Fast Increase” to create an accelerated gradient that gets closer to the previous color faster, and turns into the color to the left at that color’s pin.

Slow Increase

Choose “Slow Increase” to create an decelerated gradient that gets closer to the previous color slower, and turns into the color to the left at that color’s pin.

S-Curve

Choose “S-Curve” to create a narrower gradient between the pin and the previous color’s pin and leaves more of the original colors along the gradient in between.

Selected Material Section

Diffuse Color Well and buttons

The Ground Effect's Diffuse Color (or texture) always appears wherever the Selected Material's Ground Overlay appears, unless you set the transparency of the Material to 100%. Click the Diffuse Color well to edit the Diffuse Color in the Color Editor.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's Diffuse Color with texture patterns.

When you use a texture, the Colors in the texture will replace the Diffuse Color, unless you use less than 100% Opacity in the Texture Editor, in which case the texture and the Diffuse Color will be mixed.

Strata Icon

Click the Strata icon to open the Material Strata Editor. There you can add Strata texturing to the Material.

Load and Save Material Icons

Clicking the relevant icon will either open the Component Gallery or the Component Signature Window, allowing you to load or save Ground Effect materials as required.

Diffuse Intensity Field and Buttons

The diffuse intensity of a material is a measure of how much of the diffuse color of a surface is returned to the camera. Reducing this value to 0% will result in a black surface (i.e.: 0 color) and setting it to 100% will result in the pure diffuse color as set in the Diffuse Color Well.

You can animate the value over time, and also drive its intensity with a texture.

This attribute is useful for simulating dirt (try driving this field with a Fractal Noise texture element), streaks, moisture (drive Diffuse Intensity with a Dynamic parameter of Water Level or Elevation to simulate moist surfaces at the edges of lakes and streams etc.)

The maximum value for this parameter is 10000%.

Luminosity Percentage Field and Buttons

Luminosity affects how the Material is shaded by Lights (see Light Editor). You can adjust it to create 3D-shaded Objects, flat-shaded Objects or anything in-between.

With zero percent luminosity, the Material will be fully shaded by Lights. This produces a 3D look. In deeply shadowed areas, the Material's color will be a darker shade of itself based on the Ambient Light Intensity and Color. Where fully lit by Lights, the color will be the Diffuse Color or texture (see above) modulated by the Intensity and Color of any Lights.

By raising the luminosity, you can lighten the shaded areas. This can be useful to do if the terrain that uses the Material seems too dark. Raising the luminosity a little bit decreases the shading contrast for the Material.

With 100 percent luminosity, the Material will ignore Lights completely. This produces a flat, unshaded look. The Material will always be the Diffuse Color or texture. This can be useful for Materials used to create the flat, paper-cutout-style animations used by certain cartoon shows.

You can also subtract light by using negative luminosity to make the object tend toward the Ambient Light colors. With 100 percent negative luminosity, the Material will ignore Lights. The Material will be flat-shaded with the Ambient colors.

You can animate the Luminosity percentage to simulate lighting changes. This lets you animate the effect of nearby lightning or explosions.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's luminosity with a texture pattern. This can be useful for creating the look of glowing lava.

When you use a texture, a white value in the texture will equal the amount of luminosity you set in the Luminosity percentage field. A black value in the texture will equal zero luminosity. Gray values will be in-between.

Transparency Percentage Field and Buttons

Use the Transparency field to adjust how much you can see through the Ground Overlay. Zero percent will cover the terrain with opaque Ground Overlay. One hundred percent makes the Ground Overlay invisible, and you will instead see a Ground Effect on the terrain polygons. Anything in-between will mix the Ground Overlay with the Ground Effect.

Note: There is always at least one global Ground Effect in any VNS Project.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's transparency with a texture pattern to make some areas more transparent than others.

When you use a texture, a white value in the texture will equal the amount of Transparency you set in the Transparency percentage field. A black value in the texture will equal zero Transparency. Gray values will be in-between.

Specularity Percentage Field and Buttons

Specularity is the amount of shininess for a material.

Use the Specularity Percentage field to adjust the shininess of the material. Zero percent means no specular highlight, while 100 percent is maximum shininess.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's specularity value with texture patterns.

When you use a texture, a white value in the texture will equal the amount of Specularity you set in the Specularity percentage field. A black value in the texture will equal zero Specularity. Gray values will be in-between.

Specular Exponent Field and Buttons

Use the Specular Exponent field to adjust the size of the shiny spot. The useful range is from 1 to infinity. Higher numbers will produce a smaller spot, with less feathering at its edge.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's specular exponent value with texture patterns.

When you use a texture, a white value in the texture will equal the amount of Specular Exponent you set in the Specular Exponent field. A black value in the texture will equal zero Specular Exponent. Gray values will be in-between.

Reflectivity Field and Buttons

Terrain materials can now reflect their surroundings, as well as parts of their own geometry. This is ideal for simulating surfaces such as snowfields, or mirages.

Set this value to an amount greater than 0% to see reflections on these surfaces.

You can animate the value over time, and also drive its intensity with a texture.

The maximum value for this parameter is 10000%.

Bump Intensity Percentage Field and Bump Map Icon

Bump mapping lets you simulate detailed relief shadowing without requiring dense geometry. For more about using bump mapping, see [Bump Mapping Controls](#).

Label Editor

The Label Editor lets you control each Label Component in your Project. The controls apply to the Label shown in the Editor's title bar.

Note: You can select a different Label to edit by double clicking the name of another Label in the Scene-At-A-Glance or by clicking the You can import Components into your Projects using the Component Gallery. on the editor title bar.

Labels are only rendered if their underlying DEM is rendered. You can specify whether they will appear at an absolute elevation or an elevation relative to either the terrain or Vector elevation.

What is a Label?

A Label lets you place a rectangular information flag onto the terrain. You can place a single flag or multiple flags as defined by the points of a Vector Object.

Label flags can be a solid color or have a border and a flag pole. The flag can have a text message on it that is either constant or determined from a database attribute. It can also contain dynamic numbers generated during rendering such as the view direction and viewpoint location or the flag location and distance. All the parts of the Label can have independently controlled transparency. You can control the size of the Label in real-world units.

Labels are useful for things like identifying buildings, towns, roads and landmarks, showing distances along golf fairways or to faraway mountain peaks, bringing attention to significant features and providing textual information to the viewers of your scenes.

You could use a Label as a visual time or frame counter in an animation or tell the viewer what direction they are looking in and what the viewer's location is.

Using Pre-made Components

Click the Open Component Gallery icon in the Label Editor to see the Component Gallery, ready to load a pre-made Label Component. VNS will reset the parameters of the Label being edited to those of the Component you selected.

You can create and export your own pre-built Label Components from the Label Editor by setting up the Label the way you want it and then clicking the Sign or Save Component to Disk icon. VNS will open the Component Signature Window where you can fill in the information, choose a representative image for the Component's thumbnail and save the Component in the Component Gallery.

You can later reuse the Label in other Projects.

General Page

General Features Section

Each Label is configurable to act in different ways depending on your needs. The General features section lets you control several important aspects of the Label Component.

Name Field

Use the Name field to edit the name of the current Label. The Component Name of the Label should not be confused with the text that will appear on the Label itself.

Enabled Checkbox

The Enabled checkbox lets you enable or disable the Label for rendering.

Disabling an object can be useful to speed up rendering if you are doing test renders to check some other aspect of your scene and don't need to see the Label(s). Make sure you re-enable them for renders you want the Labels to appear in.

Note: To see the Label in your rendering, it must be visible to the Camera you selected for the Render Job you are using (see Render Job Editor), and Labels must be enabled in the Render Options you are using (see Render Options Editor).

Render Items Occluded By This Label Checkbox

Selecting this checkbox will force VNS to render those elements of the scene obscured by this Label. This will allow reflections to accurately represent terrain and foliage that has been hidden from the camera by this Label. Select this checkbox if you are experiencing "holes" in reflections of terrain and foliage objects near a Label.

Base Elevation Controls

Base Elevation Field and Buttons

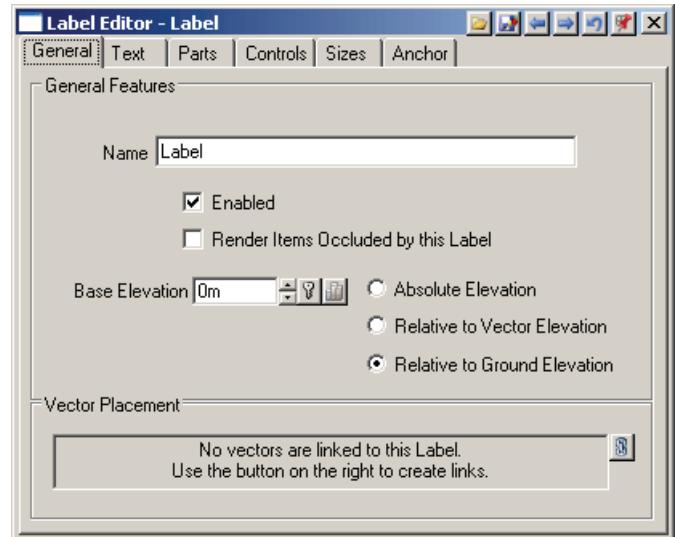
The Base Elevation is an offset from ground elevation if you chose the Relative to Ground radio button; an offset from the Vector elevation if you chose the Relative to Vector radio button, or the actual elevation in meters if you chose the Absolute radio button.

Base Elevation Radio Buttons

The Base Elevation Radio buttons let you choose how the Base Elevation works.

Absolute Elevation Radio Button

Choose the Absolute Elevation radio button to make the Base Elevation (see above) be the actual elevation of the base of the Label in meters above sea level.



Note: Sea Level is the surface of the Project Coordinate System's Ellipsoid, which is an elevation of zero. You can see the Project's Coordinate System in the Planet Options Editor.

Relative to Ground Elevation Radio Button

Choose the Relative to Ground radio button to make the Base Elevation be an offset in meters from the elevation of the terrain below the Label.

Note: If the Label's Vector is above NULL value terrain the Label will be rendered at the NULL elevation.

Relative to Vector Elevation Radio Button

Choose the Relative to Vector radio button to make the Base Elevation be an offset in meters from the elevation of the Vector to which the Label is applied.

Vector Placement Section

By attaching Vectors to Labels you can control where they appear. Vectors can be dynamically linked with Search Queries or hard linked.

Vector Links Button

This control allows you to perform various tasks relating to the association of vectors with components. To learn how to use it, see Vector Links Icon.

Attached Hard-Linked Vectors Display

The Hard-Linked Vectors display tells you if there are any Vectors hard-linked to the Component, and if so, how many. It will also display vectors attached by Search queries and list the names of the search query or queries in use.

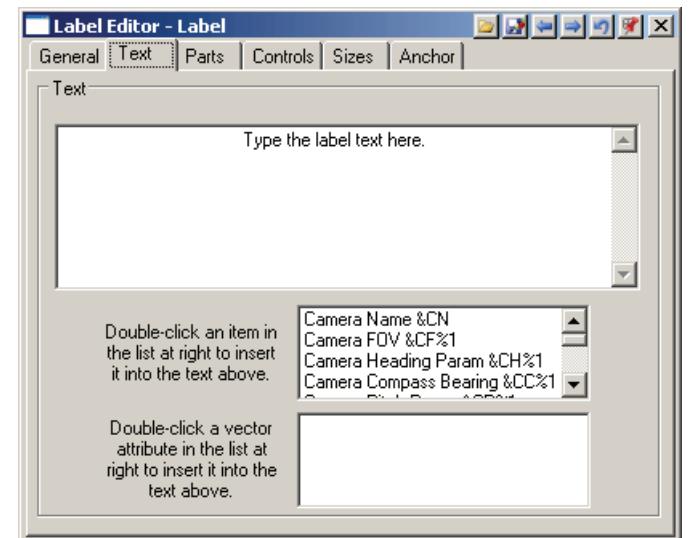
Text Page

The Text page lets you edit the text that will appear on the Label flag.

Text Entry Window

Enter the text that you wish to use into this window. You may enter multiple lines of text: use the enter key to generate carriage returns as you would in a word processing program.

You can also enter a number of Autoentry Variables (see below) to create dynamic text elements that reflect things such as Project name or Camera Heading. However, you are recommended to add these through the use of the Autoentry Variables Selection List (see below)



Autoentry Variables Selection List

This is a list of the available variables that can be used to add dynamic content to your Label without incurring unnecessary typing. These are automatically updated for every frame, so should you use one that references a variable that changes throughout the animation, you will see these changes in the rendered Label.

This is particularly useful for creating markers that need to indicate project names, frame numbers, coordinates and other diagnostic data.

The list of available variables is as follows:

&CN	Camera Name	&VY%3	Vertex Latitude
&CF%1	Camera Field of View	&VZ%0m	Vertex Elevation
&CH%1	Camera Heading	&VD%0m	Vertex Distance
&CC%1	Camera Compass Bearing	&GZ%0	Ground Elevation
&CP%1	Camera Pitch	&VN	Vector Name
&CT%1	Camera Tilt	&VL	Vector Label
&CB%1	Camera Bank	&TD%0	Distance To Camera
&CX%3	Camera Longitude	&FN4	Frame Number
&CY%3	Camera Latitude	&FS	SMPTE Time Code
&CZ%0	Camera Elevation	&PN	Project Name
&TX%3	Camera Target Longitude	&RN	Render Options Name
&TY%3	Camera Target Latitude	&RD	Render Date and Time
&TZ%0	Camera Target Elevation	&UN	User Name
&VX%3	Vertex Longitude	&UE	User Email Address

In the above list, a % sign followed by a number defines the number of decimal places to be displayed for that variable when rendered as text. In the case of the Camera Field of View variable, the 1 represents 1 digit to the right of the decimal, i.e. 32.2, 19.7 and so on. You can edit these numbers to suit your own requirements.

Autoentry Attributes Selection List

This is a list of the available vector Attributes that can be used to add dynamic content to your Label without incurring unnecessary typing. These are automatically customized for every instance of Label, so should you use one that references an attribute that is different on each vector, you will see these variations in the rendered Labels.

This is particularly useful for creating markers that need to indicate feature names, scenario data, textual polygon classes and other diagnostic data.

The list of available Attributes will be populated according to what Attributes are present in your project.

To add an attribute to the text window, double click on its entry in this list. The appropriate attribute will be automatically added to the text window at the last cursor location.

Parts Page

The Parts page lets you control the presence, color and transparency of the major visual pieces that make up a Label flag.

Label Parts Section

The Label Parts section has three types of controls (Enabled, Color, Transparency), for each of the five major visual Parts of a Label (Text, Outline, Flag, Border and Pole). For simplicity, these combinations will be described categorically, as the explanation applies identically to all five Parts.

Enabled Checkbox

The Enabled checkbox lets you enable or disable the Part in question for rendering.

Color Controls

Each Part has its own color specifications, and each Part color can be animated, independently. You can edit the colors for each Part by clicking the color well to open the Color Editor.

Transparency Percentage Field

The Transparency Percentage field lets you make the various Parts of a Label partially or completely transparent, and can also be animated. The default value is 0% (opaque), and can range up to 100% (invisible).

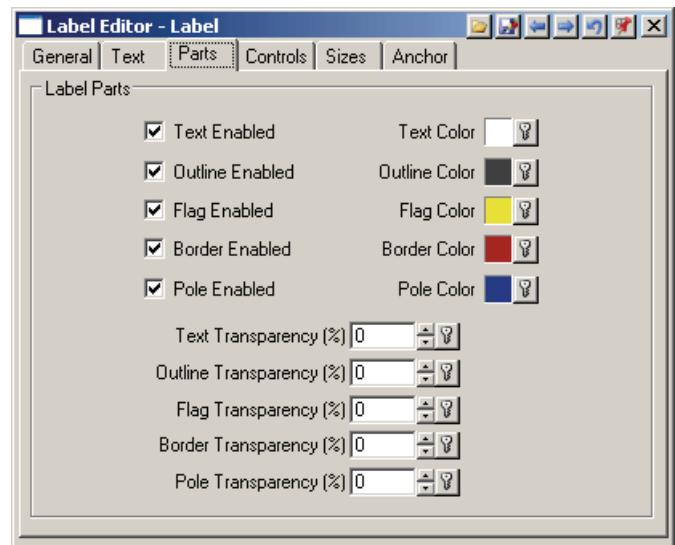
Controls Page

The Controls page lets you specify several important formatting, geoentry and style aspects of a Label.

Controls Section

Text Justification Radio Buttons

The Text Justification options (Left, Center, Right) determine where the text of the Label will be placed relative to the space available for it on the face of the Label Flag. Since the Flag dimensions are specified in real-world units (see Sizes Page, below), the Label Flag can be either larger, or smaller than the text it contains. In the event the Label Flag is larger, the Text Justification will determine the placement of the text within the Label Flag.



Word Wrap Enabled Checkbox

The Word Wrap Enabled checkbox determines if the text will be allowed to automatically wrap onto a new line, should it be too long to fit on one line.

Hi-res Font Radio Buttons

At times, large Labels that are seen close-up will begin to have blocky-looking text. These controls allow you to choose under what circumstances a higher-resolution (more detailed, crisper-edged) font will be used.

The meanings of the Always and Never options are self-apparent. When Sometimes is selected, the high-res font will be used for all Labels with text messages equal to or shorter than 40 characters. For Label texts longer than 40 characters, the lower-resolution font will be used.

For rendering, there is little reason to use any setting other than Always, since the performance penalty of the high-resolution font is minor. The resolution controls are primarily useful when exporting to real-time scenes using Scene Express, where large texture bitmaps can degrade realtime performance.

Text Field Width Radio Buttons

The Text Field Width controls specify what should be done when the text is not exactly the same size as the Flag width specified in the Sizes Page (below). There are three options, "Variable up to Max", "Fixed Width" and "Fixed, Shrink Text to Fit".

Variable up to Max

This option will cause the width of the flag to vary to best fit the text, as long at it remains smaller than the Max Text Width field on the Sizes Page (below).

Fixed Width

This option will cause the width of the flag to be constant, as set by the Text Width field on the Sizes Page (below).

Fixed, Shrink Text to Fit

This option will cause the width of the flag to be constant. Should the text be too large horizontally to fit in the flag, the entire text will be scaled down proportionally to make it fit.

Text Field Height Radio Buttons

The Text Field Height controls specify what should be done when the text is not exactly the same height as the Flag height specified in the Sizes Page (below). There are two options, "Variable up to Max" and "Fixed Height".

Variable up to Max

This option will cause the height of the flag to vary to best fit the text, as long at it remains smaller than the Max Text Height field on the Sizes Page (below).

Fixed Height

This option will cause the height of the flag to be constant, as set by the Text Height field on the Sizes Page (below).

Pole Position Radio Buttons

The Pole Position radio buttons let you determine which side of the Label Flag the Pole (if enabled in the Parts section, above) will be located on. Options are Left, Centered and Right.

Pole Full Width Checkbox

The Pole Full Width checkbox is only available when Pole Position (above) is set to Centered. If Pole Full Width is enabled, the top of the pole extends all the way from the left side of the Flag to the right. The width of the bottom of the Pole will be determined by the state of the Pole Base Style radio buttons, below. If Pole Base Style is Square, the Pole will be the full width of the flag at the bottom as well. If Pole Base Style is Tapered, the Pole will taper to a point at the bottom.

Pole Full Height Checkbox

The Pole Full Height checkbox is only available when Pole Position (above) is set to Left or Right. This checkbox determines if the Pole continues all the way up the edge of the Flag, or if it terminates at the bottom edge of the Flag.

Pole Style Radio Buttons

The Pole Style Radio buttons determine the graphical style of the Pole (if enabled in the Parts Page, above). There are two options available, "Vertical" and "Angled".

Vertical

Vertical Style creates a simple Pole that always runs vertically from the specified Pole Position (see above) to specified placement location. Vertical Style is always available, with all combinations to other Controls on this Page.

Angled

Angled Style creates a more exotic Pole that runs from the specified Pole Position (see above) to a point centered below the Flag. Angled Style is not available with Square Pole Base Style (below), nor is it available in conjunction with Centered Pole Position (above).

Pole Base Style Radio Buttons

The Pole Base Style radio buttons control the appearance of the bottom end of the Label Flag Pole. Two Styles are available, "Square" and "Tapered".

Square

Square Pole Base Style creates a Pole with the same width at the bottom as it has at the top. Square Pole Base Style is unavailable in conjunction with Angled Pole Style (above).

Tapered

Tapered Pole Base Style creates a Pole that tapers to a point at the bottom. Tapered Pole Base Style is available under all circumstances.

Sizes Page

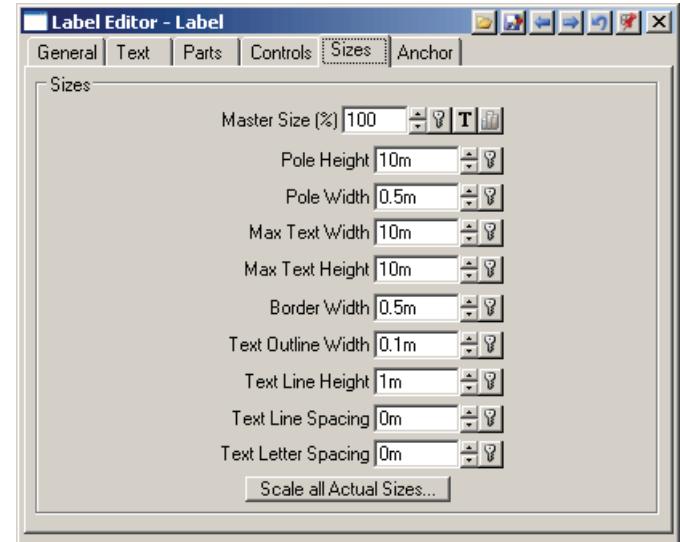
The controls on the Sizes Page control the absolute and relative size of the various Parts of a Label. Other than the Master Size Percentage Field, each of the Size fields can range from 0 essentially to infinity.

Master Size Percentage Field

The Master Size Percentage field lets you instruct the program to uniformly scale the Label larger or smaller as a whole, without having to individually adjust each of the individual Part sizes. The default value is 100% (normal size, as described the individual Part sizes, below). You can set this field as high as 10000%.

Pole Height Field

The Pole Height field controls the height, in real-world units, of the Pole Part of the Label.



Pole Width Field

The Pole Width field controls the width, in real-world units, of the Pole Part of the Label.

(Max) Text Width Field

The (Max) Text Width field controls the width (or maximum width, depending on the state of the Text Field Width Radio Buttons on the Controls Page, above) in real-world units of the text flag Part of the Label.

(Max) Text Height Field

The Max Text Height field controls the height (or maximum height, depending on the state of the Text Field Height Radio Buttons on the Controls Page, above) in real-world units of the text flag Part of the Label.

Border Width Field

The Border Width field controls the width (in real-world units) of the border Part surrounding the Flag on a Label.

Text Outline Width Field

The Text Outline Width field controls the height (in real-world units) of the border Part surrounding the Flag on a Label.

Text Line Height Field

The Text Line Height field controls the height (in real-world units) of the text on the Label Flag.

Text Line Spacing Field

The Text Line Spacing field controls the height (in real-world units) of the vertical spacing between lines of text.

Text Letter Spacing Field

The Text Letter Spacing field controls the distance (in real-world units) of the horizontal spacing between adjacent letters.

Scale all Actual Sizes Button

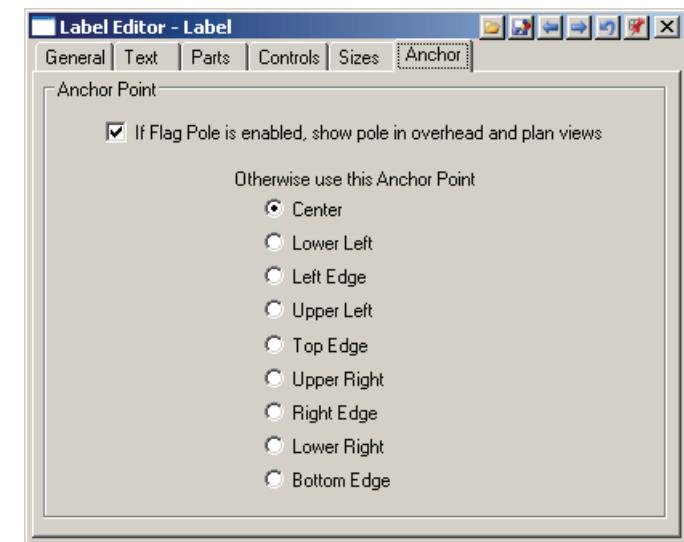
The Scale all Actual Sizes button allows you to permanently alter the sizes of all the Sizes controls (except the Master Size) in one operation. A variety of convenient notations for specifying the new size ratio are available.

Anchor Page

The controls on the Anchor Page control the appearance of the Label in Overhead and Planimetric Cameras, where special circumstances (cartography) require additional flexibility.

If Flag Pole... Button

The first control on the page is named "If Flag Pole is enabled, show pole in overhead and plan views". This control defaults to on. When on, the Flag Pole Part will be visible in all types cameras, perspective and Overhead/Planimetric. When off, the Pole Part of a Label will be hidden, but only in Overhead and Planimetric cameras. This permits the removal of the (sometimes distracting) Pole part when doing cartographic work, but leaves it present in perspective views where it is more useful. If this control is off, the remaining radio buttons (see below) on this page become significant. If this control is on, the radio buttons are not relevant.



Anchor Point Radio Buttons

The Anchor Point Radio buttons are significant only when the Flag Pole Button (immediately above) is off. When the Flag Pole is so disabled in Overhead and Planimetric renderings, the Anchor Point radio buttons determine where the Flag is placed relative to the vertex that caused the creation of the Flag. Nine options are available, each specifying which location on the Flag itself will be placed over top of the anchoring vertex point. The default is Center, which places the horizontal/vertical center of the Flag directly over the anchoring point.

Lake Editor

The Lake Editor lets you control Lakes. It gives you common controls that affect all Lakes you may have in a Project, along with a set of controls that apply to a single Lake. You can control Water, Foam, Wave and Beach parameters for each Lake.

To open the Lake Editor double-click any Lake Component in the Scene-At-A-Glance. You can also select a Lake's name in the Component Library's Current Project Components list and click the Edit button.

Another quick way to open the Lake Editor is to double click a Lake name in either the Component Library's Current Project Component list or the Database Editor's "Components attached to the active Object" list on the Comp page.

The Lake Editor will open, ready to edit the selected Lake. You can edit other Lakes by using the You can import Components into your Projects using the Component Gallery..

What is a Lake?

A Lake is a water surface. The Lake Editor lets you create lakes, oceans, and ponds. With different texturing and displacement you can even create ice, lava pools and sand dunes. You may create as many Lakes as you like, limited only by your computer's memory.

Lakes have beaches. You can control the beach Materials just like an Ecosystem, with foliage and texturing. You can cause lakes to flood onto the surrounding terrain past the beach area if you wish.

A Lake with no Vectors attached is an Ocean. When you attach a Vector the Lake will be limited to the area within the Vector.

If there are more than one unattached Lakes, VNS renders the one with the highest priority. If more than one are at the same priority, VNS will render the one at the highest elevation.

A Vector-bounded lake can overlap another, even at different elevations. Each lake can have different reflectivity, color and other parameters. Where Lakes overlap, VNS will always render the lake at the highest elevation.

Lake can use waves you create with the Wave Model Editor. You can also create wave patterns using textures.

Creating a Lake

You can create a new Lake by selecting the Lake category in the Scene-At-A-Glance and clicking the Add or Clone Selected Item icon. You can set the elevation of the Lake in the Lake Editor. If you don't attach a Vector it will become an ocean that covers the entire terrain and appears wherever the terrain is below the Lake's elevation.

To create a Vector-bounded lake you can digitize a Lake and Vector in one step by selecting the lake component in the Scene-At-A-Glance and clicking the Create Icon on the main toolbar. Alternatively you can first create a Vector Object that encloses an area and then attach it to a Lake by dragging one over the other in the Scene-At-A-Glance.

VNS will automatically connect the start and ending points of your Vector when it calculates the Lake. Make sure that your Vector Object encompasses an area that is below the elevation of the surface of the Lake. The lake surface will extend under the surrounding terrain. In other words, any terrain that is above the elevation of the Lake but within the area of the Vector will still show above the lake.

If your lake area ends and the surrounding terrain is lower than the lake's elevation, VNS will create a wall from the lake to the terrain below. This is a result you may want to avoid, or perhaps exploit as a special effect.

You can apply a Lake Object and an Area Terraffector to the same Vector Object. This lets you dig a lake basin with the Terraffector and fill it with water using the Lake. Since the Lake takes into account the depth of the water (bathymetry) when shading the surface of the water and calculating breakers, you may want to dig the lake basin with an Area Terraffector to give your lake depth.

The Vectors to which you apply Lakes may overlap. You may be able to create subtle or wild effects by overlapping several lakes at the same elevation but with different colors; by overlapping lakes at different elevations, etc. For example, you may be able to create a frozen look with one Lake and a water look with another, to create a composite lake that is partially frozen. Use your imagination and see what you come up with.

You can apply the same Lake to any number of Vectors.

To create a new Lake you can also select "Lake" in the Component Library's Current Project Components list and click the Create New Effect button. The Lake Editor will open, ready to edit the new Lake.

General Page

General Features Section

Name Field

Use the Name field to name the current Lake.

If you select an existing Lake and click the Create New Effect button to create a new Lake, VNS will name the new Lake with the same name, but with a number appended to the end. If there was already a number at the end of the name of the original Lake, VNS will increment the number. This ensures that the new Lake will have a different name.

Enabled Checkbox

Use the Enabled checkbox to enable or disable the Lake for rendering.

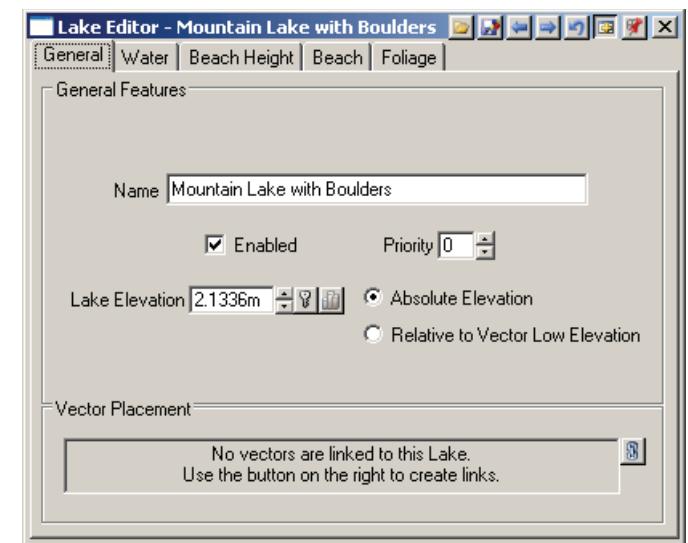
If you disable a Lake it will not lose its parameter values. It may be useful to temporarily disable a particular Lake to see how the terrain looks without it, or to speed preview rendering when you're working on some other aspect of your scene.

Make sure you remember to enable the Lake for the final rendering if you want VNS to render it.

Note: To see the Lake in your rendering, it must be visible to the Camera you selected for the Render Job you are using (see Render Job Editor), and Lakes must be enabled in the Render Options you are using (see Render Options Editor).

Priority Field

The Priority field and buttons let you specify the rendering priority of a Lake that overlaps another Lake.



The Lake with a highest priority will be rendered when Lakes overlap.

If there are overlapping Lakes set to the same priority, VNS will render the one at the highest Elevation.

Elevation Field

The Elevation field lets you set the elevation of the surface of the lake. Enter a value above sea level. To create a lake with an elevation below sea level, set this value to be a negative number.

Note: Sea Level is the surface of the Project Coordinate System's Ellipsoid, which is an elevation of zero. You can see the Project's Coordinate System in the Planet Options Editor. You can click in a View where you want the shoreline and look in the Diagnostic Data Window to find the elevation for your lake. If you render a preview in the View first the elevation will be more accurate. You can copy the value from the Diagnostic Data's Elevation field by highlighting it and hitting control-c on your keyboard. You can paste the value by clicking in the Lake Editor's Elevation field and hitting control-v on your keyboard. Alternatively, you can make sure that the lake component is the active item, and Ctrl-click in a view at the elevation you require for the lake. The lake's elevation parameter will be set to the elevation value of the point that you clicked in the view.

Elevation Method Radio Buttons

Select one of the two following radio buttons to determine how VNS calculates the lake components elevation:

Absolute Elevation

If this option is selected, VNS will place the water surface at an elevation above sea level corresponding to the value entered in the Elevation Field (see above)

Relative to Vector Low Elevation

If this option is selected, VNS will place the water surface at an elevation above sea level corresponding to the elevation of the lowest point of the bounding vector. This allows you to drive multiple lakes of different elevation but otherwise similar parameters, with one lake component. Simply create your lake component, and attach it to the vectors in question, making sure that Relative to Vector Low Elevation is selected as the components elevation method, and at render time, VNS will calculate each lakes elevation dynamically based on the elevation values found in each bounding vector.

Vector Placement Section

By attaching Vectors to Lakes you can control where they appear. Vectors can be dynamically linked with Search Queries or hard linked.

Vector Links Button

This control allows you to perform various tasks relating to the association of vectors with components. To learn how to use it, see Vector Links Icon.

Attached Hard-Linked Vectors Display

The Hard-Linked Vectors display tells you if there are any Vectors hard-linked to the Component, and if so, how many. It will also display vectors attached by Search queries and list the names of the search query or queries in use.

Water Page

The Water page lets you add new Materials to the Lake.

The Material Gradient Driver lets you tell VNS which Material to use. If you select a texture or animate the material gradient driver % value, the Lake can use multiple Materials.

Material Gradient & Driver Section

Material Gradient Driver Percentage Controls

The Material Gradient Driver field lets you pick a Material for the Lake based on a position along the Material Gradient (see below).

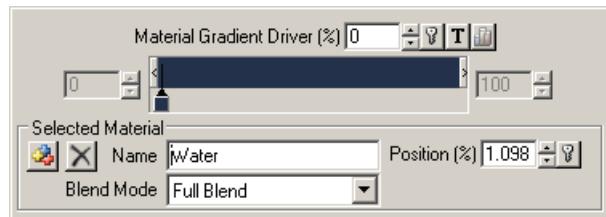
Enter a percentage from zero to 100 where zero is the left edge of the gradient and 100 is the right edge. VNS will use the Material at the gradient position you specify. If there is no Material represented at that position, VNS will create a blend between the nearest two Materials.

You can animate the Material Gradient Driver percentage to change Materials over time. This is great for animating through a variety of Materials such as between different-colored water surfaces or from hot dark rocky matter to molten boiling lava.

By clicking the Texture Control icon you can control the Material Gradient Driver percentage with the Texture Editor. This lets you use all the Materials in the Gradient. Textures can range in gray values from black to white, with black representing 0% on the Gradient and white representing 100% on the gradient.

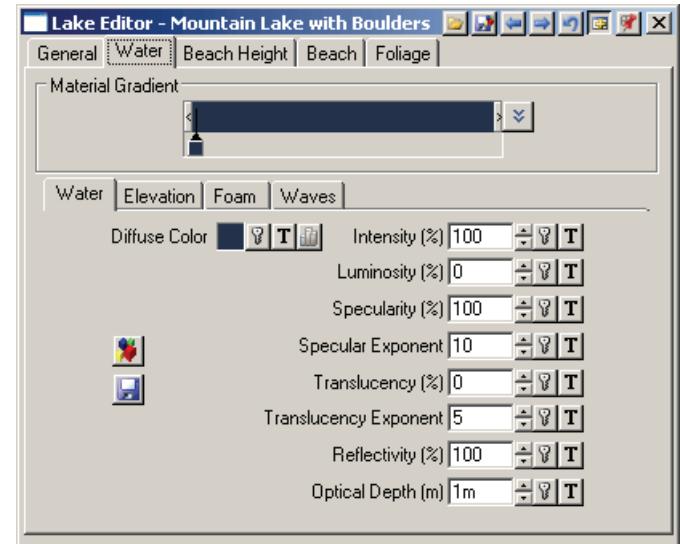
For example, if you use an F1 Cell Basis Element in the texture that ranges from black to white, VNS will cover the Lake's area with Materials in an F1 Cell Basis wave pattern ranging from the left-most Material in the Gradient to the right-most Material in the Gradient.

To Access the Gradient, click on the Gradient popdown icon . This will display the Material Gradient Editor:



Material Gradient

The Material Gradient shows a colored bar with one or more colored pins beneath it. The bar is a place to create Materials. Click it to create a new Material.



When you click the Gradient to create a new Material, VNS will give the new Material a random Diffuse Color. You can change the color on the Material and Foliage page.

VNS represents each Material with a pin that is colored with the Diffuse Color of the Material. Click any Pin to select a Material.

Material Gradient Range Fields

The Material Gradient Range fields are on either side of the Material Gradient. They show the range of the value that controls the gradient.

If there's no texture enabled for the Material Gradient Driver, the range of the gradient is zero to 100 percent.

If there is a texture enabled for the Material Gradient Driver, then there are two cases:

1) The first Texture Element is a Dynamic Parameter.

In this case, the Range fields show the range of input values for the Dynamic Parameter you have selected. For example if Water Depth is the Dynamic Parameter and the Elevation range in the texture editor (Input Low and Input High) is zero to 80 meters, then in the Range fields you'll see zero on the left and 80 on the right.

You can directly edit those texture values in the Lake Editor's Range fields. This is handy because you don't have to reopen the Texture Editor if you want to edit these values.

2) The first Texture Element is not a Dynamic Parameter.

In this case, the Range fields are zero to 100 percent, and are non-editable.

Add Material Icon

Click the Add Material Icon to add a new Material. VNS will ask for the position in the Gradient. Enter a position and click the OK button.

Alternatively you can click directly in the Gradient in a spot where no other Material exists.

VNS will create a new Material and give it a random Diffuse Color. The Material will be represented in the Gradient with a pin in the color of its Diffuse Color.

Remove Material Icon

Click the Remove Material Icon if you want to delete the selected Material.

Material Name Field

The Material Name field is above the Water Material list. After you create a Material it will have a default name of "Material." It's a good idea to enter a unique name in the Material Name field to identify how you will use the Material. For example "sand," "forest" or "fall foliage."

Position in Gradient Field

The Position in Gradient field shows the percentage along the Gradient for the selected Material. You can move the Material's pin to the left by decreasing this number or to the right by increasing this number. You can also drag the pin along the Gradient with the mouse.

Blend Drop Box

The Blend drop box lets you choose the rate of change between the selected Material and the Material to its left in the gradient.

These are easiest to visualize if you try them and see what they look like in the gradient. You can see how VNS blends Materials between the pins by how it blends the Diffuse Colors along the Gradient.

You can change the blending by selecting different blend types from the Blend Drop Box. If you have more than one material in the gradient, use the following choices to decide how the gradient blends the materials together.

Sharp Edge

Choose "Sharp Edge" if you want an instant change with no gradient.

Soft Edge

Choose "Soft Edge" to create a gradient that turns into the color to the left 1/10 of the way toward that color's pin.

Quarter Blend

Choose "Quarter Blend" to create a gradient that turns into the color to the left 1/4 of the way toward that color's pin.

Half Blend

Choose "Half Blend" to create a gradient that turns into the color to the left 1/2 of the way toward that color's pin.

Full Blend

Choose "Full Blend" to create a smooth gradient that turns into the color to the left at that color's pin.

Fast Increase

Choose "Fast Increase" to create an accelerated gradient that gets closer to the previous color faster, and turns into the color to the left at that color's pin.

Slow Increase

Choose "Slow Increase" to create an decelerated gradient that gets closer to the previous color slower, and turns into the color to the left at that color's pin.

S-Curve

Choose "S-Curve" to create a narrower gradient between the pin and the previous color's pin and leaves more of the original colors along the gradient in between.

Water Sub-page

Diffuse Color Well

The Lake's Diffuse Color (or texture) always appears wherever the Lake appears. Click the Diffuse Color well to edit the Diffuse Color in the Color Editor.

Using the Keyframe animation popup menu to the right of the diffuse color well allows you to animate the water color over time.

The water will be a solid color over the entire surface unless you have a texture. With a texture you can use anything you want to control water color.

You can apply, edit or delete a texture using the texture popup menu. Using these commands you can replace the Material's Diffuse Color with texture patterns.

Textures can take water depth into account. For example to make a lighter, sandy color near the shore a blue color in deeper areas and a darker color in the deepest areas of the water body, use a dynamic parameter Element based on water depth in the Texture Editor. Then set up the color gradient for the Water Depth Element with a sandy color at zero depth and then a blue and black color inward along the gradient at the gradient positions representing the depths where you want them to appear.

When you use a texture, the Colors in the texture will replace the Diffuse Color, unless you use less than 100% Opacity in the Texture Editor, in which case the texture and the Diffuse Color will be mixed.

Diffuse Intensity Field and Buttons

The diffuse intensity of a material is a measure of how much of the diffuse color of a surface is returned to the camera. Reducing this value to 0% will result in a black surface (i.e.: 0 color) and setting it to 100% will result in the pure diffuse color as set in the Diffuse Color Well.

You can animate the value over time, and also drive its intensity with a texture.

This attribute is useful for simulating dirt (try driving this field with a Fractal Noise texture element), streaks, moisture (drive Diffuse Intensity with a Dynamic parameter of Water Level or Elevation to simulate moist surfaces at the edges of lakes and streams etc.)

The maximum value for this parameter is 10000%.

Luminosity Percentage Field and Buttons

Luminosity affects how the Material is shaded by Lights (see Light Editor). You can adjust it to create 3D-shaded Objects, flat-shaded Objects or anything in-between.

With zero percent luminosity, the Material will be fully shaded by Lights. This produces a 3D look. In deeply shadowed areas, the Material's color will be a darker shade of itself based on the Ambient Light Intensity and Color. Where fully lit by Lights, the color will be the Diffuse Color or texture (see above) modulated by the Intensity and Color of any Lights.

By raising the luminosity, you can lighten the shaded areas. This can be useful to do if the terrain that uses the Material seems too dark. Raising the luminosity a little bit decreases the shading contrast for the Material.

With 100 percent luminosity, the Material will ignore Lights completely. This produces a flat, unshaded look. The Material will always be the Diffuse Color or texture. This can be useful for Materials used to create the flat, paper-cutout-style animations used by certain cartoon shows.

You can also subtract light by using negative luminosity to make the object tend toward the Ambient Light colors. With 100 percent negative luminosity, the Material will ignore Lights. The Material will be flat-shaded with the Ambient colors.

You can animate the Luminosity percentage to simulate lighting changes. This lets you animate the effect of nearby lightning or explosions.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's luminosity with a texture pattern. This can be useful for creating the look of glowing lava.

When you use a texture, a white value in the texture will equal the amount of luminosity you set in the Luminosity percentage field. A black value in the texture will equal zero luminosity. Gray values will be in-between.

Specularity Percentage Field and Buttons

Specularity is the amount of shininess for a material.

Use the Specularity Percentage field to adjust the shininess of the material. Zero percent means no specular highlight, while 100 percent is maximum shininess.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's specularity value with texture patterns.

When you use a texture, a white value in the texture will equal the amount of Specularity you set in the Specularity percentage field. A black value in the texture will equal zero Specularity. Gray values will be in-between.

Specular Exponent Field and Buttons

Use the Specular Exponent field to adjust the size of the shiny spot. The useful range is from 1 to 100. Higher numbers will produce a smaller spot, with less feathering at its edge.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's specular exponent value with texture patterns.

When you use a texture, a white value in the texture will equal the amount of Specular Exponent you set in the Specular Exponent field. A black value in the texture will equal zero Specular Exponent. Gray values will be in-between.

Translucency Percentage Field

Use the Translucency Percentage field to adjust the light transmission of the material. Zero percent means no extra highlighting, while 100 percent is maximum transmission. This is useful if you have underwater lights.

For even brighter glows you can enter a value that is more than 100%. In that case VNS will actually increase the Value of the material's color to further increase brightness.

Note: Value is one of the Parameters you can manually adjust on the Color Editor.

To see Translucency, the material must be between the Camera and a Light. You can adjust the amount of light transmission and the angle from the Light within which the material will show the effect.

During rendering there are several things that affect translucency. VNS will make translucent materials brighter when the polygons they are on are directly facing the Light. In other words, if the polygons are perpendicular to a line between the water surface and the Light. VNS will also make translucent materials brighter when the polygons they are on are most directly between the Camera and Light.

The Translucent effect is less bright for materials on polygons who's faces are angled away from the Light and for materials that are farther from the direct line between the Camera and Light.

You can apply, edit or delete a Texture Editor texture using the controls to the right. Using these controls you can replace the Material's translucency percentage with a texture pattern.

Translucency Exponent Field

Use the Translucency Exponent field to adjust the cone of the light transmission. This is a measure of how far the material can be off axis from a line extending from the Camera to the SunLight. The useful range is from 1 to infinity. Higher numbers will produce a smaller cone, with less feathering at its edge. The larger the cone (smaller numbers) the larger the area the material can be in and still be affected by translucency.

You can apply, edit or delete a Texture Editor texture using the controls to the right. Using these controls you can replace the Material's translucency values with texture patterns (see below).

Reflectivity Percentage Field and Icons

Use the Reflectivity Percentage to adjust the percentage that the colors from reflections blend with the color of the water.

A Reflection percentage value of 0 will make the water surface entirely colored by the Diffuse Color or texture (see above), with Foam mixed in for whitecaps and breakers (see below). A value of 100 will make the surface of the water have theoretically correct Fresnel reflectivity.

For greater realism, reflections will tend to diminish as the camera becomes aligned with the terrain surface normal. In other words, as the camera points down at the water, reflections diminish naturally.

Note: A "surface normal" is a line perpendicular to any water polygon.

You can increase the Reflectivity percentage to get greater than normal reflectivity. If you want you can increase reflectivity up to 500%. Reflections will still diminish as the camera becomes aligned with the surface normal.

Optical Depth Field and Buttons

Use the Optical Depth Field to adjust the transparency of water when Transparent Water is enabled in the view's Render Options. It should be initially set to the distance beyond which you want objects to be occluded by the Diffuse Color of the water material at that point. Once set, the value can be adjusted until the required effect has been achieved.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's Optical Depth value with texture patterns.

When you use a texture, a white value in the texture will equal the Optical Depth you set in the Optical Depth field. A black value in the texture will equal zero Optical Depth. Gray values will be in-between.

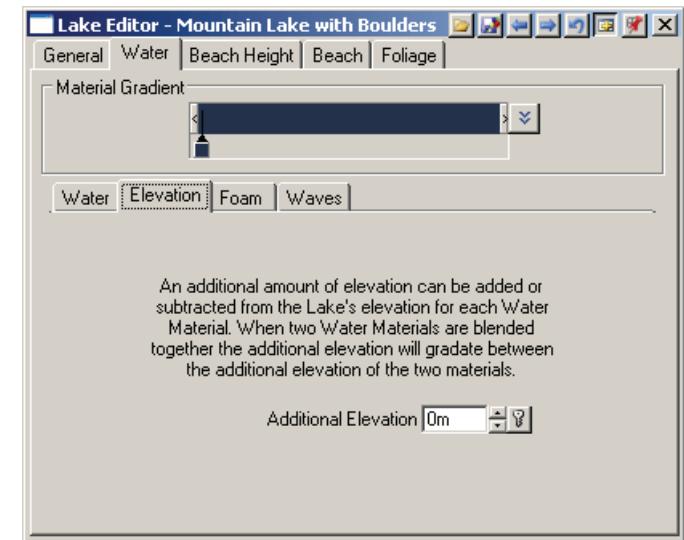
Increasing Optical Depth will make the water material more transparent, showing less of its diffuse color. Reducing Optical Depth will have the reverse effect, reducing transparency and increasing the intensity of diffuse color observed.

Using the Keyframe controls to the right of this field, you can animate this parameter to simulate a change in turbidity of the water body over time.

Elevation Sub-page

Additional Elevation Field

Use the Additional Elevation field to add additional Elevation to the Lake's surface. This can be used to make, for example, an Ice material that covers part of your lake that is several inches higher than the surrounding water surface.



Foam Sub-page

Foam Color Well

The Foam Color (or texture) always appears wherever Foam appears. Click the Color well to edit the Foam Color in the Color Editor.

The foam will be a solid color wherever it appears unless you use a texture to control the foam color.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's Foam Color with texture patterns. Fractal noise or F1 Cell Basis Elements work well for foam.

Foam Control Icon

Click the Foam Control Icon to either allow foam for the water material.

From the popup menu, you will be able to select from a commands that will allow you to Copy, Delete, Enable, Disable and Activate (Create) Foam.

Foam Diffuse Intensity Field and Buttons

The diffuse intensity of a material is a measure of how much of the diffuse color of a surface is returned to the camera. Reducing this value to 0% will result in a black surface (i.e.: 0 color) and setting it to 100% will result in the pure diffuse color as set in the Diffuse Color Well.

You can animate the value over time, and also drive its intensity with a texture.

This attribute is useful for simulating dirt (try driving this field with a Fractal Noise texture element), streaks, moisture (drive Diffuse Intensity with a Dynamic parameter of Water Level or Elevation to simulate moist surfaces at the edges of lakes and streams etc.)

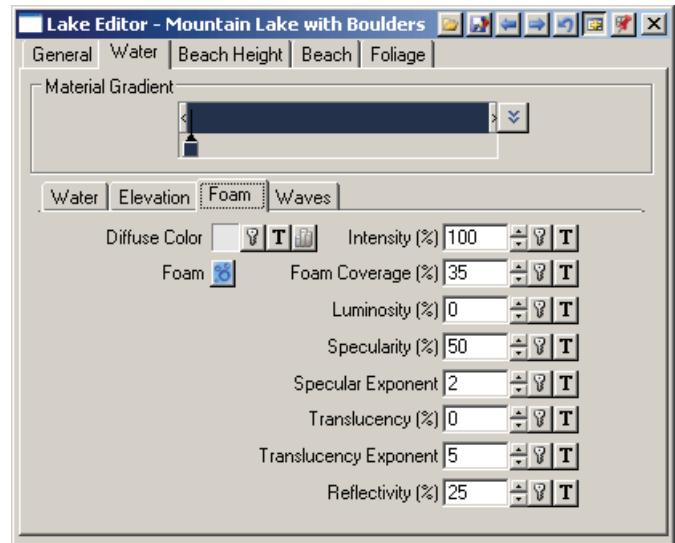
The maximum value for this parameter is 10000%.

Foam Coverage Percentage Field

The Foam Coverage percentage field lets you add foam to the waves. Zero percent is no foam and 100 percent is complete coverage. VNS adds the foam from the top of waves downward.

Textures can take water depth into account. For example to make breakers near the beach but not over deeper water, use a dynamic parameter Element based on water depth in the Texture Editor.

When you use a texture, a white value in the texture will equal the amount of coverage you set in the Foam Coverage percentage field. A black value in the texture will equal zero coverage. Gray values will be in-between. By modulating the white value with another texture you can break up the places where foam appears into realistic patterns. Fractal noise or F1 Cell Basis Elements work well for foam patterns.



Luminosity Percentage Field and Buttons

Luminosity affects how the Material is shaded by Lights (see Light Editor). You can adjust it to create 3D-shaded Objects, flat-shaded Objects or anything in-between.

With zero percent luminosity, the Material will be fully shaded by Lights. This produces a 3D look. In deeply shadowed areas, the Material's color will be a darker shade of itself based on the Ambient Light Intensity and Color. Where fully lit by Lights, the color will be the Diffuse Color or texture (see above) modulated by the Intensity and Color of any Lights.

By raising the luminosity, you can lighten the shaded areas. This can be useful to do if the terrain that uses the Material seems too dark. Raising the luminosity a little bit decreases the shading contrast for the Material.

With 100 percent luminosity, the Material will ignore Lights completely. This produces a flat, unshaded look. The Material will always be the Diffuse Color or texture. This can be useful for Materials used to create the flat, paper-cutout-style animations used by certain cartoon shows.

You can also subtract light by using negative luminosity to make the object tend toward the Ambient Light colors. With 100 percent negative luminosity, the Material will ignore Lights. The Material will be flat-shaded with the Ambient colors.

You can animate the Luminosity percentage to simulate lighting changes. This lets you animate the effect of nearby lightning or explosions.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's luminosity with a texture pattern. This can be useful for creating the look of glowing lava.

When you use a texture, a white value in the texture will equal the amount of luminosity you set in the Luminosity percentage field. A black value in the texture will equal zero luminosity. Gray values will be in-between.

Specularity Percentage Field and Buttons

Specularity is the amount of shininess for a material.

Use the Specularity Percentage field to adjust the shininess of the material. Zero percent means no specular highlight, while 100 percent is maximum shininess.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's specularity value with texture patterns.

When you use a texture, a white value in the texture will equal the amount of Specularity you set in the Specularity percentage field. A black value in the texture will equal zero Specularity. Gray values will be in-between.

Specular Exponent Field and Buttons

Use the Specular Exponent field to adjust the size of the shiny spot. The useful range is from 1 to infinity. Higher numbers will produce a smaller spot, with less feathering at its edge.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's specular exponent value with texture patterns.

When you use a texture, a white value in the texture will equal the amount of Specular Exponent you set in the Specular Exponent field. A black value in the texture will equal zero Specular Exponent. Gray values will be in-between.

Translucency Percentage Field

Use the Translucency Percentage field to adjust the light transmission of the material. Zero percent means no extra highlighting, while 100 percent is maximum transmission. This is useful if you have underwater lights.

For even brighter glows you can enter a value that is more than 100%. In that case VNS will actually increase the Value of the material's color to further increase brightness.

Note: Value is one of the Parameters you can manually adjust on the Color Editor.

To see Translucency, the material must be between the Camera and a Light. You can adjust the amount of light transmission and the angle from the Light within which the material will show the effect.

During rendering there are several things that affect translucency. VNS will make translucent materials brighter when the polygons they are on are directly facing the Light. In other words, if the polygons are perpendicular to a line between the foam surface and the Light. VNS will also make translucent materials brighter when the polygons they are on are most directly between the Camera and Light.

The Translucent effect is less bright for materials on polygons who's faces are angled away from the Light and for materials that are farther from the direct line between the Camera and Light.

You can apply, edit or delete a Texture Editor texture using the controls to the right. Using these controls you can replace the Material's translucency percentage with a texture pattern.

Translucency Exponent Field

Use the Translucency Exponent field to adjust the cone of the light transmission. This is a measure of how far the material can be off axis from a line extending from the Camera to the SunLight. The useful range is from 1 to infinity. Higher numbers will produce a smaller cone, with less feathering at its edge. The larger the cone (smaller numbers) the larger the area the material can be in and still be affected by translucency.

You can apply, edit or delete a Texture Editor texture using the controls to the right. Using these controls you can replace the Material's translucency values with texture patterns.

Reflectivity Percentage Field and Icons

Use the Reflectivity Percentage to adjust the percentage that the colors from reflections blend with the color of the foam.

A Reflection percentage value of 0 will make the foam surface entirely colored by the Diffuse Color or texture (see above). A value of 100 will make the surface of the foam have theoretically correct Fresnel reflectivity.

For greater realism, reflections will tend to diminish as the camera becomes aligned with the terrain surface normal. In other words, as the camera points down at the foam, reflections diminish naturally.

Note: A “surface normal” is a line perpendicular to a foam terrain polygon.

You can increase the Reflectivity percentage to get greater than normal reflectivity. If you want you can increase reflectivity up to 500%. Reflections will still diminish as the camera becomes aligned with the surface normal.

Waves Sub-page

The Waves sub-page lets you attach Wave Models to your Lake.

If a Wave Model is not attached to a Vector it will cover the entire Lake surface. If it is attached to a Vector it will cover only the area of the Lake that is within the Vector.

Wave Model List

The Wave Model List shows any Wave Models attached to the Lake. Disabled Wave Models are shown in gray. You can double click the name of a Wave Model to open the Wave Model Editor.

Add Wave Model Icon

Click the Add Wave Model icon to add a Wave Model to the Lake. VNS will open a window where you can select one or more Wave Models to add from the Wave Models in your Project. Click to select a Wave Model. Shift-click or control-click to select multiple Wave Models. Click the OK button to accept the selection.

Remove Wave Model Icon

Click the Remove Wave Model icon to remove the selected Wave Model from the Lake.

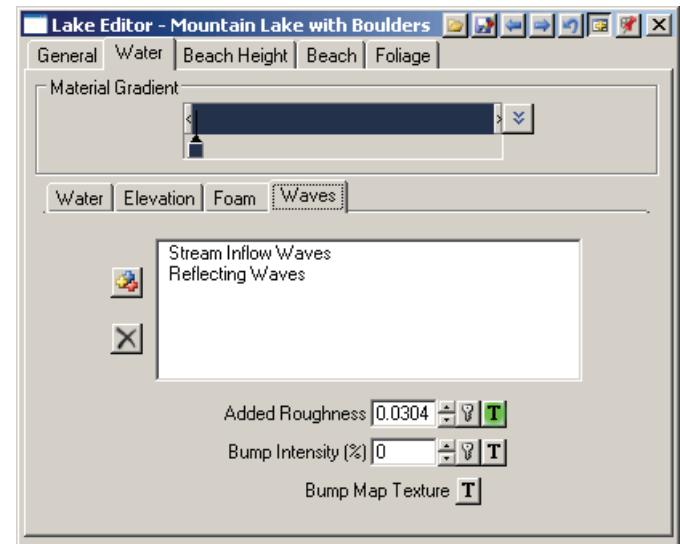
VNS will also ask if you want to remove the Wave Model from the Project. Be careful, don't remove it from the Project unless you really want to delete the Wave Model forever!

Added Roughness Percentage Field

Use the Amplitude Parameter and its texture controls to add roughness displacement to the water. This is great for creating the complex wave patterns typical of large bodies of water. You can use this along with the normal VNS wave sources (see Waves Section above).

You can apply, edit or delete a texture using the texture controls to the right. The texture will control the Roughness pattern that will displace the water.

Choose any texture. The F1 Cell Basis texture element works well, especially with a Bias Component as Remap Function 1 to make sharper wave peaks. You can even use a Terrain element of water depth to make waves higher or lower based on the distance between the water surface and the underwater topography.



Enter the amount of displacement, in meters, into the Amplitude field. The texture you use can then vary the water displacement up to the amount you entered. White areas in the texture will displace the water the full amount. Black areas will not displace the water. Gray areas will displace the water more than black areas and less than white areas.

You can even animate the velocity of the roughening texture in the Texture Editor to create a moving roughness pattern.

Bump Intensity Percentage Field and Bump Map Texture Icon

Bump mapping lets you simulate detailed relief shadowing without requiring dense geometry. For more about using bump mapping, see [Bump Mapping Controls](#).

Beach Height Page

The Beach Height page lets you adjust the beach height.

Beach Height & Reference Elevation Section

Use Reference Elevation Field and Checkbox

This lets you take tides or receding flood waters into account for beaches. Select the checkbox and enter the actual elevation you want the top of the beach to be when Beach Height Minimum is set to zero. You can further adjust the top of the beach with the Beach Height Minimum and Beach Height Variation fields (see below).

This will lock the top of the beach at a specific elevation even if the Lake's elevation is animated to rise or fall. For example, you can animate the Lake's elevation so it follows tidal patterns, revealing or covering the beach just as tides do in nature.

You can animate the Lake's elevation to flood past the beach and onto the surrounding terrain. Areas flooded beyond the beach will show tall Ecosystem foliage standing in the water.

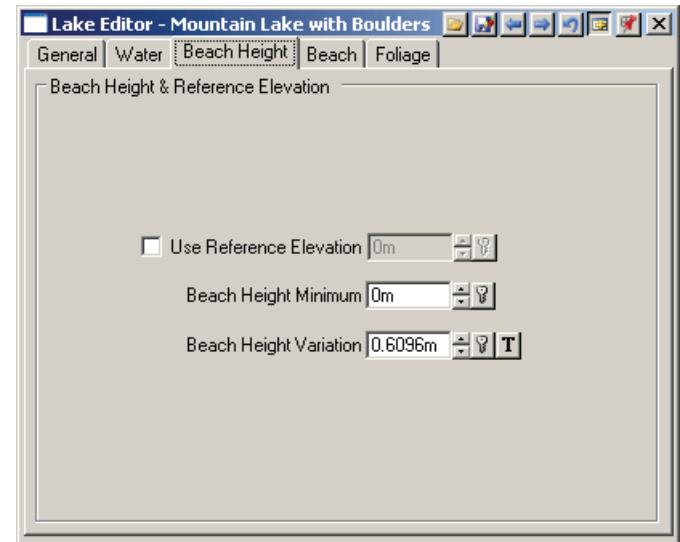
Note: Foliage growing in Ecosystems or Foliage Effects surrounding the Lake will still appear within the flood waters. You can control the Lake's elevation with the Elevation field on the General page. You can also control elevation for each of the Lake's Water Materials from the Water page, on the Elev sub-page, using the Additional Elevation field.

Deselect the checkbox if you want beach height to vary with the Lake's elevation. This is great for lakes where the surface elevation of the lake does not change. Then you can control the amount of beach with the Beach Height Minimum and Beach Height Variation fields.

Beach Height Minimum Field

Beach Height Minimum works two ways, depending on whether the Use Reference Elevation checkbox is selected (see above).

If the Use Reference Elevation checkbox is not selected, you can use the Beach Height Minimum field to set the minimum amount of terrain above the Lake's shore that is textured by Beach Materials. You can enter a value of zero or even use a negative number to eliminate the beach entirely.



If the Use Reference Elevation checkbox is selected, you can use the Beach Height Minimum field to specify the minimum amount of terrain about the Reference Elevation you specify (see above). This lets you keep the beaches from following changes in water elevation. Use this if you are simulating tides or flood waters. Areas flooded beyond the beach will show tall Ecosystem foliage standing in the water.

In either case, you can add further beach height randomly using the Beach Height Variation field (see below).

Note: You can edit the beach's Materials on the Beach page (see below).

Beach Height Variation Field

Use the Beach Height Variation to raise the beach height beyond that created by the Beach Height Minimum field (see above). Beach height is the terrain directly adjacent to the water that is covered with Beach Materials.

VNS will add additional beach height on a random basis. The additional beach ranges between zero and the value you enter in the Beach Height Variation field, in meters.

Beach Page

The Beach page lets you add new Materials to the Beach.

The Material Gradient Driver lets you tell VNS which Material to use. You can use a texture to combine multiple Materials on the beach.

Material Gradient & Driver Section

Material Gradient Driver Percentage Controls

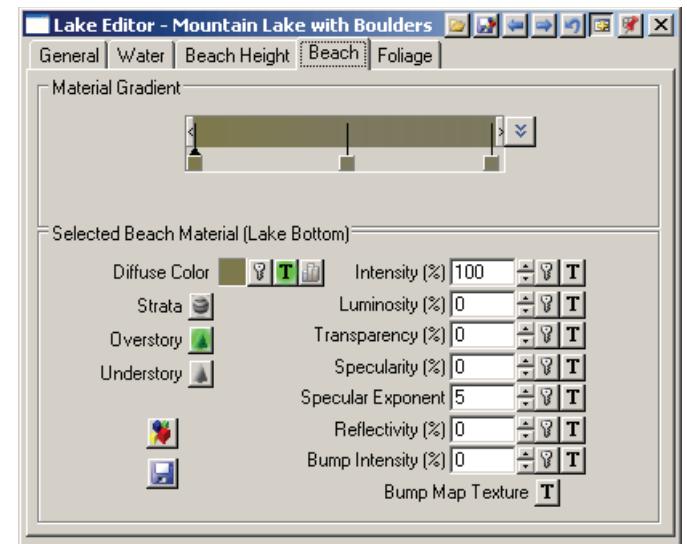
The Material Gradient Driver field lets you pick a Material for the Beach based on a position along the Material Gradient (see below).

Enter a percentage from zero to 100 where zero is the left edge of the gradient and 100 is the right edge. VNS will use the Material at the gradient position you specify. If there is no Material represented at that position, VNS will create a blend between the nearest two Materials.

You can animate the Material Gradient Driver percentage to change Materials over time. This is great for climate change animations where you could animate through a variety of Materials such as from a desert to a rain forest.

By clicking the Texture Control icon you can control the Material Gradient Driver percentage with the Texture Editor. This lets you use all the Materials in the Gradient. Textures can range in gray values from black to white, with black representing 0% on the Gradient and white representing 100% on the gradient.

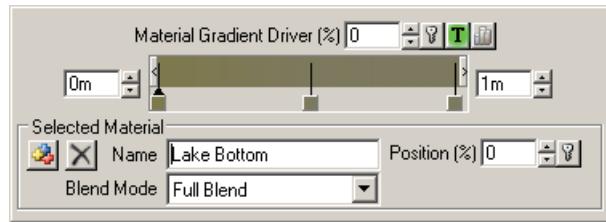
For example, if you use a fractal noise Element in the texture that ranges from black to white, VNS will cover the Beach's area with Materials in a fractal noise pattern ranging from the left-most Material in the Gradient to the right-most Material in the Gradient.



Another example: You could use a Dynamic Parameter of Slope in the Texture Editor and set its Input Low field to the lowest slope on the beach area and the Input High field to the highest slope in your terrain. Then VNS will arrange the Materials in the Beach's Material Gradient so that the Materials on the left side of the gradient will grow on the lower sloped areas and the Materials on the right side of the Gradient will grow on the higher sloped areas. You can use this to make the flatter areas textured with sand and the steeper areas textured with rock.

If you are using an Ecotype to add foliage to your beach and you don't want the foliage to appear under water, you may want to use a Dynamic Parameter of Water Depth to control the Material Gradient Driver. To keep foliage from appearing in the water, use a material with no Ecotype foliage and place it in the Material Gradient where the water depth becomes greater than zero.

To Access the Gradient, click on the Gradient popdown icon . This will display the Material Gradient Editor:



Material Gradient

The Material Gradient shows a colored bar with one or more colored pins beneath it. The bar is a place to create Materials. Click it to create a new Material.

When you click the Gradient to create a new Material, VNS will give the new Material a random Diffuse Color. You can change the color on the Material and Foliage page.

VNS represents each Material with a pin that is colored with the Diffuse Color of the Material. Click any Pin to select a Material.

Material Gradient Range Fields

The Material Gradient Range fields are on either side of the Material Gradient. They show the range of the value that controls the gradient.

If there's no texture enabled for the Material Gradient Driver, the range of the gradient is zero to 100 percent.

If there is a texture enabled for the Material Gradient Driver, then there are two cases:

1) The first Texture Element is a Dynamic Parameter.

In this case, the Range fields show the range of input values for the Dynamic Parameter you have selected. For example if Elevation is the Dynamic Parameter and the Elevation range in the texture editor (Input Low and Input High) is zero to 1000 meters, then in the Range fields you'll see zero on the left and 1000 on the right.

You can directly edit those texture values in the Lake Editor's Range fields. This is handy because you don't have to reopen the Texture Editor if you want to edit these values.

2) The first Texture Element is not a Dynamic Parameter.

In this case, the Range fields are zero to 100 percent, and are non-editable.

Add Material Icon

Click the Add Material Icon to add a new Material. VNS will ask for the position in the Gradient. Enter a position and click the OK button.

Alternatively you can click directly in the Gradient in a spot where no other Material exists.

VNS will create a new Material and give it a random Diffuse Color. The Material will be represented in the Gradient with a pin in the color of its Diffuse Color.

Remove Material Icon

Click the Remove Material Icon if you want to delete the selected Material.

Position in Gradient Field

The Position in Gradient field shows the percentage along the Gradient for the selected Material. You can move the Material's pin to the left by decreasing this number or to the right by increasing this number. You can also drag the pin along the Gradient with the mouse.

Blend Drop Box

The Blend drop box lets you choose the rate of change between the selected Material and the Material to its left in the gradient.

These are easiest to visualize if you try them and see what they look like in the gradient. You can see how VNS blends Materials between the pins by how it blends the Diffuse Colors along the Gradient.

You can change the blending by selecting different blend types from the Blend Drop Box. If you have more than one material in the gradient, use the following choices to decide how the gradient blends the materials together.

Sharp Edge

Choose "Sharp Edge" if you want an instant change with no gradient.

Soft Edge

Choose "Soft Edge" to create a gradient that turns into the color to the left 1/10 of the way toward that color's pin.

Quarter Blend

Choose "Quarter Blend" to create a gradient that turns into the color to the left 1/4 of the way toward that color's pin.

Half Blend

Choose “Half Blend” to create a gradient that turns into the color to the left 1/2 of the way toward that color’s pin.

Full Blend

Choose “Full Blend” to create a smooth gradient that turns into the color to the left at that color’s pin.

Fast Increase

Choose “Fast Increase” to create an accelerated gradient that gets closer to the previous color faster, and turns into the color to the left at that color’s pin.

Slow Increase

Choose “Slow Increase” to create an decelerated gradient that gets closer to the previous color slower, and turns into the color to the left at that color’s pin.

S-Curve

Choose “S-Curve” to create a narrower gradient between the pin and the previous color’s pin and leaves more of the original colors along the gradient in between.

Material Name Field

The Material Name field is above the Material list. After you create a Material it will have a default name of “Material.” It’s a good idea to enter a unique name in the Material Name field to identify how you will use the Material. For example “sand,” “forest” or “fall foliage.”

Beach Material Properties Section

The Beach page lets you edit the properties of the selected Material. You can select a Material on the Beach page by clicking the Material’s colored pin in the Gradient (see above).

Ecotypes let you add foliage to the Beach. There are two Ecotypes, an Overstory and an Understory. In nature, the Overstory represents taller trees while the Understory represents shorter foliage. You can add appropriate foliage to the Overstory Ecotype and Understory Ecotype to simulate this in VNS. On a Beach you may only need one Ecotype.

Overstory and Understory Ecotype Controls

To create an Overstory or Understory, click the Overstory or Understory Ecotype Operations icon to see the Ecotype Operations commands. If there is no Ecotype yet created (icon has a gray background), select the Create Ecotype command. If there is an existing Ecotype (icon has a green background), select the Edit Ecotype command.

If you want to disable an Ecotype, click its Ecotype Operations icon and select the Disable Ecotype command. The icon will show a red diagonal stripe to indicate that there is an Ecotype but it’s disabled. This is the same as deselecting the Ecotype Enabled checkbox on the General page of the Ecotype Editor for the Ecotype. VNS will ignore disabled Ecotypes for rendering.

If you want to enable a disabled Ecotype, click its Ecotype Operations icon and select the Enable Ecotype command. The icon will no longer show a red diagonal stripe. This is the same as selecting the Ecotype Enabled checkbox on the General page of the Ecotype Editor for the Ecotype.

If you want to delete an Ecotype, click its Ecotype Operations icon and select the Remove Ecotype command. Because this is destructive, VNS will ask you to confirm this choice. Click OK to remove the Ecotype forever.

If you want to copy an Ecotype, click its Ecotype Operations icon and select the Copy Ecotype command. If you want to paste an Ecotype, click the Ecotype Operations icon for the destination Ecotype and select the Paste Ecotype command.

If you want to make an Ecotype the Active Item, click its Ecotype Operations icon and select the Activate Ecotype command. VNS will make it the Active Item.

Selected Material Ground Overlay

The Selected Material Ground Overlay lets you add color or texturing to the beach.

Diffuse Color Well and buttons

The Ground Effect's Diffuse Color (or texture) always appears wherever the Selected Material's Ground Overlay appears, unless you set the transparency of the Material to 100%. Click the Diffuse Color well to edit the Diffuse Color in the Color Editor.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's Diffuse Color with texture patterns. For example, you can use the fractal noise Element to create the appearance of sand.

When you use a texture, the Colors in the texture will replace the Diffuse Color, unless you use less than 100% Opacity in the Texture Editor, in which case the texture and the Diffuse Color will be mixed.

Diffuse Intensity Field and Buttons

The diffuse intensity of a material is a measure of how much of the diffuse color of a surface is returned to the camera. Reducing this value to 0% will result in a black surface (i.e.: 0 color) and setting it to 100% will result in the pure diffuse color as set in the Diffuse Color Well.

You can animate the value over time, and also drive its intensity with a texture.

This attribute is useful for simulating dirt (try driving this field with a Fractal Noise texture element), streaks, moisture (drive Diffuse Intensity with a Dynamic parameter of Water Level or Elevation to simulate moist surfaces at the edges of lakes and streams etc.)

The maximum value for this parameter is 10000%.

Strata Buttons

Click the Strata icon to open the Material Strata Editor. There you can add Strata texturing to the Material.

Luminosity Percentage Field and Buttons

Luminosity affects how the Material is shaded by Lights (see Light Editor). You can adjust it to create 3D-shaded Objects, flat-shaded Objects or anything in-between.

With zero percent luminosity, the Material will be fully shaded by Lights. This produces a 3D look. In deeply shadowed areas, the Material's color will be a darker shade of itself based on the Ambient Light Intensity and Color. Where fully lit by Lights, the color will be the Diffuse Color or texture (see above) modulated by the Intensity and Color of any Lights.

By raising the luminosity, you can lighten the shaded areas. This can be useful to do if the terrain that uses the Material seems too dark. Raising the luminosity a little bit decreases the shading contrast for the Material.

With 100 percent luminosity, the Material will ignore Lights completely. This produces a flat, unshaded look. The Material will always be the Diffuse Color or texture. This can be useful for Materials used to create the flat, paper-cutout-style animations used by certain cartoon shows.

You can also subtract light by using negative luminosity to make the object tend toward the Ambient Light colors. With 100 percent negative luminosity, the Material will ignore Lights. The Material will be flat-shaded with the Ambient colors.

You can animate the Luminosity percentage to simulate lighting changes. This lets you animate the effect of nearby lightning or explosions.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's luminosity with a texture pattern. This can be useful for creating the look of glowing lava.

When you use a texture, a white value in the texture will equal the amount of luminosity you set in the Luminosity percentage field. A black value in the texture will equal zero luminosity. Gray values will be in-between.

Transparency Percentage Field and Buttons

Use the Transparency field to adjust how much you can see through the Ground Overlay. Zero percent will cover the terrain with opaque Ground Overlay. One hundred percent makes the Ground Overlay invisible, and you will instead see a Ground Effect on the terrain polygons. Anything in-between will mix the Ground Overlay with the Ground Effect.

Note: There is always at least one global Ground Effect in any VNS Project.

You can apply, edit or delete a texture using the texture popup menu. Using these commands you can replace the Material's transparency with a texture pattern to make some areas more transparent than others.

When you use a texture, a white value in the texture will equal the amount of Transparency you set in the Transparency percentage field. A black value in the texture will equal zero Transparency. Gray values will be in-between.

Specularity Percentage Field and Buttons

Specularity is the amount of shininess for a material.

Use the Specularity Percentage field to adjust the shininess of the material. Zero percent means no specular highlight, while 100 percent is maximum shininess.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's specularity value with texture patterns.

When you use a texture, a white value in the texture will equal the amount of Specularity you set in the Specularity percentage field. A black value in the texture will equal zero Specularity. Gray values will be in-between.

Specular Exponent Field and Buttons

Use the Specular Exponent field to adjust the size of the shiny spot. The useful range is from 1 to infinity. Higher numbers will produce a smaller spot, with less feathering at its edge.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's specular exponent value with texture patterns.

When you use a texture, a white value in the texture will equal the amount of Specular Exponent you set in the Specular Exponent field. A black value in the texture will equal zero Specular Exponent. Gray values will be in-between.

Reflectivity Field and Buttons

Beach materials can now reflect their surroundings, as well as parts of their own geometry.

Set this value to an amount greater than 0% to see reflections on these surfaces.

You can animate the value over time, and also drive its intensity with a texture.

The maximum value for this parameter is 10000%.

Bump Intensity Percentage Field and Bump Map Texture Icon

Bump mapping lets you simulate detailed relief shadowing without requiring dense geometry. For more about using bump mapping, see Bump Mapping Controls.

Foliage Page

To create Ecotypes for a beach material, perform the following:

- Add one or more Ecotypes using the controls on the Material Page, or directly to an existing (and selected) Material using the Ecotype Control Icon underneath the Foliage List on the Foliage Page.
- Add one or more Foliage Groups to each Ecotype using the Foliage Group Control Icon underneath the Foliage List on the Foliage Page.
- Add one or more Foliage Objects to each Group using the Foliage Object Control Icon underneath the Foliage List on the Foliage Page.
- Adjust the properties for each Foliage Object, Group and Ecotype on the parameters pages that appear when the appropriate item is selected in the Foliage List page.

You can specify height and density for each Foliage Object, Foliage Group and the entire Ecotype. You can even use textures to control height and density to create natural-looking foliage clumping based on procedural textures, images and dynamic parameters.

The way the controls interact depends on the choices you make on the General page. There you can configure the Ecotype to behave according to your needs.

Foliage Objects can be Image Objects or 3D Objects. Image Objects can be still images or animated sequences (see the Image Object Library section). Typically they will be images or animations of trees and other foliage, but they can be any images or animations of anything you like. If you have an animation of a dancing munchkin and want an entire forest of dancing munchkins, you can create that effect using Image Objects and the Ecotype Editor.

Using Pre-made Components

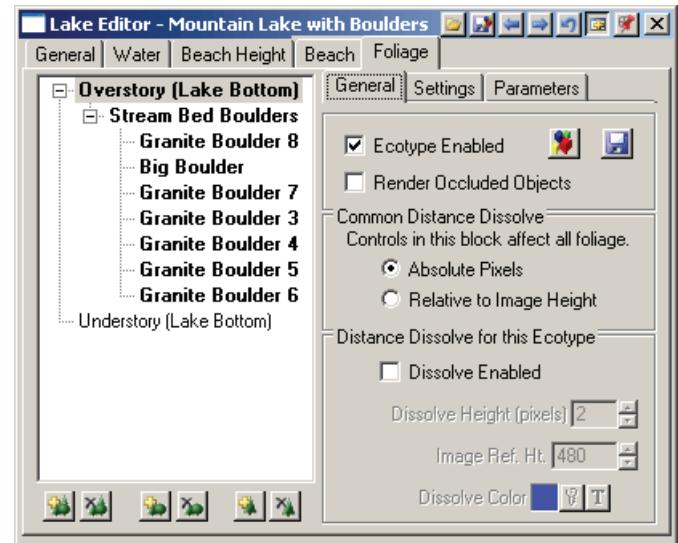
Click the Load Component From Disk Icon to see the Component Gallery, ready to load a pre-made Ecotype. Ecotypes are multiple groups of Foliage Objects with the Ecotype, Group and Object controls already set up. You can select from any previously created Ecotype files. Double-click the thumbnail image to load the Ecotype Component. VNS will reset the parameters of the Ecotype to those of the Component you selected.

You can create and export your own pre-built Ecotype Components from the Ecotype Editor by setting up the Ecotype the way you want it and then clicking the Save Component To Disk Icon. VNS will open the Component Signature Window where you can fill in the information, choose a representative image for the Component's thumbnail and save the Component in the Component Gallery.

For example, this makes it easy to create different kinds of forests with complex foliage mixes. You can later reuse the Ecotype another Project and have an instant complex forest.

Material Foliage List

This list will show the foliage associated with the currently selected Ecosystem Material. The selected Material name will be in brackets behind the Overstory and understory foliage types.



Note: Overstory and understory vegetation are simply logical groupings. There is no reason why you can not contain similar species, or why one can exist while the other doesn't.

Enabled Items in the list will be displayed in Bold text. Disabled Items will still be displayed, but not emboldened.

At the bottom of the Material Foliage List, there are the following Control Icons:

Add Ecotype

Click the Add Ecotype icon if you want to add a new Ecotype to the Material.

Note: An Ecotype must exist in the Material in order for there to be Foliage groups, and therefore Foliage Objects in that Material.

Remove Ecotype

Click the Remove Ecotype icon if you want to delete an Ecotype. VNS will remove the Ecotype from the Material, along with all associated Foliage groups and FOliage Objects in those Groups.

If the Ecotype existed when you last opened the Ecosystem Editor, you can undo the removal by clicking the Undo All Changes in this Window icon. Otherwise the Ecotype will be gone forever.

Add Foliage Group

Click the Add Foliage Group icon if you want to add a new Foliage Group to the Ecotype. VNS will ask for a name.

Note: You have to add at least one Foliage Group to an Ecotype before you can add Foliage Objects on the Objects page (see below).

Remove Foliage Group

Click the Remove Foliage Group icon if you want to delete a Foliage Group. VNS will remove the Foliage Group from the Ecotype.

If the Foliage Group existed when you last opened the Ecosystem Editor, you can undo the removal by clicking the Undo All Changes in this Window icon. Otherwise the Foliage Group will be gone forever.

Add Foliage Object

Click the Add Foliage Object icon to Create a new, blank entry in the Foliage Objects list.

Then choose either the Image Object or 3D Object radio button in the Selected Object section (see below). Finally, select an object from the drop box in the Image Object section or 3D Object section (see below).

Remove Foliage Object

If you want to remove a Foliage Object from the selected Foliage Group, select it in the Foliage Objects list and click the Remove Foliage Object icon.

VNS will ask if you want to remove the object. Click OK and VNS will remove it from the Foliage Group.

General Sub-Page

Ecotype Enabled Checkbox

The Enabled checkbox lets you enable or disable the Ecotype for rendering.

Note: You can also enable and disable an Ecotype from its Ecotype Operations icon on the Ecosystem, Lake or Stream Editor, wherever you first created the Ecotype. Select the icon's Disable Ecotype command to disable the Ecotype. The icon will be displayed with a red diagonal stripe to indicate that it's disabled. Select the icon's Enable Ecotype command to enable the Ecotype. The Ecotype will be enabled and the red stripe will disappear.

Disabling an Ecotype can be useful to speed up rendering if you are doing test renders to check some other aspect of your scene and don't need to see the Ecotype's foliage. Make sure you remember to enable it for the final rendering if you want to see the foliage.

Note: To see the Ecotype in your rendering, it must be part of an Ecosystem or Beach that is visible to the Camera you selected for the Render Job you are using (see Render Job Editor), and Other Foliage must be enabled in the Render Options you are using (see Render Options Editor).

Render Items Occluded By This Ecotype's Image Objects Checkbox

Selecting this checkbox will force VNS to render those elements of the scene obscured by this foliage effect. This will allow reflections to accurately represent terrain and foliage that has been hidden from the camera by this foliage effect. Select this checkbox if you are experiencing "holes" in reflections of terrain and foliage objects near to a Foliage Effect.

Common Distance Dissolve Section

The Common Distance Dissolve section lets you specify whether VNS will calculate Distance Dissolve Height based on an absolute pixel height or as a pixel height relative to a specified image size. This applies to all the Ecotypes and Foliage Effects in your Project (see also Foliage Effect Editor).

Distance Dissolve Height is the height at which VNS will stop rendering foliage Image Objects and instead render a color or texture. You can enable Distance Dissolve in the Image Object Distance Dissolve section (see below). There you can specify a pixel height for Image Objects at which VNS stops trying to render foliage and instead renders a simple color or a texture.

For example, if a tree is so far away that its height is below the Distance Dissolve Height in pixels, it will no longer be rendered and VNS will instead render the color or texture you specify. This can make rendering much, much faster because VNS can calculate a color or texture much faster than a combination of foliage. Rendering the actual trees and plants far in the distance may take a long time for little or no visual benefit.

The default choice is Absolute Pixels. The default value for Distance Dissolve Height is 2 pixels. This means that VNS will replace a foliage object with a color or texture whenever the foliage object is shorter than two pixels in your rendered image. This makes a lot of sense because you can't see a complete tree in two pixels anyway, so there's not much point wasting the rendering time in the attempt.

You can enable Distance Dissolve in the Image Object Distance Dissolve section (see below).

Absolute Pixels Radio Button

Select the Absolute Pixels radio button to choose a specific height in pixels below which VNS will no longer render an Image Object. VNS will instead replace the Image Object with the color or texture you specify in the Image Object Distance Dissolve section (see below).

By default, the Absolute Pixels radio button is selected.

Relative to Image Height Radio Button

Select the Relative to Image Height radio button to relate the minimum pixel height at which VNS will render Image Objects to the size of your rendered images. This will let you see a more consistent rendering no matter what size image you render. Image Object foliage will then appear in the same areas and be dissolved to a color or texture in the same areas at any image size.

When you use the Relative to Image Height option, VNS will automatically change the Distance Dissolve Height based on the size of your rendering. VNS does this by using the Image Reference Height you specify in the Image Object Distance Dissolve section (see below).

You may want to select this option in order for preview renderings in Views to give you a more accurate visual indication of where plants will actually be rendered in your final renderings. Views are typically rendered at a different resolution than your final renderings and may show different results if you use the Absolute Pixels option (see above).

If you are rendering the same scene for a poster and for a video animation, using the Relative to Image Height option will make the foliage dissolve away in the same places in both scenes.

Be careful with this option, it may add to rendering time when you render at lower resolutions than what is in the Image Reference Height field (see below). This is because as you decrease the size of the rendered image, VNS will correspondingly decrease the Distance Dissolve Height. You may then end up with VNS wasting time rendering Image Object foliage even for Image Objects that would be less than a single pixel in height.

Note: When you use the Relative to Image Height option VNS will take into account whatever constrained preview rendering size you use if you have selected the Constrain Render Area icon (see Constrain Render Area). Image height will be calculated using the pixel height of the constrained render area, not the pixel height of the View.

Distance Dissolve for this Ecotype Section

You can reduce rendering times by enabling Distance Dissolve and adjusting the Dissolve Height. Then Image Object foliage will transition to a fast-rendering color or a texture in the distance.

If you are using the Absolute Pixels option then the Dissolve Height is an absolute value in pixels (see the Common Distance Dissolve section above). This gives you the more efficient rendering.

If you are using the Relative to Image Height option then the Dissolve Height will be scaled depending on the resolution of your rendering (see the Common Distance Dissolve section above). This allows the most consistency between renderings at different resolutions, including preview renderings in a View.

Dissolve Enabled Checkbox

Select the Dissolve Enable checkbox to enable Distance Dissolve. Deselect it to disable Distance Dissolve.

Dissolve Height Field

Dissolve Height lets you control how small the rendered foliage can get in the distance before VNS replaces it with a color or texture.

If the Absolute Pixels radio button is selected in the Common Distance Dissolve section (see above), then this value will apply no matter what resolution you render your images.

If the Relative to Image Height radio button is selected in the Common Distance Dissolve section (see above), then this value will apply only for images that are rendered at the vertical resolution you enter into the Image Reference Height field (see below). VNS will scale the Dissolve Height for images rendered at a different horizontal resolution than specified in the Image Reference Height field. This allows Image Objects to change to a color or texture at the same place on the terrain no matter what resolution you render.

Image Reference Height Field

The "Image Ref. Ht." field is only available when you select the "Relative to Image Height" radio button in the Common Distance Dissolve section (see above).

Use the Image Reference Height field to specify the rendered image height in pixels at which the actual Dissolve Height value is used. This lets you control the amount of up or down Dissolve Height scaling that will occur when you render images at different resolutions. The specified Dissolve Height will always be multiplied by the rendered image height (in pixels) divided by the Image Reference Height (in pixels).

The default Image Reference Height value is 480 pixels. You may want to set it to match the resolution of your preview renderings or your final image renderings.

Example

Let's look at how this works. Suppose you use an Image Reference Height of 480 pixels. If you render an image with a height of 480 pixels and you have an Ecotype that uses a Dissolve Height of 2 pixels, then any rendered images that are 480 pixels high will really have a Dissolve Height of 2 pixels for that Ecotype. $2 \times 480 / 480 = 2$

But if you render a preview image at half that resolution, 240 pixels, VNS will scale the Dissolve Height down by 50% and that Ecotype will have an actual Dissolve Height of 1 pixel in that rendered image. $2 \times 240 / 480 = 1$

If you render a poster with an image height of 1920 pixels, the actual Dissolve Height for the Ecotype in that image will become 8 pixels. $2 \times 1920 / 480 = 8$.

The end result is that the Ecotype will dissolve out to a color or texture at the same place on the terrain in all three examples. This would not have been true if you were using the Absolute Pixels option in the Common Distance Dissolve section (see above).

Note: You can set the rendered image height with the Height field on the Size and Range page of the Render Options Editor.

The Image Reference Height is always the same for all Ecotypes and Foliage Effects. When you change it for one Ecotype or Foliage Effect you are changing it for all Ecotypes and Foliage Effects.

Note: All Ecotypes and Foliage Effects are also affected when you select either the Absolute Pixels radio button or the Relative to Image Height radio button in the Common Distance Dissolve section (see above).

However, the Dissolve Height is unique to each Ecosystem or Foliage Effect.

Dissolve Color Controls

Click the Dissolve Color well to open the Color Editor. There you can edit the color VNS will render on the terrain in the distance.

If you'd rather use a texture, click the Texture icon to open the Texture Editor. There you can create a more complex pattern to represent your distant foliage. Textures will take longer to render than a simple color.

Settings Sub-Page

Absolute Size Radio Buttons

Select the "Absolute Size is in Ecotype" radio button if you want to control the actual size of the Ecotype's foliage using the Maximum Size field, on the Parameters page in the Ecotype Size section. You can then set the size of each Foliage Group as a percentage of the Ecotype's Maximum Size.

Select the "Absolute Size is in Foliage Group" radio button if you want to set the actual size of each Foliage Group directly instead of setting each group as a percentage of the Ecotype Size. VNS will disable the Ecotype Size controls and you can directly set a Group Size and Group Minimum Size for each Foliage Group on the Groups page.

Note: In both cases, the size of each Foliage Object is a percentage of the size of the Foliage Group to which it belongs. You can set the size percentage for each Foliage Object.

However you choose to control the absolute size, you'll set it in the units you selected in the Height field on the Units page of the Preferences Window.

Second Size Radio Buttons

The "Second Size is" radio buttons let you configure how the Ecotype Editor lets you control a second size for the Ecotype's foliage.

Second Size is in Absolute Minimum radio button

Select the Second Size is in Absolute Minimum (Min) radio button if you want to be able to set a secondary Size as a specific, using the units you selected in the Height field on the Units page of the Preferences Window.

If you've selected the "Absolute Size is in Ecotype" radio button (see above), you can then control a minimum size for all Foliage Groups using the Minimum Size percentage field on the Parameters page.

If you've selected the "Absolute Size is in Foliage Group" radio button (see above), you can then control a minimum size for separately for each Foliage Group using the Group Minimum Size field on the Parameters page for a selected Foliage Group. This controls the minimum size separately for each Group.

Second Size is Minimum Percentage Radio Button

Select the Second Size is in Minimum (Min) percentage radio button if you want to be able to set the secondary size as a percentage of the absolute size.

If you've selected the "Absolute Size is in Ecotype" radio button (see above), you can then control a minimum size for all Foliage Groups using the Minimum Size Percentage field on the Parameters page. The minimum size of the Ecotype's foliage will be a percentage of the value you entered into the Maximum Size field. VNS will vary the size of the foliage between these two sizes. You can further control the size of each Foliage Group by adjusting the Group Size percentage field on the Parameters page for each Foliage Group.

If you've selected the "Absolute Size is in Foliage Group" radio button (see above), you can instead control a minimum size for separately for each Foliage Group using the Group Minimum size field on the parameters page for a selected Foliage Group. This controls the minimum size separately for each Group.

Second Size is Plus or Minus a Percentage Radio Button

Select the Second Size is +/- percentage radio button if you want to be able to set the secondary size as a percentage range above and below the absolute size.

If you've selected the "Absolute Size is in Ecotype" radio button (see above), you can then control a range of size for all Foliage Groups using the Size Range Plus/Minus Percentage field on the Parameters page. The Ecotype's foliage will range in size as a percentage above or below the value you entered into the Maximum Size field. VNS will vary the size of the foliage within this percentage range. You can further control the size of each Foliage Group by adjusting the Group Size percentage field on the Parameters page for each Foliage Group.

If you've selected the "Absolute Size is in Foliage Group" radio button (see above), you can instead control a range of size separately for each Foliage Group using the Group Size Range Plus/Minus Percentage field on the Parameters page for a selected Foliage Group. This controls the size range separately for each Group.

Absolute Density Radio Buttons

Select the "Absolute Density is in Ecotype" radio button if you want to specify the overall density of the Ecotype's foliage for the entire Ecotype using the Density field in the Ecotype Density section on the Ecotype page. You can then set the density of each Foliage Group as a percentage of the Ecotype's overall Density.

Select the "Absolute Density is in Foliage Group" radio button if you want to specify the density of each Foliage Group directly instead of setting each group as a percentage of the Ecotype Density. VNS will disable the Density field on the Ecotype page and you can directly set a Group Density for each Foliage Group using the Group Density field on the Groups page instead.

Note: In both cases, the density of each Foliage Object is a percentage of the density of the Foliage Group to which it belongs. You can set the density percentage for each Foliage Object on the Objects page.

Density Radio Buttons

The Ecotype page's Density Field and the Group page's Group Density field work differently depending on whether you select the "Density is per Polygon" or "Density is per Unit Area" radio button.

VNS lets you choose whether to have the Ecotype's foliage density be linked to the polygon density for more efficient rendering or be a constant across the terrain. Polygon density is increased near the Camera when you render with Variable or Fractal Maps options on the Terrain Parameter Editor.

Density per Polygon Radio Button

With the “Density is per Polygon” radio button selected, the Density or Group Density field lets you specify the percentage of polygons that will be covered with the Ecotype. Enter an integer value between 0 and 100 percent or use the arrow buttons to change the value. A value of zero will cause no trees or textures to be rendered for the given Ecotype. A value of 100 will cause a tree or texture to be applied at all polygon sites where the Ecotype appears.

With Density per Polygon the density of the foliage is directly related to the polygon density. The more polygons you have, the more foliage you will have. Anything that affects the polygon density will also affect the tree density. This includes things like Fractal Depth, Variable Fractal Depth and Fractal Depth Maps.

You can increase the polygons available during rendering by increasing the Fractal Depth in the Terrain Parameter Editor. The foliage density will be different when you render at lower or higher Fractal Depth settings. To see how it all works out you'll have to render an image.

If you use Variable Fractal Depth, the foliage density will be higher nearer the Camera. If you use Fractal Depth Maps, the foliage density will be higher along the Camera path.

In many cases the varying tree density is not noticeable, and using Density per Polygon may render faster. But if you notice uneven tree density; if you want to be able to change fractal depth without changing the tree density; or if you see distant trees disappearing during an animation, use Density per Unit Area instead (see below).

When changing from Density per Polygon to Density per Unit Area, you will generally need to increase the density field between 5 to 10 times its previous value to get a similar look as the non-fixed scene. Use your judgment based on what you want it to look like.

Density per Unit Area Radio Button

Select the Density is per Unit Area” radio button when you want the tree density to be unrelated to the polygon density. With the Density is per Unit Area” radio button selected, the number of trees won't change when you raise or lower the fractal depth. The distribution of trees on the landscape will be consistent even if you are using variable fractal depth or fractal depth maps.

The Density you set in the Density or Group Density field is the actual number of foliage stems per unit. You can select the kind of unit from the Area Units drop box (see below). To save rendering time, enter the lowest Density value that gives you the look you want. To see the result, render an image.

To make Density per Unit Area foliage render more efficiently, use the controls in the Image Object Distance Dissolve section to dissolve distant foliage to a color or texture (see below).

Increase the Density or Group Density value if you want to see more trees from the Ecotype. If it's an Overstory Ecotype, lower values can leave more bare spots where the Understory Ecotype will show through.

Area Units Drop Box

If you select the “Density is in Unit Area” radio button you can use the Area Units drop box to select the units for area density. Choose between stems per Hectare, Acre, Square Meter or Square Foot.

Parameters Sub-Page

The Ecotype Size section's fields are available if you select the Absolute Size is in Ecotype radio button on the General Sub-Page (see above).

Note: These fields let you adjust foliage sizes for the entire Ecotype. You can further adjust foliage sizes for each of the Ecotype's Foliage Groups and for individual Foliage Objects by selecting the relevant Group or Object and using the context sensitive controls which appear (see below). You can also adjust Foliage sizes for all the foliage from all Ecosystems used within an Environment. To do so, use the Foliage Height Factor field on the Foliage and Gradients page of the Environment Editor.

Maximum Height Field

Use the Maximum Height field to specify the upper limit for how large you'd like the foliage in the Active Ecosystem to appear.

Enter a value for the Maximum Height field in the units you selected for height on the Units page of the Preferences Window.

Controlling Height with a Texture

If you want to control foliage height with a texture, click the Texture Operations Icon next to the field for the variable you want to control, which in this case is Maximum Height.

Select the Create Texture command from the Texture Operations Icon's commands and VNS will create a new texture and open the Texture Editor. There you can edit your texture to control the variable. Wherever the Texture is white, you'll have the full height using the value you set in the Maximum Height field. Wherever the texture is gray you'll have less height and where it is black you'll have zero height. This is a good way to make naturally varied foliage heights.

Controlling Height with a Thematic Map

If you want to control foliage height with a Thematic Map, click the Thematic Map Operations Icon next to the field for the variable you want to control, which in this case is Maximum Height.

Select the Create Thematic Map command from the Thematic Map Operations Icon's commands and VNS will create a new Thematic Map and open the Thematic Map Editor. There you can select one or more Vector attributes to control the variable. In this case the height value will be inherited from the Vector attribute you select. The attribute value comes from the Ecosystem's attached Vector. This is a good way to let your GIS data control actual foliage height in VNS.

Second Size Field

The second Size field lets you control Minimum Size, Minimum Size Percentage or Size Range +/- Percentage depending on your Second Size radio button selection on the General page (see above).

If you select the Second Size is in Absolute Min (Minimum) on the Settings sub-page, the second Size field will be labelled "Minimum Height." Enter the height you want for the shortest foliage in the Ecotype. When you render, VNS will place trees with a random mix of heights from the Minimum Height you specified in the Minimum Height field up to the Maximum Height you specified in the Maximum Height field (see above).

Note: The Minimum Height field uses the units you selected for height on the Units page of the Preferences Window.

If you select the Second Size is in Min (Minimum) Percentage on the Settings sub-page, the second size field will be labelled "Minimum Height Percentage." Enter the height you want for the shortest foliage in the Ecotype as a percentage of the Maximum Height field. When you render, VNS will place trees with a random mix of heights from the Minimum Height percentage you specified in the Minimum Height Percentage field up to the Maximum Height you specified in the Maximum Height field (see above).

If you select the Second Size is in Min (Minimum) Percentage on the General page, the second Height field will be labelled "Height Range (+/-)." Enter the height you want for the shortest foliage in the Ecotype as a percentage above and below the value in the Maximum Height field. When you render, VNS will place trees with a random mix of heights ranging above and below the value you specified in the Maximum Height field (see above).

Ecotype Density Section

The Ecotype Density section is available if you select the Absolute Density is in Ecotype radio button on the General page (see above). You can then set the density of each Foliage Group on the Groups page as a percentage of the Ecotype's overall density, and for individual Foliage Objects on the Objects page as a percentage of the Group's density.

VNS lets you choose whether to have the foliage density be linked to the polygon density for more efficient rendering or be a constant across the terrain. Polygon density is increased near the Camera when you render with Variable or Fractal Maps options on the Terrain Parameter Editor.

The Ecotype page's Density Field works differently depending on whether you select the "Density is per Polygon" or "Density is per Unit Area" radio button on the General page.

If the Density is per Unit Area radio button selected on the General page, the Density you set in the Density field is the actual number of foliage stems per unit. You can select the kind of unit from the Area Units drop box on the General page. To save rendering time, enter the lowest Density value that gives you the look you want.

To see the result, render a final image from the Render Control Window.

Note: Preview renderings may not show densities accurately if your View is significantly smaller than the final rendered image size you set in the set of Render Options you're using in the Render Job. This is especially true if you are using Image Object Distance Dissolve (see below) with Common Distance Dissolve set to Absolute Pixels.

If the Density is per Polygon radio button selected on the General page, the Density field lets you specify the percentage of polygons that will be covered with the Ecotype. Enter an integer value between 0 and 100 percent or use the arrow buttons to change the value. A value of zero will cause no trees or textures to be rendered for the given Ecotype. A value of 100 will cause a tree or texture to be applied at all polygon sites where the Ecotype appears.

Note: With Density is per Polygon radio button selected, the more polygons you have, the more trees you will have. You can increase the polygons available during rendering by increasing the Fractal Depth in the Terrain Parameter Editor. To see how it all works out you'll have to render an image.

Increase the Density value if you want to see more trees from the Ecotype. If the Ecotype is an Overstory, lower values will leave more bare spots where the Understory Ecosystem can show through.

Controlling Density with a Texture

If you want to control density with a texture, click the Texture Operations icon next to the field for the variable you want to control, which in this case is Ecotype Density.

Select the Create Texture command from the Texture Operations icon's commands and VNS will create a new texture and open the Texture Editor. There you can edit your texture to control the variable. Wherever the Texture is white, you'll have the full density using the value you set in the Density field. Wherever the texture is gray you'll have less density and where it is black you'll have no density. This is a good way to make naturally clumpy groups of foliage.

Controlling Density with a Thematic Map

If you want to control density with a Thematic Map, click the Thematic Map Operations icon next to the field for the variable you want to control, which in this case is Ecotype Density.

Select the Create Thematic Map command from the Thematic Map Operations Icon's commands and VNS will create a new Thematic Map and open the Thematic Map Editor. There you can select one or more Vector attributes to control the variable. In this case the density value will be inherited from the Vector attribute you select. The attribute value comes from the Ecosystem's attached Vector. This is a good way to let your GIS data control actual foliage density in VNS.

Foliage Group Controls

The following controls appear when the selected item in the Material Foliage List is a Foliage group:

Load Foliage Group Icon

Click the Load Foliage Group icon to open the Component Gallery where you can load a Foliage Group Component.

Save Foliage Group Icon

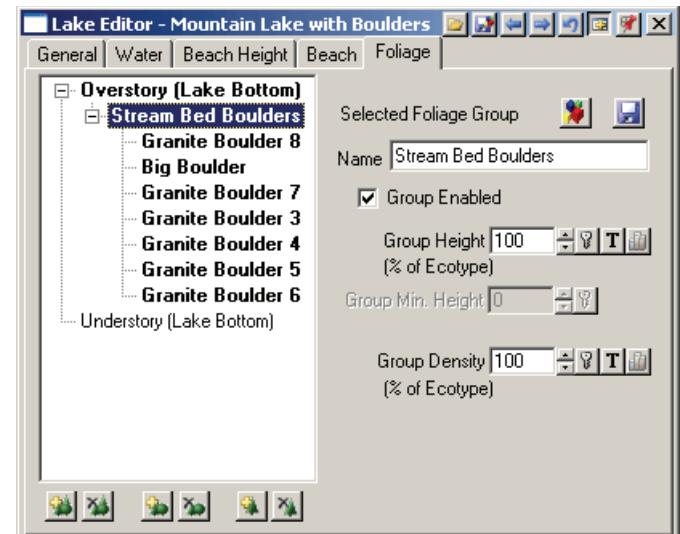
Click the Save Foliage Group icon to open the Component Signature Window where you can save the selected Foliage Group as a Component for use in other Projects.

Name Field

Whenever you create a Foliage Group VNS asks you for a name. You can change the name of a Foliage Group by selecting it in the Foliage Group list and changing it in the Name field.

Group Enabled Checkbox

Select the Group Enabled checkbox to make the Group available for rendering. Deselect it if you want to disable the Group for rendering.



Group Size Controls

Each Foliage Group has its own height specification. This determines how tall the Foliage Objects in the Group are compared to other Foliage Groups in the Ecotype. You can also adjust the height of each Foliage Object in the Group on the Objects page (see below). This gives you tremendous flexibility to customize an Ecotype.

Note: If you don't care for subtleties, just select the "Absolute Height is in Ecotype" radio button on the General page, leave all the heights set to 100% on the Groups and Objects pages and modify the values on the Ecotype page to get the right look.

If you selected the "Absolute Height is in Ecotype" radio button on the General page, you'll control the actual height of the Ecotype's foliage using the Maximum Height field on the Ecotype page in the Ecotype Height section. You can then set the height of each Foliage Group here with the Group Height field as a percentage of the Ecotype's Maximum Height.

If you selected the "Absolute Height is in Foliage Group" radio button on the General page, you'll control the actual height of each Foliage Group directly instead of setting each group as a percentage of the Ecotype Height. VNS will disable the Ecotype Height controls and you can directly set a Group Height and a Secondary height for each Foliage Group on the Groups page.

Second Height Field

The second Height field lets you control Minimum Height, Minimum Height Percentage or Height Range +/- Percentage depending on your Second Height radio button selection on the General page (see above).

If you select the Second Height is in Absolute Min (Minimum) on the General page, the second Height field will be labelled "Group Minimum Height." Enter the height you want for the shortest foliage in the Foliage Group. When you render, VNS will place trees with a random mix of heights from the Group Minimum Height you specified in the Minimum Height field up to the Maximum Height you specified in the Group Height field (see above).

Note: The Group Minimum Height field uses the units you selected for height on the Units page of the Preferences Window.

If you select the Second Height is in Min (Minimum) Percentage on the General page, the second Height field will be labelled "Group Min (Minimum) Height Percentage." Enter the height you want for the shortest foliage in the Foliage Group as a percentage of the Group Height field. When you render, VNS will place trees with a random mix of heights from the Group Minimum Height percentage you specified in the Group Min Height Percentage field up to the Maximum Height you specified in the Group Height field (see above).

If you select the Second Height is in Min (Minimum) Percentage on the General page, the second Height field will be labelled "Group Ht (Height) Range (+/-)." Enter the height you want for the shortest foliage in the Foliage Group as a percentage above and below the value in the Group Height field. When you render, VNS will place trees with a random mix of heights ranging above and below the value you specified in the Group Height field (see above).

If you wish you can control the group's height with a Thematic Map or a texture.

Group Density Percentage Controls

Each Foliage Group has its own density specification. This determines how often the object is repeated compared to other Foliage Objects in the Ecotype. You can also adjust the density of each Foliage Object in the Group on the Objects page (see below).

This gives you tremendous flexibility to customize an Ecotype.

Note: If you don't care for subtleties, just select the "Absolute Height is in Ecotype" radio button on the General page, leave all the heights set to 100% on the Groups and Objects pages and tweak the values on the Ecotype page to get the right look.

If you select the Absolute Density is in Foliage Group radio button on the General page (see above) you can then set the absolute density of each Foliage Group on the Groups page.

If you select the Absolute Density is in Ecotype radio button on the General page you can then set the density of each Foliage Group as a percentage of the Ecotype's overall density.

In either case you can set the density of individual Foliage Objects on the Objects page as a percentage of the Group's density.

VNS lets you choose whether to have the foliage density be linked to the polygon density for more efficient rendering or be a constant across the terrain. Polygon density is increased near the Camera when you render with Variable or Fractal Maps options on the Terrain Parameter Editor.

The Group page's Group Density field works differently depending on whether you select the "Density is per Polygon" or "Density is per Unit Area" radio button on the General page.

If the Density is per Unit Area radio button selected on the General page, the Density you set in the Group Density field is the actual number of foliage stems per unit. You can select the kind of unit from the Area Units drop box on the General page. To save rendering time, enter the lowest Density value that gives you the look you want.

To see the result, render a final image from the Render Control Window.

Note: Preview renderings may not show densities accurately if your View is significantly smaller than the final rendered image size you set in the set of Render Options you're using in the Render Job. This is especially true if you are using Image Object Distance Dissolve (see below) with Common Distance Dissolve set to Absolute Pixels.

If the Density is per Polygon radio button selected on the General page, the Group Density field lets you specify the percentage of polygons that will be covered with the Ecotype. Enter an integer value between 0 and 100 percent or use the arrow buttons to change the value. A value of zero will cause no trees or textures to be rendered for the given Ecotype. A value of 100 will cause a tree or texture to be applied at all polygon sites where the Ecotype appears.

Note: With Density is per Polygon radio button selected, the more polygons you have, the more trees you will have. You can increase the polygons available during rendering by increasing the Fractal Depth in the Terrain Parameter Editor. To see how it all works out you'll have to render an image.

Increase the Group Density value if you want to see more trees from the Ecotype. If the Ecotype is an Overstory, lower values will leave more bare spots where the Understory Ecosystem can show through.

If you wish you can control the group's density with a Thematic Map or a texture.

Foliage Object Controls

Image Object or 3D Object Radio Buttons

These radio buttons let you select whether the selected Foliage Object should be an Image Object or a 3D Object.

If you select the Image Object radio button, VNS will show the Image Object section at the bottom of the Objects page (see below). There you can select an Image Object and adjust its properties.

If you select the 3D Object radio button, VNS will show the 3D Object section at the bottom of the Objects page (see below). There you can select a 3D Object and adjust its properties.

Enabled Checkbox

The Enabled checkbox lets you enable or disable the selected Foliage Object for rendering. Disabled Foliage Objects are shown in gray in the Foliage Objects list.

Image Object Options

Image Object Drop Box

Select an Image Object in the Image Object drop box. VNS will replace the selected Foliage Object in the Foliage Objects list (see above) with the Image Object you choose.

If you want to load a new Image Object, select “New Image Object.” VNS will open a file requester where you can select a new Image Object. Image Objects can be images or image sequences in any supported format (see Image Loading and Saving).

Width, Height and Image Bands Display Fields

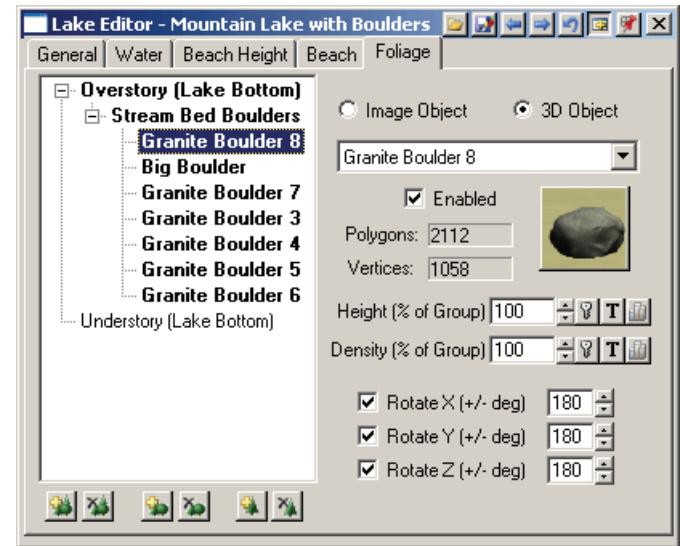
The Width, Height and Image Bands display fields show the pixel dimensions and number of 8-bit image bands of the Selected Image Object.

Thumbnail

The Thumbnail shows a small version of the selected Image Object. You can double-click it if you want to see the full version.

Random Flip X Checkbox

Select the Random Flip X checkbox to have VNS randomly reverse the Image Object from left-to-right during rendering. This will give you more variety in the foliage since the selected Image Object will appear in different places in normal and reversed versions.



Apply 3D Shading Checkbox

Select the Apply 3D Shading checkbox to tell VNS to shade the Image Object based on the direction of the light. This will give foliage a more 3-dimensional appearance.

Replace Gray Color Controls

By using unique colors for a Group of images or even individual Foliage Objects you can create a scene of nearly unlimited color variety. You can animate colors to create a kaleidoscopic landscape. Change the color of maple trees first, then the birches followed by the oaks and leave the conifers green, and voila - New England in October.

Each Image Object has its own color specifications. The color for each image can come from the Image Object itself or from a color. If it comes from a color, you can animate that color. You can edit the colors for the selected Image Object by clicking the Replace Gray color well to open the Color Editor.

Note: This only works for gray scale images, or images that have been set to gray scale in the Image Object Library. If the Image Object contains a color image and it has not been changed to gray scale in the Image Object Library, the Replace Gray color well will be disabled.

You can change the Gray Replacement Color for a gray-scale Image Object independently at any time or leave it with the color it inherited when you added the Image Object.

Note: Gray Scale Images require 1/3 the amount of memory that 24 bit color images require when rendering.

Height Percentage Controls

Each Foliage Object has its own height specifications. These determine how tall the object is compared to other objects in the Ecotype.

The Height Percentage field for the currently selected Foliage Object is a percentage of the number entered in the Group Height field for the Foliage Group on the Groups page (see above).

If you wish you can control the object's height with a Thematic Map or a texture.

Density Percentage Controls

Each Foliage Object has its own density specifications. These determine how often the object is repeated compared to other Foliage Objects in the Ecotype.

Density of coverage for a Foliage Object is based on its Density within its group (set with the Density Percentage field for the selected Foliage Object), the group's Density in the Ecotype (set with the Group Density field on Group page for the selected Group).

If you wish you can control the object's density with a Thematic Map or a texture.

Back Light Percentage Field

The Back Light Percentage field lets you allow light to shine through backlit Image Object foliage. The default value is 25%. You can set it higher than 100%.

Use the Back Light Percentage when the Camera is looking into the light and the foliage looks too dark. It allows light to be transmitted through the leaves. This will brighten the foliage and increase color saturation. The result can be much more realistic small vegetation when the vegetation is backlit.

You can adjust the Back Light Percentage individually for any Foliage Object by selecting it in the Foliage Objects list and changing the value in the Back Light Percentage field. You can increase the Back Light percentage to brighten objects that are between the Camera and a light. Decrease it if you want a silhouette effect.

Apply to Group Button

Click the Apply to Group button if you want to set the Back Light Percentage of all members of the Group to be the same as the value in the Back Light Percentage field (see above). This is much faster than setting the Back Light Percentage individually for each member of the Group.

If the Back Light Percentage for the current Foliage Object has key frames, they will also be copied to the other members of the Group.

3D Object Options

Rotate X, Y and Z Checkboxes and Fields

The Rotation controls let you add random rotation to the current 3D Object. Select a checkbox and enter a value and VNS will randomly rotate the object along that axis every time it places it on a Vector vertex, within the rotation limit you set.

The X axis runs east to west. A positive X axis is to the east. The Y axis runs vertically. A positive Y axis is up. The Z axis runs north to south. A positive Z axis is to the north.

Enter a number in the X Field to rotate the 3D Object around the X axis. Enter a number in the Y Field to rotate the 3D Object around the Y axis. Enter a number in the Z Field to rotate the 3D Object around the Z axis.

A value of zero in any field means no rotation for that axis.

Polygons, Vertices and Materials Display Fields

The Vertices display field shows the number of vertices in the current 3D Object. The more vertices there are, the longer it will take to render. VNS does not impose a limit to the number of vertices an object may have, other than the limit imposed by the available memory on your system.

The Polygons display field shows the number of polygons in the current 3D Object. The more polygons there are, the longer it will take to render. VNS does not impose a limit to the number of polygons an object may have, other than the limit imposed by the available memory on your system.

The Materials display field shows how many materials there are in the current 3D Object. A Material is a texture applied to groups of polygons within the object. For example, a car object may have a body Material, a bumper Material, a tire Material and a glass Material. You can edit the properties of each Material using the 3D Material Editor.

Height Percentage Controls

Each Foliage Object has its own height specifications. These determine how tall the object is compared to other objects in the Ecotype.

The Height Percentage field for the currently selected Foliage Object is a percentage of the number entered in the Group Height field for the Foliage Group on the Groups page (see above).

If you wish you can control the object's height with a Thematic Map or a texture.

Density Percentage Controls

Each Foliage Object has its own density specifications. These determine how often the object is repeated compared to other Foliage Objects in the Ecotype.

Density of coverage for a Foliage Object is based on its Density within its group (set with the Density Percentage field for the selected Foliage Object), the group's Density in the Ecotype (set with the Group Density field on Group page for the selected Group).

If you wish you can control the object's density with a Thematic Map or a texture.

Lake Editor - Forestry Edition

If you are not running the Forestry Edition you will need to refer to the section relating to the regular version of the Lake Editor.

The Lake Editor lets you control Lakes. It gives you common controls that affect all Lakes you may have in a Project, along with a set of controls that apply to a single Lake. You can control Water, Foam, Wave and Beach parameters for each Lake.

To open the Lake Editor double-click any Lake Component in the Scene-At-A-Glance. You can also select a Lake's name in the Component Library's Current Project Components list and click the Edit button.

Another quick way to open the Lake Editor is to double click a Lake name in either the Component Library's Current Project Component list or the Database Editor's "Components attached to the active Object" list on the Comp page.

The Lake Editor will open, ready to edit the selected Lake. You can edit other Lakes by using the You can import Components into your Projects using the Component Gallery..

What is a Lake?

A Lake is a water surface. The Lake Editor lets you create lakes, oceans, and ponds. With different texturing and displacement you can even create ice, lava pools and sand dunes. You may create as many Lakes as you like, limited only by your computer's memory.

Lakes have beaches. You can control the beach Materials just like an Ecosystem, with foliage and texturing. You can cause lakes to flood onto the surrounding terrain past the beach area if you wish.

A Lake with no Vectors attached is an Ocean. When you attach a Vector the Lake will be limited to the area within the Vector.

If there are more than one unattached Lakes, VNS renders the one with the highest priority. If more than one are at the same priority, VNS will render the one at the highest elevation.

A Vector-bounded lake can overlap another, even at different elevations. Each lake can have different reflectivity, color and other parameters. Where Lakes overlap, VNS will always render the lake at the highest elevation.

Lake can use waves you create with the Wave Model Editor. You can also create wave patterns using textures.

Creating a Lake

You can create a new Lake by selecting the Lake category in the Scene-At-A-Glance and clicking the Add or Clone Selected Item icon. You can set the elevation of the Lake in the Lake Editor. If you don't attach a Vector it will become an ocean that covers the entire terrain and appears wherever the terrain is below the Lake's elevation.

To create a Vector-bounded lake you can digitize a Lake and Vector in one step by selecting the lake component in the Scene-At-A-Glance and clicking the Create Icon on the main toolbar. Alternatively you can first create a Vector Object that encloses an area and then attach it to a Lake by dragging one over the other in the Scene-At-A-Glance.

VNS will automatically connect the start and ending points of your Vector when it calculates the Lake. Make sure that your Vector Object encompasses an area that is below the elevation of the surface of the Lake. The lake surface will extend under the surrounding terrain. In other words, any terrain that is above the elevation of the Lake but within the area of the Vector will still show above the lake.

If your lake area ends and the surrounding terrain is lower than the lake's elevation, VNS will create a wall from the lake to the terrain below. This is a result you may want to avoid, or perhaps exploit as a special effect.

You can apply a Lake Object and an Area Terraffector to the same Vector Object. This lets you dig a lake basin with the Terraffector and fill it with water using the Lake. Since the Lake takes into account the depth of the water (bathymetry) when shading the surface of the water and calculating breakers, you may want to dig the lake basin with an Area Terraffector to give your lake depth.

The Vectors to which you apply Lakes may overlap. You may be able to create subtle or wild effects by overlapping several lakes at the same elevation but with different colors; by overlapping lakes at different elevations, etc. For example, you may be able to create a frozen look with one Lake and a water look with another, to create a composite lake that is partially frozen. Use your imagination and see what you come up with.

You can apply the same Lake to any number of Vectors.

To create a new Lake you can also select "Lake" in the Component Library's Current Project Components list and click the Create New Effect button. The Lake Editor will open, ready to edit the new Lake.

General Page

General Features Section

Name Field

Use the Name field to name the current Lake.

If you select an existing Lake and click the Create New Effect button to create a new Lake, VNS will name the new Lake with the same name, but with a number appended to the end. If there was already a number at the end of the name of the original Lake, VNS will increment the number. This ensures that the new Lake will have a different name.

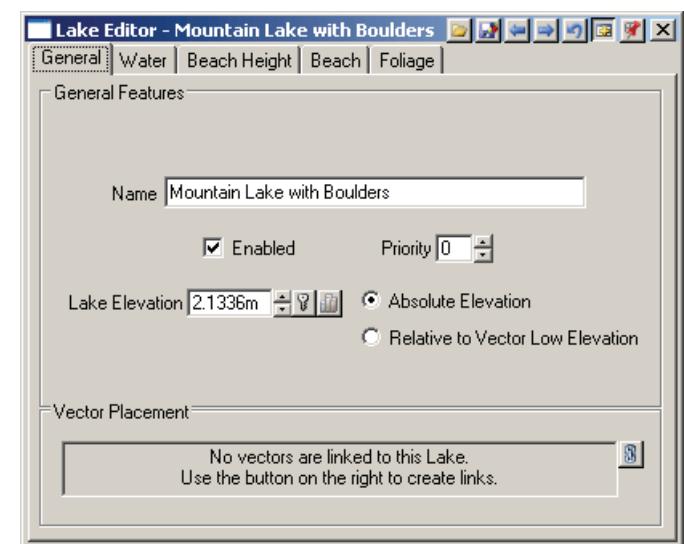
Enabled Checkbox

Use the Enabled checkbox to enable or disable the Lake for rendering.

If you disable a Lake it will not lose its parameter values. It may be useful to temporarily disable a particular Lake to see how the terrain looks without it, or to speed preview rendering when you're working on some other aspect of your scene.

Make sure you remember to enable the Lake for the final rendering if you want VNS to render it.

Note: To see the Lake in your rendering, it must be visible to the Camera you selected for the Render Job you are using (see Render Job Editor), and Lakes must be enabled in the Render Options you are using (see Render Options Editor).



Priority Field

The Priority field and buttons let you specify the rendering priority of a Lake that overlaps another Lake.

The Lake with a highest priority will be rendered when Lakes overlap.

If there are overlapping Lakes set to the same priority, VNS will render the one at the highest Elevation.

Elevation Field

The Elevation field lets you set the elevation of the surface of the lake. Enter a value above sea level. To create a lake with an elevation below sea level, set this value to be a negative number.

Note: Sea Level is the surface of the Project Coordinate System's Ellipsoid, which is an elevation of zero. You can see the Project's Coordinate System in the Planet Options Editor. You can click in a View where you want the shoreline and look in the Diagnostic Data Window to find the elevation for your lake. If you render a preview in the View first the elevation will be more accurate. You can copy the value from the Diagnostic Data's Elevation field by highlighting it and hitting control-c on your keyboard. You can paste the value by clicking in the Lake Editor's Elevation field and hitting control-v on your keyboard. Alternatively, you can make sure that the lake component is the active item, and Ctrl-click in a view at the elevation you require for the lake. The lake's elevation parameter will be set to the elevation value of the point that you clicked in the view.

Elevation Method Radio Buttons

Select one of the two following radio buttons to determine how VNS calculates the lake components elevation:

Absolute Elevation

If this option is selected, VNS will place the water surface at an elevation above sea level corresponding to the value entered in the Elevation Field (see above)

Relative to Vector Low Elevation

If this option is selected, VNS will place the water surface at an elevation above sea level corresponding to the elevation of the lowest point of the bounding vector. This allows you to drive multiple lakes of different elevation but otherwise similar parameters, with one lake component. Simply create your lake component, and attach it to the vectors in question, making sure that Relative to Vector Low Elevation is selected as the components elevation method, and at render time, VNS will calculate each lakes elevation dynamically based on the elevation values found in each bounding vector.

Vector Placement Section

By attaching Vectors to Lakes you can control where they appear. Vectors can be dynamically linked with Search Queries or hard linked.

Vector Links Button

This control allows you to perform various tasks relating to the association of vectors with components. To learn how to use it, see Vector Links Icon.

Attached Hard-Linked Vectors Display

The Hard-Linked Vectors display tells you if there are any Vectors hard-linked to the Component, and if so, how many. It will also display vectors attached by Search queries and list the names of the search query or queries in use.

Water Page

The Water page lets you add new Materials to the Lake.

The Material Gradient Driver lets you tell VNS which Material to use. If you select a texture or animate the material gradient driver % value, the Lake can use multiple Materials.

Material Gradient & Driver Section

Material Gradient Driver Percentage Controls

The Material Gradient Driver field lets you pick a Material for the Lake based on a position along the Material Gradient (see below).

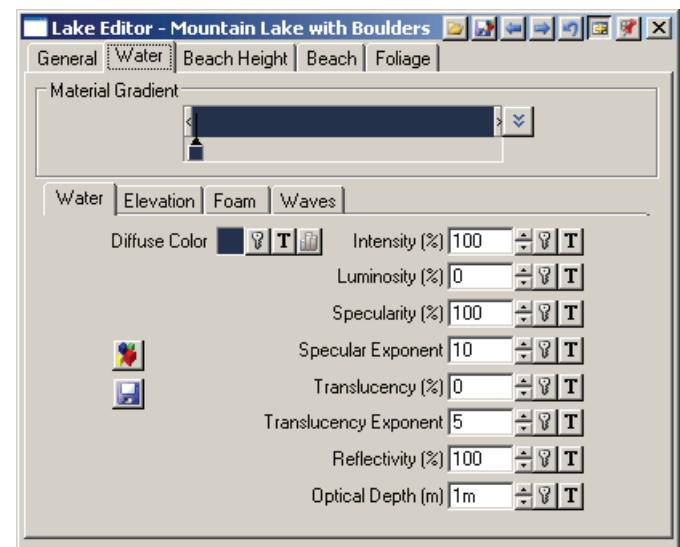
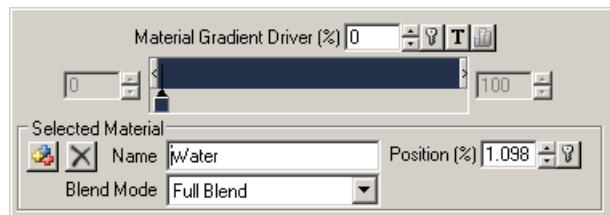
Enter a percentage from zero to 100 where zero is the left edge of the gradient and 100 is the right edge. VNS will use the Material at the gradient position you specify. If there is no Material represented at that position, VNS will create a blend between the nearest two Materials.

You can animate the Material Gradient Driver percentage to change Materials over time. This is great for animating through a variety of Materials such as between different-colored water surfaces or from hot dark rocky matter to molten boiling lava.

By clicking the Texture Control icon you can control the Material Gradient Driver percentage with the Texture Editor. This lets you use all the Materials in the Gradient. Textures can range in gray values from black to white, with black representing 0% on the Gradient and white representing 100% on the gradient.

For example, if you use an F1 Cell Basis Element in the texture that ranges from black to white, VNS will cover the Lake's area with Materials in an F1 Cell Basis wave pattern ranging from the left-most Material in the Gradient to the right-most Material in the Gradient.

To Access the Gradient, click on the Gradient popdown icon . This will display the Material Gradient Editor:



Material Gradient

The Material Gradient shows a colored bar with one or more colored pins beneath it. The bar is a place to create Materials. Click it to create a new Material.

When you click the Gradient to create a new Material, VNS will give the new Material a random Diffuse Color. You can change the color on the Material and Foliage page.

VNS represents each Material with a pin that is colored with the Diffuse Color of the Material. Click any Pin to select a Material.

Material Gradient Range Fields

The Material Gradient Range fields are on either side of the Material Gradient. They show the range of the value that controls the gradient.

If there's no texture enabled for the Material Gradient Driver, the range of the gradient is zero to 100 percent.

If there is a texture enabled for the Material Gradient Driver, then there are two cases:

1) The first Texture Element is a Dynamic Parameter.

In this case, the Range fields show the range of input values for the Dynamic Parameter you have selected. For example if Water Depth is the Dynamic Parameter and the Elevation range in the texture editor (Input Low and Input High) is zero to 80 meters, then in the Range fields you'll see zero on the left and 80 on the right.

You can directly edit those texture values in the Lake Editor's Range fields. This is handy because you don't have to reopen the Texture Editor if you want to edit these values.

2) The first Texture Element is not a Dynamic Parameter.

In this case, the Range fields are zero to 100 percent, and are non-editable.

Add Material Icon

Click the Add Material Icon to add a new Material. VNS will ask for the position in the Gradient. Enter a position and click the OK button.

Alternatively you can click directly in the Gradient in a spot where no other Material exists.

VNS will create a new Material and give it a random Diffuse Color. The Material will be represented in the Gradient with a pin in the color of its Diffuse Color.

Remove Material Icon

Click the Remove Material Icon if you want to delete the selected Material.

Material Name Field

The Material Name field is above the Water Material list. After you create a Material it will have a default name of "Material." It's a good idea to enter a unique name in the Material Name field to identify how you will use the Material. For example "sand," "forest" or "fall foliage."

Position in Gradient Field

The Position in Gradient field shows the percentage along the Gradient for the selected Material. You can move the Material's pin to the left by decreasing this number or to the right by increasing this number. You can also drag the pin along the Gradient with the mouse.

Blend Drop Box

The Blend drop box lets you choose the rate of change between the selected Material and the Material to its left in the gradient.

These are easiest to visualize if you try them and see what they look like in the gradient. You can see how VNS blends Materials between the pins by how it blends the Diffuse Colors along the Gradient.

You can change the blending by selecting different blend types from the Blend Drop Box. If you have more than one material in the gradient, use the following choices to decide how the gradient blends the materials together.

Sharp Edge

Choose "Sharp Edge" if you want an instant change with no gradient.

Soft Edge

Choose "Soft Edge" to create a gradient that turns into the color to the left 1/10 of the way toward that color's pin.

Quarter Blend

Choose "Quarter Blend" to create a gradient that turns into the color to the left 1/4 of the way toward that color's pin.

Half Blend

Choose "Half Blend" to create a gradient that turns into the color to the left 1/2 of the way toward that color's pin.

Full Blend

Choose "Full Blend" to create a smooth gradient that turns into the color to the left at that color's pin.

Fast Increase

Choose "Fast Increase" to create an accelerated gradient that gets closer to the previous color faster, and turns into the color to the left at that color's pin.

Slow Increase

Choose “Slow Increase” to create an decelerated gradient that gets closer to the previous color slower, and turns into the color to the left at that color’s pin.

S-Curve

Choose “S-Curve” to create a narrower gradient between the pin and the previous color’s pin and leaves more of the original colors along the gradient in between.

Water Sub-page

Diffuse Color Well

The Lake's Diffuse Color (or texture) always appears wherever the Lake appears. Click the Diffuse Color well to edit the Diffuse Color in the Color Editor.

Using the Keyframe animation popup menu to the right of the diffuse color well allows you to animate the water color over time.

The water will be a solid color over the entire surface unless you have a texture. With a texture you can use anything you want to control water color.

You can apply, edit or delete a texture using the texture popup menu. Using these commands you can replace the Material's Diffuse Color with texture patterns.

Textures can take water depth into account. For example to make a lighter, sandy color near the shore a blue color in deeper areas and a darker color in the deepest areas of the water body, use a dynamic parameter Element based on water depth in the Texture Editor. Then set up the color gradient for the Water Depth Element with a sandy color at zero depth and then a blue and black color inward along the gradient at the gradient positions representing the depths where you want them to appear.

When you use a texture, the Colors in the texture will replace the Diffuse Color, unless you use less than 100% Opacity in the Texture Editor, in which case the texture and the Diffuse Color will be mixed.

Diffuse Intensity Field and Buttons

The diffuse intensity of a material is a measure of how much of the diffuse color of a surface is returned to the camera. Reducing this value to 0% will result in a black surface (i.e.: 0 color) and setting it to 100% will result in the pure diffuse color as set in the Diffuse Color Well.

You can animate the value over time, and also drive its intensity with a texture.

This attribute is useful for simulating dirt (try driving this field with a Fractal Noise texture element), streaks, moisture (drive Diffuse Intensity with a Dynamic parameter of Water Level or Elevation to simulate moist surfaces at the edges of lakes and streams etc.)

The maximum value for this parameter is 10000%.

Luminosity Percentage Field and Buttons

Luminosity affects how the Material is shaded by Lights (see Light Editor). You can adjust it to create 3D-shaded Objects, flat-shaded Objects or anything in-between.

With zero percent luminosity, the Material will be fully shaded by Lights. This produces a 3D look. In deeply shadowed areas, the Material's color will be a darker shade of itself based on the Ambient Light Intensity and Color. Where fully lit by Lights, the color will be the Diffuse Color or texture (see above) modulated by the Intensity and Color of any Lights.

By raising the luminosity, you can lighten the shaded areas. This can be useful to do if the terrain that uses the Material seems too dark. Raising the luminosity a little bit decreases the shading contrast for the Material.

With 100 percent luminosity, the Material will ignore Lights completely. This produces a flat, unshaded look. The Material will always be the Diffuse Color or texture. This can be useful for Materials used to create the flat, paper-cutout-style animations used by certain cartoon shows.

You can also subtract light by using negative luminosity to make the object tend toward the Ambient Light colors. With 100 percent negative luminosity, the Material will ignore Lights. The Material will be flat-shaded with the Ambient colors.

You can animate the Luminosity percentage to simulate lighting changes. This lets you animate the effect of nearby lightning or explosions.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's luminosity with a texture pattern. This can be useful for creating the look of glowing lava.

When you use a texture, a white value in the texture will equal the amount of luminosity you set in the Luminosity percentage field. A black value in the texture will equal zero luminosity. Gray values will be in-between.

Specularity Percentage Field and Buttons

Specularity is the amount of shininess for a material.

Use the Specularity Percentage field to adjust the shininess of the material. Zero percent means no specular highlight, while 100 percent is maximum shininess.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's specularity value with texture patterns.

When you use a texture, a white value in the texture will equal the amount of Specularity you set in the Specularity percentage field. A black value in the texture will equal zero Specularity. Gray values will be in-between.

Specular Exponent Field and Buttons

Use the Specular Exponent field to adjust the size of the shiny spot. The useful range is from 1 to 100. Higher numbers will produce a smaller spot, with less feathering at its edge.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's specular exponent value with texture patterns.

When you use a texture, a white value in the texture will equal the amount of Specular Exponent you set in the Specular Exponent field. A black value in the texture will equal zero Specular Exponent. Gray values will be in-between.

Translucency Percentage Field

Use the Translucency Percentage field to adjust the light transmission of the material. Zero percent means no extra highlighting, while 100 percent is maximum transmission. This is useful if you have underwater lights.

For even brighter glows you can enter a value that is more than 100%. In that case VNS will actually increase the Value of the material's color to further increase brightness.

Note: Value is one of the Parameters you can manually adjust on the Color Editor.

To see Translucency, the material must be between the Camera and a Light. You can adjust the amount of light transmission and the angle from the Light within which the material will show the effect.

During rendering there are several things that affect translucency. VNS will make translucent materials brighter when the polygons they are on are directly facing the Light. In other words, if the polygons are perpendicular to a line between the water surface and the Light. VNS will also make translucent materials brighter when the polygons they are on are most directly between the Camera and Light.

The Translucent effect is less bright for materials on polygons who's faces are angled away from the Light and for materials that are farther from the direct line between the Camera and Light.

You can apply, edit or delete a Texture Editor texture using the controls to the right. Using these controls you can replace the Material's translucency percentage with a texture pattern.

Translucency Exponent Field

Use the Translucency Exponent field to adjust the cone of the light transmission. This is a measure of how far the material can be off axis from a line extending from the Camera to the SunLight. The useful range is from 1 to infinity. Higher numbers will produce a smaller cone, with less feathering at its edge. The larger the cone (smaller numbers) the larger the area the material can be in and still be affected by translucency.

You can apply, edit or delete a Texture Editor texture using the controls to the right. Using these controls you can replace the Material's translucency values with texture patterns (see below).

Reflectivity Percentage Field and Icons

Use the Reflectivity Percentage to adjust the percentage that the colors from reflections blend with the color of the water.

A Reflection percentage value of 0 will make the water surface entirely colored by the Diffuse Color or texture (see above), with Foam mixed in for whitecaps and breakers (see below). A value of 100 will make the surface of the water have theoretically correct Fresnel reflectivity.

For greater realism, reflections will tend to diminish as the camera becomes aligned with the terrain surface normal. In other words, as the camera points down at the water, reflections diminish naturally.

Note: A “surface normal” is a line perpendicular to any water polygon.

You can increase the Reflectivity percentage to get greater than normal reflectivity. If you want you can increase reflectivity up to 500%. Reflections will still diminish as the camera becomes aligned with the surface normal.

Optical Depth Field and Buttons

Use the Optical Depth Field to adjust the transparency of water when Transparent Water is enabled in the view's Render Options. It should be initially set to the distance beyond which you want objects to be occluded by the Diffuse Color of the water material at that point. Once set, the value can be adjusted until the required effect has been achieved.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's Optical Depth value with texture patterns.

When you use a texture, a white value in the texture will equal the Optical Depth you set in the Optical Depth field. A black value in the texture will equal zero Optical Depth. Gray values will be in-between.

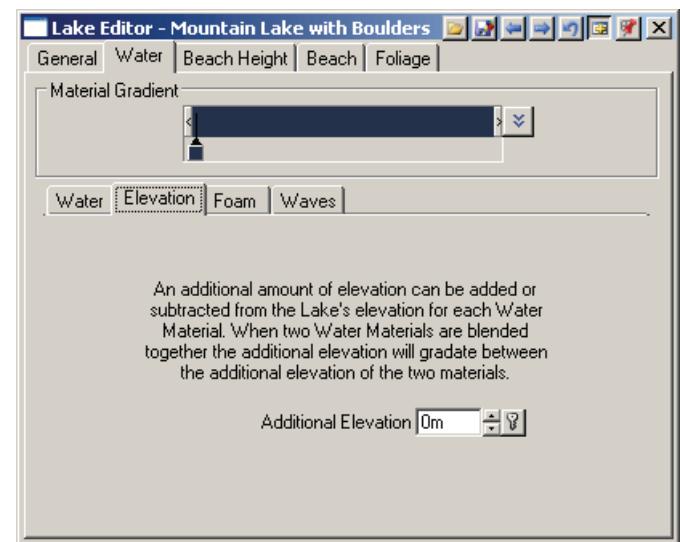
Increasing Optical Depth will make the water material more transparent, showing less of its diffuse color. Reducing Optical Depth will have the reverse effect, reducing transparency and increasing the intensity of diffuse color observed.

Using the Keyframe controls to the right of this field, you can animate this parameter to simulate a change in turbidity of the water body over time.

Elevation Sub-page

Additional Elevation Field

Use the Additional Elevation field to add additional Elevation to the Lake's surface. This can be used to make, for example, an Ice material that covers part of your lake that is several inches higher than the surrounding water surface.



Foam Sub-page

Foam Color Well

The Foam Color (or texture) always appears wherever Foam appears. Click the Color well to edit the Foam Color in the Color Editor.

The foam will be a solid color wherever it appears unless you use a texture to control the foam color.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's Foam Color with texture patterns. Fractal noise or F1 Cell Basis Elements work well for foam.

Foam Control Icon

Click the Foam Control Icon to either allow foam for the water material.

From the popup menu, you will be able to select from a commands that will allow you to Copy, Delete, Enable, Disable and Activate (Create) Foam.

Foam Diffuse Intensity Field and Buttons

The diffuse intensity of a material is a measure of how much of the diffuse color of a surface is returned to the camera. Reducing this value to 0% will result in a black surface (i.e.: 0 color) and setting it to 100% will result in the pure diffuse color as set in the Diffuse Color Well.

You can animate the value over time, and also drive its intensity with a texture.

This attribute is useful for simulating dirt (try driving this field with a Fractal Noise texture element), streaks, moisture (drive Diffuse Intensity with a Dynamic parameter of Water Level or Elevation to simulate moist surfaces at the edges of lakes and streams etc.)

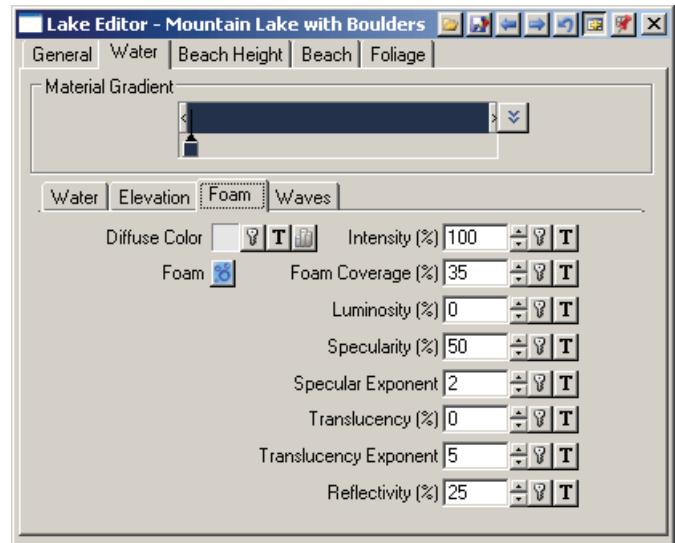
The maximum value for this parameter is 10000%.

Foam Coverage Percentage Field

The Foam Coverage percentage field lets you add foam to the waves. Zero percent is no foam and 100 percent is complete coverage. VNS adds the foam from the top of waves downward.

Textures can take water depth into account. For example to make breakers near the beach but not over deeper water, use a dynamic parameter Element based on water depth in the Texture Editor.

When you use a texture, a white value in the texture will equal the amount of coverage you set in the Foam Coverage percentage field. A black value in the texture will equal zero coverage. Gray values will be in-between. By modulating the white value with another texture you can break up the places where foam appears into realistic patterns. Fractal noise or F1 Cell Basis Elements work well for foam patterns.



Luminosity Percentage Field and Buttons

Luminosity affects how the Material is shaded by Lights (see Light Editor). You can adjust it to create 3D-shaded Objects, flat-shaded Objects or anything in-between.

With zero percent luminosity, the Material will be fully shaded by Lights. This produces a 3D look. In deeply shadowed areas, the Material's color will be a darker shade of itself based on the Ambient Light Intensity and Color. Where fully lit by Lights, the color will be the Diffuse Color or texture (see above) modulated by the Intensity and Color of any Lights.

By raising the luminosity, you can lighten the shaded areas. This can be useful to do if the terrain that uses the Material seems too dark. Raising the luminosity a little bit decreases the shading contrast for the Material.

With 100 percent luminosity, the Material will ignore Lights completely. This produces a flat, unshaded look. The Material will always be the Diffuse Color or texture. This can be useful for Materials used to create the flat, paper-cutout-style animations used by certain cartoon shows.

You can also subtract light by using negative luminosity to make the object tend toward the Ambient Light colors. With 100 percent negative luminosity, the Material will ignore Lights. The Material will be flat-shaded with the Ambient colors.

You can animate the Luminosity percentage to simulate lighting changes. This lets you animate the effect of nearby lightning or explosions.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's luminosity with a texture pattern. This can be useful for creating the look of glowing lava.

When you use a texture, a white value in the texture will equal the amount of luminosity you set in the Luminosity percentage field. A black value in the texture will equal zero luminosity. Gray values will be in-between.

Specularity Percentage Field and Buttons

Specularity is the amount of shininess for a material.

Use the Specularity Percentage field to adjust the shininess of the material. Zero percent means no specular highlight, while 100 percent is maximum shininess.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's specularity value with texture patterns.

When you use a texture, a white value in the texture will equal the amount of Specularity you set in the Specularity percentage field. A black value in the texture will equal zero Specularity. Gray values will be in-between.

Specular Exponent Field and Buttons

Use the Specular Exponent field to adjust the size of the shiny spot. The useful range is from 1 to infinity. Higher numbers will produce a smaller spot, with less feathering at its edge.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's specular exponent value with texture patterns.

When you use a texture, a white value in the texture will equal the amount of Specular Exponent you set in the Specular Exponent field. A black value in the texture will equal zero Specular Exponent. Gray values will be in-between.

Translucency Percentage Field

Use the Translucency Percentage field to adjust the light transmission of the material. Zero percent means no extra highlighting, while 100 percent is maximum transmission. This is useful if you have underwater lights.

For even brighter glows you can enter a value that is more than 100%. In that case VNS will actually increase the Value of the material's color to further increase brightness.

Note: Value is one of the Parameters you can manually adjust on the Color Editor.

To see Translucency, the material must be between the Camera and a Light. You can adjust the amount of light transmission and the angle from the Light within which the material will show the effect.

During rendering there are several things that affect translucency. VNS will make translucent materials brighter when the polygons they are on are directly facing the Light. In other words, if the polygons are perpendicular to a line between the foam surface and the Light. VNS will also make translucent materials brighter when the polygons they are on are most directly between the Camera and Light.

The Translucent effect is less bright for materials on polygons who's faces are angled away from the Light and for materials that are farther from the direct line between the Camera and Light.

You can apply, edit or delete a Texture Editor texture using the controls to the right. Using these controls you can replace the Material's translucency percentage with a texture pattern.

Translucency Exponent Field

Use the Translucency Exponent field to adjust the cone of the light transmission. This is a measure of how far the material can be off axis from a line extending from the Camera to the SunLight. The useful range is from 1 to infinity. Higher numbers will produce a smaller cone, with less feathering at its edge. The larger the cone (smaller numbers) the larger the area the material can be in and still be affected by translucency.

You can apply, edit or delete a Texture Editor texture using the controls to the right. Using these controls you can replace the Material's translucency values with texture patterns.

Reflectivity Percentage Field and Icons

Use the Reflectivity Percentage to adjust the percentage that the colors from reflections blend with the color of the foam.

A Reflection percentage value of 0 will make the foam surface entirely colored by the Diffuse Color or texture (see above). A value of 100 will make the surface of the foam have theoretically correct Fresnel reflectivity.

For greater realism, reflections will tend to diminish as the camera becomes aligned with the terrain surface normal. In other words, as the camera points down at the foam, reflections diminish naturally.

Note: A “surface normal” is a line perpendicular to a foam terrain polygon.

You can increase the Reflectivity percentage to get greater than normal reflectivity. If you want you can increase reflectivity up to 500%. Reflections will still diminish as the camera becomes aligned with the surface normal.

Waves Sub-page

The Waves sub-page lets you attach Wave Models to your Lake.

If a Wave Model is not attached to a Vector it will cover the entire Lake surface. If it is attached to a Vector it will cover only the area of the Lake that is within the Vector.

Wave Model List

The Wave Model List shows any Wave Models attached to the Lake. Disabled Wave Models are shown in gray. You can double click the name of a Wave Model to open the Wave Model Editor.

Add Wave Model Icon

Click the Add Wave Model icon to add a Wave Model to the Lake. VNS will open a window where you can select one or more Wave Models to add from the Wave Models in your Project. Click to select a Wave Model. Shift-click or control-click to select multiple Wave Models. Click the OK button to accept the selection.

Remove Wave Model Icon

Click the Remove Wave Model icon to remove the selected Wave Model from the Lake.

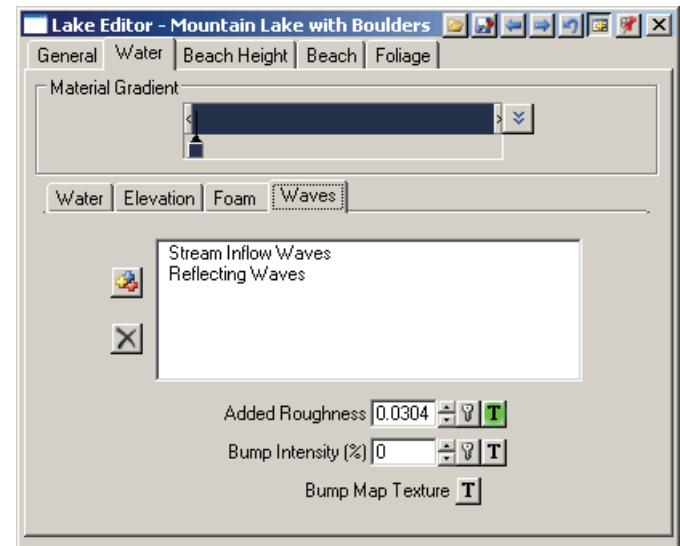
VNS will also ask if you want to remove the Wave Model from the Project. Be careful, don't remove it from the Project unless you really want to delete the Wave Model forever!

Added Roughness Percentage Field

Use the Amplitude Parameter and its texture controls to add roughness displacement to the water. This is great for creating the complex wave patterns typical of large bodies of water. You can use this along with the normal VNS wave sources (see Waves Section above).

You can apply, edit or delete a texture using the texture controls to the right. The texture will control the Roughness pattern that will displace the water.

Choose any texture. The F1 Cell Basis texture element works well, especially with a Bias Component as Remap Function 1 to make sharper wave peaks. You can even use a Terrain element of water depth to make waves higher or lower based on the distance between the water surface and the underwater topography.



Enter the amount of displacement, in meters, into the Amplitude field. The texture you use can then vary the water displacement up to the amount you entered. White areas in the texture will displace the water the full amount. Black areas will not displace the water. Gray areas will displace the water more than black areas and less than white areas.

You can even animate the velocity of the roughening texture in the Texture Editor to create a moving roughness pattern.

Bump Intensity Percentage Field and Bump Map Texture Icon

Bump mapping lets you simulate detailed relief shadowing without requiring dense geometry. For more about using bump mapping, see [Bump Mapping Controls](#).

Beach Height Page

The Beach Height page lets you adjust the beach height.

Beach Height & Reference Elevation Section

Use Reference Elevation Field and Checkbox

This lets you take tides or receding flood waters into account for beaches. Select the checkbox and enter the actual elevation you want the top of the beach to be when Beach Height Minimum is set to zero. You can further adjust the top of the beach with the Beach Height Minimum and Beach Height Variation fields (see below).

This will lock the top of the beach at a specific elevation even if the Lake's elevation is animated to rise or fall. For example, you can animate the Lake's elevation so it follows tidal patterns, revealing or covering the beach just as tides do in nature.

You can animate the Lake's elevation to flood past the beach and onto the surrounding terrain. Areas flooded beyond the beach will show tall Ecosystem foliage standing in the water.

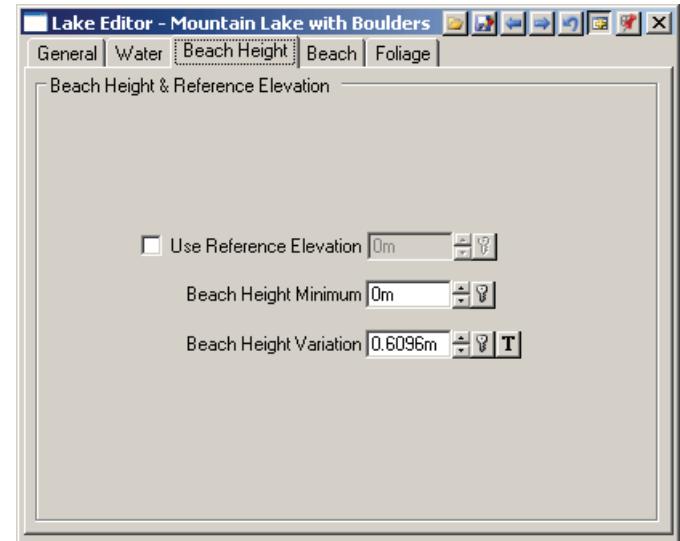
Note: Foliage growing in Ecosystems or Foliage Effects surrounding the Lake will still appear within the flood waters. You can control the Lake's elevation with the Elevation field on the General page. You can also control elevation for each of the Lake's Water Materials from the Water page, on the Elev sub-page, using the Additional Elevation field.

Deselect the checkbox if you want beach height to vary with the Lake's elevation. This is great for lakes where the surface elevation of the lake does not change. Then you can control the amount of beach with the Beach Height Minimum and Beach Height Variation fields.

Beach Height Minimum Field

Beach Height Minimum works two ways, depending on whether the Use Reference Elevation checkbox is selected (see above).

If the Use Reference Elevation checkbox is not selected, you can use the Beach Height Minimum field to set the minimum amount of terrain above the Lake's shore that is textured by Beach Materials. You can enter a value of zero or even use a negative number to eliminate the beach entirely.



If the Use Reference Elevation checkbox is selected, you can use the Beach Height Minimum field to specify the minimum amount of terrain about the Reference Elevation you specify (see above). This lets you keep the beaches from following changes in water elevation. Use this if you are simulating tides or flood waters. Areas flooded beyond the beach will show tall Ecosystem foliage standing in the water.

In either case, you can add further beach height randomly using the Beach Height Variation field (see below).

Note: You can edit the beach's Materials on the Beach page (see below).

Beach Height Variation Field

Use the Beach Height Variation to raise the beach height beyond that created by the Beach Height Minimum field (see above). Beach height is the terrain directly adjacent to the water that is covered with Beach Materials.

VNS will add additional beach height on a random basis. The additional beach ranges between zero and the value you enter in the Beach Height Variation field, in meters.

Beach Page

The Beach page lets you add new Materials to the Beach.

The Material Gradient Driver lets you tell VNS which Material to use. You can use a texture to combine multiple Materials on the beach.

Material Gradient & Driver Section

Material Gradient Driver Percentage Controls

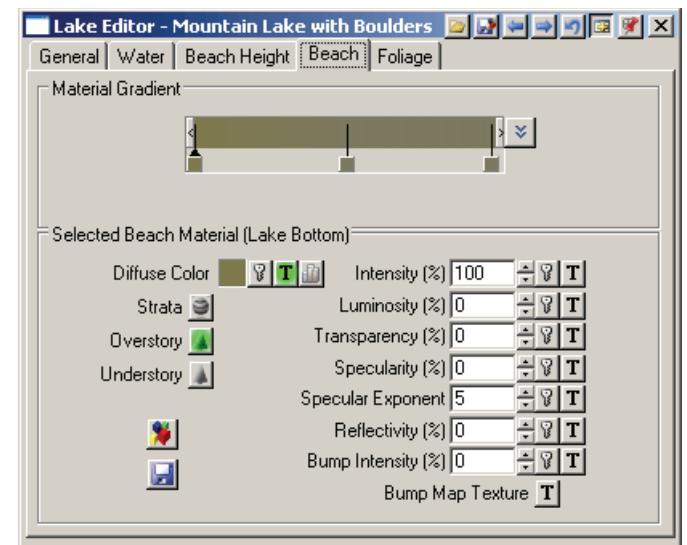
The Material Gradient Driver field lets you pick a Material for the Beach based on a position along the Material Gradient (see below).

Enter a percentage from zero to 100 where zero is the left edge of the gradient and 100 is the right edge. VNS will use the Material at the gradient position you specify. If there is no Material represented at that position, VNS will create a blend between the nearest two Materials.

You can animate the Material Gradient Driver percentage to change Materials over time. This is great for climate change animations where you could animate through a variety of Materials such as from a desert to a rain forest.

By clicking the Texture Control icon you can control the Material Gradient Driver percentage with the Texture Editor. This lets you use all the Materials in the Gradient. Textures can range in gray values from black to white, with black representing 0% on the Gradient and white representing 100% on the gradient.

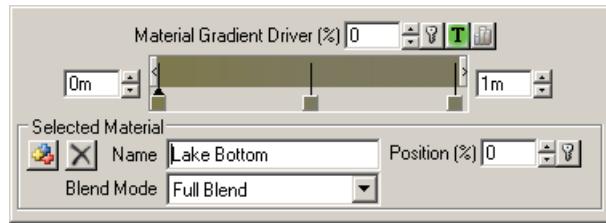
For example, if you use a fractal noise Element in the texture that ranges from black to white, VNS will cover the Beach's area with Materials in a fractal noise pattern ranging from the left-most Material in the Gradient to the right-most Material in the Gradient.



Another example: You could use a Dynamic Parameter of Slope in the Texture Editor and set its Input Low field to the lowest slope on the beach area and the Input High field to the highest slope in your terrain. Then VNS will arrange the Materials in the Beach's Material Gradient so that the Materials on the left side of the gradient will grow on the lower sloped areas and the Materials on the right side of the Gradient will grow on the higher sloped areas. You can use this to make the flatter areas textured with sand and the steeper areas textured with rock.

If you are using an Ecotype to add foliage to your beach and you don't want the foliage to appear under water, you may want to use a Dynamic Parameter of Water Depth to control the Material Gradient Driver. To keep foliage from appearing in the water, use a material with no Ecotype foliage and place it in the Material Gradient where the water depth becomes greater than zero.

To Access the Gradient, click on the Gradient popdown icon . This will display the Material Gradient Editor:



Material Gradient

The Material Gradient shows a colored bar with one or more colored pins beneath it. The bar is a place to create Materials. Click it to create a new Material.

When you click the Gradient to create a new Material, VNS will give the new Material a random Diffuse Color. You can change the color on the Material and Foliage page.

VNS represents each Material with a pin that is colored with the Diffuse Color of the Material. Click any Pin to select a Material.

Material Gradient Range Fields

The Material Gradient Range fields are on either side of the Material Gradient. They show the range of the value that controls the gradient.

If there's no texture enabled for the Material Gradient Driver, the range of the gradient is zero to 100 percent.

If there is a texture enabled for the Material Gradient Driver, then there are two cases:

1) The first Texture Element is a Dynamic Parameter.

In this case, the Range fields show the range of input values for the Dynamic Parameter you have selected. For example if Elevation is the Dynamic Parameter and the Elevation range in the texture editor (Input Low and Input High) is zero to 1000 meters, then in the Range fields you'll see zero on the left and 1000 on the right.

You can directly edit those texture values in the Lake Editor's Range fields. This is handy because you don't have to reopen the Texture Editor if you want to edit these values.

2) The first Texture Element is not a Dynamic Parameter.

In this case, the Range fields are zero to 100 percent, and are non-editable.

Add Material Icon

Click the Add Material Icon to add a new Material. VNS will ask for the position in the Gradient. Enter a position and click the OK button.

Alternatively you can click directly in the Gradient in a spot where no other Material exists.

VNS will create a new Material and give it a random Diffuse Color. The Material will be represented in the Gradient with a pin in the color of its Diffuse Color.

Remove Material Icon

Click the Remove Material Icon if you want to delete the selected Material.

Position in Gradient Field

The Position in Gradient field shows the percentage along the Gradient for the selected Material. You can move the Material's pin to the left by decreasing this number or to the right by increasing this number. You can also drag the pin along the Gradient with the mouse.

Blend Drop Box

The Blend drop box lets you choose the rate of change between the selected Material and the Material to its left in the gradient.

These are easiest to visualize if you try them and see what they look like in the gradient. You can see how VNS blends Materials between the pins by how it blends the Diffuse Colors along the Gradient.

You can change the blending by selecting different blend types from the Blend Drop Box. If you have more than one material in the gradient, use the following choices to decide how the gradient blends the materials together.

Sharp Edge

Choose "Sharp Edge" if you want an instant change with no gradient.

Soft Edge

Choose "Soft Edge" to create a gradient that turns into the color to the left 1/10 of the way toward that color's pin.

Quarter Blend

Choose "Quarter Blend" to create a gradient that turns into the color to the left 1/4 of the way toward that color's pin.

Half Blend

Choose “Half Blend” to create a gradient that turns into the color to the left 1/2 of the way toward that color’s pin.

Full Blend

Choose “Full Blend” to create a smooth gradient that turns into the color to the left at that color’s pin.

Fast Increase

Choose “Fast Increase” to create an accelerated gradient that gets closer to the previous color faster, and turns into the color to the left at that color’s pin.

Slow Increase

Choose “Slow Increase” to create an decelerated gradient that gets closer to the previous color slower, and turns into the color to the left at that color’s pin.

S-Curve

Choose “S-Curve” to create a narrower gradient between the pin and the previous color’s pin and leaves more of the original colors along the gradient in between.

Material Name Field

The Material Name field is above the Material list. After you create a Material it will have a default name of “Material.” It’s a good idea to enter a unique name in the Material Name field to identify how you will use the Material. For example “sand,” “forest” or “fall foliage.”

Beach Material Properties Section

The Beach page lets you edit the properties of the selected Material. You can select a Material on the Beach Material page by clicking the Material’s colored pin in the Gradient (see above).

Ecotypes let you add foliage to the Beach. There are two Ecotypes, an Overstory and an Understory. In nature, the Overstory represents taller trees while the Understory represents shorter foliage. You can add appropriate foliage to the Overstory Ecotype and Understory Ecotype to simulate this in VNS. On a Beach you may only need one Ecotype.

Overstory and Understory Ecotype Controls

To create an Overstory or Understory, click the Overstory or Understory Ecotype Operations icon to see the Ecotype Operations commands. If there is no Ecotype yet created (icon has a gray background), select the Create Ecotype command. If there is an existing Ecotype (icon has a green background), select the Edit Ecotype command.

If you want to disable an Ecotype, click its Ecotype Operations icon and select the Disable Ecotype command. The icon will show a red diagonal stripe to indicate that there is an Ecotype but it’s disabled. This is the same as deselecting the Ecotype Enabled checkbox on the General page of the Ecotype Editor for the Ecotype. VNS will ignore disabled Ecotypes for rendering.

If you want to enable a disabled Ecotype, click its Ecotype Operations icon and select the Enable Ecotype command. The icon will no longer show a red diagonal stripe. This is the same as selecting the Ecotype Enabled checkbox on the General page of the Ecotype Editor for the Ecotype.

If you want to delete an Ecotype, click its Ecotype Operations icon and select the Remove Ecotype command. Because this is destructive, VNS will ask you to confirm this choice. Click OK to remove the Ecotype forever.

If you want to copy an Ecotype, click its Ecotype Operations icon and select the Copy Ecotype command. If you want to paste an Ecotype, click the Ecotype Operations icon for the destination Ecotype and select the Paste Ecotype command.

If you want to make an Ecotype the Active Item, click its Ecotype Operations icon and select the Activate Ecotype command. VNS will make it the Active Item.

Selected Material Ground Overlay

The Selected Material Ground Overlay lets you add color or texturing to the beach.

Diffuse Color Well and buttons

The Ground Effect's Diffuse Color (or texture) always appears wherever the Selected Material's Ground Overlay appears, unless you set the transparency of the Material to 100%. Click the Diffuse Color well to edit the Diffuse Color in the Color Editor.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's Diffuse Color with texture patterns. For example, you can use the fractal noise Element to create the appearance of sand.

When you use a texture, the Colors in the texture will replace the Diffuse Color, unless you use less than 100% Opacity in the Texture Editor, in which case the texture and the Diffuse Color will be mixed.

Diffuse Intensity Field and Buttons

The diffuse intensity of a material is a measure of how much of the diffuse color of a surface is returned to the camera. Reducing this value to 0% will result in a black surface (i.e.: 0 color) and setting it to 100% will result in the pure diffuse color as set in the Diffuse Color Well.

You can animate the value over time, and also drive its intensity with a texture.

This attribute is useful for simulating dirt (try driving this field with a Fractal Noise texture element), streaks, moisture (drive Diffuse Intensity with a Dynamic parameter of Water Level or Elevation to simulate moist surfaces at the edges of lakes and streams etc.)

The maximum value for this parameter is 10000%.

Strata Buttons

Click the Strata icon to open the Material Strata Editor. There you can add Strata texturing to the Material.

Luminosity Percentage Field and Buttons

Luminosity affects how the Material is shaded by Lights (see Light Editor). You can adjust it to create 3D-shaded Objects, flat-shaded Objects or anything in-between.

With zero percent luminosity, the Material will be fully shaded by Lights. This produces a 3D look. In deeply shadowed areas, the Material's color will be a darker shade of itself based on the Ambient Light Intensity and Color. Where fully lit by Lights, the color will be the Diffuse Color or texture (see above) modulated by the Intensity and Color of any Lights.

By raising the luminosity, you can lighten the shaded areas. This can be useful to do if the terrain that uses the Material seems too dark. Raising the luminosity a little bit decreases the shading contrast for the Material.

With 100 percent luminosity, the Material will ignore Lights completely. This produces a flat, unshaded look. The Material will always be the Diffuse Color or texture. This can be useful for Materials used to create the flat, paper-cutout-style animations used by certain cartoon shows.

You can also subtract light by using negative luminosity to make the object tend toward the Ambient Light colors. With 100 percent negative luminosity, the Material will ignore Lights. The Material will be flat-shaded with the Ambient colors.

You can animate the Luminosity percentage to simulate lighting changes. This lets you animate the effect of nearby lightning or explosions.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's luminosity with a texture pattern. This can be useful for creating the look of glowing lava.

When you use a texture, a white value in the texture will equal the amount of luminosity you set in the Luminosity percentage field. A black value in the texture will equal zero luminosity. Gray values will be in-between.

Transparency Percentage Field and Buttons

Use the Transparency field to adjust how much you can see through the Ground Overlay. Zero percent will cover the terrain with opaque Ground Overlay. One hundred percent makes the Ground Overlay invisible, and you will instead see a Ground Effect on the terrain polygons. Anything in-between will mix the Ground Overlay with the Ground Effect.

Note: There is always at least one global Ground Effect in any VNS Project.

You can apply, edit or delete a texture using the texture popup menu. Using these commands you can replace the Material's transparency with a texture pattern to make some areas more transparent than others.

When you use a texture, a white value in the texture will equal the amount of Transparency you set in the Transparency percentage field. A black value in the texture will equal zero Transparency. Gray values will be in-between.

Specularity Percentage Field and Buttons

Specularity is the amount of shininess for a material.

Use the Specularity Percentage field to adjust the shininess of the material. Zero percent means no specular highlight, while 100 percent is maximum shininess.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's specularity value with texture patterns.

When you use a texture, a white value in the texture will equal the amount of Specularity you set in the Specularity percentage field. A black value in the texture will equal zero Specularity. Gray values will be in-between.

Specular Exponent Field and Buttons

Use the Specular Exponent field to adjust the size of the shiny spot. The useful range is from 1 to infinity. Higher numbers will produce a smaller spot, with less feathering at its edge.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's specular exponent value with texture patterns.

When you use a texture, a white value in the texture will equal the amount of Specular Exponent you set in the Specular Exponent field. A black value in the texture will equal zero Specular Exponent. Gray values will be in-between.

Reflectivity Field and Buttons

Beach materials can now reflect their surroundings, as well as parts of their own geometry.

Set this value to an amount greater than 0% to see reflections on these surfaces.

You can animate the value over time, and also drive its intensity with a texture.

The maximum value for this parameter is 10000%.

Bump Intensity Percentage Field and Bump Map Texture Icon

Bump mapping lets you simulate detailed relief shadowing without requiring dense geometry. For more about using bump mapping, see Bump Mapping Controls.

Foliage Page

To create Ecotypes for a beach material, perform the following:

- Add one or more Ecotypes using the controls on the Material Page, or directly to an existing (and selected) Material using the Ecotype Control Icon underneath the Foliage List on the Foliage Page.
- Add one or more Foliage Groups to each Ecotype using the Foliage Group Control Icon underneath the Foliage List on the Foliage Page.
- Add one or more Foliage Objects to each Group using the Foliage Object Control Icon underneath the Foliage List on the Foliage Page.
- Adjust the properties for each Foliage Object, Group and Ecotype on the parameters pages that appear when the appropriate item is selected in the Foliage List page.

You can specify height and density for each Foliage Object, Foliage Group and the entire Ecotype. You can even use textures to control height and density to create natural-looking foliage clumping based on procedural textures, images and dynamic parameters.

The way the controls interact depends on the choices you make on the General page. There you can configure the Ecotype to behave according to your needs.

Foliage Objects can be Image Objects or 3D Objects. Image Objects can be still images or animated sequences (see the Image Object Library section). Typically they will be images or animations of trees and other foliage, but they can be any images or animations of anything you like. If you have an animation of a dancing munchkin and want an entire forest of dancing munchkins, you can create that effect using Image Objects and the Ecotype Editor.

Using Pre-made Components

Click the Load Component From Disk Icon to see the Component Gallery, ready to load a pre-made Ecotype. Ecotypes are multiple groups of Foliage Objects with the Ecotype, Group and Object controls already set up. You can select from any previously created Ecotype files. Double-click the thumbnail image to load the Ecotype Component. VNS will reset the parameters of the Ecotype to those of the Component you selected.

You can create and export your own pre-built Ecotype Components from the Ecotype Editor by setting up the Ecotype the way you want it and then clicking the Save Component To Disk Icon. VNS will open the Component Signature Window where you can fill in the information, choose a representative image for the Component's thumbnail and save the Component in the Component Gallery.

For example, this makes it easy to create different kinds of forests with complex foliage mixes. You can later reuse the Ecotype another Project and have an instant complex forest.

Material Foliage List

This list will show the foliage associated with the currently selected Ecosystem Material. The selected Material name will be in brackets behind the Overstory and understory foliage types.



Note: Overstory and understory vegetation are simply logical groupings. There is no reason why you they can not contain similar species, or why one can exist while the other doesn't.

Enabled Items in the list will be displayed in Bold text. Disabled Items will still be displayed, but not emboldened.

At the bottom of the Material Foliage List, there are the following Control Icons:

Add Ecotype

Click the Add Ecotype icon if you want to add a new Ecotype to the Material.

Note: An Ecotype must exist in the Material in order for there to be Foliage groups, and therefore Foliage Objects in that Material.

Remove Ecotype

Click the Remove Ecotype icon if you want to delete an Ecotype. VNS will remove the Ecotype from the Material, along with all associated Foliage groups and FOliage Objects in those Groups.

If the Ecotype existed when you last opened the Ecosystem Editor, you can undo the removal by clicking the Undo All Changes in this Window icon. Otherwise the Ecotype will be gone forever.

Add Foliage Group

Click the Add Foliage Group icon if you want to add a new Foliage Group to the Ecotype. VNS will ask for a name.

Note: You have to add at least one Foliage Group to an Ecotype before you can add Foliage Objects on the Objects page (see below).

Remove Foliage Group

Click the Remove Foliage Group icon if you want to delete a Foliage Group. VNS will remove the Foliage Group from the Ecotype.

If the Foliage Group existed when you last opened the Ecosystem Editor, you can undo the removal by clicking the Undo All Changes in this Window icon. Otherwise the Foliage Group will be gone forever.

Add Foliage Object

Click the Add Foliage Object icon to Create a new, blank entry in the Foliage Objects list.

Then choose either the Image Object or 3D Object radio button in the Selected Object section (see below). Finally, select an object from the drop box in the Image Object section or 3D Object section (see below).

Remove Foliage Object

If you want to remove a Foliage Object from the selected Foliage Group, select it in the Foliage Objects list and click the Remove Foliage Object icon.

VNS will ask if you want to remove the object. Click OK and VNS will remove it from the Foliage Group.

General Sub-Page

Ecotype Enabled Checkbox

The Enabled checkbox lets you enable or disable the Ecotype for rendering.

Note: You can also enable and disable an Ecotype from its Ecotype Operations icon on the Ecosystem, Lake or Stream Editor, wherever you first created the Ecotype. Select the icon's Disable Ecotype command to disable the Ecotype. The icon will be displayed with a red diagonal stripe to indicate that it's disabled. Select the icon's Enable Ecotype command to enable the Ecotype. The Ecotype will be enabled and the red stripe will disappear.

Disabling an Ecotype can be useful to speed up rendering if you are doing test renders to check some other aspect of your scene and don't need to see the Ecotype's foliage. Make sure you remember to enable it for the final rendering if you want to see the foliage.

Note: To see the Ecotype in your rendering, it must be part of an Ecosystem or Beach that is visible to the Camera you selected for the Render Job you are using (see Render Job Editor), and Other Foliage must be enabled in the Render Options you are using (see Render Options Editor).

Render Items Occluded By This Ecotype's Image Objects Checkbox

Selecting this checkbox will force VNS to render those elements of the scene obscured by this foliage effect. This will allow reflections to accurately represent terrain and foliage that has been hidden from the camera by this foliage effect. Select this checkbox if you are experiencing "holes" in reflections of terrain and foliage objects near to a Foliage Effect.

Common Distance Dissolve Section

The Common Distance Dissolve section lets you specify whether VNS will calculate Distance Dissolve Height based on an absolute pixel height or as a pixel height relative to a specified image size. This applies to all the Ecotypes and Foliage Effects in your Project (see also Foliage Effect Editor).

Distance Dissolve Height is the height at which VNS will stop rendering foliage Image Objects and instead render a color or texture. You can enable Distance Dissolve in the Image Object Distance Dissolve section (see below). There you can specify a pixel height for Image Objects at which VNS stops trying to render foliage and instead renders a simple color or a texture.

For example, if a tree is so far away that its height is below the Distance Dissolve Height in pixels, it will no longer be rendered and VNS will instead render the color or texture you specify. This can make rendering much, much faster because VNS can calculate a color or texture much faster than a combination of foliage. Rendering the actual trees and plants far in the distance may take a long time for little or no visual benefit.

The default choice is Absolute Pixels. The default value for Distance Dissolve Height is 2 pixels. This means that VNS will replace a foliage object with a color or texture whenever the foliage object is shorter than two pixels in your rendered image. This makes a lot of sense because you can't see a complete tree in two pixels anyway, so there's not much point wasting the rendering time in the attempt.

You can enable Distance Dissolve in the Image Object Distance Dissolve section (see below).

Absolute Pixels Radio Button

Select the Absolute Pixels radio button to choose a specific height in pixels below which VNS will no longer render an Image Object. VNS will instead replace the Image Object with the color or texture you specify in the Image Object Distance Dissolve section (see below).

By default, the Absolute Pixels radio button is selected.

Relative to Image Height Radio Button

Select the Relative to Image Height radio button to relate the minimum pixel height at which VNS will render Image Objects to the size of your rendered images. This will let you see a more consistent rendering no matter what size image you render. Image Object foliage will then appear in the same areas and be dissolved to a color or texture in the same areas at any image size.

When you use the Relative to Image Height option, VNS will automatically change the Distance Dissolve Height based on the size of your rendering. VNS does this by using the Image Reference Height you specify in the Image Object Distance Dissolve section (see below).

You may want to select this option in order for preview renderings in Views to give you a more accurate visual indication of where plants will actually be rendered in your final renderings. Views are typically rendered at a different resolution than your final renderings and may show different results if you use the Absolute Pixels option (see above).

If you are rendering the same scene for a poster and for a video animation, using the Relative to Image Height option will make the foliage dissolve away in the same places in both scenes.

Be careful with this option, it may add to rendering time when you render at lower resolutions than what is in the Image Reference Height field (see below). This is because as you decrease the size of the rendered image, VNS will correspondingly decrease the Distance Dissolve Height. You may then end up with VNS wasting time rendering Image Object foliage even for Image Objects that would be less than a single pixel in height.

Note: When you use the Relative to Image Height option VNS will take into account whatever constrained preview rendering size you use if you have selected the Constrain Render Area icon (see Constrain Render Area). Image height will be calculated using the pixel height of the constrained render area, not the pixel height of the View.

Distance Dissolve for this Ecotype Section

You can reduce rendering times by enabling Distance Dissolve and adjusting the Dissolve Height. Then Image Object foliage will transition to a fast-rendering color or a texture in the distance.

If you are using the Absolute Pixels option then the Dissolve Height is an absolute value in pixels (see the Common Distance Dissolve section above). This gives you the more efficient rendering.

If you are using the Relative to Image Height option then the Dissolve Height will be scaled depending on the resolution of your rendering (see the Common Distance Dissolve section above). This allows the most consistency between renderings at different resolutions, including preview renderings in a View.

Dissolve Enabled Checkbox

Select the Dissolve Enable checkbox to enable Distance Dissolve. Deselect it to disable Distance Dissolve.

Dissolve Height Field

Dissolve Height lets you control how small the rendered foliage can get in the distance before VNS replaces it with a color or texture.

If the Absolute Pixels radio button is selected in the Common Distance Dissolve section (see above), then this value will apply no matter what resolution you render your images.

If the Relative to Image Height radio button is selected in the Common Distance Dissolve section (see above), then this value will apply only for images that are rendered at the vertical resolution you enter into the Image Reference Height field (see below). VNS will scale the Dissolve Height for images rendered at a different horizontal resolution than specified in the Image Reference Height field. This allows Image Objects to change to a color or texture at the same place on the terrain no matter what resolution you render.

Image Reference Height Field

The "Image Ref. Ht." field is only available when you select the "Relative to Image Height" radio button in the Common Distance Dissolve section (see above).

Use the Image Reference Height field to specify the rendered image height in pixels at which the actual Dissolve Height value is used. This lets you control the amount of up or down Dissolve Height scaling that will occur when you render images at different resolutions. The specified Dissolve Height will always be multiplied by the rendered image height (in pixels) divided by the Image Reference Height (in pixels).

The default Image Reference Height value is 480 pixels. You may want to set it to match the resolution of your preview renderings or your final image renderings.

Example

Let's look at how this works. Suppose you use an Image Reference Height of 480 pixels. If you render an image with a height of 480 pixels and you have an Ecotype that uses a Dissolve Height of 2 pixels, then any rendered images that are 480 pixels high will really have a Dissolve Height of 2 pixels for that Ecotype. $2 \times 480 / 480 = 2$

But if you render a preview image at half that resolution, 240 pixels, VNS will scale the Dissolve Height down by 50% and that Ecotype will have an actual Dissolve Height of 1 pixel in that rendered image. $2 \times 240 / 480 = 1$

If you render a poster with an image height of 1920 pixels, the actual Dissolve Height for the Ecotype in that image will become 8 pixels. $2 \times 1920 / 480 = 8$.

The end result is that the Ecotype will dissolve out to a color or texture at the same place on the terrain in all three examples. This would not have been true if you were using the Absolute Pixels option in the Common Distance Dissolve section (see above).

Note: You can set the rendered image height with the Height field on the Size and Range page of the Render Options Editor.

The Image Reference Height is always the same for all Ecotypes and Foliage Effects. When you change it for one Ecotype or Foliage Effect you are changing it for all Ecotypes and Foliage Effects.

Note: All Ecotypes and Foliage Effects are also affected when you select either the Absolute Pixels radio button or the Relative to Image Height radio button in the Common Distance Dissolve section (see above).

However, the Dissolve Height is unique to each Ecosystem or Foliage Effect.

Dissolve Color Controls

Click the Dissolve Color well to open the Color Editor. There you can edit the color VNS will render on the terrain in the distance.

If you'd rather use a texture, click the Texture icon to open the Texture Editor. There you can create a more complex pattern to represent your distant foliage. Textures will take longer to render than a simple color.

Settings Sub-Page

Absolute Size Radio Buttons

Select the "Absolute Size is in Ecotype" radio button if you want to control the actual size of the Ecotype's foliage using the Maximum Size field, on the Parameters page in the Ecotype Size section. You can then set the size of each Foliage Group as a percentage of the Ecotype's Maximum Size.

Select the "Absolute Size is in Foliage Group" radio button if you want to set the actual size of each Foliage Group directly instead of setting each group as a percentage of the Ecotype Size. VNS will disable the Ecotype Size controls and you can directly set a Group Size and Group Minimum Size for each Foliage Group on the Groups page.

Note: In both cases, the size of each Foliage Object is a percentage of the size of the Foliage Group to which it belongs. You can set the size percentage for each Foliage Object.

However you choose to control the absolute size, you'll set it in the units you selected in the Height field on the Units page of the Preferences Window.

Second Size Radio Buttons

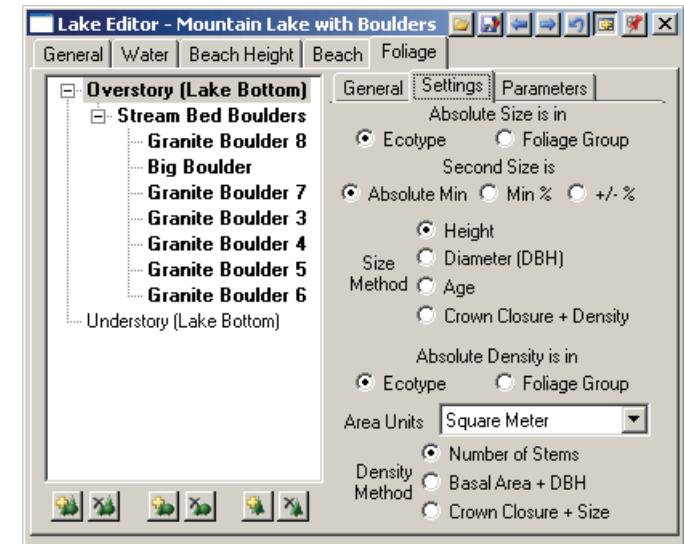
The "Second Size is" radio buttons let you configure how the Ecotype Editor lets you control a second size for the Ecotype's foliage.

Second Size is in Absolute Minimum radio button

Select the Second Size is in Absolute Minimum (Min) radio button if you want to be able to set a secondary Size as a specific, using the units you selected in the Height field on the Units page of the Preferences Window, and using the size method chosen in the Size Method section (see below).

If you've selected the "Absolute Size is in Ecotype" radio button (see above), you can then control a minimum size for all Foliage Groups using the Minimum Size percentage field on the Parameters page.

If you've selected the "Absolute Size is in Foliage Group" radio button (see above), you can then control a minimum size for separately for each Foliage Group using the Group Minimum Size field on the Parameters page for a selected Foliage Group. This controls the minimum size separately for each Group.



Second Size is Minimum Percentage Radio Button

Select the Second Size is in Minimum (Min) percentage radio button if you want to be able to set the secondary size as a percentage of the absolute size.

If you've selected the "Absolute Size is in Ecotype" radio button (see above), you can then control a minimum size for all Foliage Groups using the Minimum Size Percentage field on the Parameters page. The minimum size of the Ecotype's foliage will be a percentage of the value you entered into the Maximum Size field. VNS will vary the size of the foliage between these two sizes. You can further control the size of each Foliage Group by adjusting the Group Size percentage field on the Parameters page for each Foliage Group.

If you've selected the "Absolute Size is in Foliage Group" radio button (see above), you can instead control a minimum size for separately for each Foliage Group using the Group Minimum size field on the parameters page for a selected Foliage Group. This controls the minimum size separately for each Group.

Second Size is Plus or Minus a Percentage Radio Button

Select the Second Size is +/- percentage radio button if you want to be able to set the secondary size as a percentage range above and below the absolute size.

If you've selected the "Absolute Size is in Ecotype" radio button (see above), you can then control a range of size for all Foliage Groups using the Size Range Plus/Minus Percentage field on the Parameters page. The Ecotype's foliage will range in size as a percentage above or below the value you entered into the Maximum Size field. VNS will vary the size of the foliage within this percentage range. You can further control the size of each Foliage Group by adjusting the Group Size percentage field on the Parameters page for each Foliage Group.

If you've selected the "Absolute Size is in Foliage Group" radio button (see above), you can instead control a range of size separately for each Foliage Group using the Group Size Range Plus/Minus Percentage field on the Parameters page for a selected Foliage Group. This controls the size range separately for each Group.

Size Method Radio Buttons

VNS Forestry Edition offers four methods to specify the desired size of Ecotypes: Height, Diameter (DBH), Age or Crown Closure plus Density. Height is the most straight forward. You simply tell VNS how tall to make the foliage. But sometimes you might have other data that VNS can use to infer foliage heights indirectly. Diameter, age and crown closure are the three additional methods supported for Ecotypes.

If you wish to use either of the alternate methods, diameter or age, you will also need to tell VNS what the relationship is between diameter and height or age and height. You will do that by creating a graph of the relationship. A default graph is provided for your use if you lack real height relationship data.

If you wish to use crown closure your density values will be used in a formula along with the specified crown closure to infer the correct size of foliage to draw. There are some restrictions on the use of crown closure for size calculation which are discussed below.

Height Radio Button

Select the Height Radio Button if you wish to control foliage size directly with height values.

Diameter (DBH) Radio Button

Select the Diameter (DBH) Radio Button if you wish to control foliage size indirectly with diameter values and a diameter/height relationship graph. DBH stands for Diameter at Breast Height, a standard height above the ground for measuring tree diameters. You can use the Diameter (DBH) Size Method even if your tree diameters were measured at some other height from the ground. VNS does not care at which height diameters were measured so long as it is consistent with the DBH/Height graph that is used (see below).

Age Radio Button

Select the Age Radio Button if you wish to control foliage size indirectly with age values and an age/height relationship graph.

Crown Closure plus Density Radio Button

Crown Closure is a measure of the percentage of an area that has foliage directly overhead. The remaining area is open to the sky.

Select the Crown Closure plus Density Radio Button if you wish to control foliage size indirectly with crown closure percentage combined with whatever your density value is. The way this works is VNS first determines the foliage density for an area that is about to be drawn. Then from the density and the average width to height ratio of all the images or 3d objects that represent the Ecotype or Foliage Group (depending on whether the Absolute Size is in the Ecotype or Foliage Group), the size of foliage stems to be drawn for that area is calculated using a standard formula.

Note: Because foliage items are drawn in random positions there may be more overlap between items than would normally occur in nature. Therefore a specification of 100% crown closure will probably result in gaps between foliage items which would not be there if items were evenly spaced throughout the area. When you select Crown Closure plus Density you will not be able to select Crown Closure plus Size for the Density Method (see below) since they are mutually exclusive. Also Absolute Size and Absolute Density will be forced to agree to be in either Ecotype or Foliage Group since it is required that the density be available for use in the size calculation.

Absolute Density Radio Buttons

Select the “Absolute Density is in Ecotype” radio button if you want to specify the overall density of the Ecotype’s foliage for the entire Ecotype using the Density field in the Ecotype Density section on the Ecotype page. You can then set the density of each Foliage Group as a percentage of the Ecotype’s overall Density.

Select the “Absolute Density is in Foliage Group” radio button if you want to specify the density of each Foliage Group directly instead of setting each group as a percentage of the Ecotype Density. VNS will disable the Density field on the Ecotype page and you can directly set a Group Density for each Foliage Group using the Group Density field on the Groups page instead.

Note: In both cases, the density of each Foliage Object is a percentage of the density of the Foliage Group to which it belongs. You can set the density percentage for each Foliage Object on the Objects page.

Density Radio Buttons

The Ecotype page’s Density Field and the Group page’s Group Density field work differently depending on whether you select the “Density is per Polygon” or “Density is per Unit Area” radio button.

VNS lets you choose whether to have the Ecotype's foliage density be linked to the polygon density for more efficient rendering or be a constant across the terrain. Polygon density is increased near the Camera when you render with Variable or Fractal Maps options on the Terrain Parameter Editor.

When you select Density is per Unit Area the VNS Forestry Edition allows you to choose the format of your density data. You can use actual stems per unit area, basal area or crown closure data to determine density. Which method you choose will affect the appearance of the Ecotype page's Density Field and the Group page's Group Density field.

Density per Polygon Radio Button

With the "Density is per Polygon" radio button selected, the Density or Group Density field lets you specify the percentage of polygons that will be covered with the Ecotype. Enter an integer value between 0 and 100 percent or use the arrow buttons to change the value. A value of zero will cause no trees or textures to be rendered for the given Ecotype. A value of 100 will cause a tree or texture to be applied at all polygon sites where the Ecotype appears.

Note: For forestry work you will almost never use Density is per Polygon for timber ecotypes. For understory vegetation you might prefer to use Density is per Polygon for speedier rendering where the density is not very critical.

With Density per Polygon the density of the foliage is directly related to the polygon density. The more polygons you have, the more foliage you will have. Anything that affects the polygon density will also affect the tree density. This includes things like Fractal Depth, Variable Fractal Depth and Fractal Depth Maps.

You can increase the polygons available during rendering by increasing the Fractal Depth in the Terrain Parameter Editor. The foliage density will be different when you render at lower or higher Fractal Depth settings. To see how it all works out you'll have to render an image.

If you use Variable Fractal Depth, the foliage density will be higher nearer the Camera. If you use Fractal Depth Maps, the foliage density will be higher along the Camera path.

In many cases the varying tree density is not noticeable, and using Density per Polygon may render faster. But if you notice uneven tree density; if you want to be able to change fractal depth without changing the tree density; or if you see distant trees disappearing during an animation, use Density per Unit Area instead (see below).

When changing from Density per Polygon to Density per Unit Area, you will generally need to increase the density field between 5 to 10 times its previous value to get a similar look as the non-fixed scene. Use your judgment based on what you want it to look like.

Density per Unit Area Radio Button

Select the Density is per Unit Area" radio button when you want the tree density to be unrelated to the polygon density. With the Density is per Unit Area" radio button selected, the number of trees won't change when you raise or lower the fractal depth. The distribution of trees on the landscape will be consistent even if you are using variable fractal depth or fractal depth maps.

Note: For forestry work you will almost always use Density is per Unit Area for timber ecotypes. For understory vegetation you might prefer to use Density is per Polygon for speedier rendering where the density is not very critical.

When you select Density is per Unit Area the VNS Forestry Edition allows you to choose the format of your density data. You can use actual stems per unit area, basal area or crown closure data to determine density. Which method you choose will affect the appearance of

the Ecotype page's Density Field and the Group page's Group Density field. In the paragraphs below the word Density will be used in a generic sense. It can be either stems per unit area, basal area of trunk per unit area or percentage of crown closure.

The Density you set in the Density or Group Density field is the actual number of foliage stems or basal area units per unit of area or the actual percentage of crown closure. You can select the kind of areal unit from the Area Units drop box (see below). To save rendering time, enter the lowest Density value that gives you the look you want. To see the result, render an image.

To make Density per Unit Area foliage render more efficiently, use the controls in the Image Object Distance Dissolve section to dissolve distant foliage to a color or texture (see below).

Increase the Density or Group Density value if you want to see more trees from the Ecotype. If it's an Overstory Ecotype, lower values can leave more bare spots where the Understory Ecotype will show through.

Area Units Drop Box

If you select the "Density is in Unit Area" radio button you can use the Area Units drop box to select the units for area density. Choose between stems per Hectare, Acre, Square Meter or Square Foot.

Density Method Radio Buttons

VNS Forestry Edition offers three methods to specify the desired density per unit area of Ecotype foliage: Number of Stems, Basal Area plus DBH, or Crown Closure plus Size. Number of Stems is the most straight forward. You simply tell VNS how many items of foliage to draw in a unit area of land. But sometimes you might have other data that VNS can use to infer foliage density indirectly. Basal area plus DBH and crown closure plus size are the three additional methods supported for Ecotypes.

If you wish to use crown closure your size values will be used in a formula along with the specified crown closure to infer the correct number of foliage stems per unit area. There are some restrictions on the use of crown closure for density calculation which are discussed below.

Note: Density Method Radio Buttons are disabled unless Density is per Unit Area (see above).

Number of Stems Radio Button

Select the Number of Stems Radio Button if you wish to control foliage density directly with the number of foliage stems per unit area. Be sure to select the appropriate areal unit with the Area Units drop box (see above).

Basal Area plus DBH Radio Button

Basal Area is a measure of the area of tree trunk within some unit of land area. A typical expression would be: 100 square feet of basal area per acre. That would indicate that all the trees in an acre combine to have a cross-sectional area, of 100 square feet. Basal area is usually measured at breast height four and a half feet above the ground. By combining an average diameter, also measured at the same height, with the basal area, an actual number of foliage stems per area of land can be calculated with a simple formula.

Select the Basal Area plus DBH Radio Button if you wish to control foliage density indirectly with basal area and diameter (DBH) values. In the Ecotype Size & Density section of the Ecotype page or the Selected Group section of the Groups page you will need to supply both a diameter and a basal area value. If the Size Method is Diameter (DBH) then that diameter will be used in the density calculation as well as in computing the foliage size. You will also be asked to supply the units for the basal area value. Typical units are square feet and square

meters. The basal area units will usually be different than the Area Units selected on the General page because they represent quantities with different orders of magnitude.

Note: You can only have the combination of Basal Area plus DBH for the Density Method and Diameter (DBH) for the Size Method if Absolute Size and Absolute Density are both in either Ecotype or in Foliage Group. Otherwise selections will be greyed out to indicate they are not valid combinations.

Crown Closure plus Size Radio Button

Crown Closure is a measure of the percentage of an area that has foliage directly overhead. The remaining area is open to the sky.

Select the Crown Closure plus Size Radio Button if you wish to control foliage density indirectly with crown closure percentage combined with whatever your size value is. The way this works is VNS first determines the average foliage size for an area that is about to be drawn. Then from the size and the average width to height ratio of all the images or 3d objects that represent the Ecotype or Foliage Group (depending on whether the Absolute Density is in the Ecotype or Foliage Group), the number of foliage stems to be drawn for that area is calculated using a standard formula.

In forestry practice 100% would be the highest amount of closure that could be achieved by a single layer of forest canopy. In VNS higher percentages are permitted so you can compensate for the overlapping of foliage stems that result from pseudo-random foliage placement. Closure values of 200% or 300% may be necessary to achieve the full coverage of an area without intervening gaps of significant size. Naturally this results in more foliage items being drawn than would really be there for 100% closure.

Note: Because foliage items are drawn in random positions there may be more overlap between items than would normally occur in nature. Therefore a specification of 100% crown closure will probably result in gaps between foliage items which would not be there if items were evenly spaced throughout the area. To compensate for that you may wish to use two or three times the amount of crown closure to achieve the correct look for the foliage density. If you are using a Thematic Map to control crown closure you can set a multiplier value of 2 or 3 in the Thematic Map's Data page to adjust your database values appropriately. When you select Crown Closure plus Size you will not be able to select Crown Closure plus Density for the Size Method (see above) since they are mutually exclusive. Also Absolute Size and Absolute Density will be forced to agree to be in either the Ecotype or Foliage Group since it is required that the size be available for use in the density calculation.

Parameters Sub-Page

The Ecotype Size section's fields are available if you select the Absolute Size is in Ecotype radio button on the Settings Sub-Page (see above).

Note: These fields let you adjust foliage sizes for the entire Ecotype. You can further adjust foliage sizes for each of the Ecotype's Foliage Groups and for individual Foliage Objects by selecting the relevant Group or Object and using the context sensitive controls which appear (see below). You can also adjust Foliage sizes for all the foliage from all Ecosystems used within an Environment. To do so, use the Foliage Height Factor field on the Foliage and Gradients page of the Environment Editor.

Depending on the Size Method you choose on the General Page (see above) you will see different controls in the Size & Density section. All have the same purpose - to let you specify the largest or average size and a second size which may be either a smaller size, a percentage size or a percentage range depending on the Second Size type selected on the General Page.

Maximum Height Field

Use the Maximum Height field to specify the upper limit for how tall you'd like the foliage in this Ecotype to appear. This control only appears if the Size Method is Height and if the Second Size is Absolute Minimum or Second Size is Minimum Percentage on the General Page (see above).

Enter a value for the Maximum Height field in the units you selected for height on the Units page of the Preferences Window.

Mean Height Field

Use the Mean Height field to specify the average for how tall you'd like the foliage in this Ecotype to appear. This control only appears if the Size Method is Height and the Second Size is Plus or Minus Percentage on the General Page (see above).

Enter a value for the Maximum Height field in the units you selected for height on the Units page of the Preferences Window.

Maximum DBH Field

Use the Maximum DBH field to specify the upper limit for how large you'd like the foliage in this Ecotype to appear. This control only appears if the Size Method is Diameter (DBH) and if the Second Size is Absolute Minimum or Second Size is Minimum Percentage on the General Page (see above). DBH stands for Diameter at Breast Height, a standard height above the ground for measuring tree diameters.

Enter a value for the Maximum Diameter field in the units you selected for distance on the Units page of the Preferences Window. Diameter is usually specified as diameter at breast height (DBH) but it does not really matter to VNS how your diameter is measured.

Mean DBH Field

Use the Mean DBH field to specify the average for how large you'd like the foliage in this Ecotype to appear. This control only appears if the Size Method is Diameter (DBH) and the Second Size is Plus or Minus Percentage on the General Page (see above).

Enter a value for the Maximum Diameter field in the units you selected for distance on the Units page of the Preferences Window. Diameter is usually specified as diameter at breast height (DBH) but it does not really matter to VNS how your diameter is measured.

Edit DBH/Height Graph Button

VNS needs to convert the diameters you give it to heights which can be rendered. To do this you must specify a Diameter/Height graph.

The Edit DBH/Height Graph Button only appears if the Size Method is Diameter.

Click the Edit DBH/Height Graph Button to open an editor for the Diameter/Height Graph. Modify the default curve by adjusting points up or down or changing the distance of points in the graph. You can also add or remove points to achieve the diameter/height relationship that describes the foliage in this Ecotype. The same curve will be applied to all Foliage Objects in this Ecotype. If you wish to use a different graph for each Foliage Group then you should select Absolute Size is in Foliage Group on the General Page.

Horizontal units in the graph are the units you selected for distance on the Units page of the Preferences Window. Vertical units in the graph are the units you selected for height on the Units page of the Preferences Window.

Maximum Age Field

Use the Maximum Age field to specify the upper limit for how old you'd like the foliage in this Ecotype to appear. This control only appears if the Size Method is Age and if the Second Size is Absolute Minimum or Second Size is Minimum Percentage on the General Page (see above).

Enter a value for the Maximum Age field in any units you wish. The units do not matter to VNS.

Mean Age Field

Use the Mean Age field to specify the average for how old you'd like the foliage in this Foliage Effect to appear. This control only appears if the Size Method is Age and the Second Size is Plus or Minus Percentage on the General Page (see above).

Enter a value for the Mean Age field in any units you wish. The units do not matter to VNS.

Edit Age/Height Graph Button

VNS needs to convert the ages you give it to heights which can be rendered. To do this you must specify an Age/Height graph.

The Edit Age/Height Graph Button only appears if the Size Method is Age.

Click the Edit Age/Height Graph Button to open an editor for the Age/Height Graph. Modify the default curve by adjusting points up or down or changing the distance of points in the graph. You can also add or remove points to achieve the age/height relationship that describes the foliage in this Ecotype. The same curve will be applied to all Foliage Objects in this Ecotype. If you wish to use a different graph for each Foliage Group then you should select Absolute Size is in Foliage Group on the General Page.

Horizontal units in the graph are dimensionless. Vertical units in the graph are the units you selected for height on the Units page of the Preferences Window.

Maximum Closure Field

Use the Maximum Closure field to specify the upper limit for crown closure of this Ecotype. This control only appears if the Size Method is Crown Closure plus Density and if the Second Size is Absolute Minimum or Second Size is Minimum Percentage on the General Page (see above).

Enter a value for the Maximum Closure field in units of percentage ranging from 0 to 100 or more. VNS allows percentage closure values in excess of the normal 100% to accommodate overlapping between foliage items which reduces the apparent closure.

Mean Closure Field

Use the Mean Closure field to specify the average for crown closure of this Ecotype. This control only appears if the Size Method is Crown Closure plus Density and the Second Size is Plus or Minus Percentage on the General Page (see above).

Enter a value for the Mean Closure field in units of percentage ranging from 0 to 100 or more. VNS allows percentage closure values in excess of the normal 100% to accommodate overlapping between foliage items which reduces the apparent closure.

Controlling Size with a Texture

If you want to control foliage size with a texture, click the Texture Operations icon next to the field for the variable you want to control, which in this case is Maximum Height, DBH, Age or Closure.

Select the Create Texture command from the Texture Operations icon's commands and VNS will create a new texture and open the Texture Editor. There you can edit your texture to control the variable. Wherever the Texture is white, you'll have the full size using the value you set in the field for the controlled variable. Wherever the texture is gray you'll have less size and where it is black you'll have zero height. This is a good way to make naturally varied foliage sizes.

Controlling Size with a Thematic Map

If you want to control foliage size with a Thematic Map, click the Thematic Map Operations icon next to the field for the variable you want to control, which in this case is Maximum Height, DBH, Age or Closure.

Select the Create Thematic Map command from the Thematic Map Operations Icon's commands and VNS will create a new Thematic Map and open the Thematic Map Editor. There you can select one or more Vector attributes to control the variable. In this case the Height, DBH, Age or Closure value will be inherited from the Vector attribute you select. The attribute value comes from the Ecosystem's attached Vector. This is a good way to let your GIS data control actual foliage size in VNS.

The units in which height or diameter should be represented by the Thematic map are meters. The units in which age should be presented do not matter to VNS so long as they are consistent with the Age/Height graph. The units in which crown closure should be presented are percentage normally ranging from 0 to 100 but may be higher if desired. You can use the Data Multiplier field in the Data Input section of the Data page of the Thematic Map Editor to correct for data provided in the wrong units.

Second Size Field

The second size field lets you control Minimum Size, Minimum Size Percentage or Size Range Plus or Minus Percentage depending on your Second Size radio button selection on the General page (see above).

The actual label for the Second Size field will either say Height, DBH, Age or Closure instead of Size, depending on your selection of Size Method on the General page (see above).

If you select the Second Size is Absolute Min (Minimum) on the General page, the second size field will be labelled Minimum Height, Minimum DBH, Minimum Age or Minimum Closure. Enter the appropriate size you want for the smallest foliage in the Ecotype. When you render, VNS will place trees with a random mix of sizes from the minimum size you specified in the Minimum Size field up to the maximum size you specified in the Maximum Size field (see above).

Note: The Minimum Height field uses the units you selected for height on the Units page of the Preferences Window. The Minimum DBH field uses the units you selected for distance there. Minimum Age has no specific units as far as VNS is concerned. Minimum Closure is expressed as a percent normally varying between 0 and 100 but may be higher if desired.

If you select the Second Size is Min (Minimum) Percentage on the General page, the second size field will be labelled Min Height (Percentage of Max), Min DBH (Percentage of Max), Min Age (Percentage of Max) or Min Closure (Percentage of Max). Enter the size you want for the smallest foliage in the Ecotype as a percentage of the Maximum Size field. When you render, VNS will place trees with a random mix of sizes from the Minimum Size percentage you specified in the Min Size (Percentage of Max) field up to the maximum size you specified in the Maximum Size field (see above).

If you select the Second Size is Plus or Minus Percentage on the General page, the second size field will be labelled Height Range (Plus or Minus Percentage), DBH Range (Plus or Minus Percentage), Age Range (plus or minus percentage) or Closure Range (plus or minus percentage). Enter the size you want for the largest and smallest foliage in the Ecotype as a percentage above and below the value in the Mean Size field. When you render, VNS will place trees with a random mix of sizes ranging above and below the value you specified in the Mean Size field (see above).

You can also adjust the size for each Group on the Groups page and for each Foliage Object on the Objects page.

Ecotype Density Section

The Ecotype Size & Density section's density fields are available if you select the Absolute Density is in Ecotype radio button on the General page (see above).

Note: These fields let you adjust foliage densities for the entire Ecotype. You can further adjust foliage densities for each of the Ecotype's image groups on the Groups page, and for individual Foliage Objects on the Objects page (see below).

Depending on the Density Method you choose on the General Page (see above) and whether you choose Density is per Polygon or per Unit Area you will see different controls in the Size & Density page's density fields. All have the same purpose - to let you specify the number of foliage items to be drawn in a given area of land.

VNS lets you choose whether to have the foliage density be linked to the polygon density for more efficient rendering or be a constant across the terrain. Polygon density is increased near the Camera when you render with Variable or Fractal Maps options on the Terrain Parameter Editor.

The Ecotype page's Density Field works differently depending on whether you select the "Density is per Polygon" or "Density is per Unit Area" radio button on the General page.

If the Density is per Unit Area radio button selected on the General page, the Density you set in the Density field is the actual number of foliage stems per unit or the actual basal area per unit or the actual crown closure. You can select the kind of unit from the Area Units drop box on the General page. To save rendering time, enter the lowest Density value that gives you the look you want.

If the Density is per Unit Area and the Area Units is Acre, the Density field will either be labelled Density (Stems per Acre), Basal Area (BA per Acre) or Crown Closure (percentage). These labels correspond with the Density Method selections Number of Stems, Basal Area plus DBH or Crown Closure plus Size, respectively.

Density (Stems per Unit) Field

Use the Density (Stems per Unit) field to specify the actual average number of foliage items to be drawn within a typical area of Unit size. So if you enter 100 and the areal units are acres the result would be approximately 100 foliage items in a one acre parcel of land. For smaller areas, fewer items will be drawn and conversely larger areas will contain more.

Keep in mind that you are telling the average number to draw. There will be some random variation from one unit parcel to another and the items will be placed randomly within the area. There may be some places where items are very close together and other places where they are farther apart leaving natural looking gaps. You can gain more control over the arrangement by using a patterned texture to modify density (see below).

Density (Stems per Unit) field is only visible if the Density Method on the General page is Number of Stems.

Basal Area (BA per Unit) Field

Use the Basal Area (BA per Unit) field to specify the average amount of basal area of trunk to be used in calculating the actual average number of foliage items to be drawn within a typical area of Unit size. Basal Area will be combined with the diameter (DBH) specified for the area to make the calculation. If you have not chosen Diameter (DBH) for your Size Method on the General page, you will need to specify the DBH as well.

Enter a value for the Basal Area (BA per Unit) field in the units you selected for basal area in the Basal Area Units drop box to the right.

Basal Area (BA per Unit) field is only visible if the Density Method on the General page is Basal Area plus DBH.

Basal Area Units Drop Box

Use the Basal Area Units drop box to specify the units that basal area is measured in. This will probably be a different unit from the Area Units on the General page although it doesn't have to be. Be sure to set this correctly as it can have a very large effect on the number of foliage items drawn. Incorrect values can cause extremely high foliage densities and very slow rendering.

Basal Area Units drop box is only visible if the Density Method on the General page is Basal Area plus DBH.

Diameter (DBH) Field

Use the Diameter (DBH) field to specify the average trunk diameter to use in calculating the number of foliage items to draw in a given unit area. Diameter is part of the formula for converting basal area into number of stems. DBH stands for Diameter at Breast Height, a standard height above the ground for measuring tree diameters.

Enter a value for the Diameter (DBH) field in the units you selected for distance on the Units page of the Preferences Window.

Diameter (DBH) field is only visible beneath the Basal Area (BA per Unit) field if the Density Method on the General page is Basal Area plus DBH and the Size Method is not Diameter (DBH). If the Size Method is Diameter (DBH) then the size control DBH values will be used to compute density in conjunction with the basal area (see Ecotype Size Controls above).

Crown Closure (Percentage) Field

Use the Crown Closure (Percentage) field to specify the average amount of crown closure for this Ecotype. Crown Closure is a measure of the percentage of an area that has foliage directly overhead. The remaining area is open to the sky.

Enter a value for the Crown Closure in percentage. The normal range is from 0 to 100 but you may use larger values if you wish to achieve the proper appearance.

Crown Closure (Percentage) field is only visible if the Density Method on the General page is Crown Closure plus Size.

The way crown closure is used is VNS first determines the average foliage size for an area that is about to be drawn. Then from the size and the average width to height ratio of all the images or 3d objects that represent the Ecotype or Foliage Group (depending on whether the Absolute Density is in the Ecotype or Foliage Group), the number of foliage stems to be drawn for that area is calculated using a standard formula.

Note: Because foliage items are drawn in random positions there may be more overlap between items than would normally occur in nature. Therefore a specification of 100% crown closure will probably result in gaps between foliage items which would not be there if

items were evenly spaced throughout the area. To compensate for that you may wish to use two or three times the amount of crown closure to achieve the correct look for the foliage density. If you are using a Thematic Map to control crown closure you can set a multiplier value of 2 or 3 in the Thematic Map's Data page to adjust your database values appropriately.

To see the result of your density settings, render a final image from the Render Control Window.

Note: Preview renderings may not show densities accurately if your View is significantly smaller than the final rendered image size you set in the set of Render Options you're using in the Render Job. This is especially true if you are using Image Object Distance Dissolve (see below) with Common Distance Dissolve set to Absolute Pixels.

If the Density is per Polygon radio button selected on the General page, the Density field lets you specify the percentage of polygons that will be covered with the Ecotype. Enter an integer value between 0 and 100 percent or use the arrow buttons to change the value. A value of zero will cause no trees or textures to be rendered for the given Ecotype. A value of 100 will cause a tree or texture to be applied at all polygon sites where the Ecotype appears.

Note: With the Density is per Polygon radio button selected, the more polygons you have, the more trees you will have. You can increase the polygons available during rendering by increasing the Fractal Depth in the Terrain Parameter Editor. To see how it all works out you'll have to render an image.

Increase the Density value if you want to see more trees from the Ecotype. If the Ecotype is an Overstory, lower values will leave more bare spots where the Understory Ecotype can show through.

Controlling Density with a Texture

If you want to control density with a texture, click the Texture Operations Icon next to the field for the variable you want to control, which in this case is Ecotype Density.

Select the Create Texture command from the Texture Operations Icon's commands and VNS will create a new texture and open the Texture Editor. There you can edit your texture to control the variable. Wherever the Texture is white, you'll have the full density using the value you set in the Density field. Wherever the texture is gray you'll have less density and where it is black you'll have no density. This is a good way to make naturally clumpy groups of foliage.

Controlling Density with a Thematic Map

If you want to control density with a Thematic Map, click the Thematic Map Operations Icon next to the field for the variable you want to control, which in this case is Ecotype Density.

Select the Create Thematic Map command from the Thematic Map Operations Icon's commands and VNS will create a new Thematic Map and open the Thematic Map Editor. There you can select one or more Vector attributes to control the variable. In this case the density value will be inherited from the Vector attribute you select. The attribute value comes from the Ecosystem's attached Vector. This is a good way to let your GIS data control actual foliage density in VNS.

Foliage Group Controls

The following controls appear when the selected item in the Material Foliage List is a Foliage group:

Load Foliage Group Icon

Click the Load Foliage Group icon to open the Component Gallery where you can load a Foliage Group Component.

Save Foliage Group Icon

Click the Save Foliage Group icon to open the Component Signature Window where you can save the selected Foliage Group as a Component for use in other Projects.

Name Field

Whenever you create a Foliage Group VNS asks you for a name. You can change the name of a Foliage Group by selecting it in the Foliage Group list and changing it in the Name field.

Group Enabled Checkbox

Select the Group Enabled checkbox to make the Group available for rendering. Deselect it if you want to disable the Group for rendering.

Group Size Controls

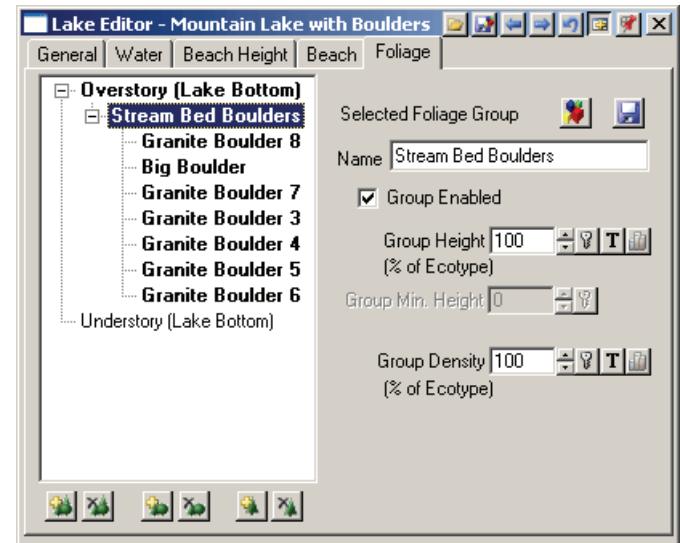
Each Foliage Group has its own size specification. This determines how large the Foliage Objects in the Group are compared to other Foliage Groups in the Ecotype. You can also adjust the relative size of each Foliage Object in the Group on the Parameters sub-page for the selected Foliage Object (see below). This gives you tremendous flexibility to customize an Ecotype.

Note: If you don't care for subtleties, just select the "Absolute Size is in Ecotype" radio button on the General page, leave all the group heights set to 100% on the Parameters sub-page for Foliage Groups and Foliage Objects and modify the values on the Parameters sub-page for the Ecotype to get the right look.

If you selected the "Absolute Size is in Ecotype" radio button on the Settings sub-page, you'll control the actual size of the Foliage Group's foliage using one of the Maximum or Mean Size fields on the Settings sub-page. You can then set the relative size of each Foliage Group here with the Group Height field as a percentage of the Ecotype's Maximum Size.

If you selected the "Absolute Size is in Foliage Group" radio button on the General page, you'll control the actual size of each Foliage Group directly instead of setting each group as a percentage of the Ecotype Size. VNS will disable the Ecotype Size controls and you can directly set a Group Size and a secondary size for each Foliage Group on the Parameters sub-page.

For a more detailed explanation of all the possible configurations you might see in the Group Size section see the section above for Ecotype Size Controls. When you select the "Absolute Size is in Foliage Group" radio button on the General page, all of the controls and options described in Ecotype Size Controls on the Ecotype page will be disabled and will instead appear in the Group Parameter sub-page.



There may also be additional buttons here to allow you to edit a diameter/height graph or an age/height graph depending on the Size Method you have chosen. Each Group can have its own different graph.

Second Size Field

The second Size field lets you control Minimum Size, Minimum Size (Percentage of Max) or Size Range (Plus or Minus Percentage) depending on your Second Size radio button selection on the General page (see above). Exactly what the labels say depends also on the Size Method selected on the Settings sub-page (see above). Second Size Field is only available if Absolute Size is in Foliage Group.

If you select the Second Size is Absolute Min (Minimum) on the Settings sub-page, the second Size field will be labelled Group Minimum Height, Group Minimum DBH, Group Minimum Age or Group Minimum Closure. Enter the size you want for the smallest foliage in the Foliage Group. When you render, VNS will place trees with a random mix of sizes from the Group Minimum Size you specified in the Minimum Size field up to the Maximum Size you specified in the Group Maximum Size field (see above).

Note: The Group Minimum Height field uses the units you selected for height on the Units page of the Preferences Window. the Group Minimum DBH field uses the units you selected for distance on the Units page of the Preferences Window.

If you select the Second Size is Min (Minimum) Percentage on the Settings sub-page, the second Size field will be labelled Group Min Height (Percentage of Max), Group Min DBH (Percentage of Max), Group Min Age (Percentage of Max) or Group Min Closure (Percentage of Max). Enter the size you want for the smallest foliage in the Foliage Group as a percentage of the Group Maximum Size field. When you render, VNS will place trees with a random mix of sizes from the Group Minimum Size percentage you specified in the Group Min Size (Percentage of Max) field up to the Maximum Size you specified in the Group Maximum Size field (see above).

If you select the Second Size is Plus or Minus Percentage on the Settings sub-page, the second Size field will be labelled Group Height Range (Plus or Minus Percentage), Group DBH Range (Plus or Minus Percentage), Group Age Range (Plus or Minus Percentage) or Group Closure Range (Plus or Minus Percentage). Enter the size you want for the largest and smallest foliage in the Foliage Group as a percentage above and below the value in the Group Mean Size field. When you render, VNS will place trees with a random mix of sizes ranging above and below the value you specified in the Group Mean Size field (see above).

If you wish you can control the group's size with a Thematic Map or a texture. See the Ecotype Size Controls section above for more details. Each Foliage Group can have its own size texture or Thematic Map. It can be very useful to drive the size of each group separately from a different database attribute depending on the design of your database. Thematic Maps can be used to adjust group relative percentages too if the Absolute Size is in Ecotype. In that case the Thematic Map should generate values of percentage ranging from 0 to 100. Otherwise Thematic Maps should generate values in meters of height or diameter. Age has no specific units. Closure should generate values of percentage from 0 to 100, or higher if needed.

Group Density Percentage Controls

Each Foliage Group has its own density specification. This determines how often the object is repeated compared to other Foliage Objects in the Ecotype. You can also adjust the density of each Foliage Object in the Group on the Parameters sub-page for the selected Foliage Object (see below). This gives you tremendous flexibility to customize an Ecotype.

Note: If you don't care for subtleties, just select the "Absolute Density is in Ecotype" radio button on the Settings sub-page, leave all the densities set to 100% on the Parameters sub-page for Foliage Groups and Foliage Objects and tweak the values on the Ecotype page to get the right look.

If you select the Absolute Density is in Foliage Group radio button on the Settings sub-page (see above) you can then set the absolute density of each Foliage Group on the Parameters sub-page.

If you select the Absolute Density is in Ecotype radio button on the Settings sub-page you can then set the density of each Foliage Group as a percentage of the Ecotype's overall density.

In either case you can set the density of individual Foliage Objects on the Objects page as a percentage of the Group's density.

VNS lets you choose whether to have the foliage density be linked to the polygon density for more efficient rendering or be a constant across the terrain. Polygon density is increased near the Camera when you render with Variable or Fractal Maps options on the Terrain Parameter Editor. For forestry work you will almost always use Density is per Unit Area for timber ecotypes. For understorey vegetation you might prefer to use Density is per Polygon for speedier rendering where the density is not very critical.

The Parameters sub-page's Group Density fields work differently depending on whether you select the "Density is per Polygon" or "Density is per Unit Area" radio button on the General page.

If you selected the "Absolute Density is in Ecotype" radio button on the Settings sub-page, you'll control the actual density of the Foliage Group's foliage using one of the density fields on the Parameters sub-page. You can then set the relative density of each Foliage Group here with the Group Density field as a percentage of the Ecotype's Density.

If you selected the "Absolute Density is in Foliage Group" radio button on the Settings sub-page, you'll control the actual density of each Foliage Group directly instead of setting each group as a percentage of the Ecotype Density. VNS will disable the Ecotype Density controls and you can directly set a Group Density for each Foliage Group on the Parameters sub-page.

For a more detailed explanation of all the possible configurations you might see in the Group Density section see the section above for Ecotype Density Controls. When you select the "Absolute Density is in Foliage Group" radio button on the Settings sub-page, all of the controls and options described in Ecotype Density Controls on the Ecotype page will be disabled and will instead appear in the Parameters sub-page for the selected Foliage Group. There may also be additional controls here to allow you to select special units such as for basal area.

To see the result of your density settings, render a final image from the Render Control Window.

Note: Preview renderings may not show densities accurately if your View is significantly smaller than the final rendered image size you set in the set of Render Options you're using in the Render Job. This is especially true if you are using Image Object Distance Dissolve (see below) with Common Distance Dissolve set to Absolute Pixels.

If the Density is per Polygon radio button selected on the Settings sub-page, the Group Density field lets you specify the percentage of polygons that will be covered with the Foliage Group. Enter an integer value between 0 and 100 percent or use the arrow buttons to change the value. A value of zero will cause no trees or textures to be rendered for the given Group. A value of 100 will cause a tree or texture to be applied at all polygon sites where the Group appears.

Note: With the Density is per Polygon radio button selected, the more polygons you have, the more trees you will have. You can increase the polygons available during rendering by increasing the Fractal Depth in the Terrain Parameter Editor. To see how it all works out you'll have to render an image.

Increase the Group Density value if you want to see more trees from the Foliage Group. If the Ecotype is an Overstorey, lower values will leave more bare spots where the Understorey Ecotype can show through.

If you wish you can control the group's density with a Thematic Map or a texture. Thematic Maps should generate values of percentage ranging from 0 to 100.

Foliage Object Controls

Image Object or 3D Object Radio Buttons

These radio buttons let you select whether the selected Foliage Object should be an Image Object or a 3D Object.

If you select the Image Object radio button, VNS will show the Image Object section at the bottom of the Objects page (see below). There you can select an Image Object and adjust its properties.

If you select the 3D Object radio button, VNS will show the 3D Object section at the bottom of the Objects page (see below). There you can select a 3D Object and adjust its properties.

Enabled Checkbox

The Enabled checkbox lets you enable or disable the selected Foliage Object for rendering. Disabled Foliage Objects are shown in gray in the Foliage Objects list.

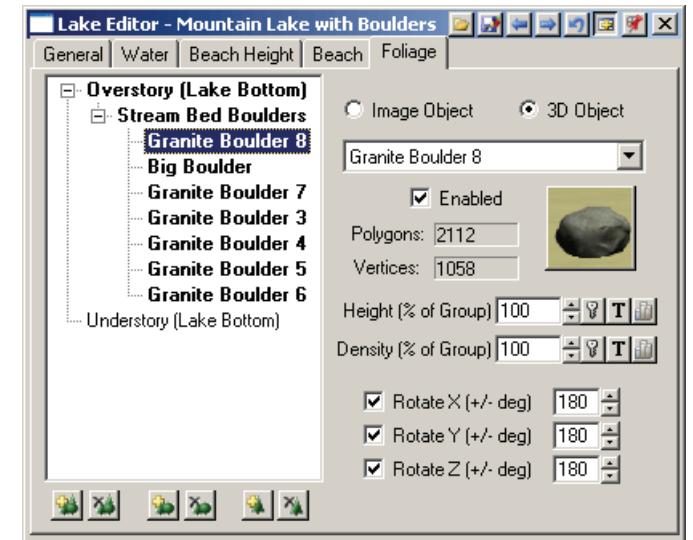


Image Object Options

Image Object Drop Box

Select an Image Object in the Image Object drop box. VNS will replace the selected Foliage Object in the Foliage Objects list (see above) with the Image Object you choose.

If you want to load a new Image Object, select "New Image Object." VNS will open a file requester where you can select a new Image Object. Image Objects can be images or image sequences in any supported format (see Image Loading and Saving).

Width, Height and Image Bands Display Fields

The Width, Height and Image Bands display fields show the pixel dimensions and number of 8-bit image bands of the Selected Image Object.

Thumbnail

The Thumbnail shows a small version of the selected Image Object. You can double-click it if you want to see the full version.

Random Flip X Checkbox

Select the Random Flip X checkbox to have VNS randomly reverse the Image Object from left-to-right during rendering. This will give you more variety in the foliage since the selected Image Object will appear in different places in normal and reversed versions.

Apply 3D Shading Checkbox

Select the Apply 3D Shading checkbox to tell VNS to shade the Image Object based on the direction of the light. This will give foliage a more 3-dimensional appearance.

Replace Gray Color Controls

By using unique colors for a Group of images or even individual Foliage Objects you can create a scene of nearly unlimited color variety. You can animate colors to create a kaleidoscopic landscape. Change the color of maple trees first, then the birches followed by the oaks and leave the conifers green, and voila - New England in October.

Each Image Object has its own color specifications. The color for each image can come from the Image Object itself or from a color. If it comes from a color, you can animate that color. You can edit the colors for the selected Image Object by clicking the Replace Gray color well to open the Color Editor.

Note: This only works for gray scale images, or images that have been set to gray scale in the Image Object Library. If the Image Object contains a color image and it has not been changed to gray scale in the Image Object Library, the Replace Gray color well will be disabled.

You can change the Gray Replacement Color for a gray-scale Image Object independently at any time or leave it with the color it inherited when you added the Image Object.

Note: Gray Scale Images require 1/3 the amount of memory that 24 bit color images require when rendering.

Height Percentage Controls

Each Foliage Object has its own height specifications. These determine how tall the object is compared to other objects in the Ecotype.

The Height Percentage field for the currently selected Foliage Object is a percentage of the number entered in the Group Height field for the Foliage Group on the Groups page (see above).

If you wish you can control the object's height with a Thematic Map or a texture.

Density Percentage Controls

Each Foliage Object has its own density specifications. These determine how often the object is repeated compared to other Foliage Objects in the Ecotype.

Density of coverage for a Foliage Object is based on its Density within its group (set with the Density Percentage field for the selected Foliage Object), the group's Density in the Ecotype (set with the Group Density field on Group page for the selected Group).

If you wish you can control the object's density with a Thematic Map or a texture.

Back Light Percentage Field

The Back Light Percentage field lets you allow light to shine through backlit Image Object foliage. The default value is 25%. You can set it higher than 100%.

Use the Back Light Percentage when the Camera is looking into the light and the foliage looks too dark. It allows light to be transmitted through the leaves. This will brighten the foliage and increase color saturation. The result can be much more realistic small vegetation when the vegetation is backlit.

You can adjust the Back Light Percentage individually for any Foliage Object by selecting it in the Foliage Objects list and changing the value in the Back Light Percentage field. You can increase the Back Light percentage to brighten objects that are between the Camera and a light. Decrease it if you want a silhouette effect.

Apply to Group Button

Click the Apply to Group button if you want to set the Back Light Percentage of all members of the Group to be the same as the value in the Back Light Percentage field (see above). This is much faster than setting the Back Light Percentage individually for each member of the Group.

If the Back Light Percentage for the current Foliage Object has key frames, they will also be copied to the other members of the Group.

3D Object Options

Rotate X, Y and Z Checkboxes and Fields

The Rotation controls let you add random rotation to the current 3D Object. Select a checkbox and enter a value and VNS will randomly rotate the object along that axis every time it places it on a Vector vertex, within the rotation limit you set.

The X axis runs east to west. A positive X axis is to the east. The Y axis runs vertically. A positive Y axis is up. The Z axis runs north to south. A positive Z axis is to the north.

Enter a number in the X Field to rotate the 3D Object around the X axis. Enter a number in the Y Field to rotate the 3D Object around the Y axis. Enter a number in the Z Field to rotate the 3D Object around the Z axis.

A value of zero in any field means no rotation for that axis.

Polygons, Vertices and Materials Display Fields

The Vertices display field shows the number of vertices in the current 3D Object. The more vertices there are, the longer it will take to render. VNS does not impose a limit to the number of vertices an object may have, other than the limit imposed by the available memory on your system.

The Polygons display field shows the number of polygons in the current 3D Object. The more polygons there are, the longer it will take to render. VNS does not impose a limit to the number of polygons an object may have, other than the limit imposed by the available memory on your system.

The Materials display field shows how many materials there are in the current 3D Object. A Material is a texture applied to groups of polygons within the object. For example, a car object may have a body Material, a bumper Material, a tire Material and a glass Material. You can edit the properties of each Material using the 3D Material Editor.

Height Percentage Controls

Each Foliage Object has its own height specifications. These determine how tall the object is compared to other objects in the Ecotype.

The Height Percentage field for the currently selected Foliage Object is a percentage of the number entered in the Group Height field for the Foliage Group on the Groups page (see above).

If you wish you can control the object's height with a Thematic Map or a texture.

Density Percentage Controls

Each Foliage Object has its own density specifications. These determine how often the object is repeated compared to other Foliage Objects in the Ecotype.

Density of coverage for a Foliage Object is based on its Density within its group (set with the Density Percentage field for the selected Foliage Object), the group's Density in the Ecotype (set with the Group Density field on Group page for the selected Group).

If you wish you can control the object's density with a Thematic Map or a texture.

Light Editor

VNS lets you have multiple lights. They can be any combination of omni-directional, spotlight, parallel or distant lights.

The Light Editor lets you adjust the type, position and intensity of a Light. You can also adjust shadow and Atmospheric parameters and access color control.

Lights can interact with the Sky. Lights set to Distant on the General page will affect the Sky Gradient's "Toward Light/Away from Light" axis, based on their intensity and color. You'll be able to see a preview of this on the Sky Gradient thumbnail, on the Color Gradients page of the Sky Editor. You'll also see the results when you render. Non-distant lights will not affect the sky.

You'll see Key Frame and TimeLine icons next to the fields of every animatable Parameter.

Using the Include/Exclude list you can now have lights only affect certain components within your scene, or explicitly not affect certain components. This would allow you, for example, to easily add illumination to a foreground 3D Object without affecting surrounding foliage.

General Page

General Features

Name Field

Enter a name for the Light. For example, if it is your main light for the sun, you might call it simply "Sun Light".

By default VNS will name new lights "Light", and add a number after the name if there is more than one light named "Light".

Enabled Checkbox

Use the Enabled checkbox to enable or disable the Light for rendering.

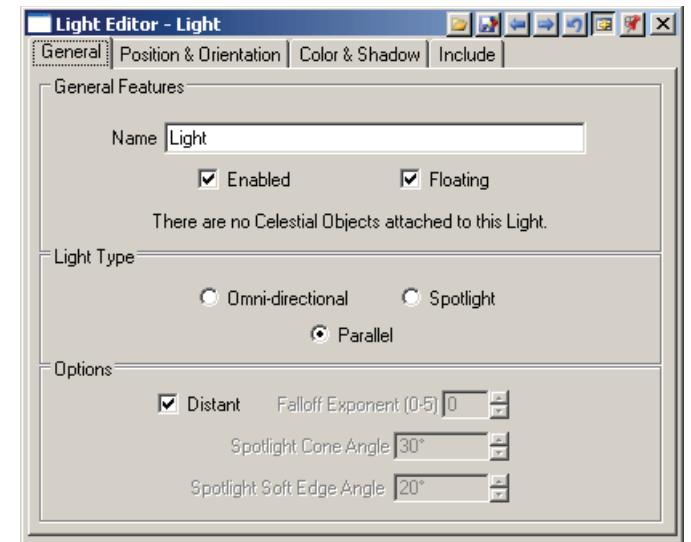
If you disable a Light it will not lose its parameter values. It may be useful to temporarily disable a particular Light to see how the scene looks without it, or to speed preview rendering when you're working on some other aspect of your scene.

Make sure you remember to enable the Light for the final rendering if you want VNS to render it.

Note: For the Light to affect your rendering, it must shine light into an area visible to the Camera you selected for the Render Job you are using (see Render Job Editor), and Lights must be enabled in the Render Options you are using (see Render Options Editor).

Floating Checkbox

Click the Floating Checkbox to cause the Light to float. VNS will position the Light where it can see as much of the terrain as possible. If you add more terrain, the Light will move to keep the new terrain in view where possible.



Making a Light float will delete any positional key frames the Light may have. If the Light has key frames, VNS will ask you before deleting the key frames and floating the Light.

As soon as you change the Light's position in any way, VNS will deselect the Floating checkbox automatically.

Attached Celestial Objects Message

The Attached Celestial Objects message tells you if there are any Celestial Objects attached to the Light. By attaching Celestial Objects to Lights you can have an image or animation appear where the Light appears. For example, you can have an image of the sun appear where the sun Light appears.

Light Type Radio Buttons

Choose Omni-directional, Parallel or Spotlight. All Light types can cast shadows.

Omni-directional

An omni-directional Light projects light in all directions like a bare light bulb. Use this for uncovered streetlights, firelight, etc. Omni-directional lights have no need for rotation, therefore there is no heading, pitch or targeting settings available on the Position and Orientation page when you select this type of Light.

You can set the position on the Position and Orientation page (see below). VNS shows Omni-directional Lights as OpenGL spheres in Realtime Views.

Parallel

A parallel Light projects light along one axis throughout the scene. A parallel Light set to Distant (see below) is a good choice for your main sunlight because it simulates the way the sun's rays are virtually parallel when they hit the earth.

You can set the position, heading, pitch and targeting on the Position and Orientation page (see below). VNS shows Parallel Lights as OpenGL tubes in Realtime Views.

Spotlight

A spotlight is a light that projects in a cone. Spotlights are good for things like street lights, search lights and for highlighting specific areas of a scene.

You can set the cone and soft edge angles in the Options section (see below). You can set the position, heading, pitch and targeting on the Position and Orientation page (see below). VNS shows Spotlights as OpenGL cones in Realtime Views.

Options Section

Distant Checkbox

The Distant checkbox, when selected, forces the light to 1 Astronomical Unit (AU) from the terrain, mimicking light from the sun itself. Regardless of light type selected, when enabled, the falloff, Cone angle and softedge angle fields will be grayed out, as will the controls in the orientation section of the Position and Orientation page (see below).

When this checkbox is enabled, the play of light on the terrain is directly related to the light's lat/lon position relative to the geographic bounds of the terrain model in question.

Falloff Exponent Field and Buttons

The Falloff Exponent field lets you control how the amount of light diminishes as it gets further from the light source. The larger the value, the more the light diminishes over distance. The lower the value, the less the light diminishes.

A value of zero means there is no falloff. Five falls off very fast. Decimals are allowed.

A value of 2 is considered the "scientifically correct" value. In some scenes it may look better to try a bit less, like 1.5.

Spotlight Cone Angle Field and Buttons

The Spotlight Cone Angle field lets you set the angle the hot spot of the light will cover. This is the area of bright light inside of any soft edge you may add (see below).

Spotlight Soft Edge Angle Field and Buttons

The Spotlight Soft Edge Angle field lets you set an additional angle of added falloff of light brightness, which is added at the outside of the Spotlight Cone Angle (see above). Adding a soft edge lets you create a natural transition around the outside of the light cone from full brightness to no brightness.

Position and Orientation Page

Position Controls

The Position controls let you specify where the Light should be.

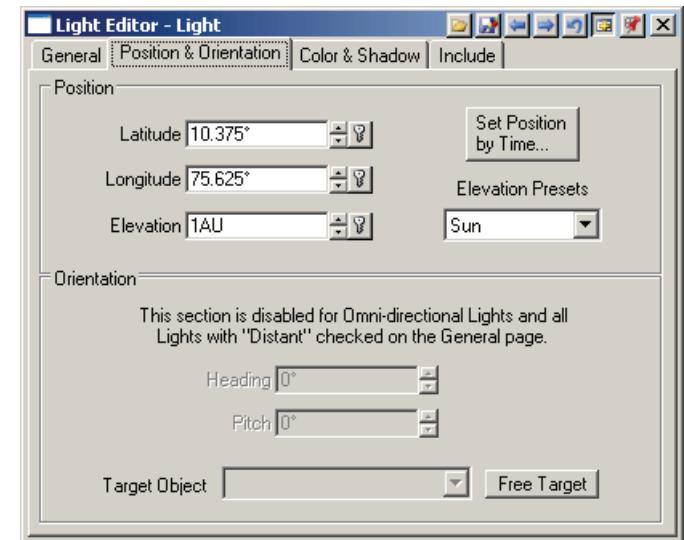
Note: If you want to place a Light on or just above the terrain, select the Light as the Active Object and control-click in any View. VNS will position the Light where you click and ask for an Elevation.

Latitude, Longitude and Elevation Fields

Light Latitude, Longitude and Elevation are members of the Light Group. They let you position the Light over the terrain.

The Latitude field lets you position the north-south position of the point at which the Light is directly overhead. The maximum is 90.0 degrees, which is directly over the north Pole. The minimum is -90.0 degrees, which is directly over the south Pole.

The Longitude field lets you position the east-west position of the point at which the light source is directly overhead. Although there are only 360 degrees of longitude around the planet, the maximum is 1 million degrees and the minimum is negative one million degrees. This lets you fly the light in multiple orbits around the planet if you wish.



The Elevation field lets you specify the distance of the Light from the Earth's surface. You can enter a value directly or choose the distance of common solar system objects from the Elevation Presets drop box.

It's worth taking the time to experiment with Light Latitude, Longitude and Elevation. Small changes in the angle of the light can create big changes in the look of your images.

You can see the position and result of the Light in Views.

Set Position by Time Button

Click the Set Position By Time Button to open the Light Position By Time Window. Here you can position the Light by entering a date and time and VNS will put the Light where the sun would be at that time. This works best for an Omni-directional Light set to Distant on the General page.

The Light Position window makes it easy to light your terrain with the light at any time of day. For example if you want morning light, enter a time in the morning.

Orientation Controls

Enabled Message

At the top of the Orientation section is this reminder: "This section is disabled for Omni-directional Lights and all Lights with "Distant" checked on the General page."

Another way to put it is that the Orientation controls let you rotate and target Parallel Lights and Spot Lights, as long as they are not set to "Distant."

Heading Field

The Heading field lets you rotate the direction of the Light from left to right.

Pitch Field

The Pitch field lets you rotate the direction of the Light up and down.

Target Object Drop Box

The Target drop box lets you tell VNS to aim the Light at any 3D Object in your Project. Select a 3D Object from the drop box if you want the Light to point at that object.

Free Target Button

Click the Free Target button if the Light has a Target Object and you no longer want the Light to point at that object.

Color & Shadows Page

Color Controls

Light Color & Intensity Color Well and Buttons

Click the Light Color & Intensity color well to open the Color Editor. There you can adjust the color and intensity of the Light. VNS will shade the elements in your scene with the Light based on its color, intensity, position and falloff.

Use the Keyframe icon to add, remove and adjust keyframe values for this parameter. This allows you to animate the light color and/or intensity over time.

By using the Texture Operations Icon, you can open the Texture Editor, allowing you to texture your lights. This is useful for simulating non-specific shadows or shadows cast by off screen elements.

For example, you could use a black and white image of a French Window, where the wood areas were black and the glass areas white, as a “cookie cutter” or “gobo”. Apply this image as a texture to a spotlight, and you can simulate light streaming through French Windows. Alternatively, using an animated turbulence texture on a light, especially one which is shining through a volumetric atmosphere, can give some very realistic “swirling dust” effects.

By using Dynamic Parameters to drive light intensity and/or color, some amazing effects can be achieved.

Edit Ambient Button

Click the Edit Ambient button to open the Atmosphere Editor where you can edit the Ground and Sky Ambient Light colors and intensities. The Ambient Lights recreate the effect of light bouncing off the sky and ground. They give your scene a basic light level which is especially noticeable in shadowed areas.

Shadow Controls

Cast Shadows Checkbox

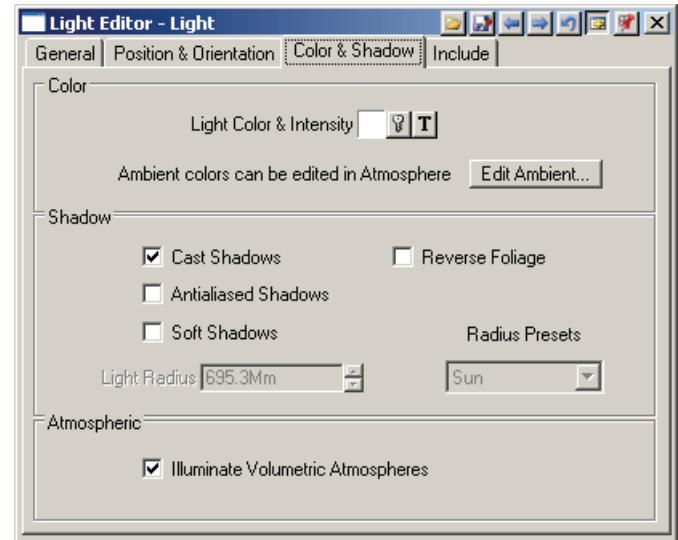
Select the Cast Shadows checkbox if you want the Light to be able to cast shadows.

Note: In order to see shadows you will also have to have at least one Shadow Component to receive shadows, and enable shadows for 3D Objects, Atmospheres and Cloud Models if you wish.

The light will cast hard-edged shadows unless you select the Antialiased Shadows checkbox or the Soft Shadows checkbox.

Antialiased Shadows Checkbox

Select the Antialiased Shadows checkbox if you want the Light to cast shadows with slightly softened edges.



Soft Shadows Checkbox

Select the Soft Shadows checkbox if you want the Light to cast shadows with softer edges. The softness of the shadows depends on the Light Radius (see below).

Reverse Foliage Checkbox

When backlit, foliage objects cast reversed shadows. That is to say, the shadows will appear in the correct position in the scene relative to light position, but they will be “flipped” as if generated by a light coming from behind the camera. This is a symptom of the way in which VNS calculates shadow maps. By selecting this checkbox, you force VNS to flip the shadow map or maps for this light, so that shadows cast by this light will be oriented properly. You should only use this checkbox if your light is in front of the camera and objects between it and the camera have shadows enabled. Even when these conditions apply, you sometimes will be unable to notice the discrepancy between foliage object and shadow, but in those circumstances where you can, this checkbox should solve the problem.

Light Radius Field and Presets Drop Box

The Light Radius field and Presets let you specify how big the light source is for the purpose of calculating how soft the shadows will be. A larger Light Radius will create a softer shadow.

This matters if you select the Soft Shadows checkbox (see above).

This also lets you set the size of the OpenGL visualization of the Light in Views. You can adjust the Light size by momentarily enabling Soft Shadows and adjusting the Light Radius. If you disable Soft Shadows again the size will still be used for the OpenGL Light display.

Atmospheric Controls

Illuminate Volumetric Atmospheres Checkbox

Select the Illuminate Volumetric Atmospheres checkbox if you want Volumetric Atmospheres to react to this Light.

Include Page

Include/Exclude Controls

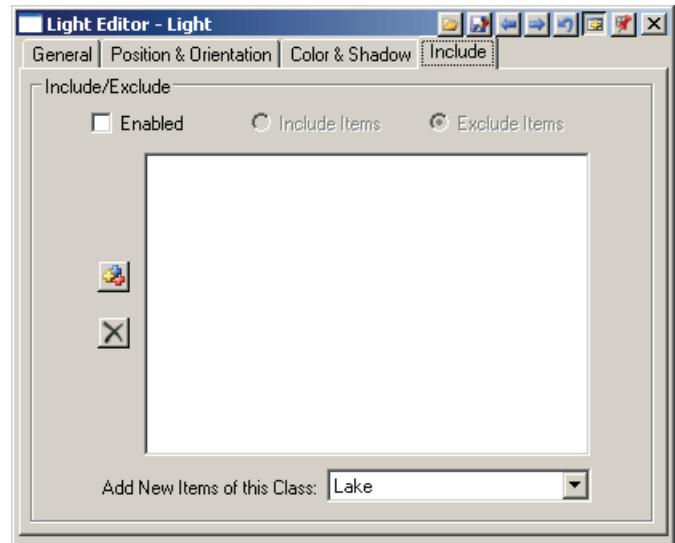
Enabled Checkbox

Select this checkbox to enable the Include/Exclude list for evaluation. How the contents of this list are evaluated, will depend upon which of the two Radio Buttons has been selected.

Include/Exclude Items Radio Buttons

Select the Include Radio Button to have the current light affect only the items in the Include/Exclude List.

Select the Exclude radio Button to have the current light affect all items in the scene apart from those in the Include/Exclude List.



Include/Exclude List

This is where a list of included/excluded components is built. Items in this list are either included or excluded from this light's effects, depending upon which Radio Button is selected.

Add Include/Exclude Items Icon

Clicking this icon will bring up a list of all items of the selected class. If there are no items of the selected class in the scene, you will receive a message warning you of such. To avoid this, before adding a new item, make sure you have selected the correct class of item from the dropdown list at the bottom of the editor window.

Remove Include/Exclude Items Icon

Clicking this icon will delete the currently selected item from the Include/Exclude list. If there are no items currently selected, you will receive a message warning you of such.

Add New Items of this Class Dropdown List

Clicking this dropdown list will present you with a list of available item classes (Lakes, Ecosystems, Cloud Models etc.). Select the class of object you wish to add to the list before clicking the Add Include/Exclude Items Icon.

Material Strata Editor

The Material Strata Editor lets you edit Strata for Ecosystem, Ground Effect and Beach Materials.

To open it, click the Strata Operations Icon on the Material page of the Ecosystem Editor, the Material page in the Ground Effect Editor or the Beach page on the Lake Editor or Stream Editor. You'll see the Strata Operations command menu which will show you the Strata commands currently available.

Click the Create Strata command to create Strata if none exists for the Material. Click the Edit Strata command to edit Strata if it exists. VNS will open the Material Strata Editor.

Strata are lines and colors that simulate the effect of millions of years of sediment forming into layers of rock.

Material Strata are rendered along with any Diffuse Coloring or textures you may have in an Ecosystem, Ground Effect or Beach Material.

VNS first renders the Material's Diffuse Color without a texture. If you enabled Strata Band Colors, VNS replaces the Diffuse Color with the Strata Band Color. Then it looks at any texture on the Diffuse color. Texture opacity determines how much base color or strata shows, and how much the texture shows. If you enabled Strata Lines, VNS adds them on top, which darkens the colors along lines to simulate stratification boundaries.

Strata Enabled Checkbox

Select the Strata Enabled checkbox to enable the strata patterns for the Material. Deselect the Strata Enabled checkbox if you don't want to see strata patterns for the Material.

Note: The name of the Material is in the Material Strata Editor's title bar.

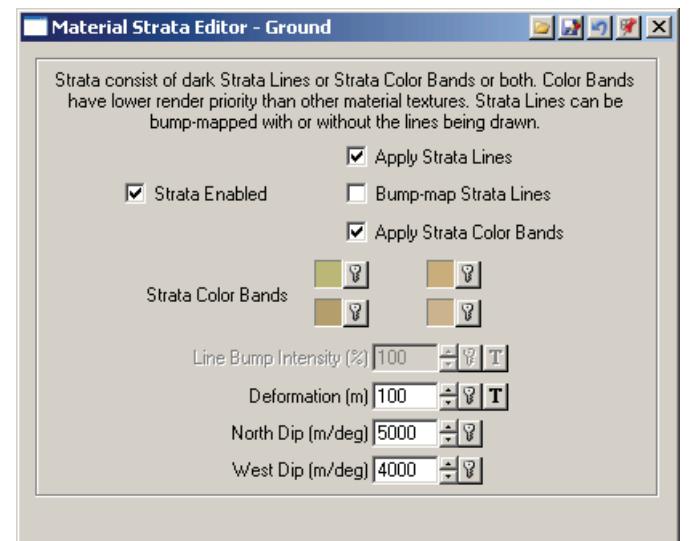
Apply Strata Lines Checkbox

Strata can have either or both of two components: dark separation lines and Color Bands. At the break between two different rock layers, due to the difference in hardness, the break point is eroded deeper in the cliff creating shadowed bands.

Select the Apply Strata Lines checkbox if you want to add dark line patterns to simulate the eroded boundaries of exposed rock strata.

After textures are applied, VNS will apply dark strata lines to simulate the erosion between layers as a displacement of the surface; a sort of bump mapping. The dark bands will reduce specularity on the surface of the rock in proportion to the darkness of the strata lines.

To make the lines appear etched into the surface of the rock, select the Bump-map Strata Lines checkbox (see below).



Bump-map Strata Lines Checkbox

Select the Bump-map Strata Lines checkbox to cause strata lines to appear like grooves cut into the surface of the Material. If you don't select the Apply Strata Lines checkbox (see above), VNS will create the appearance of grooves without the lines.

You can set the amount of bump mapping with the Line Bump Intensity Percentage field (see below).

Bump mapping lets you simulate detailed relief shadowing without requiring dense geometry. Shadowing is calculated by using the Strata Lines to vary the apparent surface normal across each polygon. This makes strata appear to be indented into the Material.

Apply Strata Color Bands Checkbox

Select the Apply Strata Color Bands checkbox if you want to add colored bands to simulate layers of exposed rock strata.

VNS will evaluate Strata Band Colors first. VNS will replace the Ecosystem, Beach or Ground's Diffuse Color with the Strata Band Colors. Then VNS will apply Ecosystem or Ground texture over that.

By using less than 100% opacity for the texture, you can blend the texture with the strata. For example, this will let you create a varnished desert look of blotchy patterns over strata.

Strata Band Color Wells

When you select the Strata Band Colors checkbox VNS will add colored strata using the Strata Band Colors shown in the color wells. These bands of color are applied in varying widths.

Click any color well to open the Color Editor where you can change these colors to whatever is appropriate for your scene, such as shades of dark brown, red or gray.

Line Bump Intensity Percentage Field

The Line Bump Intensity Percentage field lets you control the amount of bump mapping. 100 percent is full bump mapping and 0 percent is no bump mapping. You can exaggerate the bump mapping by entering a value larger than 100.

Deformation Field

You can change the slope of the stratification throughout the rocks in your scene. One way to do so is to set the Dip fields on the Strata page of the Ecosystem Editor. Another way is to use a texture to create complex folding of strata through the rocks in your scene. You can combine these two methods.

Where the texture is at 100% VNS will use the Deformation elevation in the Deformation field. Where the texture is zero VNS will use the original elevation.

North Dip Field

Enter a value in degrees into the North Dip field if you want to angle the strata downward toward the north. Enter a negative value to angle the strata downward toward the south.

West Dip Field

Enter a value in degrees into the West Dip field if you want to angle the strata downward toward the west. Enter a negative value to angle the strata downward toward the east.

Planet Options Editor

The Planet Options Editor lets you adjust terrain scaling and planet size, select a Coordinate System and control planet rotation.

General Page

General Features

Name field

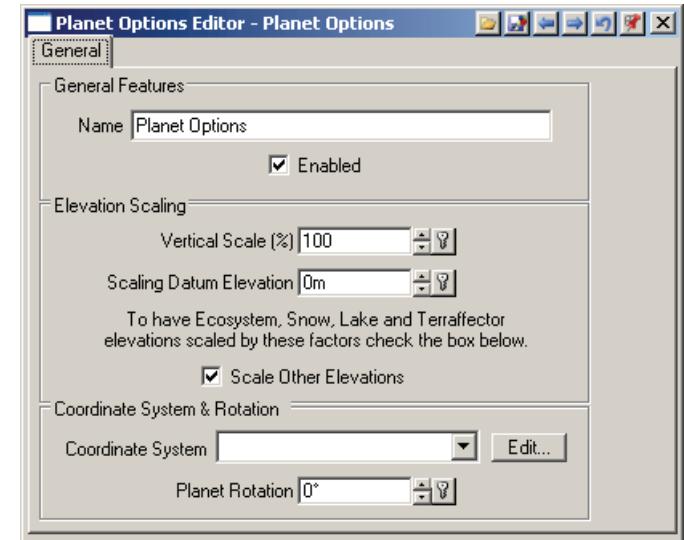
Enter a name for the Planet Options. For example, if it is set up to the specifications of Mars, you might call it simply "Mars".

By default VNS will name new Planet Options "Planet Options", and add a number after the name if there is more than one set of Planet Options named "Planet Options".

Enabled Checkbox

Use the Enabled checkbox to enable or disable the Planet Options for rendering.

If you disable a set of Planet Options it will not lose its parameter values.



VNS can only render one Planet Options at a time. If you have more than one set of Planet Options in your Project VNS will only allow one set to be enabled. When you enable a set of Planet Options, VNS will automatically disable any other Planet Options.

Elevation Scaling Controls

Vertical Scale Percentage Field

The Vertical Scale percentage field lets you change the terrain height.

A Vertical Scale of 100% is normal unscaled terrain. A Vertical Scale greater than 100% will make the terrain taller and less than 100% will shrink the terrain height. For example 200% is twice the normal terrain height while 50% is half the normal terrain height.

Negative numbers invert the terrain.

Technically what the Vertical Scale Percentage does is change elevation values relative to the Scaling Datum elevation. You can set the Scaling Datum elevation with the Scaling Datum field (see below).

Vertical Scaling can be relative to sea level if you set the Scaling Datum Elevation to zero (the default value), but it can also be relative to any other elevation you set with the Scaling Datum Elevation field.

Note: Sea Level is the surface of the Project Coordinate System's Ellipsoid, which is an elevation of zero. You can see the Project's Coordinate System in the Coordinate System drop box (see below).

Vertical Scaling is useful for enhancing shading when low resolution or low relief DEMs are being used. For instance, when using the low resolution global DEM set, a positive Vertical Scaling value will enhance the appearance of significant topography. In this case you should enable the “Scale Other Elevations” checkbox so that Ecosystems are not altered by the added relief.

The effects of the Vertical Scaling Percentage can also change shading and produce new elevation conditions for Beaches or simply create vertical distortion of the existing shading and Ecosystems, depending on the state of the “Scale Other Elevations” checkbox (see below).

Scaling Datum Elevation Field and Buttons

Datum is the elevation that is considered the reference elevation from which the terrain is exaggerated when you use Vertical Scaling (see above).

For example, lets say you have a Vertical Scale of 200% for terrain with a high point of 1000 meters. If you use a Scaling Datum of zero the high point of the terrain would scale to 2000 meters. If you use a Scaling Datum of 500 you'd end up with terrain scaling to 1500, and an elevation of zero scaling down to negative 500. If you use a Scaling Datum of 1000, the high point wouldn't change at all, but elevations of zero would become negative 1000.

Hint: If you use the camera's elevation as the datum then the terrain will expand around that elevation.

Scale Other Elevations Checkbox

Select the Scale Other Elevations checkbox if you want Ecosystem, Snow, Lake and Terraffector elevations to move with the landscape when you change the Vertical Scale (see above). This is useful when you are using Vertical Scaling to increase terrain relief. You might do this if you are using VNS to create a map and want to make the map more readable.

For example, if you use Vertical Scaling to enhance the relief of the terrain, if there's any snow it will stay at the same longitude and latitude position no matter how tall or short the mountains appear to be. Also, if you make mountains taller, the shading from the Sun will not change.

Deselect the Scale Other Elevations checkbox if you DON'T want Ecosystem, Snow, Lake and Terraffector elevations to move with the landscape when you change the Vertical Scale. For example, this lets you animate mountains into and through various Ecosystems.

This is a more realistic effect if you are simulating the birth of a mountain range. If you use Vertical Scaling to grow mountains, snow will not appear until the mountains grow above the snow line.

Coordinate System & Rotation Section

Coordinate System Drop Box

The Coordinate System drop box lets you select a Coordinate System for your Project.

If no Coordinate System is visible, VNS will use Geographic-WGS84. This is the case when you start a new Project.

If you want to use a different Coordinate System for the Project you can create a new Coordinate System Component in the Scene-At-A-Glance and select it in the Planet Options Editor's Coordinate System drop box. If you have other Coordinate Systems in the Project, such as any which were added by the Import Wizard when you imported projected data, they will appear in the Coordinate System drop box.

Note: You can create a new Coordinate System by selecting the Coordinate System category in the Scene-At-A-Glance and clicking the Add or Clone Selected Item icon.

The Ellipsoid defined in the Coordinate System you select in the Planet Options Editor affects the shape of the final rendering. Data that otherwise does not have a Coordinate System attached to it individually will use the Coordinate System selected in the Planet Options Editor. If you set your Project Preferences to display in projected coordinates, VNS will convert everything into this Coordinate System for display and editing.

Coordinate System Edit Button

Click the Coordinate System Edit button to open the Coordinate System Editor. There you can edit the Project's Coordinate System.

Post Process Editor

The Post Process Editor is where you create Post Process effects by combining Post Process Events. Post Processes can be applied to your rendered output through the Post page of the Render Options Editor.

The Editor consists of three pages, not all of which will contain adjustable parameters, depending upon which Post Process Event is selected in the Post process Event List.

Common Controls

There follows a description of all controls common to all Post Process Events. Controls specific to a particular Event type, including the page on which they are located are detailed in sections specific to each Post Process Event which follow the more general list. Most of the controls on the General Page of the editor are common to all Post Process Event types.

General Features Section

Name Field

This field provides you with the ability to name each Post Process Component that you create. Enter a name for the event or combination of events that make up this Post Process component.

Enabled Checkbox

Selecting this checkbox enables this Post Process component for selection on the Post page of the Render Options Editor. Deselecting this checkbox will result in this Post Process being unavailable for addition to the Post list for a Render Job.

Preview Only Checkbox

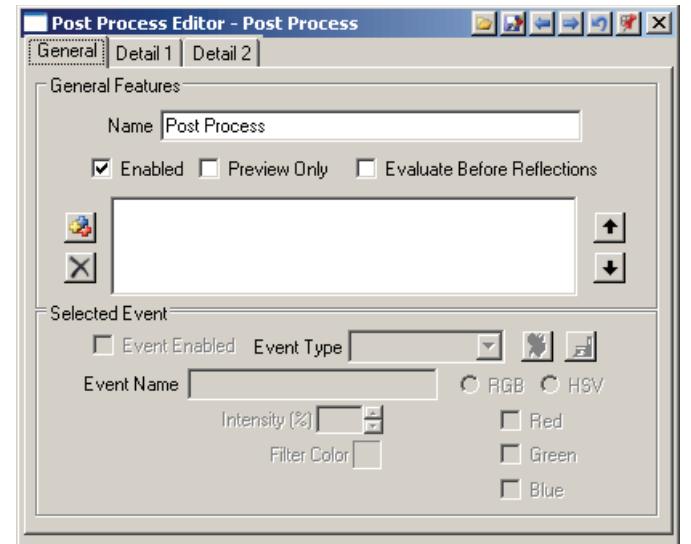
Selecting this checkbox will apply the current Post Process settings to the preview render in an active view. This allows you to modify the settings and gain near-realtime feedback as to how your changes will affect rendered output. Deselect this checkbox if you find that, due to the complexity of the component created, each change in the interface takes unduly long to refresh the rendered view.

For Post Processing to be applied, the selected Post Process Components must be enabled and added to the Post Page of the current set of Render Options in the Render Options Editor.

Evaluate Before Reflections Checkbox

Select this checkbox if you wish the effect of Post Process events to be calculated before the reflection pass occurs. This allows reflective surfaces to reflect the effects of Post Process events such as Composite and Text Overlay.

Note: When performing Compositing using the Post process Composite Event, you will be prompted to enable this checkbox, if you have not already. It is highly recommended that you do so.



Post Process Event List

This space contains a list of all Post Process Events that contribute towards creating the final Post Process component. Events are applied to the rendered image in order from the top of the list to the bottom.

Add Post Process Event Icon

Click this icon to add a Gamma Post Process Event to the Post Process Event list. The type of event can be changed at will by selecting a new event type from the Event Type Dropdown List.

Remove Post Process Event Icon

Clicking this icon will remove the selected Post Process Event from the Post Process Event List.

Raise Post Process Event Rendering Priority Icon

Click this icon to move the selected Post Process event higher in the list. The event at the top of the list will be applied to rendered output first.

Lower Post Process Event Rendering Priority Icon

Click this icon to move the selected Post Process event lower in the list. The event at the bottom of the list will be applied to rendered output last.

Selected Event Section

Event Enabled Checkbox

Selecting this checkbox will enable the currently selected event as part of the current Post Process component. Deselecting this checkbox will disable the currently selected event, but will not remove it from the Post Process Event List, or alter any of its settings.

Event Type Dropdown List

Click this dropdown list to display and select the different Post Process Event Types available. To change an existing event type, select the event in the Post Process Event List and select a new event type from the Event Type Dropdown List.

Load Post Process Event Component From Gallery Icon

Click this icon to open the Component Gallery. From there you can select and load Post Process Events previously saved as components.

Note: This is not the same as loading a Post Process Component from the Component Gallery, although this is possible also, by clicking on the Load Component From Gallery icon on the right hand edge of the editor window itself. A Post Process Component may consist of many Post Process Events.

Save Post Process Event Component Icon

Click this icon to open the Component Signature Window. From here you will be able to sign and save the currently selected Post Process Event to disk as a component.

Event Name Field

This field allows you to rename individual Post Process Events. Enter a new name for the selected event in this field.

RGB Radio Button

Select this radio button if you wish to have access to separate Red, Green and Blue channel checkboxes for channel-specific application of Events.

Red Checkbox

Select this checkbox if you wish the currently selected Event to be applied to the Red Channel in the rendered output. Deselect it if you wish the Red Channel to be unaffected by the selected Post process Event.

Green Checkbox

Select this checkbox if you wish the currently selected Event to be applied to the Red Channel in the rendered output. Deselect it if you wish the Red Channel to be unaffected by the selected Post process Event.

Blue Checkbox

Select this checkbox if you wish the currently selected Event to be applied to the Red Channel in the rendered output. Deselect it if you wish the Red Channel to be unaffected by the selected Post process Event.

HSV Radio Button

Select this radio button if you wish to have access to separate Hue, Saturation and Value channel checkboxes for channel-specific application of Events.

Hue Checkbox

Select this checkbox if you wish the currently selected Event to be applied to the Hue Channel in the rendered output. Deselect it if you wish the Hue Channel to be unaffected by the selected Post process Event.

Saturation Checkbox

Select this checkbox if you wish the currently selected Event to be applied to the Saturation Channel in the rendered output. Deselect it if you wish the Saturation Channel to be unaffected by the selected Post process Event.

Value Checkbox

Select this checkbox if you wish the currently selected Event to be applied to the Value Channel in the rendered output. Deselect it if you wish the Value Channel to be unaffected by the selected Post process Event.

Intensity % Field and Buttons

This field allows you to control the intensity of the Event. A value of 100% will result in the selected event showing 100% of its effect whilst a value of 0% will result in no effect being apparent from the selected Event.

By using the Animation Operations Icon, you can keyframe changes in this value over time.

By applying a Texture to this value, using the Texture Operations Icon and the power of the Texture Editor, you can create variable intensity values across the rendered image. This can be most useful when combined with the Include/Exclude and Object Type Texture elements, as these will allow you to restrict the effect of Post Process Events to only certain elements within your scene. For example, you might apply a star filter and drive the intensity with an Include/Exclude filter of "Lakes". In this way, the sparkling stars would only appear on the surfaces of your lake objects, and nowhere else in your scene.

Post Process Event Types

VNS 3 provides you with 24 different Post process Events which can be combined to create a wide range of different custom Post Process Components. The Event types are as follows:

- **Gain**
- **Gamma**
- **Levels**
- **Lighten**
- **Darken**
- **Contrast**
- **Exposure**
- **Texture Overlay**
- **Text Overlay**
- **Median Filter**
- **Chromax**
- **Box Filter**
- **Depth Of Field**
- **Distort**
- **Edge Ink**
- **Posterize**
- **Glow**
- **Line**
- **Negative**
- **Star**
- **Halo**
- **Image**
- **Composite**

Each one is described in more detail the following list, including explanations of all the Event-specific controls and where in the interface you can find them.

Gain

The Gain Event type has the same effect as a Gain remap function would in the Texture Editor. This can be used to increase or decrease saturation in an image. Its effects are similar to Gamma.

Filter Texture

Click the Texture Operations Icon to access the texture popup menu and from there, the Texture Editor itself. This will be set to a Gain texture element with default settings. You can leave this as it is, or use the power of the texture element to modify its parameters here. In most cases leaving the default settings and adjusting the intensity of effect with the controls provided in the Post Process editor will suffice.

Gain % Value

This field is a global control for the Gain Event. A value of 0% will result in desaturation and loss of contrast in your rendered image. A value of 100% will increase contrast and saturation.

By using the Animation Operations Icon, you can keyframe changes in this value over time.

Gamma

The Gamma event applies an s-shaped remap function to the rendered output. It has the same effect as a Gamma remap function would in the Texture Editor. Gamma correction is often used to adjust images for print, where colors can sometimes appear far darker in print than they did on a Computer Monitor.

Filter Texture

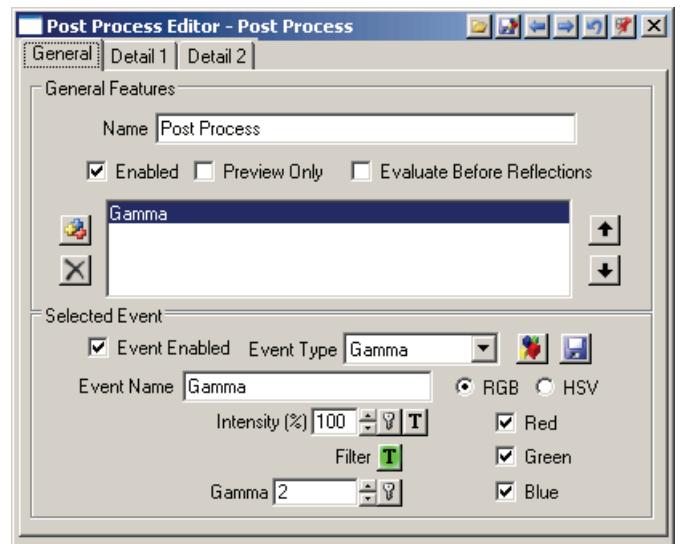
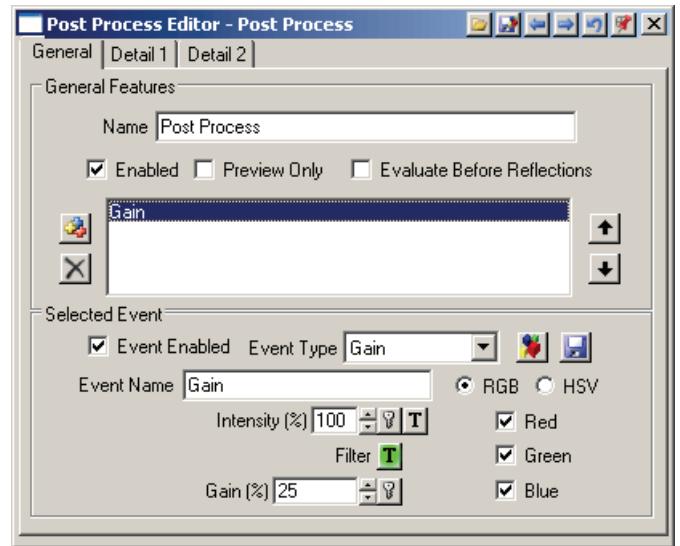
Click the Texture Operations Icon to access the texture popup menu and from there, the Texture Editor itself. This will be set to a Gamma texture element with default settings. You can leave this as it is, or use the power of the texture element to modify its parameters here. In most cases leaving the default settings and adjusting the intensity of effect with the controls provided in the Post Process editor will suffice.

Gamma is the default Post Process Event type when adding a new event to the Post Process Event List.

Gamma Value

This field is a global control for the Gain Event. A value of 1 will result in no change to the rendered output. Lower values will result in darkening of the rendered image, whilst higher values will result in the opposite. Commonly used values are between 0.9 and 1.6.

By using the Animation Operations Icon, you can keyframe changes in this value over time.



Levels

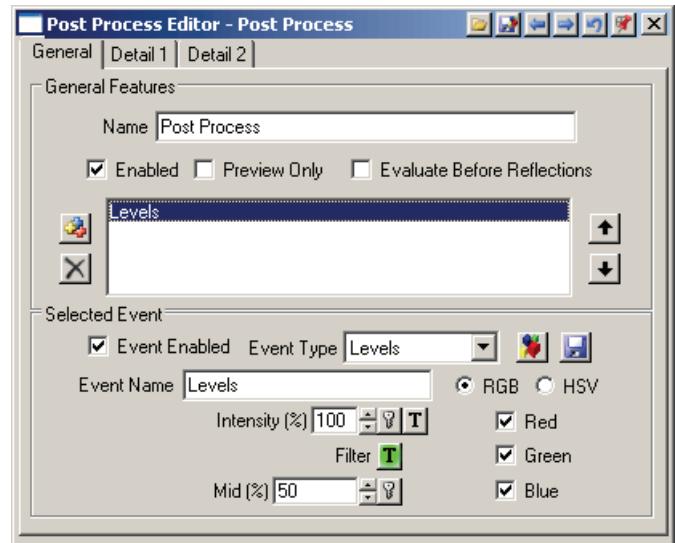
This Event is similar in function to the Levels Command in many digital painting products.

Filter Texture

Click the Texture Operations Icon to access the texture popup menu and from there, the Texture Editor itself. This will be set to a Levels texture element with default settings. You can leave this as it is, or use the power of the texture element to modify its parameters here. In most cases leaving the default settings and adjusting the intensity of effect with the controls provided in the Post Process editor will suffice.

Mid % Value

This field is a global control for the Levels Event. A value of 50% will result in no change to the rendered output. Lower values will result in lightening of the rendered image, whilst higher values will result in the opposite. Commonly used values are between 40% and 60%.



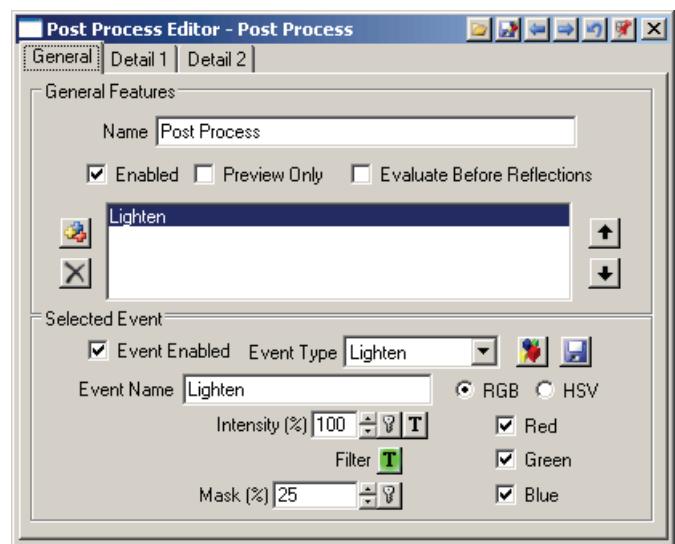
Lighten

Filter Texture

Click the Texture Operations Icon to access the texture popup menu and from there, the Texture Editor itself. This will be set to a Lighten texture element with default settings. You can leave this as it is, or use the power of the texture element to modify its parameters here. In most cases leaving the default settings and adjusting the intensity of effect with the controls provided in the Post Process editor will suffice.

Mask % Value

This field is a global control for the Lighten Event. A value of 0% will result in no change to the rendered output. The higher the value entered, the lighter the final output will be. Try applying this event type to just one channel - increasing amounts of this event applied only to the Saturation Channel, for example, will result in increasing levels of desaturation, with a value of 100% resulting in a grayscale version of the original render.



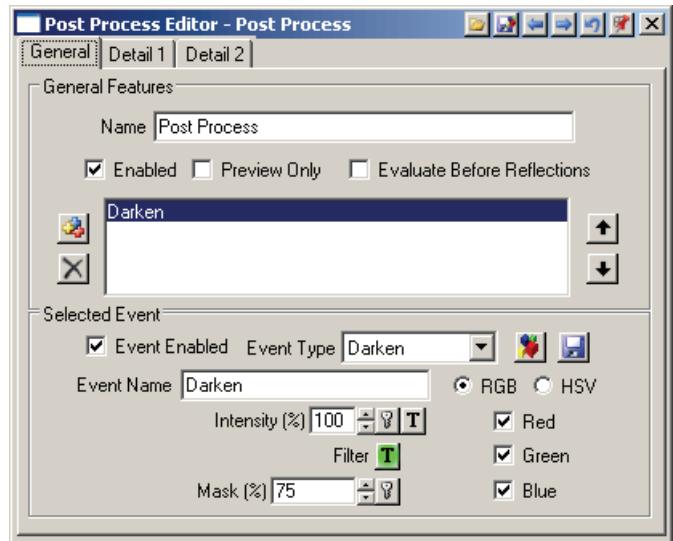
Darken

Filter Texture

Click the Texture Operations Icon to access the texture popup menu and from there, the Texture Editor itself. This will be set to a Darken texture element with default settings. You can leave this as it is, or use the power of the texture element to modify its parameters here. In most cases leaving the default settings and adjusting the intensity of effect with the controls provided in the Post Process editor will suffice.

Mask % Value

This field is a global control for the Darken Event. A value of 100% will result in no change to the rendered output. The lower the value entered, the lighter the final output will be. Try applying this event type to just one channel - increasing amounts of this event applied only to the Saturation Channel, for example, will result in increasing levels of desaturation, with a value of 0% resulting in a grayscale version of the original render.



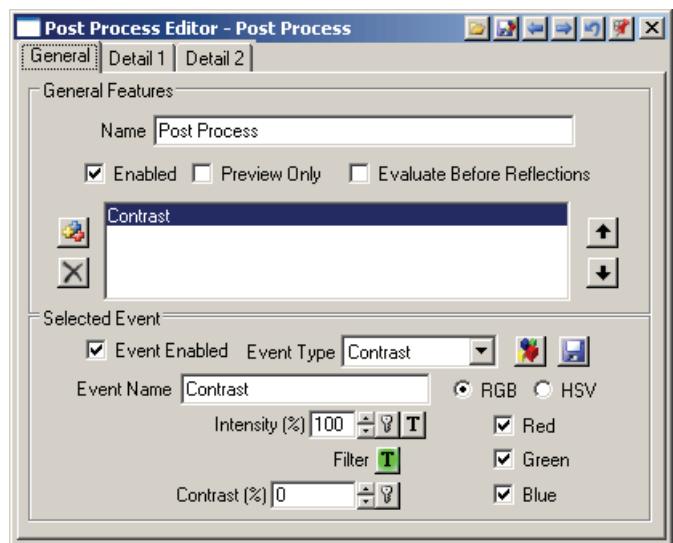
Contrast

Filter Texture

Click the Texture Operations Icon to access the texture popup menu and from there, the Texture Editor itself. This will be set to a Contrast texture element with default settings. You can leave this as it is, or use the power of the texture element to modify its parameters here. In most cases leaving the default settings and adjusting the intensity of effect with the controls provided in the Post Process editor will suffice.

Contrast % Value

This field is a global control for the Contrast Event. A value of 50% will result in no change to the rendered output. Lower values will result in a reduction in contrast of the rendered image, whilst higher values will result in the opposite. Commonly used values are between 40% and 60%.

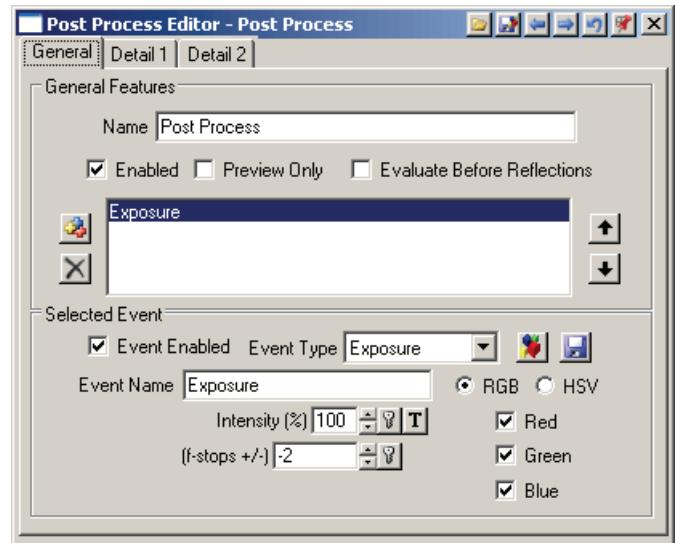


Exposure

The Exposure Post Process event makes use of the High Dynamic Range of VNS renders to adjust exposure levels in terms of photographic f-stop (or exposure setting). For those users familiar with real-world photography, this concept will be familiar.

f-Stops +/- Value

Increasing the exposure, or f-stop will increase the amount of light hitting the "film", and therefore result in a lightening of the image as it is progressively over-exposed. By reducing the f-stop, the opposite effect is achieved. Since VNS uses High Dynamic Range rendering, this increase or reduction in exposure will be more accurate than simply increasing or decreasing brightness in the rendered output.



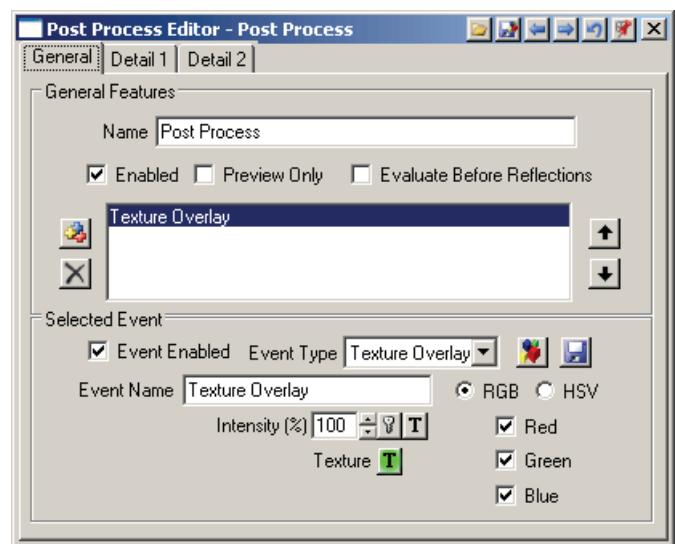
Texture Overlay

The Texture Overlay Event type allows you to apply a texture over your rendered image.

Texture

Clicking the Texture Operations Icon will allow you to access the Texture Editor in order to design and apply a texture to your rendered output. All texture editor functions are available, so the overlay texture you design is limited only by your imagination and proficiency with the texture editor controls and methodology.

How this texture is applied to your image is dependent upon the type of texture Coordinate Space selected for the texture overlay. See Coordinate Systems for more information.



Text Overlay

The Text Overlay Event provides a quick and easy way to add video titling elements to your rendered output. In addition to standard text strings, you are also provided with a number of variables that can be automatically updated on a frame by frame basis. These include things like Camera Heading, Pitch and Bank, Project Name and so on. See Autoentry Variables Selection List below, for more detail and a full list of available parameters. You can also apply texturing to your text, and control settings such as border thickness.

Note: Only one typeface is available, although its style can be somewhat modified using the provided controls and parameters. Should this not suffice, however, consider creating your text overlay effect with a Texture Overlay or Composite event.

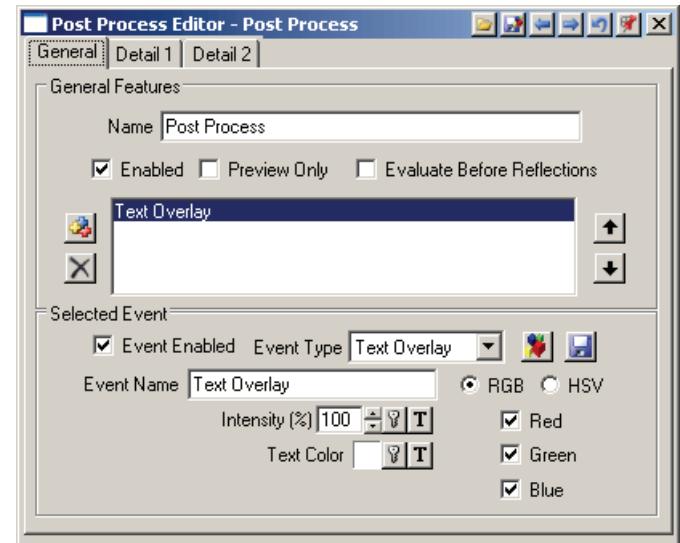
General Page

Text Color

Click the color well to open the Color Editor. This allows you to select a base color for your text. It defaults to white, but can be any color.

By using the Animation Operations Icon, you can keyframe changes in this value over time.

By applying a Texture to this value, using the Texture Operations Icon and the power of the Texture Editor, you can create complex color effects on your text. These look particularly effective when combined with a visible Outline Width.



Detail 1 Page

X Center %

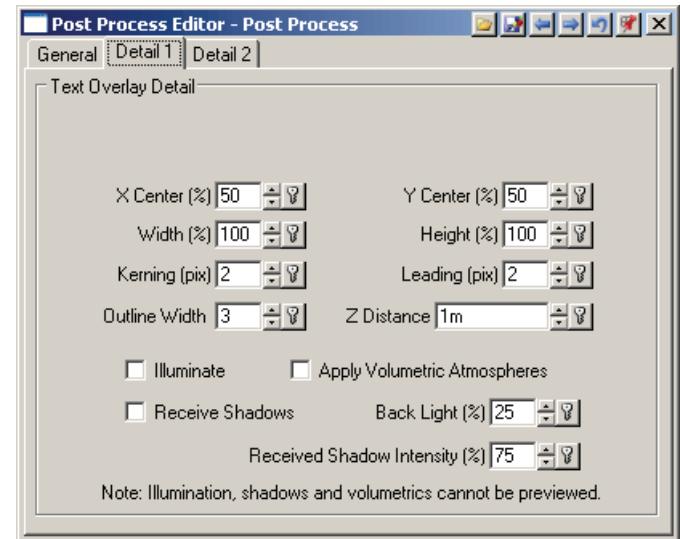
This value controls the position of the reference point of your body of text relative to the boundaries of your rendered frame. A value of 50% will place the horizontal center of your text in the horizontal center of the image. The reference point of the text body is determined by the type of Justification selected using Autoentry Variables (see below)

This field can accept values below 0% and above 100%. Each multiple of 100% represents a distance of the image width to the left (in the case of negative percentages) or right (in the case of positive percentages) of the edge of the rendered output.

By using the Animation Operations Icon, you can keyframe changes in this value over time. In combination with the Z Distance field and Evaluate Before Reflections checkbox, you can achieve some amazing scrolling text effects without compositing, where the text moves in front and behind of foliage and other scene elements, as well as showing in reflective surfaces.

Y Center %

This value controls the position of the center of your body of text relative to the boundaries of your rendered frame. A value of 50% will place the vertical center of your text in the vertical center of the image. The reference point of the text body is determined by the type of Justification selected using Autoentry Variables (see below)



This field can accept values below 0% and above 100%. Each multiple of 100% represents a distance of the image height above (in the case of negative percentages) or below (in the case of positive percentages) of the edge of the rendered output.

By using the Animation Operations Icon, you can keyframe changes in this value over time. In combination with the Z Distance field and Evaluate Before Reflections checkbox, you can achieve some amazing scrolling text effects without compositing, where the text moves in front and behind of foliage and other scene elements, as well as showing in reflective surfaces.

Width %

This is an arbitrary field controlling the horizontal scale of your text. Adjust to suit.

By using the Animation Operations Icon, you can keyframe changes in this value over time.

Height %

This is an arbitrary field controlling the vertical scale of your text. Adjust to suit.

By using the Animation Operations Icon, you can keyframe changes in this value over time.

Kerning

This value controls how much each letter in your text is squashed horizontally so as to increase the gaps between letters. This is slightly different to the kerning controls in Word Processing software where the letters are shifted relative to each other. Adjust to suit.

By using the Animation Operations Icon, you can keyframe changes in this value over time.

Leading

This value controls the spacing between lines in multi-line bodies of text. Adjust to suit.

By using the Animation Operations Icon, you can keyframe changes in this value over time.

Outline Width

This value controls the thickness of the outline around each letter in your text. Regardless of text color or texturing, the outline is always rendered in Black. This value is measured in Pixels, and should be adjusted to suit.

By using the Animation Operations Icon, you can keyframe changes in this value over time.

Z Distance

This value represents the imaginary distance at which the text is located from the camera. This is required so that the render engine can accurately calculate effects such as foliage occlusion and reflections. You can use the Diagnostic Data Window to gain feedback about Z Distances in your scene, and set this value to a suitable amount.

Low values in this field will result in a text overlay that does not appear to be interacting with scene elements. Setting this value to 0.1m, for example will place the text as if it were 10cm from the camera lens.

Higher values in this field, will result in a text overlay that appears to interact with scene elements, where possible. The text will pass behind trees that are between it and the camera, and if “Evaluate Before Reflections” is enabled, it will reflect in any reflective surfaces visible to the camera.

Set this value to a suitable level to achieve the effect that you require. Foliage and terrain occlusion of your text will be represented in the preview, but reflections will not.

By using the Animation Operations Icon, you can keyframe changes in this value over time.

Illuminate Checkbox

By selecting this checkbox, you make your text react to lights in the scene. They will react to light position, just as foliage in your scene would do.

Apply Volumetric Atmospheres

By selecting this checkbox, you make your text react to volumetric atmospheric effects. This includes Cloud Models and Atmospheres. By enabling this checkbox, your text can fly up through clouds, and become occluded by haze and fog as it travels into the distance.

Receive Shadows

By selecting this checkbox, you can enable shadow receiving for your text. This means that shadow effects from other elements within the scene will be cast onto the text, making it seem much more integrated with the rest of your VNS scene.

When combined with some of the other features such as Z Distance and animation controls, this becomes very powerful.

Back Light %

Just as with Foliage objects, the Back Light % adds a definable amount of self-illumination to your text, so that even if the Illuminate checkbox is selected and the sun is behind the text, it will still retain a percentage of its color, in cases where it would have normally become over-dark.

Received Shadow Intensity %

If the Receive Shadows checkbox is selected, this field controls the intensity of those shadows on the surface of your text.

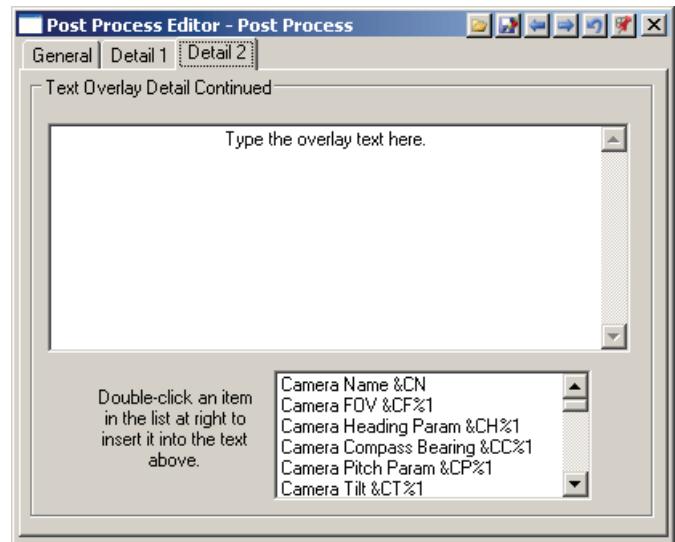
Detail 2 Page

Text Entry Window

Enter the text that you wish to use into this window. You may enter multiple lines of text: use the enter key to generate carriage returns as you would in a word processing program. You can also enter a number of Autoentry Variables (see below) to create dynamic text elements that reflect things such as Project name or Camera Heading. However, you are recommended to add these through the use of the Autoentry Variables Selection List (see below)

Autoentry Variables Selection List

This is a list of the available variables that can be used to add dynamic content to your Text Overlay element without incurring unnecessary typing. These are automatically updated for every frame, so should you use one that references a variable that changes throughout the animation, you will see these changes in the Text Overlay of your rendered output. This is particularly useful for creating pre-production rushes that need to be digitally “stamped” with project names, frame numbers and other diagnostic data.



The list of available variables is as follows:

&CN	Camera Name	&TD%0	Distance to Camera Target
&CF%1	Camera Field of View	&FN4	Frame Number
&CH%1	Camera Heading	&FS	SMTPE Time Code
&CC%1	Camera Compass Bearing	&PN	Project Name
&CP%1	Camera Pitch	&RN	Render Options Name
&CT%1	Camera Tilt	&UN	User Name
&CB%1	Camera Bank	&UE	User Email Address
&CX%3	Camera Longitude	&JC	Center Justify
&CY%3	Camera Latitude	&JL	Left Justify
&CZ%0	Camera Elevation	&JR	Right Justify
&TX%3	Camera Target Longitude	&JN	No Justify
&TY%3	Camera Target Latitude	&I	Italics
&TZ%0	Camera Target Elevation	&&	Plain Ampersand

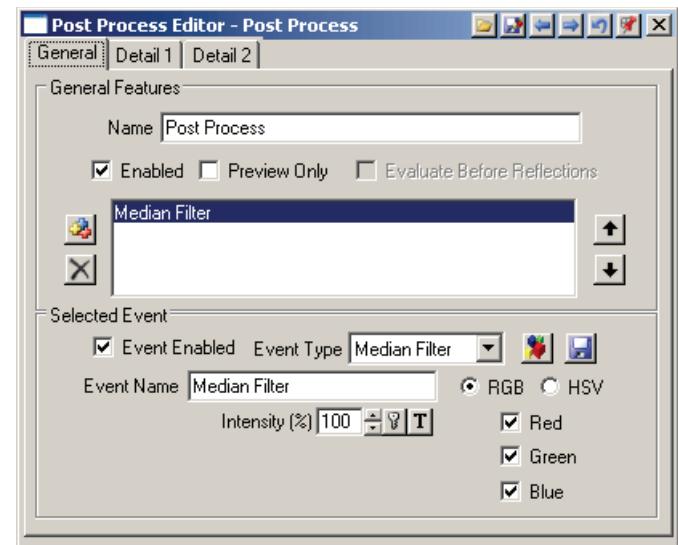
To add a variable to the text window, double click on its entry in this list. The appropriate replaceable variable will be automatically added to the text window at the last cursor location.

In the above list, a % sign followed by a number defines the number of decimal places to be displayed for that variable when rendered as text. In the case of the Frame Number variable, the 4 represents 4 digits of frame numbering i.e. filename0001, filename0002, filename0003 and so on. You can edit these numbers to suit your own requirements.

Median Filter

The Median Filter Event applies a 5x5 unweighted median filter to the rendered output. This tends to reduce detail and creates a painted look.

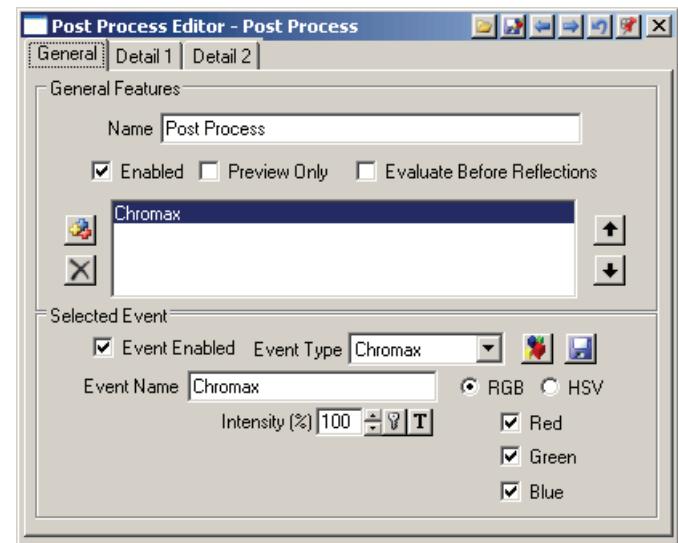
This Event type has no additional control beyond those already described in the Common Controls section.



Chromax

The Chromax Event applies a strong Gain function to Saturation and Value in the image, creating very bright colors and washing out some shading.

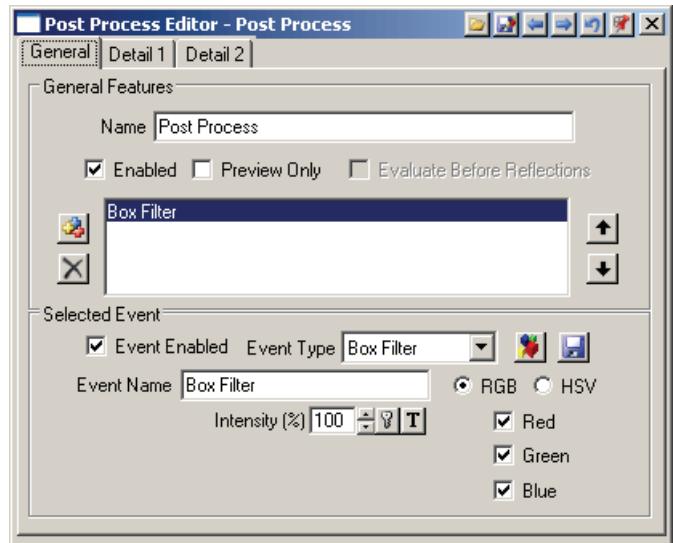
This Event type has no additional control beyond those already described in the Common Controls section.



Box Filter

The Box Filter Event applies a 3x3 equal-weighted Box Filter blur to the rendered output. This Event is akin to the 'Blur' option in the Lens tab of the Camera. Unlike the version in the Camera Editor, this has no option for Z-thresholding, but can be masked with an Intensity Texture using a "Distance From Camera" Dynamic Parameter.

This Event type has no additional control beyond those already described in the Common Controls section.



Depth Of Field

The Depth of Field Event simulates the depth of field blurring that can sometimes be seen with real camera lenses. It is analogous to the Depth of Field controls in the Camera Editor, but in most cases will render faster. In addition, this version can be previewed, as can all Post Process components, and so it offers advantages over the old method of producing the same effect.

Focal Depth

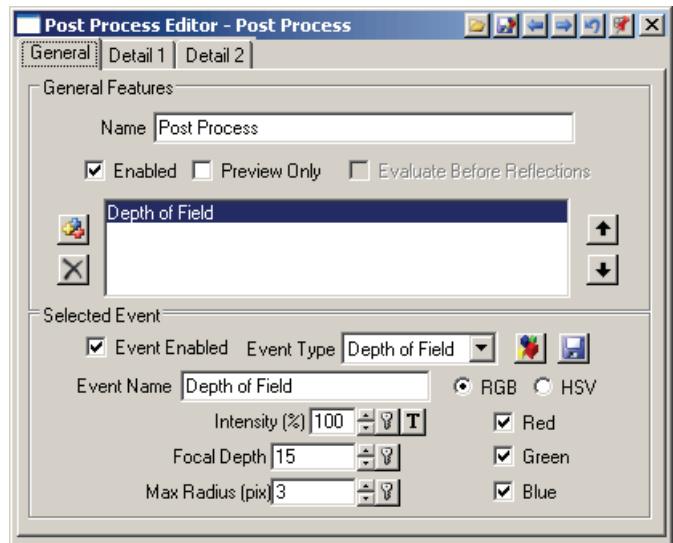
The Focal Depth is equivalent to the Focal Length value in the Depth of Field settings on the Lens page of the Camera Editor. For a shallower area of focus and more areas that are blurred, use a higher value. For a deeper area of focus with less areas that are blurred, use a lower value.

By using the Animation Operations Icon, you can keyframe changes in this value over time.

Max Radius

This is the maximum radius of blurring that will occur to rendered output. The limit is 4 pixels. If you wish to achieve a more extreme blurring effect, then you have to use the Depth of Field controls on the Lens page of the Camera Editor.

By using the Animation Operations Icon, you can keyframe changes in this value over time.



Distort

The Distort Event shifts Pixels in the rendered image horizontally and/or vertically by predefined amounts. By using an animated texture to drive the intensity of the distortion, and limiting the effect by using Include/Exclude lists or Object Type texture elements, you can achieve some powerful effects.

General Page

X Distort

This is the amount that pixels in the final image will be shifted horizontally to the left.

By using the Animation Operations Icon, you can keyframe changes in this value over time.

If a texture is being used to drive distortion amount, then the value of the texture at that point in the image will be multiplied by this number to get the actual distortion amount.

Y Distort

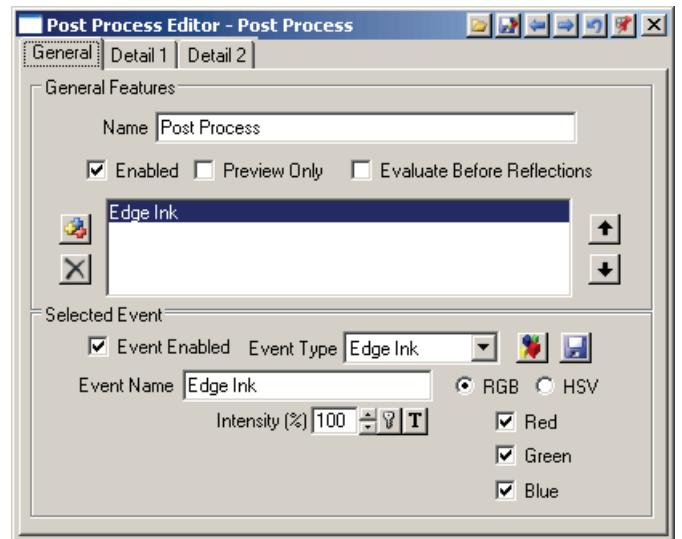
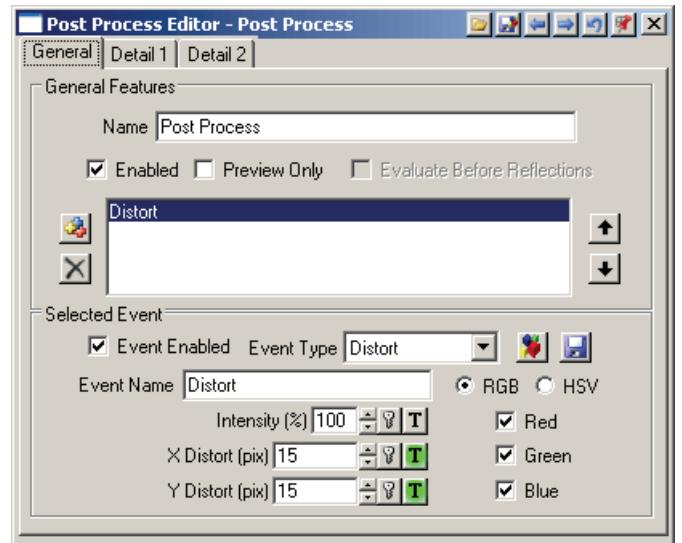
This is the amount that pixels in the final image will be shifted vertically upwards.

By using the Animation Operations Icon, you can keyframe changes in this value over time.

If a texture is being used to drive distortion amount, then the value of the texture at that point in the image will be multiplied by this number to get the actual distortion amount.

Edge Ink

The Edge Ink Event attempts to locate strong edges in the image, and applies a dark inking to those edges. When combined with other Post Process Events such as Chromax and Median, complex Cel Shader effects can be created. The Toonify component supplied on your DVD is an example of just such an effect.



Detail 1 Page

There are three sets of fields, one for each, Near, Mid and Far. These correspond with the three distance-based 'Zones' that EdgeInk provides. You can define the distances for each Zone, and define a complete set of Edge inking parameters for each Zone. This allows you to have more dramatic inking detail on foreground objects and more subtle inking in distant areas. The parameters are smoothly interpolated between Zones.

Near Column

This column of values relate to the closest of the three Zones used to decide edge inking parameters.

Mid Column

This column of values relate to the middle of the three Zones used to decide edge inking parameters.

Far Column

This column of values relate to the farthest of the three Zones used to decide edge inking parameters

Distance

The Distance value defines the distance from the camera where this Zone's parameters are in effect. Between Zones, parameters are interpolated. Closer than the Near Zone Distance, the Near Zone parameters will be used unaltered. Likewise, beyond the Far Zone, the Far Zone parameters will apply.

Dist

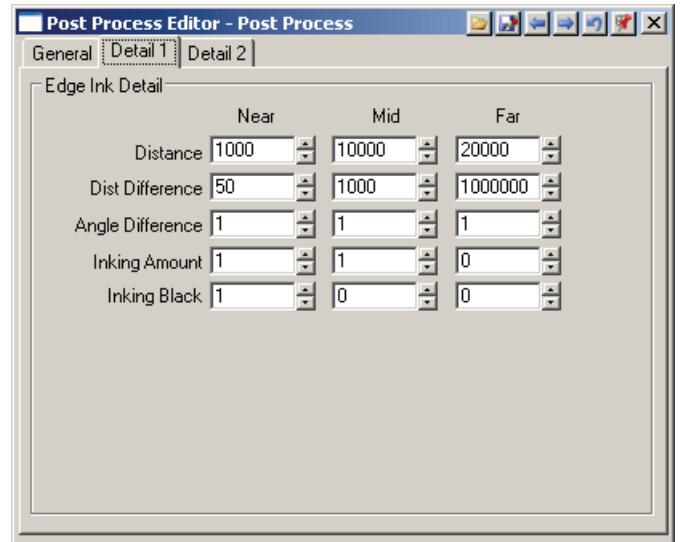
The Distance Difference value (Dist) specifies how much difference in adjacent pixel distance (Z) values will be required in order to cause the specified amount of inking (see Ink Amount, below). For example, if this is 1000m, then a ridgeline where the foreground is at least 1000m closer than the background will have inking applied at the boundary.

Angle Difference

The Angle Difference value specifies whether the inking effect will be sensitive to changes in adjacent pixels' angular (surface normal) values. If this value is 1, inking will be sensitive to adjacent pixels of identical distance but differing surface normals, for example, corners of buildings and creases in the landscape. If this is 0, inking will occur regardless of the angle change between surfaces. Intermediate values are permitted.

Inking Amount

The Inking Amount value controls the amount of inking allowed in that zone. A value of 0 will prevent any Inking in the specified Zone, and 1 will permit full Inking. Intermediate values are permitted.



Inking Black

The Inking Black value controls how dark the ink is. A value of 0 will cause Inking in the specified Zone to be done by darkening the existing color at each inked pixel. A value of 1 will cause the inking to be done in pure black. Intermediate values are permitted.

Posterize

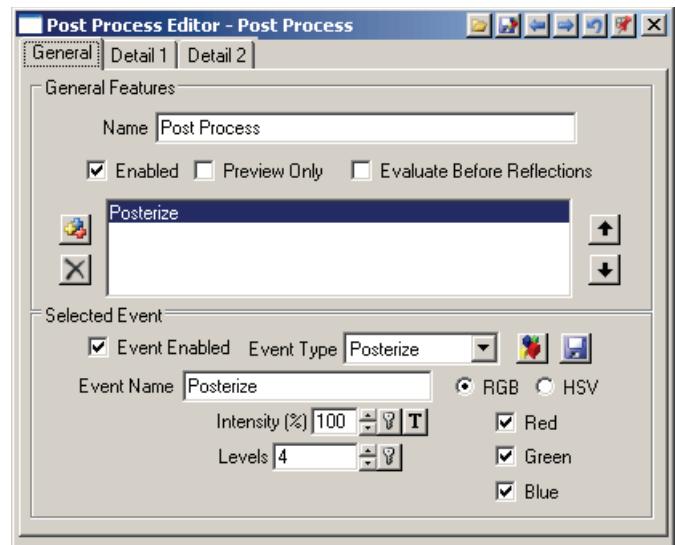
The Posterize Event reduces the number of colors in the image, producing a "Poster Print" type effect.

Levels

The Levels value controls the number of colors that are allowed in the Posterized palette. Increasing this value will progressively increase the number of colors until the posterized image is indistinguishable from the original. Reducing this value will abstract the image more and more as the number of colors reduces.

Note: You may find that you have to adjust the balance of the rendered image with another Post Process Event before its dynamic range is suitable for Posterization.

By using the Animation Operations Icon, you can keyframe changes in this value over time.



Glow

The Glow Event applies a user-definable glow to the rendered output.

Note: The entries on the Detail 1 Page for Amount % and Radius are the same as on the General Page. Changing the values on either page will result in the other page's fields being updated accordingly.

General Page

Amount %

The Amount % value and associated texture controls the amount of glow effect seen in the rendered output. By default this is driven by a Dynamic Parameter texture of Luminosity. Areas of high luminosity will receive a more intense glow than areas of low luminosity.

By using the Animation Operations Icon, you can keyframe changes in this value over time.

Note: Just because Glow is driven by Luminosity by default does not mean that you have to use that particular dynamic parameter to drive Glow Amount.

Radius

The Radius value defines the Maximum Glow radius in pixels. If a texture is being used to drive glow radius, then the value of the texture at that point in the image will be multiplied by this number to get the actual glow radius amount.

By using the Animation Operations Icon, you can keyframe changes in this value over time.

Detail 1 Page

Color

Clicking on the color well will open the Color Editor, allowing you to select a color for the glow effect.

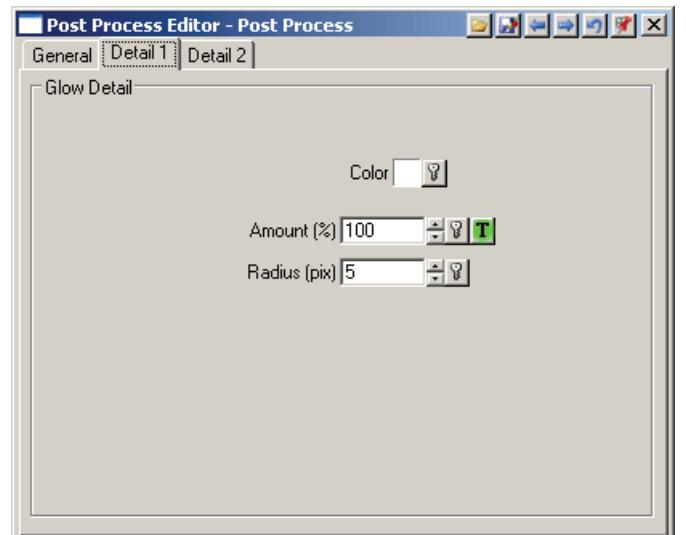
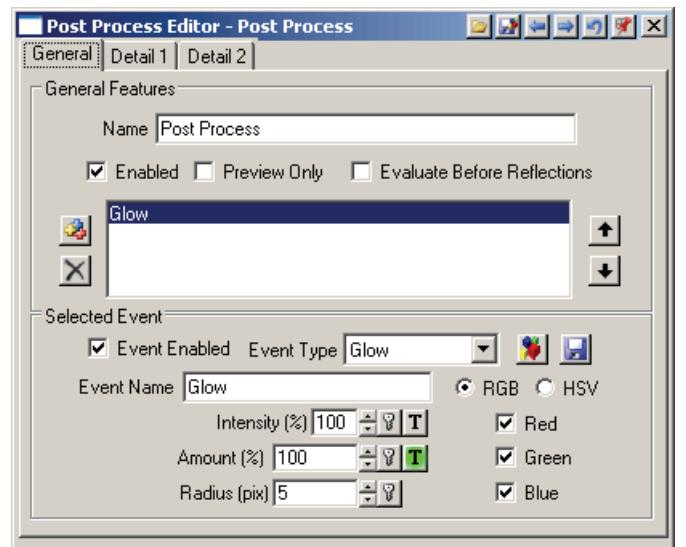
By using the Animation Operations Icon, you can keyframe changes in this value over time.

Amount %

The Amount % value and associated texture controls the amount of glow effect seen in the rendered output. By default this is driven by a Dynamic Parameter texture of Luminosity. Areas of high luminosity will receive a more intense glow than areas of low luminosity.

By using the Animation Operations Icon, you can keyframe changes in this value over time.

Note: Just because Glow is driven by Luminosity by default does not mean that you have to use that particular dynamic parameter to drive Glow Amount.



Radius

The Radius value defines the Maximum Glow radius in pixels. If a texture is being used to drive glow radius, then the value of the texture at that point in the image will be multiplied by this number to get the actual glow radius amount.

By using the Animation Operations Icon, you can keyframe changes in this value over time.

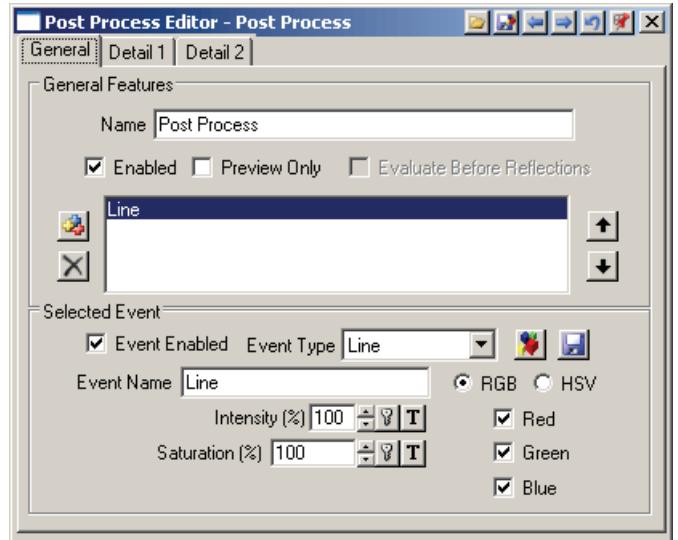
Line

The Line event applies a Sobel edge-detection routine to the rendered image. This picks out areas of high contrast in the rendered image with bright, highly saturated lines of color.

Saturation %

The Saturation value controls the intensity and brightness of the edges produced by the Line Post process Event. A value of 100% will produce maximum coverage and saturation of lines. A value of 0% will produce the minimum coverage and saturation.

By using the Animation Operations Icon, you can keyframe changes in this value over time. You can also drive this value by using the Texture Operations Icon and the power of the Texture Editor.



Negative

The Negative Event inverts the color space of the rendered image to provide you with an exact negative of your rendered output.

This Event type has no additional control beyond those already described in the Common Controls section.

Star

The Star Event applies a series of small stars to your image, like those seen when viewing highly specular surfaces such as a brightly lit water surface, through a polarizing photographic filter.

Note: The entries on the Detail 1 Page for Amount % and Radius are the same as on the General Page. Changing the values on either page will result in the other page's fields being updated accordingly.



General page

Amount %

The Amount % value and associated texture controls the amount of star effect seen in the rendered output. By default this is driven by a Dynamic Parameter texture of Luminosity. Areas of high luminosity will receive a more intense star than areas of low luminosity.

By using the Animation Operations Icon, you can keyframe changes in this value over time.

Note: Just because Star is driven by Luminosity by default does not mean that you have to use that particular dynamic parameter to drive Star Amount.

Radius

The Radius value defines the Maximum Star radius in pixels. If a texture is being used to drive star radius, then the value of the texture at that point in the image will be multiplied by this number to get the actual star radius amount.

By using the Animation Operations Icon, you can keyframe changes in this value over time.

Detail 1 Page

Color

Clicking on the color well will open the Color Editor, allowing you to select a color for the star effect.

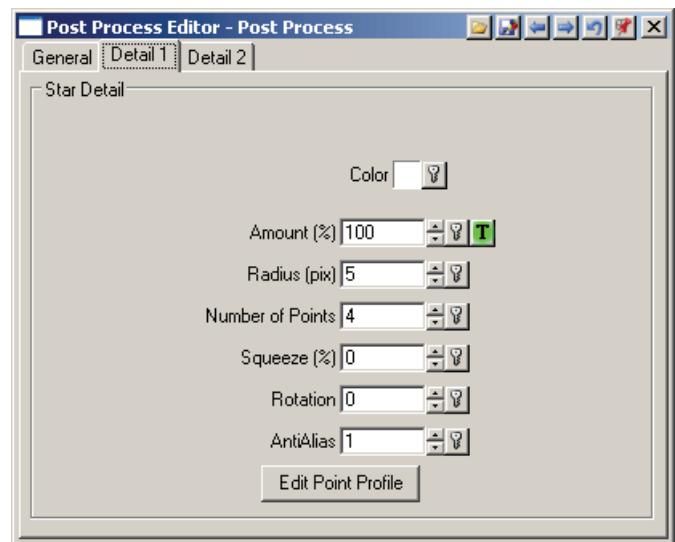
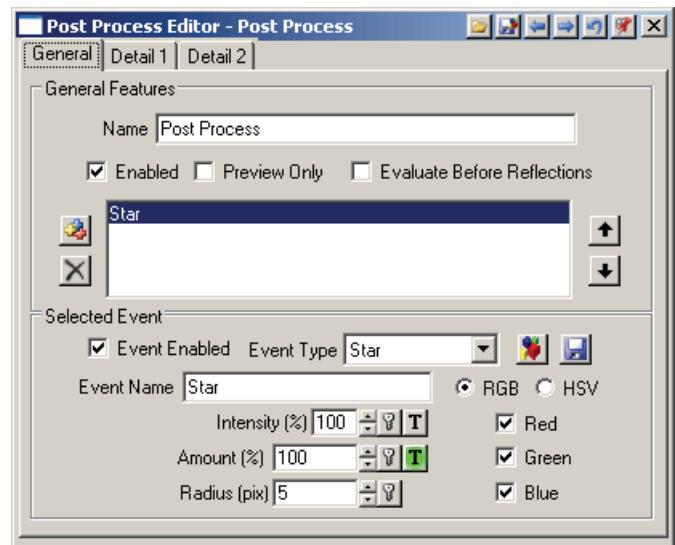
By using the Animation Operations Icon, you can keyframe changes in this value over time.

Amount %

The Amount % value and associated texture controls the amount of star effect seen in the rendered output. By default this is driven by a Dynamic Parameter texture of Luminosity. Areas of high luminosity will receive a more intense star than areas of low luminosity.

By using the Animation Operations Icon, you can keyframe changes in this value over time.

Note: Just because Star is driven by Luminosity by default does not mean that you have to use that particular dynamic parameter to drive Star Amount.



Radius

The Radius value defines the Maximum Star radius in pixels. If a texture is being used to drive star radius, then the value of the texture at that point in the image will be multiplied by this number to get the actual star radius amount.

By using the Animation Operations Icon, you can keyframe changes in this value over time.

Number of Points

The Number of Points defines how many “spikes” make up the star. The minimum value is 2 and the maximum 1000, although values of 4 to 8 have proved most useful.

By using the Animation Operations Icon, you can keyframe changes in this value over time.

Squeeze %

The Squeeze value controls the amount of distortion applied to the stars themselves. Each star will be squashed horizontally if this value exceeds 0%. At 100% the amount of distortion is so extreme as to make each star look as if it has only 2 points.

By using the Animation Operations Icon, you can keyframe changes in this value over time.

Rotation

The Rotation value allows you to rotate individual stars. Enter a value in degrees into this field to effect this rotation.

By using the Animation Operations Icon, you can keyframe changes in this value over time.

Antialias

The Antialias value allows you to apply additional levels of antialiasing to the stars generated by this Event. Especially with low rotation values applied, the lines that make up each star may start to break up or exhibit aliasing artifacts.

Increase this value until the aliasing disappears.

By using the Animation Operations Icon, you can keyframe changes in this value over time.

Edit Point Profile Button

Click this button to open the Edit Point Profile Editor. This window is a standard profile editor interface (for more information on this interface see the Edit Custom Curve Window, which has descriptions of all of the controls).

By editing the location and values of points on the default curve, you can modify the shape of the stars themselves.

Note: Changes made in this window will not be reflected in previews until you deselect and reselect the Preview Only checkbox.

Halo

The Halo event applies a halo or soft-edged border of color around the selected elements in your scene. This is similar in effect to the Glow Event, but the edge of the colored area is not as feathered.

Note: The entries on the Detail 1 Page for Amount % and Radius are the same as on the General Page. Changing the values on either page will result in the other page's fields being updated accordingly.

General page

Amount %

The Amount % value and associated texture controls the amount of halo effect seen in the rendered output. By default this is driven by a Dynamic Parameter texture of Luminosity. Areas of high luminosity will receive a more intense halo than areas of low luminosity.

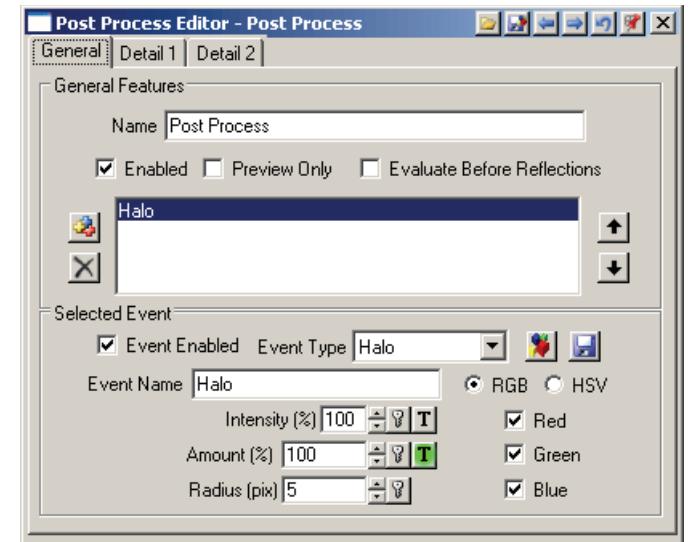
By using the Animation Operations Icon, you can keyframe changes in this value over time.

Note: Just because halo is driven by Luminosity by default does not mean that you have to use that particular dynamic parameter to drive halo Amount.

Radius

The Radius value defines the Maximum halo radius in pixels. If a texture is being used to drive halo radius, then the value of the texture at that point in the image will be multiplied by this number to get the actual halo radius amount.

By using the Animation Operations Icon, you can keyframe changes in this value over time.



Detail 1 Page

Color

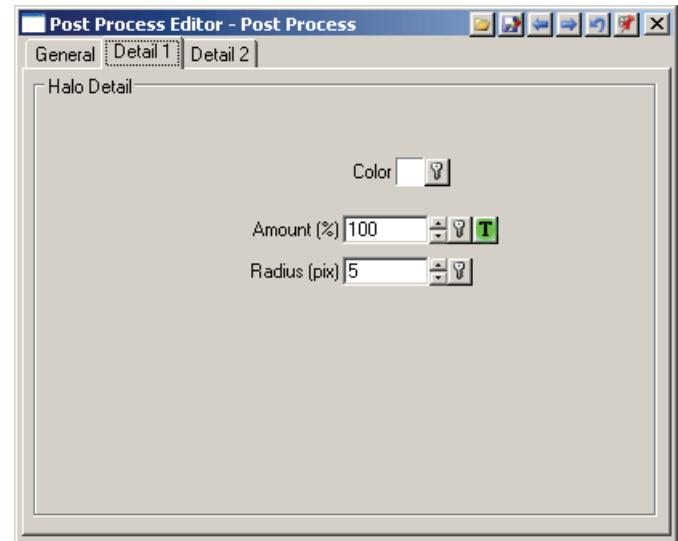
Clicking on the color well will open the Color Editor, allowing you to select a color for the halo effect.

By using the Animation Operations Icon, you can keyframe changes in this value over time.

Amount %

The Amount % value and associated texture controls the amount of halo effect seen in the rendered output. By default this is driven by a Dynamic Parameter texture of Luminosity. Areas of high luminosity will receive a more intense halo than areas of low luminosity.

By using the Animation Operations Icon, you can keyframe changes in this value over time.



Note: Just because halo is driven by Luminosity by default does not mean that you have to use that particular dynamic parameter to drive halo Amount.

Radius

The Radius value defines the Maximum halo radius in pixels. If a texture is being used to drive halo radius, then the value of the texture at that point in the image will be multiplied by this number to get the actual halo radius amount.

By using the Animation Operations Icon, you can keyframe changes in this value over time.

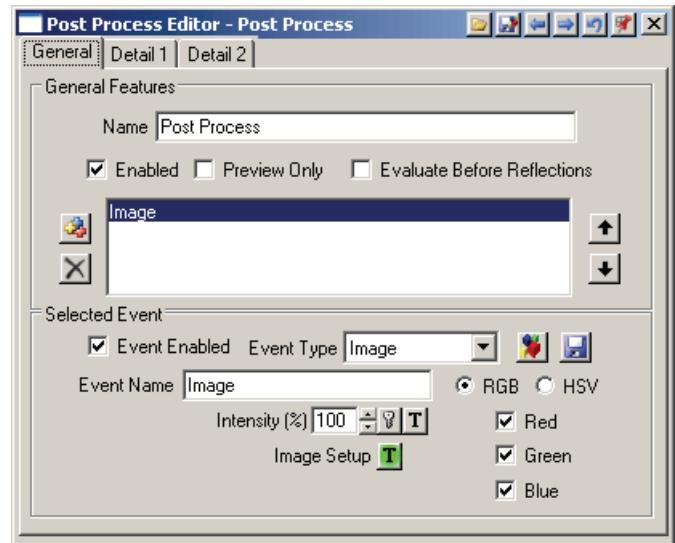
Image

The Image Event allows you to position an image in your rendered scene. Many of the controls are analogous to the Text Overlay Event, and the degree of interaction with the scenery is the same. However, much the same effect can be achieved through use of the Texture Overlay or Composite Events.

General Page

Image Setup

This allows you to access the Texture Editor settings that are driving this Image placement. While using this Event, many of the texture controls such as size, can only be changed through the provided Post Process Event interface.



Detail 1 Page

Image Selection Box

This dropdown list contains all the image objects in your project. Select the one that you wish to use in this Post Process event as an Image Overlay. If the image does not exist in the list, and you do not wish to add it through the Image Object Library, you can use the New Image Object command from the list to load it directly.

X Center %

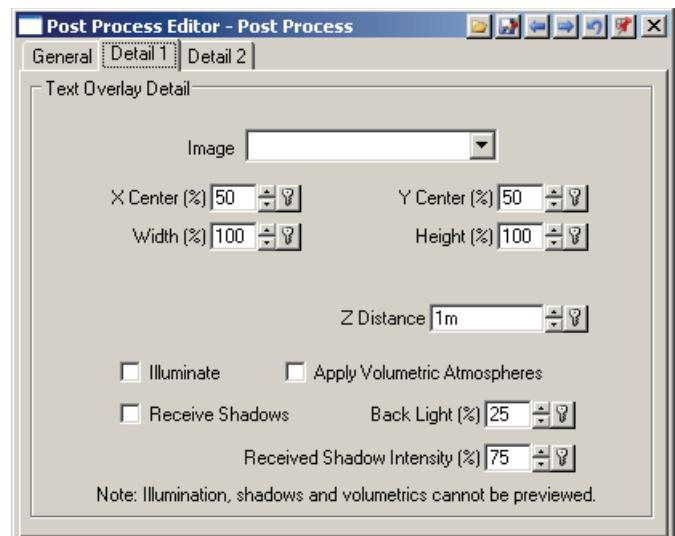
This value controls the position of the center of your image relative to the boundaries of your rendered frame. A value of 50% will place the horizontal center of your Post Process image in the horizontal center of the rendered image.

This field can accept values below 0% and above 100%. Each multiple of 100% represents a distance of the image width to the left (in the case of negative percentages) or right (in the case of positive percentages) of the edge of the rendered output.

By using the Animation Operations Icon, you can keyframe changes in this value over time. In combination with the Z Distance field and Evaluate Before Reflections checkbox, you can achieve some amazing moving image effects without compositing, where the image moves in front and behind of foliage and other scene elements, as well as showing in reflective surfaces.

Y Center %

This value controls the position of the center of your image relative to the boundaries of your rendered frame. A value of 50% will place the vertical center of your Post Process image in the vertical center of the rendered image.



This field can accept values below 0% and above 100%. Each multiple of 100% represents a distance of the image height above (in the case of negative percentages) or below (in the case of positive percentages) of the edge of the rendered output.

By using the Animation Operations Icon, you can keyframe changes in this value over time. In combination with the Z Distance field and Evaluate Before Reflections checkbox, you can achieve some amazing moving image effects without compositing, where the image moves in front and behind of foliage and other scene elements, as well as showing in reflective surfaces.

Width %

When set to 100%, this value will scale the Post Process Image so that it is the width it would be if it had been scaled proportionally until the height was the same as the rendered output. Depending upon the Aspect Ratio of the image you are using, this may or may not result in the Post Process image completely covering the Rendered output.

Height %

When set to 100%, this value will scale the Post Process image so that it is exactly the same height as the rendered output.

Z Distance

This value represents the imaginary distance at which the Post Process image is located from the camera. This is required so that the render engine can accurately calculate effects such as foliage occlusion and reflections. You can use the Diagnostic Data Window to gain feedback about Z Distances in your scene, and set this value to a suitable amount.

Low values in this field will result in a image that does not appear to be interacting with scene elements. Setting this value to 0.1m, for example will place the image as if it were 10cm from the camera lens.

Higher values in this field, will result in a Post Process image that appears to interact with scene elements, where possible. The text will pass behind trees that are between it and the camera, and if "Evaluate Before Reflections" is enabled, it will reflect in any reflective surfaces visible to the camera.

Set this value to a suitable level to achieve the effect that you require. Foliage and terrain occlusion of the image will be represented in the preview, but reflections will not.

By using the Animation Operations Icon, you can keyframe changes in this value over time.

Illuminate Checkbox

By selecting this checkbox, you make your image react to lights in the scene. It will react to light position, just as foliage in your scene would do.

Apply Volumetric Atmospheres

By selecting this checkbox, you make your image react to volumetric atmospheric effects. This includes Cloud Models and Atmospheres. By enabling this checkbox, your image can fly up through clouds, and become occluded by haze and fog as it travels into the distance.

Receive Shadows

By selecting this checkbox, you can enable shadow receiving for your image. This means that shadow effects from other elements within the scene will be cast onto the image, making it seem much more integrated with the rest of your VNS scene.

When combined with some of the other features such as Z Distance and animation controls, this becomes very powerful.

Back Light %

Just as with Foliage objects, the Back Light % adds a definable amount of self-illumination to your image, so that even if the Illuminate checkbox is selected and the sun is behind the image, it will still retain a percentage of its color, in cases where it would have normally become over-dark.

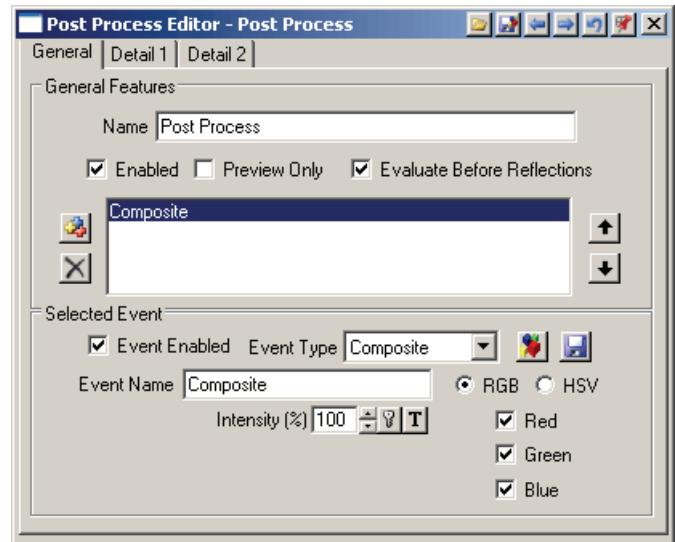
Received Shadow Intensity %

If the Receive Shadows checkbox is selected, this field controls the intensity of those shadows on the surface of your Post Process image.

Composite

The Composite Post Process Event allows the combination of two or more layers of imagery at rendertime. This is usually achieved through use of an RLA or RPF file format, which contains z-buffer (or depth) information.

This Post process event is the preferred method for the integration of output rendered in an external 3D application such as 3DS Max or Lightwave.



Detail 1 Page

Image Object To Composite Selection Box

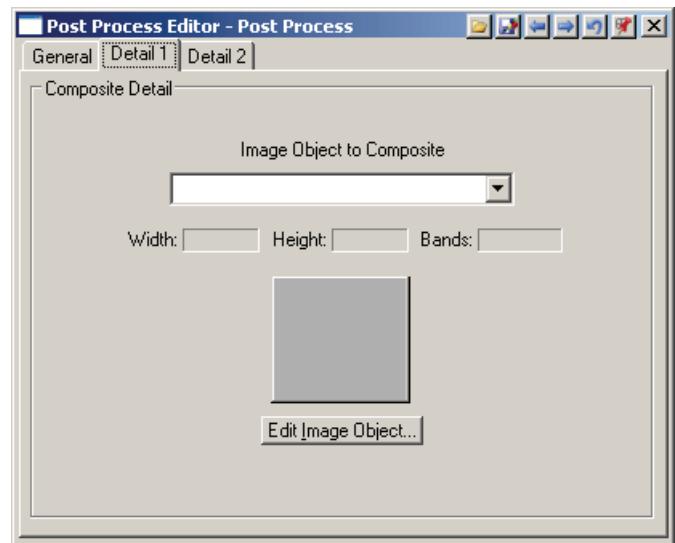
This dropdown list contains all the image objects in your project. Select the image that you wish to composite with rendered output through the use of this Post Process event. If the image does not exist in the list, and you do not wish to add it through the Image Object Library, you can use the New Image Object command from the list to load it directly.

Note: If compositing with an Image Sequence, you will only be able to load the first image in the sequence by using the New Image Object command. Defining the parameters of your image sequence must be performed in the Image Object Library.

Edit Image Object Button

Clicking this button will open the Image Object Library and allow you to edit various properties of the image objects within your scene.

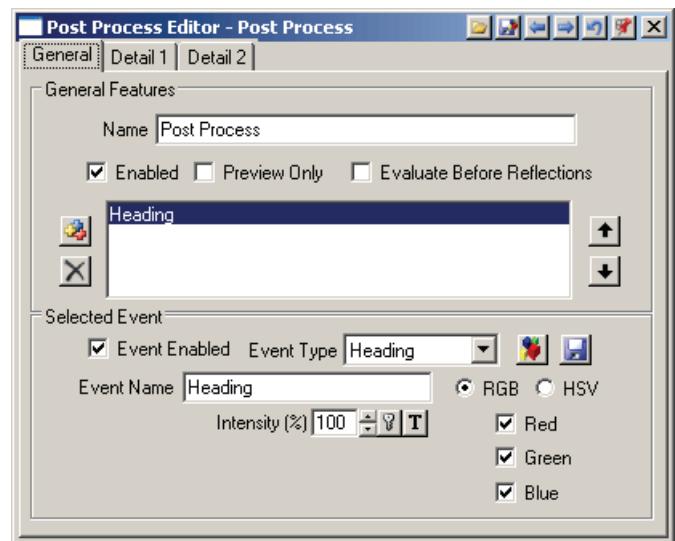
Note: There is more detail on setting up and performing Post Process compositing in the relevant Tutorials, and also in Appendix J: Integrating VNS with External 3D Programs.



Heading

The Heading post-process element allows you to add a graticule to the lower edge of your render showing the current camera heading.

Note: This element only works with perspective cameras with less than 1 degree of pitch (positive or negative). In other words, it will not work with Planimetric or Overhead cameras. It will, however, work with Orthographic, Stereo and Panoramic cameras.



Detail 1 Page

Letter Marks Checkbox

Enable this checkbox to have letters added to the graticule showing the heading in terms of compass points.

Letter Marks Dropdown List

Select the type of letter display required from this dropdown list. The options are:

- Cardinals**

N, E, S, W

- Cardinals & Ordinals**

N, NE, E, SE, S, SW, W, NW

- Cardinals, Ordinals & Interordinals**

N, NNE, NE, ENE, E, ESE, SE, SSE, S, SSW, SW, WSW, W, WNW, NW, NNW

Degree Marks Checkbox

Enable this checkbox to have letters added to the graticule showing the heading in terms of degrees from 0 (North).

Degree Marks Interval Dropdown List

Select the interval at which you wish the degree marks to be displayed from this dropdown list. The options are 30 degrees, 45 degrees, or 90 degrees.

Degree Marks Format Dropdown List

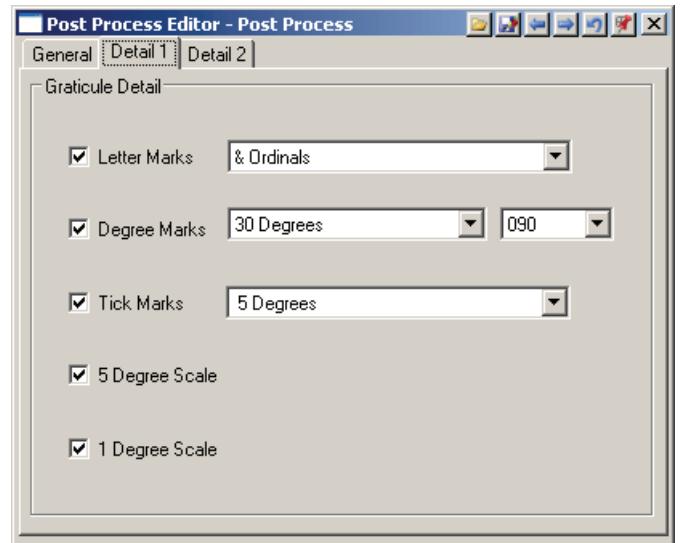
Select the format in which you wish the degree marks displayed from this dropdown list.

Tick Marks Checkbox

Enable this checkbox to have vertical ticks added to the graticule at the interval selected in the Tick Marks Interval Dropdown List (see below). All ticks will be at the same height, unless the 5 degree option is selected, in which case the 5 degree ticks will be half the height of the 10 degree ticks.

Tick Marks Interval Dropdown List

Select the interval at which you wish the Tick marks to be displayed from this dropdown list. The options are 5 degrees, 10 degrees, 30 degrees or 45 degrees.



5 Degree Scale Checkbox

Enable this checkbox to have alternating black and white horizontal scale bars added to the graticule in 5 degree increments.

1 Degree Scale Checkbox

Enable this checkbox to have alternating black and white horizontal scale bars added to the graticule in 1 degree increments.

Render Job Editor

The Render Job Editor lets you set up a Render Job. A Render Job includes your choice of any Camera (see Camera Editor) and any set of Render Options (see Render Options Editor).

Once you've created one or more Render Jobs, you can open the Render Control Window and render any or all of them.

General Page

General Features

Name Field

Enter a name for the Render Job. For example, if it is set up to render with NTSC video Render Options and an overhead Camera, you might call it simply "NTSC Video, Overhead".

By default VNS will name new Render Jobs "Render Job", and add a number after the name if there is more than one set of Render Jobs named "Render Job".

Enabled Checkbox

Use the Enabled checkbox to enable or disable the Render Job for rendering.

If you disable a Render Job it will not lose its parameter values. You'll need to disable any Render Job that you don't want to render or if don't want its camera included in Fractal Map calculations.

Make sure you remember to enable the Render Job for the final rendering if you want VNS to render it. Make sure you enable the Render Job before creating Fractal Maps in the Dynamic Parameter Editor, if you want the Render Job's Camera to be considered for Fractal Map creation.

Priority Field

The Priority field lets you set the order of the Render Job relative to others.

Note: This will also change the order in Scheduled Job list on the Render Control Window.

Camera Drop Box and Edit Button

VNS supports multiple Cameras. This lets you set up different views or Camera animation paths within the same project.

You'll see all the Cameras that exist in a project shown in the Camera drop box. Select a Camera to use in the Render Job.

You can quickly create a new Camera by selecting "New Camera" at the top of the drop box.

You can edit the selected Camera's parameters by clicking the Edit button. VNS will open the Camera Editor for the selected Camera.



Render Options Drop Box and Edit Button

VNS supports multiple Render Options. This lets you set up different types of rendering parameters, with different frame sizes, animation ranges and output files within the same project. You can also control what features are enabled for each set of Render Options.

You'll see all the Render Options that exist in a project shown in the Render Options drop box. Select a set of Render Options to use in the Render Job.

You can quickly create a new set of Render Options by selecting "New Render Options" at the top of the drop box.

You can edit the selected Camera's parameters by clicking the Edit button. VNS will open the Render Options Editor for the selected set of Render Options.

Scenarios Section

Scenario Display List

This space displays a list of all Render Scenarios that have been added to the current Render Job.

Add Scenario Button

Click the Add Render Scenario icon to open a window with a list of Render Scenario components in your Project. Select one or more Render Scenario by clicking, shift-clicking or control-clicking. Click the Add Items button to add the selected components to the Render Options.

Click the Cancel button if you want to close the window without adding any Render Scenarios to the Render Options.

Remove Scenario Button

Select (click, control-click or shift-click) a Render Scenario or Render Scenarios in the Render Scenario list and click the Remove Render Scenario icon to remove it or them from the Render Options.

Raise Scenario Priority Button

Select an Render Scenario in the Render Scenarios list and click the Raise Render Scenario Priority to move it higher in the Render Scenarios list. The items in the list are evaluated from top to bottom.

Lower Scenario Priority Button

Select an Render Scenario in the Render Scenarios list and click the Raise Render Scenario Priority to move it lower in the Render Scenarios list. The items in the list are evaluated from top to bottom.

Render Options Editor

The Render Options Editor lets you control a set of parameters for rendering. You can control image size; frame range; and output file base name, type, extension and paths. You can also enable or disable a variety of rendering options.

You can have multiple Render Options. This makes it easy to set up options for different kinds of output from the same project.

When you start a new project, VNS creates two sets of Render Options for you, named "Preview Options" and "Render Options". By default, the "Preview Options" set is used by Views for preview rendering and the "Render Options" set is used by a Render Job for final Rendering (see Render Job Editor). This lets you quickly switch from rendering quick previews with various Component types disabled, to final rendering with all Components types enabled.

Note: To do final rendering, you will use the Render Control Window, which can render multiple Render Jobs. Each Render Job contains one set of Render Options and a Camera. To do preview rendering in a View you can select the "Render a Preview" command from the View's Matrix Popup Menus. You can select the Render Options set and Camera for a view from the Matrix popup menus or the View Preferences Window.

To open the Render Options Editor, double-click any Render Options listed in the Scene-At-A-Glance.

Size & Range Page

General Features

Name Field

Enter a name for the Render Options. For example, if it is set up to render an NTSC video animation, you might call it simply "NTSC Video".

By default VNS will name new Render Options "RenderOptions", and add a number after the name if there is more than one set of Render Options named "RenderOptions".

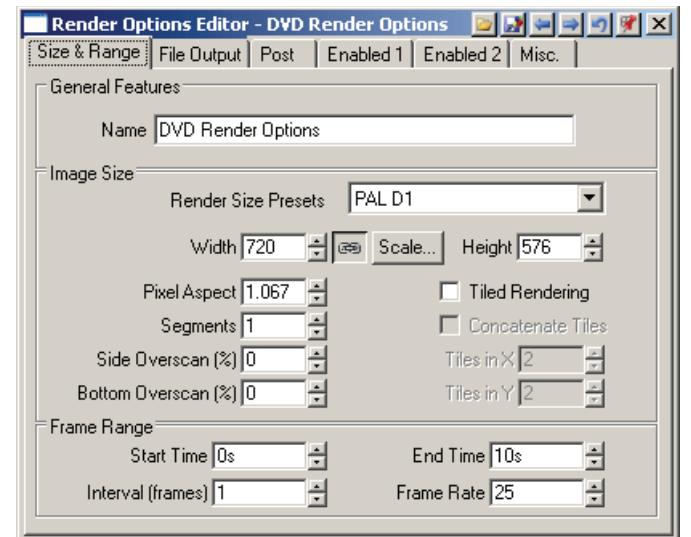
Image Size Controls

Render Size Presets Drop Box

The Presets drop box lets you set Dimensions and Pixel Aspect in one step. Simply select one of the presets and VNS will fill in the fields for you. Presets include:

- **NTSC D1**

Select NTSC D1 to set the resolution to 720/486 and the Pixel Aspect to .9. Use this setting to generate images for NTSC D1 digital video recorders. Some motion JPEG cards also use this resolution (check the manual for your hardware).



- **NTSC D2**

Select NTSC D2 to set the resolution to 752/486 and the Pixel Aspect to .859. Use this setting to generate images for NTSC D2 digital video recorders.

- **NTSC M-JPEG**

Select NTSC M-JPEG to set the resolution to 720/480 and the Pixel Aspect to .9. Use this setting to generate images for NTSC motion JPEG cards like the DPS Perception. Some motion JPEG cards will instead require the NTSC D1 setting (check the manual for your hardware).

- **NTSC Toaster/Flyer**

Select NTSC Toaster/Flyer to set the resolution to 752/480 and Pixel Aspect to .859. Use this setting to generate images for the NewTek Video Toaster or Flyer.

- **PAL D1**

Select PAL D1 to set the resolution to 720/576 and the Pixel Aspect to 1.067. Use this setting to generate images for PAL D1 digital video recorders.

- **PAL D2**

Select PAL D2 to set the resolution to 752/576 and Pixel Aspect to 1.019. Use this setting to generate images for PAL D2 digital video recorders.

- **1:1 (VGA/Mac/Print)**

Select 1:1 (VGA/Mac/Print) to set Pixel Aspect to one. Use this setting to generate images for computer screen display or print output.

Since there is no standard size for computer screen displays or print output, this option does not set the Dimensions. You can set them by entering values into the Width and Height fields.

- **HDTV 1080i**

Select HDTV 1080i to set the resolution to 1920/1080 and the Pixel Aspect to 1. Use this setting to generate images for HDTV 1080i digital video recorders.

- **HDTV 720p**

Select HDTV 720p to set the resolution to 1280/720 and the Pixel Aspect to 1. Use this setting to generate images for HDTV 720p digital video recorders.

- **Custom**

Select Custom to leave the Pixel Aspect, Width and Height as they were. Use this setting when you want to enter your own dimensions and pixel aspect ratio into the Dimensions and Aspect fields.

Width and Height Fields and Constrain Proportions button

The Width and Height fields show the resolution of the rendered image in pixels. To change the resolution, enter new values or select a preset from the Render Size Presets drop box (see above).

For the "1:1 (VGA/Mac/Print)" and "Custom" presets you can enter your own width and height values into the fields. To do so type a number in each field. You can also click the arrow buttons next to each field to increase or decrease the value.

Select the Constrain Proportions button if you want a change in one field to proportionally affect the value of the other field. That way the image aspect will stay the same. Deselect the Constrain Proportions button if you want to be able to change the Width and Height values independently.

For print output decide how many dots-per-inch you need. Then multiply the inches of width and height by the dots-per-inch amount to arrive at the actual Width and Height values you need. The only limit to the width and height you use is the amount of available memory in your computer.

You can quickly change the output image resolution by clicking the Scale button (see below).

Note: Large image sizes require large amounts of RAM. You can economize on memory and still render high resolution images by rendering in segments or tiles as described below.

Scale button

Click the Scale button to open a requester where you can type a factor (such as "3" to triple the dimensions), a percentage value (such as "300%" to triple the dimensions), word or abbreviation (such as "triple" or "t" to triple the dimensions), all are valid ways to change the Width and Height values (see above). This is a quick and easy way to change output image resolution.

Click the OK button in the requester to scale the dimensions proportionally by the factor, percentage, word or abbreviation you entered. Click the Cancel button in the requester instead if you want to abort the scaling operation.

Here are more examples of valid entries:

h = H = half = .5 = 50 = 50% = -50 = -.5 = -50%

t = T = triple = 3 = 300 = 300%

d = D = double = 2 = 200 = 200%

th = Th = TH = tH = third = .333 = 33.3 = 33.3% = -.667 = -66.7 = -66.7%

q = Q = quarter = .25 = 25 = 25% = -.75 = -75 = -75%

f = F = four times = 4 = 400 = 400%

Pixel Aspect Field

Aspect lets you create square or non-square pixels. Video, print and multimedia applications can require different pixel aspect ratios for accurate rendering. VNS lets you accommodate any pixel aspect you may need.

The Presets drop box lets you select a variety of aspect ratios for common uses (see above). To set your own, select the Custom preset and enter a Pixel Aspect in the Pixel Aspect field.

The Pixel Aspect field lets you specify the pixel aspect of the rendered image. This number is the ratio of pixel height to pixel width, with pixel width always set to 1. It refers to the actual size of a single pixel, not the image as a whole. To change it, type a new number. You can also click the arrow buttons next to the field to increase or decrease the value.

You can use any pixel aspect ratio. To create more vertical stretch in the output pixels enter a larger number in the Pixel Aspect field.

A value of 1.0 gives you square pixels (1:1) which are usually suitable for print media including color copiers and slides. There are some computer-based video playback cards using a resolution of 320/240 or 640/480 that also use square pixels.

Make sure you enter the proper aspect ratio for your application.

Segments Field

VNS can render the whole image at once or do it in horizontal segments. Use the Segment field to set the number of segments for rendering. Normally you should use a segment of 1, since this will give you the fastest rendering. If you don't have enough memory to render in 1 segment, use more segments. VNS will automatically combine the segments into a complete image.

Large print resolution images need more memory to render than video sized images. If you find you are out of memory when you begin to render (you will be warned with a dialog box) try using multiple segments for rendering. Start with 2 and work your way up until you're able to successfully render the image.

You can specify any number of segments. It's best if the height of the image is evenly divisible by the number of segments. Otherwise a few pixel rows may be lost at the bottom. In general, the larger the number of segments the longer the rendering time because some DEMs will need to be computed more than once per image.

If you choose to render in segments you might want to increase the number in the Bottom Overscan field (see below) to minimize the possibility of disappearing trees.

Note: Reflections will not work properly if you render with more than one segment.

Side and Bottom Overscan Percentage Fields

The Side and Bottom Overscan fields let you add temporary pixel rows to the sides and bottom of an image while rendering in order to keep Ecotype foliage from disappearing when you get very close to them. This works as a percentage of the regular image size set in the width and height fields (see above).

Note: Overscan is not needed for Foliage Effects or 3D Objects.

When VNS renders trees it starts from the base of the tree. When you get so close to a tree that its base falls to one side or below the bottom of the image, the whole tree will disappear. To correct that problem VNS lets you add overscan pixels along the sides and below the bottom of the image. It will render those pixels just to catch the base of any such trees. That way the tops of those trees will still be seen within the final image dimensions. The overscan pixels are then thrown out since they aren't within the final image dimensions.

Making the Side and Bottom Overscan larger will cost some memory and processing time, but it's better to have it too large than too small. If this number is too small you'll see trees disappearing when their bases fall off to the side or below the edge of the picture, or below the edge of each segment if you're rendering in segments.

To change either of these fields, type a new number. You can also click the arrow buttons next to the field to increase or decrease the value.

Setting Values

If you see trees popping out of the picture as they get close to the camera during an animation, try increasing both Side and Bottom Overscan values. Try to set side overscan to the width of the closest trees as a percentage of the width of the image. Try to set bottom overscan to the height of the closest trees as a percentage of the height of the image. For example, if the nearest tree height is 48 pixels and the image height is 480 pixels, you should set bottom overscan to ten percent. You should never have to make either overscan value larger than 100 percent.

You'll need to use higher values if the camera is very close to the trees. Where the trees are more distant, you can use much lower values.

You may need higher values for Bottom Overscan than Side Overscan.

Segment Rendering Issues

The Bottom Overscan value is even more important if you're rendering images in segments using a "Segments" setting greater than one (see above). Trees don't have to be very close for some of their bases to fall below the edge of each segment. It is safer, albeit slower, to err on the generous side so you don't get horizontal lines across your images where segments join.

Tiled Rendering Checkbox

Enable this checkbox to render your image in tiled sections.

Concatenate Tiles Checkbox

Enable this checkbox to have VNS automatically "stitch" the rendered, tiled output into 1 seamless file.

Tiles In X Field

Enter the number of tiles you require in the horizontal axis of your image. For example, if you were rendering an image 10,000 pixels wide, and you wanted each tile to be no more than 800 pixels wide, you would enter 13 into this field ($10,000/800 = 12.5$, so 13 is the nearest whole number that will give you a tile width of 800 pixels or less).

Tiles In Y Field

Enter the number of tiles you require in the vertical axis of your image. For example, if you were rendering an image 8,000 pixels wide, and you wanted each tile to be no more than 600 pixels high, you would enter 14 into this field ($8,000/600 = 13.3$, so 14 is the nearest whole number that will give you a tile height of 600 pixels or less).

Frame Range Controls

When you Render with these Render Options, VNS will start with the frame or time specified in the Start field and render to the frame or time specified in the End field. VNS will use the frame step you specify in the Interval field with the frame rate you specify in the Frame Rate field.

Start and End Fields

Use the Start and End fields to tell VNS what times or frames to start and end the animation.

This lets you start and end with any frame when you render. You don't have to start with the first frame of your animation. For example, you can render a long animation in pieces over several nights. You can also render any part of an animation without having to render the whole animation from the beginning.

You can type a new Start or End value into the fields. You can also click the arrow buttons next to either field to increment the existing value higher (right arrow) or lower (left arrow).

If you want to render an animation backward you can set the Start field to a higher number than End field.

Start and End fields can be in units of frames or seconds, depending on the units you select on the Units page of the Preferences Window.

Frames

If you choose "Frames" as the Time Units, the Start Field will be labelled the "Start Frame" field and the End Field will be labelled the "End Frame" field.

In the Start Frame field, enter the frame number where you want the animation to start.

In the End Frame field, enter the frame number where you want the animation to end.

Use the Start Field to specify the time or frame where you want VNS to begin when you click the Render button. VNS will then start with that time or frame and render the number of frames specified in the Frames field, using the frame interval specified in the Step field.

Seconds

If you choose "Seconds" as the Time Units, the Start Field will be labelled the "Start Time" field and the End Field will be labelled the "End Time" field.

In the Start Time field, enter the time in seconds for the time when you want the animation to start.

In the End Time field, enter the time in seconds for the time when you want the animation to end.

If you have time set to seconds, you can change the frame rate without changing the length of the animation. This makes it easy to render versions of the same animation for NTSC, PAL and Film output.

Interval Field

Use the Interval field to set the frame step. VNS will render every N frames, where N is the number you enter in the Interval field. Normally you will render with an interval of 1.

To change the Interval field, type a new number. You can also click the arrow buttons next to the field to increment the existing number up (right arrow) or down (left arrow) by one frame per click.

Note: This is just like previous versions of VNS except you can't have a negative interval or an interval of less than one. To render an animation backward you can set the Start field to a higher number than End field (see above).

Set the Interval field to 1 if you want to render every frame in the animation. Set it to a higher number to render fewer frames.

Note: If you have more than one computer rendering the same animation, you can use the Frame Start field to set each machine to start at a succeeding frame, and then set the Interval field to the number of computers. For example, with three computer, you could set the first computer to start on frame 1, the second computer to start on frame 2, and the third computer to start on frame 3. Then set the Interval to 3 for all three computers. That way they will all render different frames and together will render the whole animation three times faster than one computer could do alone. However, it is now recommended that you utilize the supplied render controller program, SuperConductor™ as this will make the setup of such distributed render jobs far easier.

Frame Rate Field

Enter the number of frames you want per second. For NTSC video this would be 30. For film this would typically be 24. For PAL video this would be 25. For web animations this is often 15.

For quick motion previews this could be any number less than your final frame rate, such as 10.

File Output Page

The File Output page has three sections: Scheduled File Output Events, Selected Event and Temporary File Storage.

The Scheduled File Output Events section lets you add and delete types of files to save when you render.

The Selected Event section lets you specify the type of file for each event, enable or disable the event, choose to automatically add a file extension to the file name(s), specify the file base name and path, specify which channels to save and select options for the selected file format.

Scheduled File Output Events Controls

Output Events List

The Scheduled File Output Events list lets you tell VNS what kind of files will be saved when you render. Each entry in the list is a type of file that will be saved.

You can save the same animation to as many different file types as you want. This is useful for generating images in one or more file formats, along with compositing data such as Z-Buffers or RLA files, all at the same time.

You can also use multiple Output Events to save the same file format to different drives in the same computer or across network, for automatic backup as you render.

When you render, VNS will use the Scheduled File Output Events from the selected Render Options. If there is more than one Scheduled File Output Event, VNS will still only render once for each frame. But VNS will save multiple times, once for each Scheduled File Output Event.

Add Output Event Icon

Click the Add Output Event icon if you want to save another file for each rendered frame. VNS will add another Output Event, and you can choose the file type and other options in the Selected Event section (see below).

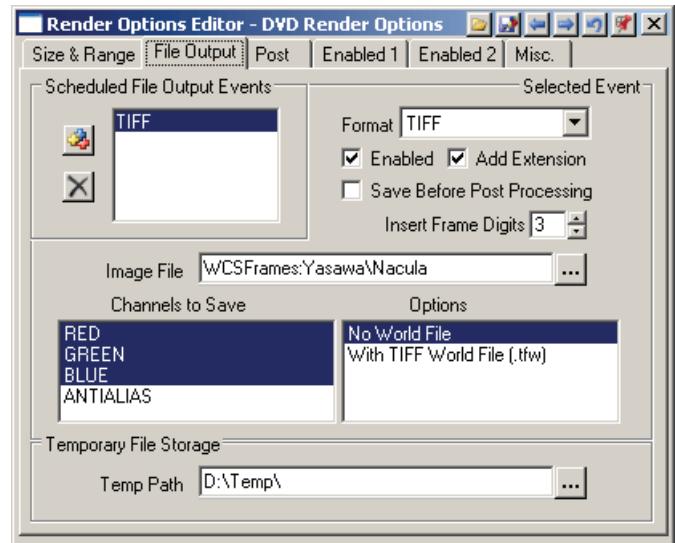
Remove Output Event Icon

Click the Remove Output Event icon if you want to remove an item from the Scheduled File Output Events list. VNS will remove the item from the list.

Selected Event Section

Format Drop Box

Use the Image Format drop box to choose how VNS should save rendered images. The quality will be the same no matter which format you choose. Use the format that works best for you.



Several of the formats have the option of saving an Antialias channel in the “Channels to Save” list (see below). An Antialias channel is an unsigned single byte array that defines how much of the image is covered by objects. This is useful for game producers and for compositing.

If you select RLA you get additional options useful for compositing VNS animations with other animations, video or film within external compositing programs.

Use the Format drop box to choose from these formats:

IFF-ILBM

This image format is supported by a variety of programs on most computers and is the Amiga standard. An advantage of using IFF-ILBM is that it has efficient lossless compression which can often store images more efficiently than other formats, thus saving hard drive space.

Targa

The Targa image format is widely supported on a variety of computers. It was originally developed for the Targa family of graphics hardware. VNS supports uncompressed Targa output.

Note: Compressed Targa was tested but it proved to slow down file operations and typically produced larger VNS image files than uncompressed Targa.

BMP

The BMP image format is common on computers running Microsoft operating systems and widely supported on other systems.

You can optionally save it with a World file which stores coordinates in the Coordinate System used by the Project.

PICT

The PICT image format is common on Apple Macintosh computers and widely supported on other systems.

RLA

The RLA format includes extra channels that are useful for compositing VNS animations with other animations, video or film within external compositing programs.

The Antialias channel is an unsigned single byte array that defines how much of the image is covered by objects.

The ZBUF channel contains distance information for compositing.

The Object channel allows quick selection of portions of the image in post processing (all Blue Spruce images could be selected at once, an entire lake body, etc.).

The Surface Normal X/Y/Z channels are intended for post process lighting.

The Latitude and Longitude channels are not generally supported by other programs but are included for potential future custom plugins.

Raw

The RAW format was designed for scientific usage, and stores image information as a raw stream of bytes (hence the name). Multiple Channels can be stored in this format, and each channel of information is stored separately from the next. For example: All the Red values for all pixels, then all the Green values, then all the Blue values, then all the Alpha values etc.

There are two options for this filetype: Full Precision and Scale to 8-bit. When Full precision is selected, the image is stored using 32 bits, in IEEE single-precision floating point format. This allows a far higher range of values in each channel than if Scale to 8-bit is selected. In the latter case, each channel has its values scaled to a discreet range from 0-255.

Raw Interleaved RGB

RAW Interleaved files store their channel information “interleaved”, hence the name. What this means is that instead of storing (as with the RAW format) all the red channel information, then all the blue channel information etc. the Interleaved format stores channel information on a per-pixel basis. In other words, the file contains the Red channel for the first pixel, followed by the Green channel for the first pixel, followed by the Blue channel for the first pixel, and then onto the second pixel, third pixel and so on.

This output format differs from the RAW format in the number of channels available for selection, and the precision options.

IFF-ZBUF

IFF-ZBUF files are Z-Buffer files which contain the distance from the camera for each pixel in each rendered image.

IFF-ZBUF files have a unique extension and are numbered identically to the rendered images to which they correspond.

You can use IFF-ZBUF files to do 3D compositing of VNS images with other programs such as LightWave 3D and 3D Studio MAX, using the included Z-Buffer plugins. That way 3D objects rendered in those programs can actually go in front of some already rendered VNS terrain features and behind other VNS terrain features. It is now preferred to use the Composite Post Process Events in VNS 3 to do the compositing within VNS itself with RLA or IFF-ZBUF files produced by other 3D applications.

An IFF-ZBUF file is a 4 byte floating point array.

Note: Format specifications for the IFF ZBUF and ZBOD chunks are available by contacting 3D Nature, LLC.

If you set up a Z-Buffer file Output Event, you can use the Image File field to save the Z-Buffer files in a different directory from the rendered images.

Some systems, notably the Perception card from DPS, cannot store Z-Buffer files in the same directory as image files.

Z-Buffer Gray IFF

Z-Buffer Gray IFF format is similar to the IFF-ZBUF format (see above) except it is saved as a standard 8 bit IFF gray scale image suitable for viewing or manipulating in an image processing or paint program.

Note: The IFF-ZBUF floating point format is necessary if you want to import them for future VNS renderings.

Illustrator™

Illustrator output lets you save a Project's enabled Vectors, with or without a linked VNS image, into an Adobe Illustrator file. This is particularly useful for cartographic projects where you may want to add text, map icons and other artwork to your VNS rendering using a structured drawing program.

The Illustrator output will include any Vectors that have their "Enabled" and "Render" checkboxes selected in the Database Editor.

Note: You can also select these checkboxes on the Properties page of the Vector Editor, but it's easier to do it from the Database Editor where you can more easily view and select any Vector.

If you choose to export a rendered VNS image, VNS will not embed the actual image in the AI file itself. Instead VNS creates two different layers (one called Raster, one called Vectors) and puts an image link into the raster layer to refer to a separate image file written by the next Image Output Event.

This is much more efficient than embedding the imagery in the AI file itself, which could make it many megabytes larger. You also have complete control over the format and options of the embedded image.

If you wish to include a linked rendered image, first select "Linework linked to next saver" in the Options list. Then set up a new Image Output Event after the Illustrator File Output Event. Select any of the supported image formats for the new Image Output Event (see Image Loading and Saving).

Adobe Illustrator or compatible programs will show the vector lines superimposed over the embedded image, in separate layers.

If you don't wish to include a rendered image, select "Linework only" in the Options list.

Note: If there is no enabled File Output Event below the Illustrator Image Output Event, VNS will not be able to include a linked rendered image.

Binary Terrain

Binary Terrain is a simple terrain format intended for use in realtime 3D engines. Select it when you want to create a Binary Terrain DEM file to import into other programs. VNS will save the DEM data in Binary Terrain format.

You can render with a Planimetric Camera using a Binary Terrain File Output Event to create a terrain file and an image File Output Event in any supported image format (see Image Loading and Saving) to create a matching image file. Then you can import the Binary Terrain file into a realtime 3D engine and drape the image file as a texture map for use in interactive games or on the internet.

WCS DEM

WCS DEM is the native terrain format for Visual Nature Studio and World Construction Set. Select it when you want to export a WCS DEM file complete with the changes created by any Terraffectors and Area Terraffectors in your Project.

You can render with a Planimetric Camera using a WCS DEM File Output Event to create a terrain file and an image File Output Event in any supported image format (see Image Loading and Saving) to create a matching image file. Then you can import the new WCS DEM file back into VNS using the Import Wizard or Database Editor. Disable the original DEM(s) and you will see your Terraffected terrain in your OpenGL Views!

If you drape the image file as a Color Map you can interact with textured, Terraffected terrain in realtime OpenGL Views. To see Color Maps in the selected OpenGL View, select the Ecosystem Map checkbox on the Overlay/Gradient page of the View Preferences Window.

You can use the Scene Export Window to export the Terraffected terrain to Lightwave or 3D Studio MAX. You can drape the VNS image file in LightWave or MAX for a quick textured terrain reference. This can make it easier to line things up between the programs when placing 3D objects in Lightwave or MAX.

Radiance RGBE HDR

The contrast between a scene's lightest and darkest points is referred to as its "Dynamic Range". Radiance High Dynamic Range images are designed to store image data where the dynamic range in a scene exceeds the discreet 256 levels available with a 24 bit RGB image.

Instead of storing a pixel's "color" (8 bits each of Red, Green and Blue), HDR images store each pixel as an amount of light in each of the Red, Green and Blue color channels. Since these values are stored as floating point numbers, the file can store a greater amount of information about illumination levels in the scene.

Output as Radiance HDR format is most commonly used as Global Illumination maps in radiosity based rendering solutions.

JPEG

JPEG (Joint Photographic Experts Group) is an image format that allows massive compression. We do not recommend using JPEG images for foliage and Celestial Objects because the compression artifacting could cause fringing. We do not recommend using JPEG images for Ecosystem Matching Color Maps because compression artifacting could cause fringing around Ecosystems. JPEG artifacts may also be noticeable in animations so you may want to avoid rendering animations in JPEG format.

Choose the level of compression you want from the Options list (see below).

TIFF

TIFF stands for Tagged Image File Format. It's commonly used in publishing and GIS applications. VNS doesn't support saving LZW compressed TIFFs, but can load them.

You can optionally save it with a World file which stores coordinates in the Coordinate System used by the Project.

ER Mapper ECW

ECW (Extreme Compression by Wavelets) is a georeferenced image format used in GIS applications.

PNG

PNG (Portable Network Graphics) is a flexible image format created for use on the internet.

AVI

AVI is an animation format used for computer-based playback. When you save in AVI, VNS will ask which codec you want to use from the codecs available on your system. All your animation frames will then be saved in a single file, suitable for playback by AVI players.

Quicktime MOV

Quicktime is an animation format used for computer-based playback. When you save in Quicktime, VNS will ask which codec you want to use from the codecs available on your system. All your animation frames will then be saved in a single file, suitable for playback by Quicktime-compatible players.

Arc GRID BIL

Arc GRID BIL is a terrain format compatible with ESRI products.

Arc GRIDFLOAT

Arc GRIDFLOAT is a terrain format compatible with ESRI products.

Arc ASCII DEM

Arc ASCII DEM is a terrain format compatible with ESRI products.

Enabled Checkbox

Select the Enabled checkbox if you want VNS to save the Selected Event when you render. Disable it if you want VNS to ignore the Selected Event when you render.

Add Extension Checkbox

Select the Add Extension checkbox and VNS will automatically add an appropriate extension to the file name in the Image File field (see below) based on the format you selected in the Format drop box (see above). For example, for an IFF image, VNS will add ".iff" at the end of each file name.

Save Before Post Processing Checkbox

Select the Save Before Post Processing checkbox to save a file before any post process components are applied. For example, to save two output images, one with and one without postprocessing, you would add two identical output events with different filenames and/or paths, one with the Save Before Post processing checkbox enabled.

Insert Frame Digits Field

The Insert Frame Digits field lets you set the number of digits VNS will append to the base name of your animation. Make sure it's large enough to accommodate the number of animation frames you want render. For example, if you are rendering 300 frames you need at least 3 Frame Digits, whereas you'll need at least 4 Frame Digits if you are rendering 1,000 frames.

Image File Field and Icon

Use the Image File field to choose the directory and specify a name for your rendered images. You can type a path and name directly, or just click the Disk icon to open a file requester and navigate to the drawer where you want images saved. Then specify a name in the file requester.

Typically you will want to enter "WCSFrames:" as a stand-in for the hardwired path to the directory where you are keeping your rendered frames, and then a base name for the animation. For example:

"WCSFrames:MyAnimation".

VNS will then use the complete path for "WCSFrames:" as entered in the Preferences Window on the Paths page.

Note: If you're about to render frames from a new Project you might want to first create a new directory for the frames inside your WCS-Frames directory. See your operating system manual for information about creating directories. To tell VNS to actually save rendered images to your hard drive, make sure the Enabled checkbox is selected for an Output Event set to one of the supported image formats (see above). To begin rendering, click the Go button at the bottom of the Render Control Window.

If you fill up a hard drive during a rendering session VNS will display a file requester asking where you want to save the rest of the frames.

If you are rendering more than one frame to create an animation, VNS will take the file name you specified in the Image File field and add a frame number to the end of it. For example, if you enter the name

"WCSFrames:Flight"

into the Image File field, enter "1" into the Start field, and enter "150" into the End field, VNS will save 150 frames named "Flight001," "Flight002," and so on up to "Flight150."

Note: The Start and End fields are on the Size & Range page (see above).

This way your frame sequence can be easily handled by other programs which recognize such numbered frame sequences.

For backward compatibility to old versions of World Construction Set you can optionally add number symbols to the name to force VNS to use a certain amount of digits for frame numbers. For example, you could put "WCSFrames:MyAnim####.iff" after the path in the Image File field to force VNS to use four digits for the number.

But In VNS 3 you don't have to do this any more. Simply use the Frame Digits field (see above). VNS will use the amount of digits you enter in the Insert Frame Digits field for frame numbers.

Note: If you want VNS to add an file extension after the number, select the Add Extension checkbox (see above). Some programs, such as Adobe PhotoShop, require extensions in order to load images. Some operating systems, such as versions of Microsoft Windows, also require extensions to identify file types. VNS itself does not generally require extensions since graphics files typically identify their types in their headers, a part of the file which any program can read. Extensions ought to be for the convenience of humans, not required by programs and operating systems, but be aware that not all programs and operating systems are necessarily all that smart. In a world of dumb software you should probably use extensions as a matter of habit.

Channels to Save List

The Channels to Save list to select the channels you'd like VNS to include when saving files for the Selected Event. The available channels depend on the file format you selected in the Format drop box (see above).

Most file formats include Red, Green and Blue channels to create a 24-bit color image. To add other available channels, control click to select or deselect a channel. Shift-click to select a range of channels. Selected channels have white text against a blue background. Unselected channels have black text on a white background.

Options List

The Options list lets you select any options for the file format you selected in the Format drop box (see above). These may include compression and bit depth options. Not every file format will have options to select.

Selected options have white text against a blue background. Unselected options have black text on a white background. Only one set of options is selectable for any File Output event.

Temporary File Storage Controls

Temp Path Field and Icon

Use the Temp Path field to choose the drawer where you want VNS to save temporary files during field rendering. You can type a path directly, or just click the Disk button to bring up a dialog to locate a directory where you want temporary files saved.

The temporary file path is used to store the first field of each frame when field rendering. The resulting temporary file only exists until VNS finishes rendering the second field. At that time VNS combines the two fields and removes the temporary file from the hard disk. The Temp path is also used in a similar way during multipass AA/motionblur and panoramic rendering.

Note: Be aware that your VNS Temp path field must point to a different folder for each iteration of VNS you are running, either on a renderfarm or a multiprocessor machine. If you have multiple iterations of VNS using the same Temp path, the likelihood is that as temp files overwrite each other, at least some of your rendered output (if not all) will be unusable.

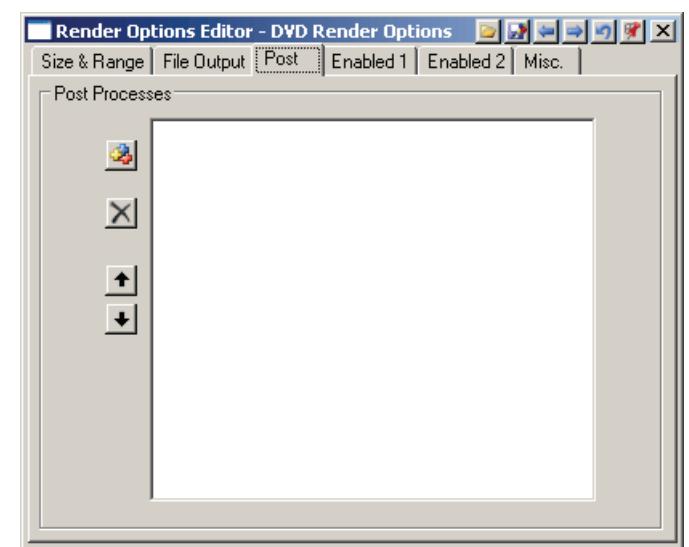
Post Page

This page contains the controls necessary for the addition and application of Post Process components to the rendered output from the selected Render Option set.

Note: Post Process components can be shared between multiple Render Option sets. If you have multiple sets of Render Options, each one can contain a reference to one Post Process effect. This allows Post Process continuity between Render Option sets and also reduces the number of Post Process components that must be created or cloned.

Post Process List

The Post Process List contains a list of Post Process components that are being applied to the output of the current render options. Post Process components within the current project must be added to this list in order for their effects to be visible in rendered output.



Add Post Process Icon

Click the Add Post Process icon to open a window with a list of Post Process components in your Project. Select one or more Post Process component by clicking, shift-clicking or control-clicking. Click the Add Items button to add the selected components to the Render Options.

Click the Cancel button if you want to close the window without adding any Post Processes to the Render Options.

Remove Post Process Icon

Select (click, control-click or shift-click) a Post Process or Post Processes in the Post Process list and click the Remove Post Process icon to remove it or them from the Render Options.

Raise Post Process Rendering Priority

Select an Post Process in the Post Process list and click the Raise Post Process Rendering Priority to make it higher in the Post Process list. The items in the list are applied to the rendered output from top to bottom.

Lower Post Process Rendering Priority

Select a Post Process in the Post Process list and click the Lower Post Process Rendering Priority to make it lower in the Post Process list. The items in the list are applied to the rendered output from top to bottom.

Enabled 1 Page

The Enabled 1 page lets you control whether Land, Water, Vegetation or 3D Objects will render. Select checkboxes for those Component types you want to see in your rendered images. Deselect checkboxes for those Component types you do not want to see in your rendered images.

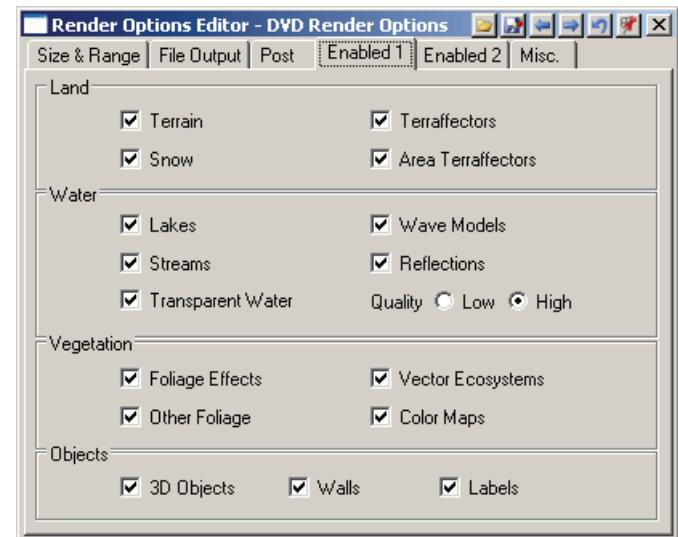
Land Controls

Terrain Checkbox

Select the Terrain checkbox to see terrain in your rendered images. Deselect the Terrain checkbox to prevent terrain from appearing in your rendered images.

Note: In order to see terrain in your rendered images, you must have DEM data in your Project, and it must be visible to the Camera you are using for the rendering. You can import DEM data with the Import Wizard. You can create DEM data with the Terrain Gridder Editor or the Terrain Generator.

If you deselect the Terrain checkbox, other items which depend on terrain will also be prevented from appearing in your images. These include all items on both the Enabled 1 and Enabled 2 pages except 3D Objects.



Snow Checkbox

Select the Snow checkbox to see snow in your rendered images. Deselect the Snow checkbox to prevent snow from appearing in your rendered images.

Note: In order to see snow in your rendered images, you must have an enabled Snow Effect within view of the rendering Camera (see Snow Effect Editor).

Terraffectors Checkbox

Select the Terraffectors checkbox to see Terraffectors in your rendered images. Deselect the Terraffectors checkbox to prevent Terraffectors from appearing in your rendered images.

Note: In order to see Terraffectors in your rendered images, you must have an enabled Terraffecter within view of the rendering Camera (see Terraffecter Editor).

Area Terraffectors Checkbox

Select the Area Terraffectors checkbox to enable all Area Terraffectors. Deselect it to disable all Area Terraffectors. If you disable Area Terraffectors they will not lose their parameter values.

It may be useful to temporarily disable all Area Terraffectors to see how the terrain looks without them, or to speed preview rendering.

Select the Area Terraffectors checkbox to see Area Terraffectors in your rendered images. Deselect the Area Terraffectors checkbox to prevent Area Terraffectors from appearing in your rendered images.

Note: In order to see Area Terraffectors in your rendered images, you must have an enabled Area Terraffecter within view of the rendering Camera (see Area Terraffecter Editor).

Water Controls

Lakes Checkbox

Select the Lakes checkbox to see an ocean or lakes in your rendered images. Deselect the Lakes checkbox to prevent an ocean or lakes from appearing in your rendered images.

Note: In order to see lakes in your rendered images, you must have an enabled Lake within view of the rendering Camera (see Lake Editor). An ocean is a lake which is not assigned to a Vector, and will thus appear everywhere the terrain is below the lake's elevation.

Streams Checkbox

Select the Streams checkbox to see streams in your rendered images. Deselect the Streams checkbox to prevent streams from appearing in your rendered images.

Note: In order to see streams in your rendered images, you must have an enabled Stream within view of the rendering Camera (see Stream Editor).

Transparent Water Checkbox

Select the Transparent water checkbox to enable transparent water in your rendered output. This setting is only available if Pixel Fragment rendering is enabled on the Misc page of the Render Options in use (See Render Options Editor).

Wave Models Checkbox

Select the Waves checkbox to see waves in your rendered images. Deselect the Waves checkbox to prevent waves from appearing in your rendered images.

Note: In order to see waves in your rendered images, you must have an enabled Wave Model attached to a Lake or Stream within view of the rendering Camera (see Wave Model Editor).

Reflections Checkbox

Select the Reflections checkbox to see reflections in your rendered images. Deselect the Reflections checkbox to prevent reflections from appearing in your rendered images.

Note: In order to see reflections in your rendered images, you must have an enabled Lake or Stream using a Material with some percentage of Reflections, within view of the rendering Camera.

Reflection Quality Radio Buttons

High

Select the High Quality radio button if you want more accurate reflections at the expense of slightly longer render times.

Low

Select the Low Quality radio button if you wish to save render time at the expense of accurate reflections. If your reflective surfaces are distorted or the camera is moving at some speed, this setting may save time without noticeably compromising quality.

Vegetation Controls

Foliage Effects Checkbox

Select the Foliage Effects checkbox to see Foliage Effects in your rendered images. Deselect the Foliage Effects checkbox to prevent Foliage Effects from appearing in your rendered images.

Note: In order to see Foliage Effects in your rendered images, you must have an enabled Foliage Effect within view of the rendering Camera (see Foliage Effect Editor).

Other Foliage Checkbox

Select the Other Foliage checkbox to see Ecotype Foliage in your rendered images. Deselect the Other Foliage checkbox to prevent Ecotype Foliage from appearing in your rendered images.

Note: In order to see Ecotype Foliage in your rendered images, you must have an enabled Ecosystem (see Ecosystem Editor), Lake Beach (see Lake Editor) or Stream Beach (See Stream Editor) within view of the rendering Camera.

Vector Ecosystems Checkbox

Select the Vector Ecosystems checkbox to see Vector-bounded Ecosystems in your rendered images. Deselect the Vector Ecosystem checkbox to prevent Vector-bounded Ecosystems from appearing in your rendered images.

Note: In order to see Vector Ecosystems in your rendered images, you must have an enabled Ecosystem (see Ecosystem Editor) attached to a Vector within view of the rendering Camera.

Note: If the Other Foliage checkbox is deselected (see above), you will not see any Ecotype foliage in Vector Ecosystems. You will only see the Ground Overlay textures.

Color Maps Checkbox

Select the Color Maps checkbox to see Color Maps in your rendered images. Deselect the Color Maps checkbox to prevent Color Maps from appearing in your rendered images.

Note: In order to see Color Maps in your rendered images, you must have an enabled Color Map (see Color Map Editor) within view of the rendering Camera. If the Other Foliage checkbox is deselected (see above), you will not see any Color Mapped foliage. You will only see Colors from Color Maps.

Objects Controls

3D Objects Checkbox

Deselect the 3D Objects checkbox if you want to prevent all 3D Objects from rendering. This can be useful to do when you are working on some other aspect of the Project and don't need to see the 3D Objects for a while.

Select the 3D Objects checkbox to allow all individually enabled 3D Objects to render. The next time you render using this set of Render Options, any 3D Objects that have their individual Enabled checkboxes selected and are visible to the camera will appear in your scene.

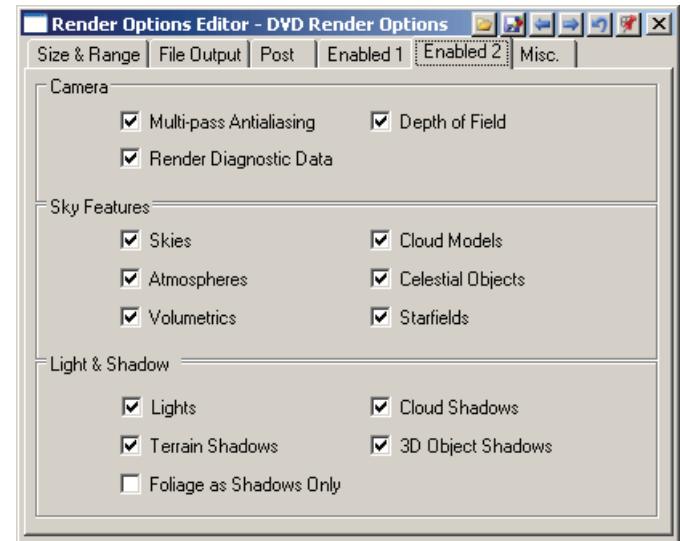
Note: In order to see 3D objects in your rendered images, you must import them with the 3D Object Editor and they must be visible to the Camera you selected in the current Render Job (see Render Job Editor).

Walls Checkbox

Select the Walls Checkbox to enable rendering of Walls in your scene. The next time you render using this set of options, all Walls components attached to active vectors that have their Enabled checkboxes selected and are visible to the camera will render in your scene.

Enabled 2 Page

The Enabled 2 page lets you control whether Camera Attributes, Sky Features or Light & Shadow Attributes will render. Select checkboxes for those items you want to see in your rendered images. Deselect checkboxes for those items you do not want to see in your rendered images.



Camera Features

Multipass Antialiasing Checkbox

Select the Multipass Antialiasing checkbox to see multipass antialiasing in your rendered images. Deselect the Multipass Antialiasing checkbox to prevent multipass antialiasing in your rendered images.

If you're rendering a test animation and don't need to see multipass antialiasing for the test animation, deselecting this checkbox will save a lot of rendering time. If you need multipass antialiasing for your final rendering, make sure you turn it back on before doing your final rendering.

Note: In order to see multipass antialiasing in your rendered images, you must have more than 1 in the Antialias Passes field on the Lens page of the Camera Editor for your rendering Camera.

Render Diagnostic Data Checkbox

Select the Render Diagnostic Data checkbox to tell VNS to keep rendered diagnostics information in memory after the render is finished.

Leaving this checkbox selected in your final render options will increase (sometimes considerably) the amount of memory required by VNS. If you are having trouble allocating sufficient memory for a render, you should try deselecting this checkbox.

VNS will open the Diagnostic Data Window after you render an image. Click in the rendering (a View or the Rendering in Progress window) to see useful information displayed in the Diagnostics Data window for the point you clicked.

Deselect the Render Diagnostic Data checkbox if you don't want to keep rendered diagnostics information in memory after the render is finished. In this case, the Diagnostics Data window will only display a limited set of data when you click in a View, and none when you click in the Rendering in Progress window.

Note: To open the Rendering in Progress window, click the Show Rendering checkbox on the Render Control window before or during a final render.

Depth of Field Checkbox

Select the Depth of Field checkbox to see depth of field blurring in your rendered images. Deselect the Depth of Field checkbox to prevent depth of field blurring from appearing in your rendered images.

Note: In order to see depth of field blurring in your rendered images, you must select the Depth Of Field checkbox on the Lens page of the Camera Editor for your rendering Camera.

Sky Features

Sky Checkbox

Select the Sky checkbox to see sky in your rendered images. Deselect the Sky checkbox to prevent sky from appearing in your rendered images.

Note: In order to see sky in your rendered images, you must have an enabled Sky within view of the rendering Camera (see Sky Editor).

Atmospheres Checkbox

Select the Atmosphere checkbox to see atmosphere in your rendered images. Deselect the Atmosphere checkbox to prevent atmosphere from appearing in your rendered images.

Note: In order to see atmosphere in your rendered images, you must have an enabled Atmosphere within view of the rendering Camera (see Atmosphere Editor).

Volumetrics Checkbox

Select the Volumetrics Checkbox to enable rendering of volumetric components in your scene. Deselecting this checkbox will prevent volumetric effects from rendering, even if their individual Enabled checkboxes are selected.

Cloud Models Checkbox

Select the Clouds checkbox to see clouds in your rendered images. Deselect the Clouds checkbox to prevent clouds from appearing in your rendered images.

Note: In order to see clouds in your rendered images, you must have an enabled Cloud Model within view of the rendering Camera (see Cloud Model Editor).

Celestial Objects Checkbox

Select the Celestial Objects checkbox to see Celestial Objects in your rendered images. Deselect the Celestial Objects checkbox to prevent Celestial Objects from appearing in your rendered images.

Note: In order to see Celestial Objects in your rendered images, you must have an enabled Celestial Object within view of the rendering Camera (see Celestial Object Editor).

Starfields Checkbox

Select the Starfields checkbox to see stars in your rendered images. Deselect the Starfields checkbox to prevent stars from appearing in your rendered images.

Note: In order to see stars in your rendered images, you must have an enabled Starfield within view of the rendering Camera (see Starfield Editor).

Light & Shadow Controls

Lights Checkbox

Select the Lights checkbox to see Lights in your rendered images. Deselect the Lights checkbox to prevent Lights from shading your rendered images. Without Lights, your images will appear as if lit by ambient light at 100% intensity. Terrain and 3D objects will show their diffuse color and nothing will have any shading applied.

Note: In order to see Lights in your rendered images, you must have an enabled Light casting light within view of the rendering Camera.

Terrain Shadows Checkbox

Select the Terrain Shadows checkbox to see terrain shadows in your rendered images. Deselect the Terrain Shadows checkbox to prevent terrain shadows from appearing in your rendered images.

Note: In order to see terrain shadows in your rendered images, you must have an enabled Shadow Component within view of the rendering Camera (see Shadow Editor).

Cloud Shadows Checkbox

Select the Cloud Shadows checkbox to see cloud shadows in your rendered images. Deselect the Cloud Shadows checkbox to prevent cloud shadows from appearing in your rendered images.

Note: In order to see cloud shadows in your rendered images, you must have an enabled Cloud Model (see Cloud Model Editor) that is set to cast shadows, and an enabled Shadow Component set to receive shadows within view of the rendering Camera (see Shadow Editor).

3D Object Shadows Checkbox

Select the 3D Object Shadows checkbox to see 3D Object shadows in your rendered images. Deselect the 3D Object Shadows checkbox to prevent 3D Object shadows from appearing in your rendered images.

Note: In order to see 3D Object shadows in your rendered images, you must have an enabled 3D Object (see 3D Object Editor) that is set to cast shadows, and an enabled Shadow Component set to receive shadows within view of the rendering Camera (see Shadow Editor).

Miscellaneous Page

Render Quality Controls

VNS 3 uses a new render methodology to generate images. Dubbed "Pixel Fragment Rendering", it works as follows:

The render engine takes every pixel as it is being rendered for a polygon and stores channels of information about it - its color, Z distance, alpha, coverage mask, reflection %, surface normal, etc. However, this information is not merged with the other data from other polygons that render at the same pixel. Instead a list is maintained of pixel data sorted in order of increasing Z. When new data is generated, whether it is a terrain polygon, water, a 3D Object, foliage image or whatever, the new fragment of data is sorted into the list. When the rendering is finished the pixel list is collapsed down into a single image pixel for saving to a file.

Of course there are optimizations so data is not stored that is not likely to be needed later but the idea is that things no longer have to render in a particular order in order to make it all work. The result should be as good as doing ray tracing with 64 rays per pixel - at least as far as antialiasing goes.

The downside of this new render method is that it takes more memory, considerably more sometimes, and it takes longer to render than a single pass render using the old render engine. Pixel Fragment rendering is always faster than multipass renders using the old render engine though, and unless motion blur is required, is the recommended render method in VNS 3.

Fragments Enabled Checkbox

Select this checkbox to enable Pixel Fragment rendering. Deselect this checkbox to disable Pixel Fragment Rendering. If disabled, certain features (transparent water, post process compositing etc.) will no longer be available.

Antialiasing Quality Field

This field controls the quality of the pixel fragment rendering performed. In actuality, it is a measure of the maximum number of fragments per pixel. Beyond the default value of 40 you are unlikely to see any noticeable increase in quality, although there is no fixed upper limit. If a pixel requires less fragments, it will use less. Values of 10 or 20 seem to work fine in most cases. Increasing this field will result in an increase in the amount of memory required to render the scene.

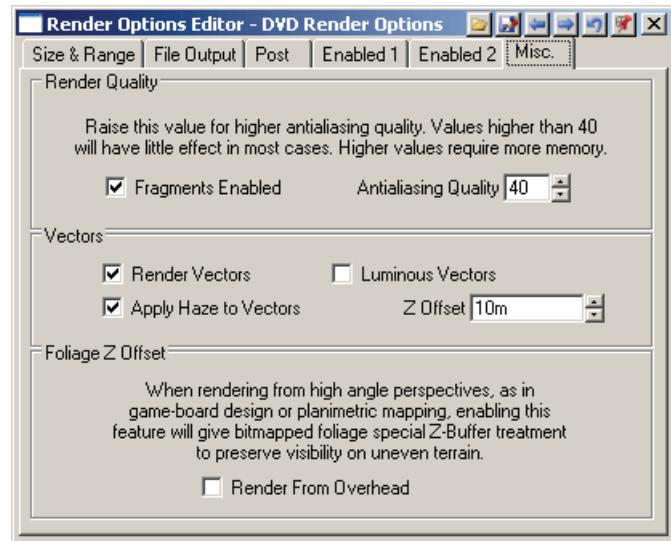
Vectors Controls

The Vectors controls determine how Vectors are treated during rendering.

Render Vectors Checkbox

Select the Render Vectors checkbox to show the Vectors on rendered images.

Deselect the Render Vectors checkbox when you don't want Vectors to appear in your rendered images.



Note: Any Terraffectors or other Components controlled by any enabled Vectors will still appear even if the Render Vectors checkbox is deselected.

If you want to see Vectors rendered into preview or final renderings, make sure you've enabled them here.

Apply Haze to Vectors Checkbox

The Apply Haze to Vectors checkbox will only be accessible when the Render Vectors checkbox is selected. Select the Haze Vectors checkbox if you want haze, fog and shading to be applied to Vector Objects when they are rendered into your images. Deselect Haze Vectors when you want Vector Objects to be unaltered by Haze settings.

Illuminated Vectors will not be shaded but will have haze and fog applied if Haze Effect is enabled.

Z Offset Field

Use the Z Offset field to set the distance offset for Vector Objects during rendering.

Vector Objects are Z-Buffered into a rendered image. Since trees and topographic irregularities may partially or fully obscure Vectors this offset value is provided to trick VNS into thinking that the Vectors are closer than they really are. This increases their rendering priority.

Positive values increase priority (as if you moved the Vectors closer to the Camera). If you are using Vectors with large segment lengths relative to the size of DEM polygons, you may need to increase this value in order to see the Vectors.

If you are rendering Vectors onto one of VNS' global DEM sets you might need to raise this value even higher to avoid having parts of the Vectors becoming obscured by the terrain.

This value does not affect the actual position of Vectors.

Foliage Z Offset Section

Render From Overhead Checkbox

Image Object trees always face the camera, even when the Camera is overhead. Select the Render from Overhead checkbox when you want to render an overhead shot without having Image object trees disappear below the terrain as they face the Camera. VNS will then render trees in front of the terrain even if their rotation to face the camera would otherwise cause them to be below the terrain.

This can be useful if you are rendering an image with an overhead camera to use as a texture in a real time game engine or an external 3D program.

Render Scenario Editor

The Render Scenario Editor allows you to edit the parameters of Render Scenarios. Render Scenarios are designed to provide you with the ability to enable and disable components in your scene at will during a single Render Job. You no longer need to create multiple projects or Render Jobs to visualize situations where 3D objects, ecosystems, color maps, vectors and so forth disappear and appear during the course of an animation. A practical example of this is given in Appendix K: Applications in GIS in the section entitled "Creating Time Slices".

Another excellent example of where Scenarios may help you manage your project data is as follows:

Most projects involve a lot of experimentation looking for just the right settings, or a lot of preliminary renders until all the data is in and set up with the right ecosystems, terraffectors, streams, and so forth. During the experimentation phase things get disabled either to better allow you to see some other feature or to speed the preview process.

It could be easy to forget to re-enable something for the final rendering with all that experimentation going on.

Use a Scenario attached to the final Render Job that turns everything on. This might be driven by a Search Query that selects everything in the Database or has all of the Ecosystems, Lakes, Streams, Terraffectors in the controlled items list.

This should be the first Scenario in the Render Job's list. Other Scenarios can then be used to disable specific items for certain frames or whatever you need to do. But the important thing is that nothing was inadvertently left disabled that should have been enabled.

The same items can be acted on by different scenarios. Scenarios are applied in the sequence found in the Render Job's Scenario list. So one Scenario can turn everything on and a later one turn some of them off. No harm is done if the Scenario enables some items that are already enabled.

General Page

General Features Section

Name Field

The name field allows you to see and edit the name for the current Render Scenario.

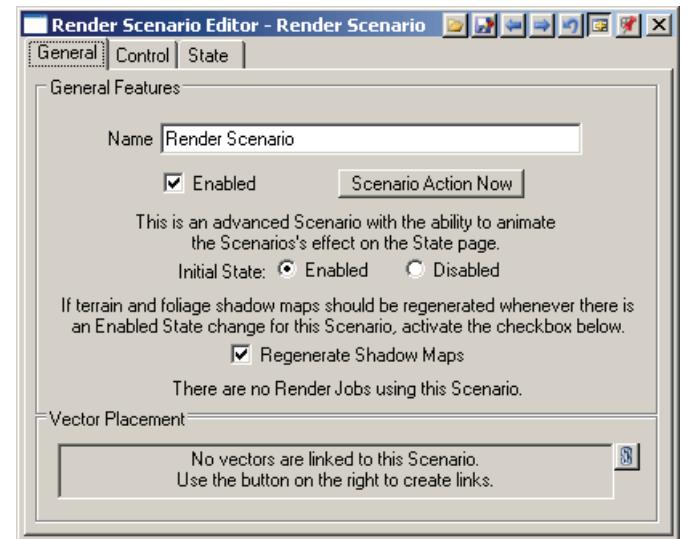
Enabled Checkbox

Select this checkbox to enable the current Render Scenario.

Deselect this checkbox to disable the current Render Scenario.

Scenario Action Now Button

Normally, Render Scenarios are applied at rendertime - without manually adjusting the enabled/disabled state of various object types to match the Render Scenario settings for the current frame, you can not see the effects that your Render Scenarios will have in a visual manner through the interface. Clicking this button will apply all the scenario settings for the current frame number to the project, so that you can see the effects of the applied Scenario or Scenarios in the VNS interface before rendering.



Initial State Radio Buttons

These buttons allow the rapid creation of Scenarios where items simply have to be enabled or disabled, and their state does not need to be animated. They set the initial state (enabled or disabled) of all items in the Controlled items Section on the Control Page.

Enabled

Select this option if the items added on the Control Page are to be Enabled by this Render Scenario

Disabled

Select this option if the items added on the Control Page are to be Disabled by this Render Scenario

Regenerate Shadow Maps Checkbox

If the currently selected Render Scenario enables or disables any terrain-related or foliage-related component in your project that would require VNS to recalculate shadow maps, select this checkbox. This will force VNS to recalculate shadow maps every time there is a state change in the current Render Scenario.

Render Job Display Area

This area displays whether or not any Render Jobs are using the Scenario, and if so, how many.

Vector Placement Section

By attaching Vectors to Ecosystems you can control where they appear. Vectors can be dynamically linked with Search Queries or hard linked.

Vector Links Button

This control allows you to perform various tasks relating to the association of vectors with components. To learn how to use it, see Vector Links Icon.

Attached Hard-Linked Vectors Display

The Hard-Linked Vectors display tells you if there are any Vectors hard-linked to the Component, and if so, how many. It will also display vectors attached by Search queries and list the names of the search query or queries in use.

Control Page

Controlled Items Section

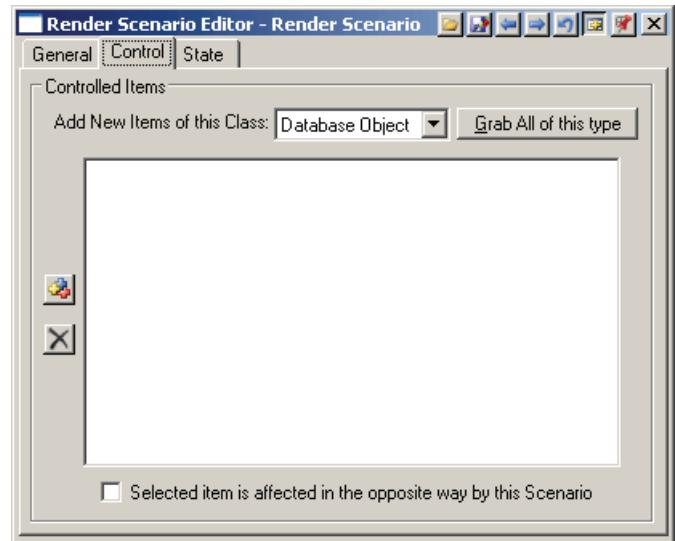
Controlled Items List

The Post Process List contains a list of components to which the current enabled state controls will be applied. Components within the current project must be added to this list in order for them to be enabled and disabled by this Render Scenario.

Add New Items Of This Class Dropdown List

Select the type of component that you wish to add from this dropdown list. The following classes of component are available:

- **Database Object**
- **Image Object**
- **3D Object**
- **Area Terraffector**
- **Atmosphere**
- **Celestial Object**
- **Cloud Model**
- **Color Map**
- **Ecosystem**
- **Environment**
- **Foliage Effect**
- **Ground Effect**
- **Lake**
- **Light**
- **Planet Option**
- **Post Process**
- **Search Query**
- **Shadow**
- **Sky**
- **Snow effect**
- **Starfield**
- **Stream**
- **Terraffector**
- **Terrain Parameter**
- **Thematic Map**
- **Wall**
- **Wave Model**



Further selection within that class of component is achieved through use of the Add & Remove Controlled Item Icons (see below)

Grab All Of This Type Button

Click this button to add all items of the currently selected class to the Controlled Items List. If the currently selected class is "Database Objects", you will be further prompted to select which subclass of database object you wish to add (Vectors, Control Points, DEMs or all of these subclasses).

Add Controlled Item Icon

Click the Add Controlled Item icon to open a window with a list of components in your project. The contents of the list will be filtered according to the object class selected in the Add New Items Of This Class dropdown list. Select one or more components by clicking, shift-clicking or control-clicking. Click the Add Items button to add the selected components to the Controlled Items List.

Click the Cancel button if you want to close the window without adding any components to the Controlled Items List.

Remove Controlled Item Icon

Select (click, control-click or shift-click) a component or components in the Controlled Items List and click the Remove Controlled Item icon to remove it or them from the currently selected Render Scenario.

Opposite Effect Checkbox

Selecting an item in the list and enabling this checkbox, allows you to create a single list where different items are affected in different ways by the Scenario. Any items for which this checkbox is enabled will have their state altered in the opposite way to that of those for whom the checkbox is not enabled.

Careful use of this checkbox will reduce the number of render scenarios required in many cases.

State Page

Animated State Control Section

Initial State Radio Buttons

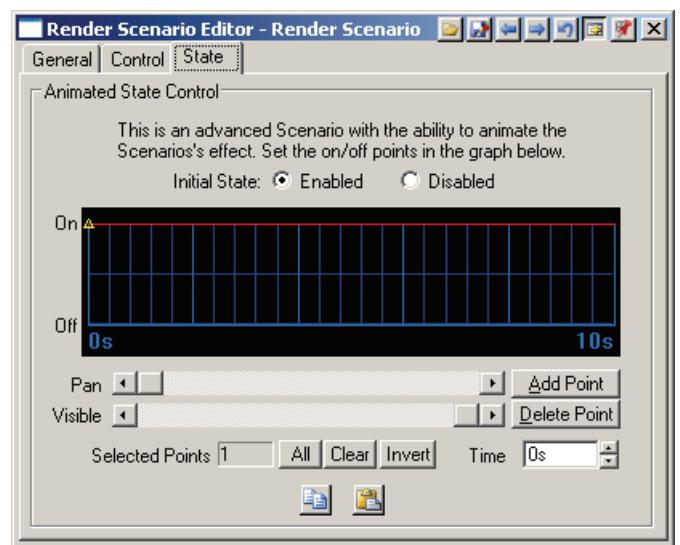
These buttons set the initial state (enabled or disabled) of all items in the Controlled items Section on the Control Page.

Enabled

Select this option if the items added on the Control Page are to be Enabled by this Render Scenario

Disabled

Select this option if the items added on the Control Page are to be Disabled by this Render Scenario



Enabled State Control Graph Area

The Graph display shows the Enabled States (on or off) of the controlled items over time. You can interactively edit the points on the graph.

The X axis of the graph represents time in the currently selected units. You can select the units on the Units page of the Preferences Window. The Y axis of the graph is a Boolean control which allows you to select On or Off (enabled or disabled).

You can click any point to select it. You can drag points in the Y axis with the mouse.

Pan Slider

Use the Pan slider to go left or right in the Graph when you've zoomed in with the Visible slider. The X axis of the graph shows a distance from the Wave Source.

Visible Slider

Use the Visible slider to zoom in and out on the X axis of the Graph display. The X axis of the graph shows time in the currently selected units.

Selected Points Display Field

The Selected Points display field shows the number of graph points that are currently selected. Click a graph point to select it. Shift-click to select more than one.

All Button

Click the All button to select all points in the graph.

Clear Button

Click the Clear button to deselect all points in the graph.

Invert Button

Click the Invert button to select all unselected points and deselect all selected points.

Add Point Button

Click the Add Point button and then click in the graph to add a new point. Each Point represents a potential state change for this Render Scenario.

Delete Point Button

Click the Delete Point button to remove the selected point or points.

Time Field

This field displays the time of the currently selected point on the graph. Enter a new value in this field to change the time at which a state change occurs in this Render Scenario.

Copy Enabled State Icon

Click this icon to copy the enabled state graph of the current Render Scenario to memory.

Paste Enabled State Icon

Click this icon to paste the enabled state graph held in memory to the current Render Scenario.

Note: Copying and pasting only works between Render Scenarios. The current Enabled State of the Render Scenario will be applied to all controlled items in that Render Scenario. This does not stop items that are enabled from being disabled by another Render Scenario that is evaluated later in the Render Scenarios List (see Render Options Editor) or vice versa.

Scene Exporter Editor

The Scene Exporter Editor is unique to Scene Express and provides the ability to export VNS scenes to other formats, designed for either realtime viewing or to provide interoperability with other 3D animation and rendering products and rapid prototyping processes. Some of the available export modules are optional and cost an additional amount over and above the cost of the basic Scene Express product.

More background information on the different formats and overviews of their strengths and weaknesses can be found in Appendix N: Scene Express Export Formats.

Note: Some formats support additional Advanced Options. See the following for more details: Scene Exporter Editor: NatureView Advanced Options; Scene Exporter Editor: STL & VRML-STL Advanced Options; Scene Exporter Editor: OpenFlight Advanced Options

General Page

General Features Section

Name Field

The name field allows you to see and edit the name for the current Scene Exporter.

Enabled Checkbox

Select this checkbox to enable the current Scene Exporter. Deselect this checkbox to disable the current Scene Exporter.

Priority Field

The Priority field lets you specify the export priority of the current Scene Exporter relative to other Components of the same category. A Scene Exporter with a higher priority will be rendered before a Scene Exporter that has a lower priority.

Compress Output Checkbox

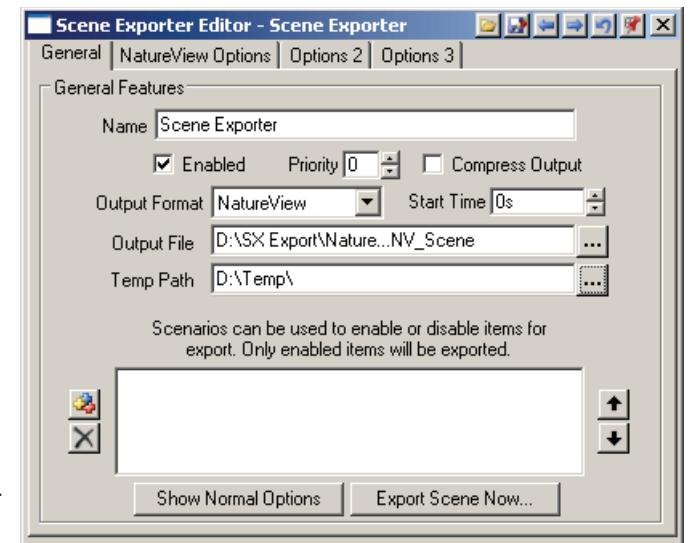
Select this checkbox if you want your exported scene to be compressed. This will save disk space for those formats where it is supported.

Note: Use of this option with VRML files may require update to the relevant viewing software to view the compressed file, as VRML files are directly viewable in compressed format (.wrz) with the latest VRML viewers.

Output Format Dropbox

This drop list contains a list of the output formats available. Select the most relevant output filetype from this list. There is a more comprehensive description of each format in Appendix N: Scene Express Export Formats.

Note: Selection of certain filetypes in this list will cause other options within the Scene Exporter interface to become grayed. A description of each filetype & the limitations inherent to each, are described in Appendix N: Scene Express Export Formats.



Start Time Field

For animated projects, this field allows you to enter the start time in seconds for the data that should be exported.

Animated items in your scene will export their full animation to the selected export format, where supported by that format. The time value selected in the Start Time field will determine the state of animated items that must be exported to non-animated representations within the export format. For example, an animated ground texture will use this value to determine how the exported drape texture will look.

Output File Field

Use the Output File field to choose the directory and specify a name for your exported project. You can type a path and name directly, or just click the disk icon to open a file requester and navigate to the drawer where you want output data saved. Then specify a name in the file requester.

Temp Path Field

Use the Temp Path field to choose the directory where temporary files created during the export process will be stored. VNS should delete these files when it is finished with the export process. If it fails to do so for any reason, it is safe to assume that this folder can be emptied of files manually after the export process has completed. You can type a path directly, or just click the disk icon to open a file requester and navigate to the folder where you want temporary output data saved. No filename is required in this field.

Scenarios List

This space displays a list of all Scenarios that have been added to the current Scene Exporter. By using Scenarios, you can enable and disable different elements of your scene for export to different formats. For example, you may wish to set up two Scene Exporters, one exporting to VRML and the other exporting to 3DS format. If the scene contains huge numbers of 3D Objects, you may wish to define a Scenario that disables the majority of (but not all) 3D Objects in the scene. This Scenario can be added to the Scenarios List associated with the VRML Scene Exporter, thus reducing export time and improving performance.

Note: Scenarios only have application within the Scene Exporter interface if export of a subset of a particular object type is required. If you simply wish to disable export of a particular object type (terrain, 3D Objects, Textures, Foliage etc), then this can be achieved through the supplied controls in the Scene Exporter Editor - Scenarios would not be required in these cases.

Add Scenario Button

Click the Add Scenario icon to open a window with a list of Scenario components in your Project. Select one or more Scenarios by clicking, shift-clicking or control-clicking. Click the Add Items button to add the selected components to the Scene Exporter Editor.

Click the Cancel button if you want to close the window without adding any Scenarios to the Scene Exporter Editor.

Remove Scenario Button

Select (click, control-click or shift-click) a Scenario or Scenarios in the Scenario list and click the Remove Scenario icon to remove it or them from the Scene Exporter Editor.

Raise Scenario Priority Button

Select an Scenario in the Scenarios list and click the Raise Scenario Priority to move it higher in the Scenarios list. The items in the list are evaluated from top to bottom.

Lower Scenario Priority Button

Select an Scenario in the Scenarios list and click the Lower Scenario Priority to move it lower in the Scenarios list. The items in the list are evaluated from top to bottom.

Show Advanced Options Button

Clicking this button will change the other pages in the Scene Exporter interface to reflect advanced features of a particular export format. Currently, the formats which support Advanced features are Natureview, STL and VRML-STL, and Openflight. When enabled, the button renames itself to "Normal Options" and clicking it a second time will return the interface to its original layout and content.

Export Scene Now Button

Clicking this button will open the Export Control Window if not already open, ready to initiate the actual export process itself.

Terrain Page

Terrain Resolution Section

Export Terrain Checkbox

Selecting this checkbox will enable export of your terrain model to the selected format at the selected resolution. If this checkbox is deselected, then export of the terrain model will be suppressed.

Note: Terrain export is not a prerequisite for all working export file formats. VRML and some other formats are happy to accept scenes that contain no terrain data as such. However, VTP does require terrain to be exported to create a valid working scene.

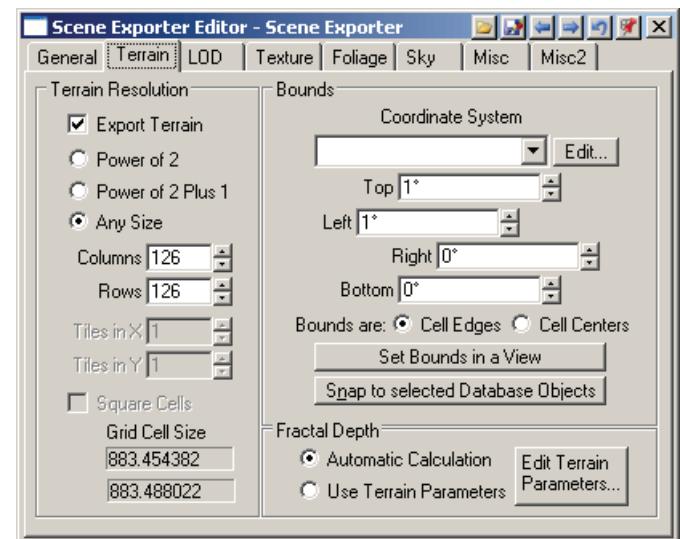
Terrain Resolution Radio Buttons

These radio buttons allow you to decide the method used to calculate the resolution of your exported terrain model.

Note: Due to restrictions in some of the export file formats, not all of these options will be available for all export formats.

Power Of 2

If this radio button is selected, then terrain models will be exported from the current project with a number of rows and columns equal to a power of two: 128, 256, 512, 1024 etc. It is not necessary that the resolution N-S is the same as the resolution E-W. ie: you can select 256



for the columns and 1024 for the rows, if you so choose. The only pre-requisite is that the values must be powers of two - the spin controls and value fields will not allow selection of any other values if this radio button is selected.

This option is required for some formats that require (due to file format restrictions) that their terrain models have a number of columns and rows equal to a Power of Two.

Power Of 2 Plus 1

If this radio button is selected, then terrain models will be exported from the current project with a number of rows and columns equal to a power of two plus one: 129, 257, 513, 1025 etc. It is not necessary that the resolution N-S is the same as the resolution E-W. ie: you can select 257 for the columns and 1025 for the rows, if you so choose. The only pre-requisite is that the values must be powers of two plus one - the spin controls and value fields will not allow selection of any other values if this radio button is selected.

This option is required for some formats (eg: VTP) that require (due to file format restrictions) that their terrain models have a number of columns and rows equal to a Power of Two plus One.

Any Size

By selecting this radio button, you give yourself the option to define your own values for the number of columns and rows in your exported terrain model. This is useful when you want to more accurately control the output cell size of your terrain model, or where the output file format limits your use of the other options.

While all three terrain Resolution Radio Buttons are available for VRML export, you will find that the "Any Size" option is the most useful.

For Example: If VRML is selected as the export format, and one selects Power of Two or Power of Two plus one, it is impossible (due to file format restrictions) to achieve output with an equal number of columns and rows that exceeds 64 by 64 (or 65 by 65, respectively). This is because VRML has a file format limit of 126 by 126 cells per terrain tile (marginally under 16,000 cells). By selecting the Any Size radio button, one can achieve the 126 by 126 cell output (or variations thereof).

The other time that the "Any Size" Radio Button will be used is if you are trying to export a piece of terrain that is non-square. In these cases, use of the Any Size option combined with uneven numbers of cells in a N-S and E-W direction can compensate for this and allow you to export cells which are roughly square, even if the terrain data is not.

Note: VNS will not allow you to select options in these fields that exceed the restrictions imposed by the selected export format.

Columns Field

This field allows you to see (and for some export formats, select) the number of columns in the exported terrain tile.

Rows Field

This field allows you to see (and for some export formats, select) the number of rows in the exported terrain tile.

Tiles In X Field

This field allows you to see (and for some export formats, select) the number of terrain tiles in the X-axis. This is most commonly associated with an E-W orientation, but depending on the selected coordinate system, this may not exactly align with an E-W axis.

Tiles In Y Field

This field allows you to see (and for some export formats, select) the number of terrain tiles in the Y-axis. This is most commonly associated with an N-S orientation, but depending on the selected coordinate system, this may not exactly align with an N-S axis.

Grid Cell Size Display Fields

These fields can not be edited directly, but rather display the dimensions of a cell in each exported terrain tile, based on the Columns, Rows and Tiles settings selected elsewhere in the interface.

Bounds Section

Coordinate System Drop Box

The Coordinate System drop box lets you select a Coordinate System for the exported scene.

Coordinate System Edit Button

Click the Coordinate System Edit button to edit the Coordinate System with the Coordinate System Editor.

Top Field

The Top field generally lets you enter the Northern extents of exported data, using the selected Coordinate System. However depending on the projection, the Top may not necessarily be toward the North.

Left Field

The Left field generally lets you enter the Western extents of exported data, using the selected Coordinate System. However depending on the projection, the Left may not necessarily be toward the West.

Right Field

The Right field lets you enter the Eastern extents of exported data, using the selected Coordinate System. However depending on the projection, the Right may not necessarily be toward the East.

Bottom Field

The Bottom field generally lets you enter the Southern extents of exported data, using the selected Coordinate System. However depending on the projection, the Bottom may not necessarily be toward the South.

Bounds Represent Cell Edges or Cell Centers Radio Buttons

You can choose whether the Top, Left, Right and Bottom bounds represent the edges of the cells in the exported terrain model or the center of the edge cells.

Select the “Bounds Represent Cell Edges” radio button to put the edges of the outer cells of the terrain model at the bounds you entered in the Top, Left, Right and Bottom fields above.

Select the “Bounds Represent Cell Centers” radio button to put the center of the outer cells of the terrain model at the bounds you entered in the Top, Left, Right and Bottom fields above.

Set Bounds in View Button

Click the Set Bounds in a View button if you want to set the section of terrain to be exported by clicking in a View. Click twice in a View to specify two corners of a rectangle from inside which terrain will be exported. VNS will automatically set the values in the Top, Left, Right and Bottom fields to match, using the selected Coordinate System.

Snap to Selected Database Objects Button

Click the Snap to Selected Database Objects button if you want to export one or more selected Database Objects.

If the Database Editor is open, VNS will ask if you have the objects you want selected. If you say yes, VNS will set the values in the North, West, East and South fields to include the selected objects. If you say Cancel, you can go and select the objects you want and then click the Snap to Selected Database Objects button again.

VNS will automatically set the values in the Top, Left, Right and Bottom fields to exactly include the selected Database Objects using the selected Coordinate System.

Fractal Depth Section

Fractal Depth Type Radio Buttons

The selection made in this section controls which method of Fractal Depth Calculation is applied, when necessary, to the exported terrain data, in order to achieve the terrain and texture cell sizes defined elsewhere in the interface.

Constant Fractal Depth

Selecting this radio button will force VNS to use the same Fractal Depth value for the whole export process.

Fractal Maps

Selecting this radio button will force VNS to use the current set of Fractal Depth Maps for the whole export process.

Note: VNS will calculate the maximum Fractal Depth required for successful export itself. Any changes you make to the Fractal Depth settings in the Terrain Parameter Editor will have no effect on the type or level of fractal depth applied during scene export.

Edit Terrain Parameters Button

Clicking this button will open the Terrain Parameter Editor from where you can control the creation or re-creation of Fractal Depth Maps for your project before export is initiated.

If Fractal Depth Maps have not been generated before scene export, and the Fractal Maps radio button has been selected, then when export is initiated through the Export Control Window, VNS will give an error stating that at least one Fractal Depth Map is missing, and will ask if export should proceed without it.

LOD (Level Of Detail) Page

Level Of Detail Section

Detail levels Field

In this field you can enter the number of Levels of Detail within your exported project.

Note: this is only applicable to some export formats, such as VRML. Increasing this number will increase output filesize.

Distance Between LOD Transitions Field

This field allows you to define the distance between which each level of detail is applied. eg: if you enter 1000m into this field, and you have 3 levels of detail in the model, the highest detail will be used for terrain features at distances 0-1000m from the camera, the next highest level of detail will be used for terrain features at distances 1000m-2000m from the camera, and the lowest level of detail will be used for terrain features at distances greater than 2000m from the camera.

Changes in LOD as one navigates through a realtime scene can sometimes be noticeable. Change these values to minimize the impact of LOD changes while maintaining adequate performance.

Distance Terrain Disappears Field

This field allows you to define the distance beyond which the terrain model is culled (hidden) to maintain performance.

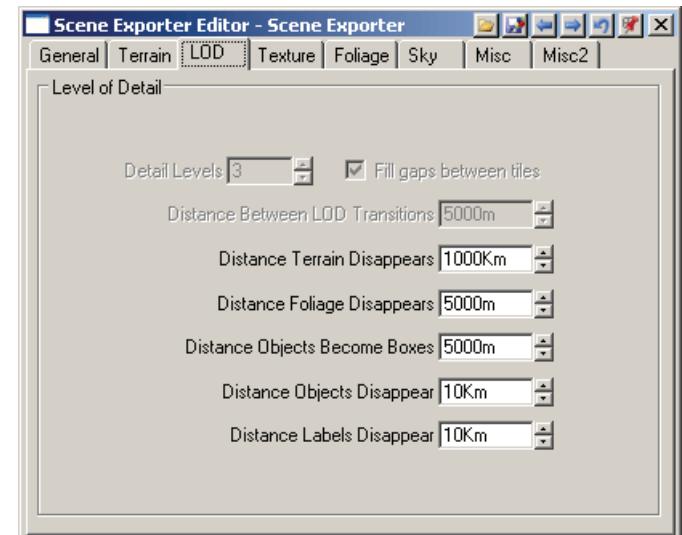
Distance Foliage Disappears Field

This field allows you to define the distance beyond which foliage objects are culled (hidden) to maintain performance.

Distance Objects Become Boxes Field

This field allows you to define the distance beyond which bounding boxes are substituted for 3D Objects in the scene to maintain performance.

Note: High numbers of polygons in exported 3D objects can severely affect realtime performance. However, since some 3D Objects are very asymmetrical and the bounding box substitution is based on the outer bounds of the model, you may find it necessary to either set this value very high to maintain object morphology, or break the object(s) into smaller pieces, each of which will have its own bounding box which more closely follows the actual model geometry.



Distance Objects Disappear Field

This field allows you to define the distance beyond which 3D Objects are culled (hidden) to maintain performance.

Distance Labels Disappear Field

This field allows you to define the distance beyond which Labels are culled (hidden) to maintain performance.

Texture Page

Texture Map Section

Export Texture Checkbox

The state of this checkbox controls whether or not VNS will export a texture map to drape on the terrain model. If enabled, the texture map will be exported using the resolution and other settings defined elsewhere on the Tex page. If deselected, export of a ground texture will be suppressed, resulting in a plain diffuse terrain model with no color or texturing.

Texture Resolution Radio Buttons

These radio buttons control the manner in which the resolution of the terrain texture is calculated.

Note: Due to restrictions in some of the export file formats, not all of these options will be available for all export formats.

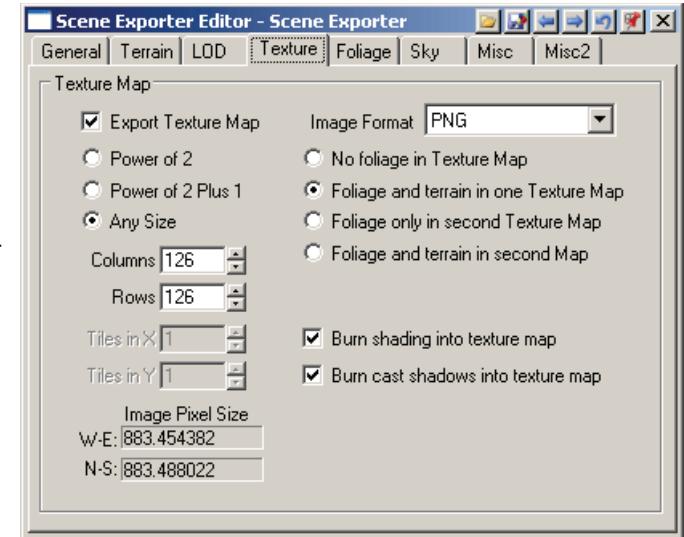
Power Of 2

If this radio button is selected, then terrain textures will be exported from the current project with a number of rows and columns equal to a power of two: 128, 256, 512, 1024 etc. It is not necessary that the resolution N-S is the same as the resolution E-W. ie: you can select 256 for the columns and 1024 for the rows, if you so choose. The only pre-requisite is that the values must be powers of two - the spin controls and value fields will not allow selection of any other values if this radio button is selected.

This option is required for some formats that require (due to file format restrictions) that their textures have a number of columns and rows equal to a Power of Two.

Power Of 2 Plus 1

If this radio button is selected, then terrain textures will be exported from the current project with a number of rows and columns equal to a power of two plus one: 129, 257, 513, 1025 etc. It is not necessary that the resolution N-S is the same as the resolution E-W. ie: you can select 257 for the columns and 1025 for the rows, if you so choose. The only pre-requisite is that the values must be powers of two plus one - the spin controls and value fields will not allow selection of any other values if this radio button is selected.



This option is required for some formats that require (due to file format restrictions) that their textures have a number of columns and rows equal to a Power of Two plus One.

Any Size

By selecting this radio button, you give yourself the option to define your own values for the number of columns and rows in your exported texture map. This is useful when you want to more accurately control the output cell size of your texture, or where the output file format places restrictions on your use of the other radio buttons.

Note: VNS will not allow you to select options in these fields that exceed the restrictions imposed by the selected export format.

Columns Field

This field allows you to see (and for some export formats, select) the number of columns in the exported texture.

Rows Field

This field allows you to see (and for some export formats, select) the number of rows in the exported texture.

Tiles In X Field

This field allows you to see (and for some export formats, select) the number of tiles in the X-axis of the texture map. This is most commonly associated with an E-W orientation, but depending on the selected coordinate system, this may not exactly align with an E-W axis.

Tiles In Y Field

This field allows you to see (and for some export formats, select) the number of tiles in the Y-axis of the texture map. This is most commonly associated with an N-S orientation, but depending on the selected coordinate system, this may not exactly align with an N-S axis.

Image Pixel Size Display Fields

These fields can not be edited directly, but rather display the dimensions of a pixel in the exported texture map, based on the Columns, Rows and Tiles settings selected elsewhere in the interface.

Image Format Drop Box

This dropdown contains a list of supported image formats for the texture map.

Note: Due to restrictions in some of the export file formats, the options available in this list may vary, depending upon the export format selected.

Texture Contents Radio Buttons

These radio buttons control the contents of the texture map or maps. Depending upon which of these is selected, the terrain texture map may contain texturing, foliage or combinations of both. Not all of these options are available for all output formats. Unavailable options will be grayed out in the interface. For example, multiple texture map export is available for 3DS, but unavailable for VRML.

No Foliage In Texture Map Radio Button

Select this option if you want overstory and understory foliage to be excluded from the rendered texture map. Ecosystems will still render, but foliage in those ecosystems will not render in the texture map. In other words, the resultant texture map will contain representations of the ecosystems' Ground Overlay colors and textures only.

Foliage and Terrain In One Texture Map Radio Button

Select this option if you want representations of overstory and understory foliage to be included in the rendered texture map.

Foliage Only In Second Texture Map Radio Button

Select this option if you want the first texture map to contain representations of the ecosystems' Ground Overlay colors and textures only, and representations of overstory and understory foliage to be included in the second rendered texture map.

Foliage And Terrain In Second Map Radio Button

Select this option if you want representations of overstory and understory foliage to only be included in the second rendered texture map, along with the underlying terrain information.

Burn Shading Into Texture Map Checkbox

By selecting this checkbox, you tell Scene Express to export a texture map which contains the shading as determined in VNS. If you want a diffusely lit texture drape with no directional shading, then deselect this checkbox, otherwise, enable it to give the impression of a directional lightsource in your realtime scene.

Burn Cast Shadows Into Texture Map Checkbox

By selecting this checkbox, you tell Scene Express to include shadows for foliage, 3D Objects, etc in the texture drape.

Note: In order for shadows to appear in your exported scene, you must still have created and enabled the necessary components in VNS. In other words, you must have created and enabled a shadow map or maps to catch the shadows you require, as well as enabling any Cast Shadows options on 3D Objects etc.

Foliage Page

Foliage Section

Export Foliage Checkbox

Select this checkbox if you wish to export Flipboard or Crossboard foliage from your scene.

Foliage Type Radio Buttons

These radio buttons allow you to select the format and properties of the exported foliage objects.

Flipboards Radio Button

Select this radio button if you want your foliage objects to be represented by single planes, with foliage images mapped onto them. This option minimizes the number of foliage polygons created, but is not available for some output formats where foliage does not automatically rotate to align itself to the camera (such as 3DS and Lightwave).

Crossboards Radio Button

Select this radio button if you want your foliage objects to be represented by crossed planes, with foliage images mapped onto them. This option increases the number of foliage polygons created, but is required to maximize realism for some output formats where foliage does not automatically rotate to align itself to the camera (such as 3DS and Lightwave).

Boards Field

This field will only be available when the Crossboards output type is selected, as Flipboards by their very nature consist of single planes. Input a number into this field, and foliage will be exported with as many crossing planes as defined. Increasing this number will increase the number of polygons in the scene, but will increase the chance of foliage appearing realistic from any angle.

Image Format Drop Box

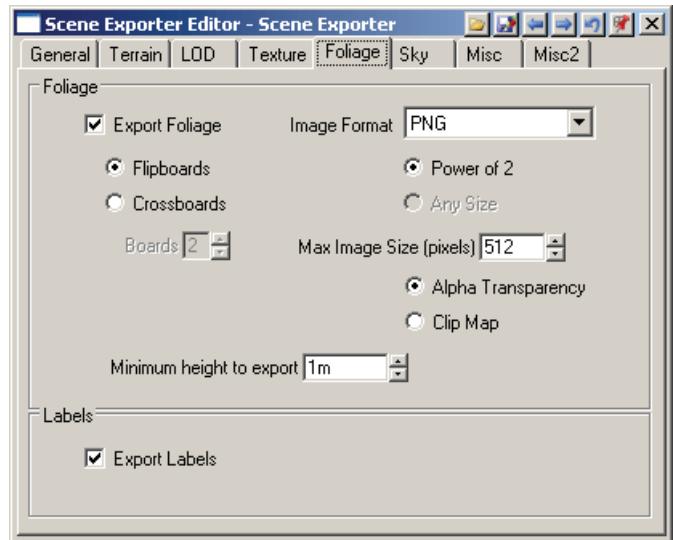
This dropdown contains a list of supported image formats for the texture map.

Note: Due to restrictions in some of the export file formats, the options available in this list may vary, depending upon the export format selected.

Image Size Radio Buttons

These radio buttons control the manner in which the resolution of exported Foliage Images is calculated.

Note: Due to restrictions in some of the export file formats, both of these options will not be available for all export formats.



Power Of 2 Radio Button

If this radio button is selected, then foliage images will be exported from the current project with a maximum number of rows and columns equal to a power of two: 128, 256, 512, 1024 etc.

This option is required for some formats that require (due to file format restrictions) that their textures have a number of columns and rows equal to a Power of Two.

Any Size Radio Button

By selecting this radio button, you give yourself the option to define your own values for the number of columns and rows in your exported foliage images.

Max Image Size Field

This field allows you to set the maximum dimension of output foliage images. The other dimension will be determined by the image aspect ratio of the foliage image being exported.

Note: VNS will not allow you to select options in these fields that exceed the restrictions imposed by the selected export format, or the selections made in the image size radio buttons.

Image Transparency Type Radio Buttons

There are two ways of “clipping” the background from a foliage image that is mapped onto a polygon. The first is to mark certain areas of the image transparent, and store that information in another “layer” known as an alpha channel. The other way is similar, but in actual fact the inverse of the alpha transparency method. It involves storing the information for which pixels in the foliage image are opaque, and ignoring the rest. This method is known as clip mapping. The only difference between the two is that Alpha transparency can store variable transparency, whereas clip mapping is a boolean (on-off) operation - either a pixel is see-through or not.

These radio buttons allow you to select an appropriate transparency method for your exported foliage images.

Note: Due to restrictions in some of the export file formats, both these options will not be available for all export formats.

Alpha Transparency Radio Button

Selecting this radio button tells Scene Express to use the Alpha Transparency method for foliage background clipping.

Clip Map Radio Button

Selecting this radio button tells Scene Express to use the Clip Map method for foliage background clipping.

Minimum Height To Export Field

This field allows you to define a minimum height for foliage export. Foliage below this height value will be excluded from the export process.

Note: Since Scene Express only provides you with a control for exported foliage based on height, high density foliage will be either exported or not (based on the Minimum Height to Export field). The number of foliage objects generated by high-density stands of foliage

will almost certainly cause an unnecessary overhead for realtime export formats, and in these cases, the density of the offending ecotype or foliage effect should be manually reduced in the source project prior to the export process. In addition, the maximum number of exported foliage stems defaults to 100,000 - this value can be increased in Scene Exporter Editor: NatureView Advanced Options if required.

Labels Section

Export Labels Checkbox

Select this checkbox if you wish to export Labels from your scene.

Sky Page

Sky Features Section

Export Sky Features Checkbox

Enabling this checkbox allows access to all the sky features that can be exported, individually. Deselecting this checkbox will globally disable sky feature export, regardless of the individual options that may have been selected.

Note: All these features, are rendered to a skydome texture. The features are rendered to a single image which is then wrapped on a sphere or cube (skydome or skycube) enclosing the scene.

Export Sky Gradient Checkbox

Select this checkbox to export the Sky gradient colors to your sky texture.

Export Clouds Checkbox

Select this checkbox to export cloud models to your sky texture.

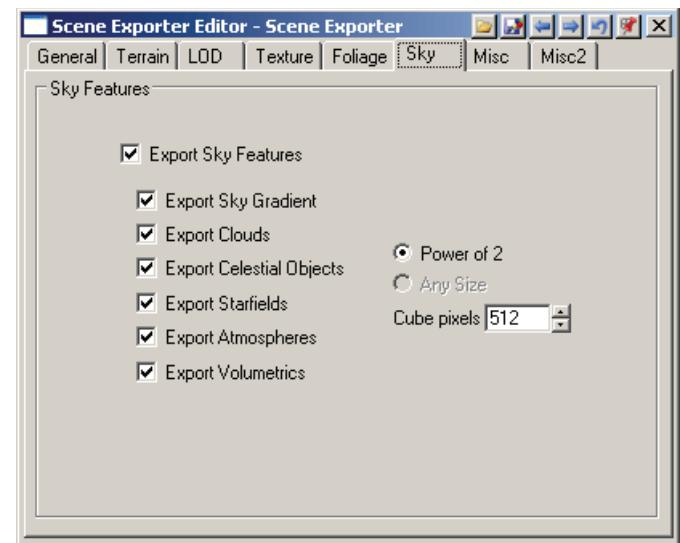
Note: if you have volumetric clouds in your project and wish them to be exported, you will need to select both this checkbox and the one for Volumetrics in order to see your clouds in the exported files.

Export Celestial Objects Checkbox

Select this checkbox to export celestial objects to your sky texture.

Export Starfields Checkbox

Select this checkbox to export starfields to your sky texture.



Export Atmospheres Checkbox

Select this checkbox to export atmospheres to your sky texture.

Note: Selecting this option will not provide any realtime atmospherics (where relevant) unless a specific Haze component is selected on the Misc2 Page, in the Haze Export List.

Export Volumetrics Checkbox

Select this checkbox to export volumetric effects to your sky texture.

Note: Selecting this option will simply create a representation of volumetric effects within your sky texture. There is no facility provided to export true volumetrics from Scene Express to other software.

Image Size Radio Buttons

These radio buttons control the manner in which the resolution of exported sky texture images is calculated.

Note: Due to restrictions in some of the export file formats, both of these options will not be available for all export formats.

Power Of 2 Radio Button

If this radio button is selected, then the sky texture will be exported from the current project with a maximum number of rows and columns equal to a power of two:128, 256, 512, 1024 etc.

This option is required for some formats that require (due to file format restrictions) that their textures have a number of columns and rows equal to a Power of Two.

Any Size Radio Button

By selecting this radio button, you give yourself the option to define your own values for the number of columns and rows in your exported sky texture.

Cube Pixels Resolution Field

This field allows you to set the maximum dimension of output sky images. The sky image is built from images which represent the 6 sides of a cube (with the camera at its center). The resolution defined here defines the output size of each of these views.

Note: VNS will not allow you to select options in these fields that exceed the restrictions imposed by the selected export format, or the selections made in the image size radio buttons.

Misc Page

3D Objects Section

Export 3D Objects Checkbox

Select this checkbox to export 3D Objects from your project.

Note: If a subset of objects is required, then use Render Scenarios (See Render Scenario Editor) to disable some 3D Objects before exporting.

Export 3D Object Foliage Checkbox

Select this checkbox to export 3D Object Foliage from your project.

Note: If a subset of objects is required, then use Render Scenarios (See Render Scenario Editor) to disable some 3D Object Foliage before exporting.

Use Original Object Files Radio Button

Selecting this radio button will tell Scene Express to reference the original object files, wherever they may be located.

If the original 3D Objects in the project are in a format not supported by the export format selected, then the exported content may not work as expected.

Selecting this option has the advantage of preserving any embedded or linked object structure, such as original texturing, UV maps, bones, and advanced animations features, where applicable to the desired output.

Note: For some export formats, this option may be grayed out and unavailable.

Create All New Object Files Radio Button

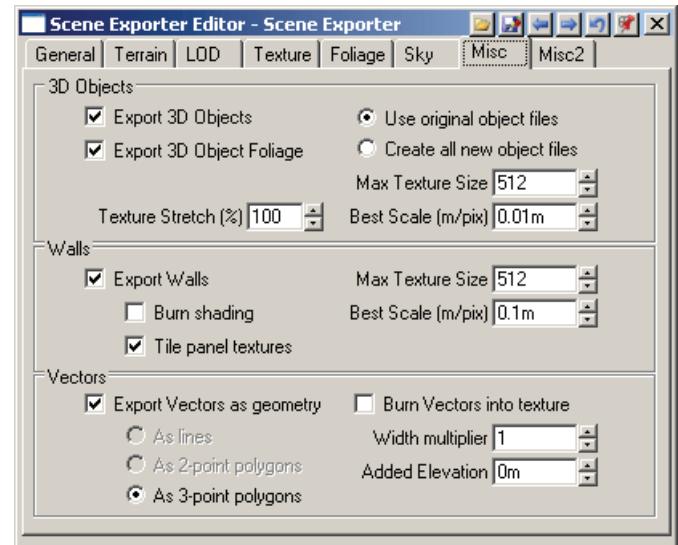
Selecting this radio button will tell Scene Express to create new 3D Object files in an appropriate format.

Note: For some export formats, this option may be grayed out and unavailable.

Max Texture Size Field

This field allows you to set the maximum dimension of output 3D Object Texture Maps. The other dimension will be determined by the image aspect ratio of the texture image being exported.

Note: VNS will not allow you to select options in these fields that exceed the restrictions imposed by the selected export format, or the selections made in the image size radio buttons.



Best Scale Field

This field determines the scaling factor and image dimensions for the texturemap, such that one pixel of texturemap equals one of the units specified here, with the absolute size limit (in pixels) being the value entered in the Max Texture Size field

When exporting to 3D Animation formats such as 3D Studio or Lightwave, it is highly recommended that you set this value smaller than the smallest texture detail that you wish to be visible in your exported project, and set the maximum texture size field as high as you can afford.

For export to realtime formats, it may be advisable in some cases to increase the best scale value and optimize the max texture size value, to reduce the 3D Object texture overhead in the scene.

Texture Stretch Field

It may be necessary, depending on what host application is viewing the exported objects, to raise this value a little. 101% or 102% should suffice in most cases.

In some host software, UV texturing seems to be handled slightly differently along seams. Thin lines may sometimes be visible at these seams. By stretching the texture a little, seam lines can be eliminated at the expense of absolute texture continuity of fine details across UV seams.

Walls Section

Export Walls Checkbox

Select this checkbox to export Walls from your project.

Burn Shading Checkbox

By selecting this checkbox, you tell Scene Express to export a Wall texture map which contains the shading as determined in VNS. If you want diffusely lit Walls with no directional shading, then deselect this checkbox, otherwise, enable it to give the impression of a directional lightsource in your realtime scene.

Tile Panel textures Checkbox

Selecting this checkbox will tell Scene Express to export a single tile for the Wall texture, and then repeat it along the length of the exported geometry, rather than exporting a single texture per panel.

Due to the constraints on maximum texture size, set both by some export formats themselves, and also by the user through use of the Max Texture Size Field, exporting a large texture that derives from a tiled source will reduce texture detail. By selecting this checkbox, you create a higher detail texture that is then tiled automatically in the host application to which it was exported.

Max Texture Size Field

This field allows you to set the maximum dimension of output Wall Texture Maps. The other dimension will be determined by the image aspect ratio of the texture image being exported.

Note: VNS will not allow you to select options in these fields that exceed the restrictions imposed by the selected export format, or the selections made in the image size radio buttons.

Best Scale Field

This field determines the scaling factor and image dimensions for the texturemap, such that one pixel of texturemap equals one of the units specified here, with the absolute size limit (in pixels) being the value entered in the Max Texture Size field

When exporting to 3D Animation formats such as 3D Studio or Lightwave, it is highly recommended that you set this value smaller than the smallest texture detail that you wish to be visible in your exported project, and set the maximum texture size field as high as you can afford.

For export to realtime formats, it may be advisable in some cases to increase the best scale value and optimize the max texture size value, to reduce the 3D Object texture overhead in the scene.

Vectors Section

Export Vectors As Geometry Checkbox

Select this checkbox to export all enabled vectors as geometry within your selected export format. The type of geometry exported is determined by the selection made in the geometry type radio buttons, below the checkbox.

Note: If a subset of objects is required, then use Scenarios (See Render Scenario Editor) to disable some 3D Object Foliage before exporting.

As Lines Radio Button

If this radio button is selected, then vectors will be exported as Line entities.

As 2-Point Polygons Radio Button

If this radio button is selected, then vectors will be exported as 2-Point polygons.

As 3-Point Polygons Radio Button

If this radio button is selected, then vectors will be exported as Polygon entities. More specifically, Trigons (triangular polygons)

Burn Vectors Into Texture Checkbox

Select this checkbox to render enabled vectors into the terrain texture, with attributes as set in the Database Editor.

Width Multiplier Field

The value entered into this field will be applied to the widths of vectors as set in the Database Editor. So, if you have set a width multiplier of 3 and you have 3 vectors in the database, with set widths of 1, 2 and 3 pixels, they will render into the texture map at absolute widths of 3, 6 and 9 pixels respectively.

Added Elevation Field

By entering a value into this field (other than 0m) you force Scene Express to add that value to the existing elevation of all vectors enabled for export. This can allow vectors that would otherwise intersect the terrain at one or more points, to be visible in the exported output along their entire length.

Misc2 Page

Cameras Section

This section of the interface has controls for exporting Cameras to your export format. Some export formats support the export of animated cameras. If not, then the position and orientation of the selected camera(s) at the frame defined by Start Time on the General page will be used.

Some formats (for example, VRML) support the export of more than one camera. In these cases, selecting more than one entity in the relevant interface will produce multiple camera viewpoints (animated or otherwise) when exported.

Export Cameras Checkbox

Select this checkbox if you wish to enable export of a specific Camera or Cameras. This checkbox enables Camera export, but you must still define the particular Camera component that you wish to be used as the basis for the export, by selecting it in the Camera list.

Camera List

This list contains the names of all the Camera components in the current project. You must select the Camera component or components that you wish to use as the basis for the exported Camera(s) by making a selection in the list. Where there is more than one component in the list, multiple components may be selected by holding the Shift or Control keys while left-clicking on the items in the list. Shift-clicking will select contiguous entries, while Ctrl-clicking will select non-contiguous entries.

Lights Section

This section of the interface has controls for exporting Lights to your export format. Some export formats support the export of animated lights. If not, then the position and orientation of the selected light(s) at the frame defined by Start Time on the General page will be used.

Export Lights Checkbox

Select this checkbox if you wish to enable export of Lights. This checkbox enables Light export, but you must still define the particular Light component that you wish to be used as the basis for the export, by selecting it in the Lights list.



Lights List

This list contains the names of all the Light components in the current project. You must select the Light component or components that you wish to use as the basis for the exported Light(s) by making a selection in the list. Where there is more than one component in the list, multiple components may be selected by left-clicking on the each item required in the list. Clicking on a selected entry will deselect it again.

Haze Section

This section of the interface has controls for exporting Haze to your export format.

Export Haze Checkbox

Select this checkbox if you wish to enable export of Haze. This checkbox enables Haze export, but you must still define the particular Atmosphere component that you wish to be used as the basis for the export, by selecting it in the Haze list.

Haze List

This list contains the names of all the Atmosphere components in the current project. You must select the Atmosphere component or components that you wish to use as the basis for the exported Haze(s) by making a selection in the list. Where there is more than one component in the list, multiple components may be selected by left-clicking on the each item required in the list. Clicking on a selected entry will deselect it again.

Note: Not all formats support the export of multiple camera, light or haze entities. If the techniques for multi-selection described above do not work, then the export format selected only supports export of one of each of these types of component.

Scene Exporter Editor: NatureView Advanced Options

Each Scene Express output format can optionally offer a page of more advanced options specific to that particular output format. The options described here are specific to the NatureView format.

If a particular format offers Advanced Options, a "Show Advanced Options" button will be available at the lower left of the General tab of the Scene Exporter. Clicking this button will replace the other normal Scene Exporter tabs common to all formats with a new set, specific to the format in question. The General Tab will remain available. To return to the General settings, click the same button (now labeled "Show Normal Options") again.

More background information on the different formats and overviews of their strengths and weaknesses can be found in Appendix N: Scene Express Export Formats.

General Page

The General page is the same page as documented in the tab common to all Scene Express formats.

NatureView Options Page

Navigation Section

Navigation Style Control

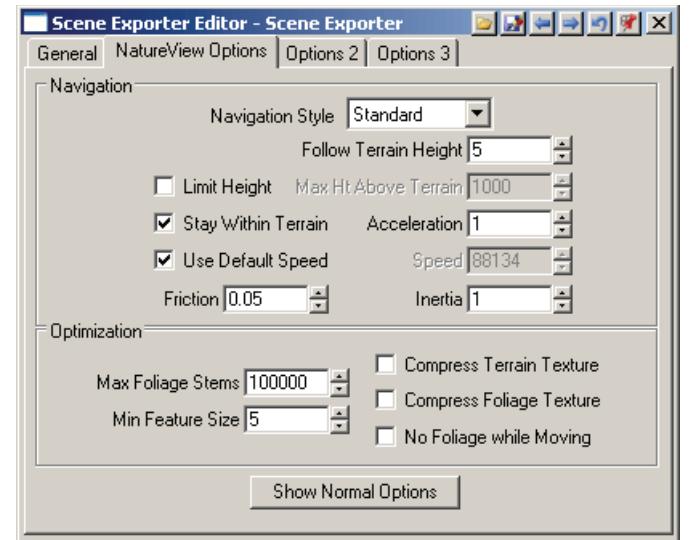
This control will allow for selection of multiple available Navigation Styles for use within the NatureView viewer. A Navigation Style is the way the viewer reacts to mouse movements and translates them into movement within the scene. At this time, only one Navigation Style is available, "Standard".

Follow Terrain Height Field

This field allows you to specify how close to the terrain (vertically) the user will be allowed to approach. Setting this value to zero (or higher) will prevent the user from crashing through the ground and viewing the landscape from below. In practice, it is more useful to set it to approximately 2 meters, which is the rough height of a person walking on the terrain. Allowing the viewpoint to actually get to 0m above the terrain permits the lower part of the camera lens to poke below the terrain mesh. With coarser terrain meshes (lower resolution) it is possible that this height will need to be higher to prevent the "peeking under the rug" effect. This setting currently defaults to 5m.

Limit Height Checkbox

This checkbox enables or disables the Limit Height feature, which is controlled by the Limit Height Field (next). This setting currently defaults to Off. Currently, this feature can be altered while the NatureView viewer is running by pressing the "T" key.



Max Ht Above Terrain Field

This field allows you to dictate how high above the terrain (vertically) the user will be allowed to fly. This imposes a 'ceiling' on the user's travels. Setting this field to the same height as the Follow Terrain Height Field (above) will prevent the user from ever moving up or down from the specified distance above the terrain. When moving around the landscape, the viewpoint will follow the ups and downs of the terrain rigidly. This setting currently defaults to 1000m, but the checkbox that enables this feature (above) defaults to Off.

Stay Within Terrain Checkbox

This checkbox allows you to dictate that the user's viewpoint can never leave the confines of the box containing the terrain model. This is useful for preventing novice users from flying off into empty space, getting lost, and not knowing how to return to the area of interest. This setting currently defaults to On.

Acceleration Field

This field allows you to control the rate of acceleration applied when the user instructs the viewer to begin moving forward. Not all Navigational Styles (above) will make use of all speed controls (such as acceleration). The current Drive, Climb and Slide modes of the Standard Navigational Style do not make any use of the Acceleration factor. The exact units of Acceleration are not defined, but larger values cause faster acceleration and smaller values, slower. The default value for this setting is 1.

Use Default Speed Checkbox

This checkbox instructs Scene Express to calculate a default value to be used for the Speed setting (below). This default Speed will be determined from the dimensions of one cell of terrain data in the exported scene. Coarser exports (lower resolution terrain) will get a faster default Speed. Finer, higher-resolution exports will be assigned a slower default Speed, on the assumption that there is more detail to show.

Speed Field

This field controls the Navigation Speed used by the NatureView viewer when the user is traveling around the exported scene. If the Use Default Speed checkbox (above) is on, this field will be unavailable, but it will still display the Default Speed that Scene Express will write to the NatureView file. The exact units of the Navigation Speed are undefined, but higher values correspond with faster movement, and vice versa. See Use Default Speed Checkbox (above) for information about the default value of this field. To avoid confusion, it is worth mentioning that this field does not affect graphics redraw speed (frame rate), it only affects movement rate.

Friction Field

This field controls the Friction Factor applied to slow down a moving viewpoint when it collides with the terrain (or more specifically, the Follow Terrain minimum Height). A reasonable amount of Friction is helpful for bringing out-of-control drivers slowly to rest when they hit the terrain. This is generally intuitive and helpful. The exact units of the Friction value are not defined, but higher values cause deceleration to happen more quickly and vice versa. The default value of this setting is 1.

Optimization Section

The settings in the Optimization Section offer greater control over the responsiveness of your scene when viewed on a variety of viewers of different CPU and graphics performance. Judicious use of these controls can greatly improve graphics redraw speed (frame rate), especially when the viewer is run on slower computers.

Max Foliage Stems Field

This setting allows you to set an upper limit on the number of stems of foliage that the NatureView viewer will attempt to load and display. This is primarily a safety factor to prevent you from creating scenes that are undisplayable with current technology. At the moment, this field defaults to 100000 stems, a value that should be viable for scenes of high foliage complexity on computers with faster CPUs and graphics systems. Future versions of the NatureView viewer and faster computers and graphics systems may all affect the usage of this field.

Min Feature Size Field

This control allows you to inform the NatureView viewer to automatically ignore (and not display) any Foliage, Label, 3D Object or Wall features when they become smaller on-screen than a specified number of pixels. This can be very valuable for making complex scenes run quickly by disregarding features as they recede in the distance to become small enough to not be missed. This control currently defaults to 5 pixels, implying that any feature that is smaller than 5 pixels on screen will be ignored until it becomes larger than 5 pixels.

Compress Terrain Texture Checkbox

This control allows you to indicate to the NatureView viewer than it should employ Texture Image Compression for the Terrain Texture, a technique for reducing the amount of graphics memory consumed. Texture Image Compression can improve the redraw speed (and therefore frame rate) of a scene that uses large textures by permitting all the texture to fit into the graphics system's on-board memory. However, on some graphics cards, employing Texture Image Compression can have negative performance impact. It is useful to try the compression options both on and off, with your scenes and your intended target computer, to see which options deliver the best performance. Texture Compression does degrade the visual quality of the texture (similar to JPEG). This setting currently defaults to Off.

Compress Foliage Texture Checkbox

This control allows you to indicate to the NatureView viewer than it should employ Texture Image Compression for the Foliage Texture. See Compress Terrain Texture (above) for an explanation of the impact of this setting. This setting currently defaults to Off.

No Foliage While Moving Checkbox

This control allows you to indicate to the NatureView viewer that it should temporarily hide Foliage objects while the viewpoint is moving. In scene with large amounts of vegetation, the majority of the redraw time can be spent depicting foliage, resulting in slow, unresponsive navigation. Allowing the viewer to neglect displaying of the foliage while the user is moving about can raise the redraw speed and frame-rate considerably in these complex scenes, resulting in a much more pleasant and controllable experience. In less-complex scenes, this is not needed. This feature currently defaults to Off. Currently, this feature can be altered while the NatureView viewer is running by pressing the "Q" key.

Show Normal Options Button

This button is a duplicate of the Show Normal Options button found on the General page. It dismisses the NatureView Format Advanced Options pages, and replaces them with the normal Scene Express Option pages common to all output formats.

Options 2 Page

The settings on this page control a variety of optional features that can be used to depict textual information displayed within the NatureView viewer while it is displaying your scene.

Overlay Section

The settings in this section control what is visible on the Overlay bar, a translucent dashboard display that typically is visible along the bottom of the main NatureView window.

Logo Image Field

The Logo Image Field allows you to specify an image to be displayed, typically along the right edge of the Overlay. This Logo Image should be 100 to 200 pixels in size, and should be in PNG format. An alpha channel is supported, allowing for the Logo to be displayed onto the Overlay with transparent or translucent cut-out regions.

Logo Text Field

The Logo Text will be displayed in the NatureView viewer, either on the Overlay bar, or in a separate floating Info window. The Logo Text can have special characters inserted into it (see next two items) that are replaced on-the-fly with dynamic text, displaying constantly-updated information within NatureView.

Insert in Logo Button

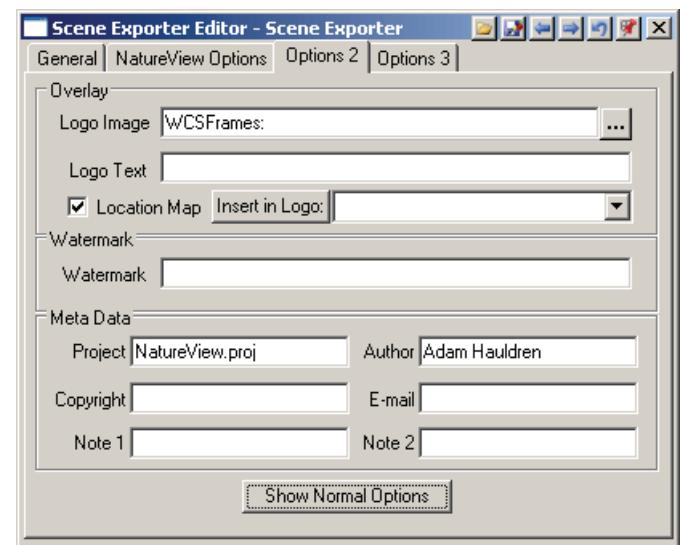
This button inserts the currently-selected Item from the Insertion Item Drop List (see below) into the Logo Text Field (see above) at the last active cursor position within the Logo Text Field.

Insertion Item Drop List

This list presents a variety of special characters that can be inserted into the Logo Text Field (see above). Each special character combination will be replaced on-the-fly within NatureView by the constantly-updated information that it is a stand-in for. To insert an item, select it in the Insertion Item Drop List, and press the Insert in Logo button (above).

Location Map Checkbox

This checkbox controls the presence of an automatically-generated Location Map that will appear in the NatureView viewer, typically near the right side of the Overlay bar. This Location Map will show an overhead view of the scene area, and will typically have graphics to indicate the current viewer position and direction.



Watermark Section

The setting in this section are used to add an intrusive Watermark text in the middle of the NatureView display. The Watermark is intended for marking unfinished scenes, prototypes, or restricted-use materials in a fashion that is impossible to ignore, and impossible to remove. The Watermark text (like all NatureView scene file settings) cannot be altered or removed from the NatureView scene without re-signing the NatureView Scene file (see Sign Natureview File menu).

Watermark Field

The text in the Watermark Field will be indelibly displayed over top of the 3D view in the NatureView viewer, typically in a high-contrast color such as red. The Watermark text (like all NatureView scene file settings) cannot be altered or removed from the NatureView scene without re-signing the NatureView Scene file (see Sign Natureview File menu). The Watermark does not support any of the special dynamic text character sequences that the Logo Text supports.

MetaData Section

The settings in this section allow for the specification of extra data that is written into the scene file. This data can be used in a variety of ways to identify the scene, and can be accessed using the Logo Text Insertion special characters (above).

Project Field

This field will normally contain the name of your project file. This can be useful in identifying exactly which project or variation the NatureView scene was created from.

Author Field

This field will normally contain the UserName, as stored in the application Prefs file. This can be useful in identifying who created the NatureView scene.

Copyright Field

This field will normally be populated with the current year. This can be useful in adding automatic copyright notices to NatureView scenes.

E-mail field

This field will normally contain the e-mail address stored in the application Prefs file. This can be useful in identifying who created the NatureView scene.

Note 1 Field

This field is provided for user configuration, to allow the scene creator to note customer, job or scenario information.

Note 2 Field

This field is provided for user configuration, to allow the scene creator to note customer, job or scenario information.

Show Normal Options Button

This button is a duplicate of the Show Normal Options button found on the General page. It dismisses the NatureView Format Advanced Options pages, and replaces them with the normal Scene Express Option pages common to all output formats.

Options 3 Page

The settings on this page control a variety of optional features that can be used to create “actionable” objects within your NatureView scene, that can be accessed by using the commercial Natureview viewer and can be used to call webpages, play sounds or video, display text messages, highlight objects or load another Natureview file when clicked upon.

Note: these features are exclusive to Scene Express 2 and are only of use if the user is viewing the scene in the commercial build of Natureview Express.

Click-to-Query Action Summary Section

Click-to-Query Action List

This space displays a list of all Action definitions that have been added to the current Scene Exporter. By adding multiple defined actions to this list, you can create output in which there are a number of different “hotspots” or actionable objects, each of which will generate a predefined behavior when activated.

Add New Click-to-Query Action Button

Click this button to add a new action to the list. It is perfectly permissible to have as many actions in this list as you require. More than one action type can be associated with the same object, for example, clicking a particular 3D Object in your scene might both play a soundfile and open a webpage.

Remove Click-to-Query Action Button

Click this button to remove the selected action definition from the list.

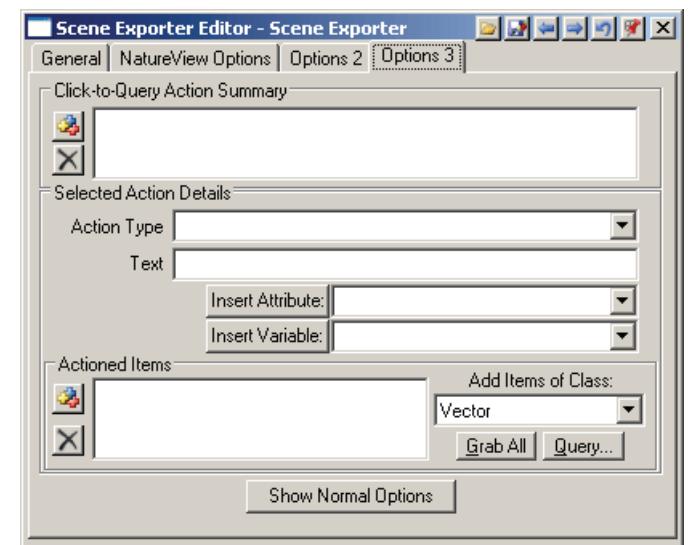
Selected Action Details Section

Action Type Dropdown List

Once an action has been added to the Click-to-Query Action list, its type can be selected from this dropdown list. There are a number of options available:

Display text as Non-Persistent Overlay

This option will display the chosen text in a “text balloon” that will disappear after a certain time, or when the user clicks on the balloon.



Display Text in Persistent Window

This option will display the chosen text in a window that will only disappear when the user actively closes it.

View Text File in Persistent Window

This option will display the contents of a particular text file in a window that will only disappear when the user actively closes it.

Display Image in Default Viewer

This option will display the selected image using whichever image viewing program is currently associated with that filetype.

Display Image within NatureView

This option will display the selected image using the image viewer built into NatureView.

Play Sound

This option will play a soundfile.

Display Web Page in Default Browser

This option will open the specified web page in whichever browser is designated as default on the target system.

Display Web Page in NatureView

This option will display the specified web page using the web browser built into NatureView.

Play Media File in Default Media Player

This option will display the selected media file using whichever Media Player is currently associated with that filetype.

Play Media File in NatureView

This option will display the selected media file using the Media Player built into NatureView

Highlight object

This option will highlight the object in question with a colored tint. The effect is similar to the highlighting of active objects in VNS itself.

Load New Scenefile

This option will unload the current NatureView scene file and load the specified one in its place.

Text Entry Field

Depending upon the type of Action chosen from the dropdown list above, the field title will display as one of the following:

Text

This option is displayed for the following Action types: “Display text as Non-Persistent Overlay” and “Display Text in Persistent Window”. Enter the text that you wish to be displayed into the empty text field.

Text File

This option is only displayed for the “View Text File in Persistent Window” action type. Enter the path to the textfile that you wish to be displayed into the empty field.

Image File

This option is displayed for the following Action types: “Display Image in Default Viewer” and “Display Image within NatureView”. Enter the path to the image file that you wish to be displayed into the empty field. The internal NatureView image viewer only supports images of type JPEG and PNG. The external viewer depends on you having an image viewer installed on the system, and associated with the filetype of the file you are trying to display. NatureView recognizes the following file extensions as images and will permit the operating system to load them:

- **gif**
- **iff**
- **tiff**
- **tif**
- **tga**
- **bmp**
- **jpg**
- **jpeg**
- **pic**
- **pict**
- **pct**
- **png**
- **ecw**
- **sid**

Sound File

This option is only displayed for the “Play Sound” action type. Enter the path to the sound file that you wish to be played into the empty field. The sound playback support is contingent on the Operating System providing Media Player codecs for the formats in question. NatureView will permit the operating system to try and play audio files with the following file extensions:

- **mp3**
- **wav**
- **avi**
- **mpg**
- **mpeg**

Web Address

This option is displayed for the following Action types: “Display Web Page in Default Browser” and “Display Web Page in NatureView”. Enter the URL of the webpage (local or remote) that you wish displayed into the empty field.

For files accessed using the file:// syntax (local files), NatureView will only permit files with the following extensions:

- **htm**
- **html**
- **jpg**
- **jpeg**
- **png**
- **gif**

For normal URLs (http://, https://, ftp:// and mailto://) it will permit any extension type. As long as the necessary support software is installed locally to support the filetype being called (Flash, Shockwave etc) then the file(s) should load and display correctly.

Media File

This option is displayed for the following Action types: “Play Media File in Default Media Player” and “Play Media File in NatureView”. Enter the path to the file that you wish to be played into the empty field. Supported Media file formats (assuming the correct support software and codec has been installed locally) include:

- **mov**
- **avi**
- **mpg**
- **mpeg**

Scene File

This option is only displayed for the “Load New Scenefile” action type. Enter the path to the NatureView scene file that you wish to be loaded into the empty field. When the action is activated, NatureView will load the new scenefile and display it. In this way it is possible to link a number of exported NatureView files together - clicking an actionable object in one can be set up to load the next.

Attribute Dropdown List

If the objects selected for actioning are vectors with attribute data associated with them, then this dropdown list will display all the associated attributes. Selecting an attribute from this list, and clicking the Insert Attribute button (see below), will cause NatureView to dynamically display the attribute value when the object is actioned, rather than using a fixed value for display purposes. This allows you to define and apply one action to a number of objects, and generate a different result based on the attribute information associated with those objects.

Insert Attribute Button

Clicking this button after selecting an attribute from the Attribute Dropdown List (see above) will cause a reference to the selected attribute to be associated with the chosen objects. When those objects are actioned in NatureView, the attribute value will be displayed.

Variable Dropdown List

This dropdown list contains a number of variables that can be used in as similar manner to the attribute values described previously. Selecting one of these variables and clicking the Insert Variable button (see below) will cause NatureView to dynamically display the variable when the object is actioned, rather than using a fixed value for display purposes. The variables available are as follows:

New Line (Line Break)

This variable inserts a line break or carriage return into whatever text you wish to be displayed.

Object Name

This variable displays the actioned objects name

Vector Name or Label

This variable causes the actioned vectors name or label to be displayed. If one of these variables does not exist, the other will be used.

Vector Label

This variable causes the vectors label to be displayed

Ampersand (&)

This variable adds an ampersand (&) into any text you might wish displayed. Since ampersands are used throughout the program to define replaceable variables, actually displaying an ampersand requires that it have its own variable.

Insert Variable Button

Clicking this button after selecting an attribute from the Variable Dropdown List (see above) will cause the selected variable to be associated with the chosen objects. When those objects are actioned in NatureView, the variable will be replaced with its value dynamically.

Actioned Items Section

Actioned Items List

This list displays the objects that are associated with the selected action.

Add Item Button

Clicking this button will open a dialog allowing you to select which items of the selected class should be associated with the selected action.

Remove Item Button

Clicking this button will remove the selected items and disassociate them with the selected action.

Add Items of Class Dropdown List

This dropdown list displays the classes or types of objects that can have actions associated with them. The class of object selected from this list controls the list of objects displayed when the Add Item Button (see above) is pressed.

Grab All Button

Clicking this button will automatically associate the selected action with all objects of the selected class.

Query Button

Clicking this button will open a window displaying all of the currently defined search queries in the project. Double clicking one of these will cause the query to be evaluated and all vectors defined by that query to be added to the actioned objects list. This is a fast and efficient way in which to select a subset of vectors for association with an action, without having to select them one at a time manually.

Show Normal Options Button

This button is a duplicate of the Show Normal Options button found on the General page. It dismisses the NatureView Format Advanced Options pages, and replaces them with the normal Scene Express Option pages common to all output formats.

Scene Exporter Editor: STL & VRML-STL Advanced Options

Each Scene Express output format can optionally offer a page of more advanced options specific to that particular output format. The options described here are specific to the STL and VRML-STL formats (if enabled).

If a particular format offers Advanced Options, a "Show Advanced Options" button will be available at the lower left of the General tab of the Scene Exporter. Clicking this button will replace the other normal Scene Exporter tabs common to all formats with a new set, specific to the format in question. The General Tab will remain available. To return to the General settings, click the same button (now labeled "Show Normal Options") again.

More background information on the different formats and overviews of their strengths and weaknesses can be found in Appendix N: Scene Express Export Formats.

General Page

The General page is the same page as documented in the tab common to all Scene Express formats.

Advanced STL Options Page

Advanced STL Features Section

Units Dropdown List

The units used for your final model should be selected here.

Build To Fit Radio Button

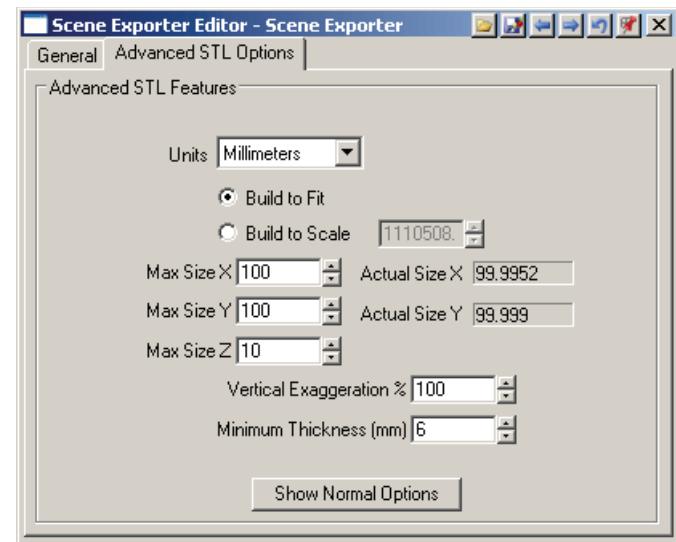
Selecting this radio button will cause the object to be automatically scaled so that it will be possible to create it in a machine of the size defined farther down the editor (see Max Size fields below)

Build To Scale Radio Button

Selecting this button allows you to define a particular scale for the output model - for example, 1:25,000. By default the field to the right of this button will be filled with a scale that represents the maximum size of model that can be output from a machine of the size defined farther down the editor (see Max Size fields below). The value in this field can be manually edited to override the number automatically provided by Scene Express.

Max Size X Field

Into this field you would enter the maximum width of model that your rapid prototyping equipment can create. This value is in the units defined in the first dropdown list. So if your machine is capable of outputting a model that is a maximum of 1 meter wide, and your chosen units are millimeters, you would enter 1000 in the Max Size X field.



Actual Size X Field

This field can not be edited, but displays the actual width of the model to be output, based on the dimensions of the digital data being provided, and the other variables selected on this page of the editor. For example, if your terrain model is 10 kilometers wide, and you have chosen a scale of 1:24,000 by entering 24000 into the scale field, and meters as your units, then the final model will be $10,000/24,000=0.416666667$ meters in width. This is the value that would be displayed in the Actual Size X field.

Max Size Y Field

Into this field you would enter the maximum length of model that your rapid prototyping equipment can create. This value is in the units defined in the first dropdown list. So if your machine is capable of outputting a model that is a maximum of 1 meter in length, and your chosen units are millimeters, you would enter 1000 in the Max Size Y field.

Actual Size Y Field

This field can not be edited, but displays the actual length of the model to be output, based on the dimensions of the digital data being provided, and the other variables selected on this page of the editor. For example, if your terrain model is 10 kilometers deep, and you have chosen a scale of 1:24,000 by entering 24000 into the scale field, and meters as your units, then the final model will be $10,000/24,000=0.416666667$ meters in length. This is the value that would be displayed in the Actual Size Y field.

Max Size Z Field

Into this field you would enter the maximum height of model that your rapid prototyping equipment can create. This value is in the units defined in the first dropdown list. So if your machine is capable of outputting a model that is a maximum of 1 meter high, and your chosen units are millimeters, you would enter 1000 in the Max Size X field.

Vertical Exaggeration Field

This field allows you to define a vertical exaggeration factor which will be used to scale your terrain model vertically and create an increased sense of relief. For example, if you have a terrain model that has a 100m elevation range, and you enter 10 into the Vertical Exaggeration field, then the terrain model will be output as if the elevation range were 1000m, not 100m.

Minimum Thickness Field

This field defines the maximum depth of “block” added to the base of the terrain model in order that the finished model have a flat base. This value can be exaggerated to create a clear “block-cut” effect.

Note: Some rapid prototyping equipment requires that the output model have a flat base, and can not reproduce the change in edge elevation present in terrain models without creating a block fill to an arbitrary level. This level should ideally exceed that of the lowest elevation in your terrain, and can be controlled using the Maximum Thickness value.

Show Normal Options Button

This button is a duplicate of the Show Normal Options button found on the General page. It dismisses the STL Advanced Options pages, and replaces them with the normal Scene Express Option pages common to all output formats.

Scene Exporter Editor: OpenFlight Advanced Options

Each Scene Express output format can optionally offer a page of more advanced options specific to that particular output format. The options described here are specific to the NatureView format.

If a particular format offers Advanced Options, a "Show Advanced Options" button will be available at the lower left of the General tab of the Scene Exporter. Clicking this button will replace the other normal Scene Exporter tabs common to all formats with a new set, specific to the format in question. The General Tab will remain available. To return to the General settings, click the same button (now labeled "Show Normal Options") again.

More background information on the different formats and overviews of their strengths and weaknesses can be found in Appendix N: Scene Express Export Formats.

General Page

The General page is the same page as documented in the tab common to all Scene Express formats.

Advanced Openflight Options Page

Create Foliage Instances Checkbox

When this option is enabled, only one object per foliage image is real, all others are translated & scaled instances. This reduces the overall geometry size, but leads to more overhead for realtime computations.

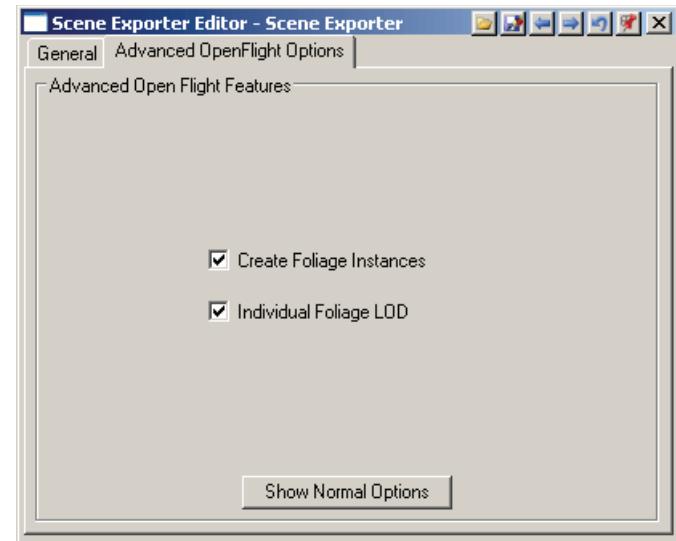
Individual Foliage LOD Checkbox

Openflight LOD (Level of Detail) nodes control when an object changes it's detail levels (generally geometry), or disappears. For foliage, this amounts to on/off on a per tree basis.

When this option is enabled, it is designed to increase performance on scenes with extremely large numbers of foliage objects (forestry visualizations, for example), but on some systems may have the opposite effect due to the overhead of managing and monitoring individual LOD for each individual foliage object.

Show Normal Options Button

This button is a duplicate of the Show Normal Options button found on the General page. It dismisses the OpenFlight Advanced Options page, and replaces it with the normal Scene Express Option pages common to all output formats.



Scene Exporter Editor: FBX Advanced Options

Each Scene Express output format can optionally offer a page of more advanced options specific to that particular output format. The options described here are specific to the NatureView format.

If a particular format offers Advanced Options, a "Show Advanced Options" button will be available at the lower left of the General tab of the Scene Exporter. Clicking this button will replace the other normal Scene Exporter tabs common to all formats with a new set, specific to the format in question. The General Tab will remain available. To return to the General settings, click the same button (now labeled "Show Normal Options") again.

More background information on the different formats and overviews of their strengths and weaknesses can be found in Appendix N: Scene Express Export Formats.

General Page

The General page is the same page as documented in the tab common to all Scene Express formats.

Advanced FBX Options Page

Save As Version 5 Checkbox

Selecting this checkbox will force VNS to save your FBX file in the version 5 file format. This may overcome some problems with importing the file into programs that don't support the latest version of the format. Check the documentation that came with your 3D software about FBX import support.

Save As Binary File Checkbox

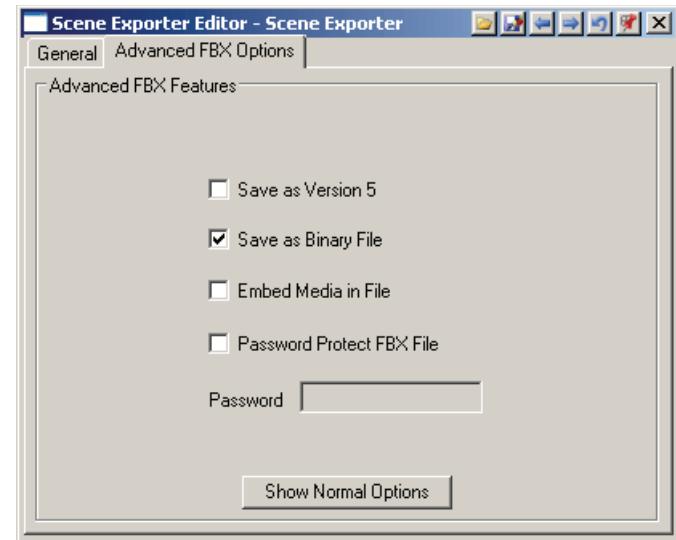
Select this checkbox to save the file as a binary, as opposed to an ASCII file. The current standard defines only binary output, so this option is only relevant if the "Save as Version 5" option is also enabled. Check the documentation that came with your 3D software about FBX import support - your particular 3D software of choice may not support binary FBX files.

Embed Media In File

Select this checkbox to embed the media (sounds, images, animations etc) associated with the export in the one, self-contained FBX file. This allows for ultimate portability between applications, but will increase file size and may not be supported by your 3D application of choice. Check the documentation that came with your 3D software about FBX import support.

Password Protect FBX File

Select this checkbox to allow password protection of FBX files exported. This will protect them against unauthorized use by a third party. This can be useful when you have to provide content to a client on an unsecured media like a public ftp server or similar.



Note: If you do not select the Embed Media in File checkbox, associated media files, such as image drapes will not be password protected.

Password Field

Provide a password for the FBX file in this field. The password will be displayed as you type it.

Search Query Editor

Dynamic Vector linking lets you link Vectors to Components at render time based on Search Queries. This gives you a fast, flexible way to let database attributes from Shape files control where Components are rendered without setting up "hard" (static) links. With Dynamic Links, if you change the Shape file and re-import it you won't have to re-link all your Components.

Use of the DEM Merger requires that Search Queries be set up to select and prioritize DEM sets for re-sampling and merging. If you are unsure on how to achieve this, the DEM Merger Wizard can help automate the process. You can also use Search Queries to dynamically add database objects to the Controlled Items list in the Render Scenario Editor.

Selecting Database Objects

The Search Query Editor lets you select database objects using one or more filters. The filters can select or deselect based on the attributes of the objects, including layer, name, label or the value in any database attribute field. You can combine multiple filters to select only those objects you want.

Once you've set up filters to select sets of objects, you can click the "Select Items Now" button on the General page to immediately select them in the Database Editor's Objects list. You can attach a Search Query to one or more Components from the Component Editors to create dynamic links.

Dynamic Vector Linking

For example, you can select a group of Vectors and dynamically link them to one or more Components using the Vector Links Icon in the relevant Component Editor(s).

Dynamic linking will change if you change the search query. If you link Vectors to Components with a Search Query, then re-import data or add new data, you don't have to re-link the search query. VNS will automatically use the Search Query to attach whatever Vectors match the Query to the Components that use the Query.

You can save Search Queries as reusable Components for use in other Projects.

Vector-Attachable Component Editors

Dynamic Vector linking is available for these Components:

- **Area Terraffectors (see Area Terraffector Editor)**
- **DEM Mergers (see DEM Merger)**
- **Ecosystems (see Ecosystem Editor)**
- **Environments (see Environment Editor)**
- **Foliage Effects (see Foliage Effect Editor)**
- **Ground Effects (see Ground Effect Editor)**
- **Lakes (see Lake Editor)**
- **Snow (see Snow Effect Editor)**

- **Streams (see Stream Editor)**
- **Terraffectors (see Terraffector Editor)**
- **Walls (see Wall Editor)**

On the General page for the Editors of these Components you will see the same Vector Links Icon. These allow you to attach a Search Query to the Component.

For all the above Components, the Vectors that are found by the Search Query will be used to place the Component onto the terrain.

For more information on how to associate search queries with the above components, see the Vector Links Icon section.

General Page

General Features Section

Name Field

The name field lets you see and edit the name for the current Search Query.

Select Items Now Button

Click the "Select Items Now" button on the General page if you want to immediately select all objects chosen by the Search Query. They will be selected in the Database Editor's Objects list.

This is like using the search button in the Database Editor, but with all the filtering power of the Search Query Editor.

You can add the selected objects to a layer, add static "hard" links to Components or just make sure your Search Query is selecting the objects you want.

Note: Static "hard" links may render faster, especially if you have a lot of vectors matched to Components. So you may want to select items and use hard links if you are creating a complex project that is not expected to change.

Summary of Filters Section

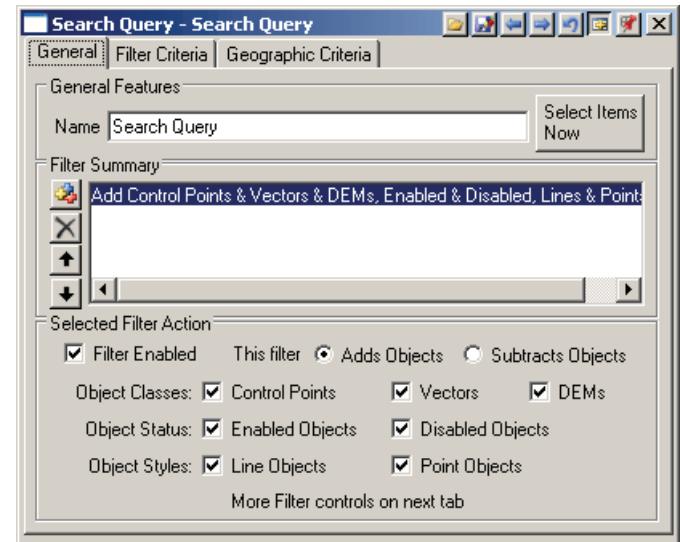
The Summary of Filters section lets you add, delete and remove filters from the Search Query.

Filter Summary List

The Filter Summary list shows a list of the Filters you specify.

The order of the filters is important. VNS applies them from top to bottom.

You can select a filter and then edit its parameters on the Selected Filter page (see below).



Add Filter Icon

Click the Add Filter icon to add a new filter to the list.

Remove Filter Icon

Select a Filter you want to delete and click the Remove Filter icon. VNS will delete the selected filter.

Raise and Lower Filter Priority Icons

The order of the filters is important. VNS applies them from top to bottom. Click the Raise Filter Priority icon to raise the selected filter higher in the list. Click the Lower Filter Priority icon to lower the selected filter lower in the list.

Selected Filter Section

The Selected Filter section lets you enable or disable the filter selected in the Filter Summary list (see above). You can specify whether the filter will add or subtract database objects, and which types of objects will be considered.

You can select the objects in the database using the Select Items Now button.

Filter Enabled Checkbox

Select the Filter Enabled checkbox to enable the currently selected filter.

Deselect the Filter Enabled checkbox to disable the currently selected filter.

Add Objects/Subtract Objects Radio Buttons

Select the Add Objects radio button if you want the objects selected by the current filter to be included the set of objects returned by the Search Query.

Select the Subtract Objects radio button if you want the objects selected by the current filter to be left out of the set of objects returned by the Search Query.

Object Classes Checkboxes

Control Points

Select the Control Points checkbox if you want the Search Query to consider Control Points.

Vectors

Select the Vectors checkbox if you want the Search Query to consider Vectors.

DEMs

Select the DEMs checkbox if you want the Search Query to consider DEMs.

Object Status Checkboxes

Enabled Objects

Select the Enabled Objects checkbox if you want the Search Query to consider Enabled Objects in the database.

Disabled Objects

Select the Disabled Objects checkbox if you want the Search Query to consider Disabled Objects in the database.

Object Style Checkboxes

Line Objects

Select the Line Objects checkbox if you want the Search Query to consider Vectors that have a Line Style.

Point Objects

Select the Point Objects checkbox if you want the Search Query to consider Vectors that have a Point Style.

More Selected Filters Display

The More Selected Filters display simply notes that there are more filter controls on the next page of the Search Query Editor; the Selected Filter page.

Selected Filter Page

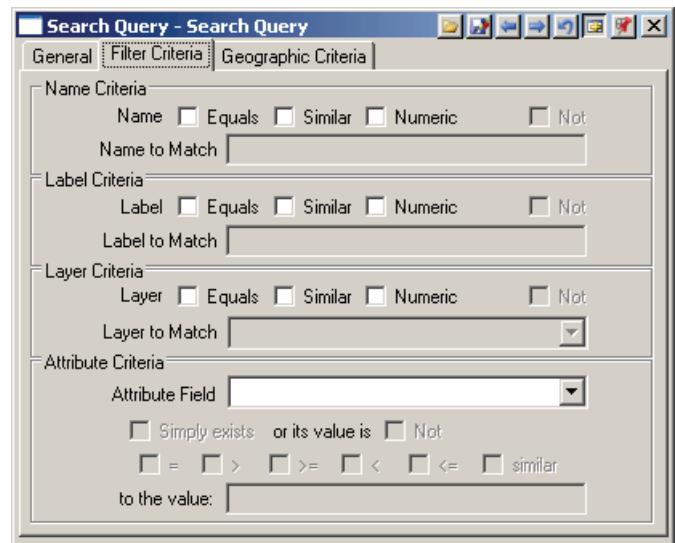
The Selected Filter page lets you edit the filtering choices for the currently selected filter. The currently selected filter is the filter selected in the Filter Summary list on the General page (see above).

Selected Filter Section

Each filter event can match objects with layers, names, labels and attributes you select using your choice of search functions. You can have more than one filter event if you need to create filters for several items of the same type.

Search Functions

For layers, names and labels, there is a consistent set of search functions: Equals, Similar, Numeric and Not. For other database attributes there is a separate set of search functions (see Attribute Field Controls below).



"Equals" chooses a layer, name, or label that matches exactly. This function is case sensitive.

"Similar" matches a layer, name or label item containing whatever characters you type. It is not case sensitive. You can match to multiple items of the same type that have the same characters in the layer, name or label.

"Numeric" matches any layer, name or label that contains a number.

"Not" inverts the selection created by the other search functions.

Name Controls

Use the Name controls to select objects by the name of the object.

The Name to Match field lets you enter an object name.

"Equals" chooses objects with a name that exactly matches the name in the Name to Match field. This function is case sensitive.

"Similar" chooses objects with a name that includes the characters in the Name to Match field. It is not case sensitive.

"Numeric" chooses objects with a name that contains a number.

"Not" inverts the selection created by the other search functions.

Label Controls

Use the Label controls to select objects by the label of the object.

The Label to Match field lets you enter an object label.

"Equals" chooses objects with a label that exactly matches the label in the Label to Match field. This function is case sensitive.

"Similar" chooses objects with a label that includes the characters in the Label to Match field. It is not case sensitive.

"Numeric" chooses objects with a label that contains a number.

"Not" inverts the selection created by the other search functions.

Layer Controls

Use the Layer controls to select objects by the name of a layer to which the objects belong.

The Layer to Match drop box lets you select a layer name from all the layers that exist in the database.

"Equals" chooses objects belonging to a layer that exactly matches the layer name in the Layer to Match drop box. This function is case sensitive.

"Similar" chooses objects belonging to a layer that has a name which includes the characters in the Layer to Match drop box. It is not case sensitive.

"Numeric" chooses objects belonging to any layer with a layer name that contains a number.

"Not" inverts the selection created by the other search functions.

Attribute Field Drop Box

The Attribute Field drop box lets you select a database attribute from all the database attributes that exist in the database.

Attribute Field Controls

Select the Simply Exists checkbox to choose all objects that have the attribute shown in the Attribute Field drop box. You can use this along with the other search functions to choose additional objects.

Deselect the Simply Exists checkbox if you don't want to choose all objects that have the attribute shown in the Attribute Field drop box.

Select the Not checkbox to invert the results of the following search functions. When you select the Not checkbox, the filter will select all the objects that do NOT match the results of the other search functions below.

Select the "=" (Equals) checkbox to choose objects with the attribute shown in the Attribute Field that match the results of the following search functions. If the Not checkbox is selected, the filter will choose the objects that do NOT match the contents of the "to the value" field.

Select the ">" (Greater Than) checkbox to choose objects with the attribute shown in the Attribute Field with a value larger than the contents of the "to the value" field. If the Not checkbox is selected, the filter will choose the objects that are NOT larger than the contents of the "to the value" field.

Select the ">+" (Greater Than and Equal To) checkbox to choose objects with the attribute shown in the Attribute Field with a value equal or larger than the contents of the "to the value" field. If the Not checkbox is selected, the filter will choose the objects that are NOT larger than the contents of the "to the value" field.

Select the "<" (Less Than) checkbox to choose objects with the attribute shown in the Attribute Field with a value smaller than the contents of the "to the value" field. If the Not checkbox is selected, the filter will choose the objects that are NOT smaller than the contents of the "to the value" field.

Select the "<+" (Less Than and Equal To) checkbox to choose objects with the attribute shown in the Attribute Field with a value equal or smaller than the contents of the "to the value" field. If the Not checkbox is selected, the filter will choose the objects that are NOT smaller than the contents of the "to the value" field.

Greater Than, Less Than and Equals can also be used with text attributes. The filter will use the ASCII value of the text (values based on alphabetical order).

Select the Similar checkbox to choose objects with text in the Attribute Field that includes the characters in the "to the value" field. It is not case sensitive.

Geographic Bounds Page

Use the controls provided on the Geographic Bounds page of the editor to control the area inside or outside which VNS will search for objects to which it can apply its selection filter(s). This allows you to further refine your search queries (and speed up particularly processor-intensive searches) by forcing VNS to only look at a user-defined subset of the terrain.

Geographic Bounds Controls

The Geographic Bounds Controls are similar to those found on the Georeference page of the Image Object Library, and allow you to define a bounded area by North, South, East and West references.

Inside Checkbox

Select this checkbox if you want VNS to apply the selected filter(s) to objects inside the defined area.

Outside Checkbox

Select this checkbox if you want VNS to apply the selected filter(s) to objects outside the defined area.

Completely Checkbox

Select this checkbox if you want VNS to apply the selected filter(s) only to those objects that lie completely inside or outside the defined area.

North Field

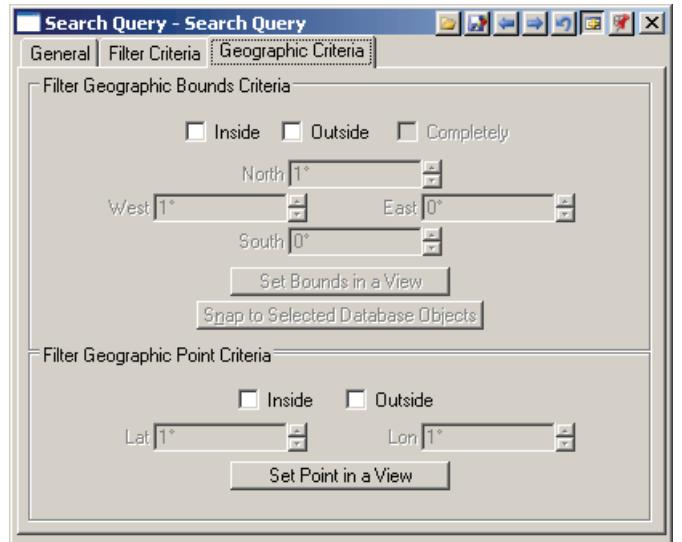
This field displays the northernmost boundary of the selected area. You can enter a value directly into this field or use the autobound buttons (See below) to set this value for you automatically.

East Field

This field displays the easternmost boundary of the selected area. You can enter a value directly into this field or use the autobound buttons (See below) to set this value for you automatically.

South Field

This field displays the southernmost boundary of the selected area. You can enter a value directly into this field or use the autobound buttons (See below) to set this value for you automatically.



West Field

This field displays the westernmost boundary of the selected area. You can enter a value directly into this field or use the autobound buttons (See below) to set this value for you automatically.

Set Bounds In A View Button

Click the Set Bounds in a View button if you want to set the bounded area by clicking in a View. Click twice in a View to specify two corners of a rectangle that you wish to be used for this Search Query. VNS will automatically set the values in the North, West, East and South fields to match.

Snap To Selected Database Objects Button

Click the Snap to Selected Database Objects button if you want the bounded area to exactly fit around one or more database objects.

If the Database Editor is open, VNS will ask if you have selected the objects you want to use. If you say yes, VNS will set the values in the North, West, East and South fields to include the selected objects. If you say Cancel, you can select the objects you want and then click the Snap to Selected Database Objects button again.

VNS will automatically set the values in the Top, Left, Right and Bottom fields to exactly include the selected objects.

Geographic Point Controls

The Geographic Point Controls allow you to define the area for inclusion by specifying a reference point, rather than an area.

Inside Checkbox

Select this checkbox if you want VNS to apply the selected filter(s) to objects inside the defined area.

Outside Checkbox

Select this checkbox if you want VNS to apply the selected filter(s) to objects outside the defined area.

Latitude (Lat) Field

Into this field, enter the latitudinal location of the point in degrees.

Longitude (Lon) Field

Into this field, enter the longitudinal location of the point in degrees.

Set Point In A View Button

Click the Set Point in a View button if you want to set the reference point for the bounded area by clicking in a View. Click once in any View to specify the point's location. VNS will automatically enter the relevant values into the Lat/Lon fields (see above).

Shadow Editor

The Shadow Editor lets you control Shadow Components. It gives you common controls that affect all Shadow Components you may have in a Project, along with a set of controls that apply to a single Shadow Component.

What is a Shadow Component?

Shadow Components let the terrain receive shadows. They also let you cast shadows from the terrain and Image Object foliage within a Vector area.

To use a Shadow Component, create a Vector Object that encloses an area. Then apply a Shadow Component to that Vector Object. VNS will automatically connect the start and ending points of your Vector when it calculates the Shadow Component.

You can use a Shadow Component to cast shadows, receive shadows or both.

You must have a Shadow Component set to receive shadows in order to see shadows from terrain, Image Objects, 3D Objects and Cloud Models on the terrain.

You must have a Shadow Component set to cast shadows in order to see shadows from Image Objects and the terrain.

If you don't have a Vector attached to a Shadow Component, it will apply to the entire terrain model. That's fine for receiving shadows. Resolution doesn't matter for Shadow Components set to receive shadows.

However it's a different story for casting shadows. To get high resolution cast shadows for the terrain and Image Object foliage, it's best to create separate Shadow Components in smaller areas for casting shadows.

An Edge Feathering Profile has no effect on a Shadow Component set up to receive shadows. Edge Feathering only affects Shadow Components set up to cast shadows.

You can adjust the Shadow Component resolution with the Low, Medium, High and Very High Quality radio buttons. However if the vector area is too big, even the Very High Quality radio button won't give you enough resolution for finely detailed shadows.

If your shadows lack detail at the Very High Quality setting, use smaller Vector areas to cast shadows.

You can apply the same Shadow Component to any number of Vectors. It's best to avoid overlapping Shadow Components that cast shadows. VNS will always take the darkest pixel from overlapped shadow maps which may not give you the finest possible shadow detail.

When you first create a Shadow Component it is set to "receive" only. If you want to use it to cast shadows, select the Cast checkbox and attach it to a Vector surrounding the Area where you want to see the Shadows.

Shadow Tips

VNS creates shadows with shadow maps. Creating shadows is a balancing act between memory requirements and quality.

Quality vs. Memory

If you only want to see shadows from large terrain features such as mountains, then high Quality may not be necessary.

Increasing the Quality setting and increasing the area set to receive shadows both will increase the memory needed for the shadow map.

There are a few ways you can reduce the memory usage:

- **Reduce the size of the vector area.**

If you need detailed shadows in the foreground, make a vector as small as possible and assign a Shadow Component with Medium or High Quality. Create one or more other vectors farther away from the Camera and assign a Shadow Component with Low Quality for casting less detailed shadows in the distance.

- **Decrease the project's fractal depth.**

This will impact the quality of the image. You can do this from the Terrain Parameter Editor.

- **Reduce the Quality level.**

You can do this using the Quality radio buttons in the Shadow Map section of the Shadows & Shadow Map page. This will create less detailed shadows. Increasing the Minimum Shadow Casting Foliage Height may help (see below).

There are several ways to increase shadow quality:

- **Increase Shadow Quality.**

You can do this using the Quality radio buttons in the Shadow Map section of the Shadows & Shadow Map page

- **Increase the Minimum Shadow Casting Foliage Height.**

This will remove the need to reproduce detailed shadows for low vegetation. Then you may be able to actually reduce the Quality level without much visible impact.

Using Multiple Shadow Components

An efficient technique is to use one or more large Shadow Component set to receive shadows every where you need to see shadows.

Note: You will not be able to see any shadows on the terrain unless you have a Shadow Component attached to a Vector covering that part of the terrain where you want to see shadows. That Shadow Component must be set to receive shadows in order to see shadows from Shadow Components that cast shadows, from clouds and from 3D objects.

You can then use smaller Shadow Components in specific areas where you actually need to see shadows, and set them to cast shadows. You can control the resolution and quality appropriately for each Shadow Component that Casts shadows. Set each to the minimum quality required.

For example, you can have a Shadow Component set up to cast large-scale shadows around distant peaks. It may have the Minimum Shadow Casting Foliage Height set to exclude all foliage for faster rendering. Then you could create a closer Shadow Component set to cast small-scale shadows in the foreground. There you can spend the rendering time to get detailed shadows where they can be seen.

Note: Avoid overlapping Shadow Components that cast shadows. Shadows are additive so overlapping areas that cast shadows may produce strange results.

Accurate Shadows with Fractal Depth Maps

For the most accurate shadows, use Fractal Maps instead of Variable Fractal Depth. Do this even for still images.

Variable Fractal Depth can cause the trees to appear in different positions than their shadows due to the difference in fractal calculations from the sun and camera positions. With Fractal Maps, VNS uses the exact same fractal calculations for both which ensures that the tree and shadow positions will match.

Note: You can select between Variable and Fractal Maps from the Terrain Parameter Editor.

Fixing Artifacts with Shadow Offset

If you see artifact patterns in your shadows, try adjusting the “Shadow Offset from Terrain” parameter on the Shadows & Shadow Map page (see below).

Rendering Speed

It takes a bit of time to generate a Shadow Map. You can reduce rendering time by reducing the area covered by a Shadow Map's host Vector or choosing a lower Quality setting (see below).

A very useful option is to select the Use File checkbox (see below) to tell VNS to save a generated Shadow Map to your hard drive. That way, it doesn't have to be regenerated every time you render.

Note: You may still want VNS to regenerate the Shadow Map whenever you make changes to Parameters that may affect the Shadow Map, such as Sun Light position; tree height, position or density; terrain height; Terraffector elevation; or 3D Object size, rotation or position. You can force VNS to regenerate the Shadow map by deselecting the Shadow Map File checkbox, or selecting the Regenerate File Next Render checkbox. Then VNS will recreate the Shadow Map the next time you render (see below).

When you are animating a Parameter that changes the Shadow Map on every frame, you have a choice. Deselect the Shadow Map File checkbox when you want VNS to generate a new Shadow Map for every frame. This will give you accurate shadows at the expense of rendering time. If the shadows don't necessarily have to be accurate, you can select the Shadow Map File checkbox and VNS will use the pre-saved Shadow Map no matter what. This will save rendering time at the expense of shadow accuracy.

Parameters that can cause VNS to regenerate the Shadow Map for every frame include animating Light positions, animating the height, position or density of Image Objects foliage, animating the height of the terrain, animating the elevation of Terraffectors or animating the size, rotation or position of 3D Objects.

If tree heights are animated but the trees being animated aren't in shadow map area, it's a good idea to select the Shadow Map File checkbox. This keeps VNS from unnecessarily regenerating the Shadow Map on each frame.

General Page

General Features

Name Field

Use the Name field to name the current Shadow Component.

If you select an existing Shadow Component and click the Create New Effect button to create a new Shadow Component, VNS will name the new Shadow Component with the same name, but with a number appended to the end. If there was already a number at the end of the name of the original Shadow Component, VNS will increment the number. This ensures that the new Shadow Component will have a different name.

Enabled Checkbox

Use the Enabled checkbox to enable or disable the Shadow Component.

If you disable a Shadow Component it will not lose its parameter values. It may be useful to temporarily disable a particular Shadow Component to see how the terrain looks without it, or to speed preview rendering.

Note: You can enable or disable all Shadow Components at once from the Enabled 2 page on the Render Options Editor. To see the Shadow Component in your rendering, it must be visible to the Camera you selected for the Render Job you are using (see Render Job Editor), and 3D Objects must be enabled in the Render Options you are using (see Render Options Editor).

Priority Field

The Priority field lets you specify the rendering priority of the Component relative to other Components of the same category. A Component with a higher priority will be rendered before a Component in the same category that has a lower priority.

Render priority only matters where Components of the same category overlap. VNS will use the values from the highest-priority Component.

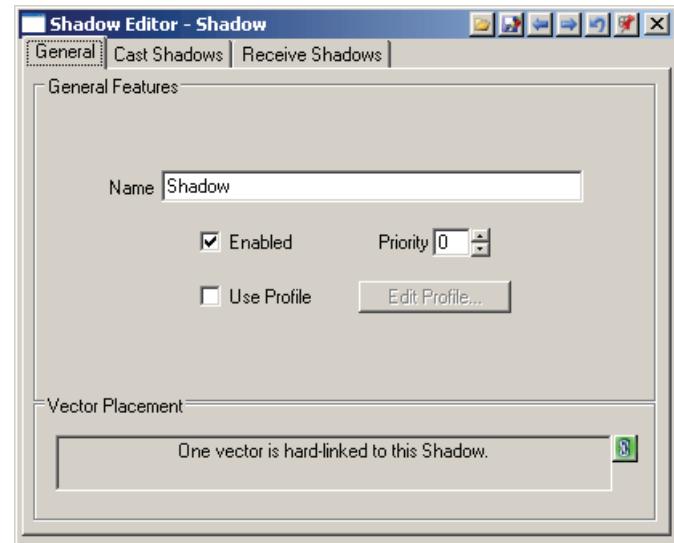
If there are overlapping Components of the same category that are each set to the same priority, VNS will mix them equally.

Use Profile Checkbox

Click the Use Profile checkbox when you want to control the amount of Shadow Component with a profile. This is based on a gradient from the edge of the Vector Object's area toward the middle, called an "Edge Feathering Profile." This lets you fade the shadowing so it doesn't end abruptly right at the outside edge of the Vector.

When you first create a new Profile by selecting the Use Profile Checkbox, it varies between no effect at the edge to the full effect 10 meters toward the middle of the Vector area. You can edit this Profile by clicking the Edit Profile button (see below).

Edge Feathering Profiles add to rendering time and take additional memory to render.



Edit Profile Button

Click the Edit Profile button to open the Edge Feathering Profile Editor. There you can alter the Edge Feathering Profile to change the intensity of the Shadow Component from the edge of the vector inward.

Vector Placement Section

By attaching Vectors to Ecosystems you can control where they appear. Vectors can be dynamically linked with Search Queries or hard linked.

Vector Links Button

This control allows you to perform various tasks relating to the association of vectors with components. To learn how to use it, see Vector Links Icon.

Attached Hard-Linked Vectors Display

The Hard-Linked Vectors display tells you if there are any Vectors hard-linked to the Component, and if so, how many. It will also display vectors attached by Search queries and list the names of the search query or queries in use.

Cast Shadows Page

Shadows Controls

Cast Checkbox

Select the Cast checkbox if you want the Shadow Component to cast shadows for the terrain and Image Object foliage.

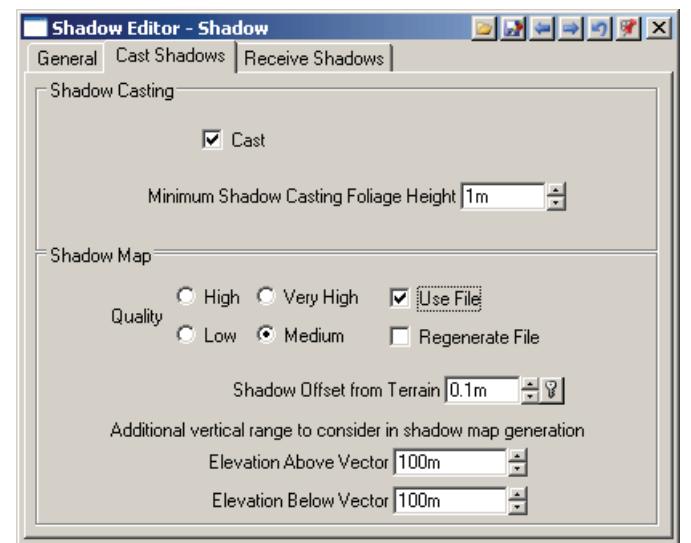
Minimum Shadow Casting Foliage Height Field

Use the Minimum Shadow Casting Foliage Height field to set a height below which VNS will not cast shadows. In other words, this lets you set the minimum height of a tree or terrain feature that will cast a shadow. Foliage below this height will not cast shadows, which will save rendering time.

You can set the Minimum Shadow Casting Foliage Height field high enough to eliminate artifacting on small shadow detail if you only need low shadow detail for casting shadows from large objects. If you need hill shadows, but not tree shadows, set this height above the height of your trees. If you need tree shadows but not grass shadows, set this height above the height of your grass.

By eliminating shadows for smaller objects, you can likely use a lower Detail setting (see below). This will further speed rendering and save memory.

The default value is 1 meter.



Shadow Map Controls

Quality Radio Buttons

To create shadows, VNS generates a shadow map for each vector that has the Shadow Component applied.

The Shadow Map Quality radio buttons let you select the resolution for the shadow maps. If you see artifacting in a shadowed area, use a higher Shadow Map Quality.

Medium is the default setting. Low will create lower resolution shadow maps and use a lot less memory. High will create higher resolution shadow maps and use a lot more memory. Very High will create the highest resolution shadow maps and use the most memory. Select the lowest setting that gives you the shadow resolution you need.

The width of the maps associated with the above settings are as follows: Low: 512 pixels, Medium: 1024 pixels, High: 2048 pixels, Very High: 4096 pixels. The height of the map will be determined by the angle of the sunlight and the area that the shadow map affect.

Use File Checkbox

Select the Use File checkbox when you want VNS to save the generated Shadow Map to your hard drive. During rendering, when VNS finds a saved Shadow Map, the program will use then use the saved Shadow Map instead of regenerating a new one.

This Shadow Map caching can save a lot of rendering time because VNS will only have to create it the first time you render. After that, VNS can load the Shadow Map from your hard drive. This is much faster than recalculating it.

VNS will save the Shadow Map in the Project's Default Directory, which you can set on the Preferences Window, on the Paths page.

Note: The Default Directory is set automatically when you create a new Project.

Deselect the Shadow Map File checkbox when you want VNS to regenerate the Shadow Map each time you render. This will take additional rendering time when you render a preview in a View or render final images from the Render Control window.

Note: VNS uses the same shadow map when rendering a preview and when rendering final images.

If you want VNS to regenerate the Shadow Map file on the next render, select the Regenerate File Next Render checkbox (see below). Do this when you've changed Parameters that effect the Shadow Map.

Things that can affect the Shadow Map include tree height, terrain height, Light position, Terraffector profile, position and elevation, 3D Object size, rotation and position, Shadow Map Width, Shadow Map Detail, Shadow Map Elevation Above and Shadow Map Elevation Below the vector.

If you've changed one of these Parameters, and you still want to use the saved Shadow Map rather than generating a new one, leave the Shadow Map File checkbox checked, and don't select the Regenerate File Next Render checkbox. This is especially useful to do if the change you made is outside the area of the Shadow Map's host Vector Object.

Regenerate File Checkbox

Select the Regenerate File checkbox to tell VNS to recalculate the Shadow Map and resave the Shadow Map file the next time you render. After the next render, VNS will deselect this checkbox automatically.

This checkbox is only available if you have selected the Shadow Map File checkbox (see above). When you are using the Shadow Map file, the Regenerate File Next Render checkbox lets you update that file automatically.

You will want to update the Shadow Map file whenever you change a Parameter that could change the Shadow Map. Things that can affect the Shadow Map include tree height, tree position, tree density, 3D Object size, rotation and position, terrain height, Sun Light position, and Terraffector profile, elevation and position.

Many of the Parameters on the Shadow Component Editor will also affect the Shadow Map, including Shadow Component Resolution, Shadow Map Width, Detail and Elevation Above and Below Vector. When you change any of these, VNS will automatically select the Regenerate File Next Render checkbox for you.

Note: If you change the Resolution Field, either directly or by using the Floating checkbox to change it whenever you add or remove terrain from the Project, VNS will automatically select the Regenerate File Next Render checkbox for all Shadow Components that have the Shadow Map File checkbox enabled. That's because the Resolution field applies to all Shadow Components.

With the Shadow Map File checkbox selected, if you change Parameters that affect the Shadow Map and you don't regenerate the Shadow Map, your shadows will no longer be accurate.

Shadow Offset from Terrain Field

The Shadow Offset from Terrain field lets you fix splotchy shadow artifacting on the terrain. You may see this problem in certain situations, such as with terrain that has large polygons at near right angles to the sun.

Note: You may see this problem if both the Cast and Receive checkboxes are selected (see above).

You can fix splotchy shadowing by adjusting the amount of Z offset VNS applies to the terrain's shadow map. If you don't see splotchy shadows on the terrain itself, you don't have to change the value in this field.

What the Offset field does is move the base of the shadow away from the terrain. The useful range is typically from .1 meter to 5 meters, although very large terrain features may benefit from values larger than 5 meters. The default value of .1 should be sufficient for most uses. Make the value higher if you see splotchy looking shadows on the terrain.

Note: If your units are set to something other than Meters, VNS will show the .1 meter default in your chosen units.

If you make it too high, you may see places where the shadow becomes disassociated from the terrain feature casting the shadow. For instance a hill casting a shadow on the ground will have a light patch between the hill's base and the start of its shadow. In that case, decrease the value in the Shadow Offset from Terrain field.

Additional Vertical Range Fields

The Additional Vertical Range fields let you tell VNS how much terrain elevation above and below the Shadow Component's Vector to consider when calculating the Shadow Map.

Elevation Above Vector Field

When VNS calculates the size of the shadow map VNS takes into account where the sun is as well as the variation of terrain elevation inside the shadow area. Set the Elevation Above value to be a little above the highest peak within the shadow area. Units are meters above the maximum height of the Vector Object defining the shadow area.

This value doesn't have to be exact. If you make it too small, you may see the shadow of your highest peaks become clipped. You'll also see the peak clipping as the shadow map is calculated if you view the Shadow Map creation. If you see clipping in the high peaks, increase the value.

If you make the value much too large it could reduce the precision of the shadow map, but you can be a little bit high with no ill effect.

Elevation Below Vector Field

When VNS calculates the size of the shadow map VNS takes into account where the sun is as well as the variation of terrain elevation inside the shadow area. Set the Elevation Below value to be a little below the lowest depression within the shadow area. Units are meters below the minimum height of the Vector Object defining the shadow area.

This value doesn't have to be exact. If you make it too small, you may see the shadows from your lowest areas become clipped. You'll also see these areas clipping as the shadow map is calculated if you view the Shadow Map creation. If that happens, increase the value.

If you make the value much too large it could reduce the precision of the shadow map, but you can be a little bit low with no ill effect.

Receive Shadows Page

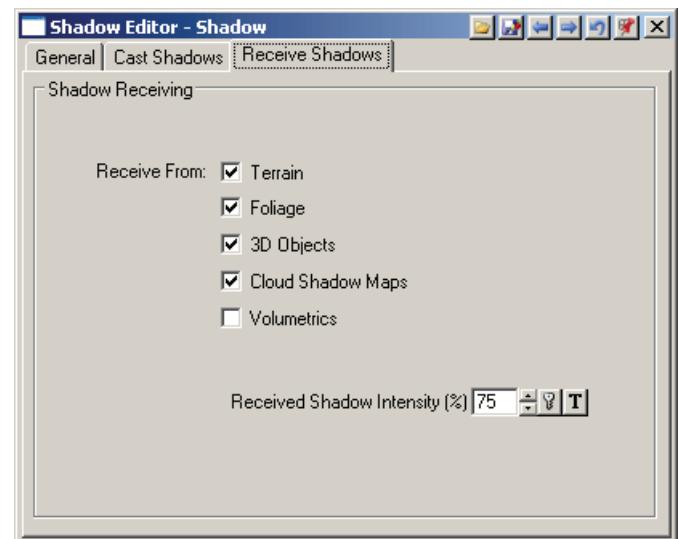
Receive Checkboxes

Select the Receive checkbox if you want the Shadow Component to receive shadows. It can receive shadows from the terrain, Image Object foliage, 3D Objects, Cloud Model Shadow Maps, and Volumetrics.

In order to receive shadows from the terrain and Image Objects, you must also select the Cast checkbox (see above).

Note: In order to receive shadows from 3D Objects you must select shadow casting in the 3D Object Editor for any 3D Objects for which you want shadows. In order to receive shadows from Cloud Models you must select shadow casting in the Cloud Model Editor for any Cloud Models for which you want shadows.

The Receive checkbox is selected by default when you create a new Shadow Component.



Received Shadow Intensity Percentage Field and Buttons

The Intensity lets you control how dark the shadows will be. Zero percent is no shadow, while 100 percent is a black shadow.

You can also change the intensity of the shadow inward from the vector via an Edge Feathering Profile, which you can access from the General page (see above). This can be useful for feathering the effect along the edge of the vector region to avoid an abrupt transition between shadows and no shadows.

Another powerful option is to vary shadow Intensity using a Texture (see below).

Received Shadow Intensity Texture Controls

The Shadow Intensity Texture controls let you alter the intensity of the Shadow Component (the darkness of the shadows), using texture patterns projected onto the terrain.

Full white in the texture will produce the amount of shadowing set in the Shadow Intensity Percentage field (see above). Full Black will create no shadows. You can vary the shadow intensity between these extremes with shades of gray in the texture.

You can also change the intensity of the shadow inward from the vector via a Profile, which you can access from the General page (see above). This can be useful for feathering the effect along the edge of the vector region to avoid an abrupt transition between shadows and no shadows.

Note: If you use an Edge Feathering Profile (see above) it will be calculated after the Shadow Intensity Textures. This allows you to feather the edges of your shadowed area even when you are also using Textures to modulate the shadow intensity.

Sky Editor

The Sky Editor lets you control the look of your Sky. You can specify the colors that appear based on a Gradient from the nadir to the zenith, and you can control how the Sky reacts to Lights.

VNS also derives the background color for Views from the Sky Color (see the Color Gradients page below).

General Page

General Features

Name Field

Enter a name for the Sky. For example, if it is set up as a sunset sky, you might call it simply "Sunset Sky".

By default VNS will name new skies "Sky", and add a number after the name if there is more than one sky named "Sky".

Enabled Checkbox

The Enabled checkbox lets you enable or disable the Sky for rendering.

Disabling a Component can be useful to speed up rendering if you are doing test renders to check some other aspect of your scene and don't need to see the 3D Object. Make sure you remember to enable it for the final rendering if you want to see the Component.

Note: To see the Sky in your rendering, it must be visible to the Camera you selected for the Render Job you are using (see Render Job Editor), and Skies must be enabled in the Render Options you are using (see Render Options Editor).

Intensity Percentage Field

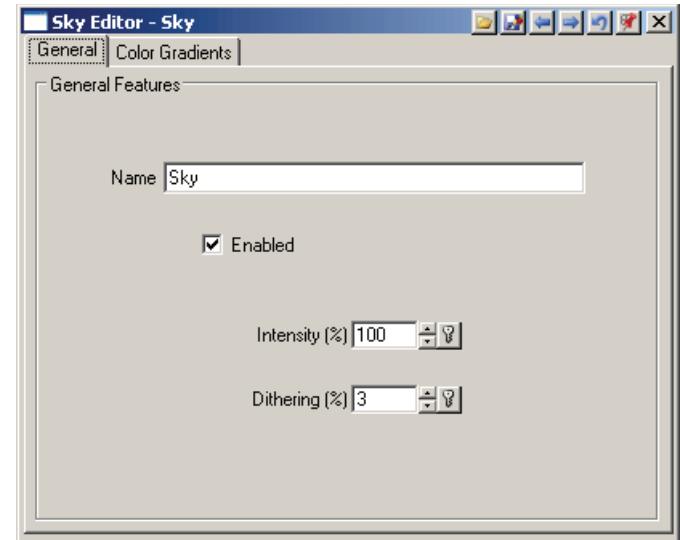
The Intensity percentage field lets you reduce the coloration from the Sky Gradient and the coloration of Lights from the Sky Light Gradient.

You can animate the Intensity percentage. For example you can decrease the intensity of a Sky set up for daytime colors while increasing the intensity of a Sky set up for night colors to animate a change from day to night.

Note: You can also animate the Sky's colors themselves, and the position of the colors in the Sky's Color Gradients (see below).

Dithering Percentage Field

The Dithering percentage field lets you control the amount of color jittering in the Sky's Gradients. If you see banding, increase the Dithering to eliminate it. If you see noise artifacts in the Sky, reduce the Dithering.



Color Gradients Page

The Color Gradients page lets you control the Sky colors from the Zenith through the Horizon to the Nadir, and toward and away from Lights.

The Sky and Light Thumbnail lets you preview how the combined color Gradients will combine in the Sky.

Sky Color Gradient

The Sky Color Gradient is at the top of the Color Gradients page. It lets you control the Sky colors from the Zenith through the Horizon to the Nadir.

VNS also derives the background color in Views from the colors in this gradient.

Note: Much like a real sky, darkening the Sky Colors has the effect of allowing Star-fields and Celestial Objects to be seen.

To Access the Sky Color Gradient, click on the Gradient popdown icon . This will display the Color Gradient Editor:



The Sky Color Gradient shows a colored bar with one or more colored pins beneath it. The bar is a place to create Sky Colors. Click it to create a new Sky Color.

When you click the Gradient to create a new Sky Color, VNS will create a random color. VNS represents each Sky Color with a colored pin. Click any pin to select a Sky Color. You can edit the color by selecting a Color Pin and clicking the Sky color well to open the Color Editor. This is the same as double-clicking a Color Pin.

You can animate the position of the Color Pins to create changing skies. You can also animate the colors from the Color Editor.

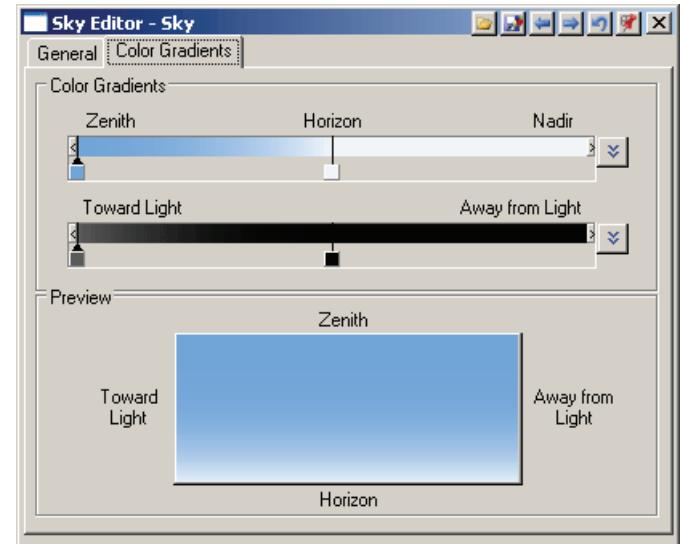
The Zenith is the sky straight above the Camera. It is represented as the left-most position in the Sky Gradient.

Note: You can slide the left-most Color Pin to the right to lower the zenith color toward the Horizon.

The Horizon is where the terrain meets the sky. It is represented as the middle of the Sky Gradient.

The Nadir is straight below the Camera. It is represented as the right-most position in the Sky Gradient.

The Nadir is usually not seen unless the terrain data you are using covers a small enough area that the Camera can see below the terrain, in which case the Nadir lets you add a background color around the terrain.



The Sky Gradient automatically curves naturally around the earth.

Note: Skies work best if the Camera is looking up into space. If you want to render the Earth from space, turn off the Sky and use a Volumetric Atmosphere.

The amount of Sky coloration from the Sky Color Gradient depends on the Intensity percentage on the General page.

Add Sky Color Icon

Click the Add Sky Color Icon to add a new Sky Color. VNS will ask for the position in the Gradient. Enter a position and click the OK button.

Alternatively you can click directly in the Gradient in a spot where no other Sky Color's pin exists.

VNS will create a new random Sky Color. The Sky Color will be represented in the Gradient with a colored pin.

Remove Sky Color Icon

Select a Sky Color's pin and click the Remove Sky Color icon if you want to delete the selected Sky Color.

Color Well

You can edit the selected Sky Color by clicking the Color well to open the Color Editor. You can animate the color here or in the Color Editor if you wish.

Blend Drop Box

The Blend drop box lets you choose the rate of change between the selected Sky Color and the Sky Color to its left in the gradient.

These are easiest to visualize if you try them and see what they look like in the gradient. You can see how VNS blends Sky Colors between the pins by how it blends the Sky Colors along the Gradient and in the Sky and Light Thumbnail (see below).

You can change the blending by selecting different blend types from the Blend Drop Box. If you have more than one Sky Color in the gradient, use the following choices to decide how the gradient blends the Sky Colors together.

Sharp Edge

Choose "Sharp Edge" if you want an instant change with no gradient.

Soft Edge

Choose "Soft Edge" to create a gradient that turns into the color to the left 1/10 of the way toward that color's pin.

Quarter Blend

Choose "Quarter Blend" to create a gradient that turns into the color to the left 1/4 of the way toward that color's pin.

Half Blend

Choose “Half Blend” to create a gradient that turns into the color to the left 1/2 of the way toward that color’s pin.

Full Blend

Choose “Full Blend” to create a smooth gradient that turns into the color to the left at that color’s pin.

Fast Increase

Choose “Fast Increase” to create an accelerated gradient that gets closer to the previous color faster, and turns into the color to the left at that color’s pin.

Slow Increase

Choose “Slow Increase” to create an decelerated gradient that gets closer to the previous color slower, and turns into the color to the left at that color’s pin.

S-Curve

Choose “S-Curve” to create a narrower gradient between the pin and the previous color’s pin and leaves more of the original colors along the gradient in between.

Position in Gradient Field

The Position in Gradient field shows the percentage along the Gradient for the selected Sky Color. You can move the Sky Color’s pin to the left by decreasing this number or to the right by increasing this number. You can also drag the pin along the Gradient with the mouse.

Sky Light Gradient

The Sky Light Gradient is at the bottom of the Color Gradients page. It lets you control how the Sky is colored by Lights.

Note: Lights set to Distant on the General page of the Light Editor will be taken into account by the Sky Light Gradient. Other lights will be ignored by the Sky Light Gradient.

To Access the Sky Light Gradient, click on the Gradient popdown icon . This will display the Color Gradient Editor:



The Sky Light Gradient shows a colored bar with one or more colored pins beneath it. The bar is a place to create Sky Light colors. Click it to create a new Sky Light Color.

When you click the Gradient to create a new Sky Light Color, VNS will create a random color. VNS represents each Sky Light Color with a colored pin. Click any pin to select a Sky Light Color. You can edit the color by double-clicking a Color Pin or clicking the Sky Light color well to open the Color Editor.

You can animate the position of the Color Pins to create changing Sky Colors around Lights. You can also animate the colors from the Color Editor.

Areas nearer to Lights are represented as the left-most position in the Sky Gradient. Areas away from Lights are represented as the right-most position in the Sky Gradient.

The Sky Light Gradient automatically curves naturally around Lights.

By placing a dark color on the left, a lighter color just to the right of the first and then another dark color just to the right of the second you can create halos around lights like those you might see around the sun or moon. If you want broader hot spot, drag the left-most pin further to the right. If you want narrower hot spot, drag the right-most pin further to the left.

The intensity and color of Lights also affects the sky, and you'll see that in the Sky and Light thumbnail (see above).

The amount of Sky coloration from the Sky Light Gradient depends on the Intensity percentage on the General page.

Note: Much like a real sky, darkening the Sky Light Colors has the effect of allowing Starfields and Celestial Objects to be seen.

Add Sky Light Color Icon

Click the Add Sky Light Color Icon to add a new Sky Light Color. VNS will ask for the position in the Gradient. Enter a position and click the OK button.

Alternatively you can click directly in the Gradient in a spot where no other Sky Light Color's pin exists.

VNS will create a new random Sky Light Color. The Sky Light Color will be represented in the Gradient with a colored pin.

Remove Sky Light Color Icon

Select a Sky Light Color's pin and click the Remove Sky Color icon if you want to delete the selected Sky Light Color.

Color Well

You can edit the selected Sky Light Color by clicking the Color well to open the Color Editor. You can animate the color here or in the Color Editor if you wish.

Blend Drop Box

The Blend drop box lets you choose the rate of change between the selected Sky Color and the Sky Color to its left in the gradient.

These are easiest to visualize if you try them and see what they look like in the gradient. You can see how VNS blends Sky Light Colors between the pins by how it blends the Sky Light Colors along the Gradient and in the Sky and Light Thumbnail (see below).

You can change the blending by selecting different blend types from the Blend Drop Box. If you have more than one Sky Light Color in the gradient, use the following choices to decide how the gradient blends the Sky Light Colors together.

Sharp Edge

Choose “Sharp Edge” if you want an instant change with no gradient.

Soft Edge

Choose “Soft Edge” to create a gradient that turns into the color to the left 1/10 of the way toward that color’s pin.

Quarter Blend

Choose “Quarter Blend” to create a gradient that turns into the color to the left 1/4 of the way toward that color’s pin.

Half Blend

Choose “Half Blend” to create a gradient that turns into the color to the left 1/2 of the way toward that color’s pin.

Full Blend

Choose “Full Blend” to create a smooth gradient that turns into the color to the left at that color’s pin.

Fast Increase

Choose “Fast Increase” to create an accelerated gradient that gets closer to the previous color faster, and turns into the color to the left at that color’s pin.

Slow Increase

Choose “Slow Increase” to create an decelerated gradient that gets closer to the previous color slower, and turns into the color to the left at that color’s pin.

S-Curve

Choose “S-Curve” to create a narrower gradient between the pin and the previous color’s pin and leaves more of the original colors along the gradient in between.

Position in Gradient Field

The Position in Gradient field shows the percentage along the Gradient for the selected Sky Light Color. You can move the Sky Light Color’s pin to the left by decreasing this number or to the right by increasing this number. You can also drag the pin along the Gradient with the mouse.

Preview Section

Sky and Light Thumbnail

The Sky and Light Thumbnail lets you preview how the combined color Gradients will combine in the Sky. Vertically it shows the half of the Sky Gradient, from the Horizon at the bottom to the Zenith at the top.

Horizontally the thumbnail shows the Light Gradient from a Light at the left edge to no Light at the right edge.

Lights set to Distant on the General page of the Light Editor will affect the sky. Their intensity and color will also affect the sky, and the Sky Gradient thumbnail will show this. Other lights will not affect the sky.

Snow Effect Editor

The Snow Effect Editor lets you add snow to the terrain.

Snow is a color or texture applied to the terrain based on Rules-of-Nature™. You can apply a Snow Effect globally or attach it to one or more Vectors to restrict the snow's area. Snow can change where it appears based on latitude to simulate the lowered temperatures toward the poles.

Note: You can disable snow for any Ecosystem using the "Snow Cannot Cover this Ecosystem" checkbox on the Color Map page. By using an Ecosystem in the Cross-section Profile for a road Terraffector, you can use this feature to plow roads.

General Page

General Features

Name Field

Enter a name for the Snow Effect. For example, if it is set up to animate snow coverage from winter to spring, you might call it simply "Winter-to-Spring".

By default VNS will name new Snow Effects "Snow", and add a number after the name if there is more than one Snow Effect named "Snow".

Enabled Checkbox

The Enabled checkbox lets you enable or disable the Snow Effect for rendering.

Disabling a Snow Effect can be useful to speed up rendering if you are doing test renders to check some other aspect of your scene and don't need to see the Snow Effect. Make sure you remember to enable it for the final rendering if you want to see the Snow Effect.

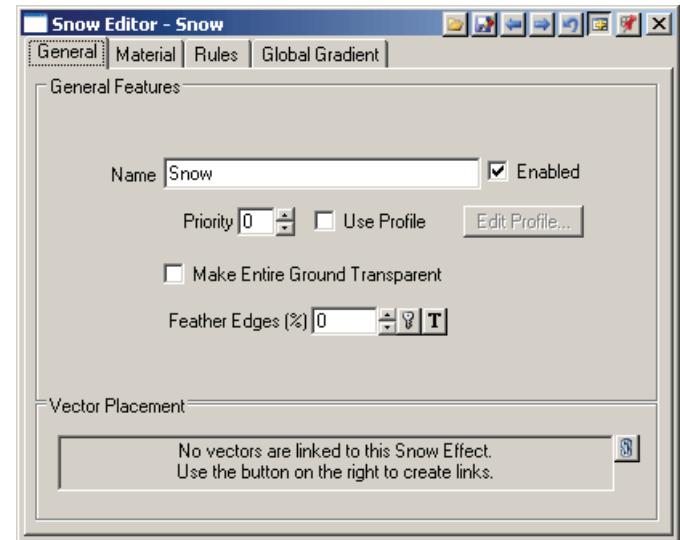
Note: To see the Snow Effect in your rendering, it must be visible to the Camera you selected for the Render Job you are using (see Render Job Editor), and 3D Objects must be enabled in the Render Options you are using (see Render Options Editor).

Priority Field

The Priority field lets you specify the rendering priority of the Component relative to other Components of the same category. A Component with a higher priority will be rendered before a Component in the same category that has a lower priority.

Render priority only matters where Components of the same category overlap. VNS will use the values from the highest-priority Component.

If there are overlapping Components of the same category that are each set to the same priority, VNS will mix them equally.



Use Profile Checkbox

Click the Use Profile checkbox when you want to control the amount of the Snow Effect based on a gradient from the edge of the Vector Object's area toward the middle. This lets you fade the snow so it doesn't end abruptly at the outside edge of the Vector.

When you first create a Snow Effect VNS will create a default Edge Feathering Profile. The default Profile varies between no effect at the edge to the full effect 10 meters toward the middle of the Vector area. You can edit this Profile by clicking the Edit Profile button (see below).

Profiles add to rendering time and take additional memory to render.

Edit Profile Button

Click the Edit Profile button to open the Edge Feathering Profile Editor. There you can alter the Edge Feathering Profile to change the intensity of the Snow Effect from the edge of the vector inward.

Make Entire Ground Transparent Checkbox

Select this checkbox if you want the polygons with snow on them to not be rendered at all.

Feather Edges Percentage Field and Buttons

The Feather Edges field lets you create a more gradual transition between snowy areas and non-snowy areas.

You can enter a value from zero to one hundred percent. Enter zero percent when you want no feathering. VNS will render snow with polygons that are either all snow color or all understory color.

Enter one hundred percent for the maximum amount of feathering. VNS will gradually mix in Ground Effect or Ecosystem colors with the snow color for polygons that are closest to the slope, elevation and relative elevation limits of the Snow Effect.

A Snowline Feathering percentage of 75% is a good value to try when you want a smooth transition from snow to Ground Effect or Ecosystem colors.

Snowline Feathering looks particularly good when you are animating slope, elevation or relative elevation values for the Snow. You might do this when animating the change of seasons or a climate change simulation.

Vector Placement Section

By attaching Vectors to Snow Effects you can control where they appear. Vectors can be dynamically linked with Search Queries or hard linked.

Vector Links Button

This control allows you to perform various tasks relating to the association of vectors with components. To learn how to use it, see Vector Links Icon.

Attached Hard-Linked Vectors Display

The Hard-Linked Vectors display tells you if there are any Vectors hard-linked to the Component, and if so, how many. It will also display vectors attached by Search queries and list the names of the search query or queries in use.

Material Page

The Material page lets you add new Materials to the Snow Effect.

The Material Gradient Driver lets you tell VNS which Material to use. If you select a texture, the Snow Effect can use multiple Materials.

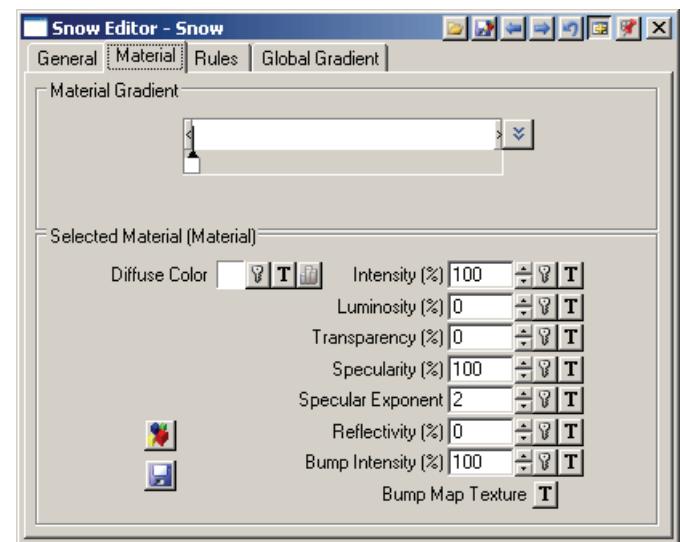
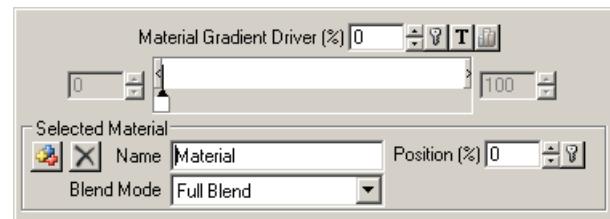
Material Gradient Section

Material Gradient and Driver

The Material Gradient controls let you add, remove and edit the materials to the Ground Effect.

Each material in an Ground Effect comprises a set of properties (color, reflectivity, transparency etc) and Strata.

To Access the Gradient, click on the Gradient popdown icon . This will display the Material Gradient Editor:



Material Gradient Driver Percentage Controls

The Material Gradient Driver field lets you pick a Material for the Ground Effect based on a position along the Material Gradient (see below).

Enter a percentage from zero to 100 where zero is the left edge of the gradient and 100 is the right edge. VNS will use the Material at the gradient position you specify. If there is no Material represented at that position, VNS will create a blend between the nearest two Materials.

You can animate the Material Gradient Driver percentage to change Materials over time. This is great for climate change animations where you could animate through a variety of Materials such as from a desert to a rain forest.

By clicking the Texture Control icon you can control the Material Gradient Driver percentage with the Texture Editor. This lets you use all the Materials in the Gradient. Textures can range in gray values from black to white, with black representing 0% on the Gradient and white representing 100% on the gradient.

For example, if you use a fractal noise Element in the texture that ranges from black to white, VNS will cover the Ground Effect's area with Materials in a fractal noise pattern ranging from the left-most Material in the Gradient to the right-most Material in the Gradient.

Another example: You could use a Dynamic Parameter of Elevation in the Texture Editor and set its Input Low field to the lowest elevation in your terrain and the Input Height field to the highest Elevation in your terrain. Then VNS will arrange the Materials in the Ground Effect's Material Gradient so that the Materials on the left side of the gradient will grow on the lower elevations and the Materials on the right side of the Gradient will grow on the higher elevations.

You can also drive the selection of Ground Effect materials using a Thematic Map. For example, you could have an attribute in your controlling vectors that assigned a numeric value based on Ground Effect, and by careful organization of your Ground Effect materials on the gradient, use this attribute to populate all your vectors with one Ground Effect, while each displayed a different material at render-time.

Material Gradient

The Material Gradient shows a colored bar with one or more colored pins beneath it. The bar is a place to create Materials. Click it to create a new Material.

When you click the Gradient to create a new Material, VNS will give the new Material a random Diffuse Color. You can change the color by using the Diffuse Color Well to open the Color Editor.

VNS represents each Material with a pin that is colored with the Diffuse Color of the Material. Click any pin to select a Material.

Material Gradient Range Fields

The Material Gradient Range fields are on either side of the Material Gradient. They show the range of the value that controls the gradient.

If there's no texture enabled for the Material Gradient Driver, the range of the gradient is zero to 100 percent.

If there is a texture enabled for the Material Gradient Driver, then there are two cases:

1) The first Texture Element is a Dynamic Parameter.

In this case, the Range fields show the range of input values for the Dynamic Parameter you have selected. For example if Elevation is the Dynamic Parameter and the Elevation range in the texture editor (Input Low and Input High) is zero to 1000 meters, then in the Range fields you'll see zero on the left and 1000 on the right.

You can directly edit those texture values in the Ground Effect Editor's Range fields. This is handy because you don't have to reopen the Texture Editor if you want to edit these values.

2) The first Texture Element is not a Dynamic Parameter.

In this case, the Range fields are zero to 100 percent (representing values of 0 to 1 in the controlling texture, or black to white), and are non-editable.

Add Material Icon

Click the Add Material icon to add a new Material. VNS will ask for the position in the Gradient. Enter a position and click the OK button.

Alternatively you can click directly in the Gradient in a spot where no other Material exists.

VNS will create a new Material and give it a random Diffuse Color. The Material will be represented in the Gradient with a pin in the color of its Diffuse Color.

Remove Material Icon

Click the Remove Material icon if you want to delete the selected Material.

Material Name

The Material Name field lets you edit the Material's name. After you create a Material it will have a default name of "Material." It's a good idea to enter a unique name in the Material Name field to identify how you will use the Material. For example "sand," "forest" or "fall foliage."

Position in Gradient Field

The Position in Gradient field shows the percentage along the Gradient for the selected Material. You can move the Material's pin to the left by decreasing this number or to the right by increasing this number. You can also drag the pin along the Gradient with the mouse.

Blend Mode Drop Box

The Blend drop box lets you choose the rate of change between the selected Material and the Material to its left in the gradient.

These are easiest to visualize if you try them and see what they look like in the gradient. You can see how VNS blends Materials between the pins by how it blends the Diffuse Colors along the Gradient.

You can change the blending by selecting different blend types from the Blend Drop Box. If you have more than one material in the gradient, use the following choices to decide how the gradient blends the materials together.

Sharp Edge

Choose "Sharp Edge" if you want an instant change with no gradient.

Soft Edge

Choose "Soft Edge" to create a gradient that turns into the color to the left 1/10 of the way toward that color's pin.

Quarter Blend

Choose “Quarter Blend” to create a gradient that turns into the color to the left 1/4 of the way toward that color’s pin.

Half Blend

Choose “Half Blend” to create a gradient that turns into the color to the left 1/2 of the way toward that color’s pin.

Full Blend

Choose “Full Blend” to create a smooth gradient that turns into the color to the left at that color’s pin.

Fast Increase

Choose “Fast Increase” to create an accelerated gradient that gets closer to the previous color faster, and turns into the color to the left at that color’s pin.

Slow Increase

Choose “Slow Increase” to create an decelerated gradient that gets closer to the previous color slower, and turns into the color to the left at that color’s pin.

S-Curve

Choose “S-Curve” to create a narrower gradient between the pin and the previous color’s pin and leaves more of the original colors along the gradient in between.

Selected Material Section

Diffuse Color Well and buttons

The Ground Effect's Diffuse Color (or texture) always appears wherever the Selected Material's Ground Overlay appears, unless you set the transparency of the Material to 100%. Click the Diffuse Color well to edit the Diffuse Color in the Color Editor.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's Diffuse Color with texture patterns.

When you use a texture, the Colors in the texture will replace the Diffuse Color, unless you use less than 100% Opacity in the Texture Editor, in which case the texture and the Diffuse Color will be mixed.

Strata Icon

Click the Strata icon to open the Material Strata Editor. There you can add Strata texturing to the Material.

Load and Save Material Icons

Clicking the relevant icon will either open the Component Gallery or the Component Signature Window, allowing you to load or save Ground Effect materials as required.

Diffuse Intensity Field and Buttons

The diffuse intensity of a material is a measure of how much of the diffuse color of a surface is returned to the camera. Reducing this value to 0% will result in a black surface (i.e.: 0 color) and setting it to 100% will result in the pure diffuse color as set in the Diffuse Color Well.

You can animate the value over time, and also drive its intensity with a texture.

This attribute is useful for simulating dirt (try driving this field with a Fractal Noise texture element), streaks, moisture (drive Diffuse Intensity with a Dynamic parameter of Water Level or Elevation to simulate moist surfaces at the edges of lakes and streams etc.)

The maximum value for this parameter is 10000%.

Luminosity Percentage Field and Buttons

Luminosity affects how the Material is shaded by Lights (see Light Editor). You can adjust it to create 3D-shaded Objects, flat-shaded Objects or anything in-between.

With zero percent luminosity, the Material will be fully shaded by Lights. This produces a 3D look. In deeply shadowed areas, the Material's color will be a darker shade of itself based on the Ambient Light Intensity and Color. Where fully lit by Lights, the color will be the Diffuse Color or texture (see above) modulated by the Intensity and Color of any Lights.

By raising the luminosity, you can lighten the shaded areas. This can be useful to do if the terrain that uses the Material seems too dark. Raising the luminosity a little bit decreases the shading contrast for the Material.

With 100 percent luminosity, the Material will ignore Lights completely. This produces a flat, unshaded look. The Material will always be the Diffuse Color or texture. This can be useful for Materials used to create the flat, paper-cutout-style animations used by certain cartoon shows.

You can also subtract light by using negative luminosity to make the object tend toward the Ambient Light colors. With 100 percent negative luminosity, the Material will ignore Lights. The Material will be flat-shaded with the Ambient colors.

You can animate the Luminosity percentage to simulate lighting changes. This lets you animate the effect of nearby lightning or explosions.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's luminosity with a texture pattern. This can be useful for creating the look of glowing lava.

When you use a texture, a white value in the texture will equal the amount of luminosity you set in the Luminosity percentage field. A black value in the texture will equal zero luminosity. Gray values will be in-between.

Transparency Percentage Field and Buttons

Use the Transparency field to adjust how much you can see through the Ground Overlay. Zero percent will cover the terrain with opaque Ground Overlay. One hundred percent makes the Ground Overlay invisible, and you will instead see a Ground Effect on the terrain polygons. Anything in-between will mix the Ground Overlay with the Ground Effect.

Note: There is always at least one global Ground Effect in any VNS Project.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's transparency with a texture pattern to make some areas more transparent than others.

When you use a texture, a white value in the texture will equal the amount of Transparency you set in the Transparency percentage field. A black value in the texture will equal zero Transparency. Gray values will be in-between.

Specularity Percentage Field and Buttons

Specularity is the amount of shininess for a material.

Use the Specularity Percentage field to adjust the shininess of the material. Zero percent means no specular highlight, while 100 percent is maximum shininess.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's specularity value with texture patterns.

When you use a texture, a white value in the texture will equal the amount of Specularity you set in the Specularity percentage field. A black value in the texture will equal zero Specularity. Gray values will be in-between.

Specular Exponent Field and Buttons

Use the Specular Exponent field to adjust the size of the shiny spot. The useful range is from 1 to infinity. Higher numbers will produce a smaller spot, with less feathering at its edge.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's specular exponent value with texture patterns.

When you use a texture, a white value in the texture will equal the amount of Specular Exponent you set in the Specular Exponent field. A black value in the texture will equal zero Specular Exponent. Gray values will be in-between.

Reflectivity Field and Buttons

Terrain materials can now reflect their surroundings, as well as parts of their own geometry. This is ideal for simulating surfaces such as snowfields, or mirages.

Set this value to an amount greater than 0% to see reflections on these surfaces.

You can animate the value over time, and also drive its intensity with a texture.

The maximum value for this parameter is 10000%.

Bump Intensity Percentage Field and Bump Map Icon

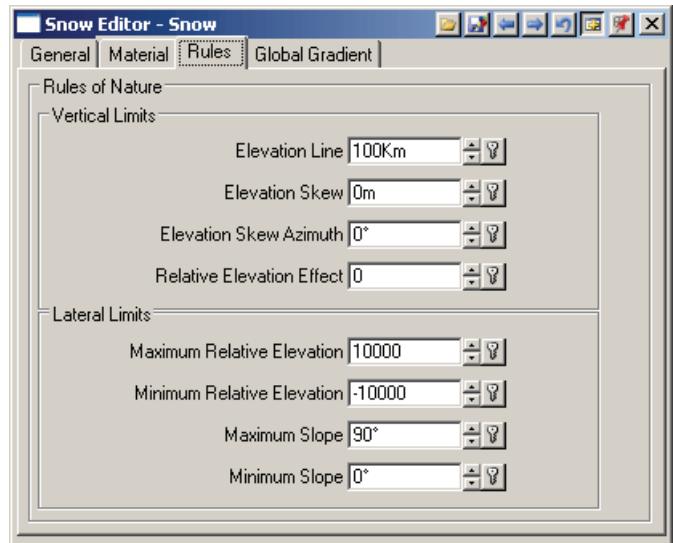
Bump mapping lets you simulate detailed relief shadowing without requiring dense geometry. For more about using bump mapping, see Bump Mapping Controls.

Rules Page

The Rules page lets you adjust where the Snow appears based on Rules-of-Nature™. The rules work exactly the same as they do for Ecosystems (see Ecosystem Editor), except for the Elevation Line, and the Elevation Skew Azimuth, which have opposite effects to their counterparts in the Ecosystem Editor:

For Snow Effects, the Elevation Line is the lower limit (not upper limit) of the snow rather than the upper limit as it is for Ecosystems. In Nature, the snow melts below the snow line.

For Snow Effects, the Elevation Line will be raised (not lowered) in the direction of the Skew Azimuth (see below) by an amount proportional to the slope and Elevation Skew.



Global Gradient Page

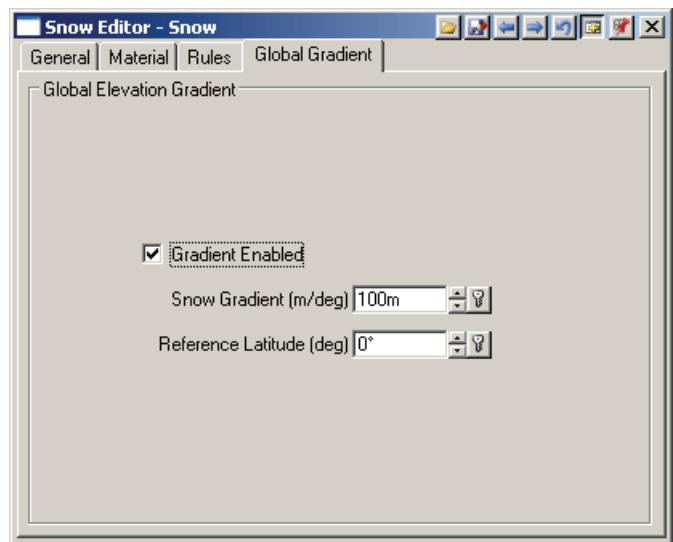
Global Elevation Gradient Controls

Use these controls when you're rendering all or most of a planet and you want to simulate the effect latitude has on snow. As you move further from the equator, climates get generally colder. This is similar to moving up the side of a mountain.

In the Snow Editor you can change the Elevation Line value to tell VNS the altitude below which the snow should melt.

Since changes in latitude have similar effect on snow as changes in altitude, VNS can simulate the changes in climate with changing latitude by changing the Elevation Line value for Snow based on latitude.

VNS lets you apply latitude-based changes to the Snow Effect's Elevation Line with these Global Elevation Gradient controls.



Gradient Enabled Checkbox

The Gradient checkbox determines whether an elevation gradient is applied to the snow's Elevation Line values based on DEM latitude, relative to a reference latitude (see below).

This is generally used to represent cooler temperatures toward the poles. The gradients are applied symmetrically to the equator. The effect on the snow's Elevation Line would be that the farther north you go the lower the elevation becomes, until at some latitude, the snow's Elevation Line reaches all the way down to sea level. You can control the severity of this effect with the Snow Gradient field.

Snow Gradient Field and Buttons

Use the Snow Gradient field to set the equivalence of latitude degrees to elevation (in meters) for snow.

Typical values are close to 100.0 meters/degree. Increasing it lowers the Snowlines more dramatically toward the poles.

Reference Latitude Field and Buttons

Use the Ref Latitude field to set the Reference Latitude for the Snow's Elevation Line (see Global Elevation Gradient Controls above).

If you're starting a planet from scratch, zero, which is the equator, is a good choice.

However if you've already set up a scene at some latitude and decide to add more DEMs and expand the scene, you might want to enter the latitude of the area you started. That way, their Ecosystem Elevation Line Parameters will not be changed by the Global Gradient.

Starfield Editor

The Starfield Editor lets you add stars to the sky. Stars are either colored dots or Image Objects.

Note: Stars may not be visible unless you disable Skies or reduce Sky Intensity.

General Page

General Features

Name Field

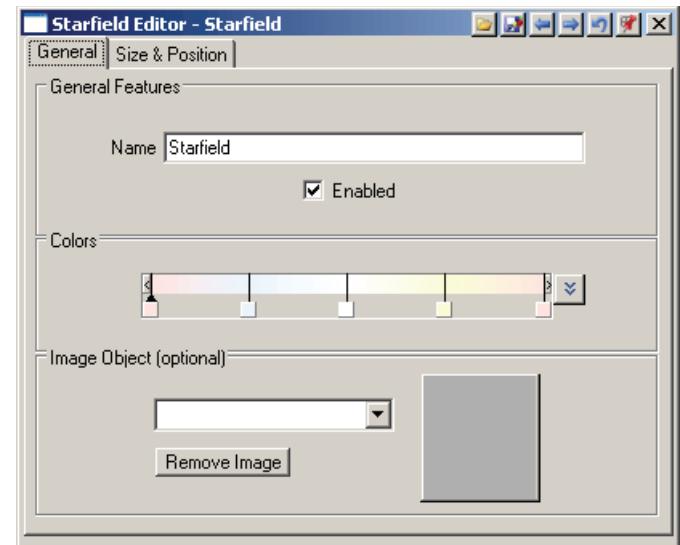
Enter a name for the Starfield. By default it will be named “Starfield”.

If there is more than one Starfield with the same name, VNS will add a number after the name.

Enabled Checkbox

The Enabled checkbox lets you enable or disable the Starfield for rendering.

Disabling an object can be useful to speed up rendering if you are doing test renders to check some other aspect of your scene and don't need to see the 3D Object. Make sure you remember to enable it for the final rendering if you want to see the object.

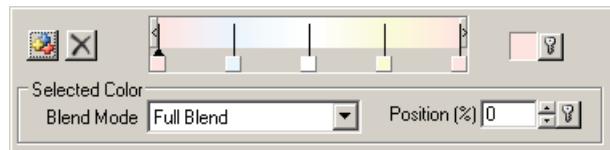


Note: To see the Starfield in your rendering, it must be visible to the Camera you selected for the Render Job you are using (see Render Job Editor), and Starfields must be enabled in the Render Options you are using (see Render Options Editor).

Colors Controls

Star Color Gradient Controls

To Access the Gradient, click on the Gradient popdown icon . This will display the Star Color Gradient Editor:



Colors are randomly assigned to the stars. Any star can get any color along the gradient, including colors in-between the Star Color Pins.

Note: If you only want two colors, add one color on the left edge of the Gradient and another color halfway across, and then set the blend for the second color to Sharp.

The Star Color Gradient shows a colored bar with one or more colored pins beneath it. The bar is a place to create Star Colors. Click it to create a new Star Color.

When you click the Gradient to create a new Star Color, VNS will give the new Star Color a random color. Click any Pin to select a Star Color.

Add Star Color Icon

Click the Add Star Color Icon to add a new Star Color. VNS will ask for the position in the Gradient. Enter a position and click the OK button.

Alternatively you can click directly in the Gradient in a spot where no other Star Color exists.

VNS will create a new random Star Color. The Star Color will be represented in the Gradient with a colored pin.

Remove Star Color Icon

Click the Remove Star Color Icon if you want to delete the selected Star Color.

Color Well

You can edit the selected Star Color by clicking the Color well to open the Color Editor. You can animate the color here or in the Color Editor if you wish.

Blend Drop Box

The Blend drop box lets you choose the rate of change between the selected Star Color and the Star Color to its left in the gradient.

These are easiest to visualize if you try them and see what they look like in the gradient. You can see how VNS blends Materials between the pins by how it blends the Diffuse Colors along the Gradient.

You can change the blending by selecting different blend types from the Blend Drop Box. If you have more than one material in the gradient, use the following choices to decide how the gradient blends the materials together.

Sharp Edge

Choose "Sharp Edge" if you want an instant change with no gradient.

Soft Edge

Choose "Soft Edge" to create a gradient that turns into the color to the left 1/10 of the way toward that color's pin.

Quarter Blend

Choose "Quarter Blend" to create a gradient that turns into the color to the left 1/4 of the way toward that color's pin.

Half Blend

Choose "Half Blend" to create a gradient that turns into the color to the left 1/2 of the way toward that color's pin.

Full Blend

Choose "Full Blend" to create a smooth gradient that turns into the color to the left at that color's pin.

Fast Increase

Choose "Fast Increase" to create an accelerated gradient that gets closer to the previous color faster, and turns into the color to the left at that color's pin.

Slow Increase

Choose "Slow Increase" to create an decelerated gradient that gets closer to the previous color slower, and turns into the color to the left at that color's pin.

S-Curve

Choose "S-Curve" to create a narrower gradient between the pin and the previous color's pin and leaves more of the original colors along the gradient in between.

Position in Gradient Field

The Position in Gradient field shows the percentage along the Gradient for the selected Star Color. You can move the Star Color's pin to the left by decreasing this number or to the right by increasing this number. You can also drag the pin along the Gradient with the mouse.

Optional Image Object Controls

Image Object Drop Box

Select an Image Object to use for stars, if you wish. Otherwise the stars will be colored dots.

If the image you want is not listed, select "New Image" and VNS will open a file requester where you can choose a new image to use for your Celestial Object. VNS will also add the image to the Image Object Library. Several fanciful star images are included with VNS, in the folder: "WCSCContent:Components\Image\Sky".

Remove Image Button

Click the Remove Image button if you want the stars to be colored dots and not use an image.

Image Object Thumbnail

The Image Object thumbnail shows a small version of the Image Object for stars, if there is one. You can double click it to see a full size preview.

Edit Image Object Button

Click the Edit Image Object button to open the Image Object Library with the Starfield's Image Object selected for editing.

Width, Height and Bands Display Fields

These display fields show the width and height in pixels, and the number of 8-bit bands in the image. A gray scale image will have one band, and a 24-bit color image will have three.

Size & Position Page

Size & Intensity Controls

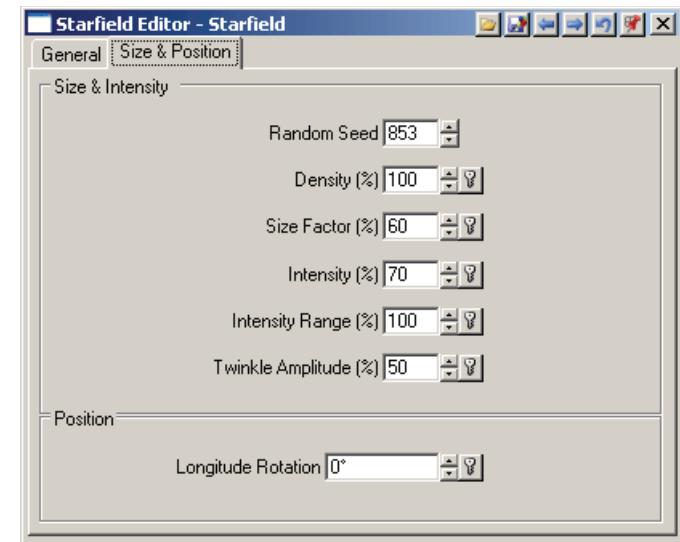
Random Seed Field

VNS uses the Random Seed field to generate a random star pattern. Enter a different number to get a different star pattern.

Density Percentage

Increase the density percentage to put more stars into the sky. Decrease it to put fewer stars into the sky.

Tip: If you are using an Image Object for your stars, start with a low Density to save preview rendering time. When you are happy with the other settings, you can increase the Density to whatever level you want to use in your final renderings.



Size Factor Percentage Field

The Size Factor field lets you adjust the size of the dots or Image Objects used as stars. It's a good idea to start out with a very low number and increase the value if needed.

Intensity Percentage Field

The Intensity percentage field lets you determine how bright your stars will be. Increase it for brighter stars, decrease it for dimmer stars.

Intensity Range Percentage Field

The Intensity Range percentage field lets you adjust the brightness variation in the stars. Increase it for a wider range between bright and dim stars. Decrease it for less brightness variation between the brightest and dimmest stars.

Twinkle Amplitude Percentage Field

The Twinkle Amplitude percentage field lets you adjust how much VNS makes the stars twinkle.

In nature, star twinkling when viewed from the ground is caused by temperature variations in the intervening atmosphere. You can simulate this with the Twinkle Amplitude percentage field. A percentage of zero is no twinkling. Higher percentages add increasing amounts of twinkling.

Position Controls

Longitude Rotation Field and Buttons

As the Earth spins on its axis, the stars change in the sky. You can use the Longitude Rotation field to move the stars. If you animate this parameter you can simulate the movement we perceive in the stars due to the rotation of the Earth.

Stream Editor

The Stream Editor lets you control Streams. It gives you common controls that affect all Streams you may have in a Project, along with a set of controls that apply to a single Stream. You can control Water, Foam, Wave and Beach parameters for each Stream.

To open the Stream Editor double-click any Stream Component in the Scene-At-A-Glance. You can also select a Stream's name in the Component Library's Current Project Components list and click the Edit button.

Another quick way to open the Stream Editor is to double click a Stream name in either the Component Library's Current Project Components list or the Database Editor's Attached Components list.

The Stream Editor will open, ready to edit the selected Stream. You can edit other Streams by using the You can import Components into your Projects using the Component Gallery..

What is a Stream?

A Stream is a water surface that can go downhill. The Stream Editor lets you create Rivers, streams and creeks. With different texturing and displacement you can even create ice and lava flows. You may create as many Streams as you like, limited only by your computer's memory.

A Stream must be attached to a Vector. The Stream will follow the path of the Vector.

Streams can overlap each other. Where Streams overlap, VNS will always render the Stream at the highest elevation.

Streams can use waves you create with the Wave Model Editor. You can also create animated wave displacement patterns with textures.

Creating a Stream

You can create a new Stream by selecting the Stream category in the Scene-At-A-Glance and clicking the Add or Clone Selected Item icon.

To create a Vector-bounded Stream you can digitize a Stream and Vector in one step by selecting the Streams Category in the s@g and clicking on the Create Icon on the main toolbar. Alternatively you can first create a Vector Object that follows a drainage and then attach it to a Stream by dragging one over the other in the Scene-At-A-Glance.

You can apply a Stream Object and a Terraffector to the same Vector Object. This lets you dig a Stream bed with the Terraffector and fill it with water using the Stream.

You can use multiple Water Materials each with unique texturing, foam, depth and wave displacement. You can vary materials based on the Vector's slope to create natural areas of whitewater where the stream flows down steeper areas and calmer water where the stream is flowing along less steep areas.

The level of the water is at the elevation of the Vector. You can offset the surface elevation of any of the Stream's Water Materials from the Vector. To do so, use the Water Depth field. The Water Depth field is on the Depth sub-page of the Water page (see below).

You can control the amount of beach along the stream with the Beach Height Minimum and Beach Height Variation controls which are on the Beach Gradient page (see below). By making the beach height below the water you can flood the stream beyond the beach. In that case, tall foliage growing in surrounding Ecosystems will still appear in the floodwaters.

The Vectors to which you apply Streams may overlap. You may be able to create subtle or wild effects by overlapping several Streams at the same elevation but with different colors; by overlapping Streams at different elevations, etc. For example, you may be able to create a frozen look with one Stream and a water look with another, to create a composite Stream that is partially frozen. Use your imagination and see what you come up with.

You can apply the same Stream to any number of Vectors.

To create a new Stream you can also select "Stream" in the Component Library's Current Project Components list and click the Create New Effect button. The Stream Editor will open, ready to edit the new Stream.

General Page

General Features Section

Name Field

Use the Name field to name the current Stream.

If you select an existing Stream and click the Create New Effect button to create a new Stream, VNS will name the new Stream with the same name, but with a number appended to the end. If there was already a number at the end of the name of the original Stream, VNS will increment the number. This ensures that the new Stream will have a different name.

Enabled Checkbox

Use the Enabled checkbox to enable or disable the Stream for rendering.

If you disable a Stream it will not lose its parameter values. It may be useful to temporarily disable a particular Stream to see how the terrain looks without it, or to speed preview rendering when you're working on some other aspect of your scene.

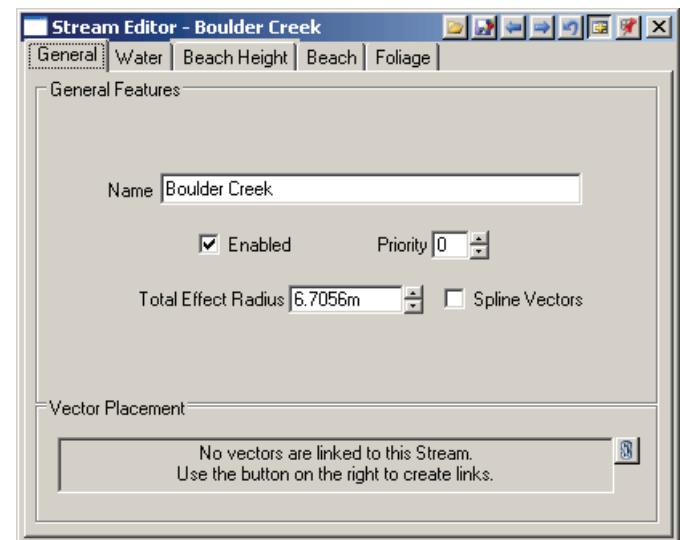
Make sure you remember to enable the Stream for the final rendering if you want VNS to render it.

Note: To see the Stream in your rendering, it must be visible to the Camera you selected for the Render Job you are using (see Render Job Editor), and Streams must be enabled in the Render Options you are using (see Render Options Editor).

Priority Field

The Priority field and buttons let you specify the rendering priority of a Stream that overlaps another Stream.

The Stream with a highest priority will be rendered when Streams overlap.



If there are overlapping Streams set to the same priority, VNS will render the one at the highest Elevation if the Overlap checkbox is selected. Otherwise VNS picks one at random.

Total Effect Radius Field

The Total Effect Radius field lets you set the width of the surface of the Stream on either side of the controlling Vector.

Spline Vectors Checkbox

Select this checkbox if you wish VNS to base your stream on a splined version of your controlling vector(s). This can give much smoother results than using normal segment based vectors, but since the spline is interpolated from the points in the original vector, it's path may be subtly different from the that of the original vector.

Vector Placement Section

By attaching Vectors to Streams you can control where they appear. Vectors can be dynamically linked with Search Queries or hard linked.

Vector Links Button

This control allows you to perform various tasks relating to the association of vectors with components. To learn how to use it, see Vector Links Icon.

Attached Hard-Linked Vectors Display

The Hard-Linked Vectors display tells you if there are any Vectors hard-linked to the Component, and if so, how many. It will also display vectors attached by Search queries and list the names of the search query or queries in use.

Water Page

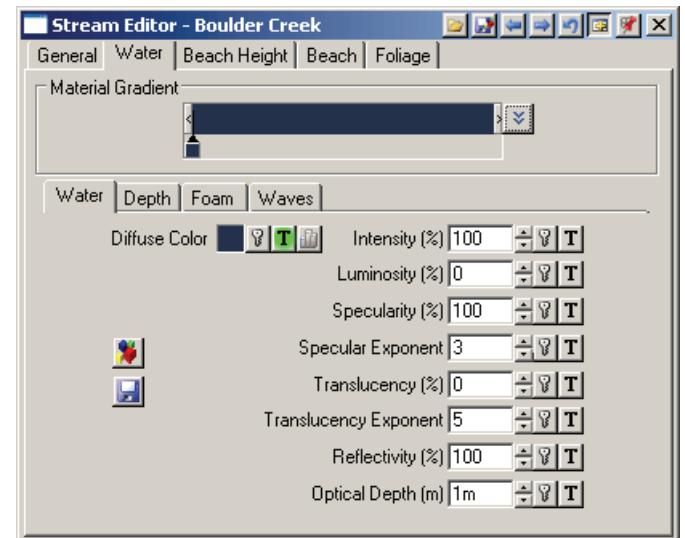
The Water page lets you add new Materials to the Lake.

The Material Gradient Driver lets you tell VNS which Material to use. If you select a texture or animate the material gradient driver % value, the Lake can use multiple Materials.

Material Gradient & Driver Section

Material Gradient Driver Percentage Controls

The Material Gradient Driver field lets you pick a Material for the Lake based on a position along the Material Gradient (see below).



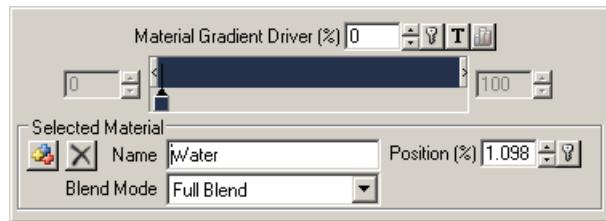
Enter a percentage from zero to 100 where zero is the left edge of the gradient and 100 is the right edge. VNS will use the Material at the gradient position you specify. If there is no Material represented at that position, VNS will create a blend between the nearest two Materials.

You can animate the Material Gradient Driver percentage to change Materials over time. This is great for animating through a variety of Materials such as between different-colored water surfaces or from hot dark rocky matter to molten boiling lava.

By clicking the Texture Control icon you can control the Material Gradient Driver percentage with the Texture Editor. This lets you use all the Materials in the Gradient. Textures can range in gray values from black to white, with black representing 0% on the Gradient and white representing 100% on the gradient.

For example, if you use an F1 Cell Basis Element in the texture that ranges from black to white, VNS will cover the Lake's area with Materials in an F1 Cell Basis wave pattern ranging from the left-most Material in the Gradient to the right-most Material in the Gradient.

To Access the Gradient, click on the Gradient popdown icon . This will display the Material Gradient Editor:



Material Gradient

The Material Gradient shows a colored bar with one or more colored pins beneath it. The bar is a place to create Materials. Click it to create a new Material.

When you click the Gradient to create a new Material, VNS will give the new Material a random Diffuse Color. You can change the color on the Material and Foliage page.

VNS represents each Material with a pin that is colored with the Diffuse Color of the Material. Click any Pin to select a Material.

Material Gradient Range Fields

The Material Gradient Range fields are on either side of the Material Gradient. They show the range of the value that controls the gradient.

If there's no texture enabled for the Material Gradient Driver, the range of the gradient is zero to 100 percent.

If there is a texture enabled for the Material Gradient Driver, then there are two cases:

1) The first Texture Element is a Dynamic Parameter.

In this case, the Range fields show the range of input values for the Dynamic Parameter you have selected. For example if Water

Depth is the Dynamic Parameter and the Elevation range in the texture editor (Input Low and Input High) is zero to 80 meters, then in the Range fields you'll see zero on the left and 80 on the right.

You can directly edit those texture values in the Lake Editor's Range fields. This is handy because you don't have to reopen the Texture Editor if you want to edit these values.

2) The first Texture Element is not a Dynamic Parameter.

In this case, the Range fields are zero to 100 percent, and are non-editable.

Add Material Icon

Click the Add Material Icon to add a new Material. VNS will ask for the position in the Gradient. Enter a position and click the OK button.

Alternatively you can click directly in the Gradient in a spot where no other Material exists.

VNS will create a new Material and give it a random Diffuse Color. The Material will be represented in the Gradient with a pin in the color of its Diffuse Color.

Remove Material Icon

Click the Remove Material Icon if you want to delete the selected Material.

Material Name Field

The Material Name field is above the Water Material list. After you create a Material it will have a default name of "Material." It's a good idea to enter a unique name in the Material Name field to identify how you will use the Material. For example "sand," "forest" or "fall foliage."

Position in Gradient Field

The Position in Gradient field shows the percentage along the Gradient for the selected Material. You can move the Material's pin to the left by decreasing this number or to the right by increasing this number. You can also drag the pin along the Gradient with the mouse.

Blend Drop Box

The Blend drop box lets you choose the rate of change between the selected Material and the Material to its left in the gradient.

These are easiest to visualize if you try them and see what they look like in the gradient. You can see how VNS blends Materials between the pins by how it blends the Diffuse Colors along the Gradient.

You can change the blending by selecting different blend types from the Blend Drop Box. If you have more than one material in the gradient, use the following choices to decide how the gradient blends the materials together.

Sharp Edge

Choose "Sharp Edge" if you want an instant change with no gradient.

Soft Edge

Choose “Soft Edge” to create a gradient that turns into the color to the left 1/10 of the way toward that color’s pin.

Quarter Blend

Choose “Quarter Blend” to create a gradient that turns into the color to the left 1/4 of the way toward that color’s pin.

Half Blend

Choose “Half Blend” to create a gradient that turns into the color to the left 1/2 of the way toward that color’s pin.

Full Blend

Choose “Full Blend” to create a smooth gradient that turns into the color to the left at that color’s pin.

Fast Increase

Choose “Fast Increase” to create an accelerated gradient that gets closer to the previous color faster, and turns into the color to the left at that color’s pin.

Slow Increase

Choose “Slow Increase” to create an decelerated gradient that gets closer to the previous color slower, and turns into the color to the left at that color’s pin.

S-Curve

Choose “S-Curve” to create a narrower gradient between the pin and the previous color’s pin and leaves more of the original colors along the gradient in between.

Water Sub-page

Diffuse Color Well

The Lake's Diffuse Color (or texture) always appears wherever the Lake appears. Click the Diffuse Color well to edit the Diffuse Color in the Color Editor.

Using the Keyframe animation popup menu to the right of the diffuse color well allows you to animate the water color over time.

The water will be a solid color over the entire surface unless you have a texture. With a texture you can use anything you want to control water color.

You can apply, edit or delete a texture using the texture popup menu. Using these commands you can replace the Material's Diffuse Color with texture patterns.

Textures can take water depth into account. For example to make a lighter, sandy color near the shore a blue color in deeper areas and a darker color in the deepest areas of the water body, use a dynamic parameter Element based on water depth in the Texture Editor. Then

set up the color gradient for the Water Depth Element with a sandy color at zero depth and then a blue and black color inward along the gradient at the gradient positions representing the depths where you want them to appear.

When you use a texture, the Colors in the texture will replace the Diffuse Color, unless you use less than 100% Opacity in the Texture Editor, in which case the texture and the Diffuse Color will be mixed.

Diffuse Intensity Field and Buttons

The diffuse intensity of a material is a measure of how much of the diffuse color of a surface is returned to the camera. Reducing this value to 0% will result in a black surface (i.e.: 0 color) and setting it to 100% will result in the pure diffuse color as set in the Diffuse Color Well.

You can animate the value over time, and also drive its intensity with a texture.

This attribute is useful for simulating dirt (try driving this field with a Fractal Noise texture element), streaks, moisture (drive Diffuse Intensity with a Dynamic parameter of Water Level or Elevation to simulate moist surfaces at the edges of lakes and streams etc.)

The maximum value for this parameter is 10000%.

Luminosity Percentage Field and Buttons

Luminosity affects how the Material is shaded by Lights (see Light Editor). You can adjust it to create 3D-shaded Objects, flat-shaded Objects or anything in-between.

With zero percent luminosity, the Material will be fully shaded by Lights. This produces a 3D look. In deeply shadowed areas, the Material's color will be a darker shade of itself based on the Ambient Light Intensity and Color. Where fully lit by Lights, the color will be the Diffuse Color or texture (see above) modulated by the Intensity and Color of any Lights.

By raising the luminosity, you can lighten the shaded areas. This can be useful to do if the terrain that uses the Material seems too dark. Raising the luminosity a little bit decreases the shading contrast for the Material.

With 100 percent luminosity, the Material will ignore Lights completely. This produces a flat, unshaded look. The Material will always be the Diffuse Color or texture. This can be useful for Materials used to create the flat, paper-cutout-style animations used by certain cartoon shows.

You can also subtract light by using negative luminosity to make the object tend toward the Ambient Light colors. With 100 percent negative luminosity, the Material will ignore Lights. The Material will be flat-shaded with the Ambient colors.

You can animate the Luminosity percentage to simulate lighting changes. This lets you animate the effect of nearby lightning or explosions.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's luminosity with a texture pattern. This can be useful for creating the look of glowing lava.

When you use a texture, a white value in the texture will equal the amount of luminosity you set in the Luminosity percentage field. A black value in the texture will equal zero luminosity. Gray values will be in-between.

Specularity Percentage Field and Buttons

Specularity is the amount of shininess for a material.

Use the Specularity Percentage field to adjust the shininess of the material. Zero percent means no specular highlight, while 100 percent is maximum shininess.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's specularity value with texture patterns.

When you use a texture, a white value in the texture will equal the amount of Specularity you set in the Specularity percentage field. A black value in the texture will equal zero Specularity. Gray values will be in-between.

Specular Exponent Field and Buttons

Use the Specular Exponent field to adjust the size of the shiny spot. The useful range is from 1 to 100. Higher numbers will produce a smaller spot, with less feathering at its edge.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's specular exponent value with texture patterns.

When you use a texture, a white value in the texture will equal the amount of Specular Exponent you set in the Specular Exponent field. A black value in the texture will equal zero Specular Exponent. Gray values will be in-between.

Translucency Percentage Field

Use the Translucency Percentage field to adjust the light transmission of the material. Zero percent means no extra highlighting, while 100 percent is maximum transmission. This is useful if you have underwater lights.

For even brighter glows you can enter a value that is more than 100%. In that case VNS will actually increase the Value of the material's color to further increase brightness.

Note: Value is one of the Parameters you can manually adjust on the Color Editor.

To see Translucency, the material must be between the Camera and a Light. You can adjust the amount of light transmission and the angle from the Light within which the material will show the effect.

During rendering there are several things that affect translucency. VNS will make translucent materials brighter when the polygons they are on are directly facing the Light. In other words, if the polygons are perpendicular to a line between the water surface and the Light. VNS will also make translucent materials brighter when the polygons they are on are most directly between the Camera and Light.

The Translucent effect is less bright for materials on polygons whose faces are angled away from the Light and for materials that are farther from the direct line between the Camera and Light.

You can apply, edit or delete a Texture Editor texture using the controls to the right. Using these controls you can replace the Material's translucency percentage with a texture pattern.

Translucency Exponent Field

Use the Translucency Exponent field to adjust the cone of the light transmission. This is a measure of how far the material can be off axis from a line extending from the Camera to the SunLight. The useful range is from 1 to infinity. Higher numbers will produce a smaller cone, with less feathering at its edge. The larger the cone (smaller numbers) the larger the area the material can be in and still be affected by translucency.

You can apply, edit or delete a Texture Editor texture using the controls to the right. Using these controls you can replace the Material's translucency values with texture patterns (see below).

Reflectivity Percentage Field and Icons

Use the Reflectivity Percentage to adjust the percentage that the colors from reflections blend with the color of the water.

A Reflection percentage value of 0 will make the water surface entirely colored by the Diffuse Color or texture (see above), with Foam mixed in for whitecaps and breakers (see below). A value of 100 will make the surface of the water have theoretically correct Fresnel reflectivity.

For greater realism, reflections will tend to diminish as the camera becomes aligned with the terrain surface normal. In other words, as the camera points down at the water, reflections diminish naturally.

Note: A "surface normal" is a line perpendicular to any water polygon.

You can increase the Reflectivity percentage to get greater than normal reflectivity. If you want you can increase reflectivity up to 500%. Reflections will still diminish as the camera becomes aligned with the surface normal.

Optical Depth Field and Buttons

Use the Optical Depth Field to adjust the transparency of water when Transparent Water is enabled in the view's Render Options. It should be initially set to the distance beyond which you want objects to be occluded by the Diffuse Color of the water material at that point. Once set, the value can be adjusted until the required effect has been achieved.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's Optical Depth value with texture patterns.

When you use a texture, a white value in the texture will equal the Optical Depth you set in the Optical Depth field. A black value in the texture will equal zero Optical Depth. Gray values will be in-between.

Increasing Optical Depth will make the water material more transparent, showing less of its diffuse color. Reducing Optical Depth will have the reverse effect, reducing transparency and increasing the intensity of diffuse color observed.

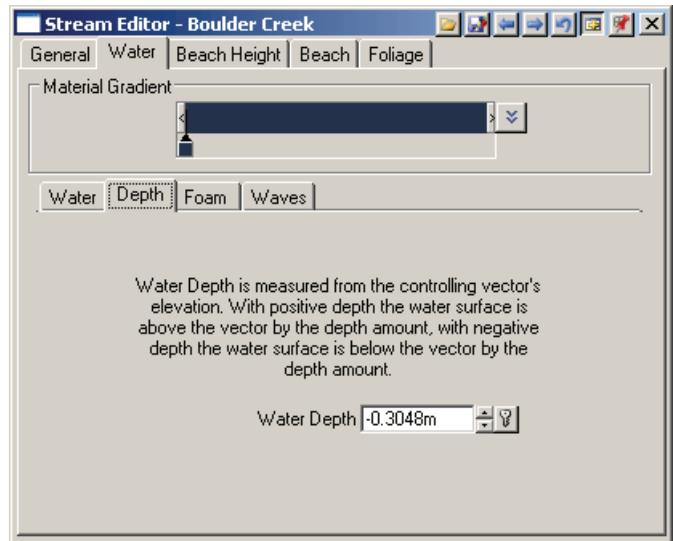
Using the Keyframe controls to the right of this field, you can animate this parameter to simulate a change in turbidity of the water body over time.

Depth Sub-page

Water Depth Field

Use the Water Depth field to adjust the Water Material's surface elevation above or below the controlling Vector.

Use a positive number to raise the water surface above the Vector and a negative number to lower the water surface below the Vector. A value of zero will keep the water surface at the same elevation as the Vector.



Foam Sub-page

Foam Color Well

The Foam Color (or texture) always appears wherever Foam appears. Click the Color well to edit the Foam Color in the Color Editor.

The foam will be a solid color wherever it appears unless you use a texture to control the foam color.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's Foam Color with texture patterns. Fractal noise or F1 Cell Basis Elements work well for foam.

Foam Control Icon

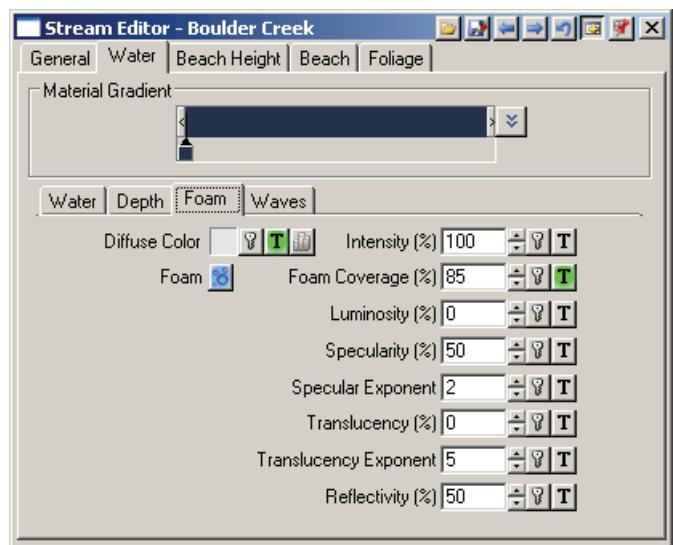
Click the Foam Control Icon to either allow foam for the water material.

From the popup menu, you will be able to select from a commands that will allow you to Copy, Delete, Enable, Disable and Activate (Create) Foam.

Foam Diffuse Intensity Field and Buttons

The diffuse intensity of a material is a measure of how much of the diffuse color of a surface is returned to the camera. Reducing this value to 0% will result in a black surface (i.e.: 0 color) and setting it to 100% will result in the pure diffuse color as set in the Diffuse Color Well.

You can animate the value over time, and also drive its intensity with a texture.



This attribute is useful for simulating dirt (try driving this field with a Fractal Noise texture element), streaks, moisture (drive Diffuse Intensity with a Dynamic parameter of Water Level or Elevation to simulate moist surfaces at the edges of lakes and streams etc.)

The maximum value for this parameter is 10000%.

Foam Coverage Percentage Field

The Foam Coverage percentage field lets you add foam to the waves. Zero percent is no foam and 100 percent is complete coverage. VNS adds the foam from the top of waves downward.

Textures can take water depth into account. For example to make breakers near the beach but not over deeper water, use a dynamic parameter Element based on water depth in the Texture Editor.

When you use a texture, a white value in the texture will equal the amount of coverage you set in the Foam Coverage percentage field. A black value in the texture will equal zero coverage. Gray values will be in-between. By modulating the white value with another texture you can break up the places where foam appears into realistic patterns. Fractal noise or F1 Cell Basis Elements work well for foam patterns.

Luminosity Percentage Field and Buttons

Luminosity affects how the Material is shaded by Lights (see Light Editor). You can adjust it to create 3D-shaded Objects, flat-shaded Objects or anything in-between.

With zero percent luminosity, the Material will be fully shaded by Lights. This produces a 3D look. In deeply shadowed areas, the Material's color will be a darker shade of itself based on the Ambient Light Intensity and Color. Where fully lit by Lights, the color will be the Diffuse Color or texture (see above) modulated by the Intensity and Color of any Lights.

By raising the luminosity, you can lighten the shaded areas. This can be useful to do if the terrain that uses the Material seems too dark. Raising the luminosity a little bit decreases the shading contrast for the Material.

With 100 percent luminosity, the Material will ignore Lights completely. This produces a flat, unshaded look. The Material will always be the Diffuse Color or texture. This can be useful for Materials used to create the flat, paper-cutout-style animations used by certain cartoon shows.

You can also subtract light by using negative luminosity to make the object tend toward the Ambient Light colors. With 100 percent negative luminosity, the Material will ignore Lights. The Material will be flat-shaded with the Ambient colors.

You can animate the Luminosity percentage to simulate lighting changes. This lets you animate the effect of nearby lightning or explosions.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's luminosity with a texture pattern. This can be useful for creating the look of glowing lava.

When you use a texture, a white value in the texture will equal the amount of luminosity you set in the Luminosity percentage field. A black value in the texture will equal zero luminosity. Gray values will be in-between.

Specularity Percentage Field and Buttons

Specularity is the amount of shininess for a material.

Use the Specularity Percentage field to adjust the shininess of the material. Zero percent means no specular highlight, while 100 percent is maximum shininess.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's specularity value with texture patterns.

When you use a texture, a white value in the texture will equal the amount of Specularity you set in the Specularity percentage field. A black value in the texture will equal zero Specularity. Gray values will be in-between.

Specular Exponent Field and Buttons

Use the Specular Exponent field to adjust the size of the shiny spot. The useful range is from 1 to infinity. Higher numbers will produce a smaller spot, with less feathering at its edge.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's specular exponent value with texture patterns.

When you use a texture, a white value in the texture will equal the amount of Specular Exponent you set in the Specular Exponent field. A black value in the texture will equal zero Specular Exponent. Gray values will be in-between.

Translucency Percentage Field

Use the Translucency Percentage field to adjust the light transmission of the material. Zero percent means no extra highlighting, while 100 percent is maximum transmission. This is useful if you have underwater lights.

For even brighter glows you can enter a value that is more than 100%. In that case VNS will actually increase the Value of the material's color to further increase brightness.

Note: Value is one of the Parameters you can manually adjust on the Color Editor.

To see Translucency, the material must be between the Camera and a Light. You can adjust the amount of light transmission and the angle from the Light within which the material will show the effect.

During rendering there are several things that affect translucency. VNS will make translucent materials brighter when the polygons they are on are directly facing the Light. In other words, if the polygons are perpendicular to a line between the foam surface and the Light. VNS will also make translucent materials brighter when the polygons they are on are most directly between the Camera and Light.

The Translucent effect is less bright for materials on polygons whose faces are angled away from the Light and for materials that are farther from the direct line between the Camera and Light.

You can apply, edit or delete a Texture Editor texture using the controls to the right. Using these controls you can replace the Material's translucency percentage with a texture pattern.

Translucency Exponent Field

Use the Translucency Exponent field to adjust the cone of the light transmission. This is a measure of how far the material can be off axis from a line extending from the Camera to the SunLight. The useful range is from 1 to infinity. Higher numbers will produce a smaller cone, with less feathering at its edge. The larger the cone (smaller numbers) the larger the area the material can be in and still be affected by translucency.

You can apply, edit or delete a Texture Editor texture using the controls to the right. Using these controls you can replace the Material's translucency values with texture patterns.

Reflectivity Percentage Field and Icons

Use the Reflectivity Percentage to adjust the percentage that the colors from reflections blend with the color of the foam.

A Reflection percentage value of 0 will make the foam surface entirely colored by the Diffuse Color or texture (see above). A value of 100 will make the surface of the foam have theoretically correct Fresnel reflectivity.

For greater realism, reflections will tend to diminish as the camera becomes aligned with the terrain surface normal. In other words, as the camera points down at the foam, reflections diminish naturally.

Note: A "surface normal" is a line perpendicular to a foam terrain polygon.

You can increase the Reflectivity percentage to get greater than normal reflectivity. If you want you can increase reflectivity up to 500%. Reflections will still diminish as the camera becomes aligned with the surface normal.

Waves Sub-page

The Waves sub-page lets you attach Wave Models to your Stream Material.

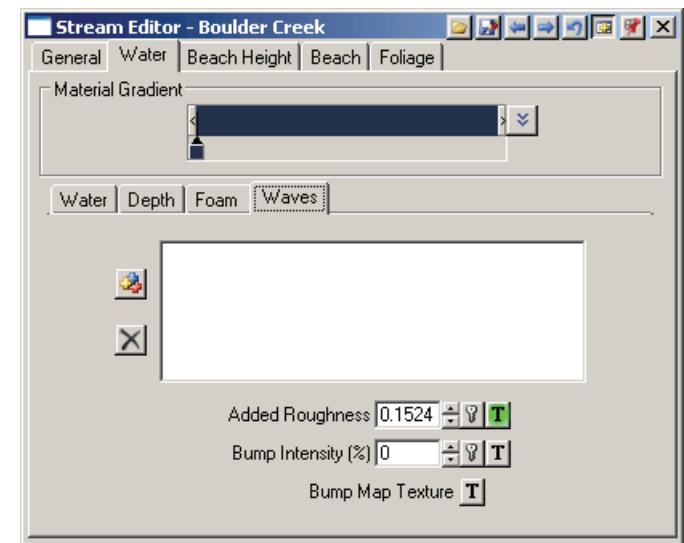
If a Wave Model is not attached to a Vector it will cover the entire Stream Material's surface. If it is attached to a Vector it can cover only the area of the Stream that is within the Vector.

Wave Model List

The Wave Model List shows any Wave Models attached to the Stream. Disabled Wave Models are shown in gray. You can double click the name of a Wave Model to open the Wave Model Editor.

Add Wave Model Icon

Click the Add Wave Model icon to add a Wave Model to the Stream. VNS will open a window where you can select one or more Wave Models to add from the Wave Models in your Project. Click to select a Wave Model. Shift-click or control-click to select multiple Wave Models. Click the OK button to accept the selection.



Remove Wave Model Icon

Click the Remove Wave Model icon to remove the selected Wave Model from the Stream.

VNS will also ask if you want to remove the Wave Model from the Project. Be careful, don't remove it from the Project unless you really want to delete the Wave Model forever!

Roughness Percentage Field

Use the Amplitude Parameter and its texture controls to add roughness displacement to the water. This is great for creating the complex wave patterns typical of large bodies of water. You can use this along with the normal VNS wave sources.

You can apply, edit or delete a texture using the controls to the right. The texture will control the Roughness pattern. Choose any texture (F1 Cell Basis works well, especially with a Bias Component as Remap Function 1 to make sharper wave peaks). Then enter the amount of displacement, in meters, into the Amplitude field.

You can even animate the velocity of the roughening texture in the Texture Editor to create a moving roughness pattern.

Bump Intensity Percentage Field and Bump Map Icon

Bump mapping lets you simulate detailed relief shadowing without requiring dense geometry. For more about using bump mapping, see Bump Mapping Controls.

Beach Height Page

The Beach Height page lets you adjust the beach height.

Beach Height & Reference Elevation Section

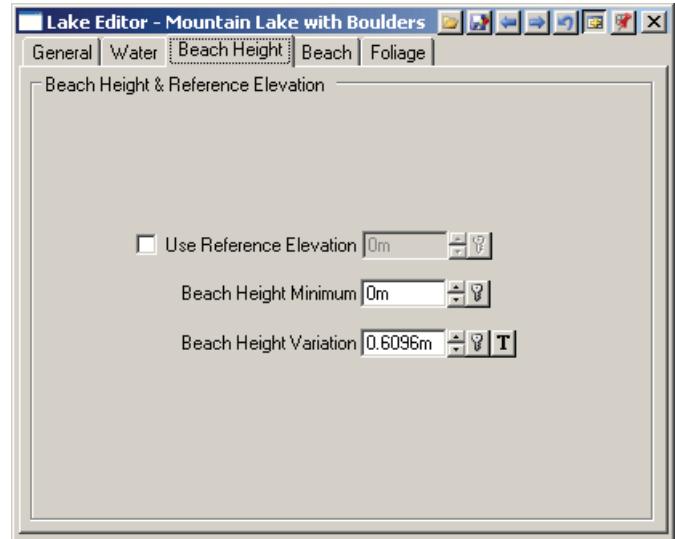
Use Reference Elevation Field and Checkbox

This lets you take tides or receding flood waters into account for beaches. Select the checkbox and enter the actual elevation you want the top of the beach to be when Beach Height Minimum is set to zero. You can further adjust the top of the beach with the Beach Height Minimum and Beach Height Variation fields (see below).

This will lock the top of the beach at a specific elevation even if the Lake's elevation is animated to rise or fall. For example, you can animate the Lake's elevation so it follows tidal patterns, revealing or covering the beach just as tides do in nature.

You can animate the Lake's elevation to flood past the beach and onto the surrounding terrain. Areas flooded beyond the beach will show tall Ecosystem foliage standing in the water.

Note: Foliage growing in Ecosystems or Foliage Effects surrounding the Lake will still appear within the flood waters. You can control the Lake's elevation with the Elevation field on the General page. You can also control elevation for each of the Lake's Water Materials from the Water page, on the Elev sub-page, using the Additional Elevation field.



Deselect the checkbox if you want beach height to vary with the Lake's elevation. This is great for lakes where the surface elevation of the lake does not change. Then you can control the amount of beach with the Beach Height Minimum and Beach Height Variation fields.

Beach Height Minimum Field

Beach Height Minimum works two ways, depending on whether the Use Reference Elevation checkbox is selected (see above).

If the Use Reference Elevation checkbox is not selected, you can use the Beach Height Minimum field to set the minimum amount of terrain above the Lake's shore that is textured by Beach Materials. You can enter a value of zero or even use a negative number to eliminate the beach entirely.

If the Use Reference Elevation checkbox is selected, you can use the Beach Height Minimum field to specify the minimum amount of terrain about the Reference Elevation you specify (see above). This lets you keep the beaches from following changes in water elevation. Use this if you are simulating tides or flood waters. Areas flooded beyond the beach will show tall Ecosystem foliage standing in the water.

In either case, you can add further beach height randomly using the Beach Height Variation field (see below).

Note: You can edit the beach's Materials on the Beach page (see below).

Beach Height Variation Field

Use the Beach Height Variation to raise the beach height beyond that created by the Beach Height Minimum field (see above). Beach height is the terrain directly adjacent to the water that is covered with Beach Materials.

VNS will add additional beach height on a random basis. The additional beach ranges between zero and the value you enter in the Beach Height Variation field, in meters.

Beach Page

The Beach page lets you add new Materials to the Beach.

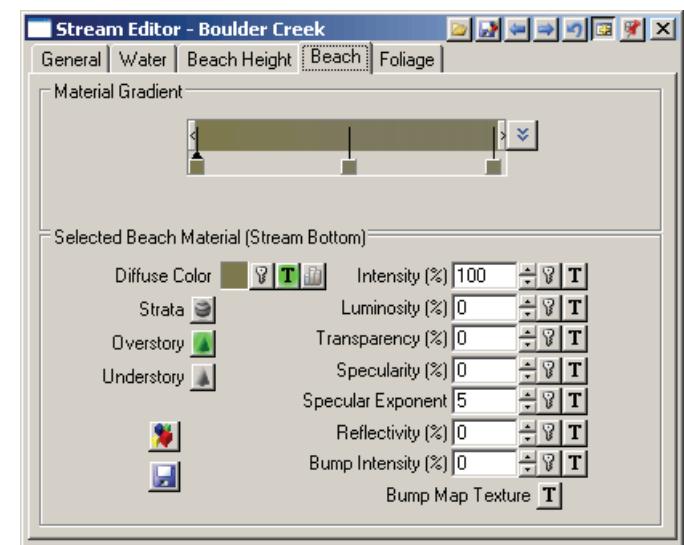
The Material Gradient Driver lets you tell VNS which Material to use. You can use a texture to combine multiple Materials on the beach.

Material Gradient & Driver Section

Material Gradient Driver Percentage Controls

The Material Gradient Driver field lets you pick a Material for the Beach based on a position along the Material Gradient (see below).

Enter a percentage from zero to 100 where zero is the left edge of the gradient and 100 is the right edge. VNS will use the Material at the gradient position you specify. If there is no Material represented at that position, VNS will create a blend between the nearest two Materials.



You can animate the Material Gradient Driver percentage to change Materials over time. This is great for climate change animations where you could animate through a variety of Materials such as from a desert to a rain forest.

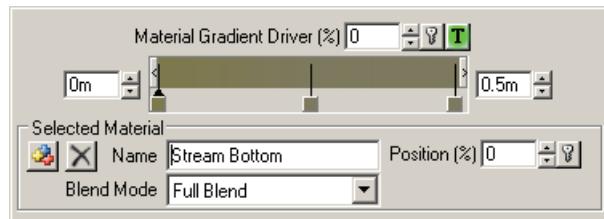
By clicking the Texture Control icon you can control the Material Gradient Driver percentage with the Texture Editor. This lets you use all the Materials in the Gradient. Textures can range in gray values from black to white, with black representing 0% on the Gradient and white representing 100% on the gradient.

For example, if you use a fractal noise Element in the texture that ranges from black to white, VNS will cover the Beach's area with Materials in a fractal noise pattern ranging from the left-most Material in the Gradient to the right-most Material in the Gradient.

Another example: You could use a Dynamic Parameter of Slope in the Texture Editor and set its Input Low field to the lowest slope on the beach area and the Input High field to the highest slope in your terrain. Then VNS will arrange the Materials in the Beach's Material Gradient so that the Materials on the left side of the gradient will grow on the lower sloped areas and the Materials on the right side of the Gradient will grow on the higher sloped areas. You can use this to make the flatter areas textured with sand and the steeper areas textured with rock.

If you are using an Ecotype to add foliage to your beach and you don't want the foliage to appear under water, you may want to use a Dynamic Parameter of Water Depth to control the Material Gradient Driver. To keep foliage from appearing in the water, use a material with no Ecotype foliage and place it in the Material Gradient where the water depth becomes greater than zero.

To Access the Gradient, click on the Gradient popdown icon . This will display the Material Gradient Editor:



Material Gradient

The Material Gradient shows a colored bar with one or more colored pins beneath it. The bar is a place to create Materials. Click it to create a new Material.

When you click the Gradient to create a new Material, VNS will give the new Material a random Diffuse Color. You can change the color on the Material and Foliage page.

VNS represents each Material with a pin that is colored with the Diffuse Color of the Material. Click any Pin to select a Material.

Material Gradient Range Fields

The Material Gradient Range fields are on either side of the Material Gradient. They show the range of the value that controls the gradient.

If there's no texture enabled for the Material Gradient Driver, the range of the gradient is zero to 100 percent.

If there is a texture enabled for the Material Gradient Driver, then there are two cases:

1) The first Texture Element is a Dynamic Parameter.

In this case, the Range fields show the range of input values for the Dynamic Parameter you have selected. For example if Elevation is the Dynamic Parameter and the Elevation range in the texture editor (Input Low and Input High) is zero to 1000 meters, then in the Range fields you'll see zero on the left and 1000 on the right.

You can directly edit those texture values in the Lake Editor's Range fields. This is handy because you don't have to reopen the Texture Editor if you want to edit these values.

2) The first Texture Element is not a Dynamic Parameter.

In this case, the Range fields are zero to 100 percent, and are non-editable.

Add Material Icon

Click the Add Material Icon to add a new Material. VNS will ask for the position in the Gradient. Enter a position and click the OK button.

Alternatively you can click directly in the Gradient in a spot where no other Material exists.

VNS will create a new Material and give it a random Diffuse Color. The Material will be represented in the Gradient with a pin in the color of its Diffuse Color.

Remove Material Icon

Click the Remove Material Icon if you want to delete the selected Material.

Position in Gradient Field

The Position in Gradient field shows the percentage along the Gradient for the selected Material. You can move the Material's pin to the left by decreasing this number or to the right by increasing this number. You can also drag the pin along the Gradient with the mouse.

Blend Drop Box

The Blend drop box lets you choose the rate of change between the selected Material and the Material to its left in the gradient.

These are easiest to visualize if you try them and see what they look like in the gradient. You can see how VNS blends Materials between the pins by how it blends the Diffuse Colors along the Gradient.

You can change the blending by selecting different blend types from the Blend Drop Box. If you have more than one material in the gradient, use the following choices to decide how the gradient blends the materials together.

Sharp Edge

Choose "Sharp Edge" if you want an instant change with no gradient.

Soft Edge

Choose “Soft Edge” to create a gradient that turns into the color to the left 1/10 of the way toward that color’s pin.

Quarter Blend

Choose “Quarter Blend” to create a gradient that turns into the color to the left 1/4 of the way toward that color’s pin.

Half Blend

Choose “Half Blend” to create a gradient that turns into the color to the left 1/2 of the way toward that color’s pin.

Full Blend

Choose “Full Blend” to create a smooth gradient that turns into the color to the left at that color’s pin.

Fast Increase

Choose “Fast Increase” to create an accelerated gradient that gets closer to the previous color faster, and turns into the color to the left at that color’s pin.

Slow Increase

Choose “Slow Increase” to create an decelerated gradient that gets closer to the previous color slower, and turns into the color to the left at that color’s pin.

S-Curve

Choose “S-Curve” to create a narrower gradient between the pin and the previous color’s pin and leaves more of the original colors along the gradient in between.

Material Name Field

The Material Name field is above the Material list. After you create a Material it will have a default name of “Material.” It’s a good idea to enter a unique name in the Material Name field to identify how you will use the Material. For example “sand,” “forest” or “fall foliage.”

Beach Material Properties Section

The Beach page lets you edit the properties of the selected Material. You can select a Material on the Beach page by clicking the Material’s colored pin in the Gradient (see above).

Ecotypes let you add foliage to the Beach. There are two Ecotypes, an Overstory and an Understory. In nature, the Overstory represents taller trees while the Understory represents shorter foliage. You can add appropriate foliage to the Overstory Ecotype and Understory Ecotype to simulate this in VNS. On a Beach you may only need one Ecotype.

Overstory and Understory Ecotype Controls

To create an Overstory or Understory, click the Overstory or Understory Ecotype Operations icon to see the Ecotype Operations commands. If there is no Ecotype yet created (icon has a gray background), select the Create Ecotype command. If there is an existing Ecotype (icon has a green background), select the Edit Ecotype command.

If you want to disable an Ecotype, click its Ecotype Operations icon and select the Disable Ecotype command. The icon will show a red diagonal stripe to indicate that there is an Ecotype but it's disabled. This is the same as deselecting the Ecotype Enabled checkbox on the General page of the Ecotype Editor for the Ecotype. VNS will ignore disabled Ecotypes for rendering.

If you want to enable a disabled Ecotype, click its Ecotype Operations icon and select the Enable Ecotype command. The icon will no longer show a red diagonal stripe. This is the same as selecting the Ecotype Enabled checkbox on the General page of the Ecotype Editor for the Ecotype.

If you want to delete an Ecotype, click its Ecotype Operations icon and select the Remove Ecotype command. Because this is destructive, VNS will ask you to confirm this choice. Click OK to remove the Ecotype forever.

If you want to copy an Ecotype, click its Ecotype Operations icon and select the Copy Ecotype command. If you want to paste an Ecotype, click the Ecotype Operations icon for the destination Ecotype and select the Paste Ecotype command.

If you want to make an Ecotype the Active Item, click its Ecotype Operations icon and select the Activate Ecotype command. VNS will make it the Active Item.

Selected Material Ground Overlay

The Selected Material Ground Overlay lets you add color or texturing to the beach.

Diffuse Color Well and buttons

The Ground Effect's Diffuse Color (or texture) always appears wherever the Selected Material's Ground Overlay appears, unless you set the transparency of the Material to 100%. Click the Diffuse Color well to edit the Diffuse Color in the Color Editor.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's Diffuse Color with texture patterns. For example, you can use the fractal noise Element to create the appearance of sand.

When you use a texture, the Colors in the texture will replace the Diffuse Color, unless you use less than 100% Opacity in the Texture Editor, in which case the texture and the Diffuse Color will be mixed.

Diffuse Intensity Field and Buttons

The diffuse intensity of a material is a measure of how much of the diffuse color of a surface is returned to the camera. Reducing this value to 0% will result in a black surface (i.e.: 0 color) and setting it to 100% will result in the pure diffuse color as set in the Diffuse Color Well.

You can animate the value over time, and also drive its intensity with a texture.

This attribute is useful for simulating dirt (try driving this field with a Fractal Noise texture element), streaks, moisture (drive Diffuse Intensity with a Dynamic parameter of Water Level or Elevation to simulate moist surfaces at the edges of lakes and streams etc.)

The maximum value for this parameter is 10000%.

Strata Buttons

Click the Strata icon to open the Material Strata Editor. There you can add Strata texturing to the Material.

Luminosity Percentage Field and Buttons

Luminosity affects how the Material is shaded by Lights (see Light Editor). You can adjust it to create 3D-shaded Objects, flat-shaded Objects or anything in-between.

With zero percent luminosity, the Material will be fully shaded by Lights. This produces a 3D look. In deeply shadowed areas, the Material's color will be a darker shade of itself based on the Ambient Light Intensity and Color. Where fully lit by Lights, the color will be the Diffuse Color or texture (see above) modulated by the Intensity and Color of any Lights.

By raising the luminosity, you can lighten the shaded areas. This can be useful to do if the terrain that uses the Material seems too dark. Raising the luminosity a little bit decreases the shading contrast for the Material.

With 100 percent luminosity, the Material will ignore Lights completely. This produces a flat, unshaded look. The Material will always be the Diffuse Color or texture. This can be useful for Materials used to create the flat, paper-cutout-style animations used by certain cartoon shows.

You can also subtract light by using negative luminosity to make the object tend toward the Ambient Light colors. With 100 percent negative luminosity, the Material will ignore Lights. The Material will be flat-shaded with the Ambient colors.

You can animate the Luminosity percentage to simulate lighting changes. This lets you animate the effect of nearby lightning or explosions.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's luminosity with a texture pattern. This can be useful for creating the look of glowing lava.

When you use a texture, a white value in the texture will equal the amount of luminosity you set in the Luminosity percentage field. A black value in the texture will equal zero luminosity. Gray values will be in-between.

Transparency Percentage Field and Buttons

Use the Transparency field to adjust how much you can see through the Ground Overlay. Zero percent will cover the terrain with opaque Ground Overlay. One hundred percent makes the Ground Overlay invisible, and you will instead see a Ground Effect on the terrain polygons. Anything in-between will mix the Ground Overlay with the Ground Effect.

Note: There is always at least one global Ground Effect in any VNS Project.

You can apply, edit or delete a texture using the texture popup menu. Using these commands you can replace the Material's transparency with a texture pattern to make some areas more transparent than others.

When you use a texture, a white value in the texture will equal the amount of Transparency you set in the Transparency percentage field. A black value in the texture will equal zero Transparency. Gray values will be in-between.

Specularity Percentage Field and Buttons

Specularity is the amount of shininess for a material.

Use the Specularity Percentage field to adjust the shininess of the material. Zero percent means no specular highlight, while 100 percent is maximum shininess.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's specularity value with texture patterns.

When you use a texture, a white value in the texture will equal the amount of Specularity you set in the Specularity percentage field. A black value in the texture will equal zero Specularity. Gray values will be in-between.

Specular Exponent Field and Buttons

Use the Specular Exponent field to adjust the size of the shiny spot. The useful range is from 1 to infinity. Higher numbers will produce a smaller spot, with less feathering at its edge.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's specular exponent value with texture patterns.

When you use a texture, a white value in the texture will equal the amount of Specular Exponent you set in the Specular Exponent field. A black value in the texture will equal zero Specular Exponent. Gray values will be in-between.

Reflectivity Field and Buttons

Beach materials can now reflect their surroundings, as well as parts of their own geometry.

Set this value to an amount greater than 0% to see reflections on these surfaces.

You can animate the value over time, and also drive its intensity with a texture.

The maximum value for this parameter is 10000%.

Bump Intensity Percentage Field and Bump Map Texture Icon

Bump mapping lets you simulate detailed relief shadowing without requiring dense geometry. For more about using bump mapping, see Bump Mapping Controls.

Foliage Page

To create Ecotypes for a beach material, perform the following:

- Add one or more Ecotypes using the controls on the Material Page, or directly to an existing (and selected) Material using the Ecotype Control Icon underneath the Foliage List on the Foliage Page.
- Add one or more Foliage Groups to each Ecotype using the Foliage Group Control Icon underneath the Foliage List on the Foliage Page.
- Add one or more Foliage Objects to each Group using the Foliage Object Control Icon underneath the Foliage List on the Foliage Page.
- Adjust the properties for each Foliage Object, Group and Ecotype on the parameters pages that appear when the appropriate item is selected in the Foliage List page.

You can specify height and density for each Foliage Object, Foliage Group and the entire Ecotype. You can even use textures to control height and density to create natural-looking foliage clumping based on procedural textures, images and dynamic parameters.

The way the controls interact depends on the choices you make on the General page. There you can configure the Ecotype to behave according to your needs.

Foliage Objects can be Image Objects or 3D Objects. Image Objects can be still images or animated sequences (see the Image Object Library section). Typically they will be images or animations of trees and other foliage, but they can be any images or animations of anything you like. If you have an animation of a dancing munchkin and want an entire forest of dancing munchkins, you can create that effect using Image Objects and the Ecotype Editor.

Using Pre-made Components

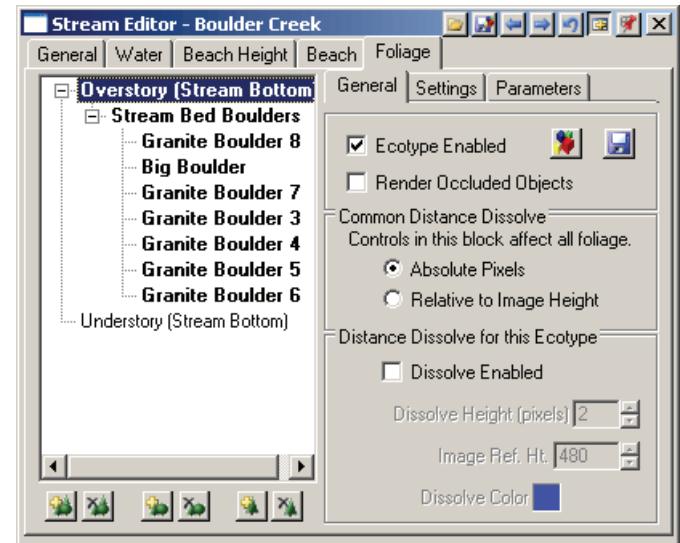
Click the Load Component From Disk Icon to see the Component Gallery, ready to load a pre-made Ecotype. Ecotypes are multiple groups of Foliage Objects with the Ecotype, Group and Object controls already set up. You can select from any previously created Ecotype files. Double-click the thumbnail image to load the Ecotype Component. VNS will reset the parameters of the Ecotype to those of the Component you selected.

You can create and export your own pre-built Ecotype Components from the Ecotype Editor by setting up the Ecotype the way you want it and then clicking the Save Component To Disk Icon. VNS will open the Component Signature Window where you can fill in the information, choose a representative image for the Component's thumbnail and save the Component in the Component Gallery.

For example, this makes it easy to create different kinds of forests with complex foliage mixes. You can later reuse the Ecotype another Project and have an instant complex forest.

Material Foliage List

This list will show the foliage associated with the currently selected Ecosystem Material. The selected Material name will be in brackets behind the Overstory and understory foliage types.



Note: Overstory and understory vegetation are simply logical groupings. There is no reason why you they can not contain similar species, or why one can exist while the other doesn't.

Enabled Items in the list will be displayed in Bold text. Disabled Items will still be displayed, but not emboldened.

At the bottom of the Material Foliage List, there are the following Control Icons:

Add Ecotype

Click the Add Ecotype icon if you want to add a new Ecotype to the Material.

Note: An Ecotype must exist in the Material in order for there to be Foliage groups, and therefore Foliage Objects in that Material.

Remove Ecotype

Click the Remove Ecotype icon if you want to delete an Ecotype. VNS will remove the Ecotype from the Material, along with all associated Foliage groups and FOliage Objects in those Groups.

If the Ecotype existed when you last opened the Ecosystem Editor, you can undo the removal by clicking the Undo All Changes in this Window icon. Otherwise the Ecotype will be gone forever.

Add Foliage Group

Click the Add Foliage Group icon if you want to add a new Foliage Group to the Ecotype. VNS will ask for a name.

Note: You have to add at least one Foliage Group to an Ecotype before you can add Foliage Objects on the Objects page (see below).

Remove Foliage Group

Click the Remove Foliage Group icon if you want to delete a Foliage Group. VNS will remove the Foliage Group from the Ecotype.

If the Foliage Group existed when you last opened the Ecosystem Editor, you can undo the removal by clicking the Undo All Changes in this Window icon. Otherwise the Foliage Group will be gone forever.

Add Foliage Object

Click the Add Foliage Object icon to Create a new, blank entry in the Foliage Objects list.

Then choose either the Image Object or 3D Object radio button in the Selected Object section (see below). Finally, select an object from the drop box in the Image Object section or 3D Object section (see below).

Remove Foliage Object

If you want to remove a Foliage Object from the selected Foliage Group, select it in the Foliage Objects list and click the Remove Foliage Object icon.

VNS will ask if you want to remove the object. Click OK and VNS will remove it from the Foliage Group.

General Sub-Page

Ecotype Enabled Checkbox

The Enabled checkbox lets you enable or disable the Ecotype for rendering.

Note: You can also enable and disable an Ecotype from its Ecotype Operations icon on the Ecosystem, Lake or Stream Editor, wherever you first created the Ecotype. Select the icon's Disable Ecotype command to disable the Ecotype. The icon will be displayed with a red diagonal stripe to indicate that it's disabled. Select the icon's Enable Ecotype command to enable the Ecotype. The Ecotype will be enabled and the red stripe will disappear.

Disabling an Ecotype can be useful to speed up rendering if you are doing test renders to check some other aspect of your scene and don't need to see the Ecotype's foliage. Make sure you remember to enable it for the final rendering if you want to see the foliage.

Note: To see the Ecotype in your rendering, it must be part of an Ecosystem or Beach that is visible to the Camera you selected for the Render Job you are using (see Render Job Editor), and Other Foliage must be enabled in the Render Options you are using (see Render Options Editor).

Render Items Occluded By This Ecotype's Image Objects Checkbox

Selecting this checkbox will force VNS to render those elements of the scene obscured by this foliage effect. This will allow reflections to accurately represent terrain and foliage that has been hidden from the camera by this foliage effect. Select this checkbox if you are experiencing "holes" in reflections of terrain and foliage objects near to a Foliage Effect.

Common Distance Dissolve Section

The Common Distance Dissolve section lets you specify whether VNS will calculate Distance Dissolve Height based on an absolute pixel height or as a pixel height relative to a specified image size. This applies to all the Ecotypes and Foliage Effects in your Project (see also Foliage Effect Editor).

Distance Dissolve Height is the height at which VNS will stop rendering foliage Image Objects and instead render a color or texture. You can enable Distance Dissolve in the Image Object Distance Dissolve section (see below). There you can specify a pixel height for Image Objects at which VNS stops trying to render foliage and instead renders a simple color or a texture.

For example, if a tree is so far away that its height is below the Distance Dissolve Height in pixels, it will no longer be rendered and VNS will instead render the color or texture you specify. This can make rendering much, much faster because VNS can calculate a color or texture much faster than a combination of foliage. Rendering the actual trees and plants far in the distance may take a long time for little or no visual benefit.

The default choice is Absolute Pixels. The default value for Distance Dissolve Height is 2 pixels. This means that VNS will replace a foliage object with a color or texture whenever the foliage object is shorter than two pixels in your rendered image. This makes a lot of sense because you can't see a complete tree in two pixels anyway, so there's not much point wasting the rendering time in the attempt.

You can enable Distance Dissolve in the Image Object Distance Dissolve section (see below).

Absolute Pixels Radio Button

Select the Absolute Pixels radio button to choose a specific height in pixels below which VNS will no longer render an Image Object. VNS will instead replace the Image Object with the color or texture you specify in the Image Object Distance Dissolve section (see below).

By default, the Absolute Pixels radio button is selected.

Relative to Image Height Radio Button

Select the Relative to Image Height radio button to relate the minimum pixel height at which VNS will render Image Objects to the size of your rendered images. This will let you see a more consistent rendering no matter what size image you render. Image Object foliage will then appear in the same areas and be dissolved to a color or texture in the same areas at any image size.

When you use the Relative to Image Height option, VNS will automatically change the Distance Dissolve Height based on the size of your rendering. VNS does this by using the Image Reference Height you specify in the Image Object Distance Dissolve section (see below).

You may want to select this option in order for preview renderings in Views to give you a more accurate visual indication of where plants will actually be rendered in your final renderings. Views are typically rendered at a different resolution than your final renderings and may show different results if you use the Absolute Pixels option (see above).

If you are rendering the same scene for a poster and for a video animation, using the Relative to Image Height option will make the foliage dissolve away in the same places in both scenes.

Be careful with this option, it may add to rendering time when you render at lower resolutions than what is in the Image Reference Height field (see below). This is because as you decrease the size of the rendered image, VNS will correspondingly decrease the Distance Dissolve Height. You may then end up with VNS wasting time rendering Image Object foliage even for Image Objects that would be less than a single pixel in height.

Note: When you use the Relative to Image Height option VNS will take into account whatever constrained preview rendering size you use if you have selected the Constrain Render Area icon (see Constrain Render Area). Image height will be calculated using the pixel height of the constrained render area, not the pixel height of the View.

Distance Dissolve for this Ecotype Section

You can reduce rendering times by enabling Distance Dissolve and adjusting the Dissolve Height. Then Image Object foliage will transition to a fast-rendering color or a texture in the distance.

If you are using the Absolute Pixels option then the Dissolve Height is an absolute value in pixels (see the Common Distance Dissolve section above). This gives you the more efficient rendering.

If you are using the Relative to Image Height option then the Dissolve Height will be scaled depending on the resolution of your rendering (see the Common Distance Dissolve section above). This allows the most consistency between renderings at different resolutions, including preview renderings in a View.

Dissolve Enabled Checkbox

Select the Dissolve Enable checkbox to enable Distance Dissolve. Deselect it to disable Distance Dissolve.

Dissolve Height Field

Dissolve Height lets you control how small the rendered foliage can get in the distance before VNS replaces it with a color or texture.

If the Absolute Pixels radio button is selected in the Common Distance Dissolve section (see above), then this value will apply no matter what resolution you render your images.

If the Relative to Image Height radio button is selected in the Common Distance Dissolve section (see above), then this value will apply only for images that are rendered at the vertical resolution you enter into the Image Reference Height field (see below). VNS will scale the Dissolve Height for images rendered at a different horizontal resolution than specified in the Image Reference Height field. This allows Image Objects to change to a color or texture at the same place on the terrain no matter what resolution you render.

Image Reference Height Field

The “Image Ref. Ht.” field is only available when you select the “Relative to Image Height” radio button in the Common Distance Dissolve section (see above).

Use the Image Reference Height field to specify the rendered image height in pixels at which the actual Dissolve Height value is used. This lets you control the amount of up or down Dissolve Height scaling that will occur when you render images at different resolutions. The specified Dissolve Height will always be multiplied by the rendered image height (in pixels) divided by the Image Reference Height (in pixels).

The default Image Reference Height value is 480 pixels. You may want to set it to match the resolution of your preview renderings or your final image renderings.

Example

Let's look at how this works. Suppose you use an Image Reference Height of 480 pixels. If you render an image with a height of 480 pixels and you have an Ecotype that uses a Dissolve Height of 2 pixels, then any rendered images that are 480 pixels high will really have a Dissolve Height of 2 pixels for that Ecotype. $2 \times 480 / 480 = 2$

But if you render a preview image at half that resolution, 240 pixels, VNS will scale the Dissolve Height down by 50% and that Ecotype will have an actual Dissolve Height of 1 pixel in that rendered image. $2 \times 240 / 480 = 1$

If you render a poster with an image height of 1920 pixels, the actual Dissolve Height for the Ecotype in that image will become 8 pixels. $2 \times 1920 / 480 = 8$.

The end result is that the Ecotype will dissolve out to a color or texture at the same place on the terrain in all three examples. This would not have been true if you were using the Absolute Pixels option in the Common Distance Dissolve section (see above).

Note: You can set the rendered image height with the Height field on the Size and Range page of the Render Options Editor.

The Image Reference Height is always the same for all Ecotypes and Foliage Effects. When you change it for one Ecotype or Foliage Effect you are changing it for all Ecotypes and Foliage Effects.

Note: All Ecotypes and Foliage Effects are also affected when you select either the Absolute Pixels radio button or the Relative to Image Height radio button in the Common Distance Dissolve section (see above).

However, the Dissolve Height is unique to each Ecosystem or Foliage Effect.

Dissolve Color Controls

Click the Dissolve Color well to open the Color Editor. There you can edit the color VNS will render on the terrain in the distance.

If you'd rather use a texture, click the Texture icon to open the Texture Editor. There you can create a more complex pattern to represent your distant foliage. Textures will take longer to render than a simple color.

Settings Sub-Page

Absolute Size Radio Buttons

Select the "Absolute Size is in Ecotype" radio button if you want to control the actual size of the Ecotype's foliage using the Maximum Size field, on the Parameters page in the Ecotype Size section. You can then set the size of each Foliage Group as a percentage of the Ecotype's Maximum Size.

Select the "Absolute Size is in Foliage Group" radio button if you want to set the actual size of each Foliage Group directly instead of setting each group as a percentage of the Ecotype Size. VNS will disable the Ecotype Size controls and you can directly set a Group Size and Group Minimum Size for each Foliage Group on the Groups page.

Note: In both cases, the size of each Foliage Object is a percentage of the size of the Foliage Group to which it belongs. You can set the size percentage for each Foliage Object.

However you choose to control the absolute size, you'll set it in the units you selected in the Height field on the Units page of the Preferences Window.

Second Size Radio Buttons

The "Second Size is" radio buttons let you configure how the Ecotype Editor lets you control a second size for the Ecotype's foliage.

Second Size is in Absolute Minimum radio button

Select the Second Size is in Absolute Minimum (Min) radio button if you want to be able to set a secondary Size as a specific, using the units you selected in the Height field on the Units page of the Preferences Window.

If you've selected the "Absolute Size is in Ecotype" radio button (see above), you can then control a minimum size for all Foliage Groups using the Minimum Size percentage field on the Parameters page.

If you've selected the "Absolute Size is in Foliage Group" radio button (see above), you can then control a minimum size for separately for each Foliage Group using the Group Minimum Size field on the Parameters page for a selected Foliage Group. This controls the minimum size separately for each Group.

Second Size is Minimum Percentage Radio Button

Select the Second Size is in Minimum (Min) percentage radio button if you want to be able to set the secondary size as a percentage of the absolute size.

If you've selected the "Absolute Size is in Ecotype" radio button (see above), you can then control a minimum size for all Foliage Groups using the Minimum Size Percentage field on the Parameters page. The minimum size of the Ecotype's foliage will be a percentage of the value you entered into the Maximum Size field. VNS will vary the size of the foliage between these two sizes. You can further control the size of each Foliage Group by adjusting the Group Size percentage field on the Parameters page for each Foliage Group.

If you've selected the "Absolute Size is in Foliage Group" radio button (see above), you can instead control a minimum size for separately for each Foliage Group using the Group Minimum size field on the parameters page for a selected Foliage Group. This controls the minimum size separately for each Group.

Second Size is Plus or Minus a Percentage Radio Button

Select the Second Size is +/- percentage radio button if you want to be able to set the secondary size as a percentage range above and below the absolute size.

If you've selected the "Absolute Size is in Ecotype" radio button (see above), you can then control a range of size for all Foliage Groups using the Size Range Plus/Minus Percentage field on the Parameters page. The Ecotype's foliage will range in size as a percentage above or below the value you entered into the Maximum Size field. VNS will vary the size of the foliage within this percentage range. You can further control the size of each Foliage Group by adjusting the Group Size percentage field on the Parameters page for each Foliage Group.

If you've selected the "Absolute Size is in Foliage Group" radio button (see above), you can instead control a range of size separately for each Foliage Group using the Group Size Range Plus/Minus Percentage field on the Parameters page for a selected Foliage Group. This controls the size range separately for each Group.

Absolute Density Radio Buttons

Select the "Absolute Density is in Ecotype" radio button if you want to specify the overall density of the Ecotype's foliage for the entire Ecotype using the Density field in the Ecotype Density section on the Ecotype page. You can then set the density of each Foliage Group as a percentage of the Ecotype's overall Density.

Select the "Absolute Density is in Foliage Group" radio button if you want to specify the density of each Foliage Group directly instead of setting each group as a percentage of the Ecotype Density. VNS will disable the Density field on the Ecotype page and you can directly set a Group Density for each Foliage Group using the Group Density field on the Groups page instead.

Note: In both cases, the density of each Foliage Object is a percentage of the density of the Foliage Group to which it belongs. You can set the density percentage for each Foliage Object on the Objects page.

Density Radio Buttons

The Ecotype page's Density Field and the Group page's Group Density field work differently depending on whether you select the "Density is per Polygon" or "Density is per Unit Area" radio button.

VNS lets you choose whether to have the Ecotype's foliage density be linked to the polygon density for more efficient rendering or be a constant across the terrain. Polygon density is increased near the Camera when you render with Variable or Fractal Maps options on the Terrain Parameter Editor.

Density per Polygon Radio Button

With the “Density is per Polygon” radio button selected, the Density or Group Density field lets you specify the percentage of polygons that will be covered with the Ecotype. Enter an integer value between 0 and 100 percent or use the arrow buttons to change the value. A value of zero will cause no trees or textures to be rendered for the given Ecotype. A value of 100 will cause a tree or texture to be applied at all polygon sites where the Ecotype appears.

With Density per Polygon the density of the foliage is directly related to the polygon density. The more polygons you have, the more foliage you will have. Anything that affects the polygon density will also affect the tree density. This includes things like Fractal Depth, Variable Fractal Depth and Fractal Depth Maps.

You can increase the polygons available during rendering by increasing the Fractal Depth in the Terrain Parameter Editor. The foliage density will be different when you render at lower or higher Fractal Depth settings. To see how it all works out you'll have to render an image.

If you use Variable Fractal Depth, the foliage density will be higher nearer the Camera. If you use Fractal Depth Maps, the foliage density will be higher along the Camera path.

In many cases the varying tree density is not noticeable, and using Density per Polygon may render faster. But if you notice uneven tree density; if you want to be able to change fractal depth without changing the tree density; or if you see distant trees disappearing during an animation, use Density per Unit Area instead (see below).

When changing from Density per Polygon to Density per Unit Area, you will generally need to increase the density field between 5 to 10 times its previous value to get a similar look as the non-fixed scene. Use your judgment based on what you want it to look like.

Density per Unit Area Radio Button

Select the “Density is per Unit Area” radio button when you want the tree density to be unrelated to the polygon density. With the “Density is per Unit Area” radio button selected, the number of trees won't change when you raise or lower the fractal depth. The distribution of trees on the landscape will be consistent even if you are using variable fractal depth or fractal depth maps.

The Density you set in the Density or Group Density field is the actual number of foliage stems per unit. You can select the kind of unit from the Area Units drop box (see below). To save rendering time, enter the lowest Density value that gives you the look you want. To see the result, render an image.

To make Density per Unit Area foliage render more efficiently, use the controls in the Image Object Distance Dissolve section to dissolve distant foliage to a color or texture (see below).

Increase the Density or Group Density value if you want to see more trees from the Ecotype. If it's an Overstory Ecotype, lower values can leave more bare spots where the Understory Ecotype will show through.

Area Units Drop Box

If you select the “Density is in Unit Area” radio button you can use the Area Units drop box to select the units for area density. Choose between stems per Hectare, Acre, Square Meter or Square Foot.

Parameters Sub-Page

The Ecotype Size section's fields are available if you select the Absolute Size is in Ecotype radio button on the General Sub-Page (see above).

Note: These fields let you adjust foliage sizes for the entire Ecotype. You can further adjust foliage sizes for each of the Ecotype's Foliage Groups and for individual Foliage Objects by selecting the relevant Group or Object and using the context sensitive controls which appear (see below). You can also adjust Foliage sizes for all the foliage from all Ecosystems used within an Environment. To do so, use the Foliage Height Factor field on the Foliage and Gradients page of the Environment Editor.

Maximum Height Field

Use the Maximum Height field to specify the upper limit for how large you'd like the foliage in the Active Ecosystem to appear.

Enter a value for the Maximum Height field in the units you selected for height on the Units page of the Preferences Window.

Controlling Height with a Texture

If you want to control foliage height with a texture, click the Texture Operations Icon next to the field for the variable you want to control, which in this case is Maximum Height.

Select the Create Texture command from the Texture Operations Icon's commands and VNS will create a new texture and open the Texture Editor. There you can edit your texture to control the variable. Wherever the Texture is white, you'll have the full height using the value you set in the Maximum Height field. Wherever the texture is gray you'll have less height and where it is black you'll have zero height. This is a good way to make naturally varied foliage heights.

Controlling Height with a Thematic Map

If you want to control foliage height with a Thematic Map, click the Thematic Map Operations Icon next to the field for the variable you want to control, which in this case is Maximum Height.

Select the Create Thematic Map command from the Thematic Map Operations Icon's commands and VNS will create a new Thematic Map and open the Thematic Map Editor. There you can select one or more Vector attributes to control the variable. In this case the height value will be inherited from the Vector attribute you select. The attribute value comes from the Ecosystem's attached Vector. This is a good way to let your GIS data control actual foliage height in VNS.

Second Size Field

The second Size field lets you control Minimum Size, Minimum Size Percentage or Size Range +/- Percentage depending on your Second Size radio button selection on the General page (see above).

If you select the Second Size is in Absolute Min (Minimum) on the Settings sub-page, the second Size field will be labelled "Minimum Height." Enter the height you want for the shortest foliage in the Ecotype. When you render, VNS will place trees with a random mix of heights from the Minimum Height you specified in the Minimum Height field up to the Maximum Height you specified in the Maximum Height field (see above).

Note: The Minimum Height field uses the units you selected for height on the Units page of the Preferences Window.

If you select the Second Size is in Min (Minimum) Percentage on the Settings sub-page, the second size field will be labelled "Minimum Height Percentage." Enter the height you want for the shortest foliage in the Ecotype as a percentage of the Maximum Height field. When you render, VNS will place trees with a random mix of heights from the Minimum Height percentage you specified in the Minimum Height Percentage field up to the Maximum Height you specified in the Maximum Height field (see above).

If you select the Second Size is in Min (Minimum) Percentage on the General page, the second Height field will be labelled "Height Range (+/-)." Enter the height you want for the shortest foliage in the Ecotype as a percentage above and below the value in the Maximum Height field. When you render, VNS will place trees with a random mix of heights ranging above and below the value you specified in the Maximum Height field (see above).

Ecotype Density Section

The Ecotype Density section is available if you select the Absolute Density is in Ecotype radio button on the General page (see above). You can then set the density of each Foliage Group on the Groups page as a percentage of the Ecotype's overall density, and for individual Foliage Objects on the Objects page as a percentage of the Group's density.

VNS lets you choose whether to have the foliage density be linked to the polygon density for more efficient rendering or be a constant across the terrain. Polygon density is increased near the Camera when you render with Variable or Fractal Maps options on the Terrain Parameter Editor.

The Ecotype page's Density Field works differently depending on whether you select the "Density is per Polygon" or "Density is per Unit Area" radio button on the General page.

If the Density is per Unit Area radio button selected on the General page, the Density you set in the Density field is the actual number of foliage stems per unit. You can select the kind of unit from the Area Units drop box on the General page. To save rendering time, enter the lowest Density value that gives you the look you want.

To see the result, render a final image from the Render Control Window.

Note: Preview renderings may not show densities accurately if your View is significantly smaller than the final rendered image size you set in the set of Render Options you're using in the Render Job. This is especially true if you are using Image Object Distance Dissolve (see below) with Common Distance Dissolve set to Absolute Pixels.

If the Density is per Polygon radio button selected on the General page, the Density field lets you specify the percentage of polygons that will be covered with the Ecotype. Enter an integer value between 0 and 100 percent or use the arrow buttons to change the value. A value of zero will cause no trees or textures to be rendered for the given Ecotype. A value of 100 will cause a tree or texture to be applied at all polygon sites where the Ecotype appears.

Note: With Density is per Polygon radio button selected, the more polygons you have, the more trees you will have. You can increase the polygons available during rendering by increasing the Fractal Depth in the Terrain Parameter Editor. To see how it all works out you'll have to render an image.

Increase the Density value if you want to see more trees from the Ecotype. If the Ecotype is an Overstory, lower values will leave more bare spots where the Understory Ecosystem can show through.

Controlling Density with a Texture

If you want to control density with a texture, click the Texture Operations icon next to the field for the variable you want to control, which in this case is Ecotype Density.

Select the Create Texture command from the Texture Operations icon's commands and VNS will create a new texture and open the Texture Editor. There you can edit your texture to control the variable. Wherever the Texture is white, you'll have the full density using the value you set in the Density field. Wherever the texture is gray you'll have less density and where it is black you'll have no density. This is a good way to make naturally clumpy groups of foliage.

Controlling Density with a Thematic Map

If you want to control density with a Thematic Map, click the Thematic Map Operations icon next to the field for the variable you want to control, which in this case is Ecotype Density.

Select the Create Thematic Map command from the Thematic Map Operations Icon's commands and VNS will create a new Thematic Map and open the Thematic Map Editor. There you can select one or more Vector attributes to control the variable. In this case the density value will be inherited from the Vector attribute you select. The attribute value comes from the Ecosystem's attached Vector. This is a good way to let your GIS data control actual foliage density in VNS.

Foliage Group Controls

The following controls appear when the selected item in the Material Foliage List is a Foliage group:

Load Foliage Group Icon

Click the Load Foliage Group icon to open the Component Gallery where you can load a Foliage Group Component.

Save Foliage Group Icon

Click the Save Foliage Group icon to open the Component Signature Window where you can save the selected Foliage Group as a Component for use in other Projects.

Name Field

Whenever you create a Foliage Group VNS asks you for a name. You can change the name of a Foliage Group by selecting it in the Foliage Group list and changing it in the Name field.

Group Enabled Checkbox

Select the Group Enabled checkbox to make the Group available for rendering. Deselect it if you want to disable the Group for rendering.



Group Size Controls

Each Foliage Group has its own height specification. This determines how tall the Foliage Objects in the Group are compared to other Foliage Groups in the Ecotype. You can also adjust the height of each Foliage Object in the Group on the Objects page (see below). This gives you tremendous flexibility to customize an Ecotype.

Note: If you don't care for subtleties, just select the "Absolute Height is in Ecotype" radio button on the General page, leave all the heights set to 100% on the Groups and Objects pages and modify the values on the Ecotype page to get the right look.

If you selected the "Absolute Height is in Ecotype" radio button on the General page, you'll control the actual height of the Ecotype's foliage using the Maximum Height field on the Ecotype page in the Ecotype Height section. You can then set the height of each Foliage Group here with the Group Height field as a percentage of the Ecotype's Maximum Height.

If you selected the "Absolute Height is in Foliage Group" radio button on the General page, you'll control the actual height of each Foliage Group directly instead of setting each group as a percentage of the Ecotype Height. VNS will disable the Ecotype Height controls and you can directly set a Group Height and a Secondary height for each Foliage Group on the Groups page.

Second Height Field

The second Height field lets you control Minimum Height, Minimum Height Percentage or Height Range +/- Percentage depending on your Second Height radio button selection on the General page (see above).

If you select the Second Height is in Absolute Min (Minimum) on the General page, the second Height field will be labelled "Group Minimum Height." Enter the height you want for the shortest foliage in the Foliage Group. When you render, VNS will place trees with a random mix of heights from the Group Minimum Height you specified in the Minimum Height field up to the Maximum Height you specified in the Group Height field (see above).

Note: The Group Minimum Height field uses the units you selected for height on the Units page of the Preferences Window.

If you select the Second Height is in Min (Minimum) Percentage on the General page, the second Height field will be labelled "Group Min (Minimum) Height Percentage." Enter the height you want for the shortest foliage in the Foliage Group as a percentage of the Group Height field. When you render, VNS will place trees with a random mix of heights from the Group Minimum Height percentage you specified in the Group Min Height Percentage field up to the Maximum Height you specified in the Group Height field (see above).

If you select the Second Height is in Min (Minimum) Percentage on the General page, the second Height field will be labelled "Group Ht (Height) Range (+/-)." Enter the height you want for the shortest foliage in the Foliage Group as a percentage above and below the value in the Group Height field. When you render, VNS will place trees with a random mix of heights ranging above and below the value you specified in the Group Height field (see above).

If you wish you can control the group's height with a Thematic Map or a texture.

Group Density Percentage Controls

Each Foliage Group has its own density specification. This determines how often the object is repeated compared to other Foliage Objects in the Ecotype. You can also adjust the density of each Foliage Object in the Group on the Objects page (see below).

This gives you tremendous flexibility to customize an Ecotype.

Note: If you don't care for subtleties, just select the "Absolute Height is in Ecotype" radio button on the General page, leave all the heights set to 100% on the Groups and Objects pages and tweak the values on the Ecotype page to get the right look.

If you select the Absolute Density is in Foliage Group radio button on the General page (see above) you can then set the absolute density of each Foliage Group on the Groups page.

If you select the Absolute Density is in Ecotype radio button on the General page you can then set the density of each Foliage Group as a percentage of the Ecotype's overall density.

In either case you can set the density of individual Foliage Objects on the Objects page as a percentage of the Group's density.

VNS lets you choose whether to have the foliage density be linked to the polygon density for more efficient rendering or be a constant across the terrain. Polygon density is increased near the Camera when you render with Variable or Fractal Maps options on the Terrain Parameter Editor.

The Group page's Group Density field works differently depending on whether you select the "Density is per Polygon" or "Density is per Unit Area" radio button on the General page.

If the Density is per Unit Area radio button selected on the General page, the Density you set in the Group Density field is the actual number of foliage stems per unit. You can select the kind of unit from the Area Units drop box on the General page. To save rendering time, enter the lowest Density value that gives you the look you want.

To see the result, render a final image from the Render Control Window.

Note: Preview renderings may not show densities accurately if your View is significantly smaller than the final rendered image size you set in the set of Render Options you're using in the Render Job. This is especially true if you are using Image Object Distance Dissolve (see below) with Common Distance Dissolve set to Absolute Pixels.

If the Density is per Polygon radio button selected on the General page, the Group Density field lets you specify the percentage of polygons that will be covered with the Ecotype. Enter an integer value between 0 and 100 percent or use the arrow buttons to change the value. A value of zero will cause no trees or textures to be rendered for the given Ecotype. A value of 100 will cause a tree or texture to be applied at all polygon sites where the Ecotype appears.

Note: With Density is per Polygon radio button selected, the more polygons you have, the more trees you will have. You can increase the polygons available during rendering by increasing the Fractal Depth in the Terrain Parameter Editor. To see how it all works out you'll have to render an image.

Increase the Group Density value if you want to see more trees from the Ecotype. If the Ecotype is an Overstory, lower values will leave more bare spots where the Understory Ecosystem can show through.

If you wish you can control the group's density with a Thematic Map or a texture.

Foliage Object Controls

Image Object or 3D Object Radio Buttons

These radio buttons let you select whether the selected Foliage Object should be an Image Object or a 3D Object.

If you select the Image Object radio button, VNS will show the Image Object section at the bottom of the Objects page (see below). There you can select an Image Object and adjust its properties.

If you select the 3D Object radio button, VNS will show the 3D Object section at the bottom of the Objects page (see below). There you can select a 3D Object and adjust its properties.

Enabled Checkbox

The Enabled checkbox lets you enable or disable the selected Foliage Object for rendering. Disabled Foliage Objects are shown in gray in the Foliage Objects list.

Image Object Options

Image Object Drop Box

Select an Image Object in the Image Object drop box. VNS will replace the selected Foliage Object in the Foliage Objects list (see above) with the Image Object you choose.

If you want to load a new Image Object, select “New Image Object.” VNS will open a file requester where you can select a new Image Object. Image Objects can be images or image sequences in any supported format (see Image Loading and Saving).

Width, Height and Image Bands Display Fields

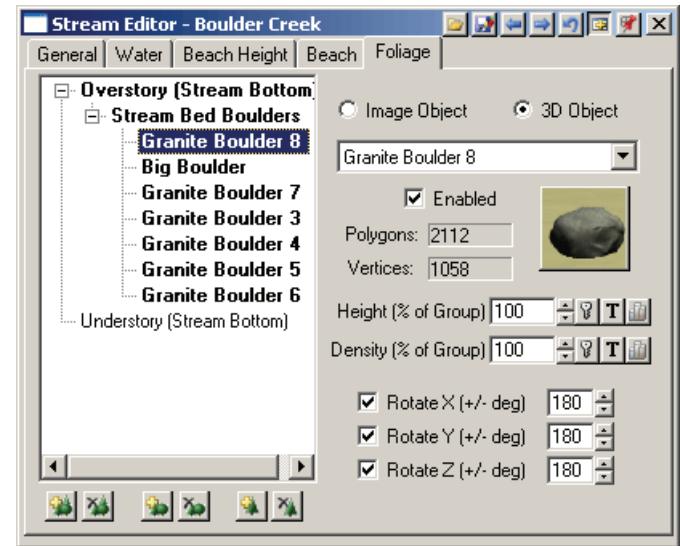
The Width, Height and Image Bands display fields show the pixel dimensions and number of 8-bit image bands of the Selected Image Object.

Thumbnail

The Thumbnail shows a small version of the selected Image Object. You can double-click it if you want to see the full version.

Random Flip X Checkbox

Select the Random Flip X checkbox to have VNS randomly reverse the Image Object from left-to-right during rendering. This will give you more variety in the foliage since the selected Image Object will appear in different places in normal and reversed versions.



Apply 3D Shading Checkbox

Select the Apply 3D Shading checkbox to tell VNS to shade the Image Object based on the direction of the light. This will give foliage a more 3-dimensional appearance.

Replace Gray Color Controls

By using unique colors for a Group of images or even individual Foliage Objects you can create a scene of nearly unlimited color variety. You can animate colors to create a kaleidoscopic landscape. Change the color of maple trees first, then the birches followed by the oaks and leave the conifers green, and voila - New England in October.

Each Image Object has its own color specifications. The color for each image can come from the Image Object itself or from a color. If it comes from a color, you can animate that color. You can edit the colors for the selected Image Object by clicking the Replace Gray color well to open the Color Editor.

Note: This only works for gray scale images, or images that have been set to gray scale in the Image Object Library. If the Image Object contains a color image and it has not been changed to gray scale in the Image Object Library, the Replace Gray color well will be disabled.

You can change the Gray Replacement Color for a gray-scale Image Object independently at any time or leave it with the color it inherited when you added the Image Object.

Note: Gray Scale Images require 1/3 the amount of memory that 24 bit color images require when rendering.

Height Percentage Controls

Each Foliage Object has its own height specifications. These determine how tall the object is compared to other objects in the Ecotype.

The Height Percentage field for the currently selected Foliage Object is a percentage of the number entered in the Group Height field for the Foliage Group on the Groups page (see above).

If you wish you can control the object's height with a Thematic Map or a texture.

Density Percentage Controls

Each Foliage Object has its own density specifications. These determine how often the object is repeated compared to other Foliage Objects in the Ecotype.

Density of coverage for a Foliage Object is based on its Density within its group (set with the Density Percentage field for the selected Foliage Object), the group's Density in the Ecotype (set with the Group Density field on Group page for the selected Group).

If you wish you can control the object's density with a Thematic Map or a texture.

Back Light Percentage Field

The Back Light Percentage field lets you allow light to shine through backlit Image Object foliage. The default value is 25%. You can set it higher than 100%.

Use the Back Light Percentage when the Camera is looking into the light and the foliage looks too dark. It allows light to be transmitted through the leaves. This will brighten the foliage and increase color saturation. The result can be much more realistic small vegetation when the vegetation is backlit.

You can adjust the Back Light Percentage individually for any Foliage Object by selecting it in the Foliage Objects list and changing the value in the Back Light Percentage field. You can increase the Back Light percentage to brighten objects that are between the Camera and a light. Decrease it if you want a silhouette effect.

Apply to Group Button

Click the Apply to Group button if you want to set the Back Light Percentage of all members of the Group to be the same as the value in the Back Light Percentage field (see above). This is much faster than setting the Back Light Percentage individually for each member of the Group.

If the Back Light Percentage for the current Foliage Object has key frames, they will also be copied to the other members of the Group.

3D Object Options

Rotate X, Y and Z Checkboxes and Fields

The Rotation controls let you add random rotation to the current 3D Object. Select a checkbox and enter a value and VNS will randomly rotate the object along that axis every time it places it on a Vector vertex, within the rotation limit you set.

The X axis runs east to west. A positive X axis is to the east. The Y axis runs vertically. A positive Y axis is up. The Z axis runs north to south. A positive Z axis is to the north.

Enter a number in the X Field to rotate the 3D Object around the X axis. Enter a number in the Y Field to rotate the 3D Object around the Y axis. Enter a number in the Z Field to rotate the 3D Object around the Z axis.

A value of zero in any field means no rotation for that axis.

Polygons, Vertices and Materials Display Fields

The Vertices display field shows the number of vertices in the current 3D Object. The more vertices there are, the longer it will take to render. VNS does not impose a limit to the number of vertices an object may have, other than the limit imposed by the available memory on your system.

The Polygons display field shows the number of polygons in the current 3D Object. The more polygons there are, the longer it will take to render. VNS does not impose a limit to the number of polygons an object may have, other than the limit imposed by the available memory on your system.

The Materials display field shows how many materials there are in the current 3D Object. A Material is a texture applied to groups of polygons within the object. For example, a car object may have a body Material, a bumper Material, a tire Material and a glass Material. You can edit the properties of each Material using the 3D Material Editor.

Height Percentage Controls

Each Foliage Object has its own height specifications. These determine how tall the object is compared to other objects in the Ecotype.

The Height Percentage field for the currently selected Foliage Object is a percentage of the number entered in the Group Height field for the Foliage Group on the Groups page (see above).

If you wish you can control the object's height with a Thematic Map or a texture.

Density Percentage Controls

Each Foliage Object has its own density specifications. These determine how often the object is repeated compared to other Foliage Objects in the Ecotype.

Density of coverage for a Foliage Object is based on its Density within its group (set with the Density Percentage field for the selected Foliage Object), the group's Density in the Ecotype (set with the Group Density field on Group page for the selected Group).

If you wish you can control the object's density with a Thematic Map or a texture.

Stream Editor - Forestry Edition

If you are not running the Forestry Edition you will need to refer to the section relating to the regular version of the *Stream Editor*.

The Stream Editor lets you control Streams. It gives you common controls that affect all Streams you may have in a Project, along with a set of controls that apply to a single Stream. You can control Water, Foam, Wave and Beach parameters for each Stream.

To open the Stream Editor double-click any Stream Component in the Scene-At-A-Glance. You can also select a Stream's name in the Component Library's Current Project Components list and click the Edit button.

Another quick way to open the Stream Editor is to double click a Stream name in either the Component Library's Current Project Component list or the Database Editor's Attached Components list.

The Stream Editor will open, ready to edit the selected Stream. You can edit other Streams by using the You can import Components into your Projects using the Component Gallery..

What is a Stream?

A Stream is a water surface that can go downhill. The Stream Editor lets you create Rivers, streams and creeks. With different texturing and displacement you can even create ice and lava flows. You may create as many Streams as you like, limited only by your computer's memory.

A Stream must be attached to a Vector. The Stream will follow the path of the Vector.

Streams can overlap each other. Where Streams overlap, VNS will always render the Stream at the highest elevation.

Streams can use waves you create with the Wave Model Editor. You can also create animated wave displacement patterns with textures.

Creating a Stream

You can create a new Stream by selecting the Stream category in the Scene-At-A-Glance and clicking the Add or Clone Selected Item icon.

To create a Vector-bounded Stream you can digitize a Stream and Vector in one step by selecting the Streams Category in the s@g and clicking on the Create Icon on the main toolbar. Alternatively you can first create a Vector Object that follows a drainage and then attach it to a Stream by dragging one over the other in the Scene-At-A-Glance.

You can apply a Stream Object and a Terraffector to the same Vector Object. This lets you dig a Stream bed with the Terraffector and fill it with water using the Stream.

You can use multiple Water Materials each with unique texturing, foam, depth and wave displacement. You can vary materials based on the Vector's slope to create natural areas of whitewater where the stream flows down steeper areas and calmer water where the stream is flowing along less steep areas.

The level of the water is at the elevation of the Vector. You can offset the surface elevation of any of the Stream's Water Materials from the Vector. To do so, use the Water Depth field. The Water Depth field is on the Depth sub-page of the Water page (see below).

You can control the amount of beach along the stream with the Beach Height Minimum and Beach Height Variation controls which are on the Beach Gradient page (see below). By making the beach height below the water you can flood the stream beyond the beach. In that case, tall foliage growing in surrounding Ecosystems will still appear in the floodwaters.

The Vectors to which you apply Streams may overlap. You may be able to create subtle or wild effects by overlapping several Streams at the same elevation but with different colors; by overlapping Streams at different elevations, etc. For example, you may be able to create a frozen look with one Stream and a water look with another, to create a composite Stream that is partially frozen. Use your imagination and see what you come up with.

You can apply the same Stream to any number of Vectors.

To create a new Stream you can also select "Stream" in the Component Library's Current Project Components list and click the Create New Effect button. The Stream Editor will open, ready to edit the new Stream.

General Page

General Features Section

Name Field

Use the Name field to name the current Stream.

If you select an existing Stream and click the Create New Effect button to create a new Stream, VNS will name the new Stream with the same name, but with a number appended to the end. If there was already a number at the end of the name of the original Stream, VNS will increment the number. This ensures that the new Stream will have a different name.

Enabled Checkbox

Use the Enabled checkbox to enable or disable the Stream for rendering.

If you disable a Stream it will not lose its parameter values. It may be useful to temporarily disable a particular Stream to see how the terrain looks without it, or to speed preview rendering when you're working on some other aspect of your scene.

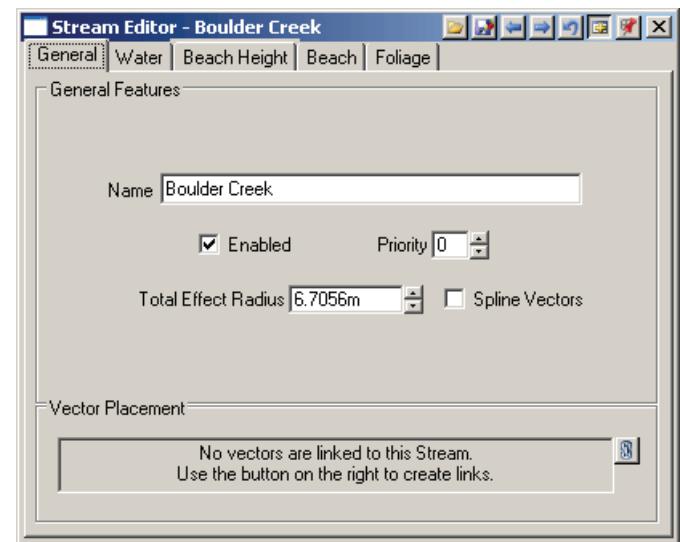
Make sure you remember to enable the Stream for the final rendering if you want VNS to render it.

Note: To see the Stream in your rendering, it must be visible to the Camera you selected for the Render Job you are using (see Render Job Editor), and Streams must be enabled in the Render Options you are using (see Render Options Editor).

Priority Field

The Priority field and buttons let you specify the rendering priority of a Stream that overlaps another Stream.

The Stream with a highest priority will be rendered when Streams overlap.



If there are overlapping Streams set to the same priority, VNS will render the one at the highest Elevation if the Overlap checkbox is selected. Otherwise VNS picks one at random.

Total Effect Radius Field

The Total Effect Radius field lets you set the width of the surface of the Stream on either side of the controlling Vector.

Spline Vectors Checkbox

Select this checkbox if you wish VNS to base your stream on a splined version of your controlling vector(s). This can give much smoother results than using normal segment based vectors, but since the spline is interpolated from the points in the original vector, it's path may be subtly different from the that of the original vector.

Vector Placement Section

By attaching Vectors to Streams you can control where they appear. Vectors can be dynamically linked with Search Queries or hard linked.

Vector Links Button

This control allows you to perform various tasks relating to the association of vectors with components. To learn how to use it, see Vector Links Icon.

Attached Hard-Linked Vectors Display

The Hard-Linked Vectors display tells you if there are any Vectors hard-linked to the Component, and if so, how many. It will also display vectors attached by Search queries and list the names of the search query or queries in use.

Water Page

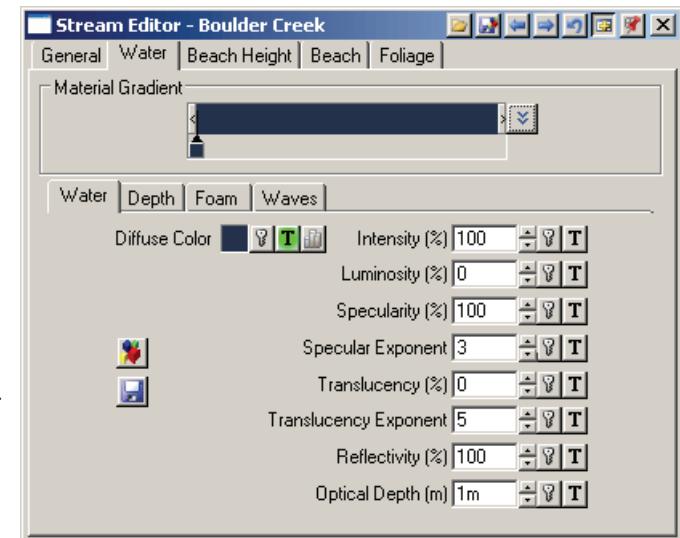
The Water page lets you add new Materials to the Lake.

The Material Gradient Driver lets you tell VNS which Material to use. If you select a texture or animate the material gradient driver % value, the Lake can use multiple Materials.

Material Gradient & Driver Section

Material Gradient Driver Percentage Controls

The Material Gradient Driver field lets you pick a Material for the Lake based on a position along the Material Gradient (see below).



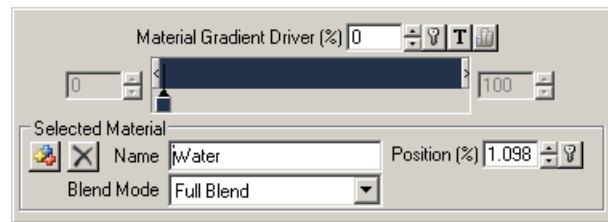
Enter a percentage from zero to 100 where zero is the left edge of the gradient and 100 is the right edge. VNS will use the Material at the gradient position you specify. If there is no Material represented at that position, VNS will create a blend between the nearest two Materials.

You can animate the Material Gradient Driver percentage to change Materials over time. This is great for animating through a variety of Materials such as between different-colored water surfaces or from hot dark rocky matter to molten boiling lava.

By clicking the Texture Control icon you can control the Material Gradient Driver percentage with the Texture Editor. This lets you use all the Materials in the Gradient. Textures can range in gray values from black to white, with black representing 0% on the Gradient and white representing 100% on the gradient.

For example, if you use an F1 Cell Basis Element in the texture that ranges from black to white, VNS will cover the Lake's area with Materials in an F1 Cell Basis wave pattern ranging from the left-most Material in the Gradient to the right-most Material in the Gradient.

To Access the Gradient, click on the Gradient popdown icon . This will display the Material Gradient Editor:



Material Gradient

The Material Gradient shows a colored bar with one or more colored pins beneath it. The bar is a place to create Materials. Click it to create a new Material.

When you click the Gradient to create a new Material, VNS will give the new Material a random Diffuse Color. You can change the color on the Material and Foliage page.

VNS represents each Material with a pin that is colored with the Diffuse Color of the Material. Click any Pin to select a Material.

Material Gradient Range Fields

The Material Gradient Range fields are on either side of the Material Gradient. They show the range of the value that controls the gradient.

If there's no texture enabled for the Material Gradient Driver, the range of the gradient is zero to 100 percent.

If there is a texture enabled for the Material Gradient Driver, then there are two cases:

1) The first Texture Element is a Dynamic Parameter.

In this case, the Range fields show the range of input values for the Dynamic Parameter you have selected. For example if Water

Depth is the Dynamic Parameter and the Elevation range in the texture editor (Input Low and Input High) is zero to 80 meters, then in the Range fields you'll see zero on the left and 80 on the right.

You can directly edit those texture values in the Lake Editor's Range fields. This is handy because you don't have to reopen the Texture Editor if you want to edit these values.

2) The first Texture Element is not a Dynamic Parameter.

In this case, the Range fields are zero to 100 percent, and are non-editable.

Add Material Icon

Click the Add Material Icon to add a new Material. VNS will ask for the position in the Gradient. Enter a position and click the OK button.

Alternatively you can click directly in the Gradient in a spot where no other Material exists.

VNS will create a new Material and give it a random Diffuse Color. The Material will be represented in the Gradient with a pin in the color of its Diffuse Color.

Remove Material Icon

Click the Remove Material Icon if you want to delete the selected Material.

Material Name Field

The Material Name field is above the Water Material list. After you create a Material it will have a default name of "Material." It's a good idea to enter a unique name in the Material Name field to identify how you will use the Material. For example "sand," "forest" or "fall foliage."

Position in Gradient Field

The Position in Gradient field shows the percentage along the Gradient for the selected Material. You can move the Material's pin to the left by decreasing this number or to the right by increasing this number. You can also drag the pin along the Gradient with the mouse.

Blend Drop Box

The Blend drop box lets you choose the rate of change between the selected Material and the Material to its left in the gradient.

These are easiest to visualize if you try them and see what they look like in the gradient. You can see how VNS blends Materials between the pins by how it blends the Diffuse Colors along the Gradient.

You can change the blending by selecting different blend types from the Blend Drop Box. If you have more than one material in the gradient, use the following choices to decide how the gradient blends the materials together.

Sharp Edge

Choose "Sharp Edge" if you want an instant change with no gradient.

Soft Edge

Choose “Soft Edge” to create a gradient that turns into the color to the left 1/10 of the way toward that color’s pin.

Quarter Blend

Choose “Quarter Blend” to create a gradient that turns into the color to the left 1/4 of the way toward that color’s pin.

Half Blend

Choose “Half Blend” to create a gradient that turns into the color to the left 1/2 of the way toward that color’s pin.

Full Blend

Choose “Full Blend” to create a smooth gradient that turns into the color to the left at that color’s pin.

Fast Increase

Choose “Fast Increase” to create an accelerated gradient that gets closer to the previous color faster, and turns into the color to the left at that color’s pin.

Slow Increase

Choose “Slow Increase” to create an decelerated gradient that gets closer to the previous color slower, and turns into the color to the left at that color’s pin.

S-Curve

Choose “S-Curve” to create a narrower gradient between the pin and the previous color’s pin and leaves more of the original colors along the gradient in between.

Water Sub-page

Diffuse Color Well

The Lake's Diffuse Color (or texture) always appears wherever the Lake appears. Click the Diffuse Color well to edit the Diffuse Color in the Color Editor.

Using the Keyframe animation popup menu to the right of the diffuse color well allows you to animate the water color over time.

The water will be a solid color over the entire surface unless you have a texture. With a texture you can use anything you want to control water color.

You can apply, edit or delete a texture using the texture popup menu. Using these commands you can replace the Material's Diffuse Color with texture patterns.

Textures can take water depth into account. For example to make a lighter, sandy color near the shore a blue color in deeper areas and a darker color in the deepest areas of the water body, use a dynamic parameter Element based on water depth in the Texture Editor. Then

set up the color gradient for the Water Depth Element with a sandy color at zero depth and then a blue and black color inward along the gradient at the gradient positions representing the depths where you want them to appear.

When you use a texture, the Colors in the texture will replace the Diffuse Color, unless you use less than 100% Opacity in the Texture Editor, in which case the texture and the Diffuse Color will be mixed.

Diffuse Intensity Field and Buttons

The diffuse intensity of a material is a measure of how much of the diffuse color of a surface is returned to the camera. Reducing this value to 0% will result in a black surface (i.e.: 0 color) and setting it to 100% will result in the pure diffuse color as set in the Diffuse Color Well.

You can animate the value over time, and also drive its intensity with a texture.

This attribute is useful for simulating dirt (try driving this field with a Fractal Noise texture element), streaks, moisture (drive Diffuse Intensity with a Dynamic parameter of Water Level or Elevation to simulate moist surfaces at the edges of lakes and streams etc.)

The maximum value for this parameter is 10000%.

Luminosity Percentage Field and Buttons

Luminosity affects how the Material is shaded by Lights (see Light Editor). You can adjust it to create 3D-shaded Objects, flat-shaded Objects or anything in-between.

With zero percent luminosity, the Material will be fully shaded by Lights. This produces a 3D look. In deeply shadowed areas, the Material's color will be a darker shade of itself based on the Ambient Light Intensity and Color. Where fully lit by Lights, the color will be the Diffuse Color or texture (see above) modulated by the Intensity and Color of any Lights.

By raising the luminosity, you can lighten the shaded areas. This can be useful to do if the terrain that uses the Material seems too dark. Raising the luminosity a little bit decreases the shading contrast for the Material.

With 100 percent luminosity, the Material will ignore Lights completely. This produces a flat, unshaded look. The Material will always be the Diffuse Color or texture. This can be useful for Materials used to create the flat, paper-cutout-style animations used by certain cartoon shows.

You can also subtract light by using negative luminosity to make the object tend toward the Ambient Light colors. With 100 percent negative luminosity, the Material will ignore Lights. The Material will be flat-shaded with the Ambient colors.

You can animate the Luminosity percentage to simulate lighting changes. This lets you animate the effect of nearby lightning or explosions.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's luminosity with a texture pattern. This can be useful for creating the look of glowing lava.

When you use a texture, a white value in the texture will equal the amount of luminosity you set in the Luminosity percentage field. A black value in the texture will equal zero luminosity. Gray values will be in-between.

Specularity Percentage Field and Buttons

Specularity is the amount of shininess for a material.

Use the Specularity Percentage field to adjust the shininess of the material. Zero percent means no specular highlight, while 100 percent is maximum shininess.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's specularity value with texture patterns.

When you use a texture, a white value in the texture will equal the amount of Specularity you set in the Specularity percentage field. A black value in the texture will equal zero Specularity. Gray values will be in-between.

Specular Exponent Field and Buttons

Use the Specular Exponent field to adjust the size of the shiny spot. The useful range is from 1 to 100. Higher numbers will produce a smaller spot, with less feathering at its edge.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's specular exponent value with texture patterns.

When you use a texture, a white value in the texture will equal the amount of Specular Exponent you set in the Specular Exponent field. A black value in the texture will equal zero Specular Exponent. Gray values will be in-between.

Translucency Percentage Field

Use the Translucency Percentage field to adjust the light transmission of the material. Zero percent means no extra highlighting, while 100 percent is maximum transmission. This is useful if you have underwater lights.

For even brighter glows you can enter a value that is more than 100%. In that case VNS will actually increase the Value of the material's color to further increase brightness.

Note: Value is one of the Parameters you can manually adjust on the Color Editor.

To see Translucency, the material must be between the Camera and a Light. You can adjust the amount of light transmission and the angle from the Light within which the material will show the effect.

During rendering there are several things that affect translucency. VNS will make translucent materials brighter when the polygons they are on are directly facing the Light. In other words, if the polygons are perpendicular to a line between the water surface and the Light. VNS will also make translucent materials brighter when the polygons they are on are most directly between the Camera and Light.

The Translucent effect is less bright for materials on polygons whose faces are angled away from the Light and for materials that are farther from the direct line between the Camera and Light.

You can apply, edit or delete a Texture Editor texture using the controls to the right. Using these controls you can replace the Material's translucency percentage with a texture pattern.

Translucency Exponent Field

Use the Translucency Exponent field to adjust the cone of the light transmission. This is a measure of how far the material can be off axis from a line extending from the Camera to the SunLight. The useful range is from 1 to infinity. Higher numbers will produce a smaller cone, with less feathering at its edge. The larger the cone (smaller numbers) the larger the area the material can be in and still be affected by translucency.

You can apply, edit or delete a Texture Editor texture using the controls to the right. Using these controls you can replace the Material's translucency values with texture patterns (see below).

Reflectivity Percentage Field and Icons

Use the Reflectivity Percentage to adjust the percentage that the colors from reflections blend with the color of the water.

A Reflection percentage value of 0 will make the water surface entirely colored by the Diffuse Color or texture (see above), with Foam mixed in for whitecaps and breakers (see below). A value of 100 will make the surface of the water have theoretically correct Fresnel reflectivity.

For greater realism, reflections will tend to diminish as the camera becomes aligned with the terrain surface normal. In other words, as the camera points down at the water, reflections diminish naturally.

Note: A "surface normal" is a line perpendicular to any water polygon.

You can increase the Reflectivity percentage to get greater than normal reflectivity. If you want you can increase reflectivity up to 500%. Reflections will still diminish as the camera becomes aligned with the surface normal.

Optical Depth Field and Buttons

Use the Optical Depth Field to adjust the transparency of water when Transparent Water is enabled in the view's Render Options. It should be initially set to the distance beyond which you want objects to be occluded by the Diffuse Color of the water material at that point. Once set, the value can be adjusted until the required effect has been achieved.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's Optical Depth value with texture patterns.

When you use a texture, a white value in the texture will equal the Optical Depth you set in the Optical Depth field. A black value in the texture will equal zero Optical Depth. Gray values will be in-between.

Increasing Optical Depth will make the water material more transparent, showing less of its diffuse color. Reducing Optical Depth will have the reverse effect, reducing transparency and increasing the intensity of diffuse color observed.

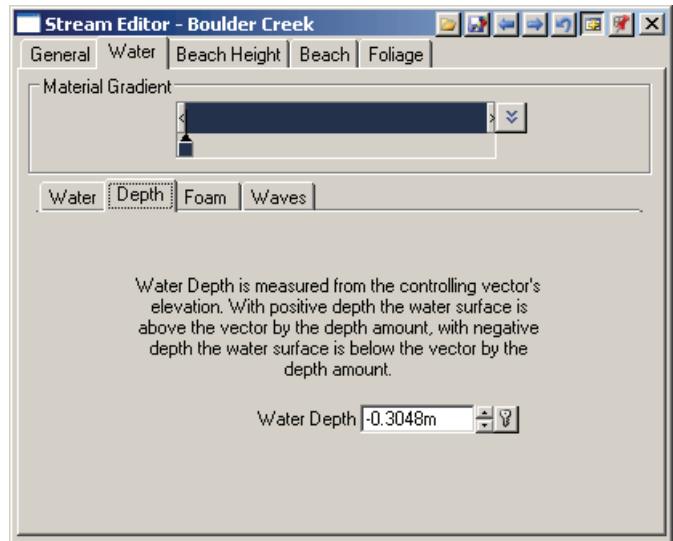
Using the Keyframe controls to the right of this field, you can animate this parameter to simulate a change in turbidity of the water body over time.

Depth Sub-page

Water Depth Field

Use the Water Depth field to adjust the Water Material's surface elevation above or below the controlling Vector.

Use a positive number to raise the water surface above the Vector and a negative number to lower the water surface below the Vector. A value of zero will keep the water surface at the same elevation as the Vector.



Foam Sub-page

Foam Color Well

The Foam Color (or texture) always appears wherever Foam appears. Click the Color well to edit the Foam Color in the Color Editor.

The foam will be a solid color wherever it appears unless you use a texture to control the foam color.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's Foam Color with texture patterns. Fractal noise or F1 Cell Basis Elements work well for foam.

Foam Control Icon

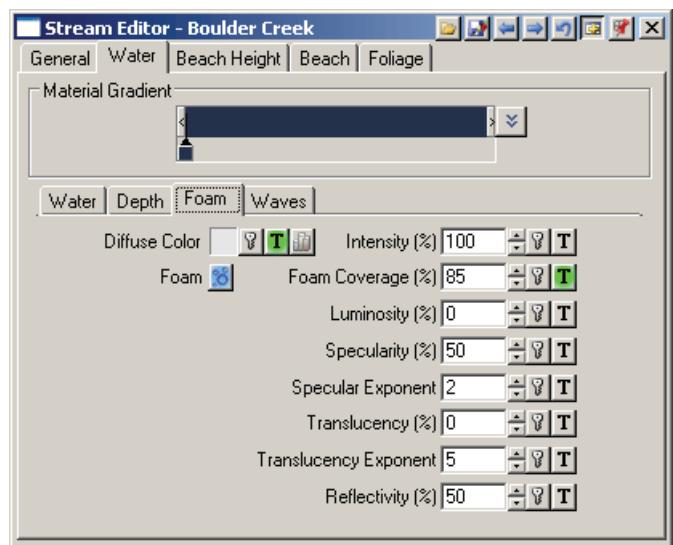
Click the Foam Control Icon to either allow foam for the water material.

From the popup menu, you will be able to select from a commands that will allow you to Copy, Delete, Enable, Disable and Activate (Create) Foam.

Foam Diffuse Intensity Field and Buttons

The diffuse intensity of a material is a measure of how much of the diffuse color of a surface is returned to the camera. Reducing this value to 0% will result in a black surface (i.e.: 0 color) and setting it to 100% will result in the pure diffuse color as set in the Diffuse Color Well.

You can animate the value over time, and also drive its intensity with a texture.



This attribute is useful for simulating dirt (try driving this field with a Fractal Noise texture element), streaks, moisture (drive Diffuse Intensity with a Dynamic parameter of Water Level or Elevation to simulate moist surfaces at the edges of lakes and streams etc.)

The maximum value for this parameter is 10000%.

Foam Coverage Percentage Field

The Foam Coverage percentage field lets you add foam to the waves. Zero percent is no foam and 100 percent is complete coverage. VNS adds the foam from the top of waves downward.

Textures can take water depth into account. For example to make breakers near the beach but not over deeper water, use a dynamic parameter Element based on water depth in the Texture Editor.

When you use a texture, a white value in the texture will equal the amount of coverage you set in the Foam Coverage percentage field. A black value in the texture will equal zero coverage. Gray values will be in-between. By modulating the white value with another texture you can break up the places where foam appears into realistic patterns. Fractal noise or F1 Cell Basis Elements work well for foam patterns.

Luminosity Percentage Field and Buttons

Luminosity affects how the Material is shaded by Lights (see Light Editor). You can adjust it to create 3D-shaded Objects, flat-shaded Objects or anything in-between.

With zero percent luminosity, the Material will be fully shaded by Lights. This produces a 3D look. In deeply shadowed areas, the Material's color will be a darker shade of itself based on the Ambient Light Intensity and Color. Where fully lit by Lights, the color will be the Diffuse Color or texture (see above) modulated by the Intensity and Color of any Lights.

By raising the luminosity, you can lighten the shaded areas. This can be useful to do if the terrain that uses the Material seems too dark. Raising the luminosity a little bit decreases the shading contrast for the Material.

With 100 percent luminosity, the Material will ignore Lights completely. This produces a flat, unshaded look. The Material will always be the Diffuse Color or texture. This can be useful for Materials used to create the flat, paper-cutout-style animations used by certain cartoon shows.

You can also subtract light by using negative luminosity to make the object tend toward the Ambient Light colors. With 100 percent negative luminosity, the Material will ignore Lights. The Material will be flat-shaded with the Ambient colors.

You can animate the Luminosity percentage to simulate lighting changes. This lets you animate the effect of nearby lightning or explosions.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's luminosity with a texture pattern. This can be useful for creating the look of glowing lava.

When you use a texture, a white value in the texture will equal the amount of luminosity you set in the Luminosity percentage field. A black value in the texture will equal zero luminosity. Gray values will be in-between.

Specularity Percentage Field and Buttons

Specularity is the amount of shininess for a material.

Use the Specularity Percentage field to adjust the shininess of the material. Zero percent means no specular highlight, while 100 percent is maximum shininess.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's specularity value with texture patterns.

When you use a texture, a white value in the texture will equal the amount of Specularity you set in the Specularity percentage field. A black value in the texture will equal zero Specularity. Gray values will be in-between.

Specular Exponent Field and Buttons

Use the Specular Exponent field to adjust the size of the shiny spot. The useful range is from 1 to infinity. Higher numbers will produce a smaller spot, with less feathering at its edge.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's specular exponent value with texture patterns.

When you use a texture, a white value in the texture will equal the amount of Specular Exponent you set in the Specular Exponent field. A black value in the texture will equal zero Specular Exponent. Gray values will be in-between.

Translucency Percentage Field

Use the Translucency Percentage field to adjust the light transmission of the material. Zero percent means no extra highlighting, while 100 percent is maximum transmission. This is useful if you have underwater lights.

For even brighter glows you can enter a value that is more than 100%. In that case VNS will actually increase the Value of the material's color to further increase brightness.

Note: Value is one of the Parameters you can manually adjust on the Color Editor.

To see Translucency, the material must be between the Camera and a Light. You can adjust the amount of light transmission and the angle from the Light within which the material will show the effect.

During rendering there are several things that affect translucency. VNS will make translucent materials brighter when the polygons they are on are directly facing the Light. In other words, if the polygons are perpendicular to a line between the foam surface and the Light. VNS will also make translucent materials brighter when the polygons they are on are most directly between the Camera and Light.

The Translucent effect is less bright for materials on polygons whose faces are angled away from the Light and for materials that are farther from the direct line between the Camera and Light.

You can apply, edit or delete a Texture Editor texture using the controls to the right. Using these controls you can replace the Material's translucency percentage with a texture pattern.

Translucency Exponent Field

Use the Translucency Exponent field to adjust the cone of the light transmission. This is a measure of how far the material can be off axis from a line extending from the Camera to the SunLight. The useful range is from 1 to infinity. Higher numbers will produce a smaller cone, with less feathering at its edge. The larger the cone (smaller numbers) the larger the area the material can be in and still be affected by translucency.

You can apply, edit or delete a Texture Editor texture using the controls to the right. Using these controls you can replace the Material's translucency values with texture patterns.

Reflectivity Percentage Field and Icons

Use the Reflectivity Percentage to adjust the percentage that the colors from reflections blend with the color of the foam.

A Reflection percentage value of 0 will make the foam surface entirely colored by the Diffuse Color or texture (see above). A value of 100 will make the surface of the foam have theoretically correct Fresnel reflectivity.

For greater realism, reflections will tend to diminish as the camera becomes aligned with the terrain surface normal. In other words, as the camera points down at the foam, reflections diminish naturally.

Note: A "surface normal" is a line perpendicular to a foam terrain polygon.

You can increase the Reflectivity percentage to get greater than normal reflectivity. If you want you can increase reflectivity up to 500%. Reflections will still diminish as the camera becomes aligned with the surface normal.

Waves Sub-page

The Waves sub-page lets you attach Wave Models to your Stream Material.

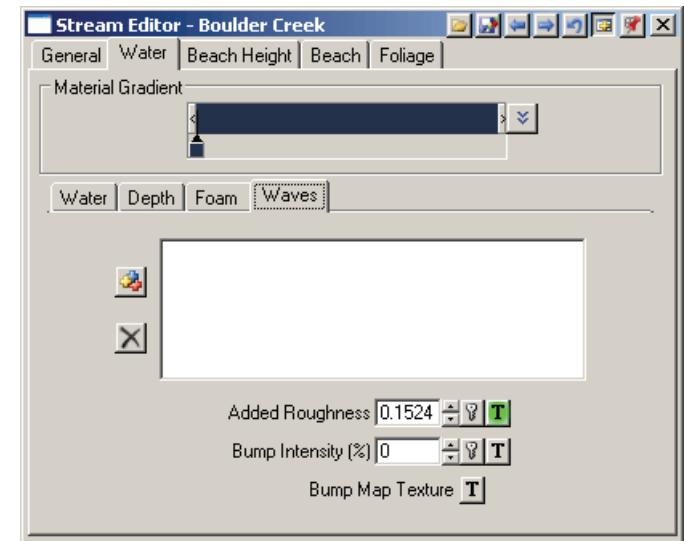
If a Wave Model is not attached to a Vector it will cover the entire Stream Material's surface. If it is attached to a Vector it can cover only the area of the Stream that is within the Vector.

Wave Model List

The Wave Model List shows any Wave Models attached to the Stream. Disabled Wave Models are shown in gray. You can double click the name of a Wave Model to open the Wave Model Editor.

Add Wave Model Icon

Click the Add Wave Model icon to add a Wave Model to the Stream. VNS will open a window where you can select one or more Wave Models to add from the Wave Models in your Project. Click to select a Wave Model. Shift-click or control-click to select multiple Wave Models. Click the OK button to accept the selection.



Remove Wave Model Icon

Click the Remove Wave Model icon to remove the selected Wave Model from the Stream.

VNS will also ask if you want to remove the Wave Model from the Project. Be careful, don't remove it from the Project unless you really want to delete the Wave Model forever!

Roughness Percentage Field

Use the Amplitude Parameter and its texture controls to add roughness displacement to the water. This is great for creating the complex wave patterns typical of large bodies of water. You can use this along with the normal VNS wave sources.

You can apply, edit or delete a texture using the controls to the right. The texture will control the Roughness pattern. Choose any texture (F1 Cell Basis works well, especially with a Bias Component as Remap Function 1 to make sharper wave peaks). Then enter the amount of displacement, in meters, into the Amplitude field.

You can even animate the velocity of the roughening texture in the Texture Editor to create a moving roughness pattern.

Bump Intensity Percentage Field and Bump Map Icon

Bump mapping lets you simulate detailed relief shadowing without requiring dense geometry. For more about using bump mapping, see Bump Mapping Controls.

Beach Height Page

The Beach Height page lets you adjust the beach height.

Beach Height & Reference Elevation Section

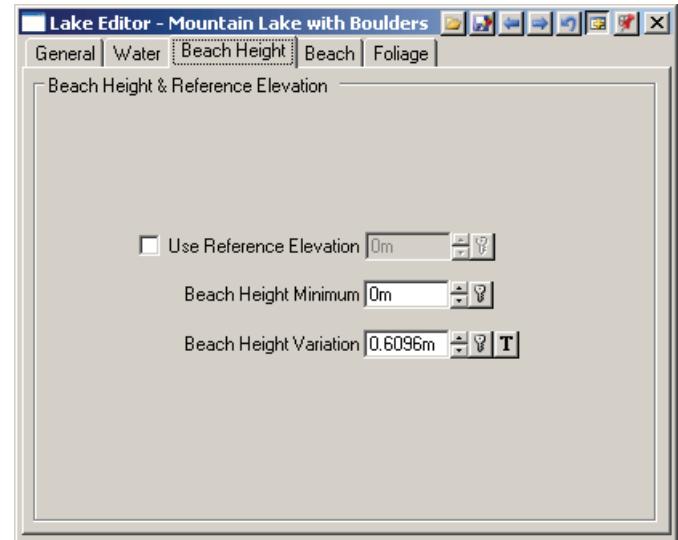
Use Reference Elevation Field and Checkbox

This lets you take tides or receding flood waters into account for beaches. Select the checkbox and enter the actual elevation you want the top of the beach to be when Beach Height Minimum is set to zero. You can further adjust the top of the beach with the Beach Height Minimum and Beach Height Variation fields (see below).

This will lock the top of the beach at a specific elevation even if the Lake's elevation is animated to rise or fall. For example, you can animate the Lake's elevation so it follows tidal patterns, revealing or covering the beach just as tides do in nature.

You can animate the Lake's elevation to flood past the beach and onto the surrounding terrain. Areas flooded beyond the beach will show tall Ecosystem foliage standing in the water.

Note: Foliage growing in Ecosystems or Foliage Effects surrounding the Lake will still appear within the flood waters. You can control the Lake's elevation with the Elevation field on the General page. You can also control elevation for each of the Lake's Water Materials from the Water page, on the Elev sub-page, using the Additional Elevation field.



Deselect the checkbox if you want beach height to vary with the Lake's elevation. This is great for lakes where the surface elevation of the lake does not change. Then you can control the amount of beach with the Beach Height Minimum and Beach Height Variation fields.

Beach Height Minimum Field

Beach Height Minimum works two ways, depending on whether the Use Reference Elevation checkbox is selected (see above).

If the Use Reference Elevation checkbox is not selected, you can use the Beach Height Minimum field to set the minimum amount of terrain above the Lake's shore that is textured by Beach Materials. You can enter a value of zero or even use a negative number to eliminate the beach entirely.

If the Use Reference Elevation checkbox is selected, you can use the Beach Height Minimum field to specify the minimum amount of terrain about the Reference Elevation you specify (see above). This lets you keep the beaches from following changes in water elevation. Use this if you are simulating tides or flood waters. Areas flooded beyond the beach will show tall Ecosystem foliage standing in the water.

In either case, you can add further beach height randomly using the Beach Height Variation field (see below).

Note: You can edit the beach's Materials on the Beach page (see below).

Beach Height Variation Field

Use the Beach Height Variation to raise the beach height beyond that created by the Beach Height Minimum field (see above). Beach height is the terrain directly adjacent to the water that is covered with Beach Materials.

VNS will add additional beach height on a random basis. The additional beach ranges between zero and the value you enter in the Beach Height Variation field, in meters.

Beach Page

The Beach page lets you add new Materials to the Beach.

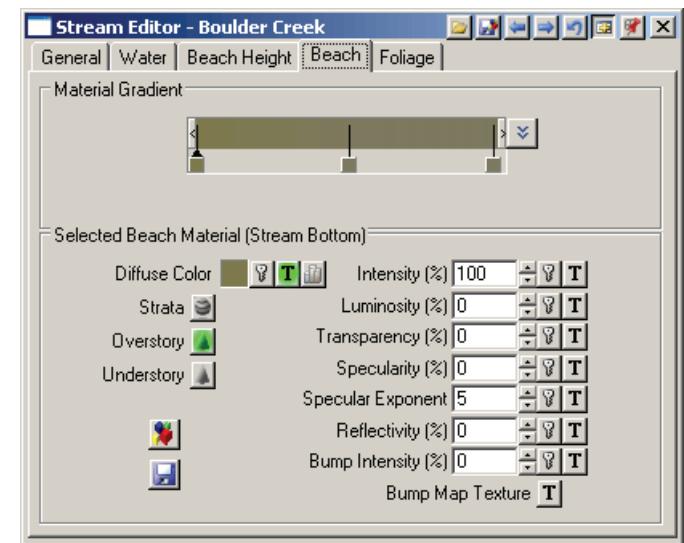
The Material Gradient Driver lets you tell VNS which Material to use. You can use a texture to combine multiple Materials on the beach.

Material Gradient & Driver Section

Material Gradient Driver Percentage Controls

The Material Gradient Driver field lets you pick a Material for the Beach based on a position along the Material Gradient (see below).

Enter a percentage from zero to 100 where zero is the left edge of the gradient and 100 is the right edge. VNS will use the Material at the gradient position you specify. If there is no Material represented at that position, VNS will create a blend between the nearest two Materials.



You can animate the Material Gradient Driver percentage to change Materials over time. This is great for climate change animations where you could animate through a variety of Materials such as from a desert to a rain forest.

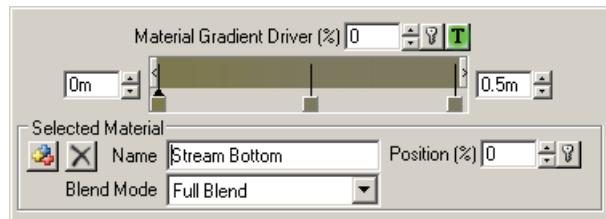
By clicking the Texture Control icon you can control the Material Gradient Driver percentage with the Texture Editor. This lets you use all the Materials in the Gradient. Textures can range in gray values from black to white, with black representing 0% on the Gradient and white representing 100% on the gradient.

For example, if you use a fractal noise Element in the texture that ranges from black to white, VNS will cover the Beach's area with Materials in a fractal noise pattern ranging from the left-most Material in the Gradient to the right-most Material in the Gradient.

Another example: You could use a Dynamic Parameter of Slope in the Texture Editor and set its Input Low field to the lowest slope on the beach area and the Input High field to the highest slope in your terrain. Then VNS will arrange the Materials in the Beach's Material Gradient so that the Materials on the left side of the gradient will grow on the lower sloped areas and the Materials on the right side of the Gradient will grow on the higher sloped areas. You can use this to make the flatter areas textured with sand and the steeper areas textured with rock.

If you are using an Ecotype to add foliage to your beach and you don't want the foliage to appear under water, you may want to use a Dynamic Parameter of Water Depth to control the Material Gradient Driver. To keep foliage from appearing in the water, use a material with no Ecotype foliage and place it in the Material Gradient where the water depth becomes greater than zero.

To Access the Gradient, click on the Gradient popdown icon . This will display the Material Gradient Editor:



Material Gradient

The Material Gradient shows a colored bar with one or more colored pins beneath it. The bar is a place to create Materials. Click it to create a new Material.

When you click the Gradient to create a new Material, VNS will give the new Material a random Diffuse Color. You can change the color on the Material and Foliage page.

VNS represents each Material with a pin that is colored with the Diffuse Color of the Material. Click any Pin to select a Material.

Material Gradient Range Fields

The Material Gradient Range fields are on either side of the Material Gradient. They show the range of the value that controls the gradient.

If there's no texture enabled for the Material Gradient Driver, the range of the gradient is zero to 100 percent.

If there is a texture enabled for the Material Gradient Driver, then there are two cases:

1) The first Texture Element is a Dynamic Parameter.

In this case, the Range fields show the range of input values for the Dynamic Parameter you have selected. For example if Elevation is the Dynamic Parameter and the Elevation range in the texture editor (Input Low and Input High) is zero to 1000 meters, then in the Range fields you'll see zero on the left and 1000 on the right.

You can directly edit those texture values in the Lake Editor's Range fields. This is handy because you don't have to reopen the Texture Editor if you want to edit these values.

2) The first Texture Element is not a Dynamic Parameter.

In this case, the Range fields are zero to 100 percent, and are non-editable.

Add Material Icon

Click the Add Material Icon to add a new Material. VNS will ask for the position in the Gradient. Enter a position and click the OK button.

Alternatively you can click directly in the Gradient in a spot where no other Material exists.

VNS will create a new Material and give it a random Diffuse Color. The Material will be represented in the Gradient with a pin in the color of its Diffuse Color.

Remove Material Icon

Click the Remove Material Icon if you want to delete the selected Material.

Position in Gradient Field

The Position in Gradient field shows the percentage along the Gradient for the selected Material. You can move the Material's pin to the left by decreasing this number or to the right by increasing this number. You can also drag the pin along the Gradient with the mouse.

Blend Drop Box

The Blend drop box lets you choose the rate of change between the selected Material and the Material to its left in the gradient.

These are easiest to visualize if you try them and see what they look like in the gradient. You can see how VNS blends Materials between the pins by how it blends the Diffuse Colors along the Gradient.

You can change the blending by selecting different blend types from the Blend Drop Box. If you have more than one material in the gradient, use the following choices to decide how the gradient blends the materials together.

Sharp Edge

Choose "Sharp Edge" if you want an instant change with no gradient.

Soft Edge

Choose “Soft Edge” to create a gradient that turns into the color to the left 1/10 of the way toward that color’s pin.

Quarter Blend

Choose “Quarter Blend” to create a gradient that turns into the color to the left 1/4 of the way toward that color’s pin.

Half Blend

Choose “Half Blend” to create a gradient that turns into the color to the left 1/2 of the way toward that color’s pin.

Full Blend

Choose “Full Blend” to create a smooth gradient that turns into the color to the left at that color’s pin.

Fast Increase

Choose “Fast Increase” to create an accelerated gradient that gets closer to the previous color faster, and turns into the color to the left at that color’s pin.

Slow Increase

Choose “Slow Increase” to create an decelerated gradient that gets closer to the previous color slower, and turns into the color to the left at that color’s pin.

S-Curve

Choose “S-Curve” to create a narrower gradient between the pin and the previous color’s pin and leaves more of the original colors along the gradient in between.

Material Name Field

The Material Name field is above the Material list. After you create a Material it will have a default name of “Material.” It’s a good idea to enter a unique name in the Material Name field to identify how you will use the Material. For example “sand,” “forest” or “fall foliage.”

Beach Material Properties Section

The Beach page lets you edit the properties of the selected Material. You can select a Material on the Beach page by clicking the Material’s colored pin in the Gradient (see above).

Ecotypes let you add foliage to the Beach. There are two Ecotypes, an Overstory and an Understory. In nature, the Overstory represents taller trees while the Understory represents shorter foliage. You can add appropriate foliage to the Overstory Ecotype and Understory Ecotype to simulate this in VNS. On a Beach you may only need one Ecotype.

Overstory and Understory Ecotype Controls

To create an Overstory or Understory, click the Overstory or Understory Ecotype Operations icon to see the Ecotype Operations commands. If there is no Ecotype yet created (icon has a gray background), select the Create Ecotype command. If there is an existing Ecotype (icon has a green background), select the Edit Ecotype command.

If you want to disable an Ecotype, click its Ecotype Operations icon and select the Disable Ecotype command. The icon will show a red diagonal stripe to indicate that there is an Ecotype but it's disabled. This is the same as deselecting the Ecotype Enabled checkbox on the General page of the Ecotype Editor for the Ecotype. VNS will ignore disabled Ecotypes for rendering.

If you want to enable a disabled Ecotype, click its Ecotype Operations icon and select the Enable Ecotype command. The icon will no longer show a red diagonal stripe. This is the same as selecting the Ecotype Enabled checkbox on the General page of the Ecotype Editor for the Ecotype.

If you want to delete an Ecotype, click its Ecotype Operations icon and select the Remove Ecotype command. Because this is destructive, VNS will ask you to confirm this choice. Click OK to remove the Ecotype forever.

If you want to copy an Ecotype, click its Ecotype Operations icon and select the Copy Ecotype command. If you want to paste an Ecotype, click the Ecotype Operations icon for the destination Ecotype and select the Paste Ecotype command.

If you want to make an Ecotype the Active Item, click its Ecotype Operations icon and select the Activate Ecotype command. VNS will make it the Active Item.

Selected Material Ground Overlay

The Selected Material Ground Overlay lets you add color or texturing to the beach.

Diffuse Color Well and buttons

The Ground Effect's Diffuse Color (or texture) always appears wherever the Selected Material's Ground Overlay appears, unless you set the transparency of the Material to 100%. Click the Diffuse Color well to edit the Diffuse Color in the Color Editor.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's Diffuse Color with texture patterns. For example, you can use the fractal noise Element to create the appearance of sand.

When you use a texture, the Colors in the texture will replace the Diffuse Color, unless you use less than 100% Opacity in the Texture Editor, in which case the texture and the Diffuse Color will be mixed.

Diffuse Intensity Field and Buttons

The diffuse intensity of a material is a measure of how much of the diffuse color of a surface is returned to the camera. Reducing this value to 0% will result in a black surface (i.e.: 0 color) and setting it to 100% will result in the pure diffuse color as set in the Diffuse Color Well.

You can animate the value over time, and also drive its intensity with a texture.

This attribute is useful for simulating dirt (try driving this field with a Fractal Noise texture element), streaks, moisture (drive Diffuse Intensity with a Dynamic parameter of Water Level or Elevation to simulate moist surfaces at the edges of lakes and streams etc.)

The maximum value for this parameter is 10000%.

Strata Buttons

Click the Strata icon to open the Material Strata Editor. There you can add Strata texturing to the Material.

Luminosity Percentage Field and Buttons

Luminosity affects how the Material is shaded by Lights (see Light Editor). You can adjust it to create 3D-shaded Objects, flat-shaded Objects or anything in-between.

With zero percent luminosity, the Material will be fully shaded by Lights. This produces a 3D look. In deeply shadowed areas, the Material's color will be a darker shade of itself based on the Ambient Light Intensity and Color. Where fully lit by Lights, the color will be the Diffuse Color or texture (see above) modulated by the Intensity and Color of any Lights.

By raising the luminosity, you can lighten the shaded areas. This can be useful to do if the terrain that uses the Material seems too dark. Raising the luminosity a little bit decreases the shading contrast for the Material.

With 100 percent luminosity, the Material will ignore Lights completely. This produces a flat, unshaded look. The Material will always be the Diffuse Color or texture. This can be useful for Materials used to create the flat, paper-cutout-style animations used by certain cartoon shows.

You can also subtract light by using negative luminosity to make the object tend toward the Ambient Light colors. With 100 percent negative luminosity, the Material will ignore Lights. The Material will be flat-shaded with the Ambient colors.

You can animate the Luminosity percentage to simulate lighting changes. This lets you animate the effect of nearby lightning or explosions.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's luminosity with a texture pattern. This can be useful for creating the look of glowing lava.

When you use a texture, a white value in the texture will equal the amount of luminosity you set in the Luminosity percentage field. A black value in the texture will equal zero luminosity. Gray values will be in-between.

Transparency Percentage Field and Buttons

Use the Transparency field to adjust how much you can see through the Ground Overlay. Zero percent will cover the terrain with opaque Ground Overlay. One hundred percent makes the Ground Overlay invisible, and you will instead see a Ground Effect on the terrain polygons. Anything in-between will mix the Ground Overlay with the Ground Effect.

Note: There is always at least one global Ground Effect in any VNS Project.

You can apply, edit or delete a texture using the texture popup menu. Using these commands you can replace the Material's transparency with a texture pattern to make some areas more transparent than others.

When you use a texture, a white value in the texture will equal the amount of Transparency you set in the Transparency percentage field. A black value in the texture will equal zero Transparency. Gray values will be in-between.

Specularity Percentage Field and Buttons

Specularity is the amount of shininess for a material.

Use the Specularity Percentage field to adjust the shininess of the material. Zero percent means no specular highlight, while 100 percent is maximum shininess.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's specularity value with texture patterns.

When you use a texture, a white value in the texture will equal the amount of Specularity you set in the Specularity percentage field. A black value in the texture will equal zero Specularity. Gray values will be in-between.

Specular Exponent Field and Buttons

Use the Specular Exponent field to adjust the size of the shiny spot. The useful range is from 1 to infinity. Higher numbers will produce a smaller spot, with less feathering at its edge.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's specular exponent value with texture patterns.

When you use a texture, a white value in the texture will equal the amount of Specular Exponent you set in the Specular Exponent field. A black value in the texture will equal zero Specular Exponent. Gray values will be in-between.

Reflectivity Field and Buttons

Beach materials can now reflect their surroundings, as well as parts of their own geometry.

Set this value to an amount greater than 0% to see reflections on these surfaces.

You can animate the value over time, and also drive its intensity with a texture.

The maximum value for this parameter is 10000%.

Bump Intensity Percentage Field and Bump Map Texture Icon

Bump mapping lets you simulate detailed relief shadowing without requiring dense geometry. For more about using bump mapping, see Bump Mapping Controls.

Foliage Page

To create Ecotypes for a beach material, perform the following:

- Add one or more Ecotypes using the controls on the Material Page, or directly to an existing (and selected) Material using the Ecotype Control Icon underneath the Foliage List on the Foliage Page.
- Add one or more Foliage Groups to each Ecotype using the Foliage Group Control Icon underneath the Foliage List on the Foliage Page.
- Add one or more Foliage Objects to each Group using the Foliage Object Control Icon underneath the Foliage List on the Foliage Page.
- Adjust the properties for each Foliage Object, Group and Ecotype on the parameters pages that appear when the appropriate item is selected in the Foliage List page.

You can specify height and density for each Foliage Object, Foliage Group and the entire Ecotype. You can even use textures to control height and density to create natural-looking foliage clumping based on procedural textures, images and dynamic parameters.

The way the controls interact depends on the choices you make on the General page. There you can configure the Ecotype to behave according to your needs.

Foliage Objects can be Image Objects or 3D Objects. Image Objects can be still images or animated sequences (see the Image Object Library section). Typically they will be images or animations of trees and other foliage, but they can be any images or animations of anything you like. If you have an animation of a dancing munchkin and want an entire forest of dancing munchkins, you can create that effect using Image Objects and the Ecotype Editor.

Using Pre-made Components

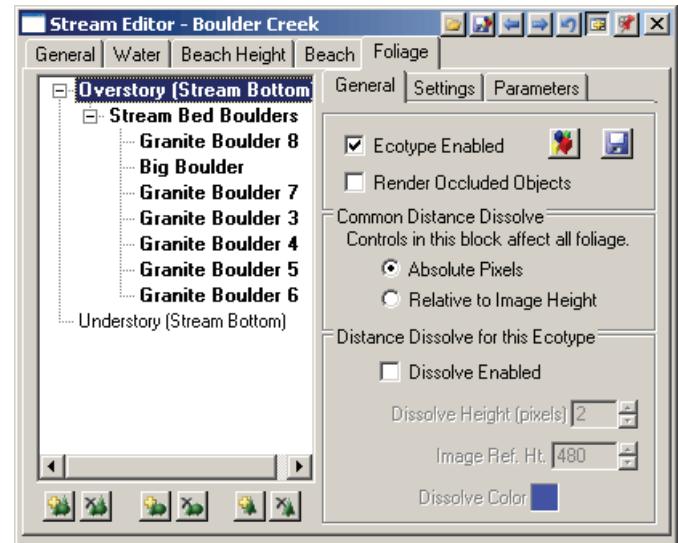
Click the Load Component From Disk Icon to see the Component Gallery, ready to load a pre-made Ecotype. Ecotypes are multiple groups of Foliage Objects with the Ecotype, Group and Object controls already set up. You can select from any previously created Ecotype files. Double-click the thumbnail image to load the Ecotype Component. VNS will reset the parameters of the Ecotype to those of the Component you selected.

You can create and export your own pre-built Ecotype Components from the Ecotype Editor by setting up the Ecotype the way you want it and then clicking the Save Component To Disk Icon. VNS will open the Component Signature Window where you can fill in the information, choose a representative image for the Component's thumbnail and save the Component in the Component Gallery.

For example, this makes it easy to create different kinds of forests with complex foliage mixes. You can later reuse the Ecotype another Project and have an instant complex forest.

Material Foliage List

This list will show the foliage associated with the currently selected Ecosystem Material. The selected Material name will be in brackets behind the Overstory and understory foliage types.



Note: Overstory and understory vegetation are simply logical groupings. There is no reason why you can not contain similar species, or why one can exist while the other doesn't.

Enabled Items in the list will be displayed in Bold text. Disabled Items will still be displayed, but not emboldened.

At the bottom of the Material Foliage List, there are the following Control Icons:

Add Ecotype

Click the Add Ecotype icon if you want to add a new Ecotype to the Material.

Note: An Ecotype must exist in the Material in order for there to be Foliage groups, and therefore Foliage Objects in that Material.

Remove Ecotype

Click the Remove Ecotype icon if you want to delete an Ecotype. VNS will remove the Ecotype from the Material, along with all associated Foliage groups and FOliage Objects in those Groups.

If the Ecotype existed when you last opened the Ecosystem Editor, you can undo the removal by clicking the Undo All Changes in this Window icon. Otherwise the Ecotype will be gone forever.

Add Foliage Group

Click the Add Foliage Group icon if you want to add a new Foliage Group to the Ecotype. VNS will ask for a name.

Note: You have to add at least one Foliage Group to an Ecotype before you can add Foliage Objects on the Objects page (see below).

Remove Foliage Group

Click the Remove Foliage Group icon if you want to delete a Foliage Group. VNS will remove the Foliage Group from the Ecotype.

If the Foliage Group existed when you last opened the Ecosystem Editor, you can undo the removal by clicking the Undo All Changes in this Window icon. Otherwise the Foliage Group will be gone forever.

Add Foliage Object

Click the Add Foliage Object icon to Create a new, blank entry in the Foliage Objects list.

Then choose either the Image Object or 3D Object radio button in the Selected Object section (see below). Finally, select an object from the drop box in the Image Object section or 3D Object section (see below).

Remove Foliage Object

If you want to remove a Foliage Object from the selected Foliage Group, select it in the Foliage Objects list and click the Remove Foliage Object icon.

VNS will ask if you want to remove the object. Click OK and VNS will remove it from the Foliage Group.

General Sub-Page

Ecotype Enabled Checkbox

The Enabled checkbox lets you enable or disable the Ecotype for rendering.

Note: You can also enable and disable an Ecotype from its Ecotype Operations icon on the Ecosystem, Lake or Stream Editor, wherever you first created the Ecotype. Select the icon's Disable Ecotype command to disable the Ecotype. The icon will be displayed with a red diagonal stripe to indicate that it's disabled. Select the icon's Enable Ecotype command to enable the Ecotype. The Ecotype will be enabled and the red stripe will disappear.

Disabling an Ecotype can be useful to speed up rendering if you are doing test renders to check some other aspect of your scene and don't need to see the Ecotype's foliage. Make sure you remember to enable it for the final rendering if you want to see the foliage.

Note: To see the Ecotype in your rendering, it must be part of an Ecosystem or Beach that is visible to the Camera you selected for the Render Job you are using (see Render Job Editor), and Other Foliage must be enabled in the Render Options you are using (see Render Options Editor).

Render Items Occluded By This Ecotype's Image Objects Checkbox

Selecting this checkbox will force VNS to render those elements of the scene obscured by this foliage effect. This will allow reflections to accurately represent terrain and foliage that has been hidden from the camera by this foliage effect. Select this checkbox if you are experiencing "holes" in reflections of terrain and foliage objects near to a Foliage Effect.

Common Distance Dissolve Section

The Common Distance Dissolve section lets you specify whether VNS will calculate Distance Dissolve Height based on an absolute pixel height or as a pixel height relative to a specified image size. This applies to all the Ecotypes and Foliage Effects in your Project (see also Foliage Effect Editor).

Distance Dissolve Height is the height at which VNS will stop rendering foliage Image Objects and instead render a color or texture. You can enable Distance Dissolve in the Image Object Distance Dissolve section (see below). There you can specify a pixel height for Image Objects at which VNS stops trying to render foliage and instead renders a simple color or a texture.

For example, if a tree is so far away that its height is below the Distance Dissolve Height in pixels, it will no longer be rendered and VNS will instead render the color or texture you specify. This can make rendering much, much faster because VNS can calculate a color or texture much faster than a combination of foliage. Rendering the actual trees and plants far in the distance may take a long time for little or no visual benefit.

The default choice is Absolute Pixels. The default value for Distance Dissolve Height is 2 pixels. This means that VNS will replace a foliage object with a color or texture whenever the foliage object is shorter than two pixels in your rendered image. This makes a lot of sense because you can't see a complete tree in two pixels anyway, so there's not much point wasting the rendering time in the attempt.

You can enable Distance Dissolve in the Image Object Distance Dissolve section (see below).

Absolute Pixels Radio Button

Select the Absolute Pixels radio button to choose a specific height in pixels below which VNS will no longer render an Image Object. VNS will instead replace the Image Object with the color or texture you specify in the Image Object Distance Dissolve section (see below).

By default, the Absolute Pixels radio button is selected.

Relative to Image Height Radio Button

Select the Relative to Image Height radio button to relate the minimum pixel height at which VNS will render Image Objects to the size of your rendered images. This will let you see a more consistent rendering no matter what size image you render. Image Object foliage will then appear in the same areas and be dissolved to a color or texture in the same areas at any image size.

When you use the Relative to Image Height option, VNS will automatically change the Distance Dissolve Height based on the size of your rendering. VNS does this by using the Image Reference Height you specify in the Image Object Distance Dissolve section (see below).

You may want to select this option in order for preview renderings in Views to give you a more accurate visual indication of where plants will actually be rendered in your final renderings. Views are typically rendered at a different resolution than your final renderings and may show different results if you use the Absolute Pixels option (see above).

If you are rendering the same scene for a poster and for a video animation, using the Relative to Image Height option will make the foliage dissolve away in the same places in both scenes.

Be careful with this option, it may add to rendering time when you render at lower resolutions than what is in the Image Reference Height field (see below). This is because as you decrease the size of the rendered image, VNS will correspondingly decrease the Distance Dissolve Height. You may then end up with VNS wasting time rendering Image Object foliage even for Image Objects that would be less than a single pixel in height.

Note: When you use the Relative to Image Height option VNS will take into account whatever constrained preview rendering size you use if you have selected the Constrain Render Area icon (see Constrain Render Area). Image height will be calculated using the pixel height of the constrained render area, not the pixel height of the View.

Distance Dissolve for this Ecotype Section

You can reduce rendering times by enabling Distance Dissolve and adjusting the Dissolve Height. Then Image Object foliage will transition to a fast-rendering color or a texture in the distance.

If you are using the Absolute Pixels option then the Dissolve Height is an absolute value in pixels (see the Common Distance Dissolve section above). This gives you the more efficient rendering.

If you are using the Relative to Image Height option then the Dissolve Height will be scaled depending on the resolution of your rendering (see the Common Distance Dissolve section above). This allows the most consistency between renderings at different resolutions, including preview renderings in a View.

Dissolve Enabled Checkbox

Select the Dissolve Enable checkbox to enable Distance Dissolve. Deselect it to disable Distance Dissolve.

Dissolve Height Field

Dissolve Height lets you control how small the rendered foliage can get in the distance before VNS replaces it with a color or texture.

If the Absolute Pixels radio button is selected in the Common Distance Dissolve section (see above), then this value will apply no matter what resolution you render your images.

If the Relative to Image Height radio button is selected in the Common Distance Dissolve section (see above), then this value will apply only for images that are rendered at the vertical resolution you enter into the Image Reference Height field (see below). VNS will scale the Dissolve Height for images rendered at a different horizontal resolution than specified in the Image Reference Height field. This allows Image Objects to change to a color or texture at the same place on the terrain no matter what resolution you render.

Image Reference Height Field

The “Image Ref. Ht.” field is only available when you select the “Relative to Image Height” radio button in the Common Distance Dissolve section (see above).

Use the Image Reference Height field to specify the rendered image height in pixels at which the actual Dissolve Height value is used. This lets you control the amount of up or down Dissolve Height scaling that will occur when you render images at different resolutions. The specified Dissolve Height will always be multiplied by the rendered image height (in pixels) divided by the Image Reference Height (in pixels).

The default Image Reference Height value is 480 pixels. You may want to set it to match the resolution of your preview renderings or your final image renderings.

Example

Let's look at how this works. Suppose you use an Image Reference Height of 480 pixels. If you render an image with a height of 480 pixels and you have an Ecotype that uses a Dissolve Height of 2 pixels, then any rendered images that are 480 pixels high will really have a Dissolve Height of 2 pixels for that Ecotype. $2 \times 480 / 480 = 2$

But if you render a preview image at half that resolution, 240 pixels, VNS will scale the Dissolve Height down by 50% and that Ecotype will have an actual Dissolve Height of 1 pixel in that rendered image. $2 \times 240 / 480 = 1$

If you render a poster with an image height of 1920 pixels, the actual Dissolve Height for the Ecotype in that image will become 8 pixels. $2 \times 1920 / 480 = 8$.

The end result is that the Ecotype will dissolve out to a color or texture at the same place on the terrain in all three examples. This would not have been true if you were using the Absolute Pixels option in the Common Distance Dissolve section (see above).

Note: You can set the rendered image height with the Height field on the Size and Range page of the Render Options Editor.

The Image Reference Height is always the same for all Ecotypes and Foliage Effects. When you change it for one Ecotype or Foliage Effect you are changing it for all Ecotypes and Foliage Effects.

Note: All Ecotypes and Foliage Effects are also affected when you select either the Absolute Pixels radio button or the Relative to Image Height radio button in the Common Distance Dissolve section (see above).

However, the Dissolve Height is unique to each Ecosystem or Foliage Effect.

Dissolve Color Controls

Click the Dissolve Color well to open the Color Editor. There you can edit the color VNS will render on the terrain in the distance.

If you'd rather use a texture, click the Texture icon to open the Texture Editor. There you can create a more complex pattern to represent your distant foliage. Textures will take longer to render than a simple color.

Settings Sub-Page

Absolute Size Radio Buttons

Select the "Absolute Size is in Ecotype" radio button if you want to control the actual size of the Ecotype's foliage using the Maximum Size field, on the Parameters page in the Ecotype Size section. You can then set the size of each Foliage Group as a percentage of the Ecotype's Maximum Size.

Select the "Absolute Size is in Foliage Group" radio button if you want to set the actual size of each Foliage Group directly instead of setting each group as a percentage of the Ecotype Size. VNS will disable the Ecotype Size controls and you can directly set a Group Size and Group Minimum Size for each Foliage Group on the Groups page.

Note: In both cases, the size of each Foliage Object is a percentage of the size of the Foliage Group to which it belongs. You can set the size percentage for each Foliage Object.

However you choose to control the absolute size, you'll set it in the units you selected in the Height field on the Units page of the Preferences Window.

Second Size Radio Buttons

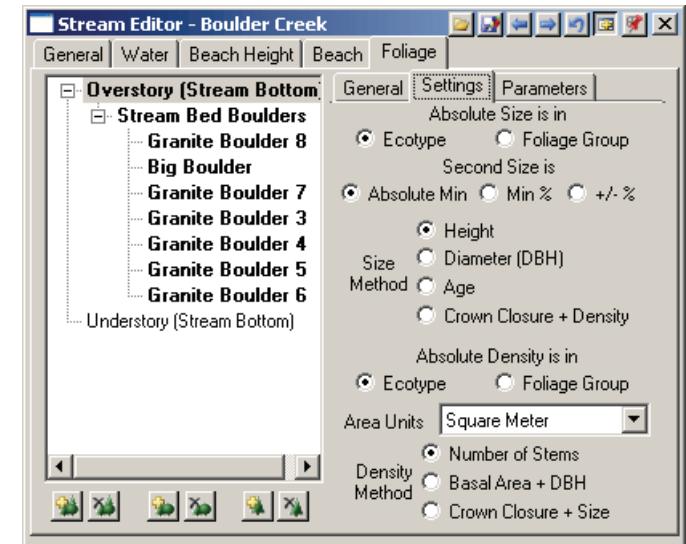
The "Second Size is" radio buttons let you configure how the Ecotype Editor lets you control a second size for the Ecotype's foliage.

Second Size is in Absolute Minimum radio button

Select the Second Size is in Absolute Minimum (Min) radio button if you want to be able to set a secondary Size as a specific, using the units you selected in the Height field on the Units page of the Preferences Window, and using the size method chosen in the Size Method section (see below).

If you've selected the "Absolute Size is in Ecotype" radio button (see above), you can then control a minimum size for all Foliage Groups using the Minimum Size percentage field on the Parameters page.

If you've selected the "Absolute Size is in Foliage Group" radio button (see above), you can then control a minimum size for separately for each Foliage Group using the Group Minimum Size field on the Parameters page for a selected Foliage Group. This controls the minimum size separately for each Group.



Second Size is Minimum Percentage Radio Button

Select the Second Size is in Minimum (Min) percentage radio button if you want to be able to set the secondary size as a percentage of the absolute size.

If you've selected the "Absolute Size is in Ecotype" radio button (see above), you can then control a minimum size for all Foliage Groups using the Minimum Size Percentage field on the Parameters page. The minimum size of the Ecotype's foliage will be a percentage of the value you entered into the Maximum Size field. VNS will vary the size of the foliage between these two sizes. You can further control the size of each Foliage Group by adjusting the Group Size percentage field on the Parameters page for each Foliage Group.

If you've selected the "Absolute Size is in Foliage Group" radio button (see above), you can instead control a minimum size for separately for each Foliage Group using the Group Minimum size field on the parameters page for a selected Foliage Group. This controls the minimum size separately for each Group.

Second Size is Plus or Minus a Percentage Radio Button

Select the Second Size is +/- percentage radio button if you want to be able to set the secondary size as a percentage range above and below the absolute size.

If you've selected the "Absolute Size is in Ecotype" radio button (see above), you can then control a range of size for all Foliage Groups using the Size Range Plus/Minus Percentage field on the Parameters page. The Ecotype's foliage will range in size as a percentage above or below the value you entered into the Maximum Size field. VNS will vary the size of the foliage within this percentage range. You can further control the size of each Foliage Group by adjusting the Group Size percentage field on the Parameters page for each Foliage Group.

If you've selected the "Absolute Size is in Foliage Group" radio button (see above), you can instead control a range of size separately for each Foliage Group using the Group Size Range Plus/Minus Percentage field on the Parameters page for a selected Foliage Group. This controls the size range separately for each Group.

Size Method Radio Buttons

VNS Forestry Edition offers four methods to specify the desired size of Ecotypes: Height, Diameter (DBH), Age or Crown Closure plus Density. Height is the most straight forward. You simply tell VNS how tall to make the foliage. But sometimes you might have other data that VNS can use to infer foliage heights indirectly. Diameter, age and crown closure are the three additional methods supported for Ecotypes.

If you wish to use either of the alternate methods, diameter or age, you will also need to tell VNS what the relationship is between diameter and height or age and height. You will do that by creating a graph of the relationship. A default graph is provided for your use if you lack real height relationship data.

If you wish to use crown closure your density values will be used in a formula along with the specified crown closure to infer the correct size of foliage to draw. There are some restrictions on the use of crown closure for size calculation which are discussed below.

Height Radio Button

Select the Height Radio Button if you wish to control foliage size directly with height values.

Diameter (DBH) Radio Button

Select the Diameter (DBH) Radio Button if you wish to control foliage size indirectly with diameter values and a diameter/height relationship graph. DBH stands for Diameter at Breast Height, a standard height above the ground for measuring tree diameters. You can use the Diameter (DBH) Size Method even if your tree diameters were measured at some other height from the ground. VNS does not care at which height diameters were measured so long as it is consistent with the DBH/Height graph that is used (see below).

Age Radio Button

Select the Age Radio Button if you wish to control foliage size indirectly with age values and an age/height relationship graph.

Crown Closure plus Density Radio Button

Crown Closure is a measure of the percentage of an area that has foliage directly overhead. The remaining area is open to the sky.

Select the Crown Closure plus Density Radio Button if you wish to control foliage size indirectly with crown closure percentage combined with whatever your density value is. The way this works is VNS first determines the foliage density for an area that is about to be drawn. Then from the density and the average width to height ratio of all the images or 3d objects that represent the Ecotype or Foliage Group (depending on whether the Absolute Size is in the Ecotype or Foliage Group), the size of foliage stems to be drawn for that area is calculated using a standard formula.

Note: Because foliage items are drawn in random positions there may be more overlap between items than would normally occur in nature. Therefore a specification of 100% crown closure will probably result in gaps between foliage items which would not be there if items were evenly spaced throughout the area. When you select Crown Closure plus Density you will not be able to select Crown Closure plus Size for the Density Method (see below) since they are mutually exclusive. Also Absolute Size and Absolute Density will be forced to agree to be in either Ecotype or Foliage Group since it is required that the density be available for use in the size calculation.

Absolute Density Radio Buttons

Select the “Absolute Density is in Ecotype” radio button if you want to specify the overall density of the Ecotype’s foliage for the entire Ecotype using the Density field in the Ecotype Density section on the Ecotype page. You can then set the density of each Foliage Group as a percentage of the Ecotype’s overall Density.

Select the “Absolute Density is in Foliage Group” radio button if you want to specify the density of each Foliage Group directly instead of setting each group as a percentage of the Ecotype Density. VNS will disable the Density field on the Ecotype page and you can directly set a Group Density for each Foliage Group using the Group Density field on the Groups page instead.

Note: In both cases, the density of each Foliage Object is a percentage of the density of the Foliage Group to which it belongs. You can set the density percentage for each Foliage Object on the Objects page.

Density Radio Buttons

The Ecotype page’s Density Field and the Group page’s Group Density field work differently depending on whether you select the “Density is per Polygon” or “Density is per Unit Area” radio button.

VNS lets you choose whether to have the Ecotype's foliage density be linked to the polygon density for more efficient rendering or be a constant across the terrain. Polygon density is increased near the Camera when you render with Variable or Fractal Maps options on the Terrain Parameter Editor.

When you select Density is per Unit Area the VNS Forestry Edition allows you to choose the format of your density data. You can use actual stems per unit area, basal area or crown closure data to determine density. Which method you choose will affect the appearance of the Ecotype page's Density Field and the Group page's Group Density field.

Density per Polygon Radio Button

With the "Density is per Polygon" radio button selected, the Density or Group Density field lets you specify the percentage of polygons that will be covered with the Ecotype. Enter an integer value between 0 and 100 percent or use the arrow buttons to change the value. A value of zero will cause no trees or textures to be rendered for the given Ecotype. A value of 100 will cause a tree or texture to be applied at all polygon sites where the Ecotype appears.

Note: For forestry work you will almost never use Density is per Polygon for timber ecotypes. For understory vegetation you might prefer to use Density is per Polygon for speedier rendering where the density is not very critical.

With Density per Polygon the density of the foliage is directly related to the polygon density. The more polygons you have, the more foliage you will have. Anything that affects the polygon density will also affect the tree density. This includes things like Fractal Depth, Variable Fractal Depth and Fractal Depth Maps.

You can increase the polygons available during rendering by increasing the Fractal Depth in the Terrain Parameter Editor. The foliage density will be different when you render at lower or higher Fractal Depth settings. To see how it all works out you'll have to render an image.

If you use Variable Fractal Depth, the foliage density will be higher nearer the Camera. If you use Fractal Depth Maps, the foliage density will be higher along the Camera path.

In many cases the varying tree density is not noticeable, and using Density per Polygon may render faster. But if you notice uneven tree density; if you want to be able to change fractal depth without changing the tree density; or if you see distant trees disappearing during an animation, use Density per Unit Area instead (see below).

When changing from Density per Polygon to Density per Unit Area, you will generally need to increase the density field between 5 to 10 times its previous value to get a similar look as the non-fixed scene. Use your judgment based on what you want it to look like.

Density per Unit Area Radio Button

Select the Density is per Unit Area" radio button when you want the tree density to be unrelated to the polygon density. With the Density is per Unit Area" radio button selected, the number of trees won't change when you raise or lower the fractal depth. The distribution of trees on the landscape will be consistent even if you are using variable fractal depth or fractal depth maps.

Note: For forestry work you will almost always use Density is per Unit Area for timber ecotypes. For understory vegetation you might prefer to use Density is per Polygon for speedier rendering where the density is not very critical.

When you select Density is per Unit Area the VNS Forestry Edition allows you to choose the format of your density data. You can use actual stems per unit area, basal area or crown closure data to determine density. Which method you choose will affect the appearance of

the Ecotype page's Density Field and the Group page's Group Density field. In the paragraphs below the word Density will be used in a generic sense. It can be either stems per unit area, basal area of trunk per unit area or percentage of crown closure.

The Density you set in the Density or Group Density field is the actual number of foliage stems or basal area units per unit of area or the actual percentage of crown closure. You can select the kind of areal unit from the Area Units drop box (see below). To save rendering time, enter the lowest Density value that gives you the look you want. To see the result, render an image.

To make Density per Unit Area foliage render more efficiently, use the controls in the Image Object Distance Dissolve section to dissolve distant foliage to a color or texture (see below).

Increase the Density or Group Density value if you want to see more trees from the Ecotype. If it's an Overstory Ecotype, lower values can leave more bare spots where the Understory Ecotype will show through.

Area Units Drop Box

If you select the "Density is in Unit Area" radio button you can use the Area Units drop box to select the units for area density. Choose between stems per Hectare, Acre, Square Meter or Square Foot.

Density Method Radio Buttons

VNS Forestry Edition offers three methods to specify the desired density per unit area of Ecotype foliage: Number of Stems, Basal Area plus DBH, or Crown Closure plus Size. Number of Stems is the most straight forward. You simply tell VNS how many items of foliage to draw in a unit area of land. But sometimes you might have other data that VNS can use to infer foliage density indirectly. Basal area plus DBH and crown closure plus size are the three additional methods supported for Ecotypes.

If you wish to use crown closure your size values will be used in a formula along with the specified crown closure to infer the correct number of foliage stems per unit area. There are some restrictions on the use of crown closure for density calculation which are discussed below.

Note: Density Method Radio Buttons are disabled unless Density is per Unit Area (see above).

Number of Stems Radio Button

Select the Number of Stems Radio Button if you wish to control foliage density directly with the number of foliage stems per unit area. Be sure to select the appropriate areal unit with the Area Units drop box (see above).

Basal Area plus DBH Radio Button

Basal Area is a measure of the area of tree trunk within some unit of land area. A typical expression would be: 100 square feet of basal area per acre. That would indicate that all the trees in an acre combine to have a cross-sectional area, of 100 square feet. Basal area is usually measured at breast height four and a half feet above the ground. By combining an average diameter, also measured at the same height, with the basal area, an actual number of foliage stems per area of land can be calculated with a simple formula.

Select the Basal Area plus DBH Radio Button if you wish to control foliage density indirectly with basal area and diameter (DBH) values. In the Ecotype Size & Density section of the Ecotype page or the Selected Group section of the Groups page you will need to supply both a diameter and a basal area value. If the Size Method is Diameter (DBH) then that diameter will be used in the density calculation as well as in computing the foliage size. You will also be asked to supply the units for the basal area value. Typical units are square feet and square

meters. The basal area units will usually be different than the Area Units selected on the General page because they represent quantities with different orders of magnitude.

Note: You can only have the combination of Basal Area plus DBH for the Density Method and Diameter (DBH) for the Size Method if Absolute Size and Absolute Density are both in either Ecotype or in Foliage Group. Otherwise selections will be greyed out to indicate they are not valid combinations.

Crown Closure plus Size Radio Button

Crown Closure is a measure of the percentage of an area that has foliage directly overhead. The remaining area is open to the sky.

Select the Crown Closure plus Size Radio Button if you wish to control foliage density indirectly with crown closure percentage combined with whatever your size value is. The way this works is VNS first determines the average foliage size for an area that is about to be drawn. Then from the size and the average width to height ratio of all the images or 3d objects that represent the Ecotype or Foliage Group (depending on whether the Absolute Density is in the Ecotype or Foliage Group), the number of foliage stems to be drawn for that area is calculated using a standard formula.

In forestry practice 100% would be the highest amount of closure that could be achieved by a single layer of forest canopy. In VNS higher percentages are permitted so you can compensate for the overlapping of foliage stems that result from pseudo-random foliage placement. Closure values of 200% or 300% may be necessary to achieve the full coverage of an area without intervening gaps of significant size. Naturally this results in more foliage items being drawn than would really be there for 100% closure.

Note: Because foliage items are drawn in random positions there may be more overlap between items than would normally occur in nature. Therefore a specification of 100% crown closure will probably result in gaps between foliage items which would not be there if items were evenly spaced throughout the area. To compensate for that you may wish to use two or three times the amount of crown closure to achieve the correct look for the foliage density. If you are using a Thematic Map to control crown closure you can set a multiplier value of 2 or 3 in the Thematic Map's Data page to adjust your database values appropriately. When you select Crown Closure plus Size you will not be able to select Crown Closure plus Density for the Size Method (see above) since they are mutually exclusive. Also Absolute Size and Absolute Density will be forced to agree to be in either the Ecotype or Foliage Group since it is required that the size be available for use in the density calculation.

Parameters Sub-Page

The Ecotype Size section's fields are available if you select the Absolute Size is in Ecotype radio button on the Settings Sub-Page (see above).

Note: These fields let you adjust foliage sizes for the entire Ecotype. You can further adjust foliage sizes for each of the Ecotype's Foliage Groups and for individual Foliage Objects by selecting the relevant Group or Object and using the context sensitive controls which appear (see below). You can also adjust Foliage sizes for all the foliage from all Ecosystems used within an Environment. To do so, use the Foliage Height Factor field on the Foliage and Gradients page of the Environment Editor.

Depending on the Size Method you choose on the General Page (see above) you will see different controls in the Size & Density section. All have the same purpose - to let you specify the largest or average size and a second size which may be either a smaller size, a percentage size or a percentage range depending on the Second Size type selected on the General Page.

Maximum Height Field

Use the Maximum Height field to specify the upper limit for how tall you'd like the foliage in this Ecotype to appear. This control only appears if the Size Method is Height and if the Second Size is Absolute Minimum or Second Size is Minimum Percentage on the General Page (see above).

Enter a value for the Maximum Height field in the units you selected for height on the Units page of the Preferences Window.

Mean Height Field

Use the Mean Height field to specify the average for how tall you'd like the foliage in this Ecotype to appear. This control only appears if the Size Method is Height and the Second Size is Plus or Minus Percentage on the General Page (see above).

Enter a value for the Maximum Height field in the units you selected for height on the Units page of the Preferences Window.

Maximum DBH Field

Use the Maximum DBH field to specify the upper limit for how large you'd like the foliage in this Ecotype to appear. This control only appears if the Size Method is Diameter (DBH) and if the Second Size is Absolute Minimum or Second Size is Minimum Percentage on the General Page (see above). DBH stands for Diameter at Breast Height, a standard height above the ground for measuring tree diameters.

Enter a value for the Maximum Diameter field in the units you selected for distance on the Units page of the Preferences Window. Diameter is usually specified as diameter at breast height (DBH) but it does not really matter to VNS how your diameter is measured.

Mean DBH Field

Use the Mean DBH field to specify the average for how large you'd like the foliage in this Ecotype to appear. This control only appears if the Size Method is Diameter (DBH) and the Second Size is Plus or Minus Percentage on the General Page (see above).

Enter a value for the Maximum Diameter field in the units you selected for distance on the Units page of the Preferences Window. Diameter is usually specified as diameter at breast height (DBH) but it does not really matter to VNS how your diameter is measured.

Edit DBH/Height Graph Button

VNS needs to convert the diameters you give it to heights which can be rendered. To do this you must specify a Diameter/Height graph.

The Edit DBH/Height Graph Button only appears if the Size Method is Diameter.

Click the Edit DBH/Height Graph Button to open an editor for the Diameter/Height Graph. Modify the default curve by adjusting points up or down or changing the distance of points in the graph. You can also add or remove points to achieve the diameter/height relationship that describes the foliage in this Ecotype. The same curve will be applied to all Foliage Objects in this Ecotype. If you wish to use a different graph for each Foliage Group then you should select Absolute Size is in Foliage Group on the General Page.

Horizontal units in the graph are the units you selected for distance on the Units page of the Preferences Window. Vertical units in the graph are the units you selected for height on the Units page of the Preferences Window.

Maximum Age Field

Use the Maximum Age field to specify the upper limit for how old you'd like the foliage in this Ecotype to appear. This control only appears if the Size Method is Age and if the Second Size is Absolute Minimum or Second Size is Minimum Percentage on the General Page (see above).

Enter a value for the Maximum Age field in any units you wish. The units do not matter to VNS.

Mean Age Field

Use the Mean Age field to specify the average for how old you'd like the foliage in this Foliage Effect to appear. This control only appears if the Size Method is Age and the Second Size is Plus or Minus Percentage on the General Page (see above).

Enter a value for the Mean Age field in any units you wish. The units do not matter to VNS.

Edit Age/Height Graph Button

VNS needs to convert the ages you give it to heights which can be rendered. To do this you must specify an Age/Height graph.

The Edit Age/Height Graph Button only appears if the Size Method is Age.

Click the Edit Age/Height Graph Button to open an editor for the Age/Height Graph. Modify the default curve by adjusting points up or down or changing the distance of points in the graph. You can also add or remove points to achieve the age/height relationship that describes the foliage in this Ecotype. The same curve will be applied to all Foliage Objects in this Ecotype. If you wish to use a different graph for each Foliage Group then you should select Absolute Size is in Foliage Group on the General Page.

Horizontal units in the graph are dimensionless. Vertical units in the graph are the units you selected for height on the Units page of the Preferences Window.

Maximum Closure Field

Use the Maximum Closure field to specify the upper limit for crown closure of this Ecotype. This control only appears if the Size Method is Crown Closure plus Density and if the Second Size is Absolute Minimum or Second Size is Minimum Percentage on the General Page (see above).

Enter a value for the Maximum Closure field in units of percentage ranging from 0 to 100 or more. VNS allows percentage closure values in excess of the normal 100% to accommodate overlapping between foliage items which reduces the apparent closure.

Mean Closure Field

Use the Mean Closure field to specify the average for crown closure of this Ecotype. This control only appears if the Size Method is Crown Closure plus Density and the Second Size is Plus or Minus Percentage on the General Page (see above).

Enter a value for the Mean Closure field in units of percentage ranging from 0 to 100 or more. VNS allows percentage closure values in excess of the normal 100% to accommodate overlapping between foliage items which reduces the apparent closure.

Controlling Size with a Texture

If you want to control foliage size with a texture, click the Texture Operations icon next to the field for the variable you want to control, which in this case is Maximum Height, DBH, Age or Closure.

Select the Create Texture command from the Texture Operations icon's commands and VNS will create a new texture and open the Texture Editor. There you can edit your texture to control the variable. Wherever the Texture is white, you'll have the full size using the value you set in the field for the controlled variable. Wherever the texture is gray you'll have less size and where it is black you'll have zero height. This is a good way to make naturally varied foliage sizes.

Controlling Size with a Thematic Map

If you want to control foliage size with a Thematic Map, click the Thematic Map Operations icon next to the field for the variable you want to control, which in this case is Maximum Height, DBH, Age or Closure.

Select the Create Thematic Map command from the Thematic Map Operations Icon's commands and VNS will create a new Thematic Map and open the Thematic Map Editor. There you can select one or more Vector attributes to control the variable. In this case the Height, DBH, Age or Closure value will be inherited from the Vector attribute you select. The attribute value comes from the Ecosystem's attached Vector. This is a good way to let your GIS data control actual foliage size in VNS.

The units in which height or diameter should be represented by the Thematic map are meters. The units in which age should be presented do not matter to VNS so long as they are consistent with the Age/Height graph. The units in which crown closure should be presented are percentage normally ranging from 0 to 100 but may be higher if desired. You can use the Data Multiplier field in the Data Input section of the Data page of the Thematic Map Editor to correct for data provided in the wrong units.

Second Size Field

The second size field lets you control Minimum Size, Minimum Size Percentage or Size Range Plus or Minus Percentage depending on your Second Size radio button selection on the General page (see above).

The actual label for the Second Size field will either say Height, DBH, Age or Closure instead of Size, depending on your selection of Size Method on the General page (see above).

If you select the Second Size is Absolute Min (Minimum) on the General page, the second size field will be labelled Minimum Height, Minimum DBH, Minimum Age or Minimum Closure. Enter the appropriate size you want for the smallest foliage in the Ecotype. When you render, VNS will place trees with a random mix of sizes from the minimum size you specified in the Minimum Size field up to the maximum size you specified in the Maximum Size field (see above).

Note: The Minimum Height field uses the units you selected for height on the Units page of the Preferences Window. The Minimum DBH field uses the units you selected for distance there. Minimum Age has no specific units as far as VNS is concerned. Minimum Closure is expressed as a percent normally varying between 0 and 100 but may be higher if desired.

If you select the Second Size is Min (Minimum) Percentage on the General page, the second size field will be labelled Min Height (Percentage of Max), Min DBH (Percentage of Max), Min Age (Percentage of Max) or Min Closure (Percentage of Max). Enter the size you want for the smallest foliage in the Ecotype as a percentage of the Maximum Size field. When you render, VNS will place trees with a random mix of sizes from the Minimum Size percentage you specified in the Min Size (Percentage of Max) field up to the maximum size you specified in the Maximum Size field (see above).

If you select the Second Size is Plus or Minus Percentage on the General page, the second size field will be labelled Height Range (Plus or Minus Percentage), DBH Range (Plus or Minus Percentage), Age Range (plus or minus percentage) or Closure Range (plus or minus percentage). Enter the size you want for the largest and smallest foliage in the Ecotype as a percentage above and below the value in the Mean Size field. When you render, VNS will place trees with a random mix of sizes ranging above and below the value you specified in the Mean Size field (see above).

You can also adjust the size for each Group on the Groups page and for each Foliage Object on the Objects page.

Ecotype Density Section

The Ecotype Size & Density section's density fields are available if you select the Absolute Density is in Ecotype radio button on the General page (see above).

Note: These fields let you adjust foliage densities for the entire Ecotype. You can further adjust foliage densities for each of the Ecotype's image groups on the Groups page, and for individual Foliage Objects on the Objects page (see below).

Depending on the Density Method you choose on the General Page (see above) and whether you choose Density is per Polygon or per Unit Area you will see different controls in the Size & Density page's density fields. All have the same purpose - to let you specify the number of foliage items to be drawn in a given area of land.

VNS lets you choose whether to have the foliage density be linked to the polygon density for more efficient rendering or be a constant across the terrain. Polygon density is increased near the Camera when you render with Variable or Fractal Maps options on the Terrain Parameter Editor.

The Ecotype page's Density Field works differently depending on whether you select the "Density is per Polygon" or "Density is per Unit Area" radio button on the General page.

If the Density is per Unit Area radio button selected on the General page, the Density you set in the Density field is the actual number of foliage stems per unit or the actual basal area per unit or the actual crown closure. You can select the kind of unit from the Area Units drop box on the General page. To save rendering time, enter the lowest Density value that gives you the look you want.

If the Density is per Unit Area and the Area Units is Acre, the Density field will either be labelled Density (Stems per Acre), Basal Area (BA per Acre) or Crown Closure (percentage). These labels correspond with the Density Method selections Number of Stems, Basal Area plus DBH or Crown Closure plus Size, respectively.

Density (Stems per Unit) Field

Use the Density (Stems per Unit) field to specify the actual average number of foliage items to be drawn within a typical area of Unit size. So if you enter 100 and the areal units are acres the result would be approximately 100 foliage items in a one acre parcel of land. For smaller areas, fewer items will be drawn and conversely larger areas will contain more.

Keep in mind that you are telling the average number to draw. There will be some random variation from one unit parcel to another and the items will be placed randomly within the area. There may be some places where items are very close together and other places where they are farther apart leaving natural looking gaps. You can gain more control over the arrangement by using a patterned texture to modify density (see below).

Density (Stems per Unit) field is only visible if the Density Method on the General page is Number of Stems.

Basal Area (BA per Unit) Field

Use the Basal Area (BA per Unit) field to specify the average amount of basal area of trunk to be used in calculating the actual average number of foliage items to be drawn within a typical area of Unit size. Basal Area will be combined with the diameter (DBH) specified for the area to make the calculation. If you have not chosen Diameter (DBH) for your Size Method on the General page, you will need to specify the DBH as well.

Enter a value for the Basal Area (BA per Unit) field in the units you selected for basal area in the Basal Area Units drop box to the right.

Basal Area (BA per Unit) field is only visible if the Density Method on the General page is Basal Area plus DBH.

Basal Area Units Drop Box

Use the Basal Area Units drop box to specify the units that basal area is measured in. This will probably be a different unit from the Area Units on the General page although it doesn't have to be. Be sure to set this correctly as it can have a very large effect on the number of foliage items drawn. Incorrect values can cause extremely high foliage densities and very slow rendering.

Basal Area Units drop box is only visible if the Density Method on the General page is Basal Area plus DBH.

Diameter (DBH) Field

Use the Diameter (DBH) field to specify the average trunk diameter to use in calculating the number of foliage items to draw in a given unit area. Diameter is part of the formula for converting basal area into number of stems. DBH stands for Diameter at Breast Height, a standard height above the ground for measuring tree diameters.

Enter a value for the Diameter (DBH) field in the units you selected for distance on the Units page of the Preferences Window.

Diameter (DBH) field is only visible beneath the Basal Area (BA per Unit) field if the Density Method on the General page is Basal Area plus DBH and the Size Method is not Diameter (DBH). If the Size Method is Diameter (DBH) then the size control DBH values will be used to compute density in conjunction with the basal area (see Ecotype Size Controls above).

Crown Closure (Percentage) Field

Use the Crown Closure (Percentage) field to specify the average amount of crown closure for this Ecotype. Crown Closure is a measure of the percentage of an area that has foliage directly overhead. The remaining area is open to the sky.

Enter a value for the Crown Closure in percentage. The normal range is from 0 to 100 but you may use larger values if you wish to achieve the proper appearance.

Crown Closure (Percentage) field is only visible if the Density Method on the General page is Crown Closure plus Size.

The way crown closure is used is VNS first determines the average foliage size for an area that is about to be drawn. Then from the size and the average width to height ratio of all the images or 3d objects that represent the Ecotype or Foliage Group (depending on whether the Absolute Density is in the Ecotype or Foliage Group), the number of foliage stems to be drawn for that area is calculated using a standard formula.

Note: Because foliage items are drawn in random positions there may be more overlap between items than would normally occur in nature. Therefore a specification of 100% crown closure will probably result in gaps between foliage items which would not be there if

items were evenly spaced throughout the area. To compensate for that you may wish to use two or three times the amount of crown closure to achieve the correct look for the foliage density. If you are using a Thematic Map to control crown closure you can set a multiplier value of 2 or 3 in the Thematic Map's Data page to adjust your database values appropriately.

To see the result of your density settings, render a final image from the Render Control Window.

Note: Preview renderings may not show densities accurately if your View is significantly smaller than the final rendered image size you set in the set of Render Options you're using in the Render Job. This is especially true if you are using Image Object Distance Dissolve (see below) with Common Distance Dissolve set to Absolute Pixels.

If the Density is per Polygon radio button selected on the General page, the Density field lets you specify the percentage of polygons that will be covered with the Ecotype. Enter an integer value between 0 and 100 percent or use the arrow buttons to change the value. A value of zero will cause no trees or textures to be rendered for the given Ecotype. A value of 100 will cause a tree or texture to be applied at all polygon sites where the Ecotype appears.

Note: With the Density is per Polygon radio button selected, the more polygons you have, the more trees you will have. You can increase the polygons available during rendering by increasing the Fractal Depth in the Terrain Parameter Editor. To see how it all works out you'll have to render an image.

Increase the Density value if you want to see more trees from the Ecotype. If the Ecotype is an Overstory, lower values will leave more bare spots where the Understory Ecotype can show through.

Controlling Density with a Texture

If you want to control density with a texture, click the Texture Operations Icon next to the field for the variable you want to control, which in this case is Ecotype Density.

Select the Create Texture command from the Texture Operations Icon's commands and VNS will create a new texture and open the Texture Editor. There you can edit your texture to control the variable. Wherever the Texture is white, you'll have the full density using the value you set in the Density field. Wherever the texture is gray you'll have less density and where it is black you'll have no density. This is a good way to make naturally clumpy groups of foliage.

Controlling Density with a Thematic Map

If you want to control density with a Thematic Map, click the Thematic Map Operations Icon next to the field for the variable you want to control, which in this case is Ecotype Density.

Select the Create Thematic Map command from the Thematic Map Operations Icon's commands and VNS will create a new Thematic Map and open the Thematic Map Editor. There you can select one or more Vector attributes to control the variable. In this case the density value will be inherited from the Vector attribute you select. The attribute value comes from the Ecosystem's attached Vector. This is a good way to let your GIS data control actual foliage density in VNS.

Foliage Group Controls

The following controls appear when the selected item in the Material Foliage List is a Foliage group:

Load Foliage Group Icon

Click the Load Foliage Group icon to open the Component Gallery where you can load a Foliage Group Component.

Save Foliage Group Icon

Click the Save Foliage Group icon to open the Component Signature Window where you can save the selected Foliage Group as a Component for use in other Projects.

Name Field

Whenever you create a Foliage Group VNS asks you for a name. You can change the name of a Foliage Group by selecting it in the Foliage Group list and changing it in the Name field.

Group Enabled Checkbox

Select the Group Enabled checkbox to make the Group available for rendering. Deselect it if you want to disable the Group for rendering.

Group Size Controls

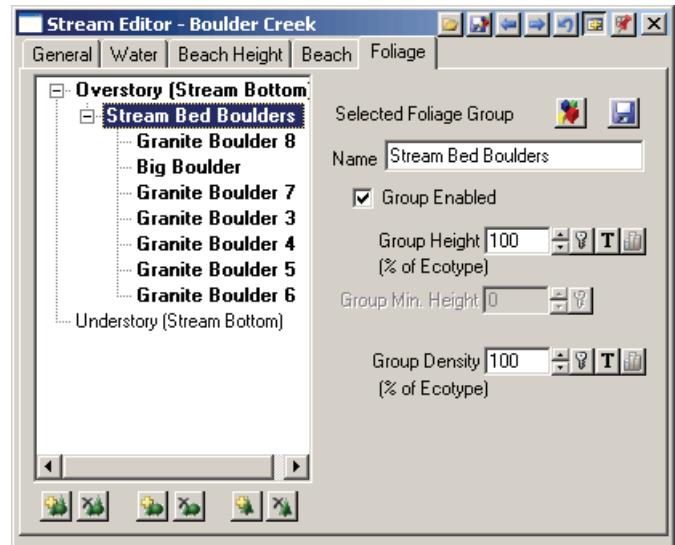
Each Foliage Group has its own size specification. This determines how large the Foliage Objects in the Group are compared to other Foliage Groups in the Ecotype. You can also adjust the relative size of each Foliage Object in the Group on the Parameters sub-page for the selected Foliage Object (see below). This gives you tremendous flexibility to customize an Ecotype.

Note: If you don't care for subtleties, just select the "Absolute Size is in Ecotype" radio button on the General page, leave all the group heights set to 100% on the Parameters sub-page for Foliage Groups and Foliage Objects and modify the values on the Parameters sub-page for the Ecotype to get the right look.

If you selected the "Absolute Size is in Ecotype" radio button on the Settings sub-page, you'll control the actual size of the Foliage Group's foliage using one of the Maximum or Mean Size fields on the Settings sub-page. You can then set the relative size of each Foliage Group here with the Group Height field as a percentage of the Ecotype's Maximum Size.

If you selected the "Absolute Size is in Foliage Group" radio button on the General page, you'll control the actual size of each Foliage Group directly instead of setting each group as a percentage of the Ecotype Size. VNS will disable the Ecotype Size controls and you can directly set a Group Size and a secondary size for each Foliage Group on the Parameters sub-page.

For a more detailed explanation of all the possible configurations you might see in the Group Size section see the section above for Ecotype Size Controls. When you select the "Absolute Size is in Foliage Group" radio button on the General page, all of the controls and options described in Ecotype Size Controls on the Ecotype page will be disabled and will instead appear in the Group Parameter sub-page.



There may also be additional buttons here to allow you to edit a diameter/height graph or an age/height graph depending on the Size Method you have chosen. Each Group can have its own different graph.

Second Size Field

The second Size field lets you control Minimum Size, Minimum Size (Percentage of Max) or Size Range (Plus or Minus Percentage) depending on your Second Size radio button selection on the General page (see above). Exactly what the labels say depends also on the Size Method selected on the Settings sub-page (see above). Second Size Field is only available if Absolute Size is in Foliage Group.

If you select the Second Size is Absolute Min (Minimum) on the Settings sub-page, the second Size field will be labelled Group Minimum Height, Group Minimum DBH, Group Minimum Age or Group Minimum Closure. Enter the size you want for the smallest foliage in the Foliage Group. When you render, VNS will place trees with a random mix of sizes from the Group Minimum Size you specified in the Minimum Size field up to the Maximum Size you specified in the Group Maximum Size field (see above).

Note: The Group Minimum Height field uses the units you selected for height on the Units page of the Preferences Window. the Group Minimum DBH field uses the units you selected for distance on the Units page of the Preferences Window.

If you select the Second Size is Min (Minimum) Percentage on the Settings sub-page, the second Size field will be labelled Group Min Height (Percentage of Max), Group Min DBH (Percentage of Max), Group Min Age (Percentage of Max) or Group Min Closure (Percentage of Max). Enter the size you want for the smallest foliage in the Foliage Group as a percentage of the Group Maximum Size field. When you render, VNS will place trees with a random mix of sizes from the Group Minimum Size percentage you specified in the Group Min Size (Percentage of Max) field up to the Maximum Size you specified in the Group Maximum Size field (see above).

If you select the Second Size is Plus or Minus Percentage on the Settings sub-page, the second Size field will be labelled Group Height Range (Plus or Minus Percentage), Group DBH Range (Plus or Minus Percentage), Group Age Range (Plus or Minus Percentage) or Group Closure Range (Plus or Minus Percentage). Enter the size you want for the largest and smallest foliage in the Foliage Group as a percentage above and below the value in the Group Mean Size field. When you render, VNS will place trees with a random mix of sizes ranging above and below the value you specified in the Group Mean Size field (see above).

If you wish you can control the group's size with a Thematic Map or a texture. See the Ecotype Size Controls section above for more details. Each Foliage Group can have its own size texture or Thematic Map. It can be very useful to drive the size of each group separately from a different database attribute depending on the design of your database. Thematic Maps can be used to adjust group relative percentages too if the Absolute Size is in Ecotype. In that case the Thematic Map should generate values of percentage ranging from 0 to 100. Otherwise Thematic Maps should generate values in meters of height or diameter. Age has no specific units. Closure should generate values of percentage from 0 to 100, or higher if needed.

Group Density Percentage Controls

Each Foliage Group has its own density specification. This determines how often the object is repeated compared to other Foliage Objects in the Ecotype. You can also adjust the density of each Foliage Object in the Group on the Parameters sub-page for the selected Foliage Object (see below). This gives you tremendous flexibility to customize an Ecotype.

Note: If you don't care for subtleties, just select the "Absolute Density is in Ecotype" radio button on the Settings sub-page, leave all the densities set to 100% on the Parameters sub-page for Foliage Groups and Foliage Objects and tweak the values on the Ecotype page to get the right look.

If you select the Absolute Density is in Foliage Group radio button on the Settings sub-page (see above) you can then set the absolute density of each Foliage Group on the Parameters sub-page.

If you select the Absolute Density is in Ecotype radio button on the Settings sub-page you can then set the density of each Foliage Group as a percentage of the Ecotype's overall density.

In either case you can set the density of individual Foliage Objects on the Objects page as a percentage of the Group's density.

VNS lets you choose whether to have the foliage density be linked to the polygon density for more efficient rendering or be a constant across the terrain. Polygon density is increased near the Camera when you render with Variable or Fractal Maps options on the Terrain Parameter Editor. For forestry work you will almost always use Density is per Unit Area for timber ecotypes. For understorey vegetation you might prefer to use Density is per Polygon for speedier rendering where the density is not very critical.

The Parameters sub-page's Group Density fields work differently depending on whether you select the "Density is per Polygon" or "Density is per Unit Area" radio button on the General page.

If you selected the "Absolute Density is in Ecotype" radio button on the Settings sub-page, you'll control the actual density of the Foliage Group's foliage using one of the density fields on the Parameters sub-page. You can then set the relative density of each Foliage Group here with the Group Density field as a percentage of the Ecotype's Density.

If you selected the "Absolute Density is in Foliage Group" radio button on the Settings sub-page, you'll control the actual density of each Foliage Group directly instead of setting each group as a percentage of the Ecotype Density. VNS will disable the Ecotype Density controls and you can directly set a Group Density for each Foliage Group on the Parameters sub-page.

For a more detailed explanation of all the possible configurations you might see in the Group Density section see the section above for Ecotype Density Controls. When you select the "Absolute Density is in Foliage Group" radio button on the Settings sub-page, all of the controls and options described in Ecotype Density Controls on the Ecotype page will be disabled and will instead appear in the Parameters sub-page for the selected Foliage Group. There may also be additional controls here to allow you to select special units such as for basal area.

To see the result of your density settings, render a final image from the Render Control Window.

Note: Preview renderings may not show densities accurately if your View is significantly smaller than the final rendered image size you set in the set of Render Options you're using in the Render Job. This is especially true if you are using Image Object Distance Dissolve (see below) with Common Distance Dissolve set to Absolute Pixels.

If the Density is per Polygon radio button selected on the Settings sub-page, the Group Density field lets you specify the percentage of polygons that will be covered with the Foliage Group. Enter an integer value between 0 and 100 percent or use the arrow buttons to change the value. A value of zero will cause no trees or textures to be rendered for the given Group. A value of 100 will cause a tree or texture to be applied at all polygon sites where the Group appears.

Note: With the Density is per Polygon radio button selected, the more polygons you have, the more trees you will have. You can increase the polygons available during rendering by increasing the Fractal Depth in the Terrain Parameter Editor. To see how it all works out you'll have to render an image.

Increase the Group Density value if you want to see more trees from the Foliage Group. If the Ecotype is an Overstorey, lower values will leave more bare spots where the Understorey Ecotype can show through.

If you wish you can control the group's density with a Thematic Map or a texture. Thematic Maps should generate values of percentage ranging from 0 to 100.

Foliage Object Controls

Image Object or 3D Object Radio Buttons

These radio buttons let you select whether the selected Foliage Object should be an Image Object or a 3D Object.

If you select the Image Object radio button, VNS will show the Image Object section at the bottom of the Objects page (see below). There you can select an Image Object and adjust its properties.

If you select the 3D Object radio button, VNS will show the 3D Object section at the bottom of the Objects page (see below). There you can select a 3D Object and adjust its properties.

Enabled Checkbox

The Enabled checkbox lets you enable or disable the selected Foliage Object for rendering. Disabled Foliage Objects are shown in gray in the Foliage Objects list.

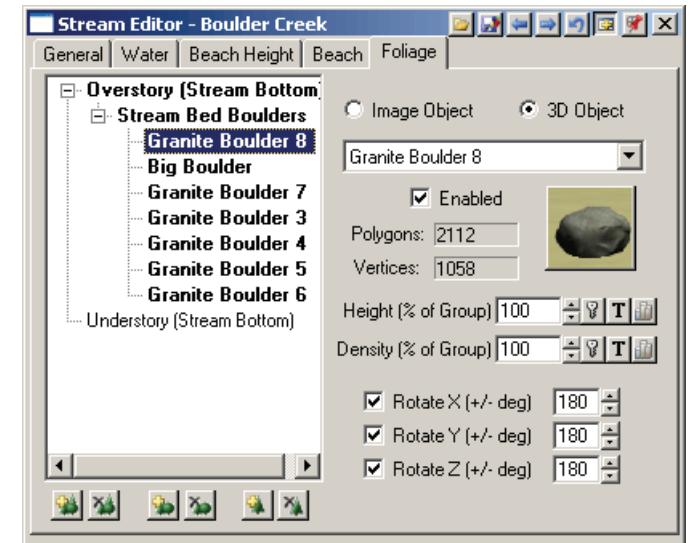


Image Object Options

Image Object Drop Box

Select an Image Object in the Image Object drop box. VNS will replace the selected Foliage Object in the Foliage Objects list (see above) with the Image Object you choose.

If you want to load a new Image Object, select "New Image Object." VNS will open a file requester where you can select a new Image Object. Image Objects can be images or image sequences in any supported format (see Image Loading and Saving).

Width, Height and Image Bands Display Fields

The Width, Height and Image Bands display fields show the pixel dimensions and number of 8-bit image bands of the Selected Image Object.

Thumbnail

The Thumbnail shows a small version of the selected Image Object. You can double-click it if you want to see the full version.

Random Flip X Checkbox

Select the Random Flip X checkbox to have VNS randomly reverse the Image Object from left-to-right during rendering. This will give you more variety in the foliage since the selected Image Object will appear in different places in normal and reversed versions.

Apply 3D Shading Checkbox

Select the Apply 3D Shading checkbox to tell VNS to shade the Image Object based on the direction of the light. This will give foliage a more 3-dimensional appearance.

Replace Gray Color Controls

By using unique colors for a Group of images or even individual Foliage Objects you can create a scene of nearly unlimited color variety. You can animate colors to create a kaleidoscopic landscape. Change the color of maple trees first, then the birches followed by the oaks and leave the conifers green, and voila - New England in October.

Each Image Object has its own color specifications. The color for each image can come from the Image Object itself or from a color. If it comes from a color, you can animate that color. You can edit the colors for the selected Image Object by clicking the Replace Gray color well to open the Color Editor.

Note: This only works for gray scale images, or images that have been set to gray scale in the Image Object Library. If the Image Object contains a color image and it has not been changed to gray scale in the Image Object Library, the Replace Gray color well will be disabled.

You can change the Gray Replacement Color for a gray-scale Image Object independently at any time or leave it with the color it inherited when you added the Image Object.

Note: Gray Scale Images require 1/3 the amount of memory that 24 bit color images require when rendering.

Height Percentage Controls

Each Foliage Object has its own height specifications. These determine how tall the object is compared to other objects in the Ecotype.

The Height Percentage field for the currently selected Foliage Object is a percentage of the number entered in the Group Height field for the Foliage Group on the Groups page (see above).

If you wish you can control the object's height with a Thematic Map or a texture.

Density Percentage Controls

Each Foliage Object has its own density specifications. These determine how often the object is repeated compared to other Foliage Objects in the Ecotype.

Density of coverage for a Foliage Object is based on its Density within its group (set with the Density Percentage field for the selected Foliage Object), the group's Density in the Ecotype (set with the Group Density field on Group page for the selected Group).

If you wish you can control the object's density with a Thematic Map or a texture.

Back Light Percentage Field

The Back Light Percentage field lets you allow light to shine through backlit Image Object foliage. The default value is 25%. You can set it higher than 100%.

Use the Back Light Percentage when the Camera is looking into the light and the foliage looks too dark. It allows light to be transmitted through the leaves. This will brighten the foliage and increase color saturation. The result can be much more realistic small vegetation when the vegetation is backlit.

You can adjust the Back Light Percentage individually for any Foliage Object by selecting it in the Foliage Objects list and changing the value in the Back Light Percentage field. You can increase the Back Light percentage to brighten objects that are between the Camera and a light. Decrease it if you want a silhouette effect.

Apply to Group Button

Click the Apply to Group button if you want to set the Back Light Percentage of all members of the Group to be the same as the value in the Back Light Percentage field (see above). This is much faster than setting the Back Light Percentage individually for each member of the Group.

If the Back Light Percentage for the current Foliage Object has key frames, they will also be copied to the other members of the Group.

3D Object Options

Rotate X, Y and Z Checkboxes and Fields

The Rotation controls let you add random rotation to the current 3D Object. Select a checkbox and enter a value and VNS will randomly rotate the object along that axis every time it places it on a Vector vertex, within the rotation limit you set.

The X axis runs east to west. A positive X axis is to the east. The Y axis runs vertically. A positive Y axis is up. The Z axis runs north to south. A positive Z axis is to the north.

Enter a number in the X Field to rotate the 3D Object around the X axis. Enter a number in the Y Field to rotate the 3D Object around the Y axis. Enter a number in the Z Field to rotate the 3D Object around the Z axis.

A value of zero in any field means no rotation for that axis.

Polygons, Vertices and Materials Display Fields

The Vertices display field shows the number of vertices in the current 3D Object. The more vertices there are, the longer it will take to render. VNS does not impose a limit to the number of vertices an object may have, other than the limit imposed by the available memory on your system.

The Polygons display field shows the number of polygons in the current 3D Object. The more polygons there are, the longer it will take to render. VNS does not impose a limit to the number of polygons an object may have, other than the limit imposed by the available memory on your system.

The Materials display field shows how many materials there are in the current 3D Object. A Material is a texture applied to groups of polygons within the object. For example, a car object may have a body Material, a bumper Material, a tire Material and a glass Material. You can edit the properties of each Material using the 3D Material Editor.

Height Percentage Controls

Each Foliage Object has its own height specifications. These determine how tall the object is compared to other objects in the Ecotype.

The Height Percentage field for the currently selected Foliage Object is a percentage of the number entered in the Group Height field for the Foliage Group on the Groups page (see above).

If you wish you can control the object's height with a Thematic Map or a texture.

Density Percentage Controls

Each Foliage Object has its own density specifications. These determine how often the object is repeated compared to other Foliage Objects in the Ecotype.

Density of coverage for a Foliage Object is based on its Density within its group (set with the Density Percentage field for the selected Foliage Object), the group's Density in the Ecotype (set with the Group Density field on Group page for the selected Group).

If you wish you can control the object's density with a Thematic Map or a texture.

Terraffector Editor

The Terraffector Editor lets you control Terraffectors. It gives you common controls that affect all the Terraffectors you may have in a Project, along with a set of controls that apply to only a single Terraffector.

What is a Terraffector?

A Terraffector lets you alter the shape of the terrain along a Vector Object. The terrain along the Vector will take the shape defined by a Cross Section Profile. This makes it easy to create things like roads, runways, dams, railroad beds and more.

Terraffectors are linear Effects. If you want to change the terrain of an area inside a Vector, try using an Area Terraffector instead (see Area Terraffector Editor).

Terraffectors will change the geometry of the underlying DEM at render time. Terraffectors do not change the geometry of the DEM files themselves. This non-destructive behavior lets you experiment freely with Terraffectors without risking the integrity of the actual DEM data.

Vectors to which you apply Terraffectors may overlap. You can apply the same Terraffector to any number of Vector Objects.

Editing an Existing Terraffector

To open the Terraffector Editor, double-click the name of the Terraffector in the Scene-At-A-Glance.

The Terraffector Editor will open, ready to edit the selected Terraffector.

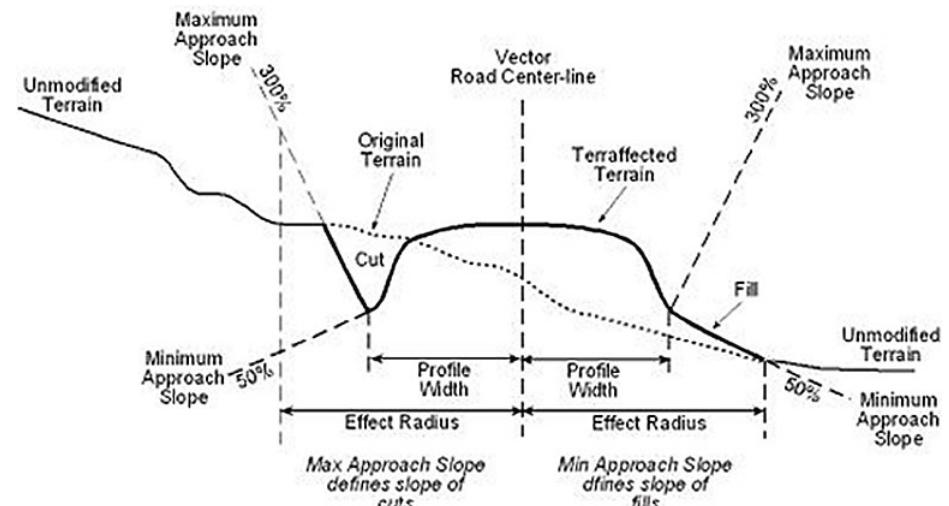
Creating a New Terraffector

To create a new Terraffector, select the Terraffector category in the Scene-At-A-Glance. Then click the "Add or Clone Selected Item" icon. The Terraffector Editor will open, ready to edit the new Terraffector.

To apply the Terraffector to a Vector, create a Vector and drag it onto the Terraffector in the Scene-At-A-Glance.

To apply multiple Vectors to a Terraffector, select the Vectors in the Database Editor's Objects list. Select your new Terraffector in the Effect Library's Current Project Effects list. Click the Apply to Object(s) button in the Effects Library. You'll see the name of the Terraffector added to the "Components attached to active Object" list on the Database Editor's Comp page.

To create a Terraffector and Vector at the same time, click the Terraffector category in the Scene-At-A-Glance and click the Create icon to open the Create Palette Window. Change the Create Palette settings if you wish, then digitize the Vector in any View or combination of Views. Right click to end digitizing and VNS will ask you for a name. Then VNS will ask if you want to create the new Vector and attached



Traffector. Click OK and WSC will open the Component Gallery in case you want to use a pre-made Traffector, and the Traffector Editor ready to edit the new Traffector.

Click the Edit Section Profile button on the Traffector Editor to open the Effect Profile Editor. VNS will project the Cross-section Profile along the Vector when it calculates the Traffector during rendering. This lets you control the shape of the terrain along the Vector.

You will not see the Traffector's terrain changes in Views unless you render a preview.

It's easy to change your mind. At any time you can edit the Profile, open a different Traffector Component, choose a different Traffector for the Vector, edit the Vector Object, apply the Traffector to one or more other Vectors, or make other changes.

If you use a Point Vector Style (point square circle or cross) the Vector will work with Traffectors as individual points rather than as one or more connected lines. You can use this to make craters. For example, a 27 point vector set to a Point Vector Style will now make 27 craters instead of a single long Traffector. Use the Style drop box on the Database Editor's Properties page to set the style for a Vector Object.

General Page

Common Traffector Controls

The Common Traffector Controls apply to all Traffectors. Changing them in any Traffector editor will change them for all the Traffectors in the current Project.

Freeze All Button

Clicking this button will bring up a requester asking for a DEM prefix. Since "freezing" Traffectors into your terrain model will edit the underlying terrain mesh, entering a prefix when prompted (the default is FRZ) will save the new DEMs to new filenames. Leaving the requester blank will cause your original DEMs to be overwritten.

Once confirmed, VNS will "embed" all enabled Traffectors into the terrain model.

General Features

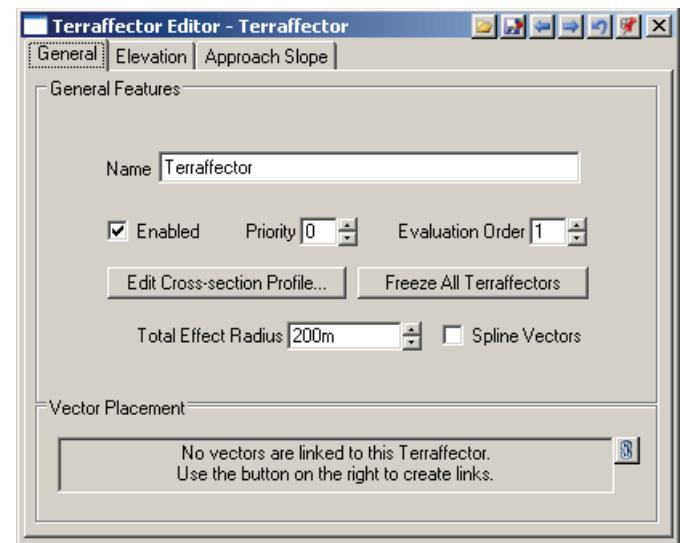
Name Field

Use the Name field to name the current Traffector.

If you select an existing Traffector and click the Create New Effect button to create a new Traffector, VNS will name the new Traffector with the same name, but with a number appended to the end. If there was already a number at the end of the name of the original Traffector, VNS will increment the number. This ensures that the new Traffector will have a different name.

Enabled Checkbox

The Enabled checkbox lets you enable or disable the Traffector for rendering.



If you disable a Terraffector it will not lose its parameter values. It may be useful to temporarily disable a particular Terraffector to see how the terrain looks without it, or to speed preview rendering.

Disabling an object can be useful to speed up rendering if you are doing test renders to check some other aspect of your scene and don't need to see the Terraffector. Make sure you remember to enable it for the final rendering if you want to see it.

Note: To see the Terraffector in your rendering, it must be visible to the Camera you selected for the Render Job you are using (see Render Job Editor), and Terraffectors must be enabled in the Render Options you are using (see Render Options Editor).

Priority Field

The Priority field and buttons let you specify the rendering priority of a Terraffector when it overlaps another Terraffector.

The Terraffector with the highest priority will be rendered when Terraffectors overlap. VNS will only consider Terraffectors of the highest priority found at any location. VNS will not average results between Terraffectors of different priorities.

If there are overlapping Terraffectors at the same priority, VNS will mix them equally.

Evaluation Order Field

Use the Evaluation Order field to tell VNS what order to render Terraffectors that are at the same priority. This only matters where Terraffectors of the same priority overlap.

Think like a contractor. If you were a contractor, what would you build first? The last Terraffector built will be modifying terrain that has already been modified by the one before it.

Imagine building an actual golf course green with a pathway along the edge. You would want to build the golf course green first, then add the path. If you are modeling this in VNS, you need to tell VNS to build the green first and then the path. In this case you would give the green a higher Evaluation Order value so VNS builds it first.

If you have ecosystems attached to the Terraffectors, the Terraffector that gets evaluated last should be the one with the ecosystems you want to see rendered on the terrain.

Each terraffector may specify an ecosystem and an amount of terrain roughness either for individual profile segments or for the approach slope. Where Cross-section Profile segments of the same priority are found, the last one evaluated will contribute its ecosystem. If the last effect evaluated has no ecosystem then the one before it will prevail, and so on.

Edit Cross-section Profile Button

Click the Edit Cross-section Profile button to open the Cross-Section Profile Editor ready to edit the Profile used by the Terraffector.

The Profile determines the shape the Terraffector will add or subtract from the terrain

Total Effect Radius Field

The Total Effect Radius is the maximum distance either side of your controlling vector to which your Terraffector can cause an effect. The Total Effect Radius is measured from the start of the Cross-section Profile. It includes the Cross-section Profile area but doesn't affect the Cross-section Profile area. However, it can stretch beyond the Profile to create an Approach Slope region.

For the area that falls inside the Total Effect Radius but is beyond the Cross-section Profile, the terrain's slope will be limited to be within the Approach Slope Max and Min Percentages (see above). Based on those slopes VNS will calculate maximum and minimum elevations in the radius area, creating a wedge shape from the edge of the Profile to the edge of the radius.

Beyond the Total Effect Radius, the existing terrain will be unchanged.

Note: If you notice very steep cliffs parallel to a Terraffector, they are probably caused by a Total Effect Radius that is too small. If you don't want cliffs, make the Total Effect Radius larger until they go away, or increase the Max and decrease the Min approach slope. Don't set the Total Effect Radius larger than it needs to be or you will unnecessarily increase rendering time and waste memory during rendering.

Spline Vectors Checkbox

Select this checkbox if you wish VNS to base your terraffector on a splined version of your controlling vector(s). This can give much smoother results than using normal segment based vectors, but since the spline is interpolated from the points in the original vector, it's path may be subtly different from the that of the original vector.

Vector Placement Section

By attaching Vectors to Terraffectors you can control where they appear. Vectors can be dynamically linked with Search Queries or hard linked.

Vector Links Button

This control allows you to perform various tasks relating to the association of vectors with components. To learn how to use it, see Vector Links Icon.

Attached Hard-Linked Vectors Display

The Hard-Linked Vectors display tells you if there are any Vectors hard-linked to the Component, and if so, how many. It will also display vectors attached by Search queries and list the names of the search query or queries in use.

Elevation Page

Elevation Controls

Elevation Type Radio Buttons

Absolute Elevation Radio Button

Choose Absolute Elevation when you want to set a Terraffector's Cross-section Profile to an absolute elevation in the Cross-Section Profile Editor.

Relative to Ground Radio Button

Choose Relative to Ground when you want the Cross-section Profile elevations in the Cross-Section Profile Editor to be above and below the existing terrain.

Relative to Vector Radio Button

Choose Relative to Vector when you want the Cross-section Profile elevations in the Cross-Section Profile Editor to be above and below the elevation of the Vector Object to which the Terraffector is attached.

Apply To Radio Buttons

The Apply To radio buttons let you choose whether the Terraffector will make its elevation changes to the original DEM elevations or if it will take other Terraffectors into account.

The Apply To radio buttons only matter for terraffectors that have a Relative to Ground Elevation Type. They have no effect if the Elevation Type is Absolute or Relative to Vector.

The height of terrain in the region of a Relative to Ground Terraffector is determined by evaluating the Terraffector's cross-section profile and adding it to the terrain elevation.

Unmodified Terrain Radio Button

Use the Unmodified Terrain radio button to tell VNS to add the Terraffector's Cross-section profile elevations to the original unmodified terrain, ignoring other Terraffectors.

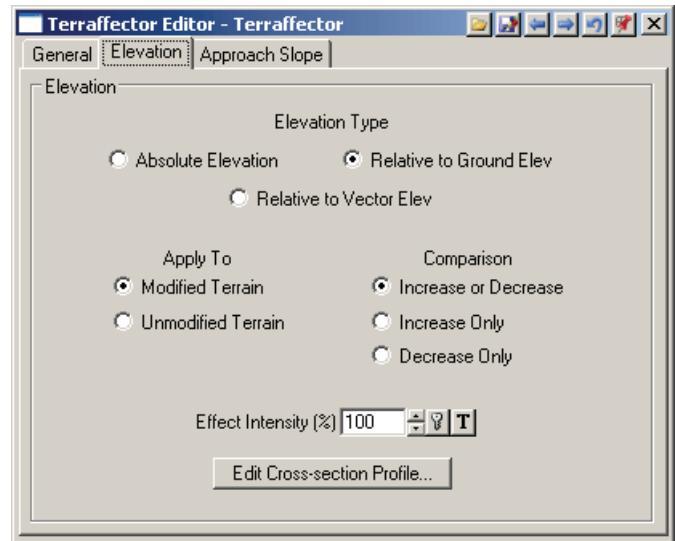
Modified Terrain Radio Button

Use the Modified Terrain radio button to tell VNS to add the Terraffector's Cross-section profile elevations to the elevations resulting from any Terraffectors or Area Terraffectors applied before it.

Note: If you want other Terraffectors previously applied to the terrain to be affected by the selected terraffector, make sure you set the order of evaluation appropriately (see the Evaluation Order field above). Linear Terraffectors are always applied after Area Terraffectors.

Comparison Radio Buttons

A Terraffector can raise the terrain, lower the terrain or both.



Increase Only Radio Button

Select the "Increase Only" radio button if you want VNS to apply the Terraffector only where it will raise the terrain. VNS will ignore the Terraffector where it would have otherwise lowered the terrain. This is great for dams or dikes.

Decrease Only Radio Button

Select the "Decrease Only" radio button if you want VNS to apply the Terraffector only where it will lower the terrain. VNS will ignore the Terraffector where it would have otherwise raised the terrain. This is great for stream beds or canals.

Increase or Decrease Radio Button

Select the "Increase or Decrease" radio button if you want VNS to apply the entire Terraffector. This is great for roads that build up over low spots and dig through high spots.

Effect Intensity Percentage Field

The Effect Intensity percentage field lets you adjust the amount of the Cross-section Profile changes actually applied to the terrain.

If a Terraffector's Cross-section Profile would change the elevation by 100m and the intensity is set to 10% then it will only change it by 10m. That may affect whether the resulting elevation is above or below the terrain, so depending on the comparison type this may change whether it gets applied at all.

Effect Intensity Percentage Texture Controls

You can use a Texture to control the Effect Intensity. This lets you vary the Terraffector's effect across the terrain to create a more natural irregularity.

The texture is multiplied by the value in the Effect Intensity field. That value is then multiplied by the elevation changes in the Cross-section Profile.

For example, suppose you have a terraffector which at some point in its profile wants to make the elevation 100 meters below the existing terrain of 200 meters, a change of -100m. Let's say the intensity is set to 50% and there is a texture which when evaluated gives a result of 10% at some point along the Terraffector.

The final terraffector elevation at that point will be $200 - (100 * .5 * .1) = 195m$

- 1) If the Compare Type is Increase or Decrease then the resulting elevation will be 195m and the Terraffector's ecosystem and roughness will be applied.**
- 2) If the Compare Type is Increase Only then the resulting elevation will remain 200m and the Terraffector's ecosystem and roughness will not be applied.**
- 3) If the Compare Type is Decrease Only then the resulting elevation will be 195m and the Terraffector's ecosystem and roughness will be applied.**

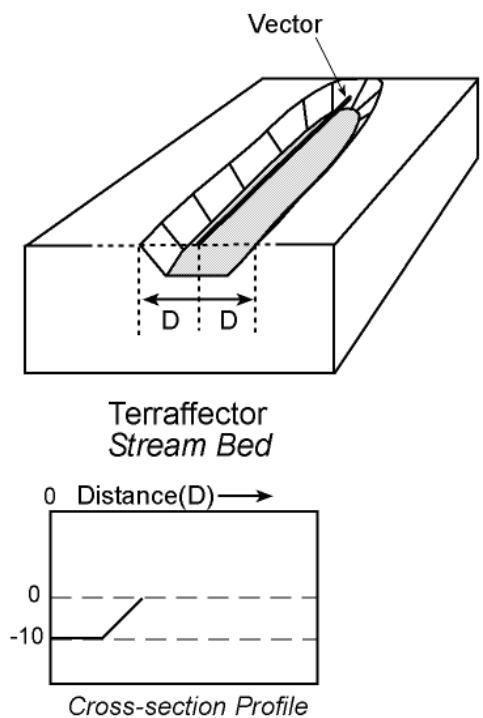
If at a different point everything else is the same but the texture evaluates to 90% then the resulting elevations in cases A, B and C would be 155, 200, 155. As you can see, the Terraffector elevations can change at different points due to the texture.

Modulating the Effect Intensity with a texture is useful to make an irregular stream channel that looks more like a stream and less like a ditch. Texture modulation can also make more natural looking earthen walls, 4-wheel drive roads and anything else where you want some irregularity in the Terraffector. Careful use of this technique allows you to make terraffectors that are not symmetrical, i.e. that are different on the left and right side of the Vector centerline. There are several Terraffector components included with VNS that exhibit this technique should you wish to study them

Edit Cross-section Profile Button

Click the Edit Cross-section Profile button to open the Cross-Section Profile Editor ready to edit the current Profile used by the Terraffector.

The Profile determines the shape the Terraffector will add or subtract from the terrain:



Approach Slope Page

The approach slope is the area beyond the Cross-section profile used by the Terraffector but still within the Total Effect Radius (see below). The approach slope controls let you determine how VNS will change the terrain within this transition zone from the existing terrain to the Terraffected terrain. The Approach Slope area lets you merge the Terraffector into the surrounding terrain.

For the area that falls inside the Total Effect Radius but is beyond the Cross-section Profile, the terrain's slope will be limited to be within the Approach Slope Max and Min Percentages (see below). Based on those slopes VNS will calculate maximum and minimum elevations in the radius area, creating a wedge shape from the edge of the Profile to the edge of the radius.

Beyond the Total Effect Radius, the existing terrain will be unchanged.

Approach Slope Controls

Maximum Slope Limits Percentage Field

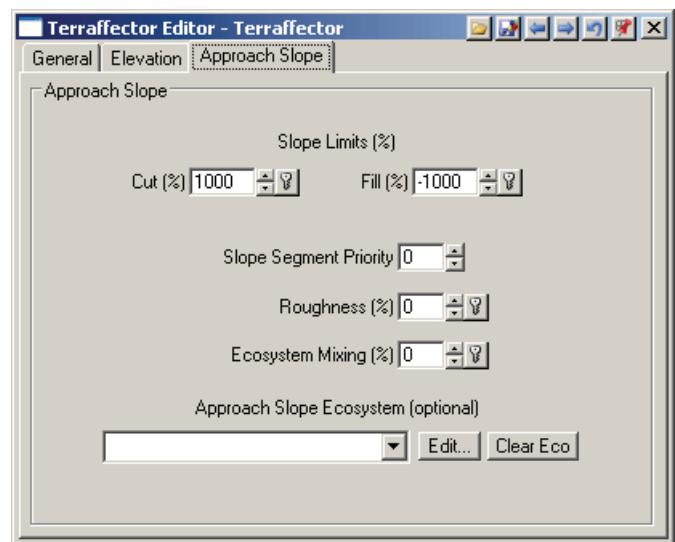
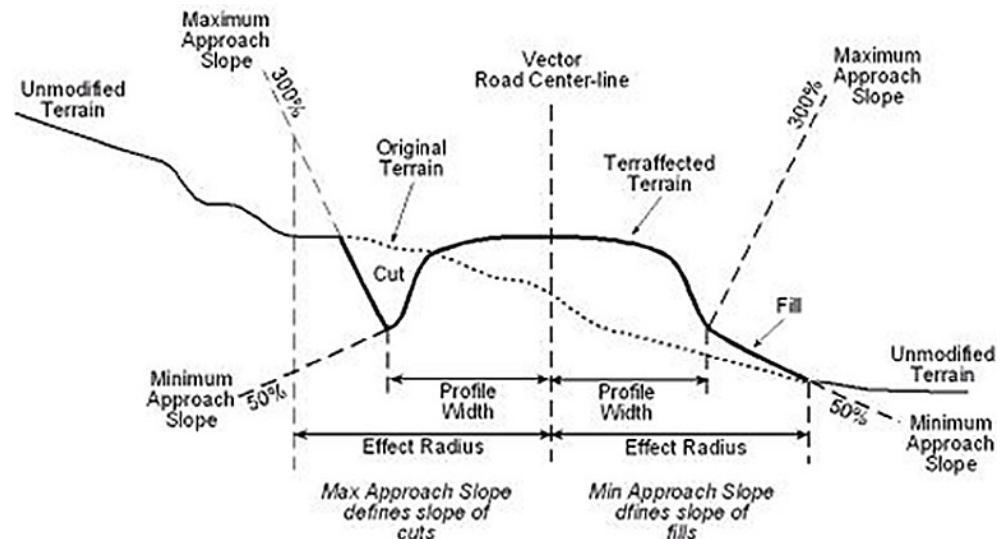
The Maximum Slope Limits percentage lets you define the slope of a "cut" as your Terraffector cuts through existing terrain. Maximum Slope Limits only come into play if the Terraffector is below the terrain. An example would be the slope beyond the shoulders of a road that cuts below existing terrain, like a Terraffector road going through a previously existing hill.

The Maximum Slope Limits percentage is the largest drop or rise you want to allow in the terrain between the outside edge of the Profile and the outside edge of the Effect Radius.

Slope percentage is rise over run. For example, one meter of elevation change for every one meter of distance would give you a rise over run of one divided by one, which equals 100 percent. That's the same as a 45 degree slope.

Minimum Slope Limits Percentage Field

The Minimum Approach Slope Limits percentage lets you define the slope of a "fill" as your Terraffector rises above existing terrain below. Minimum Slope Limits only come into play if the Terraffector is above the terrain. An example would be the slope beyond the shoulders of a road built above the existing terrain, like a Terraffector road raised over a previously existing flat area or valley.



The Minimum Slope Limits percentage is the smallest drop or rise you want to allow in the terrain over distance as you get farther from the Profile but are still within the Effect Radius.

Slope percentage is rise over run. For example, one meter of elevation change for every one meter of distance would give you a rise over run of one divided by one, which equals 100 percent. That's the same as a 45 degree slope.

Slope Segment Priority Field

Terraffectors of the same priority can have segments of all different priorities. At any give point there is a single segment priority for a Terraffector. If one Terraffector has a higher priority segment, that segment will be used.

The Slope Segment Priority will be compared to any other Approach Slope or Cross-section Profile segment during rendering.

When Terraffectors overlap, VNS will use the values from the Approach Slope or Cross-section Profile segment with the highest priority. If several segments overlap at same priority VNS goes through the Evaluation order and follows the Comparison and Apply To selections you made for each terraffector involved to determine how to combine them.

Note: VNS uses the Ecosystem from the last Terraffector applied that has an Ecosystem.

Within a given profile you may want to have some segments have higher priority than others so that terraffectors that are applied after them in the stack don't obliterate all features.

For example if you have two streets that intersect, you would not want the sidewalk of the second street to bury the pavement of the first street. You would probably want to have the gravel shoulder be lower priority than either pavement or sidewalk. And you would want the approach slope that ramps between the effect proper and the outlying terrain to have the lowest priority of all.

Here's how segment priority will be used:

- A) If the highest segment priority encountered at a point is found in only one terraffector then it alone will be applied at the point.
- B) If two or more of the highest segment priority are found then VNS will perform a weighted average. The weights will be based on the distance of the point from the inside edge of the profile segment. At the innermost end of a segment the weight will be 100%. At the outermost end of a segment the weight will fall off to 0%. If at the same point on the ground one segment has 100% weight and the other 0% then the elevation will be taken as the elevation of the first alone. If they both have a weight of 50% then they will be straight averaged, and so on. Thus the closer a point is to the inside edge of a segment the greater that segment's influence on the final elevation.

If there are more than two segments of the same priority at a point then, because of the rules of application order, the latest ones applied will have a greater effect and the effect of earlier ones will diminish. Here's a simple math example that demonstrates why that is the case:

Taking a straight average of the numbers 0, 10, 20, and 30 gives 15.

Adding two at a time and averaging like this

$$(0 + 10) / 2 = 5$$

$$(5 + 20) / 2 = 12.5$$

$$(12.5 + 30) / 2 = 21.25$$

gives a higher final value, closer to the last value applied. This underscores the importance of the evaluation order.

When any Terraffector segment is being evaluated and compared to the terrain elevation, it will always be compared against the results of those terraffectors applied before it. Even if it has a higher segment priority than those that came before. This only affects the elevation comparison to see if the Terraffector should be applied. Only where Cross-section Profile or Approach Slope segment priorities are the same will averaging between Terraffectors happen.

Roughness Percentage Field and Buttons

Approach Slope Roughness is a percentage of the Vertical Displacement value you set for the underlying DEM. It lets you make the area within the Approach Slope be smoother or rougher than the surrounding terrain.

Note: If the surrounding terrain has a Vertical Displacement of zero, this roughness value will have no effect. You can set the Vertical Displacement with the Terrain Parameter Editor.

The Approach Slope Roughness Percentage applies to any terrain that has its elevation changed by the Approach Slope Percentages (see above).

Use the Roughness Percentage field to specify a percentage of the Vertical Displacement from the Project. VNS will use this percentage of Vertical Displacement within the Approach Slope area.

Note: You can set the amount of Vertical Displacement for the Project with the Terrain Parameter Editor.

The range is from zero to 500 percent, with zero being no Vertical Displacement and 100% being the full amount of Vertical Displacement as used by the Project. Any value over 100% will increase the amount of Vertical Displacement, with 500% being five times the Vertical Displacement you set for the Project.

A Roughness percentage of 100 will apply all the Vertical Displacement from the Project into the Approach Slope area. This will cause the terrain to have the same roughness within the Approach Slope area as the terrain does outside of the Approach Slope area.

You can smooth the terrain within the Approach Slope area by using a value of less than 100 percent. For example, you can use a lower value to create a smoothly graded Approach Slope area.

You can roughen the terrain within the Approach Slope area by using a value of greater than 100 percent, up to 500 percent. For example, you can use a high number to make a roughly graded Approach Slope area.

Ecosystem Mixing Percentage Field and Buttons

The Approach Slope Eco Mixing Percentage applies to the boundary between the Approach Slope region and the existing ecosystems at the edge of the Terraffector's Total Effect Radius (see below).

Use it to mix the Approach Slope Ecosystem with the surrounding Ecosystems. It allows the surrounding Ecosystems to mix into the Approach Slope region by a percentage of the width of the Approach Slope. This lets you avoid a sharp line where Ecosystems change abruptly at the edge of the Terraffector's Total Effect Radius.

Approach Slope Ecosystem Controls

The Approach Slope Ecosystem controls let you control the Ecosystem for the Approach Slope area. This is optional. If you don't select an Ecosystem in the drop box, VNS will render Ecosystems in the Approach Slope area based on the Ecosystems that would have been rendered if there were no Terraffector.

Ecosystem Drop Box

Select an Ecosystem to be rendered in the Approach Slope area.

Ecosystem Edit Button

Click the Edit button to open the Ecosystem Editor set to edit the Ecosystem selected in the Approach Slope Ecosystem drop box.

Clear Eco Button

Click the Clear Eco button to remove the Ecosystem for the Approach Slope. VNS will then render Ecosystems in the Approach Slope area based on the Ecosystems that would have been rendered if there were no Terraffector.

Terrain Generator

The Terrain Generator lets you create new terrain data using all the tools available in the Texture Engine. As you adjust the texture you can see a preview of the terrain in OpenGL realtime Views. The Terrain Generator lets you control the position, tiling, area and size of the new terrain.

You can save two kinds of Components from the Terrain Generator to add to your gallery of terrain types. By saving the Terrain Type from the Terrain Type page you can store a terrain without specifying its position, tiling, area and size. By saving the entire Component using the Sign and Save Component to Disk icon on the right you can save the terrain type and its position, tiling, area and size together.

General Page

General Features Section

Name Field

The name field lets you see and edit the name for the current Terrain Generator.

Enabled Checkbox

The Enabled checkbox lets you enable or disable the Terrain Generator. If you disable a Terrain Generator it will not lose its parameter values.

Preview Enabled Checkbox

Select the Preview checkbox to see a realtime OpenGL version of the terrain in any open View. You can control the resolution of the preview terrain with the Size field (see below).

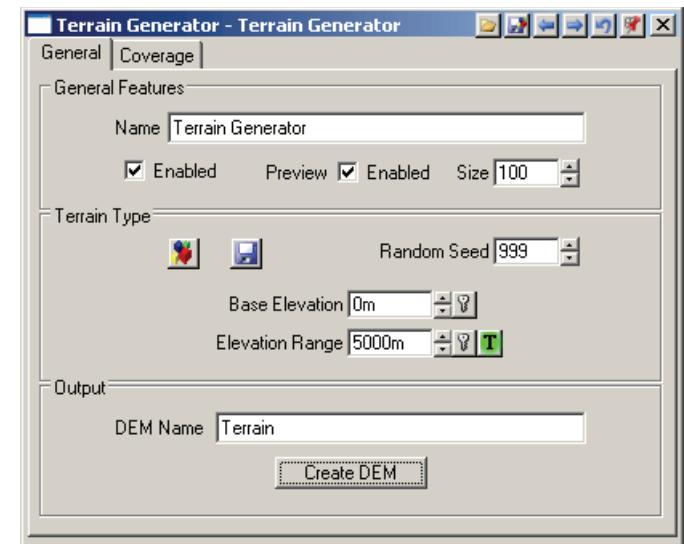
Size Field

Use the Size field to control the resolution of the realtime OpenGL terrain preview. The value is the number of cells shown on both the North/South and East/West axes.

Using fewer cells will update faster; using more cells will reveal more detail. The preview will always show the same overall terrain bounds, so as you increase the number of cells the cells become finer in resolution.

The minimum value of 100 creates a 100 x 100 cell matrix. You can increase it as needed.

The value you use here will not affect the actual resolution of the terrain you create with the Terrain Generator. You can control the actual resolution with the controls on the Coverage page (see below).



Terrain Type Section

The Terrain Type section lets you load and save terrain types, adjust the random seed used by procedural texture elements, adjust the base elevation and elevation range for the terrain and open the Texture Editor to edit the texture which will create the terrain shape.

Load Terrain Type Component Gallery Icon

Click the Load Terrain Type icon to open the Component Gallery ready to load a Terrain Type Component. A Terrain Type Component contains only the information you can edit within the Terrain Type section plus the Texture Editor. That way you can load a Terrain Type separately from terrain coverage (position and area).

Note: The Open Component Gallery and Sign or Save Component to Disk icons on the right side of the Editor let you load and save the terrain type and coverage together within a single Component.

Save Terrain Type to Disk Icon

Click the Save Terrain Type to Disk icon to open the Component Signature window ready to save the current Terrain Type as a Terrain Type Component. A Terrain Type Component contains only the information you can edit within the Terrain Type section plus the Texture Editor. That way you can save a Terrain Type separately from any specific terrain coverage (position and area).

Note: The Open Component Gallery and Sign or Save Component to Disk icons on the right side of the Editor let you load and save the terrain type and coverage together within a single Component.

Random Seed Field

The Random Seed field is added to any input seeds used by procedural textures in the Texture Editor for the Elevation Range texture. Changing it is a quick way to vary the terrain without opening the Texture Editor.

Base Elevation Field

Enter the lowest terrain elevation you want into the Base Elevation field.

Elevation Range Field

Enter the vertical distance above the Base Elevation that you want for the highest point on your terrain.

Click the Texture button to open the Texture Editor. Any area where the texture is at 100% will be at the upper limit of your Elevation Range. Any area where the texture is at 0% will be at the Base Elevation. Any areas where the texture is between 0 and 100% will vary in elevation between the Base Elevation and the upper limit of the Elevation Range.

Note: Keep in mind that depending on the texture elements you use, the resulting texture may not have any values at the 100% or 0% limits.

Use the Texture Editor to create the shape of the terrain between the Base Elevation and the Elevation Range.

Output Section

The Output section lets you generate new terrain based on the settings of the Terrain Generator's controls.

DEM Name Field

Enter a name for your new terrain. If you are using multiple tiles VNS will use this as the base name and append unique numbers to each tile.

Create DEM Button

Click the Create DEM button when you are ready to create and store your terrain. VNS will store the terrain file(s) in the Project's default directory.

Coverage Page

The Coverage page lets you specify the resolution, area and position of the new terrain.

DEM Resolution Section

The DEM Resolution section lets you specify the resolution and tiling of the new terrain.

Be sure to use appropriate resolution. If the camera is going to be near the ground you should create terrain with higher resolution than if the camera is going to be far away from the terrain.

If you see blocky polygons in your terrain the resolution may be too low. If rendering takes too long the resolution may be too high.

Rows per Tile Field

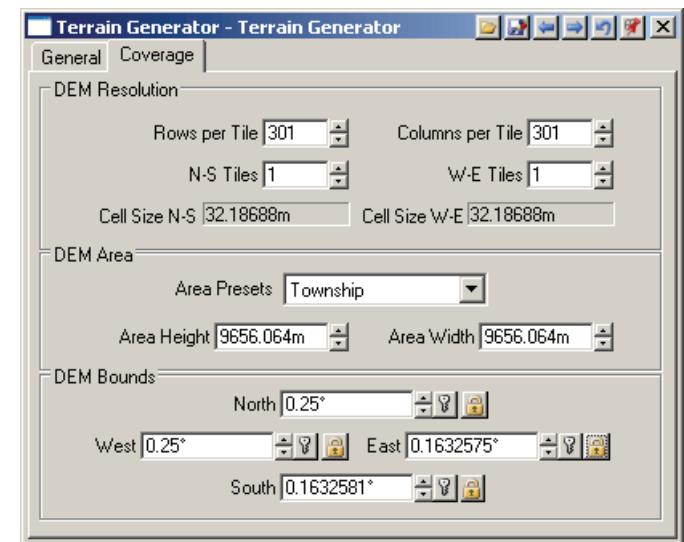
The Rows per Tile field lets you specify the North/South resolution of each terrain tile. The default value of 301 is optimal for rendering.

Columns per Tile Field

The Columns per Tile field lets you specify the East/West resolution of each terrain tile. The default value of 301 is optimal for rendering.

N-S Tiles Field

The N-S Tiles field lets you specify the number of tiles for your terrain along the latitudinal direction. Breaking the terrain into multiple tiles lets you cover large areas and still render efficiently.



W-E Tiles Field

The N-S Tiles field lets you specify the number of tiles for your terrain along the longitudinal direction. Breaking the terrain into multiple tiles lets you cover large areas and still render efficiently.

Cell Size N-S Display Field

The Cell Size N-S display field shows the North/South terrain resolution. This is the distance covered by a single row. You can affect it by changing the value in the Rows per Tile and N-S Tiles fields above it, and the Area Height value below it in the DEM Area section.

Cell Size W-E Display Field

The Cell Size N-S display field shows the East/West terrain resolution. This is the distance covered by a single column. You can affect it by changing the value in the Columns per Tile and E-W Tiles fields above it, and the Area Width value below it in the DEM Area section.

DEM Area Section

The DEM Area section lets you specify the size of the terrain.

Area Presets Drop Box

Quickly set up standard sized terrain areas. Choose from acre, hectare, square kilometer, square mile or township.

Each preset will change the Area Height and Area Width values appropriately.

Area Height Field

Enter the North/South distance you want your terrain to cover.

Area Width Field

Enter the East/West distance you want your terrain to cover.

DEM Bounds Section

The DEM Bounds section lets you specify the position of the terrain on the planet.

If you change the North or West DEM Bounds, the South and East Bound values will change to keep the Area Width and Area Height in the DEM Area Section unchanged (see above). This lets you move the terrain without changing its size.

If you change the East or South Bounds the Area Width and Area Height will change to keep the North and West Bounds unchanged. This gives you another way to resize the terrain.

By selecting any of the padlock icons, you can lock a particular value and over-ride the default behavior.

North Field

Enter a latitude value for the North edge of the terrain.

West Field

Enter a longitude value for the West edge of the terrain.

East Field

Enter a longitude value for the East edge of the terrain.

South Field

Enter a latitude value for the South edge of the terrain.

Terrain Gridder Editor

The Terrain Gridder Editor lets you generate a new DEM from Control Points or Vectors in any supported projection. This is called “gridding.”

You can import Control Points or Vectors with the Import Wizard. You can digitize Control Points or Vectors using the Create Palette Window.

When you create a new Terrain Gridder component VNS will prompt you to use the Terrain Gridder Wizard. This is optional, selecting No when prompted will open a new Terrain Gridder editor allowing you to manually edit the required settings.

General Page

General Features Section

Name Field

Enter a name for the Terrain Gridder. By default it will be named “Terrain Gridder”.

Boundaries of Grid Section

New DEMs are rectangular and oriented along north/south and east/west lines. The North, South, East, and West fields show the lat/lon boundaries of the new DEM-to-be. This is based on where the Control Points or Vectors are located.

Note: if you add more control points, these fields won't change unless you close and open the Terrain Gridder window. A better approach is to toggle the Floating checkbox off and back on which will automatically set the bounds for you. Alternatively, use the Set Bounds in a View button to control exactly where the DEM boundaries will be (see below).

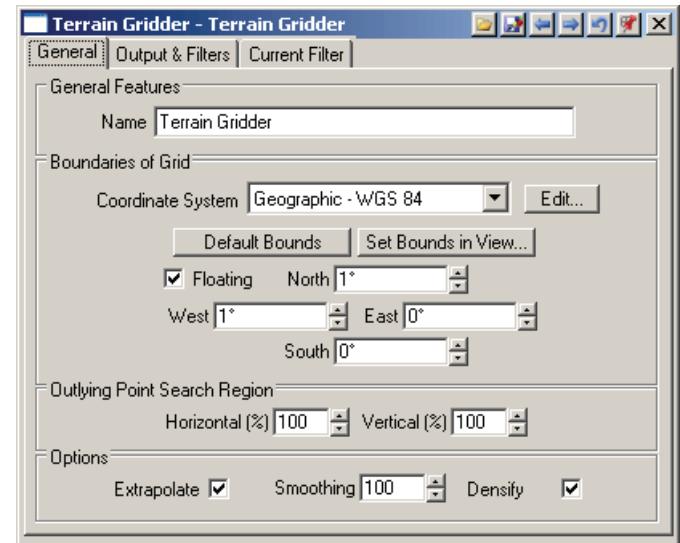
Coordinate System drop box

The Coordinate System drop box lets you select a Coordinate System for the DEM(s) you're about to grid.

Note: Be careful, using an inappropriate Coordinate System for a DEM may cause it to appear at the wrong place on the planet, and at the wrong size and shape.

If there is no Coordinate System showing in the drop box, the DEM(s) will use the Coordinate System selected in the Planet Options Editor for the Project. If there is no Coordinate System showing in the Planet Options Editor, the Project will use the VNS Back-compatible Sphere.

If a non-geographic Coordinate System is selected in the Planet Options Editor, VNS will consider it geographic for rendering and only use its datum and ellipsoid in geographic form. In that case, if there is no Coordinate System showing in the Terrain Gridder's drop box,



the Terrain Gridder will also use the Project's datum and ellipsoid but consider it geographic and show the DEM Registration Coordinates as geographic.

Default Bounds Button

Click the Default Bounds button to set the North, West, East and South fields so that the bounds of the area you will be gridding includes all the enabled Database Objects in your Project. This is like turning the Floating checkbox on and then off again.

Set Bounds in View Button

Click the Set Bounds in a View button and then you can draw the shape of the new DEM in a Planimetric View (see Views).

You can use this to draw the shape around your Control Points, or even better, slightly inside the outermost Control Points. This will change the North, West, East and South fields (see below). This will also set the output columns/rows (width/height) to the number of pixels in the View enclosed by what you draw. You can change the values in these fields

Floating Checkbox

Click the Floating checkbox if you want the boundaries to include all the enabled Database Objects in your Project.

North, West, East and South Fields

Enter latitude positions into the North and South fields, and Longitude positions into the East and West fields, to define the boundaries of the region you want to grid.

If you use the Floating checkbox, Default Bounds button or Set Bounds in View button VNS will fill in these fields automatically.

Outlying Point Search Region Section

Horizontal and Vertical Percentage Fields

Enter a percentage beyond the bounds that you want VNS to consider when gridding your DEM.

Normally the gridding function only looks at points that fall within the DEM boundaries. The Outlying Point Search Region is a "fudge factor" that tells it to look at points outside the boundaries so it doesn't have to extrapolate. We recommend entering enough overlap to include the external points. You can estimate how far outside the new DEM boundaries your external control points are, as a percentage of the size of one gridded DEM.

The default values are 100 percent of the horizontal and vertical DEM size. It is OK if these values aren't set exactly. If you don't have enough coverage you may get some flat or sharp slope break elevation anomalies where it has to extrapolate at the edge of the DEM. If this happens you may need more control points near the edge of the DEM or you may need to use a higher number in the Cell Overlap fields to include the points that are already near the DEM boundary.

If you don't have any points outside the bounds and if you are not gridding into multiple output DEM tiles, you may be able to save gridding time by setting the Horizontal and Vertical Percentage fields to zero.

Options Section

There are three options here:

- **Extrapolate**
- **Smoothing**
- **Densification**

Extrapolate Checkbox

Select the Extrapolate checkbox to have the landscape automatically extended to the edge of the boundaries even if you don't have many or any Elevation Control Points near all the boundaries. Do this to avoid having area outside of the elevation control points be flat. VNS will extrapolate the landscape shapes that are within your control points out to the edges of the DEM.

Note: This is not always fool proof. A better approach is to extend the Control Points beyond the edges of the DEM. You can then set the boundaries of the DEM with the Set Bounds in View button so the DEM is inside the region where there are Control Points.

If the Extrapolate checkbox is not selected and you have areas within the DEM that are outside the area where you have Control Points, VNS will fill those areas with the value in the Null field (see below).

Smoothing Field

Enter a value in the Smoothing field to enable a tension-based spline smoothing operation. As long as your landscape has some elevation change (isn't flat), you can use this option to create better-looking landscapes.

Smoothing goes from 0 to 100 percent. We recommend using 100%, the default value, for typical data sets. Using less smoothing may show facets in the terrain, especially in sparse data sets. You can go higher than 100 percent but that may produce strange results. Zero percent may be useful for detailed data sets where smoothing is unnecessary. In those cases setting smoothing to zero will save a moderate amount of time and use less memory.

Densify Checkbox

Checking this option will add points at the spacing of the output grid cell size to long, straight lines that contain no vertices. This should improve tesselation and resulting grid quality.

Output & Filters Page

Database Filters Section

Database Filters List

The Database Filters list shows a list of the Database Filters you specify. The Database Filters let you to choose what Database Objects will be gridded.

The order of the filters is important. VNS applies them from top to bottom.

You can select a Database Filter and then edit its parameters on the Current Filter page (see below).

Add Filter Icon

Click the Add Filter icon to add a new Database Filter to the list.

Remove Filter Icon

Select a Database Filter you want to delete and click the Remove Filter icon. VNS will delete the selected Database Filter.

Raise and Lower Filter Priority Icons

The order of the filters is important. VNS applies them from top to bottom. Click the Raise Filter Priority icon to raise the selected filter higher in the list. Click the Lower Filter Priority icon to lower the selected filter lower in the list.

Output Section

E-W Tiles and N-S Tiles Fields

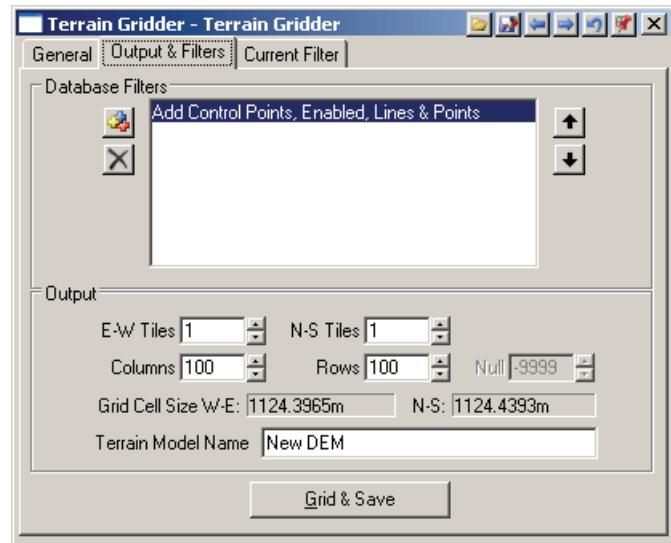
Use these fields to tell VNS how many DEMs to grid. You can create one DEM to cover the Boundary area or subdivide it into multiple DEMs. Having multiple DEMs will conserve memory during rendering.

If you set both fields to one you will create one DEM. If you set one of them to two and the other to one you will create two DEMs. If you set them both to two you will create four DEMs and so on.

Dividing large data sets into multiple DEMs will allow VNS to grid your data significantly faster. If gridding is taking too long, increase the values in one or both of these fields to divide the data into multiple DEMs.

Columns & Rows Fields

The Columns are the number of grid cells on the width (E/W) axis and the Rows are the number of grid cells on the height (N/S) axis of each of your newly created DEMs.



Note: You can generate more than one DEM by using the E-W DEMs and N-S DEMs fields (see below). The values you enter for Rows and Columns are used for each DEM you generate.

You can increase the rows and columns to get more resolution in your DEM(s). Higher resolution will take longer to create and add to VNS rendering time.

For reference, a 90 meter DEM as broken down by VNS has a grid size of 301 x 301.

Null Field

Use the Null field to tell VNS the height of any part of the new DEM that is within the rectangular area of the new DEM but outside the area described by the Elevation Control Points you entered. VNS will use this value if the Extrapolate checkbox is not selected.

If you select the Extrapolate checkbox VNS will not use the Null value. Instead VNS will extrapolate your control points to create varying elevations clear to the edges of the new DEM's rectangular area.

Grid Cell Size Display Fields

These fields show the measurements, in meters from West to East and from North to South, of a single cell in the DEMs you are about to create.

It's important to create terrain of sufficient resolution for your application. If the Camera will be close to the terrain, higher resolution (and thus lower Grid Cell Size W-E and N-S) will be required to create adequate terrain detail. If your Camera will be far from the terrain, high resolution will waste rendering time and it's better to have lower resolution (and thus higher Grid Cell Size W-E and N-S).

Terrain Model Name Field

Use the Terrain Model Name field to name your new DEM(s) before you click the Grid button.

Grid and Save Button

Click the Grid button and your new DEM(s) will be created, saved in the Default directory, and added to the current project's database.

Note: Your new DEM will be drawn in the Views just like any other enabled DEM.

A DEM will only be created if you have three or more Elevation Control Points. If you have a lot of control points it may take a long time to create a new DEM when you click the Grid button (hours, possibly, depending on your computer and the number of input points). Because of the time this can take, it's a good idea to design simple landscapes first to get close to what you want, and then if they look good, add detail and rebuild them by clicking the Grid button again. You'll need to click this button every time you want to rebuild the DEM to reflect changes you've made in the Terrain Gridder.

Current Filter Page

Select a Database Filter in the Database Filters list, on the Output & Filters page. Then you can edit the filter on the Current Filter page.

Database Filter Section

Filters Enabled Checkbox

Select the Filters Enabled checkbox to enable the selected Database Filter.

Deselect it to disable the selected Database Filter. Deselected filters are shown in gray on the Database Filters list, and are ignored during gridding.

Add or Subtract Objects Radio Buttons

Select the Add Objects radio button if you want the results of the selected Database Filter to be used for gridding.

Select the Subtract Objects radio button if you want the results of the selected Database Filter not to be used for gridding.

Control Points or Vectors Checkboxes

Select the Control Points checkbox if you want to include Control Points when Gridding. Select the Vectors checkbox if you want to include Vectors for gridding.

You must select at least one of these checkboxes.

Enabled Objects or Disabled Objects Checkboxes

Select the Enabled Objects checkbox if you want to include enabled Database Objects for gridding. Select the Disabled Objects checkbox if you want to include disabled Database Objects for gridding.

You must select at least one of these checkboxes.

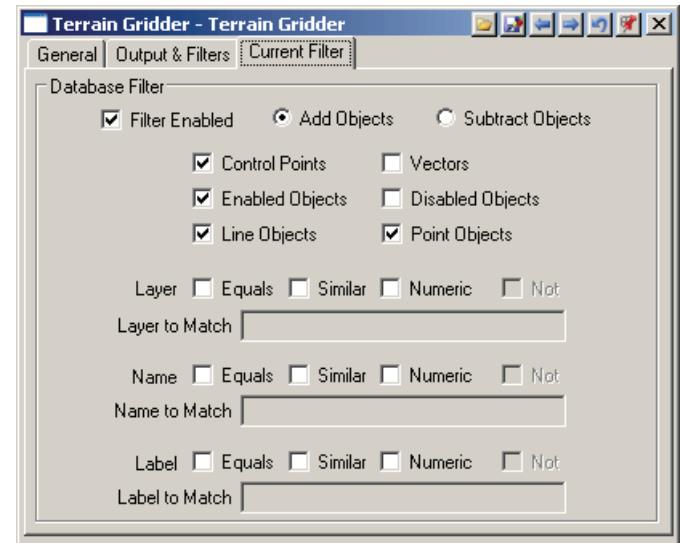
Line Objects or Point Objects Checkboxes

Select the Line Objects checkbox if you want to include Vectors or Control Points that are set to a Style of Solid, Dotted, Dashed, or Broken. Select the Points Objects checkbox if you want to include Vectors or Control Points that are set to a Style of Point, Circle, Square or Cross.

You must select at least one of these checkboxes.

Layer Checkboxes and Match Field

If you want VNS to choose Database Objects based on Layer Name, enter all or part of a Layer Name in the Layer to Match field.



Select the Layer Equals checkbox if you want VNS to choose Database Objects in a Layer with a name that exactly matches the name in the Layer to Match field.

Select the Layer Similar checkbox if you want VNS to choose Database Objects in all Layers with similar names to the name in the Layer to Match field.

Select the Layer Numeric checkbox if you want VNS to choose Database Objects in all Layers with the same number as the name in the Layer to Match field.

Select the Layer Not checkbox if you want VNS to exclude Database Objects in all Layers that would otherwise be chosen by any of the other Layer checkboxes you selected.

Name Checkboxes and Match Field

If you want VNS to choose Database Objects based on Database Object Name, enter all or part of a Database Object Name in the Name to Match field.

Select the Name Equals checkbox if you want VNS to choose Database Objects with a name that exactly matches the name in the Name to Match field.

Select the Name Similar checkbox if you want VNS to choose Database Objects with similar names to the name in the Name to Match field.

Select the Name Numeric checkbox if you want VNS to choose Database Objects with the same number as the name in the Name to Match field.

Select the Name Not checkbox if you want VNS to exclude Database Objects that would otherwise be chosen by any of the other Name checkboxes you selected.

Label Checkboxes and Match Field

If you want VNS to choose Database Objects based on Database Object Labels, enter all or part of a Database Object Label in the Label to Match field.

Select the Label Equals checkbox if you want VNS to choose Database Objects with a Label that exactly matches the name in the Label to Match field.

Select the Label Similar checkbox if you want VNS to choose Database Objects with similar Labels to the name in the Label to Match field.

Select the Label Numeric checkbox if you want VNS to choose Database Objects with the same number as the name in the Label to Match field.

Select the Label Not checkbox if you want VNS to exclude Database Objects that would otherwise be chosen by any of the other Label checkboxes you selected.

Terrain Parameter Editor

The Terrain Parameter Editor lets you choose the rendering method to control Level-of-Detail, Fractal Depth and Vertical Displacement. These controls have a major impact on the quality of your images and speed of rendering.

General Page

Common Terrain Parameter Controls

These are parameters that apply to all sets of Dynamic Parameters.

Fractal Method Radio Buttons

Use the Fractal Depth radio button to select how VNS will render your images.

Choose from:

- **Variable Fractal Depth**
- **Constant Fractal Depth**
- **Depth Maps**

All of these methods are based on the number in the Maximum Fractal Depth field in the General Features section (see below). Each of the methods varies this value over the landscape differently to determine how VNS adds additional fractal terrain detail during rendering.

Choosing the method lets you control how VNS automatically handles level of detail in your terrain. Using the method that puts the best detail where it will actually be seen will give you the most efficient rendering.

Variable Fractal Depth puts the maximum detail near the camera, which provides efficient rendering for still images. Constant Fractal Depth puts the same detail everywhere on the terrain, which is useful for images and animations of the entire planet. Depth Maps put the maximum detail near the entire camera path, which provides efficient rendering for animations with a moving Camera.

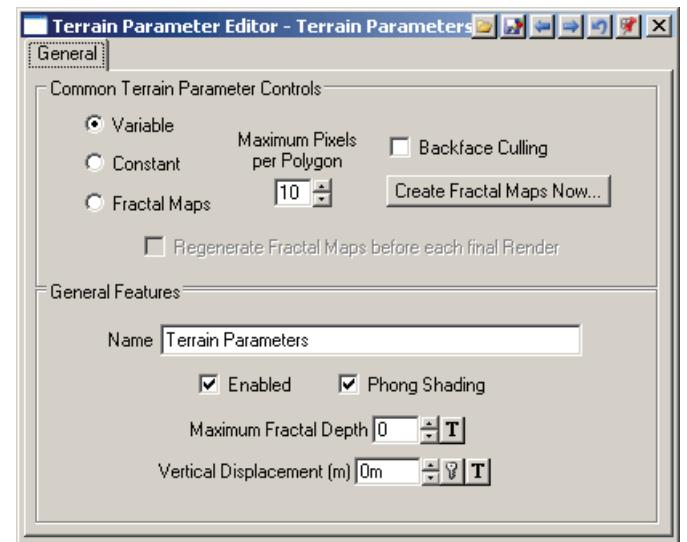
Variable Fractal Depth

Variable Fractal Depth allows the Fractal Depth to vary with distance from the Camera. This is great for rendering still images and preview (not final quality) animations, and it can save considerable rendering time.

VNS will use the Fractal Depth value you set in the Fractal Depth field for polygons that are close to the camera. Polygons farther away will be set to progressively lower fractal depth settings.

Since the detail farther away isn't seen, the loss of detail has little or no effect on the final image quality. Because VNS doesn't have to render the unneeded detail, rendering speed is faster. VNS can render polygons faster when the fractal depth setting is lower.

Variable Fractal Depth is designed for still images. When you start moving the Camera you should use Fractal Depth Maps instead (see below), unless you're just doing preview or test animations before you're sure about your motion paths. If you use Fractal Depth Maps you



have to create or update Fractal Depth Maps every time you change your motion paths. With Variable Fractal Depth you can get a pretty good idea of how your terrain is going to look without taking the time to create or regenerate Fractal Depth Maps.

However, Variable Fractal Depth is NOT good for final quality animation renderings because the fractal depth will vary as the camera moves. As polygons get closer to the camera their fractal depth setting will be raised, which will cause a noticeable artifacting. This can also cause trees to appear and disappear and other anomalies. That's why, for animations, using Variable Fractal Depth is only good for previews but not for final quality rendering.

After you finalize your motion paths, you should go ahead and create Fractal Depth Maps and use the Fractal Depth Map option for rendering (see below). If you attempt to render an animation using Variable Fractal Depth VNS will warn you and prompt you to create or update Fractal Depth Maps.

Constant Fractal Depth

Select Constant Fractal Depth to apply the same number of subpolygons over your entire visible terrain even if the terrain is so far away it doesn't matter.

This takes a much longer time to render. Constant Fractal Depth can be useful when you need to maintain consistent level of detail over entire image but will be much slower at high fractal levels and seldom necessary.

You might use this mode for making printed maps where you need maximum detail over the entire visible terrain.

Note: You can limit the maximum fractal depth for each DEM on the Database Editor's Properties page.

Depth Maps

Fractal Depth Maps are similar in effect to Variable Fractal Depth (see above), but are more sophisticated for animation. Unlike with Variable Fractal Depth, Fractal Depth Maps won't change the fractal depth of any particular polygon as the camera moves.

Rendering with Fractal Depth Maps calculated and the Fractal Depth Map mode enabled can improve the quality of your animations while at the same time decreasing rendering time.

Before you can render with Fractal Depth Maps you must first create them. When you create Fractal Depth Maps, VNS follows the course of the camera and keeps track of all the polygons that will be close to the camera and in view during the animation. These polygons will always get the highest fractal depth setting, and the others will get less and less the further away they are from the camera during the entire course of the animation.

The Fractal Depth Maps contains the information VNS uses during rendering to assign fractal depth to polygons based on closeness to the camera during the entire time of the animation. VNS creates one Fractal Depth Map per DEM.

The Fractal Depth Maps store the fractal depths appropriate for each polygon in your scene. Once these are calculated, VNS does not change these settings during the animation. This avoids the artifacting caused by using variable fractal depth.

Even though they take some time to generate, Fractal Depth Maps save a lot of rendering time while keeping your quality consistent.

Maximum Pixels per Polygon Field

After you set up your camera and focus point motion paths, set the Depth Map Maximum Pixels per Polygon field's value.

This lets you tell VNS the minimum number of pixels to use for each terrain polygon during rendering.

If you want faster rendering at the expense of a little quality, go with 2 or 3 pixels per polygon instead of the default 1 polygon per pixel. For best quality, use 1 polygon per pixel. Fractional numbers can be used here (e.g. 1.5).

Create Fractal Maps Button

Click the Create Fractal Maps button to create Depth Maps for your animation. VNS will use the pixels per polygon value you entered into the Maximum Pixels per Polygon field (see above).

When you click the Create Fractal Maps button, VNS will ask for a frame interval to scan. The default value of 5 generally works well, but you can select a higher number to speed the generation process, or a lower number to get a more accurate scan. For slow-moving camera paths you can use much higher values like 25 or even 50. For very fast moving camera paths, you might want a lower value such as 3 or even 1.

VNS creates one set of Fractal Map that are automatically generated from all Cameras belonging to enabled Render Jobs.

Note: If you won't be rendering with a particular Camera, disable its Render Job first. Otherwise your rendering time may increase for the Camera(s) you do use. This is because VNS will raise the Fractal Depth in areas near your unneeded Camera. The result will be unnecessary detail that won't help your final render but may take additional rendering time to compute if the unnecessary detail is within view of a Camera you do use. You can disable Render Jobs in the Render Job Editor or the Render Control Window.

VNS will save the Fractal Depth Maps in the Project's Default Directory. You can see and change the Default Directory with the Directory List Editor (see the Database Module chapter).

If you change any Parameter that affects the Terrain/Camera relationship, you will need to regenerate the Fractal Maps (see below).

Since you can use the same DEMs in several Projects, and since each Project will likely have different motion paths, it's important that each Project also have its own Default Directory. That way when you generate the Fractal Depth Maps for one Project it won't erase those needed by another. When you clone a Project VNS will automatically give the new Project its own Default Directory (see New Project Window).

Suggested Fractal Depth

After VNS finished generating the Fractal Depth Maps, you will see a suggested Fractal Depth Map value. This is the value VNS believes will give you optimal quality.

You may choose to enter this value into the Fractal Depth field, or you can use a higher or lower number between 1 and 7.

"Optimal" does not necessarily mean "best". Use your judgment. For some scenes where you are close to the terrain for only a short time, a higher Fractal Depth than the one suggested may still be needed. A higher Fractal Depth value will take longer to render. A lower number will lower the quality of the rendering.

Regenerating Fractal Maps

Better quality and faster rendering times are great, but if you forget to initially generate your fractal depth maps before rendering, or if you forget to regenerate Fractal Depth Maps after changing Camera or Target motion or anything that affects the Terrain, your rendering time could instead increase, and the quality may decrease!

If you are using Fractal Maps, you will need to regenerate them if you change any of the following:

- **Camera position/orientation**
- **Adding or removing a Camera**
- **Changing Camera type**
- **Target position**
- **Backface Culling state**
- **Horizontal Displacement state**
- **Vertical Exaggeration**
- **Add, move or delete Terraffectors/Area Terraffectors**
- **Planet Radius**
- **3D object changes if they are a camera target**
- **Keyframe or texture-driven animation changes for any of the above**

If you see artifacting in the terrain or missing sections of terrain, make sure you regenerate your Fractal Depth Maps.

Fractal Depth Maps must match the motion of your camera to be useful. Don't forget to generate fractal depth maps before rendering whenever you change your camera or focus point position or motion!

Whenever you render, VNS will try to determine whether or not Fractal Depth Maps are out of date and if VNS thinks they are VNS will ask if you would like to generate new ones before rendering. This could take some time but rendering will then begin automatically once Fractal Depth Map generation is complete.

You will need to re-save your project after generating Fractal Depth Maps so that VNS will remember that they are current. If you don't you will be warned that VNS thinks the Fractal Depth Maps are out of date every time you go to render. If you know they aren't out of date just answer "no" to the query and then save the Project when you are done rendering.

Note: Since backface polygon culling is applied during Fractal Depth Map generation, out of date Fractal Depth Maps may cause polygon dropouts. If you see holes in your terrain, it is a safe bet that you need to regenerate Fractal Depth Maps.

Backface Culling Checkbox

The Backface Culling button enables backface polygon culling. Backface culling means VNS doesn't render polygons which face away from the Camera such as those on the back side of a hill. This makes rendering more efficient but there are trade-offs.

Backface culling can speed up rendering for stills, but in animations backface culling may result in trees disappearing as the terrain they stand upon disappears beyond a ridge.

Backface culling can interfere with Terraffectors. If you have problems with Terraffectors, try disabling backface culling.

You may also want to disable backface culling in cases when you're very close to the terrain and the skyline looks faceted. Turning it off will roughen the horizon.

By default backface culling is disabled when you create a new Project.

Note: If you change this setting you will need to regenerate Fractal Depth Maps (see above).

General Features Section

These are parameters that apply only to one set of Dynamic Parameters.

Name Field

Enter a name for the Dynamic Parameters. For example, if it is set up with Fractal Depth Maps for animated output from the Project, you might call it simply "Animated".

By default VNS will name new Dynamic Parameters "Dynamic Parameters", and add a number after the name if there is more than one set of Dynamic Parameters named "Dynamic Parameters".

Enabled Checkbox

The Enabled checkbox lets you enable or disable the Dynamic Parameters for rendering.

Disabling Dynamic Parameters can be useful if you have more than one set. You can only use one set of Dynamic Parameters at a time.

Phong Shading Checkbox

Enabling this checkbox forces to smooth between polygon boundaries, creating a much more uniform surface without visible polygon edges. If you require a more rough look to your terrain, use the Vertical Displacement Percentage Field & Texture Controls, and Bump Mapping Controls to create that look.

Maximum Fractal Depth Field

Use the Maximum Fractal Depth field to set the level of polygon subdivision to add apparent detail to images. The value is the number of times each polygon is divided into four sub-polygons.

The Maximum Fractal Depth is 7.

When you use the Variable Fractal or Fractal Depth Maps options, VNS will use the Maximum Fractal Depth field's value only for those polygons that are near the Camera. VNS will use progressively lower levels of Fractal Depth for polygons that are progressively further away.

Note: If you limit the Fractal Depth of a DEM using the Database Editor, VNS will never set the Fractal Depth for the DEM's polygons higher than your limit, even if the Fractal Depth field is set to a higher number.

Increasing Maximum Fractal Depth increases detail and rendering time.

You can also control Fractal Depth with Textures. Wherever the texture is 100% (white) the terrain will have the Maximum Fractal Depth you set in the field. Wherever the texture is 0% (black) the terrain will have a Maximum Fractal Depth of zero. In-between percentages (gray) will create in-between levels of Fractal Depth on the terrain. This technique can be used to ensure high fractal depth in concentrated solely on important features (like roads) and low fractal depth is utilized everywhere else.

Vertical Displacement Percentage Field & Texture Controls

Control Vertical Displacement with Textures. Wherever the texture is 100% (white) the terrain will have the Maximum Vertical Displacement you set in the field. Wherever the texture is 0% (black) the terrain will have Vertical Displacement of zero. In-between percentages (gray) will create in-between levels of Vertical Displacement on the terrain. Click the Texture Operations Icon to open the Texture Editor, and use it to create an appropriate texture with which to drive terrain displacement.

Note: Terrain Displacement is dependent upon underlying resolution. With insufficient Fractal Depth, or cell resolution in your DEM, the finer detail in your displacement texture may not be apparent. In these cases, if increasing terrain resolution is not an option, you may consider using the Bump Mapping Controls in the appropriate editor to achieve the appearance of displaced terrain, but without the dependence on underlying polygon resolution.

Thematic Map Editor

The Thematic Map Editor lets you use values associated with Vectors to control some of VNS's parameters. This lets you use data from your GIS to control how tall trees grow in specific places; how dense trees grow in specific places; what Ecosystem Materials appear in different places; different elevations for a Lake Component when attached to different Vectors; the elevation of an Area Terraffector when attached to different Vectors (good for displacing building footprints upwards to create a building shape); and more.

The values come from attributes associated with Vectors in the database. This is especially useful if you are importing Vectors from an external database, such as a Shape file from a GIS. When you import a Shape file, the Import Wizard lets you import attributes associated with the polygons.

In a nutshell, you attach Vectors with attributes to a Thematic Map and one or more additional Components. Then you link each parameter you want to control to the Thematic Map you want to use to control it. From then on the parameter gets its value from the attribute of the attached Vector.

Alternatively you can create a Thematic Map directly from any thematically mappable parameter's Thematic Operations menu, and then attach Vectors to the new Thematic map.

All thematically mappable parameters have a Thematic Map Operations Icon. You can click the icon to see a menu of Thematic Map commands. You can choose appropriate actions from the command menu such as creating, linking, unlinking, editing, enabling and disabling a Thematic Map for the parameter. The icon will give you only the choices which make sense. The icons change appearance to indicate if a thematic map exists, and if so if it's enabled or disabled.

Shape Files

When you import a Shape file with the Import Wizard, VNS lets you import its table of database fields in addition to importing the geometry of the polygon shapes as Vectors. Each Vector then has a corresponding set of fields with attribute names and values. You can see the database attributes on the Attributes page in the Database Editor.

You can also see database attributes in the Search Query Editor and Thematic Map Editor on their Database Attributes pages.

Attributes let you drive Dynamic Linking of effects via Search Queries. Attributes also let you directly drive Component parameters, such as ecosystem density and height, water elevation, and more (see below) via Thematic Maps.

Controllable Parameters

Here are the parameters you can control with Thematic Maps to give them values from Vector attributes:

- **Ecotype Maximum Height**
- **Ecotype Group Height**
- **Ecotype Group Density**
- **Ecotype Replace Gray Color**
- **Ecotype Foliage Object Height**
- **Ecotype Foliage Object Density**
- **Ecosystem, Lake Material Gradient Driver**

- **Ecosystem Material Diffuse Color**
- **Ecosystem Material Gradient Driver (can control material placement)**
- **Foliage Effect Maximum**
- **Foliage Effect Group Height**
- **Foliage Effect Replace Gray Color**
- **Foliage Effect Foliage Object Height**
- **Foliage Effect Foliage Object Density**
- **Area Terraffector Elevation**
- **Lake Elevation**
- **Lake Material Diffuse Color**
- **Lake Beach Material Gradient Driver**
- **Lake Material Gradient Driver**
- **Ground Effect Material Diffuse Color**
- **Ground Effect Material Gradient Driver**
- **Wall Panel Material Diffuse Color**
- **Wall Panel Gradient Material Gradient Driver**
- **Wall Roof Material Diffuse Color**
- **Wall Roof Material Gradient Driver**

General Page

General Features Section

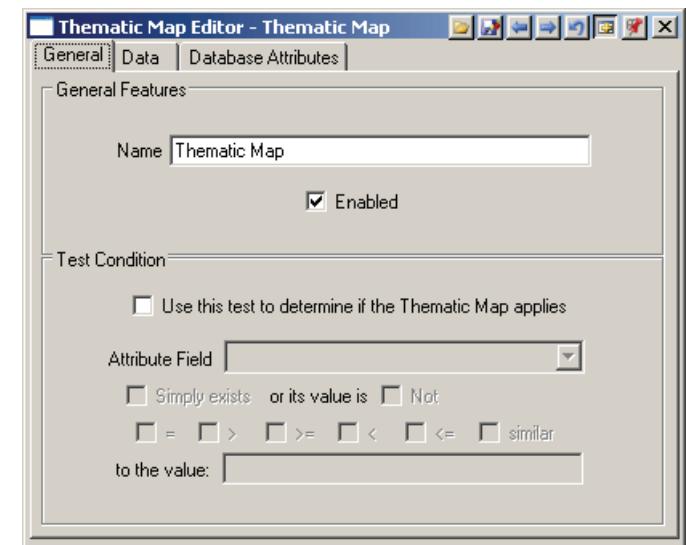
Name Field

Enter a name for the Thematic Map. By default it will be named "Thematic Map".

Enabled Checkbox

The Enabled checkbox lets you enable or disable Thematic Map for rendering.

If you disable a Thematic Map it will not lose its parameter values. Disabling the Thematic Map here will also disable it for any parameters in other Editors linked to the Thematic Map. Enabling the Thematic Map here will enable it for any parameters in other Editors linked to the Thematic Map.



Test Condition Section

You use the Test Condition controls to tell whether the TM should use the attribute field value it is linked to in the vector or return the no-data value.

For example, you may have one field that specifies the major species and another field that specify the density. You can create one ecosystem with the required number of different foliage groups, and link each foliage group to its own Thematic Map which is associated with the density field. Each of those Thematic Maps has its own Test Condition that renders it impotent for all but one species (drawn from the major species attribute).

The rendered foliage would then switch group based on the major species, but still have the density driven by the relevant attribute value. Otherwise all species, if only linked to the density attribute, would render all the time.

Essentially, think of these controls as a filter-based "switch" to allow a Thematic Map to be turned off if it does not meet some required test condition.

Use This Test Checkbox

Enable this checkbox to apply the test condition in order to determine whether or not this Thematic Map should apply to the vector-bounded effect in question.

Attribute Field Drop Box

The Attribute Field drop box lets you select a database attribute from all the database attributes that exist in the database.

Attribute Field Controls

Select the Simply Exists checkbox to choose all objects that have the attribute shown in the Attribute Field drop box. You can use this along with the other search functions to choose additional objects.

Deselect the Simply Exists checkbox if you don't want to choose all objects that have the attribute shown in the Attribute Field drop box.

Select the Not checkbox to invert the results of the following search functions. When you select the Not checkbox, the filter will select all the objects that do NOT match the results of the other search functions below.

Select the "=" (Equals) checkbox to choose objects with the attribute shown in the Attribute Field that match the results of the following search functions. If the Not checkbox is selected, the filter will choose the objects that do NOT match the contents of the "to the value" field.

Select the ">" (Greater Than) checkbox to choose objects with the attribute shown in the Attribute Field with a value larger than the contents of the "to the value" field. If the Not checkbox is selected, the filter will choose the objects that are NOT larger than the contents of the "to the value" field.

Select the ">+" (Greater Than and Equal To) checkbox to choose objects with the attribute shown in the Attribute Field with a value equal or larger than the contents of the "to the value" field. If the Not checkbox is selected, the filter will choose the objects that are NOT larger than the contents of the "to the value" field.

Select the "<" (Less Than) checkbox to choose objects with the attribute shown in the Attribute Field with a value smaller than the contents of the "to the value" field. If the Not checkbox is selected, the filter will choose the objects that are NOT smaller than the contents of the "to the value" field.

Select the "<+" (Less Than and Equal To) checkbox to choose objects with the attribute shown in the Attribute Field with a value equal or smaller than the contents of the "to the value" field. If the Not checkbox is selected, the filter will choose the objects that are NOT smaller than the contents of the "to the value" field.

Greater Than, Less Than and Equals can also be used with text attributes. The filter will use the ASCII value of the text (values based on alphabetical order).

Select the Similar checkbox to choose objects with text in the Attribute Field that includes the characters in the "to the value" field. It is not case sensitive.

Data Page

Data Input Section

Data Channels Radio Buttons

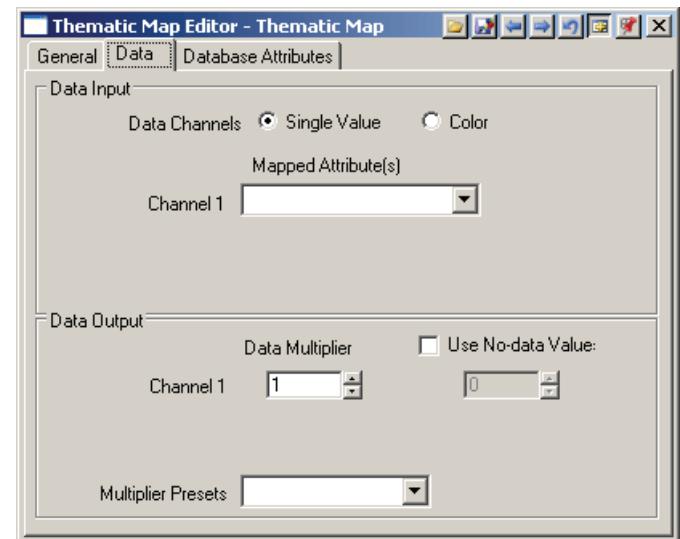
Choose the Single Value radio button to work with a single Vector attribute.

Choose the Color radio button to work with a color. You will then see three Mapped Attributes drop boxes, one for each color channel.

Mapped Attributes Drop Boxes

If you clicked the Single Value Data Channel radio button (see above), select the Vector attribute you want to use to drive one or more VNS parameters.

If you clicked the Color Data Channel radio button (see above), select a Vector attribute for each color channel in order to drive one or more VNS color parameters. Channel 1 is the red value, Channel 2 is the green value and Channel 3 is the blue value.



Data Output Section

Data Multiplier Fields

The Data Multiplier field lets you multiply the value provided by the Vector attribute to modify the value. This is useful for altering the value for visualization purposes within VNS without changing the original database.

If you clicked the Single Value Data Channel radio button (see above), you'll see a single Data Multiplier field.

If you clicked the Color Data Channel radio button (see above), you'll see a Data Multiplier field for each color channel. Channel 1 multiplies the red value, Channel 2 multiplies the green value and Channel 3 multiplies the blue value.

The default value of one leaves the Vector attribute value unchanged (multiplying any number by one does not change the original number).

The Data Multiplier field may also be useful for calculating derived values. For example, a forestry model may have a value for DBH (diameter at breast height, which is the diameter four feet up the trunk of the tree). You may be able to multiply that diameter value by a constant to derive a rough tree height for a specific tree species.

Use No-data Value Checkbox

The Use No-data Value checkbox and the associated No-data fields let you force a specific value for a Component's Thematic Mapped parameter if the Component appears outside of the attached Vector.

For example, wherever an Ecosystem is bounded by an attached Vector the Ecosystem and an Ecotype for the Ecosystem is set to get its Maximum Height from an attribute of the attached Vector, VNS will use the Vector attribute you set in the Data Input section of the Thematic Map Editor to set the Maximum Height value (see above).

However, for any areas the Ecosystem is rendered that are outside of the attached Vector, such as along a Terraffector or within Color Mapped areas, the value will normally revert to the actual value in the Ecotype Editor's Max Height field.

If you'd like to override that value, select the "Use No-data Value" checkbox. You can then force a specific Maximum Height value for areas outside the Vector. You can enter the value you'd like into the No Data Value field(s) (see below).

No-data Field(s)

The No data field(s) become available if you click the Use No-data Value checkbox (see above).

If you clicked the Single Value Data Channel radio button (see above), enter the value you want VNS to use for a linked Ecosystem parameter value if it appears outside the area of the Vector.

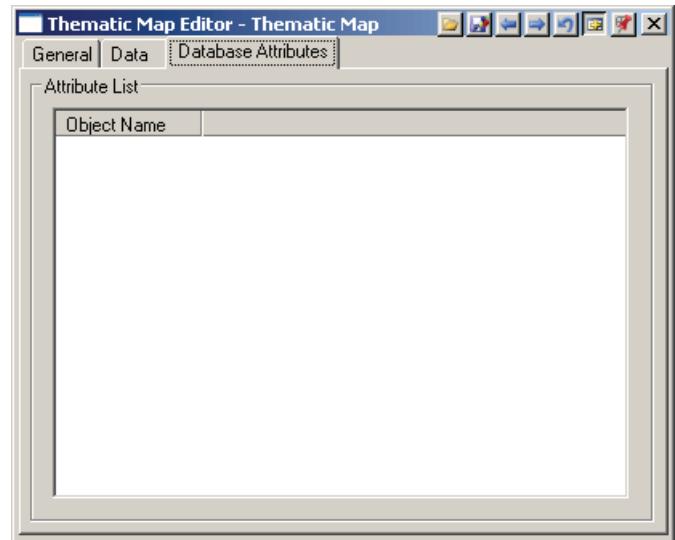
If you clicked the Color Data Channel radio button (see above), enter the color values you want VNS to use for any color linked to the Thematic Map if the Component appears outside the area of the attached Vector. Channel 1 is the red value, Channel 2 is the green value and Channel 3 is the blue value.

Multiplier Presets Dropdown List

This list contains common multiplier presets (Inches to meters, feet to meters, decimal to percent etc)

Database Attributes Page

The Attribute list shows all the Vector attributes currently available in the Project. The left column shows the name of each object. The top row shows the name of each attribute. If you go across from an object's name and down from an attribute name you can find the value of that attribute for that object.



Wall Editor

The Wall Editor lets you quickly create structures defined by Vectors.

You can use Walls to create panels along any attached Vectors. You can add a "roof" which creates a horizontal plane within each Vector area. You can render the panels and roof together, render just panels or render just the roof.

You can use Walls with panels to create fences, barriers and other shapes on the terrain. You can use Walls with panels and roofs to quickly create buildings, helicopter pads and other structures.

General Page

General Features Section

Name Field

Use the Name field to name the current Wall.

If you select an existing Wall and click the Create New Effect button to create a new Wall, VNS will name the new Wall with the same name, but with a number appended to the end. If there was already a number at the end of the name of the original Wall, VNS will increment the number. This ensures that the new Wall will have a different name.

Enabled Checkbox

Use the Enabled checkbox to enable or disable the Wall for rendering.

If you disable a Wall it will not lose its parameter values. It may be useful to temporarily disable a particular Wall to see how the terrain looks without it, or to speed preview rendering when you're working on some other aspect of your scene.

Make sure you remember to enable the Wall for the final rendering if you want VNS to render it.

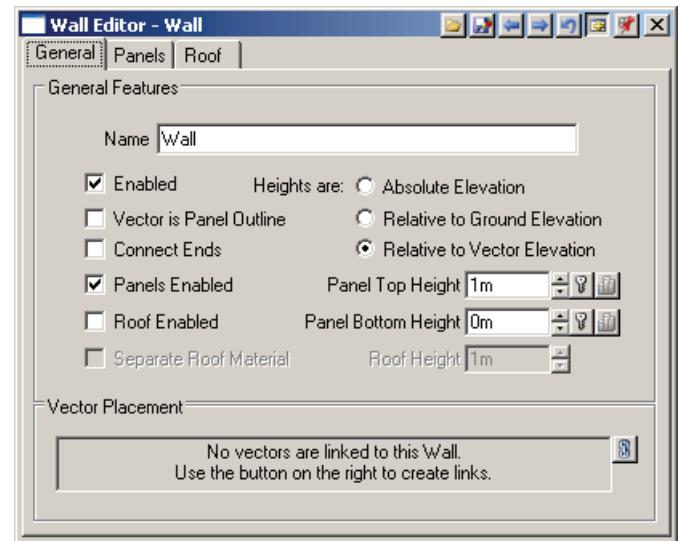
Note: To see the Wall in your rendering, it must be visible to the Camera you selected for the Render Job you are using (see Render Job Editor), and Walls must be enabled in the Render Options you are using (see Render Options Editor).

Vector Is Panel Outline Checkbox

Select this checkbox if your vector file is a 3D Shapefile which defines panel outlines, and is effectively a wireframe representation of the structure to be modelled. If the vector defines the floorplan of a building or is designed to be elevated to a particular height, but is still essentially a flat shape, then it should not be necessary to enable this checkbox.

Connect Ends Checkbox

Select the Connect Ends checkbox if you want VNS to create a wall segment between the first Vector vertex and the last Vector vertex. This will create a closed shape, especially useful when you are creating buildings and other closed structures.



Panels Enabled Checkbox

Select the Panels Enabled checkbox when you want to render Walls along any attached Vectors. Deselect it to prevent the Walls from rendering.

It may be useful to prevent the Walls from rendering if you just want to render the roof by itself

Roof Enabled Checkbox

Select the Roof Enabled checkbox when you want to render a Roof within any attached Vectors. Deselect it to prevent the Roof from rendering.

Separate Roof Material Checkbox

Select the Separate Roof Material checkbox when you want to texture the Roof differently from the Walls. When you select the Separate Roof Material checkbox you can specify the Roof Material parameters on the Roof page (see below).

Heights Are Radio Buttons

Select the elevation behavior that best fits your needs.

Absolute Elevation Radio Button

Choose Absolute Elevation when you want the panel and roof heights to be measured from a specific elevation, ignoring the elevation of the terrain or Vector. This is useful for buildings and other structures that have a set elevation.

Relative to Ground Radio Button

Choose Relative to Ground when you want panel and roof heights to follow and be measured from the elevation of the terrain. This is useful for walls, fences and other structures that typically mold themselves to the terrain.

Relative to Vector Radio Button

Choose Relative to Vector when you want the panel and roof heights to follow and be measured from the elevation of the Vector Object to which the Wall is attached. This is useful if your Vector data accurately portrays the elevation of a structure.

Panel Top Height Field

Enter the height you want for the top of each panel. The height is measured from an absolute elevation, the height of the terrain where any of the Wall's attached Vectors are located or the height of the attached Vector itself depending on which "Heights Are" radio button you selected (see above).

Panel Bottom Height Field

Enter the height you want for the bottom of each panel. The height is measured from an absolute elevation, the height of the terrain where any of the Wall's attached Vectors are located or the height of the attached Vector itself depending on which "Heights Are" radio button you selected (see above).

Roof Height Field

Enter the height you want for the roof. The height is measured from an absolute elevation, the height of the terrain where any of the Wall's attached Vectors are located or the height of the attached Vector itself depending on which "Heights Are" radio button you selected (see above).

Vector Placement Section

By attaching Vectors to Walls you can control where they appear. Vectors can be dynamically linked with Search Queries or hard linked.

Vector Links Button

This control allows you to perform various tasks relating to the association of vectors with components. To learn how to use it, see Vector Links Icon.

Attached Hard-Linked Vectors Display

The Hard-Linked Vectors display tells you if there are any Vectors hard-linked to the Component, and if so, how many. It will also display vectors attached by Search queries and list the names of the search query or queries in use.

Panels Page

The Panels Page lets you add new Materials to the panels of your Walls.

The Material Gradient Driver lets you tell VNS which Material to use. If you select a texture, the panels can use multiple Materials.

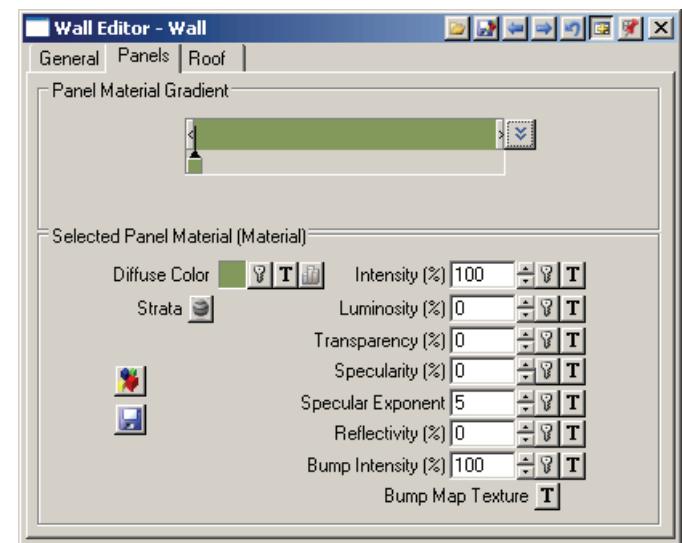
Material Gradient Section

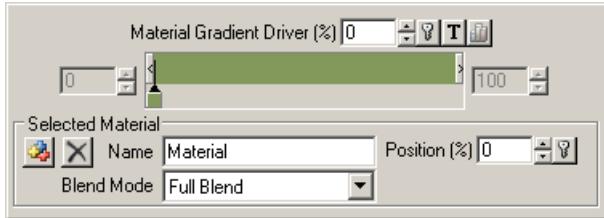
Material Gradient and Driver

The Material Gradient controls let you add, remove and edit the materials to the Ground Effect.

Each material in a panel comprises a set of properties (color, reflectivity, transparency etc) and Strata.

To Access the Gradient, click on the Gradient popdown icon . This will display the Material Gradient Editor:





Material Gradient Driver Percentage Controls

The Material Gradient Driver field lets you pick a Material for the Ground Effect based on a position along the Material Gradient (see below).

Enter a percentage from zero to 100 where zero is the left edge of the gradient and 100 is the right edge. VNS will use the Material at the gradient position you specify. If there is no Material represented at that position, VNS will create a blend between the nearest two Materials.

You can animate the Material Gradient Driver percentage to change Materials over time. This is great for climate change animations where you could animate through a variety of Materials such as from a desert to a rain forest.

By clicking the Texture Control icon you can control the Material Gradient Driver percentage with the Texture Editor. This lets you use all the Materials in the Gradient. Textures can range in gray values from black to white, with black representing 0% on the Gradient and white representing 100% on the gradient.

For example, if you use a fractal noise Element in the texture that ranges from black to white, VNS will cover the Ground Effect's area with Materials in a fractal noise pattern ranging from the left-most Material in the Gradient to the right-most Material in the Gradient.

You can also drive the selection of Ground Effect materials using a Thematic Map. For example, you could have an attribute in your controlling vectors that assigned a numeric value based on Ground Effect, and by careful organization of your Ground Effect materials on the gradient, use this attribute to populate all your vectors with one Ground Effect, while each displayed a different material at render-time.

Material Gradient

The Material Gradient shows a colored bar with one or more colored pins beneath it. The bar is a place to create Materials. Click it to create a new Material.

When you click the Gradient to create a new Material, VNS will give the new Material a random Diffuse Color. You can change the color by using the Diffuse Color Well to open the Color Editor.

VNS represents each Material with a pin that is colored with the Diffuse Color of the Material. Click any pin to select a Material.

Material Gradient Range Fields

The Material Gradient Range fields are on either side of the Material Gradient. They show the range of the value that controls the gradient.

If there's no texture enabled for the Material Gradient Driver, the range of the gradient is zero to 100 percent.

If there is a texture enabled for the Material Gradient Driver, then there are two cases:

1) The first Texture Element is a Dynamic Parameter.

In this case, the Range fields show the range of input values for the Dynamic Parameter you have selected. For example if Elevation is the Dynamic Parameter and the Elevation range in the texture editor (Input Low and Input High) is zero to 1000 meters, then in the Range fields you'll see zero on the left and 1000 on the right.

You can directly edit those texture values in the Ground Effect Editor's Range fields. This is handy because you don't have to reopen the Texture Editor if you want to edit these values.

2) The first Texture Element is not a Dynamic Parameter.

In this case, the Range fields are zero to 100 percent (representing values of 0 to 1 in the controlling texture, or black to white), and are non-editable.

Add Material Icon

Click the Add Material icon to add a new Material. VNS will ask for the position in the Gradient. Enter a position and click the OK button.

Alternatively you can click directly in the Gradient in a spot where no other Material exists.

VNS will create a new Material and give it a random Diffuse Color. The Material will be represented in the Gradient with a pin in the color of its Diffuse Color.

Remove Material Icon

Click the Remove Material icon if you want to delete the selected Material.

Material Name

The Material Name field lets you edit the Material's name. After you create a Material it will have a default name of "Material." It's a good idea to enter a unique name in the Material Name field to identify how you will use the Material. For example "sand," "forest" or "fall foliage."

Position in Gradient Field

The Position in Gradient field shows the percentage along the Gradient for the selected Material. You can move the Material's pin to the left by decreasing this number or to the right by increasing this number. You can also drag the pin along the Gradient with the mouse.

Blend Mode Drop Box

The Blend drop box lets you choose the rate of change between the selected Material and the Material to its left in the gradient.

These are easiest to visualize if you try them and see what they look like in the gradient. You can see how VNS blends Materials between the pins by how it blends the Diffuse Colors along the Gradient.

You can change the blending by selecting different blend types from the Blend Drop Box. If you have more than one material in the gradient, use the following choices to decide how the gradient blends the materials together.

Sharp Edge

Choose “Sharp Edge” if you want an instant change with no gradient.

Soft Edge

Choose “Soft Edge” to create a gradient that turns into the color to the left 1/10 of the way toward that color’s pin.

Quarter Blend

Choose “Quarter Blend” to create a gradient that turns into the color to the left 1/4 of the way toward that color’s pin.

Half Blend

Choose “Half Blend” to create a gradient that turns into the color to the left 1/2 of the way toward that color’s pin.

Full Blend

Choose “Full Blend” to create a smooth gradient that turns into the color to the left at that color’s pin.

Fast Increase

Choose “Fast Increase” to create an accelerated gradient that gets closer to the previous color faster, and turns into the color to the left at that color’s pin.

Slow Increase

Choose “Slow Increase” to create an decelerated gradient that gets closer to the previous color slower, and turns into the color to the left at that color’s pin.

S-Curve

Choose “S-Curve” to create a narrower gradient between the pin and the previous color’s pin and leaves more of the original colors along the gradient in between.

Selected Material Section

Diffuse Color Well and buttons

The Ground Effect's Diffuse Color (or texture) always appears wherever the Selected Material's Ground Overlay appears, unless you set the transparency of the Material to 100%. Click the Diffuse Color well to edit the Diffuse Color in the Color Editor.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's Diffuse Color with texture patterns.

When you use a texture, the Colors in the texture will replace the Diffuse Color, unless you use less than 100% Opacity in the Texture Editor, in which case the texture and the Diffuse Color will be mixed.

Strata Icon

Click the Strata icon to open the Material Strata Editor. There you can add Strata texturing to the Material.

Load and Save Material Icons

Clicking the relevant icon will either open the Component Gallery or the Component Signature Window, allowing you to load or save Ground Effect materials as required.

Diffuse Intensity Field and Buttons

The diffuse intensity of a material is a measure of how much of the diffuse color of a surface is returned to the camera. Reducing this value to 0% will result in a black surface (i.e.: 0 color) and setting it to 100% will result in the pure diffuse color as set in the Diffuse Color Well.

You can animate the value over time, and also drive its intensity with a texture.

This attribute is useful for simulating dirt (try driving this field with a Fractal Noise texture element), streaks, moisture (drive Diffuse Intensity with a Dynamic parameter of Water Level or Elevation to simulate moist surfaces at the edges of lakes and streams etc.)

The maximum value for this parameter is 10000%.

Luminosity Percentage Field and Buttons

Luminosity affects how the Material is shaded by Lights (see Light Editor). You can adjust it to create 3D-shaded Objects, flat-shaded Objects or anything in-between.

With zero percent luminosity, the Material will be fully shaded by Lights. This produces a 3D look. In deeply shadowed areas, the Material's color will be a darker shade of itself based on the Ambient Light Intensity and Color. Where fully lit by Lights, the color will be the Diffuse Color or texture (see above) modulated by the Intensity and Color of any Lights.

By raising the luminosity, you can lighten the shaded areas. This can be useful to do if the terrain that uses the Material seems too dark. Raising the luminosity a little bit decreases the shading contrast for the Material.

With 100 percent luminosity, the Material will ignore Lights completely. This produces a flat, unshaded look. The Material will always be the Diffuse Color or texture. This can be useful for Materials used to create the flat, paper-cutout-style animations used by certain cartoon shows.

You can also subtract light by using negative luminosity to make the object tend toward the Ambient Light colors. With 100 percent negative luminosity, the Material will ignore Lights. The Material will be flat-shaded with the Ambient colors.

You can animate the Luminosity percentage to simulate lighting changes. This lets you animate the effect of nearby lightning or explosions.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's luminosity with a texture pattern. This can be useful for creating the look of glowing lava.

When you use a texture, a white value in the texture will equal the amount of luminosity you set in the Luminosity percentage field. A black value in the texture will equal zero luminosity. Gray values will be in-between.

Transparency Percentage Field and Buttons

Use the Transparency field to adjust how much you can see through the Ground Overlay. Zero percent will cover the terrain with opaque Ground Overlay. One hundred percent makes the Ground Overlay invisible, and you will instead see a Ground Effect on the terrain polygons. Anything in-between will mix the Ground Overlay with the Ground Effect.

Note: There is always at least one global Ground Effect in any VNS Project.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's transparency with a texture pattern to make some areas more transparent than others.

When you use a texture, a white value in the texture will equal the amount of Transparency you set in the Transparency percentage field. A black value in the texture will equal zero Transparency. Gray values will be in-between.

Specularity Percentage Field and Buttons

Specularity is the amount of shininess for a material.

Use the Specularity Percentage field to adjust the shininess of the material. Zero percent means no specular highlight, while 100 percent is maximum shininess.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's specularity value with texture patterns.

When you use a texture, a white value in the texture will equal the amount of Specularity you set in the Specularity percentage field. A black value in the texture will equal zero Specularity. Gray values will be in-between.

Specular Exponent Field and Buttons

Use the Specular Exponent field to adjust the size of the shiny spot. The useful range is from 1 to infinity. Higher numbers will produce a smaller spot, with less feathering at its edge.

You can apply, edit or delete a texture using the standard texture controls to the right. Using these controls you can replace the Material's specular exponent value with texture patterns.

When you use a texture, a white value in the texture will equal the amount of Specular Exponent you set in the Specular Exponent field. A black value in the texture will equal zero Specular Exponent. Gray values will be in-between.

Reflectivity Field and Buttons

Terrain materials can now reflect their surroundings, as well as parts of their own geometry. This is ideal for simulating surfaces such as snowfields, or mirages.

Set this value to an amount greater than 0% to see reflections on these surfaces.

You can animate the value over time, and also drive its intensity with a texture.

The maximum value for this parameter is 10000%.

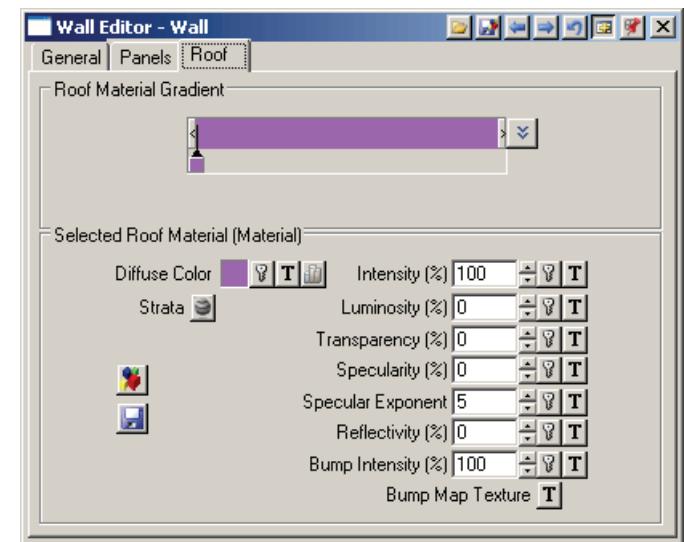
Bump Intensity Percentage Field and Bump Map Icon

Bump mapping lets you simulate detailed relief shadowing without requiring dense geometry. For more about using bump mapping, see Bump Mapping Controls.

Roof Page

The Roof page is exactly the same as the Panels page, except it lets you control the materials for the Roof.

Note: Roofs use the same materials you set up for the Panel Materials unless you select the "Separate Roof Material" checkbox on the General page.



Wave Model Editor

The Wave Model Editor lets you create sets of waves. You can attach them to Lakes in the Lake Editor and to Streams in the Stream Editor. Waves will only appear within the bodies of water to which they are attached.

You can also attach waves to a vector. In that case the waves will only appear within the vector. If a lake or stream has a Wave Model attached only those areas within the vector will show the waves. You can feather the edges of a Vector-bounded Wave Model using an Edge Feathering Profile. This lets you smoothly merge different Wave Models.

You can create multiple Wave Models. Any Wave Model can be attached to any combination of Lakes and Streams, and be bounded or unbounded by Vectors. This makes it easy to create the waves you need and put them exactly where you need them.

General Page

General Features

Name Field

Enter a name for the Wave Model. For example, if it defines waves which are animated from average waves to high stormy waves, you might call it "Approaching Storm".

By default VNS will name new waves "Wave", and add a number after the name if there is more than one set of waves named "Wave".

Enabled Checkbox

The Enabled checkbox lets you enable or disable the waves for rendering.

Disabling waves can be useful if you are doing test renders to check some other aspect of your scene and don't want to see waves. Make sure you remember to enable the waves for the final rendering if you want to see the waves.

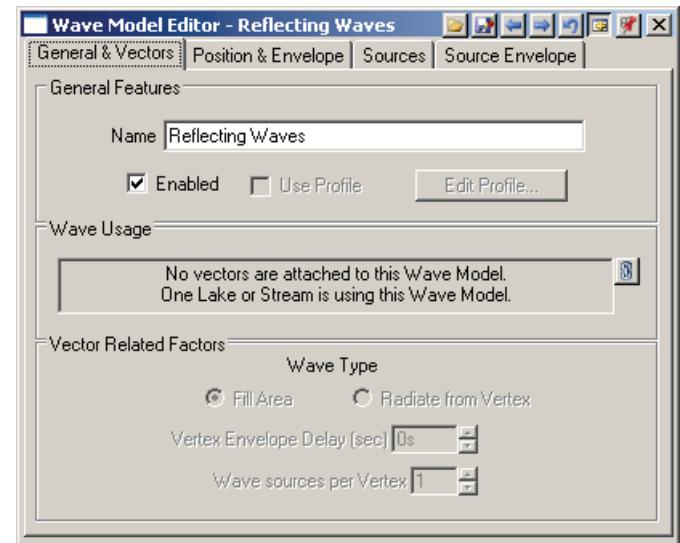
Note: To see the waves in your rendering, they must be visible to the Camera you selected for the Render Job you are using (see Render Job Editor), and waves must be enabled in the Render Options you are using (see Render Options Editor).

Use Profile Checkbox

Click the Use Profile checkbox when you want to control the amount of the Wave Model based on a gradient from the edge of the Vector Object's area toward the middle. This lets you fade in the waves so they don't end abruptly at the outside edge of the Vector.

When you first create a Wave Model VNS will create a default Edge Feathering Profile. The default Profile varies between no effect at the edge to the full effect 10 meters toward the middle of the Vector area. You can edit this Profile by clicking the Edit Profile button (see below).

Profiles add to rendering time and take additional memory to render.



Edit Profile Button

Click the Edit Profile button to open the Edge Feathering Profile Editor. There you can alter the Edge Feathering Profile to change the intensity of the Wave Model from the edge of the vector inward.

Vector Placement Section

By attaching Vectors to Walls you can control where they appear. Vectors can be dynamically linked with Search Queries or hard linked.

Vector Links Button

This control allows you to perform various tasks relating to the association of vectors with components. To learn how to use it, see Vector Links Icon.

Attached Hard-Linked Vectors Display

The Hard-Linked Vectors display tells you if there are any Vectors hard-linked to the Component, and if so, how many. It will also display vectors attached by Search queries and list the names of the search query or queries in use.

Wave Models appear within Lakes and Streams. You have to add a Wave Model to each Lake and Stream where you want it to appear. You can further restrict where a Wave Model appears by attaching it to one or more Vectors. When you attach a Wave Model to a Vector it will only be able to appear within the Vector, and only for Lakes and Streams to which the Wave Model has been added.

Attached Lakes or Streams Message

The Attached Lakes or Streams message tells you if there are any Lakes or Streams attached to the Wave Model and if so, how many. Wave Models can appear only within Lakes and Streams to which they are attached. You can attach Wave Models to Lakes in the Lake Editor and to Streams in the Stream Editor.

Vector Related Factors

These controls are only available if the Wave Model is attached to one or more Vectors.

Wave Type Radio Buttons

Choose the Fill Area radio button to tell VNS to fill the Vector area with waves from the Wave Sources in the Wave Model.

Choose the Radiate from Vector radio button to tell VNS to use the Vector's vertices as the origin for Wave Sources.

VNS will pick randomly from the Wave Model's Wave Sources and arrange them around the Vector's vertices. You can choose the number of wave sources per vertex (see below). Wave Sources with offsets other than zero will offset themselves from the Vector vertices to which they are assigned.

Per Vertex Envelope Delay Field and Buttons

The Per Vertex Envelope Delay field lets you delay the wave start of each vertex in order, all the way down the vector. This might be good for rain drop wave patterns.

Wave Sources Per Vertex Field

The Wave Sources per Vertex field lets you decide how many Wave Sources will be applied to each vertex. VNS randomly reuses the Wave Sources in the Wave Model so you don't have to have more actual Wave Sources than the value you enter into this field.

Position & Envelope Page

Position & Size Controls

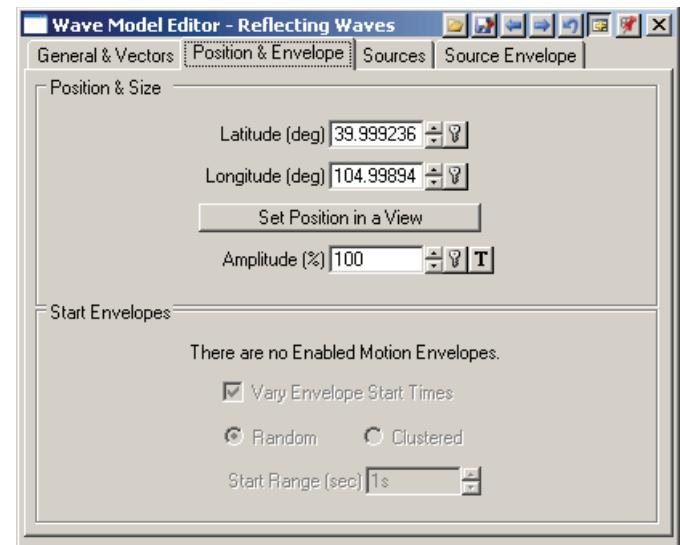
Latitude and Longitude Fields

The Latitude and Longitude fields let you position the Wave Model on the planet, in latitude and longitude degrees.

You can further position the Wave Sources belonging to the Wave Model by offsetting them from the Wave Model position. You can set the Wave Source positions on the Sources page (see below).

Set Position in a View Button

To set the Wave Model position by clicking in a View, click the Set Position in a View button and then click in a View. VNS will update the Latitude and Longitude fields.



Amplitude Percentage Controls

The Amplitude percentage field lets you offset the height of all Wave Sources together. 100% is no offset. A smaller value will reduce the height of all Wave Sources. A larger value will expand the height of all Wave Sources.

You can animate this value to cause Wave Sources to grow or shrink in amplitude over time. For example, by animating from zero to 100% you can make water go from a calm surface to a raging storm, assuming your Wave Sources are set pretty high.

You can control the Amplitude percentage with a texture. Wherever the texture is at 100% you'll get the full amount of Amplitude percentage in the field. Wherever the texture is at zero percent you'll get zero Amplitude for all Wave Sources. If you use an Element of Water Depth you can cause waves to increase or decrease near the shore.

Start Envelopes

Enabled Envelopes Message

The Enabled Envelopes message lets you see if any Wave Sources are using an Envelope to control amplitude decay.

Vary Envelope Start Times Checkbox

The Vary Envelope Start Times checkbox lets you enable or disable Start Time variation.

Each Envelope has a start time on the Source Envelope page. This checkbox randomizes that start time. Every time a wave starts, VNS picks a random number from zero to the start range (see below), and adds that to the source envelope's start time.

Envelope Radio Buttons

Choose Random to make the start times spread evenly from zero to the start range. Choose Clustered to make more wave start times be in the middle of the range, with fewer at the beginning and end of the range time. This might be good for starting a rain storm to get a steady rate of raindrop waves quickly.

Start Range Field

The Start Range field lets you adjust the range for randomizing envelope start times when you use the Vary Envelope Start Times checkbox (see above).

Sources Page

Wave Sources Controls

Wave Sources List

On the left side of the Sources page is the Wave Sources list. Here you'll see a number for each Wave Source you create. The highlighted number is the Selected Wave Source. For convenient comparison, the numbers in the list are the amplitudes of each of the Wave Sources in the list, in meters.

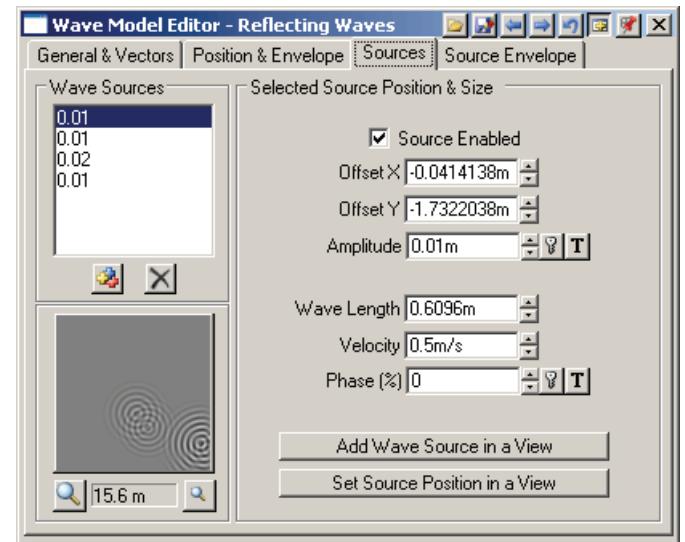
You can make any wave the Selected Wave Source by clicking its amplitude in the Waves list. The parameter values for the Selected Wave Source are shown on the right and on the Source Envelope page (see below).

Add Source Icon

Click the Add Source to create a new Wave Source. VNS will create a new Wave Source with offsets of zero an amplitude of one meter, a wavelength of one meter and a velocity of .5 meters per second. You can edit these values (see below).

Remove Source Icon

Click the Remove Source icon to delete the selected Wave Source.



Selected Source Position & Size

Source Enabled Checkbox

Select the Source Enabled checkbox to include enable the selected Wave Source. Deselect the Source Enabled checkbox to disable the selected Wave Source.

Offset X and Y Fields

The offset X and Y fields let you move the selected Wave Source to a distance away from the Wave Model position. This lets you alter the position from which the Wave Source will generate waves.

The Offset X field lets you move the Wave Source east or west. Use a positive number to move it to the east or a negative number to move it toward the west.

The Offset Y field lets you move the Wave Source north or south. Use a positive number to move it to the north or a negative number to move it toward the south.

Amplitude Field

The Amplitude field lets you adjust the height of the waves for the selected Wave Source.

Amplitude Texture Controls

The Amplitude Texture controls let you control Amplitude with a texture. This opens up intriguing possibilities. For example, you can use a Dynamic Parameter Texture Element of Water Depth to make the waves higher near the shore.

Wave Length Field

The Wave Length field lets you adjust the wavelength of the waves for the selected Wave Source.

Velocity Field

The Velocity field lets you adjust the speed of the waves for the selected Wave Source.

Phase Percentage Field

The Phase percentage field lets you change the phase of the waves for the selected Wave Source. This has the effect of delaying the waves.

Phase Texture Controls

The Phase texture controls lets you control phase with a texture. This opens up intriguing possibilities. For example, you can use a Dynamic Parameter Texture Element of Water Depth to delay the waves, causing the waves to wrap around beaches and rocks in the water.

Source Envelope Page

The Source Envelope page lets you add an Envelope to the selected Wave Source. This lets waves decay in interesting ways.

Selected Source Envelope

Envelope Enabled Checkbox

Select the Envelope Enabled checkbox to turn on an envelope for the selected Wave Source.

Deselect it if you want the Wave Source to create regular waves that do not stop or decay over distance.

Repeat Before Start Time Checkbox

Select the Repeat Before Start Time checkbox if you want cycles of the envelope to occur before the actual Start Time (see below). VNS will repeat the envelope as necessary to allow waves to occur before the Start Time.

This lets you align the peak wave energy to the frame where you set the start time, while still having waves in frames before the start time.

Repeat After Checkbox

The Repeat After checkbox if you want the envelope to repeat after it does a full cycle starting at the Start Time. Use this if you don't want the waves to die out after the envelope has run once.

Start Time Field

Enter the frame or time when you want the Source Envelope to begin.

Velocity Field

The Velocity field lets you specify how fast the Source Envelope progresses.

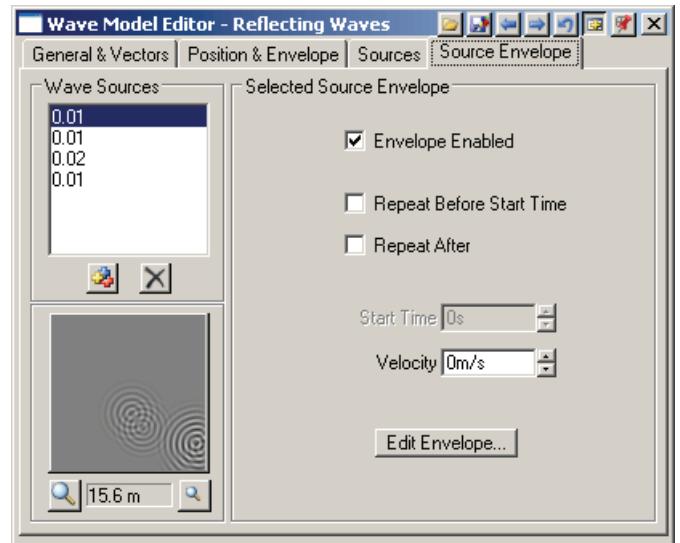
A zero velocity means the envelope controls the amplitude of the waves to make the waves decay as they leave the source. The envelope defines the maximum amplitude of the waves and how far from wave source that maximum amplitude happens.

If you make the Velocity the same as the velocity of the Wave Source itself, then as the first wave expands it won't lose amplitude, but trailing waves will diminish in amplitude.

Edit Envelope Button

Click the Edit Envelope button to open the Amplitude Envelope Editor. There you can graphically adjust the shape of the envelope.

The envelope lets you specify how the wave amplitudes will change over distance.



Other Windows

VNS has other windows that don't fit the standard Editor size, lack the standard set of Editor icons on the right and are less likely to be docked in The Matrix. Generally, you'll open them, use them and close them, although you can leave them open if you desire. They are not affected by Matrix task mode and therefore will not close when you switch task modes.

VNS gives you the following additional windows:

- **Amplitude Envelope Editor**
- **Authorization Window**
- **Color Editor**
- **Component Gallery**
- **Component Library**
- **Component Signature Window**
- **Create Palette Window**
- **Credits Window**
- **Cross-Section Profile Editor**
- **Database Editor**
- **DEM Interpolator**
- **DEM Merger Wizard**
- **DEM Painter Window**
- **Diagnostic Data Window**
- **Edge Feathering Profile Editor**
- **Edit Coverage Profile Editor**
- **Edit Custom Curve Window**
- **Edit Density Profile Editor**
- **Edit Shading Profile Editor**
- **Export Control Window***
- **Export Database Window**
- **Forestry Wizard****
- **Image Object Library**
- **Image Viewer**
- **Import Wizard**
- **Info About Point Window**
- **Light Position By Time Window**
- **Numeric Input Window**
- **New Project Window**
- **Path-Vector Transfer Window**
- **Preferences Window**
- **Realtime Foliage File Preferences Window**
- **Render Control Window**
- **Scale/Delete Key Frames Window**
- **Scale Vector Elevations Window**
- **Scene Export Window**
- **Scene Import Window**
- **Status Log**
- **Template Manager**
- **Terrain Gridder Wizard**
- **Texture Editor**
- **Timeline Editor**
- **Vector Editor**
- **Vector Profile Editor**
- **Vector Profile Export**
- **Version Window**
- **View Preferences Window**

* in versions of VNS authorized with the Scene Express add-on

** in versions of VNS authorized with the Forestry Edition add-on

Amplitude Envelope Editor

Click the Edit Envelope button on the Source Envelope page of the Wave Model Editor to open the Amplitude Envelope Editor.

Here you can graphically adjust the shape of the envelope for a Wave Source. The envelope lets you specify how the wave amplitude will change over distance.

The left edge of the graph is the Amplitude of the Wave Source at its Start Time. The elevation changes in the graph to the right represent the amplitude change of the Wave Source over a distance.

Graph Controls

Distance Field

The Distance field lets you enter a distance for the currently selected point in the graph. Distances are represented along the X axis of the graph. This is the distance from the Wave Source that the point's elevation will apply.

Value Field

The Value field lets you enter the height for the currently selected point in the graph. This is the amplitude of the wave.

Max Display Field

The Maximum Display field lets you specify the high Y limit for the graph. The Y axis shows the amplitude of the wave.

Min Display Field

The Minimum Display field lets you specify the low Y limit for the graph. The Y axis shows the amplitude of the wave.

Graph Area

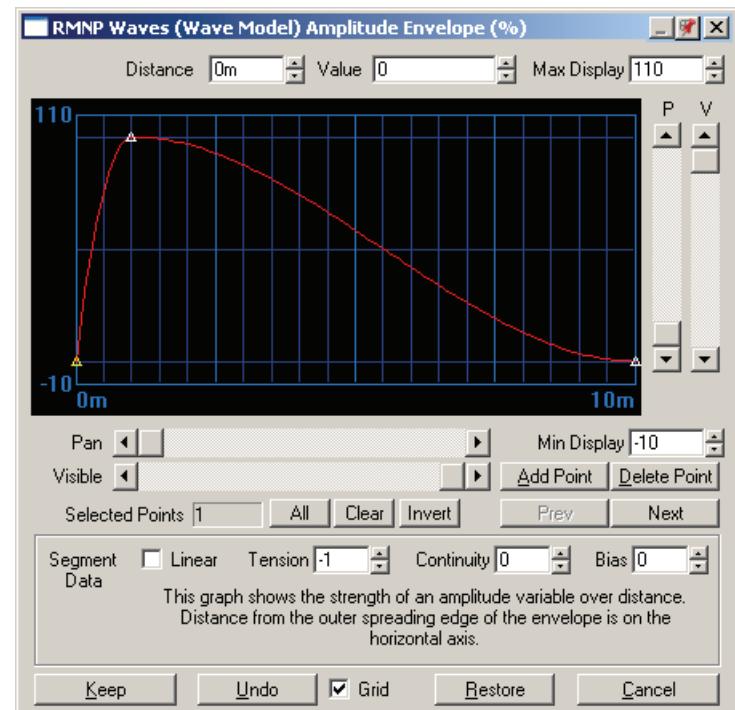
The Graph display shows the amplitude change of the wave over distance. You can interactively edit the points on the graph.

The X and Y values are both measurements in real units. The X axis of the graph shows a distance from the Wave Source. The Y axis of the graph shows a distance above or below the water surface. You can select the units on the Units page of the Preferences Window.

You can click any point to select it. You can drag points in the Y axis with the mouse.

Vertical P (Pan) Slider

Use the Vertical Pan slider to go up or down in the Graph when you've zoomed in with the Vertical Visible slider. The Y axis shows the elevation change.



Vertical V (Visible) Slider

Use the Visible slider to zoom in and out on the Y axis of the Graph display. The Y axis shows the elevation change.

Horizontal Pan Slider

Use the Horizontal Pan slider to go left or right in the Graph when you've zoomed in with the Horizontal Visible slider. The X axis of the graph shows a distance from the Wave Source.

Horizontal Visible Slider

Use the Horizontal Visible slider to zoom in and out on the X axis of the Graph display. The X axis of the graph shows a distance from the Wave Source.

Selected Points Display Field

The Selected Points display field shows the number of graph points that are currently selected. Click a graph point to select it. Shift-click to select more than one.

Use the following buttons for more selection/deselection options.

All Button

Click the All button to select all points in the graph.

Clear Button

Click the Clear button to deselect all points in the graph.

Invert Button

Click the Invert button to select all unselected points and deselect all selected points.

Previous Button

Click the Previous button to select the previous point in the graph.

Next Button

Click the Next button to select the next point in the graph.

Add Point Button

Click the Add Point button and then click in the graph to add a new point.

Delete Point Button

Click the Delete Point button to remove the selected points.

Segment Data Section

The Segment Data section lets you control parameters for individual Profile segments between points. The controls are for the segment to the left of the currently selected point on the graph.

Linear Checkbox

Select the Linear checkbox to make the shape to the left of the active point be a straight line rather than a curved spline.

Tension, Continuity and Bias Fields

The Tension, Continuity and Bias values change the shape of the curve at the active point.

Lower Edge Controls

Keep Button

Changes apply immediately when you make them. The Keep button lets you close the window without losing your changes.

Undo Button

The Undo button lets you throw away the last change you made in the Amplitude Envelope Editor. Use this as a way to undo a single change when experimenting.

Grid Checkbox

Click the Grid checkbox to toggle a grid display in the graph.

Restore Button

The Restore button lets you deliberately throw away all the changes you made since you last opened the Amplitude Envelope Editor. Use this as a way to undo changes when experimenting.

Cancel Button

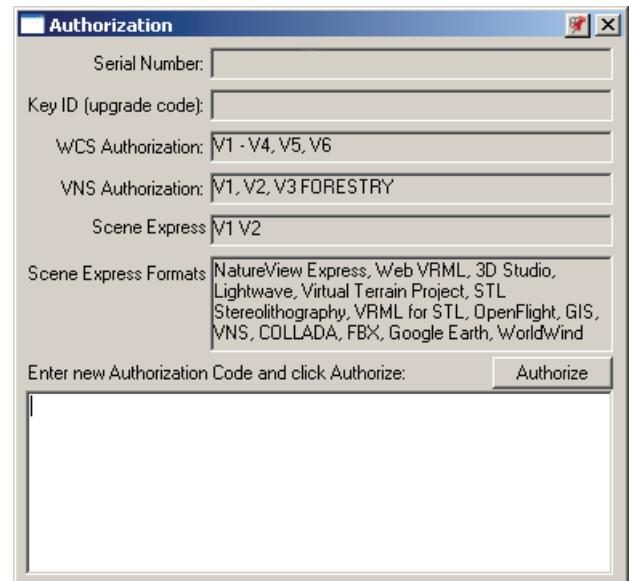
The Cancel button lets you close the window and deliberately throw away all the changes you made since you last opened it. This is like the Restore button (see above) but it also closes the Amplitude Envelope Editor.

Authorization Window

The Authorization Window provides information about what versions and features of which 3D Nature products your hardware key is authorized to run. It also displays the hardware key serial number and upgrade code, necessary for requesting authorization for new features from 3D Nature, as well as a means for entering authorization codes (supplied by 3D Nature) to enable new features or versions.

When the Authorization Window is first opened, it will converse with the hardware key, querying it to check on the availability of authorization for various versions and features. This process can take a short time. A progress bar will display at the bottom of the screen to indicate time remaining. This process cannot currently be aborted.

When the querying process is complete, the Authorization Window will be displayed.



Serial Number Field

The Serial Number field displays the serial number associated with this hardware key. This is essentially used to uniquely identify your 3D Nature software license. Typically each hardware key has a unique serial number, but if you have multiple keys that were purchased as a set, or if you purchased Additional Seat licenses, they may share the same serial number since they are licensed as a set.

Key ID (upgrade code) Field

The Key ID field shows the unique manufacturer's serial number for this particular hardware key. Every hardware key will have a unique Key ID. This number is also used by 3D Nature to generate Authorization Codes that will enable various versions or features for a particular hardware key. In this context, it is referred to as an Upgrade Code. When requesting Authorization Codes from 3D Nature, you will be asked to supply this number, as well as your Serial Number (above).

WCS Authorization Field

The WCS Authorization field indicates which versions of 3D Nature's World Construction Set software this key is authorized to run. In the screenshot above, the key is authorized for WCS versions 1-4, version 5 and version 6.

VNS Authorization Field

The VNS Authorization field indicates which versions of 3D Nature's Visual Nature Studio software this key is authorized to run. In the screenshot above, the key is authorized for VNS versions 1 and 2. If you are authorized for the VNS 2 Forestry Edition, the word FORESTRY will appear here as well, as shown in the screenshot.

Note: Typically a hardware key is automatically authorized for all versions and products that are older or lower-end than the product purchased. So, by purchasing WCS 6, one is automatically authorized to run WCS 5, 4 and all other versions of WCS prior to 6. Likewise, by purchasing Visual Nature Studio, one normally has access to all versions of WCS that are a subset of the VNS functionality (WCS 1-5 for

VNS 1 and WCS 1-6 for VNS 2). This allows use of older versions during the transition time while learning a new version, as well as going back to an older version of the software if needed for re-rendering old projects to match the appearance of older versions of the software.

Scene Express Field

The Scene Express field indicates which version of Scene Express you are authorized for, if any. The screenshot displays a hardware key authorized for Scene Express 1, currently the only version of Scene Express available.

Scene Express Formats Field

The Scene Express Formats field lists the output formats Scene Express is authorized for (if Scene Express itself is available, see above). A number of formats are available by default with the basic Scene Express (such as NatureView Express, Web VRML, 3D Studio, Lightwave, Virtual Terrain Project (VTP) as seen in the screenshot). A number of other output formats are optional, and require additional purchase and authorization (such as STL Stereolithography, VRML for STL, OpenFlight, etc).

Authorization Code Field and Authorize Button

The Authorization Code field and the Authorize button are used in combination to enter a new authorization code from 3D Nature and permanently load it into the hardware key. In practice, one would type or copy & paste the authorization code (which could be a short number or a long string of random-appearing text) into the Authorization Code Field, and then click the Authorize button. If the authorization code is valid and accepted, the program will notify you of this fact, and instruct you that it will exit. Upon re-starting the program, the newly-authorized capabilities should now be available. Should there be any problems with the Authorization Code, the program will advise you of this, and will not exit.

Color Editor

The Color Editor lets you edit colors in your Project. To edit a color, click the Color Well in any other Editor. VNS will open the Color Editor.

Color Section

RGB/HSV Fields and Sliders

Use the RGB/HSV fields, sliders and buttons to edit color parameters.

You can enter values in the fields, click the arrow buttons or use the sliders. You can adjust the color by changing its Red, Green and Blue channels using the controls on the top, or you can modify Hue, Saturation and Value with the bottom controls. The color panels between the two sets of controls shows the color you started with and the changed color as you edit.

The Red, Green and Blue values can range from 0 to 300. The sliders let you select between 0 and 255, which represent the normal 8-bits of information for each color channel. The fields let you enter higher numbers to allow you to create more luminous colors. For example, a value of 300,300,0 will create a brighter, more luminous yellow suitable for fall foliage.

Using values that are higher than 255 can counteract other factors that may dull colors in the final rendering, such as low Sun Light values or the use of Cloud Shadows. Only the RGB fields let you enter values higher than the normal 8-bit per channel values. The HSV sliders are constrained within the normal 8-bit value range.

The Hue amount ranges from 0 to 360. It represents a position on the color wheel. You can see the colors in the Vertical Gradient (see below).

Saturation and Value are percentages from 0 to 100. You can see them represented in the Gradient Pane (see below). Zero Saturation will remove all color and give you a gray scale amount based on the Value percentage. Maximum saturation gives you the maximum amount of the color selected with the Hue slider. Zero Value gives you black. Maximum Value gives you a bright color.

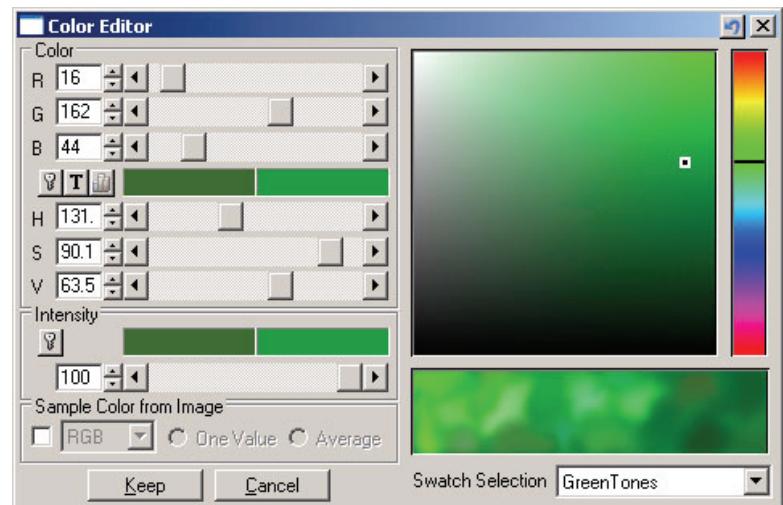
Natural colors are not highly saturated. For the most part we have found color saturations of 15 to 55 percent work well. Of course you are perfectly welcome to have hot pink trees if you like.

Color Panels

The Color panels between the RGB and HSV controls shows the color you started with and the changed color as you edit.

Gradient Pane

The Gradient Pane shows a gradient of Saturation and Value. Saturation is zero on the left and 100% on the right. Value is shown at zero on the bottom and 100% on the top.



Vertical Gradient

The Vertical Gradient shows all available hues as a vertical gradient. You can slide the narrow bar up or down along the gradient to change the Hue. This is the same as sliding the Hue (H) slider on the left side of the Color Editor.

Color Swatches

Color Swatches are premade collections of useful colors. Select a Color Swatch from the Swatch Selection drop box.

You can make your own Color Swatches in any paint or image processing program in any of the supported image formats (see Image Loading and Saving). They should be 220 pixels wide by 51 pixels high (if not, VNS will scale them to that size, possibly losing detail). You can make any pixel any color you like. Swatches can be combinations of artistic smears like an artist's paint palette, regularly spaced color wells like a watercolor palette or whatever you want to do within that pixel area.

Store them in the "Color Swatches" directory. You'll find it in the following path:

WCSContent\Images\Color Swatches

VNS will look for all the image files there and show their names in the Swatch Selection drop box.

Intensity Section

Intensity Field and Slider

Use the Intensity section if you want to darken the color you created in the Color Section. A value of 100% will not change the color. Values below 100% will darken the color.

Color Panels

The Color panels in the Intensity Section show the Intensity color you started with and the changed color as you edit.

Sample Color from Image Section

The Sample Color From Image controls let you derive a color from an image. This is great for using actual colors from nature photographs for your VNS textures, foliage, skies, etc.

Note: You can view images in the Image Viewer using the commands in the View Menu.

Sample Color from Image Checkbox

Click the Sample Color from Image checkbox if you want to derive the Color Editor's color from an image or thumbnail in VNS.

You can then derive a color by clicking in a Color well, a thumbnail, a preview rendering, an image opened in the Image Viewer or an Image Object viewed by double-clicking a thumbnail.

Color Channel Drop Box

The Color Channel drop box lets you change what you are sampling from another image.

Select the color channel(s) you want to change by sampling from an image. RGB is the default. RGB samples all three color channels. You can optionally choose to sample just red, just blue, just green, just hue, just saturation or just value.

One Value or Average Radio Buttons

Select the One Value radio button if you want to get a color by clicking on a pixel in an image.

Select the Average radio button if you want to create a color by dragging the mouse over a variety of pixels in an image. VNS will create a color that is the average of all the pixels.

Keep Button

Changes happen immediately when you make them. You can click the Keep button to simply close the Color Editor.

Cancel Button

Click the Close button to close the Color Editor and undo changes. The Color Editor will close with all changes being canceled.

All Color Parameters and their key frames will be returned to their condition prior to opening the Color Editor.

Component Gallery

The Component Gallery lets you import pre-built pieces into your Project.

By selecting a combination of Components from the Component Gallery you can quickly create a variety of different looks for your Project. Of course you can always further tweak the Parameters in the various Editors and Other Windows to get the look you want.

You can load components from any editor using the Load Component From Disk Icon, and save your own Components into the Gallery by clicking the Save Component To Disk Icon.

VNS gives you the following Component categories:

- **Projects**
- **3D Materials**
- **3D Objects**
- **Area Terraffectors**
- **Atmospheres**
- **Cameras**
- **Celestial Objects**
- **Cloud Models**
- **Color Maps**
- **Coordinate Systems**
- **DEM Mergers**
- **Ecosystems**
- **Ecotypes**
- **Environments**
- **Foliage Effects**
- **Foliage Groups**
- **Ground Effects**
- **Lakes**
- **Lights**
- **Material Strata**
- **Planet Options**
- **Post Process Components**
- **Post Process Events**



- **Render Jobs**
- **Search Queries**
- **Shadows**
- **Skies**
- **Snow Effects**
- **Starfields**
- **Streams**
- **Terraffectors**
- **Terrain Generators**
- **Terrain Gridders**
- **Terrain Parameters**
- **Textures**
- **Thematic Maps**
- **Walls**
- **Wave Models**

Pages

When you open the Component Gallery by choosing the Component Gallery command in the View Menu, VNS will Open the Component Gallery with most of the Categories showing in the tabs at the top. Click any tab to go to the page you desire. If you are in a Task Mode, only the tabs that are members of the Task Mode will appear.

When you open the Component Gallery by clicking the Load Component From Disk Icon from one of the Editors, VNS will show only the page that relates to that Editor.

Each Component Gallery page shows components in a single category (see above).

Thumbnails and Descriptions

The Thumbnail shows an image to represent the Component.

Note: When you save Components you can choose what the image will be.

Under the Thumbnail will be the name the Component was given by the Component's author.

To import a component, double-click the thumbnail for the component you want to load. If you opened the Component Gallery from an Editor, VNS will replace the Component you were Editing. Otherwise VNS will open a new Component and add it to your Project.

If you hover your mouse pointer over a thumbnail, a tooltip will appear containing the name of the selected Component, the name & email of its author, the creation date and time, and a description of the Component written by the Component's author. The description may contain special instructions for using the Component.

Component Slider

The Component Slider along the right side of the Component Gallery lets you scroll the Thumbnail section if there are more than seven Components on the current page of the Component Gallery.

Displayed Folder Field and Icon

The Displayed Folder field shows the directory where the Component Gallery is looking for Components. For Project files saved as Components this will usually be in the “WCSProjects:” master path. For other Component files this will usually be in subdirectories of the “WCSContent:” master path.

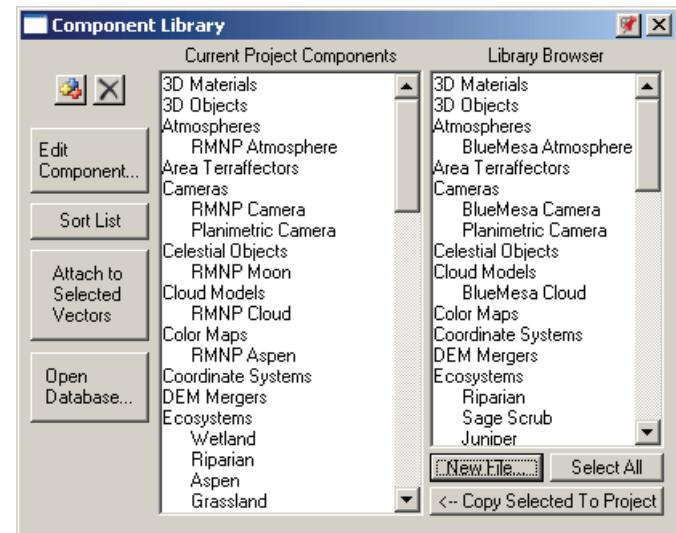
Component Library

The Component Library lets you create and import Components and attach them to any Vectors you select in the Database Editor. This is a quick way to attach a Component to multiple Vectors in one step.

Note: You can use the Scene-At-A-Glance to accomplish most of what the Component Library can do and many things it can't do. The Scene-At-A-Glance is always open and available on the left edge of the screen. You can also import pre-built Components from the Component Gallery and save your own pre-built Components using the Component Signature Window.

The Components are listed by category with the Category name on the left and the Components of that category indented to the right. You will see categories for the following component types:

- **3D Materials**
- **3D Objects**
- **Atmospheres**
- **Area Terraffectors**
- **Cameras**
- **Celestial Objects**
- **Cloud Models**
- **Color Maps**
- **Coordinate Systems**
- **DEM Mergers**
- **Ecosystems**
- **Environments**
- **Foliage Effects**
- **Ground Effects**
- **Labels**
- **Lakes**
- **Lights**
- **Planet Options**
- **Post Processes**
- **Render Jobs**
- **Render Options**
- **Render Scenarios**
- **Scene Exporters (If your license of VNS is authorized for Scene Express)**
- **Search Queries**
- **Shadows**
- **Skies**
- **Snow Effects**
- **Starfields**
- **Streams**



- **Terraffectors**
- **Terrain Parameters**
- **Terrain Generators**
- **Terrain Gridders**
- **Thematic Maps**
- **Walls**
- **Waves**

The Component Library window lets you manage the Components for your Project. You can create new ones, edit existing ones, delete Components, and import them from other Projects. You can apply Components to Vectors in the current Project.

Create or Clone a New Component and add to Library Icon

Click the Create New Component and add to Library icon to create a new Component in the selected Components category. You can also double-click the name of the category to create a new Component.

If a category name is selected in the Components List when you click the Create New Component button, VNS will create the Component using default values.

If you have a previously created Component selected, VNS will create a copy of the selected Component. The copy will have the same values as the initially selected Component. The copy will have the same name as the selected Component, with a number appended to the name. If the selected Component already had a number, VNS will increment the number by one.

You can rename the Component in the Component Editor's Name field. Make sure you don't name any Component in the same class with the same name, or VNS may render the wrong Component.

Remove Selected Components from Library Icon

Click the Remove Component icon to eliminate the selected Component.

Edit Component Button

Click the Edit button to open the Component Editor for the selected Component. This lets you edit the parameters for the Component (see below).

Sort List Button

Clicking this button will sort the Current Project Component list alphabetically

Attach To Selected Vectors Button

Click the Attach button to connect the currently selected Component(s) to the currently selected Vector(s). This lets you apply one or more Components to one or more Vectors quickly and easily.

Note: You can only apply one Component of a given category to any Vector.

You'll see the Components for any selected Vector in the Database Editor, shown in the Components list.

A Vector defines a path or area on the terrain. A Component can affect that path or area.

Open Database Button

Click the Database button to open the Database Editor. You will want to do this so you can select one or more Vectors in the Database Editor before you click the Attach button (see above).

Note: The Database Editor must be open and have one or more Vectors selected in order to use the Attach button.

Current Project Components List

The Current Project Components list is a tree structure that shows all the categories of Components. It also shows any Components you've created for the current Project. The actual Components are shown indented under the category to which they belong.

You can multi-select Components. Hold down the control key and click to select more than one Component at once.

There is always only one active Component. You'll see a box around the active Component in the list. Any other multi-selected Components are highlighted. The active Component is recognized by the "Create or Clone a New Component and add to Library" icon, the "Remove Selected Component from Library" icon and the Edit button. The Attach command and Create Combo command will act on all selected Components (see above).

A plus symbol (+) next to a Component in the Components list indicates the Component is attached to one or more Vectors.

If you disable a Component, the Component will be ghosted in the list. You can disable and enable Components by deselecting the Enabled checkbox or the Common Enabled checkbox in the Component's Editor window. Double click a Component in the list to open its Editor window.

You can open a Component's Editor by double clicking the name of the Component you want to edit. This also works in the Scene-At-A-Glance and the Components list on the Comp page of the Database Editor.

When you create a new Component VNS will open the appropriate Editor window so you can set up the Parameters for the new Component.

Library Browser

The Library Browser lets you see the Components in other Projects and import any of them into the Current Project.

New File Button

Click the New File button to choose another Project. VNS will open a file requester that you can use to select a Project. The file requester will initially show files with the ".proj" extension, but you can "show all" in case you have created projects without that extension.

When you use the file requester to choose a Project VNS will list the Components in the Project you selected.

Select All Button

Click the Select All button when you want to select all the Components in the Library Browser. This is a quick way to select all the Components in another Project when you want to bring them all into the current Project.

Copy Selected To Project Button

Click the Copy Selected To Project button when you want to move the Component you selected in the Library Browser into the current Project.

When you copy a 3D Object, VNS will include all its materials.

The name of a Component may be different after you copy it into the current Project. If the Component name ends with a number in the Library Project, VNS will look for any Components of the same type with the same name in the current Project and alter the number accordingly. For example, a Component named "Lake2" will come in as just "Lake" if there are no similar Components named "Lake" already in the Project. If there is a similar Component named "Lake" already in the current Project, the imported Component will be renamed "Lake1".

Component Signature Window

Click the Sign or Save Component to Disk icon on any Editor window (see Editors) or in the File menu to open the Component Signature window.

The Component Signature window lets you save pre-built Components from the current Project. You can then import them into other Projects using the Component Gallery.

The Component Signature window also lets you sign Components in the current Project without saving them separately.

Title Bar Display

The title bar displays the name of the Component you are about to save.

Save To Folder Field

The Save To Folder field lets you specify where you want VNS to save the Component. By default this will be to a subdirectory of the Components directory so the Component Gallery can find it automatically.

You usually won't have to change this field.

Save As Name Field

Use the Save As Name field if you want to change the name of the Component before you save it. Consider giving it a unique but descriptive name so it's easier to remember what it is later.

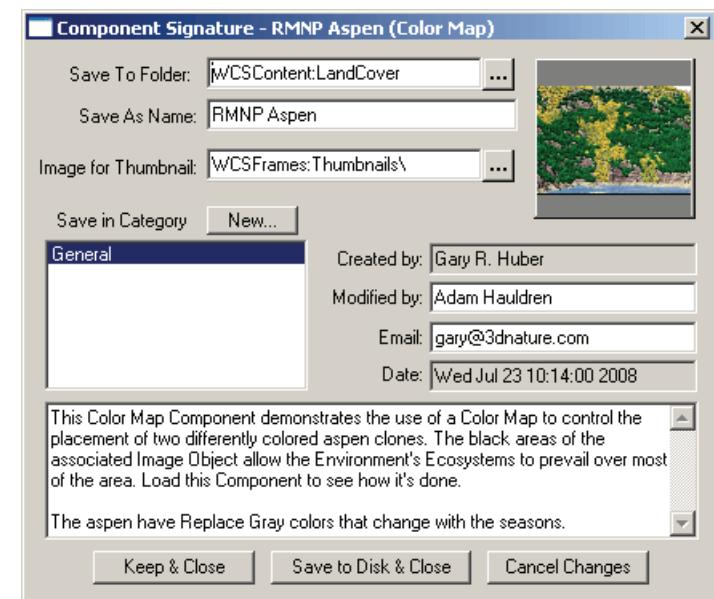
Image for Thumbnail Field and Thumbnail Display

Use the Image for Thumbnail field to select a rendered image to store as the Component's thumbnail. This is the thumbnail that will be displayed in the Component Gallery when you are choosing Components for other Projects.

Consider rendering an image from a Project that uses the Component -- perhaps the Project where you created the Component. Render an image that shows what the Component does. For example, if you are saving a Cloud Model Component, render an image that shows lots of sky, with the Cloud Model prominently featured.

You can also choose any existing thumbnail in the program to use as the Component's thumbnail. To do so, click the Component's thumbnail once and then click any other thumbnail in program. VNS will copy the second thumbnail you click into the Component's thumbnail. For example, you can use the thumbnail for one of the images in a Foliage Group to represent a Foliage Group Component; a Cloud Model's thumbnail for a Cloud Model Component; a Wave Model's thumbnail for a Wave Model Component model; a Sky gradient for a Sky Component; a texture thumbnail for a Ground Component; etc.

The Thumbnail display will show the image you choose.



Save in Category Button and List

Select a Category for the Component. Every Component type has a General category. If you want to create a special category for the Component, click the New button and enter a Category name.

Category information is stored within each Component. VNS displays each Category as a separate page in the Component Gallery.

Created By Field

When you save a new Component, enter your name here. This author credit will stay with the Component forever.

Modified By Field

If you are modifying a Component created by someone else you cannot change that person's Created By credit (see the Created By Field above). But you can take credit for modifying the Component by entering your name here.

Email Field

Enter your email address here so that others may ask you questions about your Component or contact you to hire you for VNS work.

Date Field

Enter the date when you created the Component.

Comment Field

Enter comments about the Component. It's a good idea to describe the Component and how the Component should be used.

Keep & Close Button

Click the Keep & Close button if you want to close the Component Saver without saving the Component just yet. All the data you entered into the above fields will be kept in the Project so you can save the Component later.

This lets you sign the Component without saving it.

Save to Disk & Close Button

When you are finished entering information into the above fields, click the Save to Disk & Close button to save the Component and close the Component Saver window.

You can then import the Component into any Project using the Component Gallery.

Cancel Changes Button

Click the Cancel Changes button if you want to close the Component Saver without saving the Component. All the data you entered into the above fields will be lost.

Create Palette Window

The Create Palette window lets you digitize Vectors and Control points. To open it, click the Create icon in the Icon toolbar.

If you first select a Component in the Scene-At-A-Glance, the Create Palette will let you digitize a Vector and create an attached Component of the type you selected, in one step. The Create Palette will open with default settings for creating an appropriate Vector for the selected Component type. You can change the settings before you digitize if you wish.

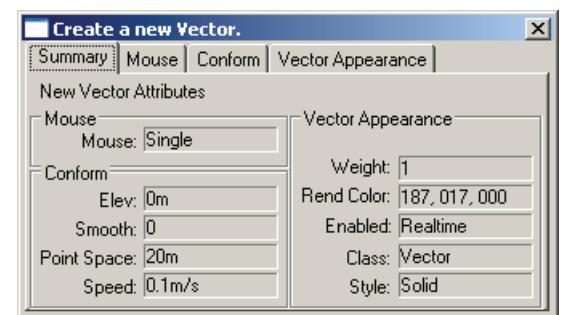
Note: "Digitizing" is clicking, drawing or sketching with the mouse in a View to create points for Control Points or Vectors.

The title bar will tell you what you are about to create. To digitize, click in any View using the technique you selected on the Mouse page. You can click in multiple Views as you digitize, if you wish.

VNS will create the Vector using the settings on the Vector Appearance page. If you are creating Control Points, VNS will use the settings on the Control Point page.

Summary Page

The Summary page lets you see the settings from the other pages at a glance. Here you can see the Mouse, Conform and Vector Appearance settings before you digitize. If you want to change any of the settings, click the tab for the appropriate page.



Mouse Page

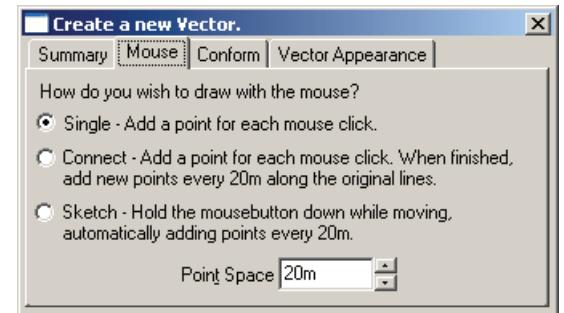
The Mouse page lets you select three options for digitizing with the mouse.

Select the Single radio button if you want to add a Vector vertex each time you click on the terrain with the mouse. This lets you precisely place every Vector vertex.

Select the Connect radio button if you want to add a Vector vertex for each click of the mouse but have VNS add vertices along the Vector between each place you clicked. You can adjust the space between the added vertices using the Point Space field.

Connect mode is great for creating aligned rows of vertices for Foliage Effects, such as rows of trees, fence posts, etc.

Select the Sketch mode if you want to draw freehand shapes. Drag with the mouse over the terrain. VNS will add a Vector vertex at regular intervals as you drag. You can set the interval in the Point Space field. This lets you create complex shapes quickly, without worrying about the exact location of each Vector vertex.

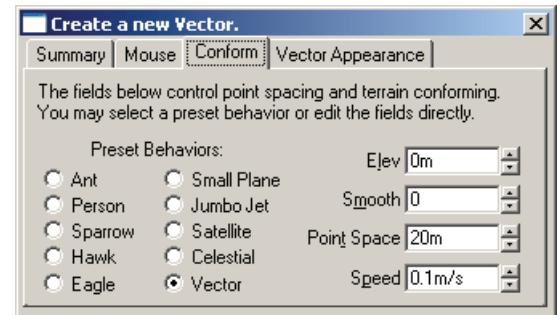


Conform Page

The Conform page lets you control point spacing, and elevation of the created vector, and can be especially useful when using the Sketch mode to digitize camera paths.

Preset Behaviors

The radio buttons for the preset behaviors provide combinations of appropriate settings for Elevation, Smoothing, Point spacing and Speed. Selecting a particular radio button will input the associated values automatically for you.



Elevation Field

The Elevation field lets you set the Elevation of new vector points. Set it to zero for vector points that conform to the underlying terrain. Set it higher and VNS will add vector points at the specified elevation above the terrain.

Note: The terrain elevation upon which the vector elevation is based is taken from the terrain point under each new vector point. These values will be much more accurate if the vector is digitized in a rendered view, as opposed to an OpenGL view.

Smooth Field

The value in this field controls how much VNS smooths sketched vector lines. For vectors created using the Single and Connect modes, this field will have no effect.

Point Space Field

The value in this field specifies the distance between Sketched or Connected vector types. This value will be reflected in the appropriate field on the Summary and Mouse pages.

Speed Field

The value in the Speed field controls the way in which VNS auto-calculates the length in time (in Seconds) of a created motion path. You can, of course, change this value through the interface that appears after creating a new motion path, but this value is used to calculate the initial time value entered into that interface.

Vector Appearance Page

The Vector Appearance page lets you control how the Vector you are digitizing will look. This page will not be present if you are creating a vector as a motion path (ie: while a camera is selected in the Scene-At-A-Glance)

Note: You can adjust these parameters for any existing Vector using the controls in the Vector editor and Database Editor.

Realtime View Enabled Checkbox

Checking this box allows the vector to be visible in Realtime Views.

Render View Enabled Checkbox

Checking this box allows the vector to be visible in Rendered Views.

Vector Color Well

The Color well lets you see the color of Vector Objects. To change the color click on the Color Well to open the Color Editor.

Style Drop Box

Use the Line Style drop box to select the line or point style for mapping a Vector in a View.

This only affects the Realtime View displays. Point Style Objects will be represented by individual shapes at the Vector's vertices. Line style Objects will have the vertices connected with the selected line style.

When you render an image, all line styles will be rendered as solid lines and all point styles as simple points.

You can choose from eight options:

Point Styles:

- **Point**
- **Circle**
- **Square**
- **Cross**

Line Styles:

- **Solid**
- **Dotted**
- **Dashed**
- **Broken**

The current style will appear in the drop box.

Line Weight Field

Use the Line Weight field to set the weight of a Vector Object for drawing and rendering.

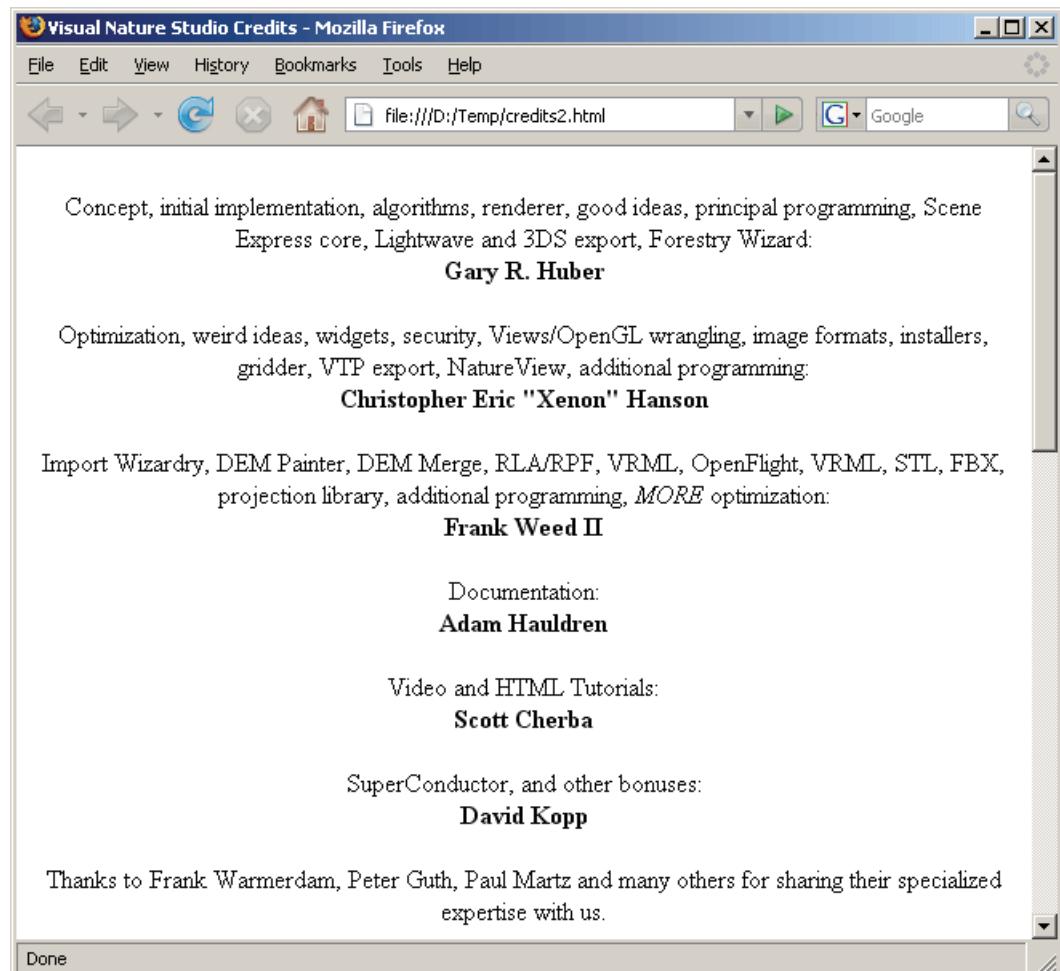
Enter the desired weight in pixels in the field or use the arrows to increase or decrease the weight one pixel at a time.

You may wish to vary the line weight to obtain consistent proportions when an image's resolution is changed. Increase it for print resolution images.

Credits Window

To open the Credits window, select the VNS Credits command in the Help menu.

The Credits window shows the names of the dedicated team that works tirelessly to bring you the wonders of Visual Nature Studio. It also includes special thanks to many of the talented people who have helped bring VNS to life, and has copyright information for the program and manuals.



Cross-Section Profile Editor

The Cross-section Profile Editor lets you adjust the curve, roughness and Ecosystems for a Terraffector.

To open the Cross-section Profile Editor, click the Edit Cross-section Profile button on the General page of the Terraffector Editor.

Cross-section Profiles are used by Terraffectors. Terraffectors are applied along Solid-style Vectors, or around the vertices of Point-style Vectors (Point, Circle, Square, or Cross).

The Cross-section Profile Editor's graph shows the change in elevation on either side of the Vector. The graph shows half of the cross-section. VNS applies the same elevation changes on both sides of the Solid-style Vectors.

The left edge of the graph is always the elevation change at the Vector itself, and the elevation changes in the graph to the right are applied on both sides of the Vector. In other words, the graph shows you the right half of the cross-section. VNS mirrors the graph to create the left half of the cross-section. By controlling the elevations in the Cross-section Profile with Solid-style Vectors, you can easily create the shape of a road bed, a stream bed, a dam, a flat building site and more.

For Point-style Vectors, VNS rotates the Cross-section profile around each Vector Vertex. For a Terraffector Effect whose host is a Point-style Vector, the graph is spun around each Vector vertex. The left edge of the graph is on each Vertex and the right edge is spun around to form a complete circle. This lets you make a craters, domes or other circular construction around each vertex in the Vector.

Note: The effectiveness of Cross-section Profiles depends on the resolution of the Terraffector. If you are not seeing a smooth transition you can increase the resolution of the Terraffector (both types), or enable the High-Res Edge option for an Area Terraffector to increase its resolution at the Vector. You can increase the resolution of a Terraffector only as much as the resolution of the underlying terrain, including the effect of Fractal Depth polygon subdivision.

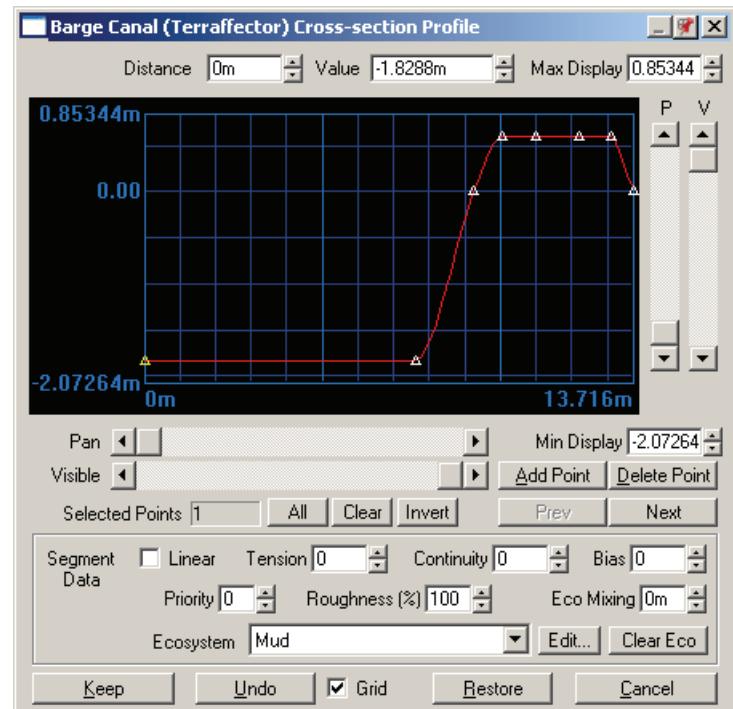
Graph Controls

Distance Field

The Distance field lets you enter a distance for the currently selected point in the graph. Distances are represented along the X axis of the graph. This is the distance the point's elevation will apply on both sides of the Terraffector's host Vector.

Value Field

The Value field lets you enter the height for the currently selected point in the graph. This is the vertical displacement the point will apply to the terrain.



Max Display Field

The Maximum Display field lets you specify the high Y limit for the graph. The Y axis shows the elevation change from the Cross-section Profile.

Min Display Field

The Minimum Display field lets you specify the low Y limit for the graph. The Y axis shows the elevation change from the Cross-section Profile.

Graph Area

The Graph display shows the shape of the profile VNS will use to reshape the terrain along the Vector. You can interactively edit the points on the graph.

The X and Y values are both measurements in real units. The X axis of the graph shows a distance from the Vector. The Y axis of the graph shows a distance above or below the existing terrain or the Vector Object, or an absolute elevation, depending on your selection in the Terraffector Editor. You can select the units on the Units page of the Preferences Window.

You can click any point to select it. You can drag points in the Y axis with the mouse.

Vertical P (Pan) Slider

Use the Vertical Pan slider to go up or down in the Graph when you've zoomed in with the Vertical Visible slider. The Y axis shows the elevation change from the Cross-section Profile.

Vertical V (Visible) Slider

Use the Visible slider to zoom in and out on the Y axis of the Graph display. The Y axis shows the elevation change from the Cross-section Profile.

Horizontal Pan Slider

Use the Horizontal Pan slider to go left or right in the Graph when you've zoomed in with the Horizontal Visible slider. The X axis of the graph shows a distance from the Vector.

Horizontal Visible Slider

Use the Horizontal Visible slider to zoom in and out on the X axis of the Graph display. The X axis of the graph shows a distance from the Vector.

Selected Points Display Field

The Selected Points display field shows the number of graph points that are currently selected. Click a graph point to select it. Shift-click to select more than one.

Use the following buttons for more selection/deselection options.

All Button

Click the All button to select all points in the graph.

Clear Button

Click the Clear button to deselect all points in the graph.

Invert Button

Click the Invert button to select all unselected points and deselect all selected points.

Previous Button

Click the Previous button to select the previous point in the graph.

Next Button

Click the Next button to select the next point in the graph.

Add Point Button

Click the Add Point button and then click in the graph to add a new point.

Delete Point Button

Click the Delete Point button to remove the selected points.

Segment Data Section

The Segment Data section lets you control parameters for individual Profile segments between points. The controls are for the segment to the left of the currently selected point on the graph.

Linear Checkbox

Select the Linear checkbox to make the shape to the left of the active point be a straight line rather than a curved spline.

Tension, Continuity and Bias Fields

The Tension, Continuity and Bias values change the shape of the curve at the active point.

Priority Field

When Terraffectors overlap, VNS will render them based on priority for Cross-section Profile segments and Approach Slopes. VNS will average those that are set to the same priority if there are no higher priorities.

Rendered Elevations also depend on Terraffector Evaluation Order, Priorities, Apply To choices and Comparison choices. This lets you control exactly how roads and other terraffected terrain behaves at intersections.

Roughness Percentage Field

Use the Roughness Percentage field to specify a percentage of the Vertical Displacement from the Project. VNS will use this percentage of Vertical Displacement within the Terraffector profile segment.

Note: You can set the amount of Vertical Displacement for the Project with the Terrain Parameter Editor.

The range is from zero to 500 percent, with zero being no Vertical Displacement and 100% being the full amount of Vertical Displacement as used by the Project. Any value over 100% will increase the amount of Vertical Displacement, with 500% being five times the Vertical Displacement you set for the Project.

A Roughness percentage of 100 will apply all the Vertical Displacement from the Project into the Area Terraffector. This will cause the terrain to have the same roughness within the Area Terraffector as the terrain does outside of the Area Terraffector.

You can smooth the terrain within the Area Terraffector by using a value of less than 100 percent. For example, you can use a lower value when you are creating a smooth road surrounded by rougher terrain.

You can roughen the terrain within the Area Terraffector by using a value of greater than 100 percent, up to 500 percent. For example, you can use a high number to make a very rough road that is still under construction.

Ecosystem Mixing Field

Use the Ecosystem Mixing field to control the amount of mixing between the Ecosystem applied to the segment to the left of the current point with the Ecosystems either side of that segment in the Profile. This lets you feather one Ecosystem into another around the selected segment in the Profile.

Note: Feathering occurs on both sides of the “selected” segment. A segment is selected by selecting the pin at the right-hand end of the required segment.

Ecosystem Drop Box

Choose any existing Ecosystem to apply it to the terrain that is defined by the segment to the left of the current point.

A blank drop box means the Terraffector will not impose an Ecosystem. It will only change the shape of the underlying terrain.

Note: The changed shape may change the Ecosystems based on how that shape interacts with the normal Ecosystem rules of nature.

However selecting an Ecosystem that uses the Ignore or Transparent texture for an Approach Slope Ecosystem or a Profile segment Ecosystem will cause holes in Terraffectors.

Edit Button

Click the Edit button to open the Ecosystem Editor ready to edit the selected Ecosystem.

Clear Ecosystem Field

Click the Clear Ecosystem field to make the current profile segment use no Ecosystem at all. The drop box will become blank. When rendering the Terraffector, VNS will not add an Ecosystem for that segment of the Terraffector. VNS will render the Ecosystem at that segment which would appear on the terrain if the Terraffector was disabled.

Lower Edge Controls

Keep Button

Changes apply immediately when you make them. The Keep button lets you close the window without losing your changes.

Undo Button

The Undo button lets you throw away the last change you made in the Cross-section Profile Editor. Use this as a way to undo a single change when experimenting.

Grid Checkbox

Click the Grid checkbox to toggle a grid display in the graph.

Restore Button

The Restore button lets you deliberately throw away all the changes you made since you last opened the Cross-section Profile Editor. Use this as a way to undo changes when experimenting.

Cancel Button

The Cancel button lets you close the window and deliberately throw away all the changes you made since you last opened it. This is like the Restore button (see above) but it also closes the Cross-section Profile Editor.

Database Editor

The Database Editor lets you manage Database Objects. Database Objects include DEMs, Control Points and Vectors.

You can determine how Database Objects will be shown in Views and how they will be rendered. You can enable Objects so they will be rendered, or disable them so they will not be rendered. For example, you can allow Vectors to be shown in Views but not rendered. This is useful when Vectors are hosts for Components (for example, when you're using a Vector to define the boundaries of a Lake).

The Database Editor works in conjunction with other editors and windows such as the Component Library so you can apply Components to one or more Vector Objects, and the DEM Merger Wizard and Terrain Gridder Wizard so that the wizards can automatically create Search Queries for you based on selections you make in the Database Editor.

You can group Objects into layers that can be enabled or disabled together, can also filter the contents of the database as well as performing basic editing operations on them such as splitting and joining vectors, editing attributes, and conforming vectors to the terrain.

To open the Database Editor click the Database Editor Icon in the Window toolbar, select the Database Editor command in the Data menu or double click the name of a DEM in the Scene-At-A-Glance.

Note: You can also open the Database Editor from the Component Library, as well as automatically when needed from certain other windows (such as the DEM Merger Wizard and Terrain Gridder Wizard). This is only for added convenience and does not affect the operation of the Database Editor.

You can position the Database Editor anywhere in the workspace by dragging the title bar, and resize it by clicking and dragging on the bottom left corner of the window. You can use the Database Editor at any time no matter what other windows are open, except during rendering.

All operations within the Database Editor take effect immediately -- you don't have to close the window. If you do close the window, none of your changes will be lost.

The Database Editor Window is divided into an Icon Toolbar, and a data display area.

The Icon Toolbar contains the following control icons:

-  **Remove/Delete Database Object Icon**
-  **Search For Database Object Icon**
-  **Edit Database Object Icon**
-  **DEM Painter Icon**
-  **Edit Vector Profile Icon**
-  **Split Database Object Icon**
-  **Join Database Objects Icon**
-  **Conform Icon**

Depending upon which class of object or objects are selected in the Database Editor, some of the above icons may not be available for use. For example, if Vectors are selected, the DEM Painter Icon has no use, and will be grayed out, while if the selected object is a DEM, only the first four Icons will be active.

The contents of the data display area are split into 5 tabbed pages:

- **Remove/Delete Database Object Icon**
- **Extent Page**
- **Comp(onent) Page**
- **Layer Page**
- **Attrib(utes) Page**

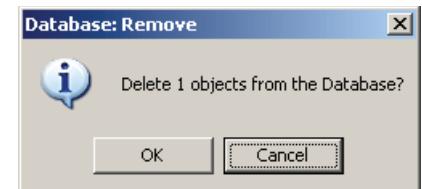
There are also some other database controls that do not fall directly into either of the above categories:

-  **Load/Append Database Icon (on Database Editor Windows Title Bar)**
-  **Save/Export Database Icon (on Database Editor Windows Title Bar)**
-  **Filter Database Icon**
-  **Show Properties Panel Icon**

Icon Toolbar

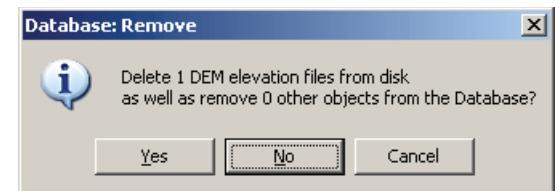
Remove/Delete Database Object Icon

Clicking this icon if a vector or vectors are selected will present a requester asking for confirmation that you wish to remove the selected objects from the database.



Clicking this icon while at least one DEM is selected will present a slightly different requester, which will also ask for confirmation as to whether or not you want the selected items removed from disk as well as from the database.

Note: Selecting No to this requester will still remove the object from the database, however, it will remain on disk (in the project folder or DEM Search Paths) as an .elev file and can be reloaded into the project directly into the Database Editor, or through the Import Wizard.



Search For Database Object Icon

Clicking this icon will open the Search Requester allowing you to enter a search string. Once confirmed, all objects in the database that conform to that search string (partially or in full) will be selected.

Note: If you want far more control over your searches, you can create a Search Query using the Search Query Editor and then use the Select Items Now Button to select the objects in the Database Editor. This method allows for the creation of powerful boolean search queries where the Search Icon only allows basic text-string searches against the database object name field.



Edit Database Object Icon

Depending upon which class of object is selected, clicking this icon will either open the Vector Editor (in the case of vectors), or the DEM Editor (in the case of DEMs), allowing further editing of the selected objects.

DEM Painter Icon

Clicking this icon will open the DEM Painter Window, allowing you to edit the elevations of the currently selected DEM.

Edit Vector Profile Icon

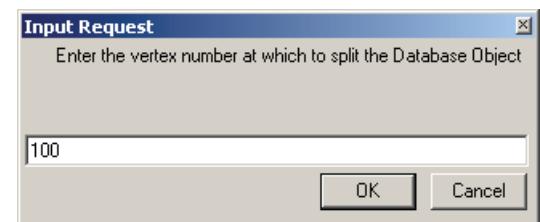
Clicking this icon will open the Vector Profile Editor, allowing you to edit the cross-section profile of the currently selected vector.

Split Database Object Icon

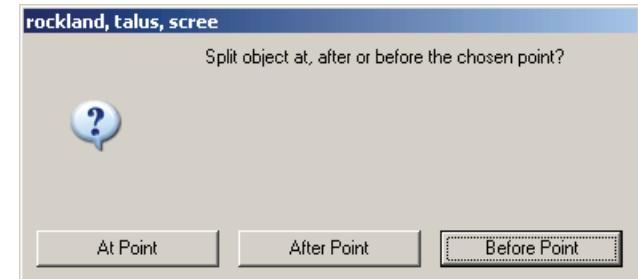
Clicking this button while a vector object is selected will split the object into two pieces. First VNS will ask you to confirm the split operation.

Once confirmed, VNS will prompt you for the vertex number at which you wish the split to occur.

Note: By default, the split will occur at the vertex that will result in the most evenly divided vector (ie: two pieces of as close to equal numbers of vertices as possible). These two vector sections may not be of equal length, as vertices may not be evenly spaced. If you wish the split to be at as near half-distance along the vector length, make sure that you have first edited the vector (using the point operations in the Vector Editor) to ensure evenly spaced points before attempting the split operation.



Once Provided, VNS will then ask as to whether you wish the split to occur at the selected point, after the selected point or before the selected point.



Once you have confirmed your choice, VNS will cut the vector at the requested point, and rename the two new vectors by appending an underscore and numbers after the original vector name. For example, if the original vector was called Roadline, the two vectors created after the split would be called Roadline_1 and Roadline_2. VNS will then ask you if you wish to disable the original object.

Join Database Objects Icon

Select two or more vector objects and click this icon to join them into one. You will be first asked to confirm the join operation. Once confirmed, VNS will prompt you for a name for the new joined object. Once provided, VNS will join the vectors and ask you if you wish to disable the original objects.

Note: In order for VNS to correctly apply area Components like Lakes and Ecosystems, you must attach a single Vector surrounding each area you want to fill with the Component. Depending on your data source, you may need to concatenate several Vectors into a single Vector that surrounds the area in question.

Conform Icon

The Conform Icon lets you conform Vectors or Control Points to the existing terrain elevations or the value in a Vector name, label, layer name or attribute.

Select the Vectors or Control Point Objects you want to conform in the Objects list. Then click the icon and choose the appropriate option from the menu that appears. The available options are:

Conform to Terrain

Choose this option if you want to conform the Object's elevations to the underlying terrain.

Conform to Name

Choose this option if you want to conform the Object's elevations to the value in the Object's Name field. This is useful if you have elevation values in the Name field. You can create elevation contours with Vectors or Control Points this way. You can then use the Vectors or Control Points to grid terrain based on these contours using the Terrain Gridder Editor.

Conform to Label

Choose this option if you want to conform the Object's elevations to the value in the Object's Label field. This is useful if you have elevation values in the Label field. You can create elevation contours with Vectors or Control Points this way. You can then use the Vectors or Control Points to grid terrain based on these contours using the Terrain Gridder Editor.

Note: Support for Labels is included for backwards compatibility with older projects that may rely on Labels for dynamic vector linkage and so forth. Formerly the Name and label fields were separate, but they have now been merged into one field in the Database Editor (the Name field). You no longer have direct access to the two fields as before, but in the case of older project data that uses Labels, editing values in the Name field will edit either the Label or the name, depending upon the object selected.

Conform to Layer

Choose this option if you want to conform the Object's elevations to the value in a Layer field. This is useful if you have elevation values in a Layer field. You can create elevation contours with Vectors or Control Points this way. You can then use the Vectors or Control Points to grid terrain based on these contours using the Terrain Gridder Editor.

Conform to Attribute

Choose this option if you want to conform the Object's elevations to the value in an Attribute field. This is useful if you have elevation values in an Attribute field. You can create elevation contours with Vectors or Control Points this way. You can then use the Vectors or Control Points to grid terrain based on these contours using the Terrain Gridder Editor.

Properties Page

This page allows you to view the various properties of the loaded objects.

Name Field

The Name field shows a DEM Object's file name or the name of the Active Vector or set of Control Points.

It can be useful to use elevation values to name or label Vectors and Control Points. You can conform their actual elevations to the name or label using the Conform To Name and Conform To Label buttons (see below).

For DEMs, this is the name someone gave the DEM when it was first created (see New Obj below). It will be blank for Vector Objects since Vector Objects are stored as part of the Project file rather than as separate files.

Note: It's a good idea to give DEM objects short names if you create new DEMs with the Data Operations features. There is no longer a limit on name length, but the use of very long filenames is still discouraged.

Name	Enabled	View	Render	Color	Class	Style	Weight	Max Fractal Depth
Spectacle Lake No. 1	✓	✓	✓		Vector	Solid	1	
Spectacle Lake No. 2	✓	✓	✓		Vector	Solid	1	
Fay Lake No. 2	✓	✓	✓		Vector	Solid	1	
Fay Lake No. 3	✓	✓	✓		Vector	Solid	1	
Ypsilon Lake	✓	✓	✓		Vector	Solid	1	
Chiquita Lake	✓	✓	✓		Vector	Solid	1	
Hazeline Lake	✓	✓	✓		Vector	Solid	1	
Rock Lake	✓	✓	✓		Vector	Solid	1	
Little Rock Lake	✓	✓	✓		Vector	Solid	1	
Forest Lake	✓	✓	✓		Vector	Solid	1	
Beaver Lake No. 1	✓	✓	✓		Vector	Solid	1	
Beaver Lake No. 2	✓	✓	✓		Vector	Solid	1	
Beaver Lake No. 3	✓	✓	✓		Vector	Solid	1	
Beaver Lake No. 4	✓	✓	✓		Vector	Solid	1	
Beaver Lake No. 5	✓	✓	✓		Vector	Solid	1	
RMNPNE	✓	✓	✓		DEM			7

No two DEMs may have the same file name since that could cause file retrieval errors. VNS won't let you change the name since other Databases may be looking for the same file. If you want to give a DEM a label to make it easier to keep track of the Object, use the Label field (see below).

Don't change DEM file names from the operating system! If a DEM file name is changed in some other fashion outside VNS' control VNS will treat the Object as disabled regardless of enabled status. You must reconcile the names by modifying the file root names to match the Object name VNS is expecting, as shown in the Name field.

Enabled, View and Render Checkboxes

These checkboxes let you turn off selected DEM, Control Point or Vector Objects without removing them from the Project. You can turn them on again at any time.

You can save rendering time by disabling Objects temporarily as you work. For example if you're working on clouds you can temporarily disable all the DEMs for faster preview rendering. If you're working on one section of a larger landscape you can temporarily disable the other sections for faster previews of the section you're concerned with (see the Layers section below for more on grouping Objects together).

Note: During rendering VNS will ignore DEMs that it thinks are not visible to the Camera.

You can also enable or disable objects by double clicking their names in the List, or by using the Layer Enable and Disable buttons to enable or disable groups of objects together (see Layers below). You might also want to use the Search button to select a group of Objects to enable or disable (see Search Button below).

You can also enable and disable selected items directly in the Scene-At-A-Glance using the Enable and Disable icons.

Enabled Checkbox

Click the Enable checkbox to enable or disable all Objects selected in the Objects list. Disabling it will disable both the View and Render checkboxes (see below).

Disabled Vectors are not available for use with attached Components.

Selecting the Enable checkbox will allow you to enable the View or Render checkboxes individually.

For a DEM, a checkmark also means the Object is enabled for exporting with the Scene Export Window.

In the Objects List and the Scene-At-A-Glance, enabled Objects are black and disabled Objects are gray.

View Checkbox

A checkmark means the Object is enabled for display in Views. No checkmark means the Object will be ignored by Views.

The View checkbox will only work if the Enable checkbox is selected (see above).

Note: To see Vectors in your Views the Plain Vectors checkbox must also be selected on the 3D/Vec/Sky page of the View Preferences Window for the current View.

Render Checkbox

A checkmark means the Object is enabled for display in renderings. No checkmark means the Object will be ignored for rendering.

The Render checkbox will only work if the Enable checkbox is selected.

Note: To see Vectors in your rendered images the Render Vectors checkbox must also be selected on the Misc page of the Render Options Editor for the Render Options you are using in the current View or Render Job.

Color Field

The Color Field lets you see the color of Vector Objects. Clicking in a cell will open the Color Editor and allow you to change the color. The selected color will be used for realtime and rendered representations of the vectors in question.

Class Field

Use the Class drop box to change an Object's Class. Every Object in the Database belongs to a "class". The class determines how the Object will be treated by Views and the Renderer.

There are three classes of Objects:

- **Terrain**

A DEM Object will be Terrain class. They will use Ecosystem and Color Parameters for placing and coloring trees, grass, rock, ground, water, and snow.

- **Vector**

Select Vector class for Vector Objects that you want to be rendered as lines or points. Vectors may be colored, shaded and even hazed. They are used to represent an unlimited array of Objects from streams and roads to the footprint of an Object that will be rendered in another program and combined with VNS renderings.

- **Control Points**

Control Points are elevation points VNS can use to grid new DEMs with a Terrain Gridder.

You cannot create a DEM Object in the Database Editor. VNS will not let you change a DEM Object to one of the other classes, or one of the other Object types to the DEM class. You can change Vector class to Control Points class and vice versa.

Note: To create a DEM Object draw Control Points with the Create Palette Window, or import them using the Import Wizard, then grid them with the Terrain Gridder Editor. To import Data as DEM Objects use the Import Wizard.

Line Style Column

Use the Line Style drop box to select the line or point style for mapping an Object in a Realtime View.

This only affects the Realtime View displays. Point Style Objects will be represented by individual shapes at the Vector's vertices. Line style Objects will have the vertices connected with the selected line style. When you render vectors in an image, all line styles will be rendered as solid lines and all point styles as simple points.

You can choose from eight options:

Point Styles:

- **Point**
- **Circle**
- **Square**
- **Cross**

Line Styles:

- **Solid**
- **Dotted**
- **Dashed**
- **Broken**

The current style will appear in the Style Field.

Line Weight Field

Use the Line Weight field to set the weight of a Vector Object for drawing and rendering.

Enter the desired weight in pixels in the field.

You may wish to vary the line weight to obtain consistent proportions when an image's resolution is changed. Increase it for print resolution images.

Maximum Fractal Depth for this DEM Field

Fractal Depth adds detail, but at the expense of rendering time. The Maximum Fractal Depth for this DEM field is a manual method that lets you decide which DEMs need detail and which don't.

VNS will do this for you automatically if you use Variable Fractal Depth or Fractal Depth Maps, which you can select from the Terrain Parameter Editor. These methods are far more precise than setting fractal depth manually for each DEM.

In general, we recommend that you leave each DEM's Maximum Fractal value set at the maximum value of "7" and use Variable Fractal Depth for still images and Fractal Depth Maps for animations. You can select Variable Fractal Depth or Fractal Depth Maps from the Terrain Parameter Editor.

If you find a reason to use the Maximum Fractal Depth for this DEM field, select a DEM Object from the Object list. If it will be close to the camera you don't have to change the default value of nine. If it will be farther from the camera, enter a low number, perhaps "0," "1" or "2" into the Maximum Fractal Depth for this DEM field to limit its Fractal Depth.

You can directly enter any integer from zero to seven or click the buttons next to the field to increment or decrement the number.

Once you've limited the DEM Objects that don't need high Fractal Levels, you can set the overall Fractal Level in the Render Settings Editor window (see the Render Module chapter).

DEMs will be rendered at the smaller of the global Fractal Depth or the DEM Max Fractal depth set here.

Be sure to check the Maximum Fractal value if you notice a lack of apparent detail for some DEMs. You may have forgotten to re-set it to 7 when you changed camera positions and brought a DEM that has a low Max Fractal value closer to the camera. Don't just set it at something less than 7 and forget about it!

Extent Page

For DEM Objects, the Database Editor shows you the area, Rows/Columns, NS and EW grid size, max/min elevation, and extents.

For Vectors, the Database Editor shows you the Area, the number of Points, the Length and the Extents.

The Points display shows the number of Vector vertices for the current Vector. Every Vector Object is defined by vertices, which are latitude/longitude coordinate pairs. When you select a Vector Object in the List, you'll see the number of vertices currently defining the Object. This gives you an idea of how large a Vector Object is, which can help if you're trying to identify a particular Vector Object.

The screenshot shows the 'Database Editor' window with the title 'Database Editor: 0 of 1676'. The window has a toolbar with icons for New, Open, Save, Print, and others. Below the toolbar is a menu bar with 'Properties', 'Extent', 'Comp', 'Layer', and 'Attrib'. The main area is a table with the following columns: Name, Area, Points, Length, Rows, Colu..., Maxi..., Minim..., North, South, East, West, NS Grid, and EW Grid. The table lists various vector objects like Spectacle Lake No. 1 through No. 5, Chiquita Lake, Hazeline Lake, Rock Lake, Little Rock Lake, Forest Lake, Beaver Lake No. 1 through No. 5, and RMNPNE. The last row is a summary with values 450, 450, 4138m, 2596m, 40.5°, 40.38°, 105.6°, 105.7°, 30.91m, and 23.62m.

Name	Area	Points	Length	Rows	Colu...	Maxi...	Minim...	North	South	East	West	NS Grid	EW Grid
Spectacle Lake No. 1	3.944 ha	25	878.5m					40.45°	40.45°	105.7°	105.7°		
Spectacle Lake No. 2	3.399 ha	33	932.9m					40.45°	40.45°	105.7°	105.7°		
Fay Lake No. 2	1.582 ha	16	495.5m					40.46°	40.45°	105.7°	105.7°		
Fay Lake No. 3	0.514 ha	10	329m					40.45°	40.45°	105.7°	105.7°		
Ypsilon Lake	2.989 ha	18	682.7m					40.44°	40.44°	105.7°	105.7°		
Chiquita Lake	1.244 ha	31	490.8m					40.44°	40.44°	105.7°	105.7°		
Hazeline Lake	1.371 ha	25	567.5m					40.49°	40.49°	105.7°	105.7°		
Rock Lake	1.263 ha	21	456.1m					40.39°	40.39°	105.7°	105.8°		
Little Rock Lake	0.159 ha	9	166.3m					40.39°	40.39°	105.7°	105.7°		
Forest Lake	3.203 ha	22	867.9m					40.39°	40.39°	105.7°	105.7°		
Beaver Lake No. 1	0.262 ha	12	216.8m					40.4°	40.4°	105.6°	105.6°		
Beaver Lake No. 2	0.249 ha	13	223m					40.4°	40.4°	105.6°	105.6°		
Beaver Lake No. 3	0.328 ha	15	232.3m					40.4°	40.4°	105.6°	105.6°		
Beaver Lake No. 4	0.296 ha	15	207.8m					40.4°	40.4°	105.6°	105.6°		
Beaver Lake No. 5	0.393 ha	16	269.2m					40.4°	40.4°	105.6°	105.6°		
RMNPNE	147.212...			450	450	4138m	2596m	40.5°	40.38°	105.6°	105.7°	30.91m	23.62m

None of these fields except for the Name are directly editable through the Database Editor.

Comp(onent) Page

This page shows any Components that you have been applied to the database objects listed in the Components Field.

Depending upon whether or not the Show Properties Panel Icon has been selected this page may be displayed as seen above, or with the following additional controls:

Selected Object Component Display Area

All the components associated with the currently selected database object will be listed here and may be selected independently of each other.

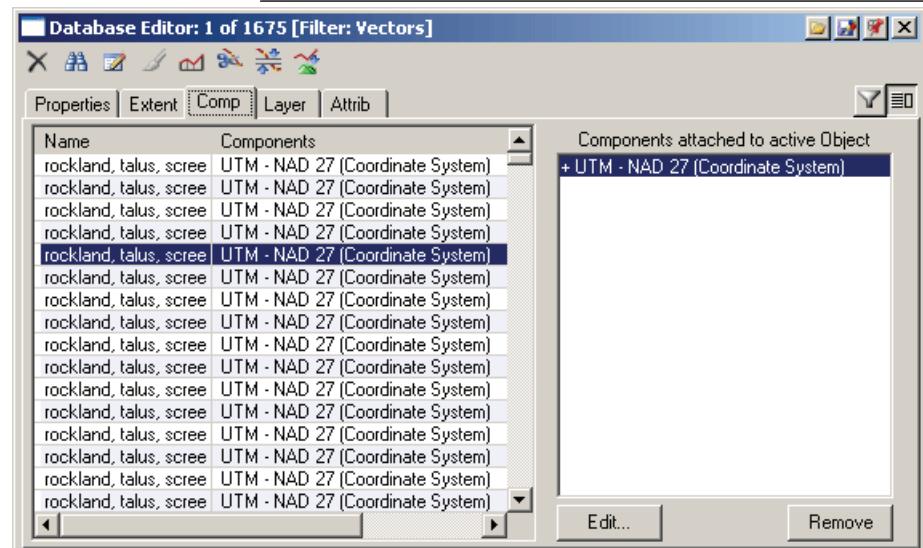
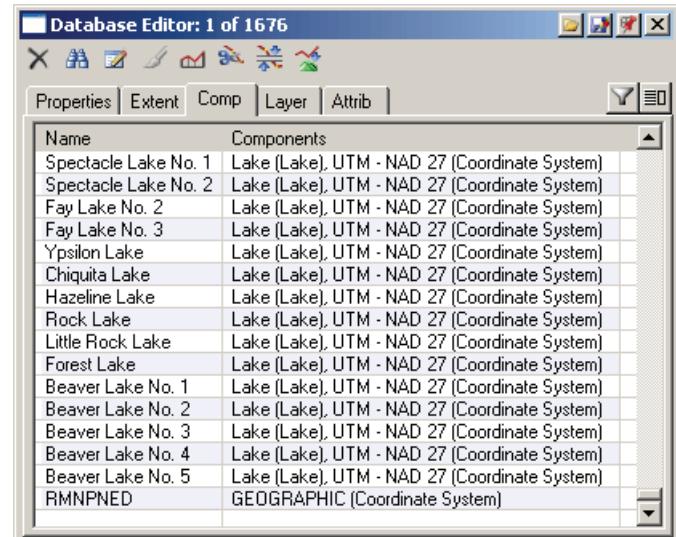
Edit Button

Click this button to open the associated Editor for the currently selected component. For example, selecting a Coordinate System and clicking the Edit Button would open the Coordinate System Editor, while selecting an Area Terraffector and clicking the Edit Button would open the Area Terraffector Editor, and so forth.

Remove Button

Clicking the Remove Button allows you to remove the selected component from the associated vector (or vectors). VNS will present a requester allowing you to choose whether you wish to remove the component from just the selected vector(s), from all vectors with which it is associated, or to cancel the remove operation.

Note: Removing a component simply breaks its association with the vector. It does not remove the component from the project completely. This must be done through the Scene-At-A-Glance, or the Component Library.



Layer Page

Layers let you group Objects in the Database in any manner you want. Once you create a layer, all the Objects in a group can be selected, enabled or disabled at once.

For example, you could turn off all low res DEMs and turn on all high res DEMs in a Project very easily. You could turn off all the roads in one proposed road design and turn on another set of roads with just a few mouse clicks.

The Layers Page of the Database Editor displays the current vector layers in the project as a series of named columns, with checkboxes for those items that exist in each layer. Adding or removing an object or series of objects to or from an existing layer is as simple as selecting the object or objects and clicking in the relevant fields to enable or disable the checkboxes.

Depending upon whether or not the Show Properties Panel Icon has been selected this page may be displayed as seen above, or with the following additional controls:

Select Button

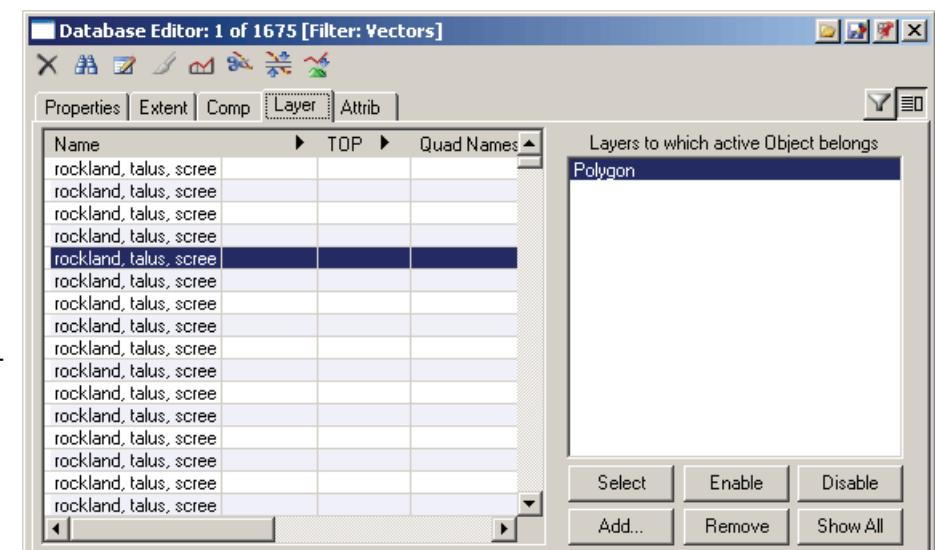
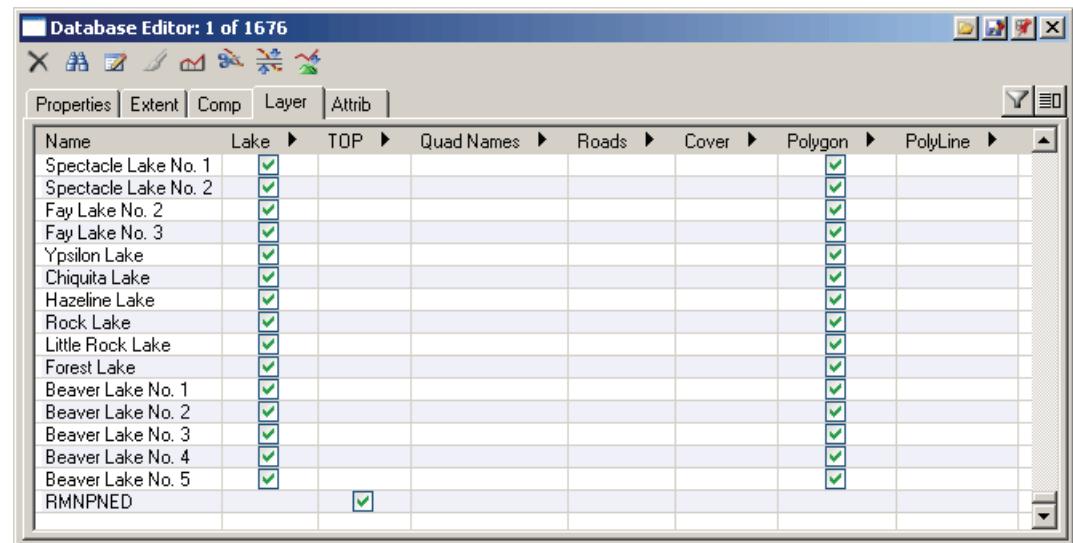
The Select button lets you select or deselect Database Objects in the Objects list, by Layer.

To select Objects by Layer, select the name of a Layer in the Layers list. You may want to enable the Show All button first so you can see all the Layers in your Project. Then click the Select button to simultaneously select all the Objects that are members of the current Layer. VNS will first deselect all selected Database Objects and then select all the members of the current Layer.

To select more Objects by Layer, select the name of another Layer in the Layers list. Then hold the shift key down and click the Select button to select additional Database Objects from the new Layer without deselecting any Objects that are already selected.

To deselect Objects by Layer, select the name of another Layer in the Layers list. Then click with the control key down to deselect all the Objects belonging to the selected Layer.

By combining these techniques as you select different Layers in the Layers list, you can select exactly the combination of Objects you want.



To deselect all but one Object, just click a single Object in the list.

Once you've selected all the members of a group, you can use the View, Render and Enable Checkboxes to enable or disable them as a group.

To select all Objects belonging to two layers, click a member of the first layer you want to select that's tagged in one of the Layer fields. Click the Select button. Then hold down the appropriate modifier key for your operating system (shift or control), and click a member of a second group that's tagged in one of the Layer fields. Finally, click the Select button. All members of both groups will be selected in the List.

You may scroll through the list with the arrow keys if you prefer.

Enable Button

Click the Enable button to enable all members of a layer for mapping and rendering. Enabled Objects are displayed in a darker shade, while disabled Objects are shown in a lighter shade.

Click an Object of the desired layer in the Object List and click the name of the Layer you want to enable in the Layers list. Then click the Enable button. All members of that Layer will be enabled.

The Enable and Disable buttons are handy for quickly enabling and disabling sections of the landscape (DEM Objects) and groups of Vector Objects like rivers, roads and boundaries.

Disable Button

Click the Disable button to disable all members of a layer for mapping and rendering (see Enable button above).

Click an Object of the desired layer in the Object List and click the name of the Layer you want to enable in the Layers list. Then click the Disable button. All members of that Layer will be disabled (shown in a lighter shade in the list).

Note: To remove a layer, select the Show Database Item By Layer icon in the Scene-At-A-Glance. Then select the Layer's name in the Vectors, Control Points or DEMs categories. Finally, click the Remove the Selected Item icon. VNS will remove the Layer but not the Objects that belonged to it.

Add Button

To create a new Layer, select the Objects you want to group together in the Layer. Then click the Add button to create a new Layer.

VNS will ask for a name.

Note: To remove a layer, select the Show Database Item By Layer icon in the Scene-At-A-Glance. Then select the Layer's name in the Vectors, Control Points or DEMs categories. Finally, click the Remove the Selected Item icon. VNS will remove the Layer but not the Objects that belonged to it.

Remove Button

Click the Remove button to remove the selected Layer in the "Layer to which the active Object belongs" list from the active Object.

Note: This does not remove the Layer from the database, it only disconnects the layer from the active Object. To delete a Layer, select the Layer Name under the Layer category in the Scene-At-A-Glance and click the "Remove the Selected Item" icon.

Show All Button

Select the Show All button to see the names of all existing Database Layers in the Layers list. Deselect the Show All button to see only the Layer names that belong to the currently selected Database Object.

Using Layers

You can have as many layers as you want. There is no limit to the number of layers that you can use in a Database.

The layers are not necessarily hierarchical but they could be. For example:

Hierarchical

Item	1st Layer	2nd Layer	Description
1	2Lane	HWY	2 Lane Highway
2	2Lane	HWY	2 Lane Highway
3	4Lane	HWY	4 Lane Highway
4	4Lane	HWY	4 Lane Highway
5	Nav	River	Navigable Waterway
6	Nav	River	Navigable Waterway
7	NonNav	River	Non-Navigable

Non-Hierarchical

Item	1st Layer	2nd Layer	Description
1	Small	HWY	2 Lane Highway
2	Small	HWY	2 Lane Highway
3	Large	HWY	4 Lane Highway
4	Large	HWY	4 Lane Highway
5	Large	River	Navigable Waterway
6	Large	River	Navigable Waterway
7	Small	River	Non-Navigable

In the first example 2Lane and 4Lane layers are subdivisions of the Highway layer. Nav and NonNav are members of the River layer. This may be convenient if two lane highways share important characteristics such as line weight or line style that are not shared by either rivers or four lane highways.

The second example assumes that small Objects, regardless of whether they are rivers or highways, have important similarities, and large Objects share similarly important characteristics. For instance you might want to make all large items three pixels in width and small ones only two regardless of their major classification.

A handy way to use Layers is to disable or enable entire groups at once. In the previous examples you might want to enable only large items in Views. In the first example you would have four layers to enable/disable. In the second you only have two.

Attrib(utes) Page

The Attributes page lets you see, edit and add attributes to Database Objects. Attributes are fields and content attached to objects. VNS lets you use attribute values to largely automate the production of photorealistic visualizations from massive GIS databases (see Appendix K: Applications in GIS).

When you import a Shape file, VNS imports its table of database fields as well as the geometry of the polygon shapes. Each GIS polygon may have a corresponding set of fields with attribute names or values. When you import a Shape file, the Import Wizard will ask you to select which fields you want to include as attributes to attach to the resulting VNS Vectors.

Name	HAB_STRU...	HEIGHTMIN	HEIGHTMAX	DENSITY	COV_DESC	ECOSYS_CODE	CROWN_COVE	COVER_TYPE	AREA
Englemann spruce, s...	3A	4	8	204.99	Englemann spruce, subalpine fir	TSF3A	20	TSF	15800
Englemann spruce, s...	2	1.67	3.33	1395.76	Englemann spruce, subalpine fir	TSF2	60	TSF	68400
Englemann spruce, s...	4B	10	20	294.83	Englemann spruce, subalpine fir	TSF4B	80	TSF	48000
lodgepole pine	4C	6.67	13.3	781.05	lodgepole pine	TLP4C	100	TLP	645700
willows		1.07	213	300	willows	SWI	0	SWI	51600
Englemann spruce, s...	4C	10	20	578.29	Englemann spruce, subalpine fir	TSF4C	100	TSF	1500
Englemann spruce, s...	4B	10	20	294.83	Englemann spruce, subalpine fir	TSF4B	80	TSF	20800
Englemann spruce, s...	4B	10	20	294.83	Englemann spruce, subalpine fir	TSF4B	80	TSF	219900
Englemann spruce, s...	3C	4	8	819.98	Englemann spruce, subalpine fir	TSF3C	80	TSF	15900
kobresia [alpine gras...		0.23	0.47	-80	kobresia [alpine grassland]	GKO	0	GKO	14900
lodgepole pine	4B	6.67	13.3	398.84	lodgepole pine	TLP4B	80	TLP	74600
Englemann spruce, s...	4A	10	20	144.57	Englemann spruce, subalpine fir	TSF4A	40	TSF	1000
Englemann spruce, s...	4A	10	20	144.57	Englemann spruce, subalpine fir	TSF4A	40	TSF	14300
Englemann spruce, s...	4A	10	20	144.57	Englemann spruce, subalpine fir	TSF4A	40	TSF	800
Englemann spruce, s...	2	1.67	3.33	1395.76	Englemann spruce, subalpine fir	TSF2	60	TSF	2800
water		0	0	0	water	WAT	0	WAT	6700
marshes, shallow po...		0	0	0	marshes, shallow ponds, etc.	WET	0	WET	28700

You can also see database attributes in the Search Query Editor and Thematic Map Editor on their Database Attributes pages. You can use attributes to dynamically link Vectors to Components via Search Queries. Thematic Mapping let you use Vector attributes to directly drive parameters of attached Components, such as Ecotype density, Ecotype height and Lake elevation.

The Attributes Page of the Database Editor displays the current vector attributes in the project as a series of named columns. The Column names correspond to the Attribute Fields, and the data in the cells of each column are the Attribute Values for each object.

Editing the attribute data may be performed directly within this interface by selecting a vector or vectors, clicking on a particular Attribute Value cell, and editing the contents of that cell. If multiple vectors are selected, the Attribute value will be updated for all of them simultaneously.

Depending upon whether or not the Show Properties Panel Icon has been selected this page may be displayed as seen above, or with the following additional controls:

Attributes Of The Active Object List

To see a list of all Attributes for a Database Object, click to select the object as the Active Object in the Objects list.

The list on the Attributes page normally shows the “Attributes of the Active Object.” However if you select the Show All button (see below) it displays “All Attribute fields in the Project.”

Select Button

Click the Select button to select all Database Objects that share the same attribute.

Set Attribute Value Button

Select an attribute in the Attributes list and click the Attribute Value button if you want to change the text or value in the selected attribute. VNS will open a dialog box where you can enter the new content for the attribute.

Add Button

Click the Add button to add a new Attribute to the Active Object. VNS will open dialog boxes where you can enter a name for the attribute and content for the attribute.

Remove Button

Click the Remove button to remove an Attribute from the Active Object.

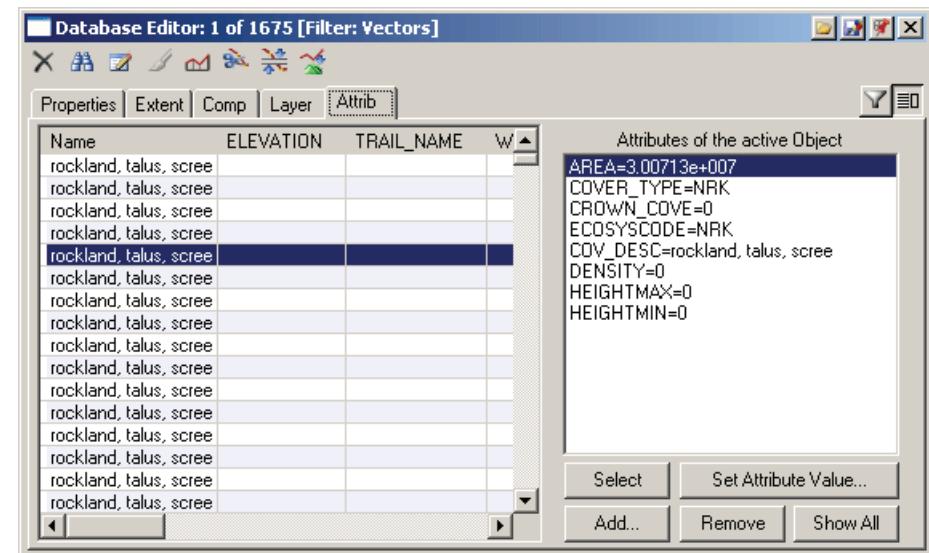
Show All Button

The list on the Attributes page normally shows the “Attributes of the Active Object.” However if you select the Show All button it displays all attribute fields in the Project’s database (the label above the list will change to tell you what the list is showing).

This is useful if you need to see all the attributes that exist in the Project. You can then click an attribute in the Attributes list and click the Select button to see what Database Objects in the Objects list share that attribute.

Other Database Controls

The Load/Append and Save/Export Icons let you load a Database from another Project or Database file, append a database from another Project or Database file into the current Project, save the Database as a separate file or export Database objects in DXF or SHP format.



The Database can include Vectors and Control Points and all of their properties, positions, Component attachments and attributes. It can also include pointers to DEM data used by the Project. If you choose to export the database, DEM objects can be selected also.

Load/Append Database Icon

Click the Load Icon to load a VNS Database into the current Project. You can load any Database saved using the Save button (see above) or the Database part of any VNS Project file. Loading a Database will replace the Database in the current Project and the Database that was in the current Project will be gone forever!

Note: This command can sometimes be used to extract the database objects from an otherwise damaged and unreadable Project file.

Hold down the Shift key and click the Load Icon if you want to append the Database objects of a Database file into the current Project. You can append any Database saved using the Save button (see above) or the Database part of any VNS Project file. Unlike the Load command above, the contents of the loaded Database will be added to the existing database without loss of the contents of the current project Database.

Save/Export Database Icon

Click the Save Icon if you want to save the current Project's Database as a separate file (with a .db extension). You can load the file into Projects using the Load/Append Icon (see below).

Hold down the Shift key and click the Save Icon to export Database objects in formats other than VNS-specific database files. VNS will open the Export Database Window where you can choose which objects to export and what Coordinate System to use.

Depending on the objects chosen for export, a number of file formats will be available. See the Export Database Window section of the manual for more information.

Filter Database Icon

The Filter Database Icon lets you apply filters to the database contents so that you can more easily navigate the object list.

Click the icon and choose the appropriate option from the menu that appears. The available options are:

Filter Database By None

Choose this option if you want to show all the database objects.

Filter Database By Vectors

Choose this option if you want to show only vector objects.

Filter Database By DEMs

Choose this option if you want to show only DEMs.

Filter Database By Enabled

Choose this option if you want to show only enabled objects

Filter Database By Layer

Choose this option if you want to show only objects that belong to a particular Layer. Select the required layer from the submenu.

Filter Database By Query

Choose this option if you want to show only objects that would be selected by a particular Search Query. Select the required Search Query from the submenu

Show Properties Panel Icon

Click this Icon if you want to display the Properties panel for the Comp(onent) Page, Layer Page and Attrib(utes) Page.

Enabling this icon will allow you access to additional controls. The functions of these controls are explained in the sections for each of the above pages.

DEM Interpolator

Select the DEM Interpolator command in the Data Menu to open the DEM Interpolator window.

Use DEM Interpolation to increase the resolution of terrain data. Whenever you see polygons that are too large and angular to be successfully disguised with increased Fractal Depth or Ecosystem Texturing you should consider interpolating the DEM data.

Interpolation is the most effective remedy for the polygon problem but it also is the most expensive in terms of rendering time, so use it sparingly.

You only need to interpolate DEMs which appear in the foreground somewhere in an image or animation. You can have DEMs of varying resolution in the same Project so long as the boundary between two different resolutions is not too near the Camera. A boundary between DEMs of different resolutions will likely have sharp linear Ecosystem changes, and the camera will notice them if it's too close.

Name Display Field

The Name field displays the path of the selected input files. This field will be blank until you select one or more files with the Select Files button (see below).

Select Files Button

Click the Select Files button to select VNS DEM files for interpolation.

A standard file dialog will appear. It will only show VNS DEM files (with a ".elev" extension). These are the only ones you should interpolate.

Navigate to a directory containing VNS DEM files. Select as many files as you want by clicking the first file and, holding down the appropriate modifier key for your computer (control or shift) click the rest. Select "OK" when you've selected all the VNS DEM files you want to interpolate.

Selected Display Field

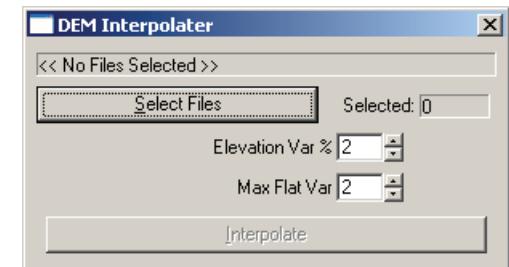
The Selected field displays the number of DEM files selected for interpolation.

If this number is one or larger the "Interpolate" button will become enabled.

Elevation Var Field

Use the Elevation Variation field to set an amount of random variation applied to surfaces. This is a function of the elevation difference between the two end points on each spline segment.

VNS uses bidirectional cubic splines to interpolate values between the data points in a DEM grid. It adds new data points based on a pair of curves between existing data points on either axis intersecting the new data point position. The VNS will randomly vary the new data point position within the percentage range you set here.



This value could range from 0 to 100%. The higher the value the more perturbed the resulting surface will be. Values of 1% or 2% appear pleasing to our eye in most cases. More than that can give the landscape a patterned look.

Using a value of 0% actually gives you the greatest flexibility because you can add similar displacement later using the Vertical Displacement parameter in the Terrain Parameter Editor. The advantage of Vertical Displacement is that it is non-destructive; it's applied at render time and you can change it at any time.

Note: If you are interpolating tiled DEM data, using Elevation Variation may cause noticeable gaps between tiles, wherever the displacement is different between corresponding edge points of adjacent tiles.

Max Flat Var Field

Use the Max Flat Variation field to set the maximum amount of elevation variation to be applied where surfaces are flat.

Since the Elevation Variation (see above) will evaluate to 0 if the surface is flat, this setting allows some randomness even on flat portions of the terrain. This is essential to creating realism on valley floors in particular. We have found that a value of 2 meters works well in many cases, but feel free to experiment.

Interpolate Button

Click the Interpolate button to start the interpolation process.

VNS will examine each selected VNS DEM file in turn. Each file will be interpolated, and the output files will be written to the same directory as the source files. For each input file four new DEM Objects will be added to the Database and be automatically enabled for rendering and mapping. The parent DEM will be disabled for mapping and rendering but will remain in the Database in case you want to revert back to it later.

If the destination device (hard drive or other storage device) becomes filled, the interpolation process will stop but all files saved successfully will remain available for use.

Note: Be sure to save the Project file after interpolating or the interpolated DEMs will not be listed in the Project's Database the next time you run VNS.

DEM Merger Wizard

When you add a new DEM Merger component to a project, VNS will offer the option of using the DEM Merger Wizard. This wizard provides you with a series of easy steps which will configure the majority of the settings in the DEM Merger itself.

Note: Use of the Wizard does not prohibit you from manually adjusting settings in the newly created DEM Merger.

DEM Merger Wizard Panels

Introductory Panel

If you choose to use the DEM Merger Wizard, the initial page that appears is an introductory page. This gives you some information about how to operate the wizard.

As with other wizards in the program, you proceed through a series of pages, answering questions and providing information where requested. Once a page has been completed, clicking the Next button allows you to proceed to the next page. If you wish to return to an earlier page and edit settings, clicking the back button will allow you to retrace your steps through the wizard.

At any time, you can cancel out of the wizard process by clicking the Cancel button.

Save Project Now Button

Clicking this button will save the project in its current state, before you proceed through the wizard itself, as saving is not possible midway through the process.

Merge Method Panel

This page allows you to select the type of DEM Merger that you intend to use.

Merge Method Radio Buttons

Normal DEM Merger

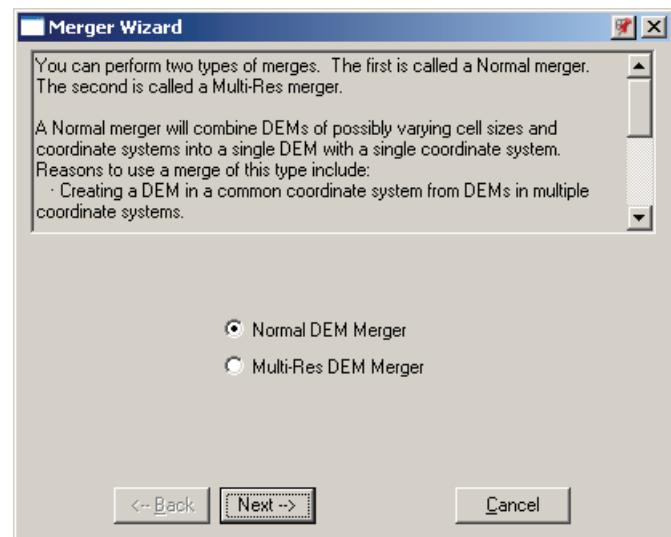
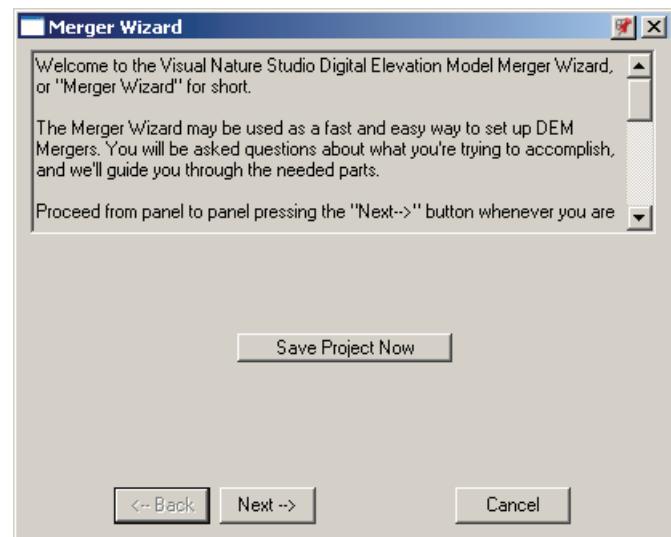
In this type of DEM Merger, multiple DEMs are merged into one tile.

These DEMs can be in different coordinate systems, and at different resolutions.

The output DEM will be in a coordinate system and at a single resolution determined by the user.

Multi-Res DEM Merger

In this type of DEM Merger, two sets of DEMs are merged to create two DEM tiles.



The source DEMs can be in different coordinate systems, and almost certainly will be at different resolutions.

This kind of Merger will create two output DEMs, one at a higher resolution than the other. The lower resolution DEM will contain an area of NULL data that corresponds to the bounds of the higher resolution DEM, and the edges of the two datasets will be modified to allow them to seamlessly match.

DEM Load Panel

This panel allows you to tell VNS whether or not you have all the DEMs loaded that you wish to merge.

Data Load State Radio Buttons

Yes, all necessary DEMs are loaded radio button

If you have already loaded the DEMs, you can select this option and proceed directly to the next panel in the wizard.

No, DEMs still need to be loaded radio button

If you do not have the necessary data loaded into VNS, you can use the import wizard or database load controls to bring the required data into VNS, without having to close down the Terrain Gridded Wizard. Once all the data has been loaded or imported, you can select the first option, and proceed to the next panel of the wizard.

Note: Until you select the first of these options, the Next button will be unavailable.

Coordinate System Panel

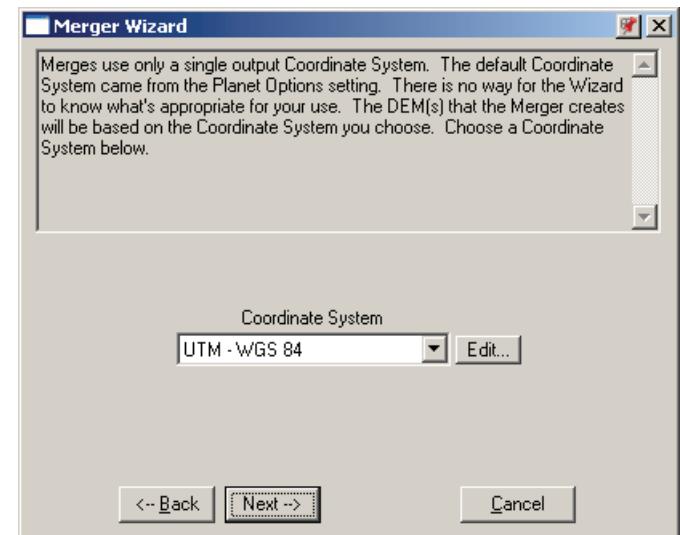
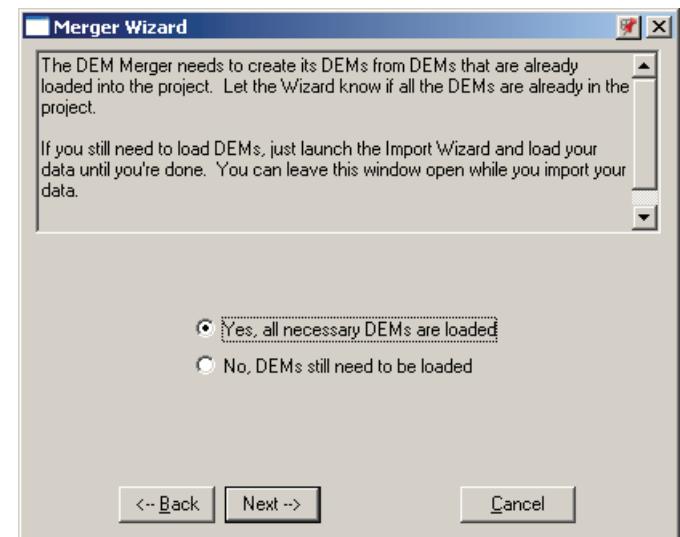
Use this panel to select or create the required coordinate system for the merging operation.

Coordinate System Dropdown List

Select the coordinate system into which you want the data merged from the dropdown list provided. This selection will be used to automatically configure the Coordinate System section of the General Page of the DEM Merger.

Coordinate System Edit Button

Clicking this button will open the Coordinate System Editor and allow you to edit the currently selected coordinate system.



Search Query Confirmation Panel

This panel allows you to tell VNS whether or not you have created all the necessary Search Queries required for the merge process.

Search Query State Radio Buttons

Yes, all the needed Search Queries are loaded radio button

Select this option if you know that all the required Search Queries already exist in your project.

Selecting this option and clicking the Next Button will open the Search Query Selection Panel.

No, we need to create Search Queries radio button

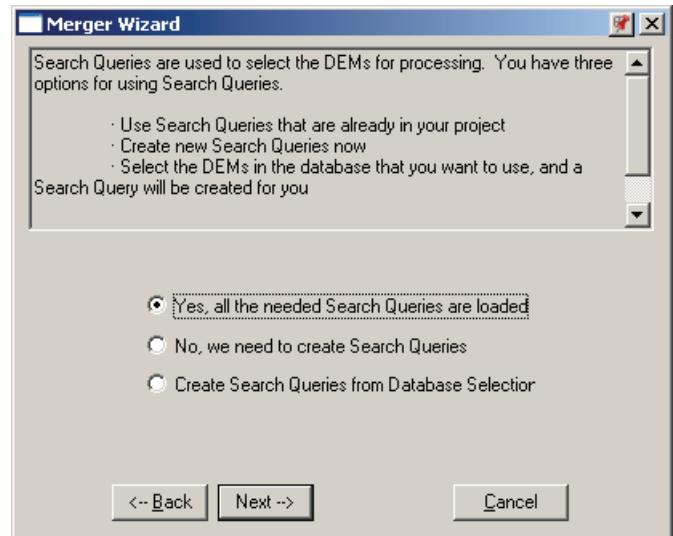
Select this option if you know that the required Search Queries do not exist in your project. You can then use the Search Query Editor to create or load the required components, or select the last option to have VNS automatically create appropriate Search Queries for you, based on selections that you make in the Database Editor.

You do not need to close down the wizard while you perform either of these steps.

Once the required Search Queries exist, you can select the first option and proceed to the next panel in the wizard by clicking the Next button. Until you select one of the other two options, the Next Button will be unavailable.

Create Search Queries from Database Selection radio button

Select this option if you want to have VNS automatically create appropriate Search Queries for you, based on selections that you make in the Database Editor. Selecting this option and clicking the Next Button will open the Search Query Create Panel.



Search Query Create Panel

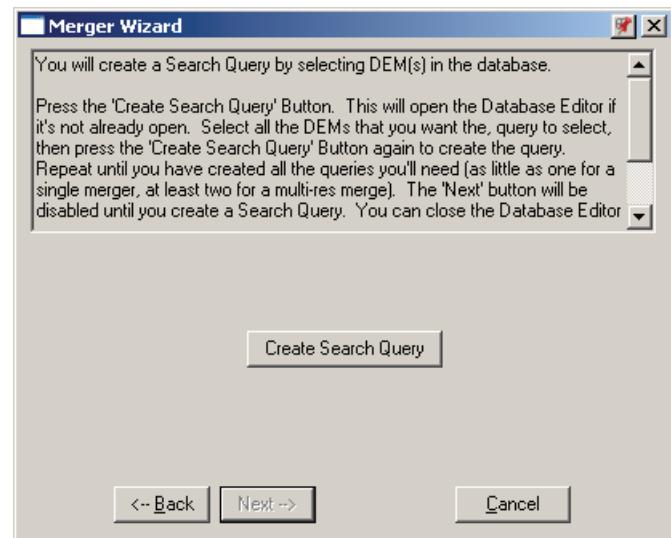
This panel allows you to create Search Queries by selecting a DEM or DEMs in the database.

Create Search Query Button

Pressing this button will open the Database Editor if it's not already open.

Select all the DEMs that you want the, query to select, then press the 'Create Search Query' Button again to create the query. Repeat until you have created all the queries you'll need (as little as one for a single merger, at least two for a multi-res merge). The 'Next' button will be disabled until you create a Search Query. You can close the Database Editor anytime after you create the query.

Note: For multi-res merges, the first query needs to be the one that selects the data for the insert (higher res) DEM.



Search Query Selection Panel

The Queries page allows you to define which Search Queries are going to contribute towards the Merge process. Search queries are used by the DEM Merger to select DEMs in the correct order for the required merge.

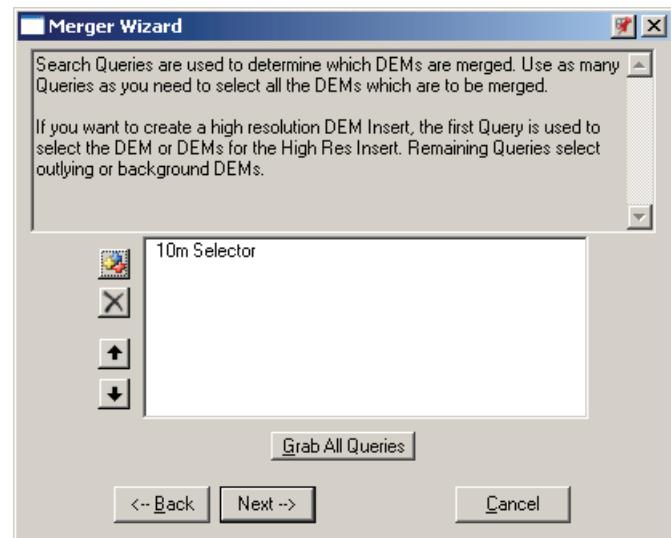
Search Queries Controls

Search Query List

The Search Query List shows all the Search Queries used in the DEM Merge process. For simple merges, one search query which selects all DEMs is all that is required, as all DEM data in the project will appear in the merged and reprojected output.

For multires merges, and merges involving incomplete datasets, the order of the Search Queries in the list is very important. DEM data is included in the merged output in the order in which their related search queries appear in this list. For example, you have SRTM data which is high detail, but contains void areas, and USGS data which has no voids but is less accurate. Setting up 2 search queries (one called SRTM, one called USGS) would allow you to select SRTM and USGS datasets independently of each other, and placing the SRTM search query first in the DEM Merger Search Query list, will force VNS to select SRTM data where possible, and only insert USGS data where no SRTM data exists (ie: the void areas).

Note: For Multires Merges, the Hires DEM is created from the first Search Query only.



Add Search Query Icon

Click the Add Search Query icon to open a window with a list of Search Queries in your Project. Select one or more Search Queries by clicking, shift-clicking or control-clicking. Click the Add Items button to add the Search Queries to the DEM Merger.

Click the Cancel button if you want to close the window without adding any Search Queries to the DEM Merger.

Remove Search Query Icon

Select an Search Query in the Search Queries list and click the Remove Search Query icon to remove it from the DEM Merger.

Raise Search Query Priority

Select an Search Query in the Search Queries list and click the Raise Search Query Priority to make it higher in the Search Queries list.

Lower Search Query Priority

Select an Search Query in the Search Queries list and click the Lower Search Query Priority to make it lower in the Search Query list.

Grab All Queries Button

Click the Grab All Queries button to add all the Project's Search Queries to the Search Query list.

Bounds Confirmation Panel

Bounds State Radio Buttons

Bounds by SQ Radio Button

Select this option if you want the bounds of your DEM Merge operation to be determined from the bounds of all DEMs selected by the Search Queries in use.

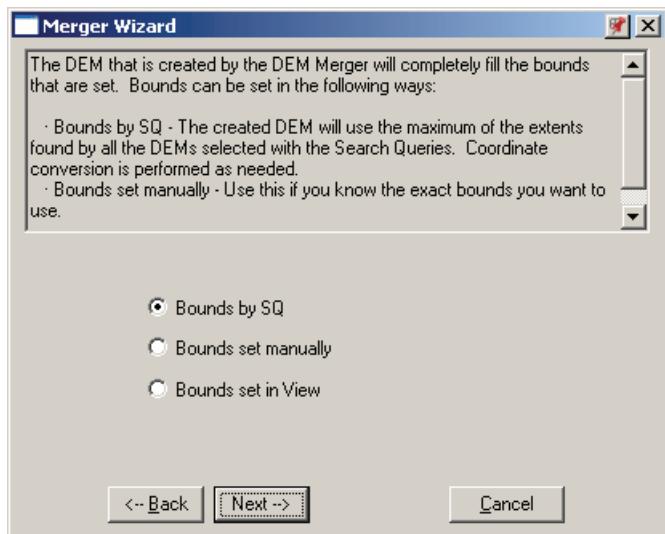
Using this option has the same effect as clicking the Update Bounds button in the Merged DEM Bounds Section on the General and Multires pages of the DEM Merger.

Bounds set manually Radio Button

Selecting this option, and clicking the Next Button will open the Bounds Entry Panel, allowing you to manually define the area you wish to merge.

Bounds set in View Radio Button

Select this option if you wish to set the bounds of the merged area interactively in a view. Selecting this option and clicking the Next Button will open a requester informing you that the next two points clicked in any view will become the DEM Merger's new bounds, and that points may be selected in any order.



Bounds Entry Panel

This panel allows you to manually set the bounds of the merged data. These fields will be automatically completed for you based on the bounds of the data that you selected in the Database Editor when processing the Search Query Selection Panel of the wizard.

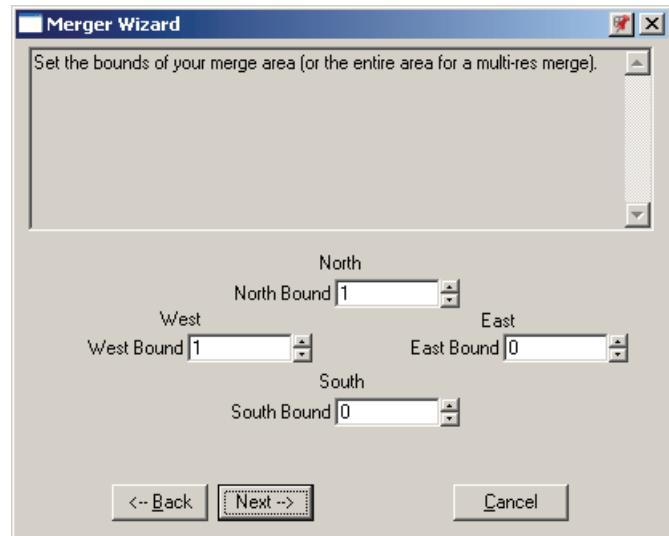
You can, however, override these values and select another area of data to merge.

These values will be used to automatically configure the merged DEM Bounds section of the General Page of the DEM Merger.

North, West, East and South Fields

Enter latitude positions into the North and South fields, and Longitude positions into the East and West fields, to define the boundaries of the region you want to merge.

Using this option has the same effect as manually setting the bounds in the Merged DEM Bounds Section on the General and Multires pages of the DEM Merger.



Resolution Confirmation Panel

This panel allows you to set the resolution of your output DEM or DEMs

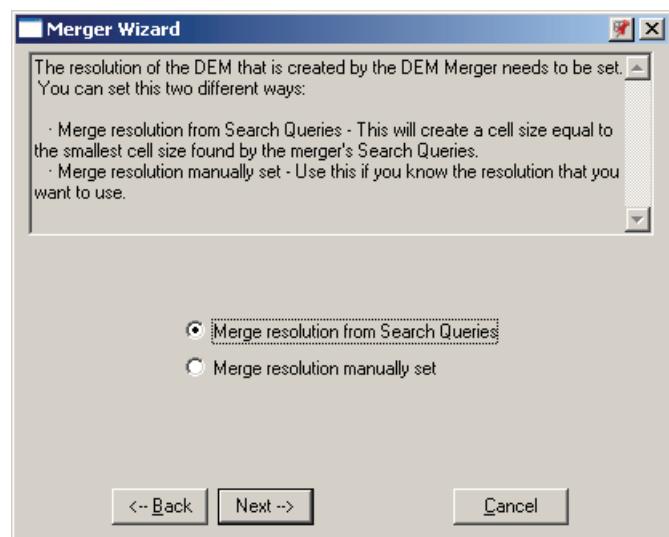
Merge Resolution State Radio Buttons

Merge resolution from Search Queries

Selecting this option will set the resolution to that of the smallest cell size found by the DEM Merger's Search Queries.

Merge resolution manually set

Selecting this option will open a requester allowing you to manually set the cell size that you desire.



Name Entry Panel

This panel allows you to provide a name for the new DEM Merger Component, and for the DEM or DEMs that it will create for you.

Merger Name Field

Enter a name for the new DEM Merger Component in this field. This data will be used to automatically configure the Name Field on the General Page of the DEM Merger.

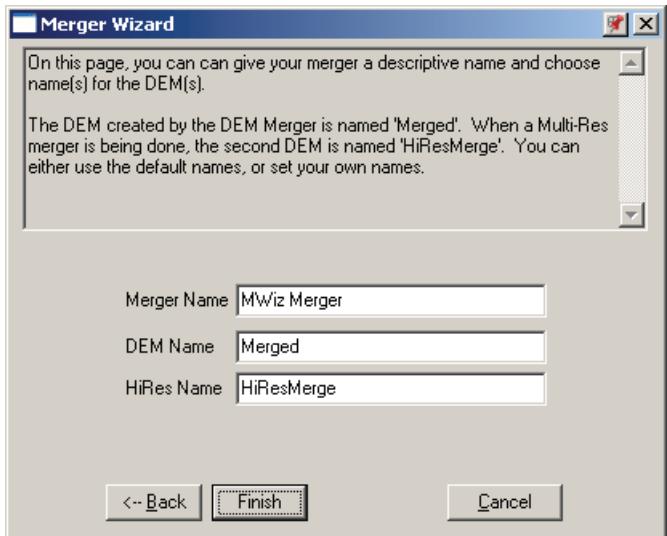
DEM Name Field

Enter a name for the new merged DEM in this field. This data will be used to automatically configure the Output DEM file Name section on the General Page of the DEM Merger.

HiRes Name Field

Enter a name for the new merged Hires DEM in this field. This data will be used to automatically configure the High Res Output file Name section on the Multires Page of the DEM Merger.

Note: This field will only be available if MultiRes DEM Merger was selected on the Merge Method Panel.



DEM Painter Window

The DEM Painter is a raster editing tool for editing terrain data with familiar, paint program-like tools.

The DEM Painter window is a resizable window, with a grayscale representation of your terrain in the main viewport, and a thumbnail and tool icons to the left of that window.

The icons fall into three areas: Navigation, Saving and Undo; Operation Selection Icons; Operation-specific Icons.

Main Painting Window

The main DEM painting window is resizable, and has slider bars to the left and right, and underneath.

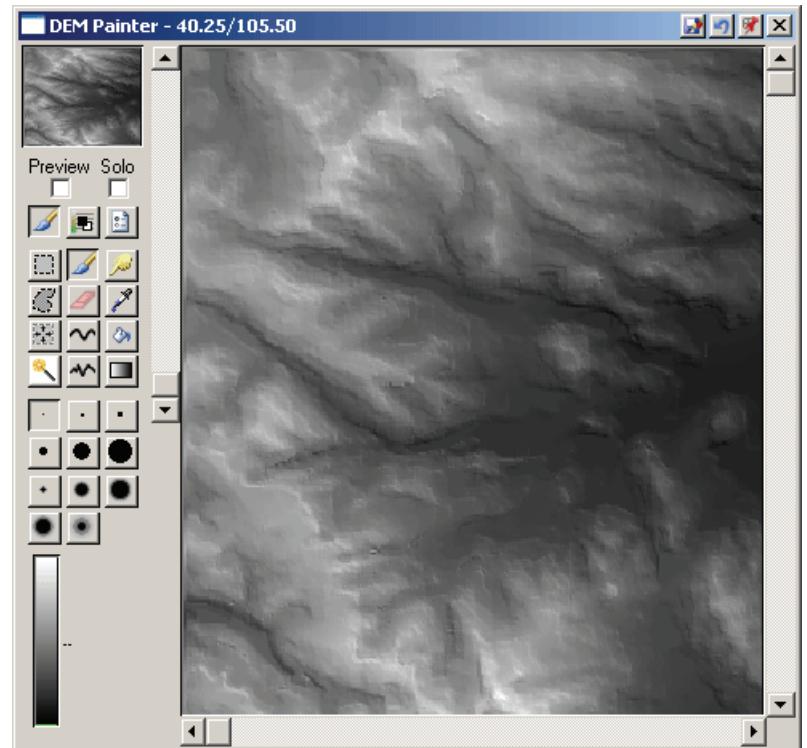
The slider bar to the left allows zooming in and out of your terrain representation, for more accurate editing. While zoomed, the scroll bars below and to the right of the main window allow navigation by scrolling.

Common Controls

The following controls are available regardless of which of the Operation Selection Icons is chosen.

Navigation Thumbnail Window

The Navigation thumbnail provides you with a scaled version of the DEM being edited. When zoomed in on the DEM in the Painting window, the area focussed on will be represented by a bright green rectangle. This can be quickly moved by clicking on it with the left mouse button and dragging it to a new location within the thumbnail, or simply by left-clicking where you want the new position of the rectangle to be. This method of navigation is far quicker than using the provided scrollbars, especially when zoom level is high.



Save DEM Icon

Click the Save DEM Icon when you have made changes to your terrain model that you wish to commit to disk. Clicking this button will open a requester asking you if you really wish to save the edited DEM, and warning you that this will affect every project which references this DEM.

You are provided with the choice to rename and save a new file, overwrite the existing DEM, or cancel the save operation. Selecting the first option will present you with a standard file requester to provide the location and name of the new .elev file.

Undo Icon

Clicking the Undo Icon will undo the last editing operation performed in the main paint window. To undo all changes since you started editing, close and re-open the DEM Painter Window without saving your changes to disk.

Pre(view) Checkbox

When this checkbox is enabled, VNS will automatically update OpenGL Views with the results of any DEM Painter modifications.

OpenGL update speed will usually become much slower when this checkbox is selected, as VNS may use a higher “Max Polys” setting than you have set in the View Preferences Window in order to display the DEM at its full resolution.

In addition to displaying the effects of DEM edits in OpenGL Views, selecting this checkbox also allows you to paint directly in any OpenGL view and have the program behave as if you have painted in the main DEM Painter window. This allows you to, for example, smooth a foreground area in the camera view that will be used for rendering, rather than “best guessing” it from the DEM Painter’s Planimetric-style view. All DEM Painter tools are available for use in this way, once the Pre checkbox has been selected.

Solo Checkbox

When this checkbox is enabled, VNS will disable OpenGL display of all terrain models except that which is currently selected for editing. The other DEMs are not disabled or deleted, but simply hidden from view while you are DEM Painting.

This can help offset the possible reduction in OpenGL speed caused by switching into Preview Mode. It also helps you to locate the current DEM when you are painting on one of many DEM tiles.

Elevation Picker Bar



This bar of grayscale shades represents the range of elevations contained within the DEM loaded into the DEM Painter. By clicking on the bar you can find the absolute elevation associated with a particular shade. You can also use this bar to quickly enter elevation values into the Foreground Elevation Field without having to switch tools to the Picker tool, and click in the main paint window itself.

Think of this as a color selector in a paint program.

Operation Selection Icons

Show Tools Icon

Selecting this icon will display the tools icon palette. This icon will change to reflect the active tool.

Show Elevations Icon

Selecting this icon will display the Foreground and Background Elevation fields and associated Swap button, and the Tolerance field.

Show Options Icon

Selecting this icon will display the Opacity field, the Paint Effect dropdown list, the Gradient type dropdown list (when the Gradient Tool is selected), and the Brush Size slider.

Paint Operation-Specific Icons

Depending upon which of the Paint Operation Icons is selected, the list of available Operation-Specific Icons will change.

Tools

Define Region Icon

When this tool is selected you can click and drag with the left mouse button in the Main Painting Window to define a blue rectangular selection. When you release the mouse button, the area outside the selection will be shaded to show that it is not available to perform operations on.

Shift-select will add to your selection, Alt-select will subtract from the existing selection.

To deselect all, click on the Define Region Icon again.

Freehand Select Icon

When this tool is selected you can click and drag with the left mouse button in the Main Painting Window to define a red freehand shape as a selection. When you release the mouse button, the area outside the selection will be shaded to show that it is not available to perform operations on.

Shift-select will add to your selection, Alt-select will subtract from the existing selection.

To deselect all, click on the Freehand Select Icon again.

Move Region Icon

While a region is defined, selecting this tool will allow you to click and drag it somewhere else on your DEM. Release the mouse button to deposit the section of terrain where you have moved it to.

To deselect the Move Region Tool, click on the Move Region Icon again.

Select Icon

When this tool is selected you can click with the left mouse button in the Main Painting Window to define a range of elevations as a selection. When you release the mouse button, the area outside the selection will be shaded to show that it is not available to perform operations on. The Tolerance value (see below) controls how large a range of elevations is selected when you click on a point in the Main Paint Window.

Shift-select will add to your selection, Alt-select will subtract from the existing selection.

To deselect all, click on the Select Icon again.

Paint Icon

When this tool is selected you can click and drag with the left mouse button in the Main Painting Window to lay down paint at the currently selected Foreground Elevation with the currently selected brush at the currently selected Opacity level.

To deselect the Paint Tool, click on another tool icon.

Erase Icon

When this tool is selected you can click and drag with the left mouse button in the Main Painting Window to erase painted elevations and restore the original (underlying) DEM with the currently selected brush at the currently selected Opacity level.

To deselect the Erase Tool, click on another tool icon.

Smooth Icon

When this tool is selected you can click and drag with the left mouse button in the Main Painting Window to smooth the terrain with the currently selected brush at the currently selected Opacity level.

To deselect the Smooth Tool, click on another tool icon.

Roughen Icon

When this tool is selected you can click and drag with the left mouse button in the Main Painting Window to roughen the terrain with the currently selected brush at the currently selected Opacity level.

To deselect the Roughen Tool, click on another tool icon.

Smear Icon

When this tool is selected you can click and drag with the left mouse button in the Main Painting Window to smear the terrain with the currently selected brush at the currently selected Opacity level.

To deselect the Smear Tool, click on another tool icon.

Pick Icon

When this tool is selected you can click with the left mouse button in the Main Painting Window to interactively pick a new Foreground Elevation value. If the Show Elevations Icon is also selected, you will be able to see the elevation entered into the Foreground elevation field. If the Show elevations Icon is not selected, you will be able to read the selected elevation from the Elevation picker Bar (see below)

To deselect the Pick Tool, click on another tool icon.

Fill icon

When this tool is selected you can click with the left mouse button in the Main Painting Window to flood the terrain with the currently selected Foreground Elevation. The terrain will fill to an elevation defined by the elevation of the point clicked plus the Tolerance Value.

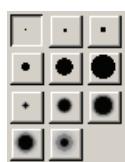
To deselect the Fill Tool, click on another tool icon.

Gradient Fill Icon

When this tool is selected you can click and drag with the left mouse button in the Main Painting Window to create a gradient of elevations on the terrain with the currently selected gradient settings.

To deselect the Gradient Fill Tool, click on another tool icon.

Brushes



This set of 11 icons provides you with a range of different brush types and sizes to choose from. You can select a brush from this set of icons, then use the Brush Size slider on the Options page to modify its size, and the Opacity Field to control the intensity of its effect.

Elevations

Foreground Elevation Field

This field contains the currently selected value for the Foreground Elevation. This is the value used when the Paint Icon is selected. It also defines the foreground elevation for Gradients.

Background Elevation Field

This field contains the currently selected value for the Background Elevation. This is the value that defines the background elevation for Gradients.

Swap Foreground and Background Elevations Button

Clicking this button will exchange the foreground and background elevation values.

This is most useful when a Gradient is being drawn with reversed elevations relative to what you would like.

Tolerance Field

This field contains the value used as a “margin of error” when selecting with the Select Icon enabled. You should usually set this to a value that represents the difference between the Elevation value you are intending to click on, and the range of values you want selected when you click.

For example, clicking on a point at 1000m elevation with a tolerance of 500m will select all contiguous elevations from 500m to 1500m (i.e. 500m either side of the selected elevation)

Options

Opacity % Field

The value in this field determines how visible the paint effect is on the terrain. A value of 100% will apply the paint at full strength, whilst a value of 0% will apply no paint.

Effect Dropdown List

Selecting this List provides you with 5 different ways in which the “elevation paint” can be applied to the terrain:

Absolute

Painting in this mode will cause paint to be applied at the current Foreground Elevation, regardless of the topography of the underlying terrain.

Abs: Raise

Painting in this mode will cause paint to be applied at the current Foreground Elevation where it exceeds that of the underlying terrain.

Abs: Lower

Painting in this mode will cause paint to be applied at the current Foreground Elevation where it is less than that of the underlying terrain.

Rel: Raise

Painting in this mode will cause paint to be applied at the elevation of the underlying terrain plus the current Foreground Elevation value.

Rel: Lower

Painting in this mode will cause paint to be applied at the elevation of the underlying terrain minus the current Foreground Elevation value.

Note: The Relative (Rel) paint mode types are not available for the Smear, Smooth and Roughen Tools.

Gradient Type Dropdown List

This list will only be activated when the Gradient Fill Icon is selected as the current tool. It will then provide you with a choice of three different Gradient types:

Linear

This gradient type creates a user-definable linear ramp between foreground and background elevations.

To create the gradient, click where you want the foreground elevation to be, then while holding the mouse button down, drag to the point where you want background elevations to appear and release the mouse button.

While dragging, VNS will represent the gradient region with a red line. When you release the mouse button, a linear gradient will be drawn perpendicular to the direction in which you dragged. Foreground values are placed along an imaginary line perpendicular to the direction of drag, and passing through the first point clicked. Background values are placed along an imaginary line perpendicular to the direction of drag, and passing through the last point clicked. The gradient goes from foreground to background between these two imaginary lines for the entire extent of the Main paint Window.

Radial

This gradient type creates a user-definable radial ramp between foreground and background elevations.

To create the gradient, click where you want the foreground elevation to be, then while holding the mouse button down, drag to the point where you want background elevations to appear and release the mouse button.

While dragging, VNS will represent the gradient region with a red line. When you release the mouse button, a circular gradient will be painted with a radius to equal to the distance dragged out in the Main Paint Window.

Foreground elevation at the center changes to background elevations at the edge over the radius of the circle.

Bump

This gradient type creates a user-definable linear ramp between foreground and background elevations.

To create the gradient, click where you want the gradient to start, then while holding the mouse button down, drag to the point where you want the gradient to end and release the mouse button.

While dragging, VNS will represent the gradient region with a red line. When you release the mouse button, a linear gradient will be drawn perpendicular to the direction in which you dragged. Foreground values are placed along an imaginary line perpendicular to the direction of drag, and passing through the first point clicked. The gradient will be mirrored around the center point (background to foreground to background) for the entire extent of the Main paint Window.

Brush Size Slider

By adjusting the slider, you can control the size of the currently selected brush. Sizes range from 1 to 31 when at minimum setting (depending on the size of brush originally chosen) and from 7 to 255 when at maximum setting.

Diagnostic Data Window

The Diagnostic Data window lets you get valuable information by clicking in Views, preview renderings and final renderings. You can open it clicking on the Diag tab at the bottom of the Scene-At-A-Glance.

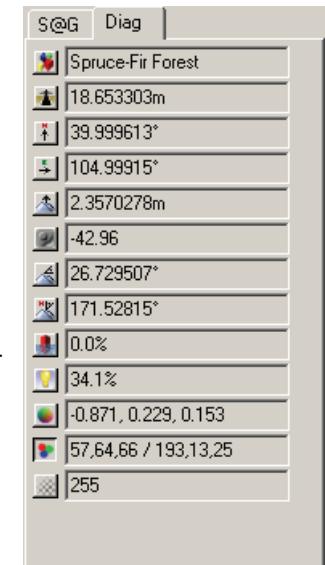
The Diagnostic Data window lets you do several things:

1) See diagnostic data about any pixel.

By clicking in a view or rendering you can see a lot of useful information about any pixel in the image. You can use this information to figure out why the image is rendering the way it is; measure distances; measure elevations; and find coordinates.

VNS will show the most information when you click on rendered images, and VNS can show the information most accurately from rendered images. When you click on OpenGL Views VNS will show approximate distance, latitude/longitude coordinates and elevation.

Hint: You can copy values from any field in the Diagnostics Data window by dragging or double clicking to select the number with the mouse and using the control-c keyboard shortcut for copy. Then you can paste it into another VNS field by clicking in the field and using the control-v keyboard shortcut for paste.



2) See a rendering of different buffers.

By clicking the radio buttons along the side you can see different buffers in a preview rendering or rendering. The sliders at the bottom let you scale the display range of these buffers.

The information in the Diagnostic Data window is the same information VNS uses when rendering an image. It includes these display fields:

- **Component Display**
- **Distance Display**
- **Latitude Display**
- **Longitude Display**
- **Elevation Display**
- **Rel El Display**
- **Slope Display**
- **Aspect Display**
- **Reflection Display**
- **Illumination Display**
- **Normal XYZ Display**
- **RGB/HSV Display**
- **Alpha Display**

Note: See Ecosystem Editor for more information about the effect of some of these Parameters.

With the Manipulate View's Camera, Move Mode, Rotate Mode and Scale/Zoom Mode icons disabled, click any pixel in a View to display diagnostic information for that pixel in the Diagnostic Data window. You can hold the left mouse button down and move the pointer around on the preview rendering to scan the information.

If the View is showing a realtime OpenGL display, fewer of the diagnostic fields will display data. If the View is showing a preview rendering, more of the diagnostic fields will display data, and the data will be more accurate.

Component Display

For rendered images, the Component display shows the name of the Component rendered at the pixel where you clicked.

Note: You can double-click on a rendered image to open the appropriate Editor.

Distance Display

The Distance display shows the distance from the Camera to the pixel where you clicked. This is also the Z Buffer value for that point.

You can use the Distance Display to measure the distance to any terrain feature. This can be handy when you want to know how far away something is before you set Haze Parameters.

This will be more accurate if you click on a rendered image.

Latitude Display

The Latitude display shows the latitude at the pixel where you clicked.

This will be more accurate if you click on a rendered image.

Longitude Display

The Longitude display shows the longitude at the pixel where you clicked.

This will be more accurate if you click on a rendered image.

Elevation Display

The Elevation display shows the elevation at the pixel where you clicked.

This will be more accurate if you click on a rendered image.

Rel El Display

For rendered images, the Rel El display shows the Relative Elevation at the pixel where you clicked.

Use this to determine Ecosystem Maximum and Minimum Relative Elevations and Relative Elevation Effect. Relative Elevations are used to determine where Ecosystems are placed on the landscape (see Ecosystem Editor).

Slope Display

For rendered images, the Slope display shows the terrain slope at the pixel where you clicked.

Slope is the angle the terrain makes measured against the horizontal plane of flat ground. It's in degrees and always positive.

Use this value to help determine Ecosystem Maximum and Minimum Slopes. You may want to limit certain types of vegetation like wetlands to slopes less than 5 degrees or forests to less than 30 degrees. The slope value will tell you if you need to raise or lower the Ecosystem Maximum slope to cover a piece of terrain.

Note: When using a Vertical Scale value greater or less than 100% (see Planet Options Editor), the terrain slopes will be affected. If Vertical Scale is less than 100% the slopes will decrease, more than 100% will make them increase. Changing slopes will affect Ecosystem coverage. This might be exactly the effect you want, increasing the amount of rock as terrain relief and slopes increase. However if you want to maintain constant coverage instead, use the diagnostic slope values found here to help determine what the Ecosystem Maximum Slope values should be.

Aspect Display

For rendered images, the Aspect display shows the aspect of the terrain at the pixel you clicked.

Aspect is the azimuth of the terrain slope vector. It is in degrees clockwise from north.

If the terrain slopes due north the aspect is 0°. If it slopes due east the aspect is 90°. Use this to determine Ecosystem Skew Azimuths. Skew Azimuth controls what direction the Ecosystem Skew is maximized (See Ecosystem Editor).

Reflection Display

For rendered images, the Reflection display shows the percentage of reflection on the pixel you clicked.

Illumination Display

For rendered images, the Illumination display shows the percentage of illumination on the pixel you clicked.

Normal XYZ Display

For rendered images, the Normal XYZ display shows surface normal information.

RGB/HSV Display

The RGB/HSV display shows the color at the pixel where you clicked in both RGB (red, green, blue) and HSV (hue, saturation and value) units.

Alpha Display

The Alpha display shows alpha channel information.

Sliders and Radio Buttons

By clicking the display field radio buttons along the side you can see different buffers in the rendering. The sliders at the bottom let you scale the display range of the buffers that are shown in gray scale.

The sliders can't do anything about the fact that for some variables in your scene the range may far exceed what is displayable. In those cases, even reducing the range by the maximum slider value of 99% isn't enough.

If you really want to see Z values or Latitude/Longitude or Elevation ranges displayed in gray scale, turn off rendering for those objects that will be really far from the immediate terrain such as Cloud Models, Skies and Celestial objects.

Most of the time you will be able to see slope, aspect, relative elevation and illumination without using the sliders.

You won't see much in the Alpha buffer unless you disable Skies behind the terrain. By the time the sky is rendered the complete alpha image should be white. That means the entire image has been filled and no part remains transparent.

Edge Feathering Profile Editor

The Edge Feathering Profile Editor lets you fade in a Component's value at the edges of Vector-bound Components. This lets you merge the Component smoothly into the surrounding conditions. Edge Feathering works for Components that can be positioned within one or more Vectors.

To open the Edge Feathering Profile Editor, click the Edit Profile button on the General page of any Area Component that has an attached Vector. Area Components are applied within the Vector(s) to which they are attached. You can open the Edge Feathering Profile Editor for each kind of Area Component from the following Editors:

- **Area Terraffector Editor**

For Area Terraffectors, the Edge Feathering Profile Editor lets you adjust the amount of Elevation change inward from the controlling Vector(s).

- **Cloud Model Editor**

For Cloud Models with attached Vectors, the Edge Feathering Profile Editor lets you fade in areas of cloudiness inward from the controlling Vector(s).

- **Ecosystem Editor**

For Vector-bounded Ecosystems, the Edge Feathering Profile Editor lets you fade in the Ecotype foliage and Ground Overlay texturing inward from the controlling Vector(s).

- **Environment Editor**

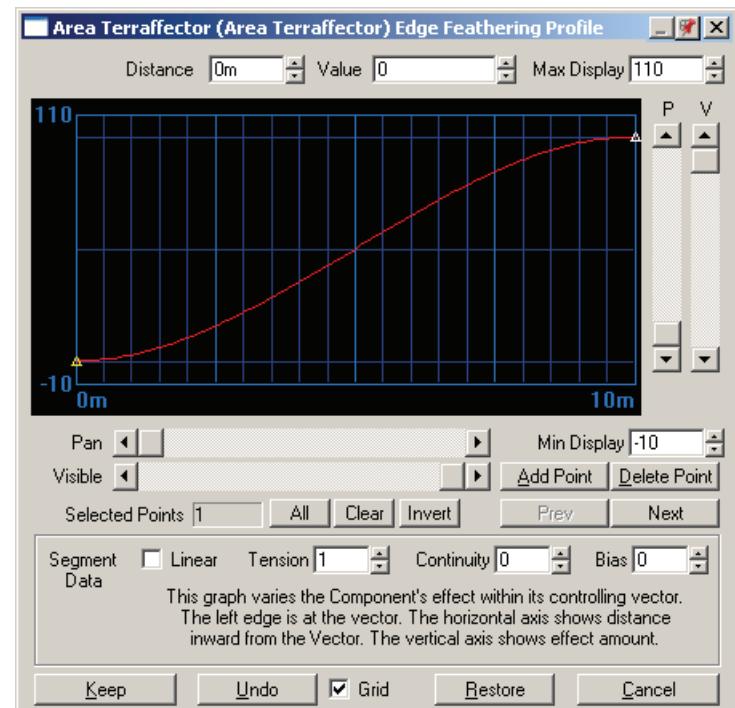
For Vector-bounded Environments, the Edge Feathering Profile Editor lets you fade in its Rules-of-Nature™ Ecosystems inward from the controlling Vector(s).

- **Ground Effect Editor**

For Vector-bounded Ground Effects, the Edge Feathering Profile Editor lets you fade in the terrain texturing inward from the controlling Vector(s).

- **Shadow Editor**

For Vector-bounded Shadow Components, the Edge Feathering Profile Editor lets you fade in the shadow intensity inward from the controlling Vector(s).



- **Snow Effect Editor**

For Vector-bounded Snow Effects, the Edge Feathering Profile Editor lets you fade in the snow terrain texturing inward from the controlling Vector(s).

- **Wave Model Editor**

For Vector-bounded Wave Models, the Edge Feathering Profile Editor lets you fade in the wave intensity inward from the controlling Vector(s).

The Edge Feathering Profile Editor's graph shows the change in the Component's value inside the Vector, from the Vector inward.

The left edge of the graph is always the value change at the Vector itself. The value changes in the graph to the right are applied on within the Vector. For example, for an Area Terraffector the value would be change in terrain elevation, while for a Shadow Component the value would be the shadow intensity.

Graph Controls

Distance Field

The Distance field lets you enter a distance for the currently selected point in the graph. Distances are represented along the X axis of the graph. This is the distance at which the Component's value will change on the inside of the host Vector.

Value Field

The Value field lets you enter the value for the currently selected point in the graph. This is the amount of the Component's effect VNS will apply to the terrain at that point.

Max Display Field

The Maximum Display field lets you specify the high Y limit for the graph. The Y axis shows the value change created by the Edge Feathering Profile.

Min Display Field

The Minimum Display field lets you specify the low Y limit for the graph. The Y axis shows the value change created by the Edge Feathering Profile.

Graph Area

The Graph display shows the shape of the profile VNS will use to alter the Component's value inside the Vector. You can interactively edit the points on the graph.

The X and Y values are both measurements in real units. The X axis of the graph shows a distance from the Vector.

The Y axis of the graph shows the Component's value. You can select the units on the Units page of the Preferences Window.

You can click any point to select it. You can drag points in the Y axis with the mouse. You can drag points in the X axis by holding down the Control key on your keyboard and dragging with the mouse.

Vertical P (Pan) Slider

Use the Vertical Pan slider to go up or down in the Graph when you've zoomed in with the Vertical Visible slider. The Y axis shows the elevation change created by the Edge Feathering Profile.

Vertical V (Visible) Slider

Use the Visible slider to zoom in and out on the Y axis of the Graph display. The Y axis shows the elevation change created by the Edge Feathering Profile.

Horizontal Pan Slider

Use the Horizontal Pan slider to go left or right in the Graph when you've zoomed in with the Horizontal Visible slider. The X axis of the graph shows a distance from the Vector.

Horizontal Visible Slider

Use the Horizontal Visible slider to zoom in and out on the X axis of the Graph display. The X axis of the graph shows a distance from the Vector.

Selected Points Display Field

The Selected Points display field shows the number of graph points that are currently selected. Click a graph point to select it. Shift-click to select more than one.

Use the following buttons for more selection/deselection options.

All Button

Click the All button to select all points in the graph.

Clear Button

Click the Clear button to deselect all points in the graph.

Invert Button

Click the Invert button to select all unselected points and deselect all selected points.

Previous Button

Click the Previous button to select the previous point in the graph.

Next Button

Click the Next button to select the next point in the graph.

Add Point Button

Click the Add Point button and then click in the graph to add a new point.

Delete Point Button

Click the Delete Point button to remove the selected points.

Segment Data Section

The Segment Data section lets you control parameters for individual Profile segments between points. The controls are for the segment to the left of the currently selected point on the graph.

Linear Checkbox

Select the Linear checkbox to make the shape to the left of the active point be a straight line rather than a curved spline.

Tension, Continuity and Bias Fields

The Tension, Continuity and Bias values change the shape of the curve at the active point.

Lower Edge Controls

Keep Button

Changes apply immediately when you make them. The Keep button lets you close the window without losing your changes.

Undo Button

The Undo button lets you throw away the last change you made in the Edge Feathering Profile Editor. Use this as a way to undo a single change when experimenting.

Grid Checkbox

Click the Grid checkbox to toggle a grid display in the graph.

Restore Button

The Restore button lets you deliberately throw away all the changes you made since you last opened the Edge Feathering Profile Editor. Use this as a way to undo changes when experimenting.

Cancel Button

The Cancel button lets you close the window and deliberately throw away all the changes you made since you last opened it. This is like the Restore button (see above) but it also closes the Edge Feathering Profile Editor.

Edit Coverage Profile Editor

For Volumetric and multi-layered clouds the Coverage Profile allows control over the cloud coverage relative to the cloud height above its base. Values in the profile can be from 0 to 100% and are multiplied times the Coverage % value (see Cloud Model Editor) to determine the coverage for any layer or sample within the cloud mass.

Typically coverage Profiles are used to sculpt the cross-sectional shape of the cloud. Often clouds have broader flatter bases and rounder tops. Anvil clouds are broader and have greater coverage at the top.

Graph Controls

Distance Field

The Distance field lets you enter a distance for the currently selected point in the graph. Distances are represented along the X axis of the graph. This is the distance as a fraction of the whole at which a value on the Y axis will be applied to the base Coverage value as a multiplier. So, if the X-axis value is 0.4, the value entered will affect cloud coverage at a point 40% of the cloud model's height from Base Elevation.

Value Field

The Value field lets you enter the value for the currently selected point in the graph. This is the multiplier applied to the coverage value

Max Display Field

The Maximum Display field lets you specify the high Y limit for the graph. The Y axis shows the value change created by the Edit Coverage Profile.

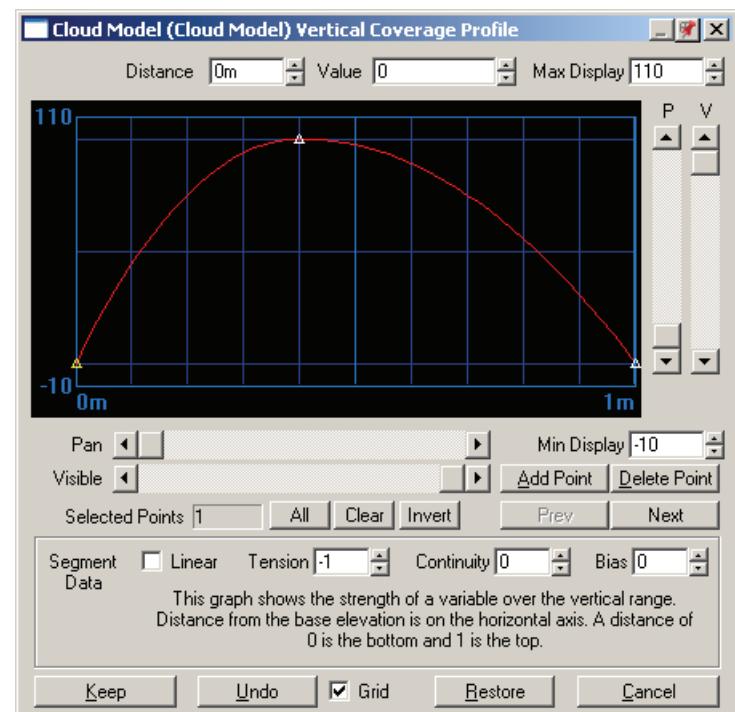
Min Display Field

The Minimum Display field lets you specify the low Y limit for the graph. The Y axis shows the value change created by the Edit Coverage Profile.

Graph Area

The Graph display shows the shape of the profile VNS will use to alter the Cloud's Coverage value as you proceed from bottom to top of the cloud mass. You can interactively edit the points on the graph.

The X axis of the graph shows a distance from the bottom to the top of the cloud mass. A value of 0 represents the bottom of the cloud (set by the elevation field) and a value of 1 represents the top of the cloud (set by the base elevation field + the thickness value).



The Y axis of the graph shows the multiplier applied to the coverage value.

You can click any point to select it. You can drag points in the Y axis with the mouse. You can drag points in the X axis by holding down the Control key on your keyboard and dragging with the mouse.

Vertical P (Pan) Slider

Use the Vertical Pan slider to go up or down in the Graph when you've zoomed in with the Vertical Visible slider. The Y axis shows the multiplier applied to the base Coverage value.

Vertical V (Visible) Slider

Use the Visible slider to zoom in and out on the Y axis of the Graph display. The Y axis shows the multiplier applied to the base Coverage value.

Horizontal Pan Slider

Use the Horizontal Pan slider to go left or right in the Graph when you've zoomed in with the Horizontal Visible slider. The X axis of the graph shows the distance as a fraction of the whole at which a value on the Y axis will be applied to the base Coverage value as a multiplier. So, if the X-axis value is 0.4, the value entered will affect cloud Coverage at a point 40% of the cloud model's height from Base Elevation.

Horizontal Visible Slider

Use the Horizontal Visible slider to zoom in and out on the X axis of the Graph display.

Selected Points Display Field

The Selected Points display field shows the number of graph points that are currently selected. Click a graph point to select it. Shift-click to select more than one.

Use the following buttons for more selection/deselection options.

All Button

Click the All button to select all points in the graph.

Clear Button

Click the Clear button to deselect all points in the graph.

Invert Button

Click the Invert button to select all unselected points and deselect all selected points.

Previous Button

Click the Previous button to select the previous point in the graph.

Next Button

Click the Next button to select the next point in the graph.

Add Point Button

Click the Add Point button and then click in the graph to add a new point.

Delete Point Button

Click the Delete Point button to remove the selected points.

Segment Data Section

The Segment Data section lets you control parameters for individual Profile segments between points. The controls are for the segment to the left of the currently selected point on the graph.

Linear Checkbox

Select the Linear checkbox to make the shape to the left of the active point be a straight line rather than a curved spline.

Tension, Continuity and Bias Fields

The Tension, Continuity and Bias values change the shape of the curve at the active point.

Lower Edge Controls

Keep Button

Changes apply immediately when you make them. The Keep button lets you close the window without losing your changes.

Undo Button

The Undo button lets you throw away the last change you made in the Edit Coverage Profile Editor. Use this as a way to undo a single change when experimenting.

Grid Checkbox

Click the Grid checkbox to toggle a grid display in the graph.

Restore Button

The Restore button lets you deliberately throw away all the changes you made since you last opened the Edit Coverage Profile Editor. Use this as a way to undo changes when experimenting.

Cancel Button

The Cancel button lets you close the window and deliberately throw away all the changes you made since you last opened it. This is like the Restore button (see above) but it also closes the Edit Coverage Profile Editor.

Edit Custom Curve Window

When using the Texture Editor, you will sometimes prefer to use a remap function whose graph has been manually setup by you. In this case you would select the Custom Curve remap function and click the Edit Curve Button. This will open the Edit Custom Curve Window, the controls of which are as follows:

Graph Controls

Distance Field

The Distance field lets you enter an input value for the currently selected point in the graph. Values are represented by distance along the X axis of the graph in meters. So, a distance of 0.4m on the X-axis represents a texture input value of 0.4.

Value Field

The Value field lets you enter the value for the currently selected point in the graph. This is the output value generated by the Edit Custom Curve for that particular input value.

Max Display Field

The Maximum Display field lets you specify the high Y limit for the graph. The Y axis shows the output value generated by the Edit Custom Curve.

Min Display Field

The Minimum Display field lets you specify the low Y limit for the graph. The Y axis shows the output value generated by the Edit Custom Curve.

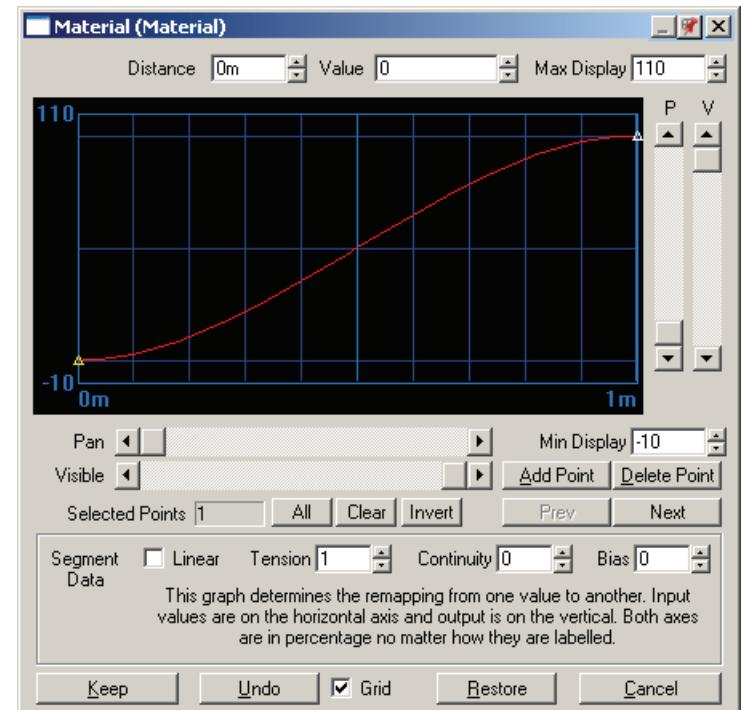
Graph Area

The Graph display shows the shape of the curve VNS will use as your custom remap function. You can interactively edit the points on the graph.

The X axis shows the input value for a texture element (from 0 to 1)

The Y axis shows the output value for a texture element (from 0 to 1)

You can click any point to select it. You can drag points in the Y axis with the mouse. You can drag points in the X axis by holding down the Control key on your keyboard and dragging with the mouse.



Vertical P (Pan) Slider

Use the Vertical Pan slider to go up or down in the Graph when you've zoomed in with the Vertical Visible slider. The Y axis shows the output value.

Vertical V (Visible) Slider

Use the Visible slider to zoom in and out on the Y axis of the Graph display. The Y axis shows the output value.

Horizontal Pan Slider

Use the Horizontal Pan slider to go left or right in the Graph when you've zoomed in with the Horizontal Visible slider. The X axis of the graph shows texture values represented by distance in meters. So, a distance of 0.4m on the X-axis represents a texture input value of 0.4.

Horizontal Visible Slider

Use the Horizontal Visible slider to zoom in and out on the X axis of the Graph display.

Selected Points Display Field

The Selected Points display field shows the number of graph points that are currently selected. Click a graph point to select it. Shift-click to select more than one.

Use the following buttons for more selection/deselection options.

All Button

Click the All button to select all points in the graph.

Clear Button

Click the Clear button to deselect all points in the graph.

Invert Button

Click the Invert button to select all unselected points and deselect all selected points.

Previous Button

Click the Previous button to select the previous point in the graph.

Next Button

Click the Next button to select the next point in the graph.

Add Point Button

Click the Add Point button and then click in the graph to add a new point.

Delete Point Button

Click the Delete Point button to remove the selected points.

Segment Data Section

The Segment Data section lets you control parameters for individual Profile segments between points. The controls are for the segment to the left of the currently selected point on the graph.

Linear Checkbox

Select the Linear checkbox to make the shape to the left of the active point be a straight line rather than a curved spline.

Tension, Continuity and Bias Fields

The Tension, Continuity and Bias values change the shape of the curve at the active point.

Lower Edge Controls

Keep Button

Changes apply immediately when you make them. The Keep button lets you close the window without losing your changes.

Undo Button

The Undo button lets you throw away the last change you made in the Edit Custom Curve Editor. Use this as a way to undo a single change when experimenting.

Grid Checkbox

Click the Grid checkbox to toggle a grid display in the graph.

Restore Button

The Restore button lets you deliberately throw away all the changes you made since you last opened the Edit Custom Curve Editor. Use this as a way to undo changes when experimenting.

Cancel Button

The Cancel button lets you close the window and deliberately throw away all the changes you made since you last opened it. This is like the Restore button (see above) but it also closes the Edit Custom Curve Editor.

Edit Density Profile Editor

For Volumetric and multi-layered clouds the Density Profile allows control over the cloud density relative to the cloud height above its base. Values in the profile can be from 0 to 100% and are multiplied times the Density % value (above) to determine the density for any layer or sample within the cloud mass.

Using the Density Profile you can create clouds that are solid at the base and wispy at the top.

Graph Controls

Distance Field

The Distance field lets you enter a distance for the currently selected point in the graph. Distances are represented along the X axis of the graph. This is the distance as a fraction of the whole at which a value on the Y axis will be applied to the base Density value as a multiplier. So, if the X-axis value is 0.4, the value entered will affect cloud density at a point 40% of the cloud model's height from Base Elevation.

Value Field

The Value field lets you enter the value for the currently selected point in the graph. This is the multiplier applied to the density value

Max Display Field

The Maximum Display field lets you specify the high Y limit for the graph. The Y axis shows the value change created by the Edit Density Profile.

Min Display Field

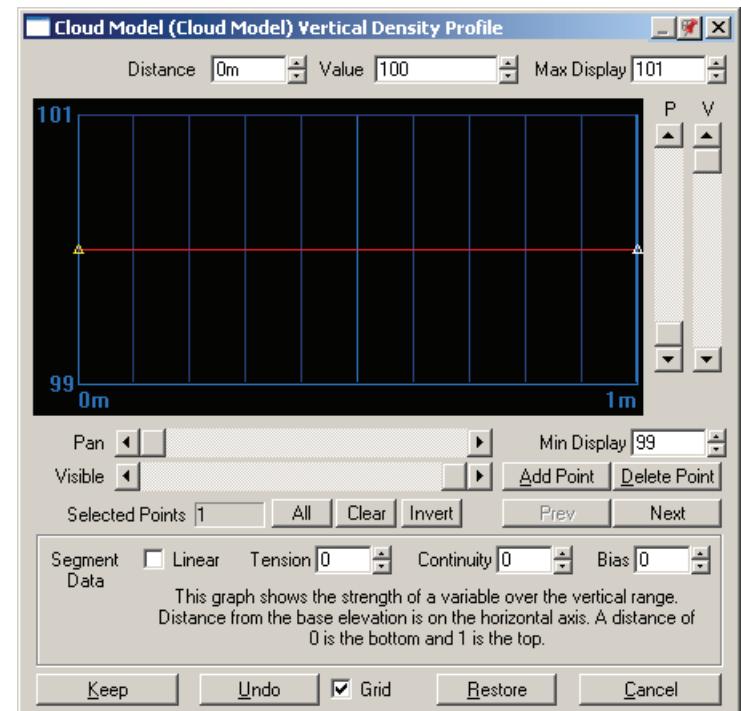
The Minimum Display field lets you specify the low Y limit for the graph. The Y axis shows the value change created by the Edit Density Profile.

Graph Area

The Graph display shows the shape of the profile VNS will use to alter the Cloud's Density value as you proceed from bottom to top of the cloud mass. You can interactively edit the points on the graph.

The X axis of the graph shows a distance from the bottom to the top of the cloud mass. A value of 0 represents the bottom of the cloud (set by the elevation field) and a value of 1 represents the top of the cloud (set by the base elevation field + the thickness value).

The Y axis of the graph shows the multiplier applied to the density value.



You can click any point to select it. You can drag points in the Y axis with the mouse. You can drag points in the X axis by holding down the Control key on your keyboard and dragging with the mouse.

Vertical P (Pan) Slider

Use the Vertical Pan slider to go up or down in the Graph when you've zoomed in with the Vertical Visible slider. The Y axis shows the multiplier applied to the base Density value.

Vertical V (Visible) Slider

Use the Visible slider to zoom in and out on the Y axis of the Graph display. The Y axis shows the multiplier applied to the base Density value.

Horizontal Pan Slider

Use the Horizontal Pan slider to go left or right in the Graph when you've zoomed in with the Horizontal Visible slider. The X axis of the graph shows the distance as a fraction of the whole at which a value on the Y axis will be applied to the base Density value as a multiplier. So, if the X-axis value is 0.4, the value entered will affect cloud Density at a point 40% of the cloud model's height from Base Elevation.

Horizontal Visible Slider

Use the Horizontal Visible slider to zoom in and out on the X axis of the Graph display.

Selected Points Display Field

The Selected Points display field shows the number of graph points that are currently selected. Click a graph point to select it. Shift-click to select more than one.

Use the following buttons for more selection/deselection options.

All Button

Click the All button to select all points in the graph.

Clear Button

Click the Clear button to deselect all points in the graph.

Invert Button

Click the Invert button to select all unselected points and deselect all selected points.

Previous Button

Click the Previous button to select the previous point in the graph.

Next Button

Click the Next button to select the next point in the graph.

Add Point Button

Click the Add Point button and then click in the graph to add a new point.

Delete Point Button

Click the Delete Point button to remove the selected points.

Segment Data Section

The Segment Data section lets you control parameters for individual Profile segments between points. The controls are for the segment to the left of the currently selected point on the graph.

Linear Checkbox

Select the Linear checkbox to make the shape to the left of the active point be a straight line rather than a curved spline.

Tension, Continuity and Bias Fields

The Tension, Continuity and Bias values change the shape of the curve at the active point.

Lower Edge Controls

Keep Button

Changes apply immediately when you make them. The Keep button lets you close the window without losing your changes.

Undo Button

The Undo button lets you throw away the last change you made in the Edit Density Profile Editor. Use this as a way to undo a single change when experimenting.

Grid Checkbox

Click the Grid checkbox to toggle a grid display in the graph.

Restore Button

The Restore button lets you deliberately throw away all the changes you made since you last opened the Edit Density Profile Editor. Use this as a way to undo changes when experimenting.

Cancel Button

The Cancel button lets you close the window and deliberately throw away all the changes you made since you last opened it. This is like the Restore button (see above) but it also closes the Edit Density Profile Editor.

Edit Shading Profile Editor

For Volumetric and multi-layered clouds the Shading Profile allows control over the shading relative to the cloud height above its base. Values in the profile can be from 0 to 100% and are multiplied times the Shading % value (above) to determine the shading allowable for any layer or sample within the cloud mass. The Shading % does not affect the amount of shadowing that can be created by Shadow Maps, Light Falloff, Spotlight Cones and the Earth Umbra casting shadows on the cloud.

Graph Controls

Distance Field

The Distance field lets you enter a distance for the currently selected point in the graph. Distances are represented along the X axis of the graph. This is the distance as a fraction of the whole at which a value on the Y axis will be applied to the base Shading value as a multiplier. So, if the X-axis value is 0.4, the value entered will affect cloud shading at a point 40% of the cloud model's height from Base Elevation.

Value Field

The Value field lets you enter the value for the currently selected point in the graph. This is the multiplier applied to the shading value

Max Display Field

The Maximum Display field lets you specify the high Y limit for the graph. The Y axis shows the value change created by the Edit Shading Profile.

Min Display Field

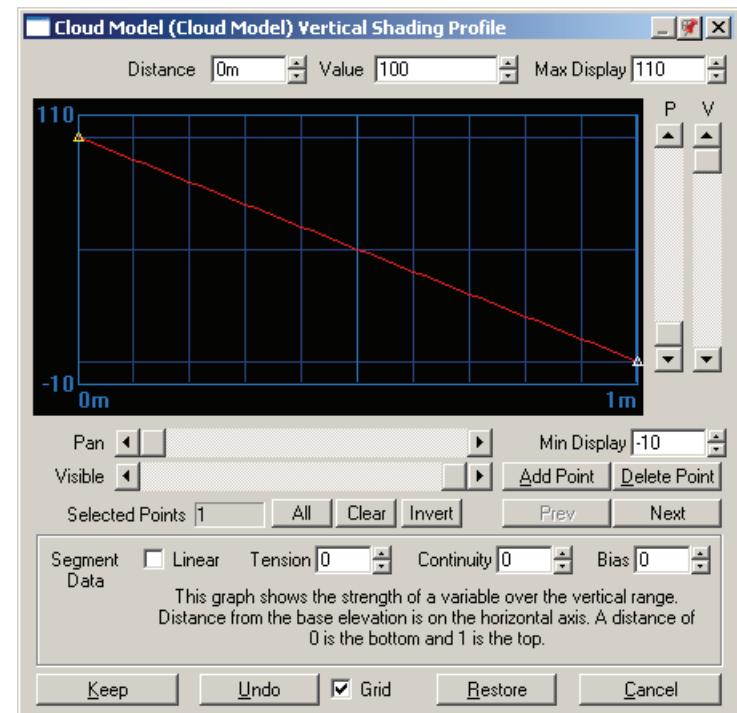
The Minimum Display field lets you specify the low Y limit for the graph. The Y axis shows the value change created by the Edit Shading Profile.

Graph Area

The Graph display shows the shape of the profile VNS will use to alter the Cloud's Shading value as you proceed from bottom to top of the cloud mass. You can interactively edit the points on the graph.

The X axis of the graph shows a distance from the bottom to the top of the cloud mass. A value of 0 represents the bottom of the cloud (set by the elevation field) and a value of 1 represents the top of the cloud (set by the base elevation field + the thickness value).

The Y axis of the graph shows the multiplier applied to the shading value.



You can click any point to select it. You can drag points in the Y axis with the mouse. You can drag points in the X axis by holding down the Control key on your keyboard and dragging with the mouse.

Vertical P (Pan) Slider

Use the Vertical Pan slider to go up or down in the Graph when you've zoomed in with the Vertical Visible slider. The Y axis shows the multiplier applied to the base Shading value.

Vertical V (Visible) Slider

Use the Visible slider to zoom in and out on the Y axis of the Graph display. The Y axis shows the multiplier applied to the base Shading value.

Horizontal Pan Slider

Use the Horizontal Pan slider to go left or right in the Graph when you've zoomed in with the Horizontal Visible slider. The X axis of the graph shows the distance as a fraction of the whole at which a value on the Y axis will be applied to the base Shading value as a multiplier. So, if the X-axis value is 0.4, the value entered will affect cloud Shading at a point 40% of the cloud model's height from Base Elevation.

Horizontal Visible Slider

Use the Horizontal Visible slider to zoom in and out on the X axis of the Graph display.

Selected Points Display Field

The Selected Points display field shows the number of graph points that are currently selected. Click a graph point to select it. Shift-click to select more than one.

Use the following buttons for more selection/deselection options.

All Button

Click the All button to select all points in the graph.

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Invert Button

Click the Invert button to select all unselected points and deselect all selected points.

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Next Button

Click the Next button to select the next point in the graph.

Add Point Button

Click the Add Point button and then click in the graph to add a new point.

Delete Point Button

Click the Delete Point button to remove the selected points.

Segment Data Section

The Segment Data section lets you control parameters for individual Profile segments between points. The controls are for the segment to the left of the currently selected point on the graph.

Linear Checkbox

Select the Linear checkbox to make the shape to the left of the active point be a straight line rather than a curved spline.

Tension, Continuity and Bias Fields

The Tension, Continuity and Bias values change the shape of the curve at the active point.

Lower Edge Controls

Keep Button

Changes apply immediately when you make them. The Keep button lets you close the window without losing your changes.

Undo Button

The Undo button lets you throw away the last change you made in the Edit Shading Profile Editor. Use this as a way to undo a single change when experimenting.

Grid Checkbox

Click the Grid checkbox to toggle a grid display in the graph.

Restore Button

The Restore button lets you deliberately throw away all the changes you made since you last opened the Edit Shading Profile Editor. Use this as a way to undo changes when experimenting.

Cancel Button

The Cancel button lets you close the window and deliberately throw away all the changes you made since you last opened it. This is like the Restore button (see above) but it also closes the Edit Shading Profile Editor.

Export Control Window

The Export Control Window lets you render your project and export it as one or more realtime export formats (see Appendix N: Scene Express Export Formats). This interface will open when you click the “Export Scene Now” button on any Scene Exporter Editor. To export, you must first have one or more Scene Exporters (see Scene Exporter Editor).

The Scene Exporter allows you to define a range of different export parameters for your realtime scene, including the terrain and drape texture resolution, foliage presence and type, sky gradients and so forth.

To export your project to the selected realtime format(s), click the Go button.

Scheduled Exports List

The Scheduled Exports list shows all the Scene Exporters in your Project.

Note: You can add or remove Scene Exporters in the Scene-At-A-Glance.

You can click any Scene Exporter in the list to select it. Information about the selected Scene Exporter is shown on the right side of the window, in the Selected Export section.

You can double-click a Scene Exporter’s name in the Scheduled Exports list to open the Scene Exporter Editor, ready to edit the selected Scene Export.

You can change the enabled status and render priority of the selected Scene Exporter using the Scheduled Exports icons.

Note: You can also enable or disable a Scene Exporter using the Enabled checkbox in the Scene Exporter Editor.

Enabled Scene Exporters are shown in black. Disabled Scene Exporters are shown in gray. Enabled Scene Exporters will export in order from top to bottom when you click the Go button at the bottom of the Scene Export Control window. Disabled Scene Exporters will not export.

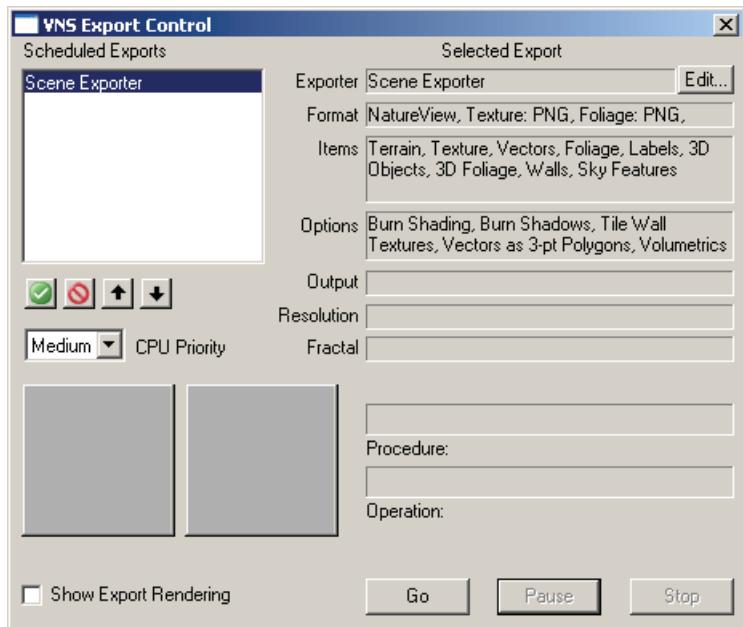
Scheduled Exports Icons

The Scheduled Exports icons are just below the Scheduled Exports list. They let you enable or disable a selected Scene Exporter, or change its priority in the Scheduled Exports list.

Enable Scene Exporter Icon

You can enable a selected Scene Exporter with the Enable Scene Exporter icon. Enabled Scene Exporters will render in order from top to bottom when you click the Go button at the bottom of the Export Control window.

Enabled Scene Exporters are shown in black. Disabled Scene Exporters are shown in gray.



Note: You can also enable or disable a Scene Exporter using the Enabled checkbox in the Scene Exporter Editor.

Disable Scene Exporter Icon

You can disable a selected Scene Exporter with the Disable Scene Exporter icon. Disabled Scene Exporters will not render.

Enabled Scene Exporters are shown in black. Disabled Scene Exporters are shown in gray.

Note: You can also enable or disable a Scene Exporter using the Enabled checkbox in the Scene Exporter Editor.

Raise Scene Exporter Priority Icon

Click the Raise Scene Exporter Priority icon to move the selected Scene Exporter higher in the Scheduled Exports list. If the Scene Exporter is enabled, moving it higher in the list will increase its priority.

This will also cause VNS to renumber the Priority values of all Scene Exporters as seen in the Priority field of each Scene Exporter Editor.

When you click the Go button at the bottom of the Export Control Window, VNS will start exporting any enabled Scene Exporter that is highest in the list, and then export the next Scene Exporter in the list and so on, until all Scene Exporters in the list have been exported.

Lower Scene Exporter Priority Icon

Click the Lower Scene Exporter Priority icon to move the selected Scene Exporter lower in the Scheduled Exports list. If the Scene Exporter is enabled, moving it lower in the list will decrease its priority.

This will also cause VNS to renumber the Priority values of all Scene Exporters as seen in the Priority field of each Scene Exporter Editor.

When you click the Go button at the bottom of the Export Control window, VNS will start exporting any enabled Scene Exporter that is highest in the list, and then export the next Scene Exporter in the list and so on, until all Scene Exporters in the list have been exported.

CPU Priority Drop Box

The CPU Priority drop box lets you choose how VNS uses your computer's CPU processing power during exporting. You can select a priority of Low, Medium or High for VNS to use when exporting projects. This will generally work as described below, but some operating systems are better at this than others.

Note: CPU stands for "Central Processing Unit". If your computer has more than one CPU, VNS will just use one of them for Scene Express functions. There is no way at the current time to remotely control Scene Export functions from a remote machine with Superconductor as there is with normal rendering.

Low

Select Low when you want VNS to not interfere with most other programs during export exporting. This way you can multitask other programs as if VNS wasn't even running, and yet when you aren't using CPU cycles VNS will grab them and use them for export processing.

Medium

Select Medium to give VNS the same priority as most other programs. Use this when you're on a deadline and you want VNS to grab its share of CPU cycles. You can still use other programs, but they may slow down somewhat.

High

Select High when you want VNS to have all the CPU cycles it can get. Most other programs will not get any CPU cycles if you choose High, so don't select this option if you need to use your computer for anything else while you export. As a practical matter, this is about the same as choosing Medium and then not using your computer to run other programs.

Current and Last Image Thumbnails

The two thumbnail images show small versions of the exported content as it exports.

The thumbnail on the left shows an image for the last entity rendered. This will be gray when you begin exporting, and will update at major stages of the export process.

Note: Due to the nature of the Realtime Export process, the left thumbnail may not actually show what you expect. The concept of a "major stage" changes as the export process proceeds, so, for example, this thumbnail will update after every sky image is generated, and yet will only update for the terrain texture when the whole map has been generated.

The thumbnail on the right shows an image for the current entity that is being exported. This will be gray at first. After you've exported out the first of any output files, a representation of it will appear here, as with the normal render control interface.

Show Export Rendering Checkbox/Export Rendering in Progress Window

The optional Export Rendering in Progress window shows a preview of that portion of the project currently exporting, as it renders.

Click the Show Export Rendering checkbox on the Export Control window if you want to open the Rendering in Progress window during Scene Export.

Click the close gadget on the Export Rendering in Progress window or deselect the Show Export Rendering checkbox if you want to close the Export Rendering in Progress window during Scene Export.

Important: Having the Export Preview window open will slow exporting. Close it for faster export.

Selected Scene Exporter Section

The Selected Scene Exporter section shows information about the selected Scene Exporter, including:

- **The Scene Exporter**
- **The Export Format Type**
- **The Items To Be Exported**
- **The Export Options**
- **The Output Filename**
- **The Output Resolution**

- **The Fractal type and depth**

The Selected Scene Exporter also shows Status bars and information for the current export procedure including:

- **The current item being exported**
- **The entire operation**

Note: Due to the disparate nature of the individual facets of the export control process, calculated time estimates would not be accurate. Consequently, they are not included in the Export Control interface.

Scene Exporter Edit Button

Next to the Scene Exporter display field is the Scene Exporter Edit button. Click it to open the Scene Exporter Editor for the selected Scene Exporter. The selected Scene Exporter is the one that is currently selected in the Scheduled Exports List.

This makes it easy to make changes to Scene Exporter settings before you begin exporting.

Go Button

Click the Go button to begin the export process itself.

Pause Button

Click the Pause button to temporarily halt the export process. Click the Pause button again to restart the export process where you left off.

Stop Button

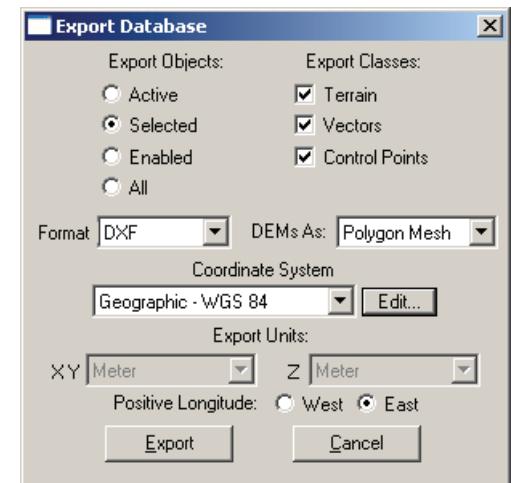
You can abort the export of your scene by clicking the Stop button. This will stop all currently queued Scene Exporters, not just the one that is currently rendering.

Export Database Window

The Export Database window lets you export objects from the current Project's Database in DXF or Shapefile format. To access it, click the Database Editor's Save Database icon, but with the Shift Key held down. VNS will open the Export Database window.

To export objects:

- 1) Choose the data you want to export using the controls on the Export Database window (see below).**
- 2) In some cases you must also select the object(s) you want to export in the Database Editor's Objects list.**
- 3) Select the Format of your exported object(s)**
- 4) Click the Export button in the Export Database window to create the DXF file or Shapefile.**



Export Objects Radio Buttons

The Export Objects radio buttons let you choose whether to export the Active, Selected, Enabled or all Database objects.

Active

Choose the Active radio button if you want to export only the Active Object in the Database Editor's Objects list. The Active Object is the object you last clicked. This is useful for exporting a single Database object. In the Database Editor's Objects list, click the object you want to export.

Selected

Choose the Selected radio button if you want to export all selected objects in the Database Editor's Objects list that are of the classes you select with the Export Classes checkboxes (see below). This is useful for exporting multiple objects.

In the Database Editor's Objects list, select the objects you want to export. You can use the Layer tools to select all members of a layer; the Attribute tools to select all objects that share a particular attribute; the Search button to select objects based on a search; shift-click to select a range of objects; or control-click to select discontinuous multiple objects. Select the classes you want to include using the Export Classes checkboxes (see below).

Enabled

Choose the Enabled radio button if you want to export all enabled objects in the Database Editor's Objects list that are of the classes you select with the Export Classes checkboxes (see below).

This is useful for exporting all the objects of any or all classes you are currently using in the Project. Select the classes you want to include using the Export Classes checkboxes (see below).

All

Choose the All radio button if you want to export all the objects in the Database Editor's Objects list that are of the classes you select with the Export Classes checkboxes (see below). This is useful for exporting all members of any class or the entire Database. Select the classes you want to include using the Export Classes checkboxes (see below).

Export Classes Checkboxes

The Export Classes checkboxes let you choose whether to export Terrain, Vectors or Control Points. Choose any combination of checkboxes to specify the data you want to export.

Note: Shape export cannot contain Terrain class objects.

Format Drop Box

The Format drop box currently lets you choose DXF or Shapefile formats. For more control over how DEMs are saved, use the DEMs As drop box (see below).

If Arc Shapefile is selected as the output format, VNS will ask you whether you want a 2D or 3D shapefile, before prompting you to provide a location for saving.

DEMs As Drop Box

The DEMs As drop box lets you choose the type of DXF format used for saving terrain data. This drop box is only available if you select the Terrain Export Class checkbox (see above).

Choose from Points, Polyline, Polygon Mesh, Polyface Mesh or 3D Faces.

This setting is irrelevant for Shape export, which cannot contain terrain data.

Coordinate System Drop Box and Edit Button

The Coordinate System drop box lets you choose a Coordinate System for the exported data.

The Edit button lets you open the Coordinate System Editor where you can edit the selected Coordinate System.

Positive Longitude Radio Buttons

Choose West or East as the positive longitude direction for your exported data.

Export and Cancel Buttons

Click the Export button to save an output file including the Database Objects you specified. VNS will prompt you for a path and filename for the output file(s).

Click the Cancel button to close the Export Database window without exporting any Database objects.

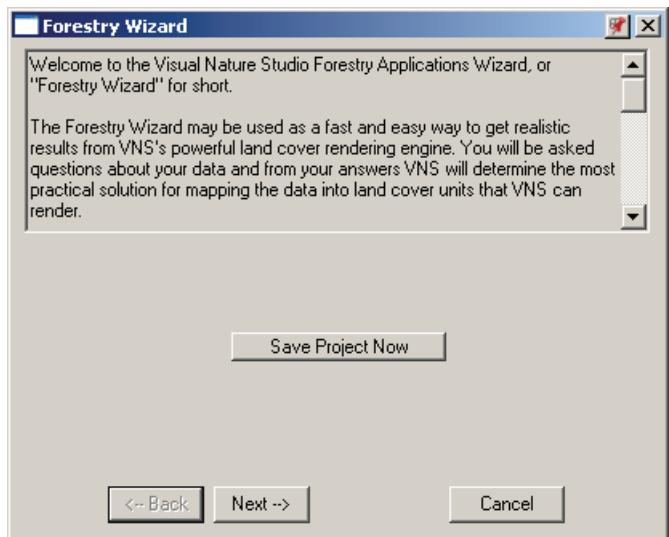
Forestry Wizard

The Forestry Wizard can help achieve the best possible visualization of forestry data without a great deal of effort or experience on the part of the user.

Typically forestry professionals have data they wish to visualize that was mapped in a GIS or a growth simulation program. They wish to bring that data into VNS with the fewest possible modifications and directly drive simulations that are both visually realistic and as accurate as the data itself permits.

VNS has a great many features designed to help foresters achieve their goals. Many of them are under-utilized due to the apparent complexity involved in their usage. Thematic Maps, Search Queries, Ecosystems and vectors all work together but the linkage between them can seem obscure at first. Even with practice they require care in their setup to avoid errors that are difficult to trace.

The Forestry Wizard is designed to make the advanced forestry features, and especially the features unique to the Forestry Edition, accessible and painless even for novice users while making them less prone to error for advanced users.



Who Should Use the Forestry Wizard?

The Forestry Wizard is designed for busy forestry professionals who have data sets that either:

- **describe forest stand attributes such as species, size and density in the form of a database with associated polygons to define areal distribution,**
- **describe individual tree specimen attributes such as species and size in the form of a database with associated point vectors to define tree positions,**
- **contain a classified image showing the areal distribution of different land cover units.**

All three of these scenarios are handled well by the Forestry Wizard and will undoubtedly save the user time and mistakes over creating all the necessary Components manually to properly visualize their data.

The Forestry Wizard does not make anything possible that cannot also be created manually by an experienced user or one who has thoroughly mastered the material in the online reference manual pertaining to Ecosystems, Ecotypes, Color Maps, Search Queries and Thematic Maps.

The Wizard is a good way to train yourself in the appropriate use of all these Component types. When a complex data set has been processed once with the Forestry Wizard the user can study the Components and linkages created with an eye to mastering the techniques.

Note: There are some circumstances when the Wizard may not be ideal or create the most optimal set of Components for visualizing a set of data. The form of the input data and database will be the determining factors here. There are no precise rules for when it is the best route and when it is not. In general it is best to try the Wizard and if its questions seem inappropriate to the data you have then it is probably not the best tool to use.

Using the Forestry Wizard

The Forestry Wizard is composed of many pages but you will see only one page at a time. Each page has a set of instructions that you must read first. Often they contain an explanation of what the Wizard needs to know followed by a question. You then answer the question using the buttons, lists, drop boxes, check boxes and radio buttons in the panel below the instructions.

The pages you are shown depend entirely upon how you answer questions and what choices you make. The questions will pertain to your forestry data, the design of your database, the attributes that control land cover classes, sizes and densities of foliage, and so on.

The first page is one that you will always see when you start the Wizard. It suggests that you back up your project before using the Wizard so that if you do not like the results the Wizard generates you do not need to start all over from scratch to undo the changes.

The next page asks the most basic of questions about your data. It is here that a major fork in the Wizard's path takes place. You will either end up on the Color Map path, the Polygon path or the Point data path.

In all cases the explanations on each page in the Instruction List box should be sufficient for you to answer the question correctly based on your knowledge of your own data.

The important thing is for you to know some information about your data before you begin. If you do not, the questions may seem unanswerable until you have explored the nature of your own data a little more.

You will need at least one of two things in your project before you begin. The Wizard will give you an opportunity to load these items if they have not been already.

You will need either a classified image that you can drape on your terrain to tell what land cover type exists across the landscape or a database of vectors, either as polygons or points, that tell where different land cover types exist or individual trees exist. These are the types of data that foresters typically have and the types that the Wizard knows how to work with.

If your database also contains attributes that tell things like species of vegetation, land cover class names, vegetation size (height, diameter, age) or density (stems per area, crown closure, basal area) these too can be used by the Wizard to enhance the accuracy and effectiveness of your visualization.

Instruction List Box

Every page in the Forestry Wizard has a set of instructions that tell you what the Wizard needs to know on that page. In most cases there is a description of what is needed and then a question asked that you answer by selecting one of the options presented. It is very important to read the instructions completely before answering the questions or filling in the necessary data. Many pages have similar sounding instructions so be very careful not to assume what is being said.

Next Button

When you have completely answered the question asked on a page or completely filled in all the information requested, hit the Next button to advance to the next Wizard page.

Back Button

If you determine that you answered a previous question incorrectly or are unsure about it, use the Back button to step backwards through the pages you have already seen. You can back all the way up to the beginning if you want to.

Note: you can go backwards and then forwards again and the Wizard will remember your answers. Only if you change an answer on a previous page might you no longer see the same pages and marked answers when you go forward. You can go backwards and forwards as much as you like until you are satisfied that you have chosen all the best possible answers.

Finish Button

When you have completed all the Wizard pages that apply to you (based on the answers you gave) the Next button will be replaced by the Finish Button. Clicking the Finish button will send the Wizard into a flurry of invisible motion. There is nothing more for you to do but sit back and wait while the Wizard digests all your answers and produces a set of Components that are capable of producing a visualization based on your data. When the Wizard is done thinking it will let you know with a final page announcing its completion.

Review Instructions Button

On the page that has the Finish button you will be given the option to review all the answers you have given. This is a final opportunity to step through every page that applies to you and modify any answers or information that you feel are incorrect. Review is not necessary but can show up errors if you check your answers carefully. You can review as often as you like. Each review will bring you back to the page with the Review and Finish buttons on it.

Cancel Button

If at any time you decide that the Wizard is not the best approach for you at this time you can use the Cancel button to opt out. You will be asked to confirm the cancellation on another page.

Whenever you cancel the Wizard before you have hit the Finish button, no changes will be made to your project or its data in any form whatsoever. There is no penalty to test the Wizard all the way to the end so long as you do not execute the Finish button.

Close Button

The Next button may be replaced by the Close button. This will happen if you have successfully completed Wizard operation with the Finish button. The Close button simply closes the Wizard window.

Once you close the Wizard you are free to experiment with the results the Wizard created by rendering some images or examining the Components created. You will find most of them in the Land Cover Task Mode but you may find some in the Vector Task Mode as well (Search Queries).

It is a good idea to save the project again after the Wizard completes. Give it a new name using the Save As command from the File menu so that if you choose to you can revert to the original project and try a different approach.

Here is a list of the types of Components that the Wizard may have created for you:

- **Ecosystems with Ecotypes, Foliage Groups, Foliage Objects and Ground Textures**

- **Color Maps**
- **Search Queries**
- **Thematic Maps**
- **Image Objects**

Future Developments

As mentioned earlier, the Forestry Wizard is not the best approach in all circumstances but it does go a long way towards making the forestry features of VNS more accessible. It also can be used as a teaching tool so you can learn how various component types work and can implement them yourself in the old fashioned manual way if necessary. That said, there are obvious areas where future program development will add the Wizard's usefulness.

One thing that is planned for a future version is to be able to save the settings of the Wizard so they can be recalled and implemented on a different but similar data set. Currently the best method to preserve the work of setting up the Wizard is to save a template project or to save individual components that can be loaded into a different project.

A second item on the programming to-do list is make a way to aggregate land cover classes. Too often foresters have many more land cover classes than are practical to design ecosystems for. Many are very similar from a visual standpoint and can be combined with no detriment to the visualization result. If they could be combined at the outset into fewer classes the work of setting up the Wizard would be cut dramatically. The best approach to the problem now is to aggregate the classes in an outside GIS before importing the data into VNS. Spreadsheets can also be used to generate additional data fields that contain an aggregate name which can then be used in the Wizard in place of the original class-designating fields.

There is no doubt additional features will occur to us and to the Wizard's users and we welcome all suggestions for making the Forestry Wizard more useful in the future.

Summary

By the time you have completed your first use of the Forestry Wizard you will probably know far more about it than this Help file can tell you. Experience will teach you when to use it and when it is not appropriate for you. We hope you find it useful and give us feedback about it.

Image Object Library

The Image Object Library lets you load and manage all the Image Objects in your Project. You can create new Image Objects or import them from other Projects.

What Are Image Objects?

Image Objects can contain still images, simple image sequences or complex image sequences. You can use them for textures (see Texture Editor); Color Maps (see Color Map Editor); and for foliage in Ecosystems (see Ecosystem Editor) and Foliage Effects (see Foliage Effect Editor).

A still image is a picture.

Simple image sequences are a series of image frames, such as those produced by an animation program, or those produced by doing time-lapse recording. You can even have slow motion and fast motion playback.

Complex image sequences are any combination of one or more still images and one or more simple image sequences. Each tree can be a mini-movie!

You can create amazing animated effects with sequences. You could use time-lapse sequences of flowers blooming as foliage in an ecosystem and have VNS propagate them across the terrain. You can use sequences to create foliage blowing in the wind. You can put animated characters on the landscape. You can have Color Maps and textures that change over time. With complex image sequences, you can even connect multiple animations. The only limit is your imagination.

Note: In the Ecosystem Editor and Foliage Effect Editor VNS gives you the option of 3D Shading the Image Object trees based on the direction of the SunLight. This gives trees a 3-dimensional appearance instead of a flat "billboard" look. For non-tree Image Objects you can turn this off. You can optionally use 3D Objects for trees in both of these Editors when a true 3D appearance is more important than rendering speed.

Supported File Formats

VNS lets you import images in the following formats:

- **8-bit gray scale IFF**
- **24-bit Color IFF**
- **24-bit Color Targa**
- **32-bit Color Targa with Alpha Channel**

Note: To use the alpha channel data in 32-bit Targa or Pict files, you must select the Alpha Enabled checkbox on the Image page (see below).

- **24-bit Color PICT**
- **32-bit Color PICT with Alpha Channel**

Note: To use the alpha channel data in 32-bit Targa or Pict files, you must select the Alpha Enabled checkbox on the Image page (see below).

- **24-bit Color JPEG (.jpg)**
- **24-bit Color PNG**
- **Indexed Color PNG (.tif)**

Note: Indexed PNGs are converted to 24-bit during loading.

- **24-bit Color BMP**

BMP can be a georeferenced format if there is an accompanying World file. VNS will recognize georeferencing data in a same-named World File (.BPW) and .PRJ file with any BMP file if they exist in the same directory.

- **24-bit Color TIFF**
- **Indexed Color TIFF (.tif)**

Note: Indexed TIFFs are converted to 24-bit during loading.

TIFF can be a georeferenced format if there is an accompanying World file. VNS will recognize georeferencing data in a same-named World File (.BPW) and .PRJ file with any TIFF file if they exist in the same directory.

- **24-bit Color ER Mapper ECW**

This is a georeferenced format.

- **24-bit Color GeoTIFF**

This is a georeferenced format.

A World file includes the coordinates of the edges of an image.

A PRJ file is an Arc format that may or may not be found accompanying Shape files or any file with a World file. The PRJ file includes the Coordinate System (geographic, UTM, Mercator, etc) and what datum and ellipsoid to use for the coordinates found in a Shape file or World file.

Georeferenced formats are suitable for use as Color Maps. VNS will create a Geo Reference page and try to set the Coordinate System and bounds automatically using the information from the image file or its accompanying World and .PRG files.

Note: Be aware that not all systems, datums and ellipsoids may map correctly between VNS and formats exported from other software. Even if VNS appears to have loaded a file exported from another program, you must double-check your results in VNS to make sure all info has been loaded correctly. Failing to check the results may lead to alignment problems.

Dissolves

Image Objects can also contain dissolves. Dissolves allow you to cross-fade from one Image Object to another. For example, a summer tree image can dissolve into a colorful fall tree image, and then into a leafless winter tree image.

Color Control

The Image Library gives you sophisticated color control for modifying colors or switching the color channels for images and sequences. You can also colorize gray scale images.

Masking

The Image Library gives you complete control over how each Image Object is composited into the scene. You can specify a range of background colors to mask out. Masking can be color-based for blue screen, green screen or other color replacement, or luminance-based for keying out black or white backgrounds.

Georeferencing

The Image Object Library gives you the ability to attach a Coordinate System and adjust registration coordinates for any Image.

VNS will add these automatically when you import images in georeferenced image formats (see above).

Georeferencing is useful for Image Objects you want to drape onto the terrain as Color Maps (see Color Map Editor).

Image Management

The Image Object Library is also the place where you initialize and configure Image Management. This is a set of memory management parameters designed to allow you to load and render much larger images than your computer or Operating System could normally support. The concepts behind this feature can be found in more detail in Appendix M: Theory and Practice of Image Management

The Image Object Library Window

To open the Image Object Library, select the Image Object Library command from the View menu, or click the Image Object Library icon in the Icon Toolbar.

What You See

The Image Object Library shows the Current Project Image Objects list in the middle, a series of icons and buttons on the left, and a collection of pages on the right.

By default there are two pages available on the right: Image and Browse. The Image page shows general information about the image. The Browse page lets you bring in Image Objects from other Projects. You can see the contents of a page by clicking its name in the tab at the top.

If you add Color Control to an Image Object, VNS will create a new Color Control page on the right. If you add a Dissolve or Sequence to an Image Object, VNS will create a new Sequence & Dissolve page on the right. If you add a Geo Reference attribute to an Image Object, VNS will add a Geo Reference page on the right. You can add Color Control, Sequencing, Dissolves and Geo Referencing using the icons along the left side of the window.

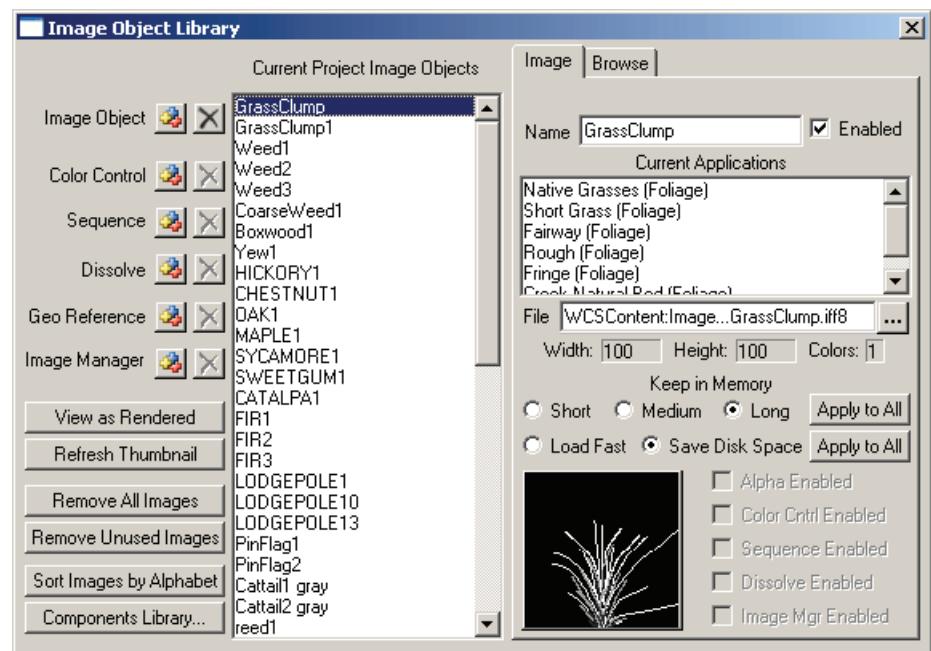


Image Object List

The Image Object list shows all the Image Objects in the current Project. The Image Objects will also appear in lists or drop boxes in the appropriate Editor windows, where you can choose to use the Image Objects as foliage in Ecosystems (see Ecosystem Editor) or Foliage Effects (see Foliage Effect Editor).

To see a full sized preview of the Image Object, double-click its name in the list. If the Image Object is a sequence, VNS will load the first frame into the Image Viewer and display it for you. If the image object is too large to fit on screen, the preview will be successively halved in size until it fits.

Note: You can also double click the thumbnail on the Image page to see the full-sized preview in the Image Viewer.

Buttons On the Left

Add and Remove Image Object Icons

Click the Add Image Object icon to add an Image Object to the Project. VNS will open a file requester where you can select an image in any of the supported file formats.

When you add an image, The Image Object will initially contain the image you selected. If you wish, you can later add simple image sequences or complex image sequences complete with dissolves (see below).

When you add an Image Object it will appear in the Image Object list (see below). The Image Object will be named by its file name, minus the extension. You can change the name using the Name field on the Image page (see below).

Click the Remove Image Object from Library icon if you wish to remove the selected Image Object from the Project.

Warning: Once you remove an Image Object, it's gone forever. The original image or sequence files will still exist on your hard drive, but you will lose any color, tiling or sequence editing you've created for the Image Object in VNS.

Color Control Icons

The Color Control icons let you add or remove Color Control for any Image Object. Color Control lets you exchange bands for satellite remote sensing imagery, adjust RGB color balance for color images, adjust gray scale images, turn color images into gray scale images, and adjust the transparency mask range.

Click the Add Color Control Attribute icon if you want to add Color Control to the selected Image Object. VNS will add a Color Control page on the right.

Click the Remove Color Control Attribute icon to remove Color Control from the selected Image Object. VNS will remove the Color Control page for that object and the object will no longer be affected by any Color Controls.

Warning: If you click the Remove button, all your changes in the Color Control page will be lost forever! If you just want to temporarily disable the Color Controls, deselect the Color Control Enabled checkbox on the Image page.

Sequence Icons

The Sequence icons let you add or remove image sequencing for the current Image Object.

Click the Add Sequence Attribute icon if you want to add sequencing to the selected Image Object. VNS will add a Sequence & Dissolve page on the right if one doesn't already exist (see below). There you can load a simple image sequence or create complex image sequences complete with dissolves.

Note: If the current Image Object already has image sequencing enabled, the Add button will be ghosted.

Click the Remove Sequence Attribute icon to remove sequencing from the selected Image Object. VNS will remove the Sequence and Dissolve page for that object and the object will no longer be affected by sequencing.

Warning: If you click the Remove button, all your changes in the Sequence & Dissolve page will be lost forever! If you just want to temporarily disable the sequences or dissolves, deselect the Sequence Enabled checkbox or Dissolve Enabled checkbox on the Image page.

Dissolve Icons

The Dissolve icons let you add or remove dissolves for the current Image Object.

Click the Add Dissolve Attribute icon if you want to add a dissolve to the selected Image Object. VNS will add a Sequence & Dissolve page on the right if one doesn't already exist (see below). There you can load a simple image sequence, create complex image sequences and add dissolves.

Note: You can also add a dissolve by selecting an existing dissolve in the Sequence and Dissolve page's list, and clicking the Add icon to the left of that list.

Click the Remove Dissolve Attribute icon to remove all dissolves from the selected Image Object.

Warning: If you click the Remove button, all your changes in the Sequence & Dissolve page will be lost forever! If you just want to temporarily disable the sequences or dissolves, deselect the Enable Sequence checkbox or Enable Dissolve checkbox on the Image page.

Geo Reference Icons

The Geo Reference icons let you add or remove georeferencing for the current Image Object. Georeferencing is important for images that you want to drape onto the terrain as a Color Map because it lets you tell VNS where the image should appear on the planet.

Click the Add Geo Reference Attribute icon to add georeferencing to the selected Image Object. VNS will add a Geo Referencing page on the right if one doesn't already exist (see below). There you can add a Coordinate System and adjust the registration coordinates for the Image Object.

When you import images in georeferenced formats, they will automatically have a Geo Reference page with their georeferencing information filled in.

Click the Remove Geo Reference Attribute icon to remove georeferencing from the selected Image Object.

Warning: If you click the Remove button, all your changes in the Geo Referencing page will be lost forever.

Image Management Icons

The Image Management icons let you add or remove Image Management for the current Image Object. Image Management allows you to render far larger images as color maps, foliage objects and textures than would have previously been possible.

Click the Add Image Management Attribute icon to add georeferencing to the selected Image Object. VNS will add an Image Management page on the right if one doesn't already exist (see below). There you can adjust attributes relating to memory management of the selected image.

When you import images that exceed 1600 pixels in either direction, they will automatically have an image Management page created for them with what VNS considers to be "appropriate" per-image parameter values already configured for you.

Click the Remove Image Management Attribute icon to remove georeferencing from the selected Image Object.

Warning: If you click the Remove button, all your changes in the Image Management page will be lost forever.

View As Rendered Button

Click the View As Rendered button to see the Image Object as it will appear at a specific frame in your VNS animation. This is handy for Image Objects that contain sequences and dissolves, so you can make sure they are animating in the way that you want.

For example, if you have a sequence of a frog turning into a prince, you can use the View As Rendered button to make sure the prince appears at the proper moment in the VNS animation.

When you click the View As Rendered button, VNS will open a requester asking for a frame number. Enter the number of the frame in the VNS animation you want to see. VNS will then load a preview of what the current Image Object will look like at that frame into the Image Viewer for display.

Refresh Thumbnail Button

Click the Refresh Thumbnail button to recalculate the thumbnail image for the current Image Object. Do this when the image or sequence used by the Image Object changes -- for example when you edit the image in an image processing program.

VNS will create a new thumbnail based on the still image or the first sequence frame in the Image Object. The new thumbnail will be stored with the Project the next time you save the Project.

VNS will also erase any pre-calculated image information after switching from Load Fast to Save Disk Space (see Image Page below).

Remove All Images Button

Click the Remove All Images button to remove the all Image Objects from the Project.

You will be warned once and asked for confirmation once, but not once for each image, used or not.

Note: Once you remove Image Objects, they are gone forever. The original image or sequence files will still exist on your hard drive, but you will lose any color, tiling or sequence editing you've done for the Image Objects in VNS.

Components Library Button

Click the Components Library button to open the Component Library. This can be handy when you are working with Components which use Image Objects. These may include Ecosystems (see Ecosystem Editor) and Foliage Effects (see Foliage Effect Editor).

Image Page

The Image page shows you information about the image you first loaded when you created the currently selected Image Object.

You will see the image's name, file name, width, height and color depth, along with a thumbnail visual representation. Double clicking this thumbnail will open the Image Viewer and display the image in question (scaled to fit on the screen).

You can control whether the Image Object is enabled, how long it's kept in memory, and whether pre-calculated image data is stored on your hard drive. If the Image Object has Color Control, Sequence, or Dissolve attributes, you can enable or disable them.

Name Field

The Name field lets you change the name of the selected Image Object. By default, VNS derives the name from the file name of the image file you selected when you added the Image object, without the extension. For example, if you selected "Conifer1.iff," VNS will name the Image Object "Conifer1".

You can rename the Image Object to whatever you like, with up to 80 characters in the name.

You might want to rename an Image Object to better indicate what it contains. For example, if it contains a complex sequence of a blowing tree that dissolves into a dancing wizard, you might want to name it something like "TreeWizard".

Image Enabled checkbox

Click the Image Object Enabled checkbox to enable (checked) or disable (unchecked) the selected Image Object wherever it's being used in the current Project. You can see where it's being used by looking in the Current Applications list below.

If you disable an Image Object, it will become invisible when used anywhere in the program as a celestial object or foliage object.

When you disable an Image Object, it will be shown in gray in the Current Project Image Objects list

Current Applications List

The Current Applications list shows any places in the program where the current Image Object is being used. This could be as a foliage object in an Ecosystem (see Ecosystem Editor) or a Foliage Effect (see Foliage Effect Editor).

Double click any current application listed to open the appropriate editor. There you can enable or disable the specific use of the Image Object.

Foliage for an Ecosystem is an exception. Double clicking the application in the list will open the Foliage Editor, but to enable or disable the use of Image Objects for that Ecosystem you'll need to open the Ecosystem Editor and select "Scaled Images in the Overstory's Texture drop box.

If a current application is shown in gray in the list, it's been disabled.

File Field and Button

The File field initially shows the path and name of the image file you loaded when you first added the selected Image Object (see "Add Image Object Button" above).

You can select a different image file for the Image Object by typing its path and name into the File field, or by clicking the File icon and using the file requester to locate a new image file.

The Image Object will use the image file shown in the File field unless you are using a sequence. You can create a sequence on the Sequence & Dissolve page (see below).

Width/Height/Colors fields

These fields display the width, height (both in pixels) and color depth of the image file shown in the File field (see above). Color depth is the number of bits per pixel. A color depth of 1 is a 2 color image. A color depth of 2 is a four color image. A color depth of 3 is an 8 color image and so on up to 24 bits, which is a 16,777,216 color image.

Keep in Memory Radio Buttons

The Keep in Memory radio buttons let you determine how long VNS will store the Image Object in your computer's memory. Storing it longer will allow VNS to render faster because the Image Object won't need to be reloaded whenever it's needed. Storing it shorter will

free up memory because the Image Object won't be held in memory. If your system has sufficient memory, you can save time by opting for a longer setting.

The options are:

- **Short**
- **Medium**
- **Long**

Short

If you select Short, VNS will load the Image Object whenever it's needed, and dump it from memory as soon as its been used. VNS will have to reload the Image Object for each frame if you are rendering multiple frames.

Medium

If you select Medium, the Image Object will stay loaded during a single rendering session. VNS will load the Image Object when you begin to render, and then dump it once rendering is complete.

Long

If you select Long, once an image is loaded for any reason it will stay in memory until you quit, replace the image, or load another project.

If you have the memory, set most or all of your Image Objects to Long, especially large ones like high resolution trees.

Keep In Memory's Apply To All Button

Click the Apply to All button when you want to set all Image Objects to match the Keep In Memory radio button setting of the current Image Object.

For example, you could set the current Image Object to Medium memory persistence by clicking the Medium radio button. Then, if you want all Image Objects in your Project to have medium memory persistence, click the Apply to All button to the right of the Keep in Memory radio buttons. Now, all Image Objects will be set to medium memory persistence.

Fast Loading Radio Buttons

Load Fast Radio Button

Select the Load Fast radio buttons to tell VNS to save pre-calculated image information to your hard drive. That way VNS won't have to do calculations every time it has to load an image which can save significant rendering time. VNS will need to do the calculations only once, the first time you render an Image Object that contains a still image file.

Using Fast Loading requires additional hard drive space for each image. A high resolution image may require six megabytes or more of extra space to store this information. Once stored, this information can be used by any Project which has an Image Object that uses the same still image file.

Note: Fast Loading works for an Image Object that contains a still image file. Fast Loading will not work for an Image Object that contains any sequences or dissolves.

Pre-calculated image information is stored in the same directory as the original image, with the same base name, and an extension of ".wfl."

Save Disk Space Radio Button

Select the Save Disk Space radio button to tell VNS not to save pre-calculated image information to your hard drive. With Save Disk Space selected VNS will calculate this information every time an image is loaded. This will add to rendering time but will not require extra hard drive space for the current Image Object.

If you switch from Load Fast to Save Disk Space, click the Refresh Thumbnail button to tell VNS to erase the pre-calculated image information from your hard drive.

Note: This will not harm the still image file used by the Image Object. VNS will simply recalculate extra information the next time it needs to use that Image Object.

Fast Loading Apply To All Button

Click the Apply to All button when you want to set all Image Objects to match the Load Fast or Save Disk Space radio button setting of the current Image Object.

For example, you could set the current Image Object to store pre-calculated image information by clicking the Load Fast radio button. Then, if you want all Image Objects in your Project to store pre-calculated image information, click the Apply to All button to the right of the Load Fast and Save Disk Space radio buttons. Now, all Image Objects will be set to store pre-calculated image information.

Note: This will not affect Image Objects which contain sequences or dissolves.

Thumbnail

VNS will create a thumbnail image whenever you create an Image Object.

The Thumbnail shows a scaled version of the base image in the Image Object. For a still image, the base image is the still image itself. For an image sequence, the base image is the image you selected from the sequence when you added the sequence on the Sequence and Dissolve page (see below). You can double-click the Thumbnail to view a full-sized image in the Image Viewer.

Thumbnails are stored with the Project when you save and they will then be there the next time you open the project.

If you change an image used by an Image Object, you can force the Thumbnail to show the new version of the image by selecting the Image Object in the list and clicking the Refresh Thumbnail button on the left side of the Image Object Library window.

Enable Checkboxes

If the selected Image Object has an alpha channel, Color Control, sequencing or dissolves, you can enable or disable them using the checkboxes.

Alpha Enabled Checkbox

Using an alpha channel gives you fine control over Image Object transparency. An alpha channel is an extra 8 bits of information that can control an image's transparency.

By using animations created in an animation program that supports 32 bit Targa, TIFF (with 'associated' alpha), PNG, or PICT output, or image sequences from DVDs or CD-ROMs of fire and explosions, you can add swirling smoke, fire, rainbows, snow, rain and other effects to your VNS scenes!

If the selected Image Object is a 32 bit Targa or Pict image or sequence with alpha channel information, the Alpha Enabled checkbox will be accessible. The Alpha Enabled checkbox lets you enable or disable the alpha channel. If you disable the alpha channel, the Image Object will act like a 24 bit image or sequence with no alpha channel data. If you enable the alpha channel, VNS will recognize the alpha channel.

If the selected Image Object is not a 32 bit Targa or PICT image or sequence, the Alpha Enabled checkbox will be ghosted.

Note: VNS supports Targa, TIFF (with 'associated' alpha), PNG or PICT images with alpha channels. VNS does not currently support IFF or BMP images with alpha channels. Photoshop 5 does not always save TIFF images with Alpha properly 'associated' and the Alpha Channel may not be recognized by VNS and other programs.

Using An Alpha Channel For Textures

To use an Image Object with an alpha channel as a texture component, you must have the "Self Opacity" checkbox selected in the Texture Editor. Do this for any Texture Component that uses the Image Object. Then the alpha channel will be used to calculate the self opacity amount for the Texture Component. If you have self-opacity disabled VNS will ignore the alpha channel for the texture component.

The color RGB 0,0,0 black won't be transparent in and of itself. But if you change the Transparency settings on the Image Object Library's Color page (see below), all of the area that is within the Max and Min color range will become black in the rendered image. You probably don't want that to happen, so for an Image Object with an alpha channel, you should probably avoid changing the Transparency settings on the Color page to avoid any complications.

For an image you are going to use as a texture, the only reason to modify the color settings in the Image Object Library is to flip red, green or blue channels, or use a formula. However for most uses of Image Objects as Textures, this will not be a common need.

Using An Alpha Channel For Foliage

When rendering foliage, the alpha channel works along with the normal transparency masking. You can add foliage in an Ecosystem with the Ecosystem Editor, and as a Foliage Effect with the Foliage Effect Editor.

Pixels in the original image that are RGB 0,0,0 black will always be completely transparent for foliage no matter what the transparency would be from the alpha channel. If you don't want that to happen, make sure your original images don't have any pixels that are RGB 0,0,0 black. You can avoid this by raising the black level in an image processing program. RGB 1,1,1 is still going to look black, but won't become automatically transparent when used in an image as VNS foliage.

You can make more of the original image's colors transparent with the Transparency controls on the Image Object Library's Color page, if you wish (see below). But normally you won't use the Color page if you are using alpha channels, unless you also want to use the Band Assignment or Formula color controls.

Color Control Enabled Checkbox

If you've added Color Control to the selected Image Object, the Color Control Enabled checkbox lets you enable or disable that Color Control. If you disable Color Control, the Image Object will ignore any changes you made on the Color Control Page. If you enable Color Control, VNS will once again use the Color Control information you specified.

Sequence Enabled Checkbox

If you've added sequencing to the selected Image Object, the Sequence Enabled checkbox lets you enable or disable all sequencing. If you disable sequencing, the Image Object will ignore any sequences you created on the Sequence & Dissolve Page. If you enable Sequencing, VNS will once again use the Sequencing information you specified.

Dissolve Enabled Checkbox

If you've added dissolves to the selected Image Object, the Dissolve Enabled checkbox lets you enable or disable all Dissolves. If you disable Dissolves, the Image Object will ignore any dissolves you created on the Sequence & Dissolve Page. If you enable Dissolves, VNS will once again use the Dissolve information you specified.

Image Management Enabled Checkbox

If you've added Image Management to the selected Image Object, the Image Management Enabled checkbox lets you enable or disable all Image Management. If you disable Image Management, the Image Object will ignore any Image Management parameters you may have configured on the Image Management Page. If you enable Image Management, VNS will once again use the Image Management information you specified.

Browse Page

The Browse page lets you import Image Objects from other Projects.

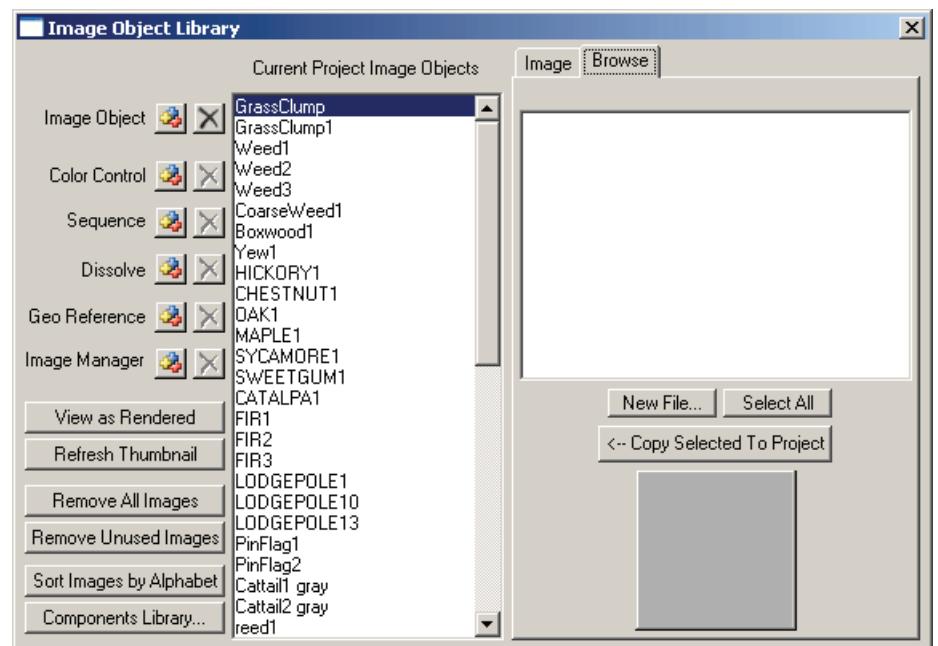
Image Object List

The Browser's Image Object list at the top of the Browse page shows any Image Objects available for importing from another Project. To see Image Objects in the list you must first select a Project with the New File button (see below).

You may select one or more Image Objects in the list. Click to select a single Image Object, shift-click to select a range of Image Objects, or control-click to select discontinuous Image Objects. Click the Select All button to select all the Objects in the Image Objects list.

The Thumbnail at the bottom of the Browse page shows a scaled version of the first image in the last selected Image Object.

Once you've select the Image Objects you want to import, click the Copy Select To Project button to bring them into the current Project.



They will then appear in the Current Project Image Objects list. From there you can use them in the current Project like any other Image Object.

New File button

Click the New File button when you want to select a Project from which to import Image Objects. VNS will open a file requester. Navigate to the Project file you want to examine and click the Open button in the file requester.

VNS will show all the Image Objects from the Project you selected in the Browser's Image Object list, above the New File button.

Select All button

Click the Select All button if you want to select all the Objects in the Image Objects list.

Copy Selected To Project button

Click the Copy Select To Project button to bring any selected Image Objects from the Brower's Image Object list into the current Project.

The imported Image Objects will then appear in the Current Project Image Objects list. From there you can use them in the current Project like any other Image Object.

Browse Thumbnail

The Thumbnail at the bottom of the Browse page shows a scaled version of the first image in the most recently selected Image Object.

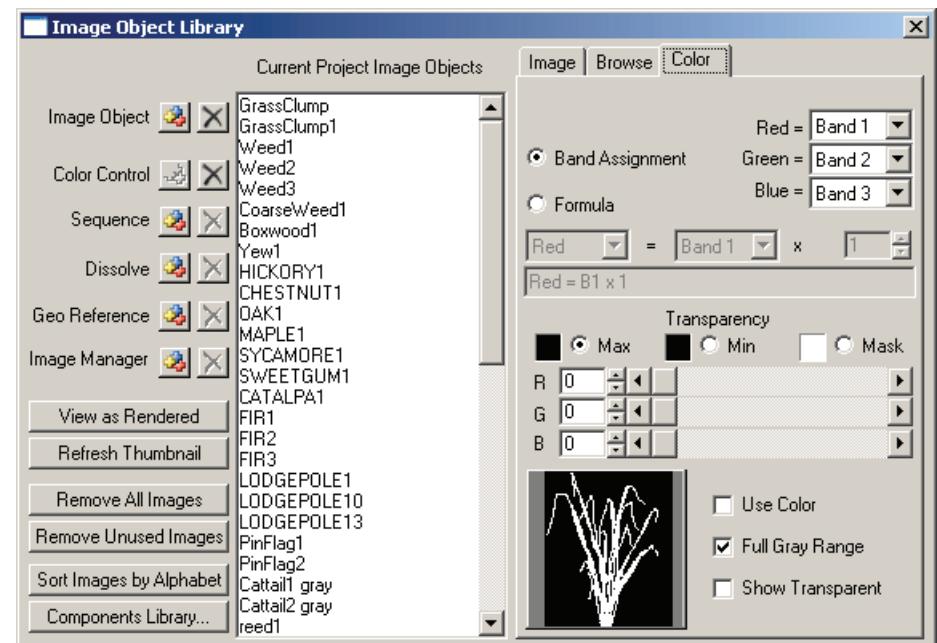
Color Control Page

The Color Control page lets you alter image colors, adjust the transparency mask, and use a color image as a gray scale image. You won't see the Color Control page until you click the Add button under Color Control on the left side of the Image Object Library window.

Color Controls

The color controls let you alter the image colors of the selected Image Object. To do so, you can use either Band Assignments or a Formula.

Band Assignments let you take any of the 8 bit channels which are normally assigned to red, green and blue information, and reassign any band to red, green or blue. Formulas let you combine any percentage of any band to adjust the levels of red green and blue.



Band Assignment Radio Button

Select the Band Assignment radio button if you want to exchange one band of color for another using the Red, Green and Blue drop boxes (see below). This allows you to take 3 band satellite imagery, such as that converted by ERDAS software, and swap the bands as you wish.

Normally, a 24-bit Red-Green-Blue (RGB) color image uses the first 8 bits of color information to describe the red band, the second 8 bits to describe the green band and the third 8 bits to describe the blue band. For most standard image uses you can ignore the Band Assignment Radio button and drop boxes. VNS defaults to RGB as bands 1, 2 and 3, which reproduces images without changing them.

Satellite imagery is acquired by space-born sensors sensitive to specific frequency bands. These bands do not necessarily correspond to the RGB channels in a 24-bit color image. GIS professionals often use frequency ranges which indicate various surface features, such as diseased trees, clouds or water, and can then produce false-color images. These images are useful for interpreting events on the planet. They are not meant to show the colors of reality. Instead, different colors indicate different things about the planet.

If you are trying to create realistic images rather than false-color GIS images, the Band Assignment feature is probably something you will not need. However it can still be useful for surrealistic effects, or fall foliage color effects.

Red, Green and Blue Drop Boxes

The Red, Green and Blue drop boxes let you change band assignments. For a normal 24-bit RGB image, Red should be assigned to Band 1, Green to Band 2, and Blue to Band 3.

Note: For most standard image uses you can ignore the Band Assignment Radio button and drop boxes. VNS defaults to RGB as bands 1, 2 and 3, which reproduces images without changing them.

If you want a funky looking tree, you can swap the green and blue band assignments, thus putting the blue information into the green color channel.

You can make a color image into a gray scale image by setting all three channels to the same band.

Note: you can also make a color image into a gray scale image by disabling the Use Color checkbox on the Color Control page (see below).

You can create a fall foliage effect by setting the band assignments for a green tree so that red is band 2 and green and blue are band 3, which will give you a reddish leaf color effect. For even more control over image color, use an image formula (see below).

You can see the result of your band assignment changes by clicking the thumbnail. For a full view, double click the thumbnail, or the Image Object's name in the Current Project Image Objects list.

Formula radio button

Instead of having a band assignment, you can use separate formulas for R, G and B.

You can use any percentage of band 1, 2 and 3 for each channel. This is useful for false color satellite imagery to highlight special features like water or diseased vegetation, or to make a more realistic looking image out of multi-spectral satellite remote sensed imagery.

You can boost contrast by increasing all bands to more than 100%. In the formulas for band re-assignment, 1 represents 100% of a channel's intensity. 50% would be represented by .5, 150% would be represented by 1.5, 200% would be represented by a 2 and so forth.

You can do color shifting or correction by making the values for each band unequal. By varying the percentage of each band, you can subtly or dramatically alter the image colors.

Double click the thumbnail or the Image Object's name in the Current Project Image Objects list to see result.

Note: The thumbnail itself will display band assignment changes but not formula changes.

Transparency Controls

VNS can see through some of the pixels in an Image Object by making them transparent. For example, this lets trees have tree shapes, rather than the rectangular shape of the original tree image. Pixels around and between the leaves of the tree can be transparent so you can see other terrain features through the leaves.

The transparency controls let you control which pixels are transparent.

RGB Radio Buttons

The Maximum Transparency (Max) and Minimum Transparency (Min) radio buttons let you use the RGB (Red, Green and Blue) color sliders to set the limits for a range of color that VNS will make transparent during rendering.

The Mask radio button lets you use the RGB color sliders to change the display color that represents the transparent area.

The effect of the transparent color range is much like the effect of keying in video, or alpha channel masking in image compositing. By varying the Maximum and Minimum Transparency colors you can make any range of color transparent.

Max Radio Button

Select Max when you want to use the RGB sliders to set the maximum RGB values of your transparent range. Any colors between this color and the Minimum Transparency color in the Image Object will be rendered as transparent.

Min Radio Button

Select Min when you want to use the RGB sliders to set the minimum RGB values of your transparent range. Any colors between this color and the Maximum Transparency color in the Image Object will be rendered as transparent.

Mask Radio Button

Select Mask when you want to use the RGB sliders to set the display color of the transparent area (mask) when the Show Transparent checkbox is selected (see below). By selecting a bright color that doesn't occur in the image, it's easier to see the transparent area.

How To Use Transparency

You can set any range of colors to be transparent. Depending on your background you might think of this as keying or masking. The transparency controls let you do what video editors call luminance keying and chroma keying, and what compositors or image editors call masking. In any case what you are doing is defining what pixels in the Image Object will be transparent based on a range of colors.

Luminance keying means making pixels transparent based on darkness or brightness. In nature, you can often photograph a tree against a light colored sky. Then you can make the light areas transparent within VNS so that only the tree is rendered.

Note: When photographing a tree against a light colored sky, make sure you open your camera's iris enough so that you get detail and color in the tree itself. If you don't, you will end up with a dark tree silhouette. It's OK to let the background sky become overexposed, in fact that will just make it easier to key out the sky in VNS.

Here's how to do luminance keying: Set both Maximum and Minimum to RGB values of 0,0,0 to make only black pixels transparent. Increase the Maximum RGB values to increase the threshold of keying. For example, with Minimum RGB values of 0,0,0 and Maximum RGB values of 25,25,25 VNS will make any black-to-dark-gray pixel transparent.

Set both Maximum and Minimum to RGB 256,256,246 to make only white pixels transparent. To lower the threshold so that a range of light-gray-to-white values are made transparent, set the Minimum values lower.

Chroma keying means making pixels transparent based on color. Most often, people are photographed against a green or blue screen, and the green or blue is then made transparent to superimpose the people over another image. When keying green-leaved trees, it might make more sense to use a shade of blue or even red as the background color. In nature you can sometimes photograph a tree against a blue sky.

Here's how to do chroma-keying for an image that is photographed against a green screen background: Set both Maximum and Minimum to the color of the green screen. If there is a variation in the green screen coloration in the photograph, set the Minimum to the values of the lowest set of RGB values, and the Maximum to the highest set of RGB values. You can use this technique to key out any color or range of colors.

Note: If you open the diagnostic data window and the preview window for your image, you can click on your image and see the RGB values in the Diagnostic Data window. These can even be copied and pasted into other value fields in other editors.

You can see the result of the transparency masking by clicking the Show Transparent checkbox and changing the Mask color to an obvious color that doesn't exist in your image. Then click the thumbnail for a small preview, or double click the thumbnail or Image Object name to see a full sized preview. VNS will replace any pixels that fall within the transparency range with pixels colored with the Mask color. This lets you quickly see what will be transparent when VNS renders the image.

Use Color Checkbox

For any color images in the current Image Object, enable the Use Color checkbox to use the colors from the image. Turn it off to force the image to be gray scale.

The Use Color checkbox makes no difference for any image that is already gray scale.

If you want to colorize an Image Object used in the Foliage Editor or Foliage Effect Editor, you must first deselect the Use Color checkbox. Then you can edit the color using the Gray Replacement Color in the Ecosystem Editor or Foliage Effect Editor. You can animate colors to produce foliage that changes color over time. For example, you can simulate summer leaves changing to fall colors.

Full Gray Range Checkbox

The Full Gray Range checkbox is for any Image Object that you're using as a gray scale image. This could be an Image Object that contains one or more gray scale images, or an Image Object that contains one or more color images when you have the Use Color Checkbox disabled to force them to be gray scale (see above).

Enable the Full Gray Range checkbox to expand the dynamic range of gray scale images so that their brightest value becomes pure white. This is good to do if you are replacing the gray color with a palette color in the foliage editor. By expanding the dynamic range of the

resulting gray scale image, you can keep the new colors from being too dark. You'll also ensure that you'll get some values in the image that are the same as the palette color.

When you use a palette color to colorize a gray scale image, VNS assigns that palette color to pixels in the image that have RGB values of 255,255,255 (pure white). Pixels that are darker than pure white are colorized with darker variations of the palette color.

Show Transparent Checkbox

Select the Show Transparent checkbox when you want to see a vivid display of the transparent areas of an Image Object. VNS will color the transparent pixels with the Mask color (see above). This makes it easier to see exactly which pixels will be transparent when VNS renders the Image Object.

If the pixels you want to be transparent aren't shown with the Mask color, you can adjust the Maximum and Minimum Transparency values until they are (see above).

Click the thumbnail to see the Image Object with the transparency range replaced by the Mask color. Double click the thumbnail to see a full sized version.

You can change the Mask color using the Mask radio button and the RGB sliders (see above).

Sequence & Dissolve Page

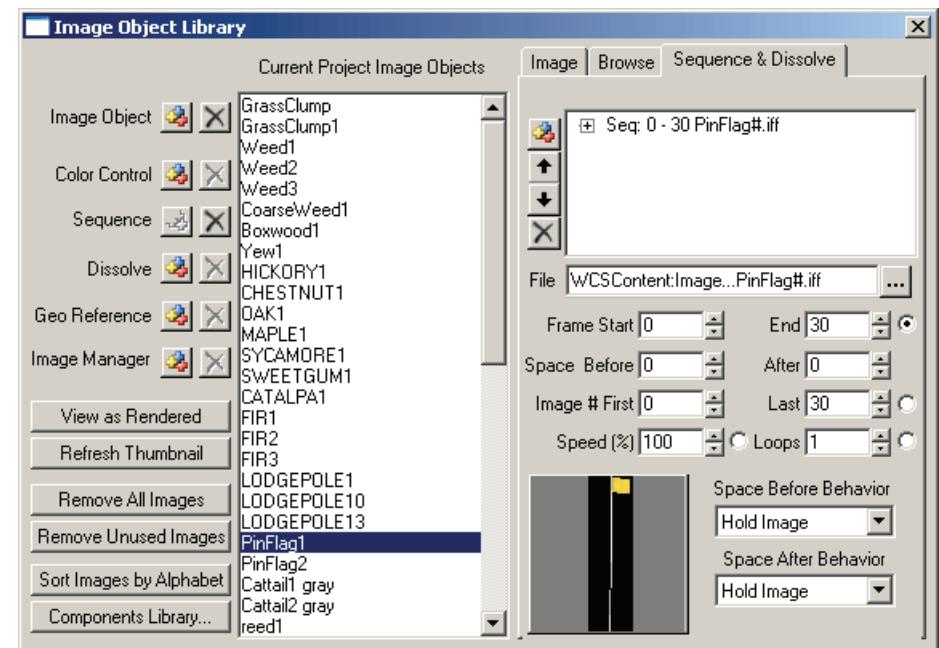
Image Objects don't have to be merely still images. They can be living, dancing, animated movies living on your landscape.

The Sequence & Dissolve page lets you import a simple frame sequence or create an edited sequence for the current Image Object. VNS also lets you create dissolves between Image Objects. You won't see the Sequence & Dissolve page until you click the Add button under either Sequence or Dissolve on the left side of the Image Object Library window.

A simple sequence could be a series of frames as generated by a 3D animation package like VNS, LightWave 3D, Inspire 3D or 3D Studio MAX. For example, you could have an animated tree, animal or character. A simple sequence could also be frames from a video capture card. For example it could be a time-lapse animation of a flower growing.

An edited sequence can be any combination of simple sequences and still images.

A Dissolve can cross-fade between a part of the current Image Object and any other Image Object. For example, you could dissolve between two aerial photos of a location taken in subsequent years to show changes over time.



Sequence List

The Sequence list shows any simple sequences and dissolves contained in the current Image object.

The last numbers in any simple sequences in the list are replaced with number signs. This signifies that VNS will load each numbered image from the simple sequence when rendering the appropriate frame in your VNS animation.

The sequence numbers do not necessarily need to be at the end of the base file name. For example, a frame sequence of a frog jumping might be numbered frog.001, frog.002 etc. or frog001.iff, frog002.iff, etc. In either case, VNS will represent the numbers with number signs, either frog.### or frog###.iff.

If you don't want number signs, for example if the original file is really a still image rather than a series of images, and it just happened to have a number in the name, you can rename the image in the file field below the Sequence list.

+ (Plus Sign)

VNS normally shows the base name of any simple sequence, or the target of a dissolve, along with the frame range for each. To the left is a plus sign.

Click the Plus sign to the left of a sequence or dissolve to see the details of any sequence or dissolve in the Sequence list.

For a sequence, when you click the Plus sign you will see any pre-sequence hold frames, the base name of the simple sequence, and any post-sequence hold frames. VNS will show the frame range for each.

For a dissolve, when you click the Plus sign you will see the contents of the Image Object that is the target of the dissolve.

When clicked, the Plus sign becomes a Minus sign. Click the Minus sign to collapse the sequence or dissolve item in the list.

Add Sequence or Dissolve Icon

The Add Icon lets you add a sequence or a dissolve to the Sequence & Dissolve list.

Adding a Sequence

If you've selected a sequence in the list, clicking the Add icon will add another sequence. If you've selected a dissolve in the list, clicking the Add icon will add another dissolve.

When you add a sequence, VNS uses the base image. You can change it to whatever you want by using the file field and icon.

The frame range of the new sequence automatically appends to end of the frame range of the last existing sequence. You can change its position with the up/down arrows. You can change its starting and ending frames in the VNS animation by using the Frame Start/ End fields.

The new sequence will be set to 30 frames. You can change this to match the actual number of frames in the image sequence by using the Image First/Last fields.

Note: If you have a sequence that starts at frame zero, your base image will never be called. If the first sequence starts at frame 1, then frame zero will use the base image. If you have a sequence that ends at frame 30, and another that starts at frame 30, frame 30 will show the second sequence. VNS will still take into account frame 30 of the first sequence for purposes of multipass antialiasing and motion blur. If there is no second sequence, frame thirty will show the last frame of the first sequence.

Put the same frame number at the Frame End of one sequence and the Frame Start of the next in the case of sequences that need to match on an identical frame.

Adding a Dissolve

Click the add button on left of the Image Object Library window if no dissolves exist. If a dissolve exists on the Sequence and Dissolve page, you can select one and click the add icon.

After you've added a dissolve, select it in the list and use the dissolve fields below the list to change its length and target.

Delete Icon

Click the Delete icon to remove the selected sequence or dissolve.

To remove all sequences, use Sequence Remove button on the left edge of the Image Object Library. To remove all dissolves, use the Dissolve Remove button on the left side of the Image Object Library.

Warning: There is no undo for these delete operations.

Up/Down arrows

Click the up or down arrow icons to move the currently selected sequence or dissolve up or down in the list.

When you move a dissolve, the target swaps with the next dissolve but the dissolve lengths stay the same.

Controls for Sequences

When you select a sequence in the list, the controls below the Sequence list let you control the details of the selected sequence.

Radio Buttons

Some of the fields have radio buttons on the right. The field with the selected radio button will be automatically calculated by VNS when you change the values in the other fields.

The radio buttons next to End, Last, Loops or Speed lets you select the one that changes when you change other values. For example, if the End field is selected when you set the first and last image fields, VNS will automatically calculate the animation length and enter a value into the End field. If you then adjust the Speed or Loops fields, VNS will change the End field's value accordingly.

If you select the Loops field when you adjust other values, VNS will calculate the number of loops automatically.

Note: You can't change the value of the field that has its radio button selected. To change its value, select a different field's radio button.

Frame Start and End Fields

The Frame Start field lets you set the VNS animation frame where the selected sequence begins playing.

The Frame End field lets you set the VNS animation frame where the selected sequence stops playing.

Space Before and After Fields

The Space Before and After fields let you set the frame range of one of three behaviors at the start and end of the sequence. You can select the behaviors using the Space Before and Space After drop boxes (see below).

If you select No Image in one of the drop boxes, the Image Object is treated as transparent.

If you select Hold Image in one of the drop boxes, VNS will hold first frame of sequence at the start, or hold the last frame of the sequence at the end.

If you select Loop, VNS will extrapolate the looping behavior (as set in speed and loops fields) backward or forward in time. This lets you place the start of the loop at a particular time, and loop into it.

Image Number First and Last Fields

The Image Number First field let you set the first frame of the original sequence to use in the VNS animation. VNS goes by the numbers in the original animation frames.

The Image Number Last fields lets you set the last frame of the original sequence to use in the VNS animation. VNS goes by the numbers in the original animation frames.

You must know the available range in the original sequence. Then you can select the range you want to use within the sequence for the current Image Object.

If VNS runs out of images, VNS will automatically hold the last image it finds until the space after behavior kicks in.

Speed Percentage Field

The Speed Percentage field lets you fit more frames into a shorter interval, or fewer frames into longer interval.

You may use decimal percentages (up to 12 decimal places). 100% is normal speed. Higher numbers are faster speeds (fast motion) while lower numbers are slower speeds (slow motion). Slow and fast motion will be created by interpolating between frames for the smoothest playback. This will take longer to render than simply repeating or dropping frames, but will look much better.

Loops Field

The Loops field lets you set how many times the current sequence repeats its Image First to Last frames within the VNS Start to End range.

If you select the Loops radio button, VNS will automatically adjust the number of loops as you change the values in the other fields.

If you select the End radio button, VNS will automatically reset the end frame to make loops fit when you adjust the number of loops.

Space Before/After Behavior Drop Boxes

The Space Before Behavior and Space After Behavior drop boxes let you set one of three behaviors that can happen before or after the current sequence.

No image

VNS treats the Image Object as transparent.

Hold image

VNS holds the first frame of the sequence at the start, or holds the last frame of the sequence at the end.

Loop

VNS extrapolates the looping behavior (as set in the Speed and Loops fields) backward or forward in time. This lets you place the start of the loop at a particular time.

To set the number of frames used by the behaviors you select, use the Space Before and After fields (see above).

Thumbnail

The thumbnail shows a scaled version of the base image for the Image Object. Double click it to see a full size preview.

Controls for Dissolves

When you select a dissolve in the list, the controls below the list let you control the details of the selected dissolve.

Target Drop Box

Use the Target Drop Box to select the Image Object to which you'd like to dissolve.

Start Dissolve At Frame Field

Use the Start Dissolve At Frame field to enter the frame number in the VNS animation where you'd like the dissolve to start.

End Dissolve At Frame Field

Use the End Dissolve At Frame field to enter the frame number in the VNS animation where you'd like the dissolve to end. If you change the Dissolve Length field, VNS will automatically adjust the End Dissolve At Frame field.

Dissolve Length Field

Use the Dissolve Length field to enter the number of frames over which you'd like to have the dissolve. If you change the End Dissolve At Frame field, VNS will automatically adjust the Dissolve Length field.

Ease In/Ease Out Checkboxes

Select the Ease In checkbox to have the dissolve start out slowly and then accelerate the rate of dissolve. Select the Ease Out checkbox to have the dissolve decelerate at its end. Leave both unchecked for a linear dissolve.

Using Ease In and Ease Out can produce a smoother looking dissolve.

Thumbnails

The thumbnail at the left shows the base image of the source Image Object. The thumbnail at the right shows the base image of the target Image Object.

Geo Reference Page

The Geo Reference page lets you select a Coordinate System and specify the boundaries of the Image Object when used as a Color Map.

When you import an image in a georeferenced format, it will already have these parameters set.

Coordinate System Drop Box

The Coordinate System drop box lets you select a Coordinate System for the image. If the image was imported from a georeferenced format, VNS will create and select the proper Coordinate System for you.

Coordinate System Edit Button

Click the Coordinate System Edit button to edit the Coordinate System with the Coordinate System Editor.

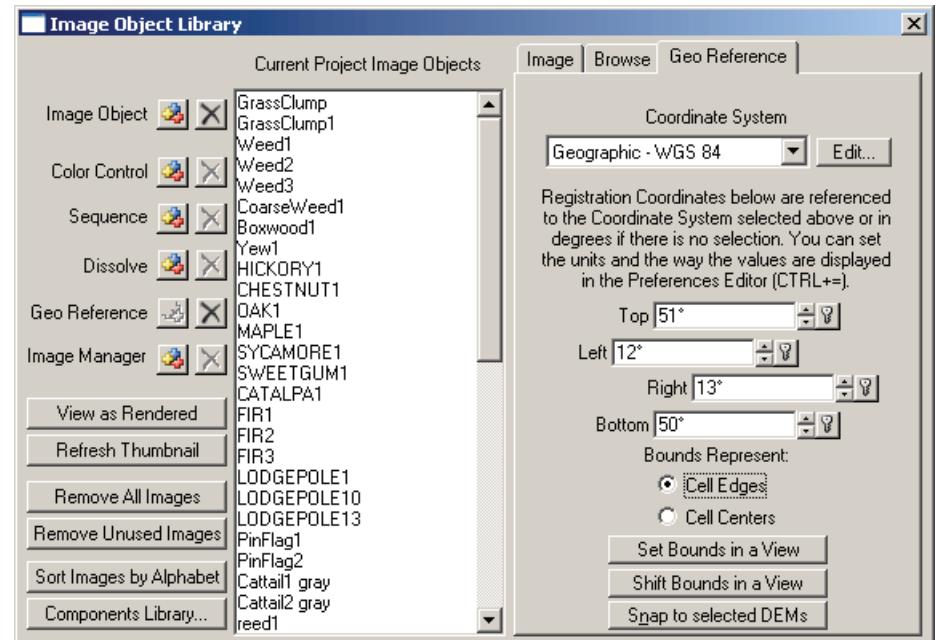
Top Field

The Top field generally lets you enter the Northern boundary where the Image Object will be draped onto the terrain as a Color Map, using the selected Coordinate System. However depending on the projection, the Top may not necessarily be toward the North.

Either the top edge of the image or the center of the top row of pixels will align at the Top boundary, depending on whether you select the "Bounds Represent Cell Edges" or "Bounds Represent Cell Centers" radio button, respectively (see below).

Left Field

The Left field generally lets you enter the Western boundary where the Image Object will be draped onto the terrain as a Color Map, using the selected Coordinate System. However depending on the projection, the Left may not necessarily be toward the West.



The Western boundary will be either the left edge of the image or the center of the left column of pixels, depending on whether you select the “Bounds Represent Cell Edges” or “Bounds Represent Cell Centers” radio button, respectively (see below).

Right Field

The Right field lets you enter the Eastern boundary where the Image Object will be draped onto the terrain as a Color Map, using the selected Coordinate System. However depending on the projection, the Right may not necessarily be toward the East.

The Eastern boundary will be either the right edge of the image or the center of the right column of pixels, depending on whether you select the “Bounds Represent Cell Edges” or “Bounds Represent Cell Centers” radio button, respectively (see below).

Bottom Field

The Bottom field generally lets you enter the Southern boundary where the Image Object will be draped onto the terrain as a Color Map, using the selected Coordinate System. However depending on the projection, the Bottom may not necessarily be toward the South.

The Southern boundary will be either the bottom edge of the image or the center of the bottom row of pixels, depending on whether you select the “Bounds Represent Cell Edges” or “Bounds Represent Cell Centers” radio button, respectively (see below).

Bounds Represent Cell Edges or Cell Centers Radio Buttons

You can choose whether the Top, Left, Right and Bottom bounds represent the edges of the image or the center of the edge pixels in the image. Most GIS data is likely to have been created with cell center bounds. Other data such as old WCS Color Maps and texture images use edge bounds. Check with the source of your data to be sure.

Select the “Bounds Represent Cell Edges” radio button to put the edges of the image at the bounds you entered in the Top, Left, Right and Bottom fields above.

Select the “Bounds Represent Cell Centers” radio button to put the center of the image’s edge pixels at the bounds you entered in the Top, Left, Right and Bottom fields above.

Set Bounds in View Button

Click the Set Bounds in a View button if you want to set the area where the Color Map will be draped by clicking in a View. Click twice in a View to specify two corners of a rectangle where you want VNS to drape the Color Map. VNS will automatically set the values in the Top, Left, Right and Bottom fields to match.

Snap to Selected DEMs Button

Click the Snap to Selected DEMs button if you want the Color Map to exactly fit around one or more DEMs.

If the Database Editor is open, VNS will ask if you have the DEMs you want selected. If you say yes, VNS will set the values in the North, West, East and South fields to include the selected DEMs. If you say Cancel, you can go select the DEMs you want and then click the Snap to Selected DEMs button again.

VNS will automatically set the values in the Top, Left, Right and Bottom fields to exactly include the selected DEMs.

Image Management Page

The Image Management page allows you to control various parameters relating to Image Management of very large image files. This is enabled by default at load time for any supported image format that exceeds 1600 pixels in either dimension.

The concepts behind this feature can be found in more detail in Appendix M: Theory and Practice of Image Management, and it is highly recommended that you read this section before attempting to manually configure the following controls.

Common Management Controls Section

These controls apply to all Image Management in the project. Any changes in this section of the Image Management page will result in that change being applied to all Image Objects currently loaded that have an Image Management tab.

Maximum Image Tile Memory (Mb) Field

In this field, enter the maximum amount of system memory that you wish to reserve for Image Managed objects.

Suggested Size Display Field

In this display field, VNS will attempt to display a “recommended” amount. Depending on a number of factors, this may not be entirely accurate for your circumstances. See Appendix M: Theory and Practice of Image Management, for more information.

Tiling Controls For This Image Section

These controls apply to Image Management for the currently selected Image Object only.

Width Display Field

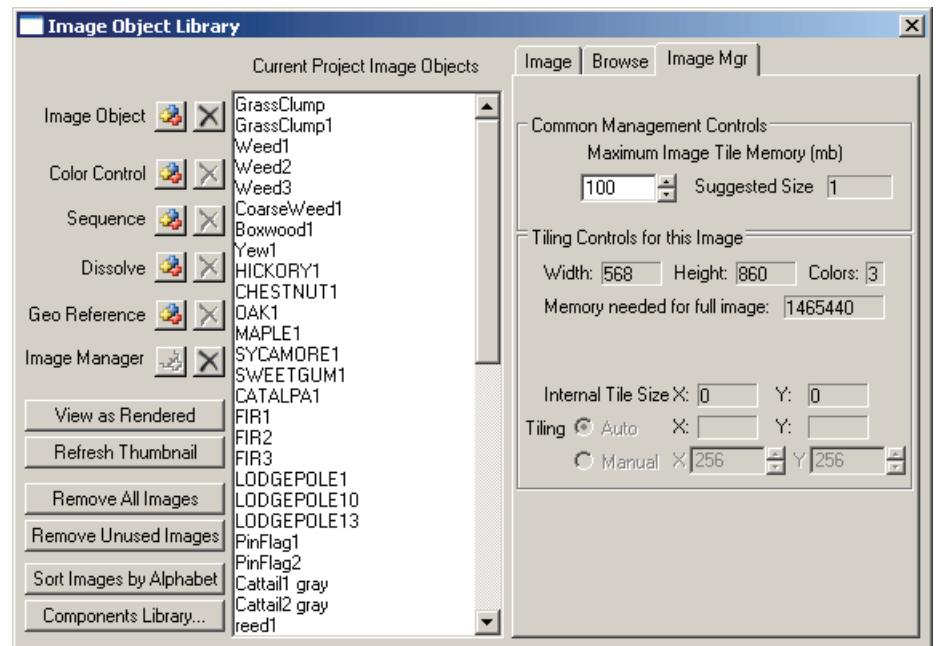
This field displays the width of the currently selected Image Object in pixels.

Height Display Field

This field displays the height of the currently selected Image Object in pixels.

Colors Display Field

This field displays the color depth of the currently selected Image Object in bytes (or channels). So, a 24 bit image would be displayed as having 3 colors (R, G, B). A multispectral LandSat image may contain more channels (R, G, B, InfraRed, UV, and so forth)



Memory Needed for Full Image Display Field

In this field, VNS displays the amount of memory required to load and handle this image if Image Management were not enabled.

Below this, VNS displays whether or not the image will support Image Management. A complete list of supported formats can be found in Appendix M: Theory and Practice of Image Management.

Internal Tile Size

These fields display the internal tile size used by the particular image loaded. From this field it is possible to determine whether a particular image is stored in tile or strip format. See Appendix M: Theory and Practice of Image Management, for more information.

Auto-Tiling Radio Button

Select this radio button if you wish VNS to assign what it thinks is an appropriate tile size for the selected image.

Manual Tiling Radio Button

Select this radio button if you wish to assign what an appropriate tile size for the selected image manually.

Note: It is highly recommended that you read Appendix M: Theory and Practice of Image Management, to fully understand the relationship between tile sized, cache access and so forth.

Tile Dimension Fields

If the Manual Tiling Radio Button is selected, then you can enter the width (X) and height (Y) values for the tile size you require in these fields. If using Auto-tiling, then these fields will be inaccessible, except to display the tile size selected for you by VNS.

Image Viewer

You can view an image from within VNS if you perform one of the following:

- **Select View Image>Last Rendered (Alt-I) from the View Menu**
- **Select View Image>From Disk (Alt-J) from the View Menu**
- **Click on the View As Rendered button in the Image Object Library**
- **Double Click on the image thumbnail in the Image Object Library**

Any of these functions will open the selected image in its own window, ready for viewing.

Note: If the image is larger than the current screen resolution, then VNS will automatically scale it to fit the screen and display a message to that effect.



Import Wizard

The Import Wizard lets you import a wide variety of DEM, Vector and Control Point data.

Using the Import Wizard

To use the Import Wizard, select the Import Wizard command from the File menu.

VNS will first open a file requester. Select the file or files you want to import. Make sure you select files of the same type for each import operation.

VNS will then open the Import Wizard. The Wizard will attempt to automatically identify the data format. It will ask you for input as needed.

What you see in the Wizard will depend on what type of files you selected to import. Follow the instructions in the text area of the Wizard, and set any radio buttons, field values, drop boxes, paths or other controls accordingly.

When you are done with one page, click the Next button at the bottom of the window.

If you want to return to a previous page to change a setting, click the Back button at the bottom of the window.

On the last page of the Wizard, the Next button will change into the Import button. Click the Import button to finish the Wizard operation.

Note: GeoCropping in the Import Wizard lets you crop rows and columns off of imported data without distorting the position of the data you keep. Null data is detected at import. Visual Nature Studio will ignore it when rendering. This lets you render irregularly shaped terrains and avoid distortions in Vertical Displacement along edges of null data areas.

Shape File Attributes

The Import Wizard lets you import Shape files with their GIS database attributes. You can use these attributes to control parameter values within VNS using Thematic Maps (see Thematic Map Editor).

Synchronizing To Your GIS Database

Whenever you import Shape files with the Import Wizard, you can tell VNS to re-import the data every time the project loads. This lets you stay synchronized with your GIS database.

To do this, select the "Re-Import When Project Loads" checkbox on the Output File Type and Name page.

That way VNS will always use the latest version of the Shape file. You can even do this for a Template Project and all Projects using that Template will automatically reload data (see New Project Window).

You can see what Shape files are set to reload automatically by looking in the Auto-Import Operators section of the Template Manager (see Template Manager).

DEM Formats accepted by the Import Wizard

- **Arc ASCII Array**

This is an array as generated by the ArcInfo GRIDASCII command.

Load As: DEM, Control Points

- **Arc Grid**

This is an array as generated by ArcInfo, in ".adf" format.

Load As: DEM, Control Points

- **Arc Export Grid**

This is an array as generated by ArcInfo, in ".e00" format.

Load As: DEM, Control Points

- **ASCII Array**

This is an array of elevation values only. Values are stored in left to right, top to bottom order.

Load As: DEM, Control Points

- **Binary Array**

This is a binary array. Values can be stored in Intel or Motorola format. Integers may be signed or unsigned, and may be 1, 2, or 4 byte values. Floating point numbers can be stored in single or double precision form. Values are stored in left to right, top to bottom order.

Load As: DEM, Control Points

- **Bryce Terrain**

This is the first terrain object found in a Bryce project file. Bryce versions 2, 3 and 4 are supported.

Load As: DEM, Control Points

- **DTED**

This is Digital Terrain Elevation Data as defined by NIMA.

Load As: DEM, Control Points

- **GTOPO30**

This is a global digital elevation model using 30 arc second (approximately 1 km.) compiled by the USGS.

Load As: DEM

- **Images**

Full color (24 bit) images in any supported formats (see File Flexibility). Elevations can be created from the colors by three methods for 24 bit images

- **Addition (R + G + B)**
- **16 bit elevation (R * 256 + G) {POV format}**
- **24 bit value (R * 65536 + G * 256 + B) {TruFlite format}**

Load As: DEM, Control Points

- **MicroDEM**

This is a DEM saved in MicroDEM's internal format.

Load As: DEM, Control Points

- **NTF DEM**

A format developed by the UK Ordnance Survey to distribute their Terrain models.

Load As: DEM, Control Points

- **NED**

NED files still import, but are now just identified as Binary Arrays

- **SDTS DEM**

This is 7.5' (30m) DEM data as generated by the USGS

Load As: DEM

- **SRTM**

Data from the Shuttle Radar Topography Mission. All resolutions are supported.

Load As: DEM, Control Points

- **STM**

This is a Simple Terrain Model, as defined by Michael Garland.

Load As: DEM, Control Points

- **Terragen Terrain**

This is a DEM saved in the Terragen format.

Load As: DEM, Control Points

- **USGS ASCII DEM**

This is DEM data in ASCII format as generated by the USGS. All geographic formats are supported, and 7.5' (30m) UTM are supported. Files created by the ArcInfo LATTICEDEM command are also accepted.¹

Load As: DEM

- **VistaPro**

This is a DEM in the VistaPro format. All versions are supported.

Load As: DEM, Control Points

- **WCS/VNS DEM**

This is a DEM (.elev file) created by any version of World Construction Set or Visual Nature Studio.

Load As: DEM, Control Points

- **WCS ZBuffer**

This is a distance buffer generated by World Construction Set.

Load As: DEM, Image

Point Formats accepted by the Import Wizard

- **WCS XYZ**

This is a format generated by the DEM Designer in previous versions of WCS.

Load As: Control Points

- **XYZ**

This is a file containing only XYZ values. For Geographic files, values need to be stored in Longitude, Latitude, and Elevation order.

For UTM files, values should be stored in Easting, Northing, and Elevation order. The files need to have one set of values per line.

Values can be separated by commas, spaces, or tabs.

Load As: Control Points

- **ASCII GPS**

This is an ASCII Text GPS waypoint file. The file will import directly and the Import Wizard will provide no options pages.

Load As: Control Points

- **GPX**

This is an GPS XML waypoint file. The file will import directly and the Import Wizard will provide no options pages.

Load As: Control Points

Vector Formats accepted by the Import Wizard

- **DXF**

This is an ASCII DXF file as generated by AutoCAD. The supported entity types are Points, Lines, and Polylines. VNS will maintain vector colors.

Load As: Vectors, Control Points (option to Grid to generate DEM)

- **SDTS DLG**

This is a SDTS Digital Line Graph file as generated by the USGS.

Load As: Vectors

- **Shapefile**

This is a shapefile as generated by ArcInfo. Both the original 2D format and the 3D format are supported.

You can choose whether the resulting VNS vectors will be rendered or not. You can tell VNS to name the resulting VNS vectors from an attribute field in the shapefile. For 2D files, you can tell VNS to assign elevations to the resulting VNS vectors from an attribute field in the shapefile.

Load As: Vectors, Control Points

- **USGS DLG**

This is a Digital Line Graph file as generated by the USGS. Only ASCII files in the Optional Distribution format are accepted.

Load As: Vectors

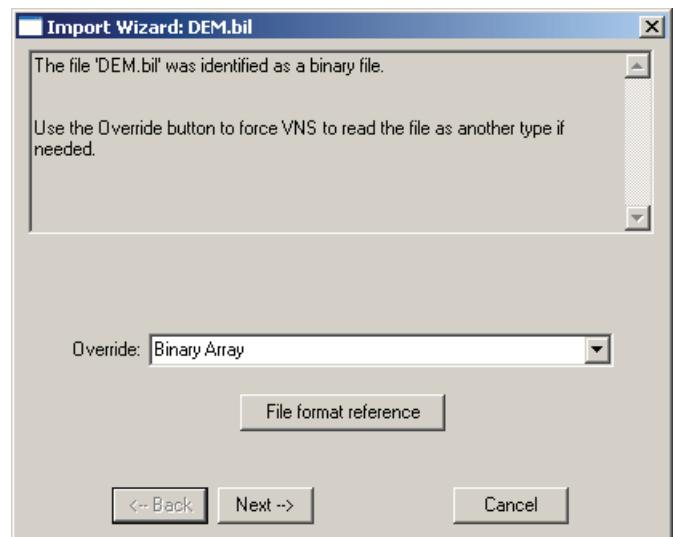
Import Wizard Panels

Identification Panel

The Identification panel is the first panel you'll encounter when you load your data. The Import Wizard will attempt to automatically determine what kind of data you're loading and will tell you what it thinks it found. If this is incorrect, you can use the Override to tell the Import Wizard what kind of data it really is.

Override Dropdown List

Select the correct filetype from the provided list of supported data formats



Load As Panel

The Load As panel will show you the options available for storing your data in the database.

Data Type Radio Buttons

DEM (Digital Elevation Model)

VNS can only render terrain that's in DEM form. This is a 2D array of elevation data. If you have terrain data in some other form, you'll need to convert it to a DEM later by gridding the data.

Control Points

These are sets of XYZ or Lat/Lon/Elevation data. A common example of this type of data is spot elevation samples of an area. A terrain model (DEM) can be generated by gridding this data.

Image

This option is only available for converting WCS Z-Buffers to either an image, or a raw binary array.

Vector

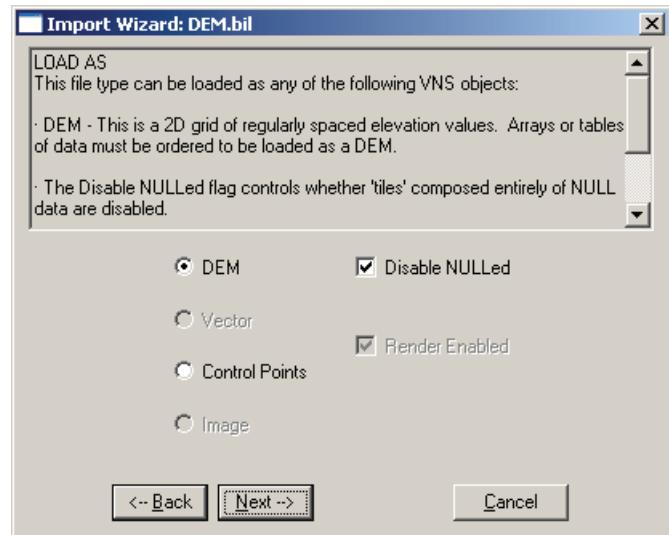
This is line data. It may be 2D or 3D data. VNS can use this type of data for a number of things, including setting ecosystem bounds, setting up Terraffectors, and showing boundaries. If your vector data represents a terrain model (as in contour line data), you'll need to grid it in order to create a DEM.

Disable NULLed Checkbox

If your DEM has NULL data in it, you can have the Import Wizard automatically disable all tiles in the database that consist of nothing but NULL data.

Render Enabled Checkbox

If you don't want your imported vectors to render for some reason (i.e.: it's data for an ecosystem bound Component), you can disable rendering for all the vectors being loaded from that file here.



Output File Type and Name Panel

The Output File Type and Name panel is used to tell the Import Wizard how the data is to be stored (i.e.: WCS DEM), where it's to be stored (defaults to your project directory), and how it is to be named in the database. The Import Wizard will try to come up with a meaningful name for your data where possible.

ReImport when Project Loads Checkbox

This is only enabled for Shapefiles. This allows you to auto-import your shapefiles when you load your project. This allows you to make changes on the shapefile attributes, or in the shape itself as a project evolves and have the changes transfer to VNS automatically.

Output Format Dropdown List

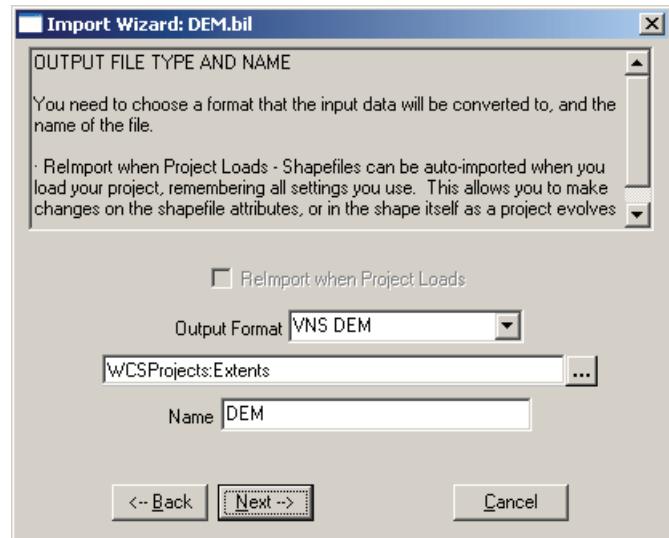
Select your output format from this dropdown list. usually this will be left at the default so that the data can be visualized within VNS. However other formats may be available depending upon the datatype being imported.

Output File Location

With DEM data, you can select an output location for the file. This is usually left at the default, but if you have changed the output format, you may wish to redirect the file to some location other than the default.

Output File Name Field

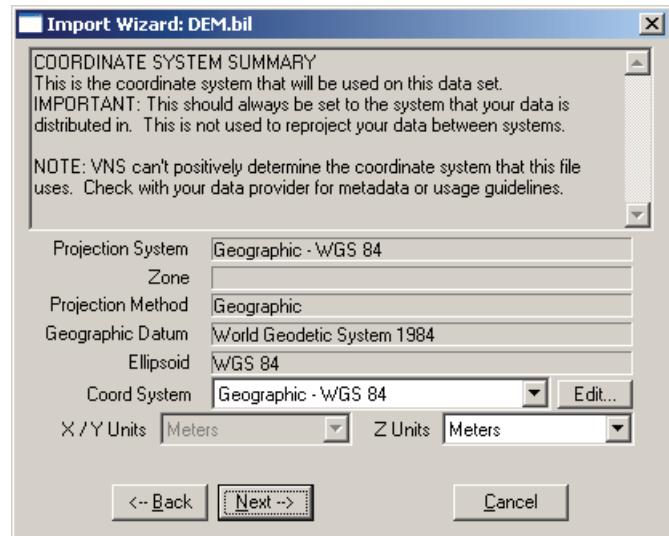
Enter the chosen file name into this field.



Coordinate System Summary Panel

The Coordinate System Summary panel is a way for you to see what Coordinate System is being attached to your data. The Import Wizard will be able to determine this automatically for some file types. If the Import Wizard can't determine this information, it will open the Coordinate System Editor for you so you can set the correct values.

- 1) Set the Units boxes as needed, such as if you have a Shapefile in State Plane feet.**
- 2) If the Import Wizard has all the info it needs at this time, press the Import button to load the data. If the Import button reads Next instead, there are more settings that the Import Wizard needs.**
- 3) For DXF and Shapefiles, this panel will also list the range of values in the file. This can help you to remember/verify the Coordinate System to be used on the file.**
- 4) The Edit button will bring up the Coordinate System Editor.**



Shape Options Panel

The Shape Options panel will allow you to change the way the data is handled as it's loaded. The attributes that were found in the file will be listed in the scroll region of the panel. When you press the Import button, you will be asked to indicate which attributes to use for any of the selected options.

Positive E Longitude Checkbox

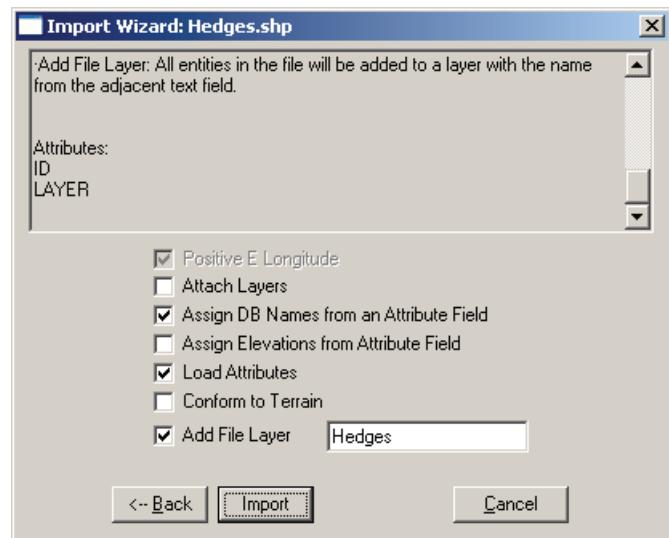
When enabled, higher X values are east of the Prime Meridian, otherwise they're west. Default is Positive E.

Attach Layers Checkbox

Layers create groups of objects that can be selected together in the database. If you wish to use an Attribute Field to set up groupings, choose this option.

Assign DB Names from an Attribute Field Checkbox

When this option is enabled, the name for the object in the database will come from an Attribute Field. When this is disabled, the name will be generated from the input file name and the record number. Selecting this option, and clicking next will open the Shape Attribute Window, allowing you to select the attributes that you want to assign to names.



Assign Elevations from an Attribute Field Checkbox

This option allows you to use an Attribute Field to assign elevations to a 2D shapefile. Selecting this option, and clicking next will open the Shape Attribute Window, allowing you to select the attributes from which you want to assign elevations.

Load Attributes Checkbox

Use this option when you want to be able to have database entries that can be queried to set up Thematic Maps. Selecting this option, and clicking next will open the Shape Attribute Window, allowing you to select the attributes that you want to load into the Database Editor.

Conform to Terrain Checkbox

Selecting this option will force the vertices of the imported shapefile to be conformed to the underlying terrain mesh.

Add File Layer Checkbox

Selecting this option and entering a name in the field provided will allow you to attach a new layer name to the shapefile being imported. This is in addition to the existing layer information, none of which will be lost should this option be chosen.

File Layer Name Field

Enter the name of the Database Layer with which you wish to tag the imported file.

Binary Input Settings Panel

The Binary Input Settings panel is used to tell the Import Wizard how to read binary arrays. The Import Wizard will attempt to determine the settings automatically if a header file is present.

Value Format Dropdown List

Value Format is used to indicate the kind of numbers stored, and may be a signed integer, an unsigned integer, or a floating point number.

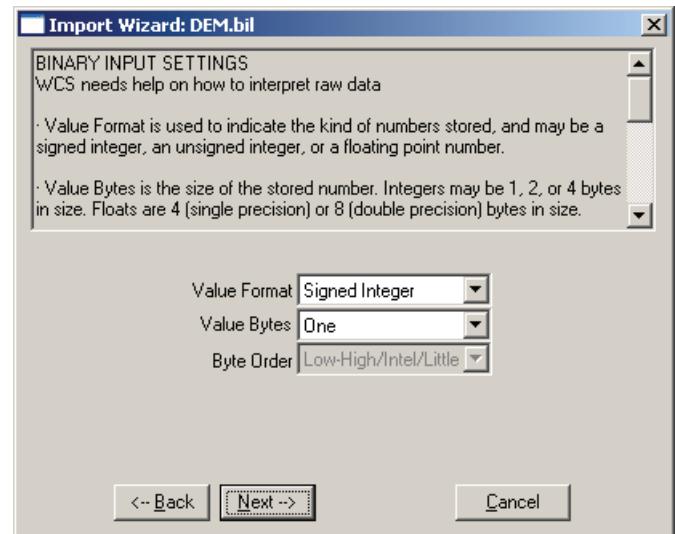
Value Bytes Dropdown List

Value Bytes is the size of the stored number. Integers may be 1, 2, or 4 bytes in size. Floats are 4 (single precision) or 8 (double precision) bytes in size.

Byte Order Dropdown List

Byte Order is only relevant if Value Bytes is two or more. Each byte holds a piece of the number. This indicates whether the pieces are stored in ascending or descending order. Motorola CPU's normally write in High-Low or Big-Endian order, while Intel CPU's normally do the opposite.

Overleaf is a list of the various Byte order options along with the range of values that they include.



- **Signed Byte = -128...+127**
- **Unsigned Byte = 0...+255**
- **Signed 2 Bytes = -32768...+32767**
- **Unsigned 2 Bytes = 0...65535**
- **Signed 4 Bytes = +/- 2 Billion**
- **Unsigned 4 Bytes = 0...4 Billion**
- **4 Byte Float = 6 Digits Precision**
- **8 Byte Float = 15 Digits Precision**

Note: When importing Binary files into VNS it is usually useful to know this information in advance, whenever possible.

Input Columns, Rows, and Header Panel

This panel is used to tell the Import Wizard what the dimensions of your 2D binary array are, and how to access it. The Import Wizard will attempt to select the correct settings for you from a header file.

Factor List Dropdown List

The Factor List drop box will contain all the possible combinations of Rows & Cols based on the File Size and the Header size.

Input Cols Field

This field displays the currently selected number of Columns in the imported data

Input Rows Field

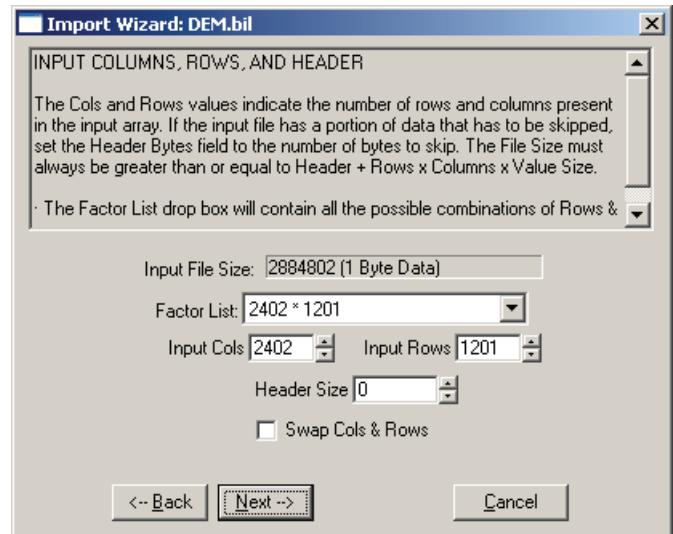
This field displays the currently selected number of Rows in the imported data

Header Size

The Header size is used to indicate the offset (in bytes) to the start of the array. Generally this is 0, but some formats store other data at the beginning of the file which needs to be skipped.

Swap Cols & Rows Checkbox

The factor list will only show one order for the factors (i.e.: 5 x 4). If this is "backwards", check this box.



Reference Coordinates Panel

The Reference Coordinates panel is used to indicate the way the data is to be positioned.

Reference Radio Buttons

Ignore Reference

This puts the data on the planet using the Horizontal Extents positioning information. Use this option to put a WCS DEM back to the same position on the planet.

Place 0,0 at Reference

This puts the data set origin at the Reference Coordinates. This is recommended for DXF files or for files with unknown origins.

Place Low X,Y at Reference

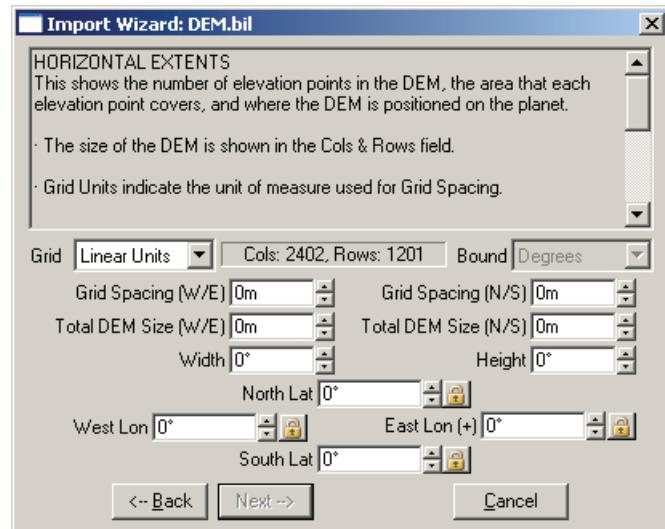
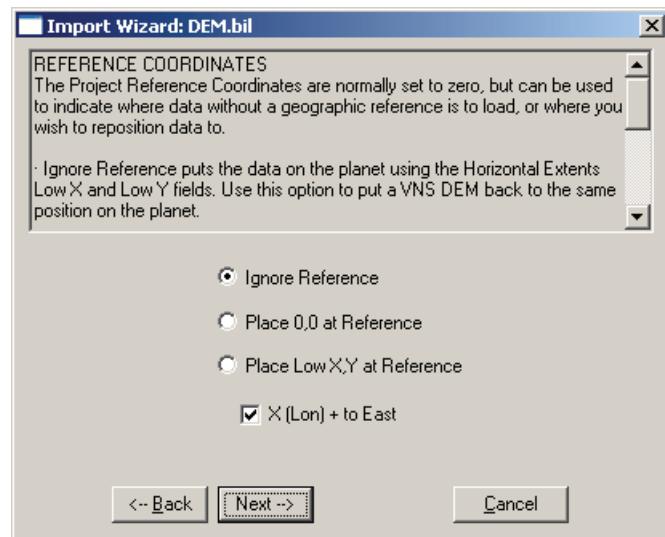
This puts the low coordinates of your data onto the planet at the Reference Coordinates.

X (Lon) + to East Checkbox

Check this box to indicate that the data is in a coordinate system which has the units increasing to the right. It is enabled by default. If your data uses the opposite format (units increasing to the Left, or West) then deselect this checkbox. If you do not know, but your data imports "flipped in the E-W sense, then deselecting this checkbox during import should solve the problem.

Horizontal Extents Panel

The Horizontal Extents panel will give you great flexibility in setting your DEM bounds if needed. The above image is what the Import Wizard shows for some DTED data of Britain, after the Grid Units box was changed to indicate Degrees. The Lat & Lon bounds are the outer cell centers that VNS will use for this DEM. This is the ONLY area that will render on this DEM. See for a discussion of Cell Centers vs. Cell Extents. The Grid Spacing values are the cell size. VNS does not need these to be equivalent. Here, the W/E spacing is 0.0167 degrees, or 1 arc minute, while the N/S is 0.0083 degrees, or 30 arc seconds. The Total DEM Size is the area that the DEM Extents would cover (Cols * GridWE and Rows * GridNS). The Width and Height is the area that is covered by the outermost cell centers, and is the size of the area that will be rendered ({Cols - 1} * GridWE and {Rows - 1} * GridNS). Entering in a value in any field will cause all the related fields to be recomputed (i.e.: entering a value in the GridWE field will cause DEMSizeWE, Width, and the Longitudes to be updated).



Grid Units Dropdown List

This displayed the currently selected Units for display. It will only show Linear Units if your Bounds are linear. If your Bounds are in degrees, Grid Units can be displayed in Linear Units (the default), or Degrees. This allows you to set a linear distance between cell centers (such as 30m postings), even though your data will be stored geographically.

Grid Spacing Fields

These fields display the current grid spacing in either linear or geographic units

DEM Size Fields

These fields show the current DEM size in either linear or geographic units

DEM Width and Height Fields

These fields show the current Width and height of the DEM in either linear or geographic units

Extent Fields

These fields show the extents of the DEM.

The bounds will show North Lat / South Lat / West Lon / East Lon if your bounds are in Degrees, along with the direction of positive longitude.

The bounds will show High Y / Low Y / Low X / High X if your bounds are in Linear Units (such as a UTM array).

The locks on the bounds can be used to fix a corner or edge of the DEM while other computations are made.#

See Import Wizard Horizontal Extents Examples for more information on this.

Pre-Processor Settings Panel

The Pre-Processor Settings panel allows you to alter the way a DEM is read into memory.

Ceiling Checkbox

When enabled, the value entered into the Ceiling Field is the maximum allowed elevation. All values above this will be clipped at the value entered.

Ceiling Field

Enter a maximum DEM elevation into this field.

Floor Checkbox

When enabled, the value entered into the Floor Field is the minimum allowed elevation. All values below this will be clipped at the value entered.

Floor Field

Enter a minimum DEM elevation into this field.

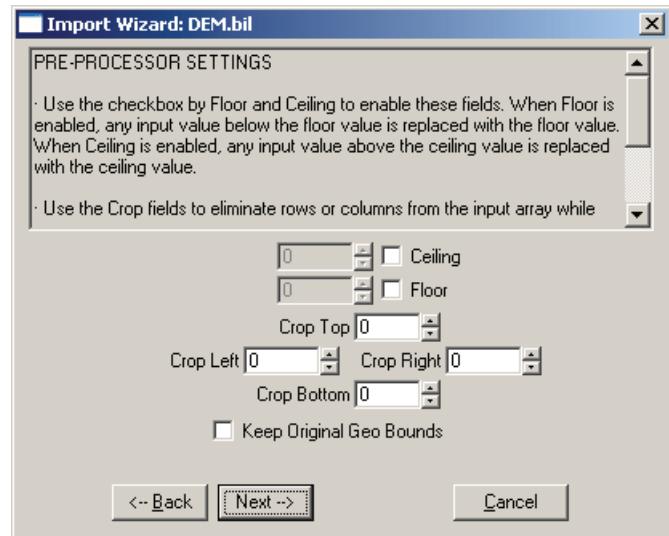
Crop Fields

When enabled, these allow you to remove rows or columns of data from the input array on the given edge.

Keep Original Geo Bounds Checkbox

When enabled, a cropped DEM will use the extents given on the Horizontal Extents panel, and thus will have the same geographic extents on import, but a different cell size.

With this disabled (the default), the extents are computed from the grid spacing and the crop values, so your cropped area will have the same cell size (but different extents) as it would be had it not been cropped.



Vertical Extents Panel

The Vertical Extents panel controls how the digital number range is converted to elevations. The numbers themselves aren't always elevation values, and this is a way to remap them to something useful. These values were returned from a Bryce DEM I generated. The 16 bit elevation model that Bryce generated has numbers in this range, but that's probably not what we'd want to use. If we type in 1000 for the high elev, and -250 for the low elev, the original 0...65008 range will be remapped in the -250...1000 range.

Elev Units Dropdown List

Select your elevation units from the options provided in this dropdown list.

Scale Field

Altering this field applies a permanent vertical exaggeration to your DEM.

Elev Modifier Field

You can raise or lower the whole DEM by entering an offset here.

High Elev

This will display the highest value that exists in the file, if the file format lists that information. Otherwise a zero will be displayed. Enter in a value here to override the mapping range on the high end.

Low Elev

This will display the lowest value that exists in the file, if the file format lists that information. Otherwise a zero will be displayed. Enter in a value here to override the mapping range on the low end.

Note: If neither High Elev or Low Elev is altered, the range of values as found in the input file will be used, even if 0/0 is displayed. Altering only one of the Elev fields will only change how that end is remapped, the other end will use the minimum/maximum found in the file.

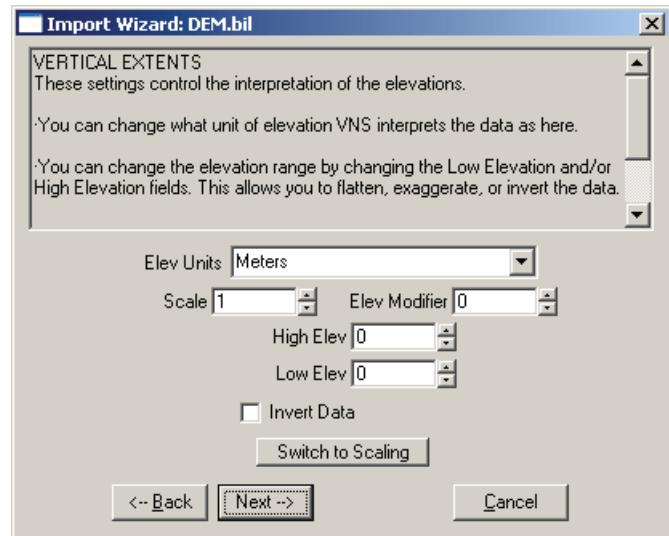
Invert Data Checkbox

To remap the data so that the low becomes high & vice versa, select this box.

Switch to Scaling Button

This is provided for those that are more familiar with the way WCS V4 and earlier handled the data scaling. Clicking it opens the Data Scaling Panel (See below).

Data Scaling Panel



There are three ways in which this panel can be used. The options can be selected from one of the following radio buttons:

- **One Val**
- **Two Val**
- **Min/Max**

Each has its own interface, and is described in more detail in the following sections.

One Val

Equivalent Value Fields

Use these fields to correlate a known input value with a desired output value (such as to assign sea level to a given value). The Equivalent Value Input and Output Fields allow you to set the related values.

Related Scaling Dropdown List

Select an option from this list to choose how the rest of the data is scaled.

- **I/O Scale**

This value is used to scale data around the central related value.

- **MinOut**

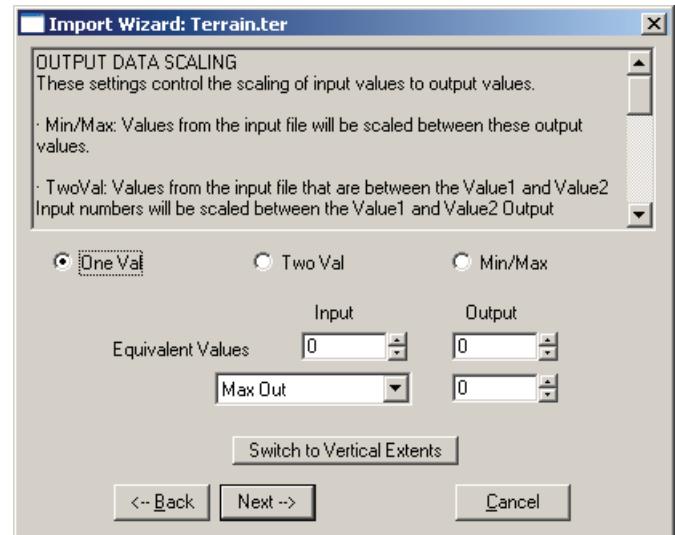
The minimum input value is set to this value, while the rest of the file is scaled proportionally to the relation set by the minimum value and the Value1 relationship.

- **MaxOut**

This works the same way as MinOut except the maximum values control the scaling.

Switch to Vertical Extents Button

Clicking this button returns to the Vertical Extents Panel.



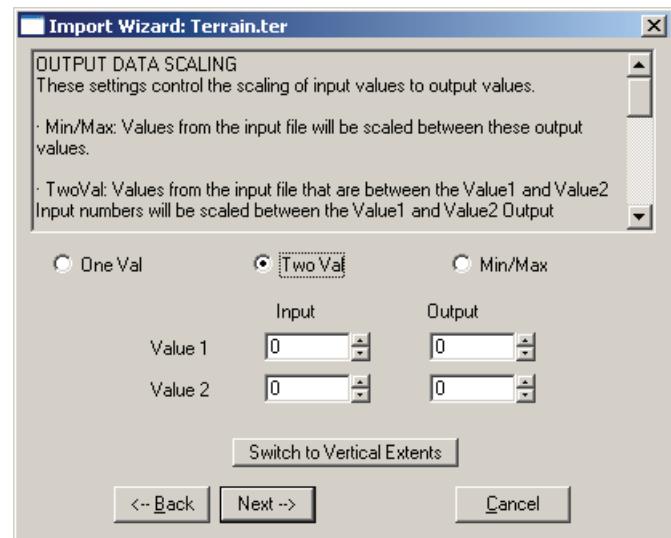
Two Val

Input & Output Value Fields

Values from the input file that are between the Value1 and Value2 Input numbers will be scaled between the Value1 and Value2 Output numbers. Values outside of the input range will be scaled proportionately.

Switch to Vertical Extents Button

Clicking this button returns to the Vertical Extents Panel.



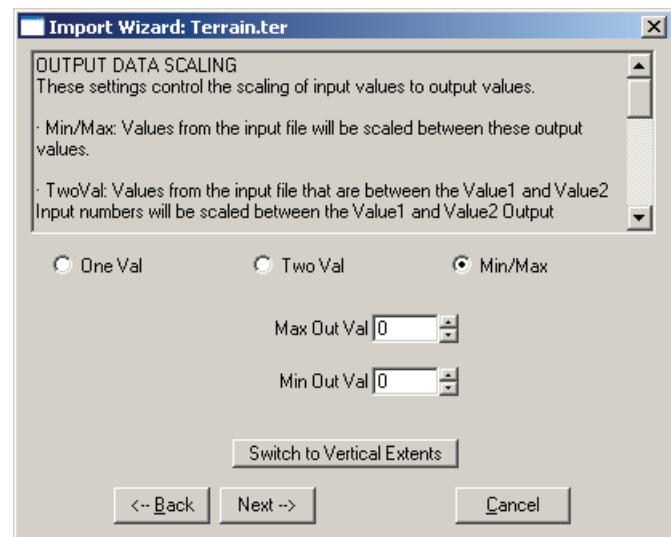
Min/Max

Max & Min Out Value Fields

Values from the input file will be scaled between these output values.

Switch to Vertical Extents Button

Clicking this button returns to the Vertical Extents Panel.



Output DEMs Panel

The Output DEMs panel controls how your DEM is “tiled”. VNS can render more efficiently if the input data is saved as overlapping tiles. A tile size of around 300 by 300 cells is recommended.

DEM's Row-Wise & Col-Wise Fields

This controls the number of tile rows & columns. In this case we'd have 32 tiles (8 x 4).

Output Cols & Rows

This is the size of the DEM that will be saved, and defaults to the number of input columns & rows. You can have the Import Wizard save a resized version of the input data by altering either of these fields.

Output Cell Size Fields

These fields display the cell size of the output DEM. If you are altering the number of rows and columns manually to achieve a particular cell size, you can use these to judge the cell size more accurately.

Note: it is not possible to manually set the cell size through this page, only to change the number of columns and rows to reflect as near the required cell size as possible.

Spline Constrain Checkbox

This field can only be modified if you change the size of the output DEM. When enabled, the resampling algorithm will use splines to try to make a smoother result.

NULL Data Panel

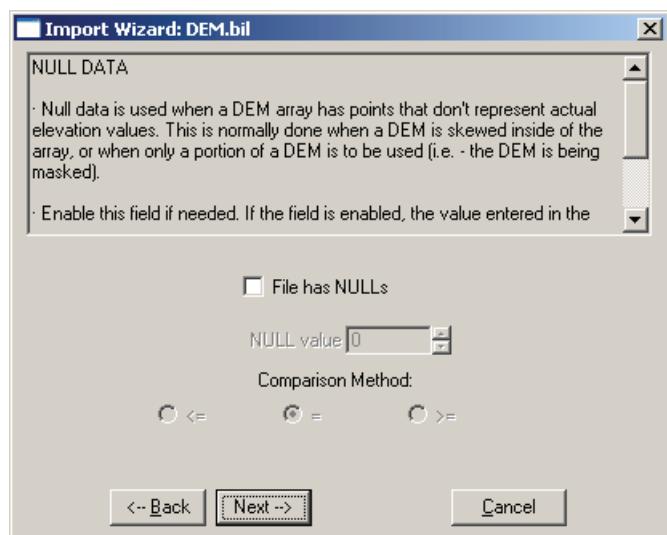
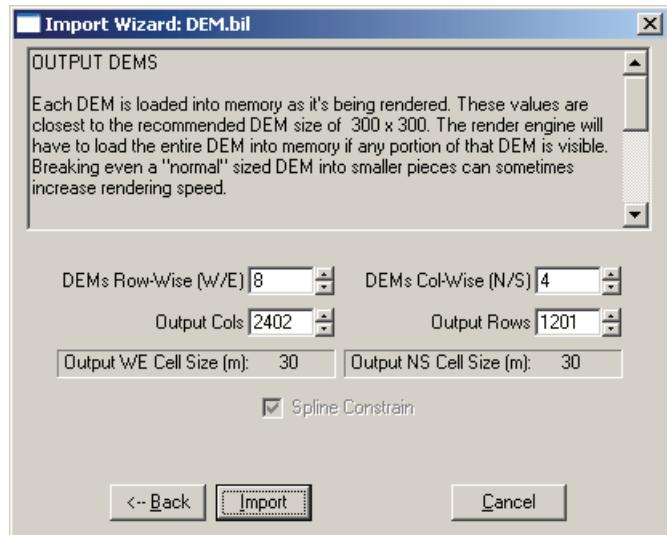
The NULL Data panel is used to tell the Import Wizard which value(s) are to be treated as NULLs, if any. The input data is compared to the NULL value using the Comparison Method to decide if the input data is a NULL.

File Has NULLs Checkbox

If the import file has NULL data within it, check this box. If you do not, then the NULL values (often a very large value, either positive or negative) will be interpreted as a valid elevation during import.

NULL Value Field

Enter the NULL Value in this field.



Comparison Method Radio Buttons

<=

Select this option if the NULL data values are less than or equal to the supplied value

=

Select this option if the NULL data values are equal to the supplied value

>=

Select this option if the NULL data values are greater than or equal to the supplied value

Data Positioning Panel

If you encounter the Data Positioning panel, you can let the Import Wizard go ahead and load the data as it normally would, or you can manually override some of the settings.

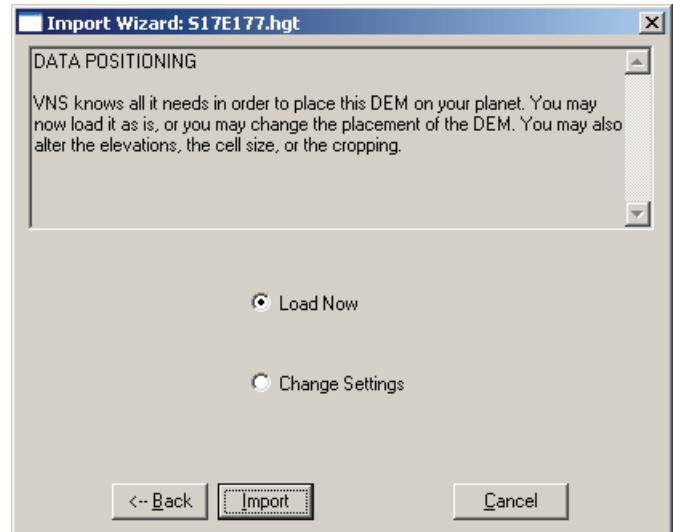
Load Now Radio Button

Select this option to load the data using the values provided so far through the wizard.

Change Settings Radio Button

Select this option to open additional data input panels allowing you to change such aspects as the horizontal or vertical extents, and the tiling options for DEMs.

An example of when you may have cause to use this option is when re-importing a VNS elevation file that has been created during a multires DEM Merge operation. The output DEMs created by such a process are single tiles and often cause errors when rendering due to their size, not to mention the fact that they will render offscreen for extended periods without affecting the visible rendered output. By tiling the DEM into smaller sections, you can reduce memory requirements and speed rendering.



Color to Elevation Method Panel

In this panel, you tell VNS which method of computing elevation you wish to use. The red, green, and blue (RGB) components of the image are used to determine elevation.

Color to Elevation Radio Buttons

Additive

Elevation is equal to $R + G + B$ and therefore ranges from 0 to 765.

16 bit

Elevation is treated like a 16 bit unsigned value in POVRay format ($R * 256 + G$), therefore the elevation range is 0 to 65535.

24 bit

Elevation is treated as an unsigned 24 bit RGB value ($R * 65536 + G * 256 + B$), therefore the elevation range is 0 to 16777215.

Note: The Vertical Extents panel will let you remap these elevation ranges into something more useful.

Grid Data Panel

The Grid Data panel lets you choose between loading your data as Control Points or immediately gridding them to generate a DEM.

- **Load Control Pts**

VNS will import the data into the Project's database as Control Points. This will allow you to manually set all gridding options later with the Terrain Gridded Editor in order to create a DEM. Choose this when you want more control over the gridding process.

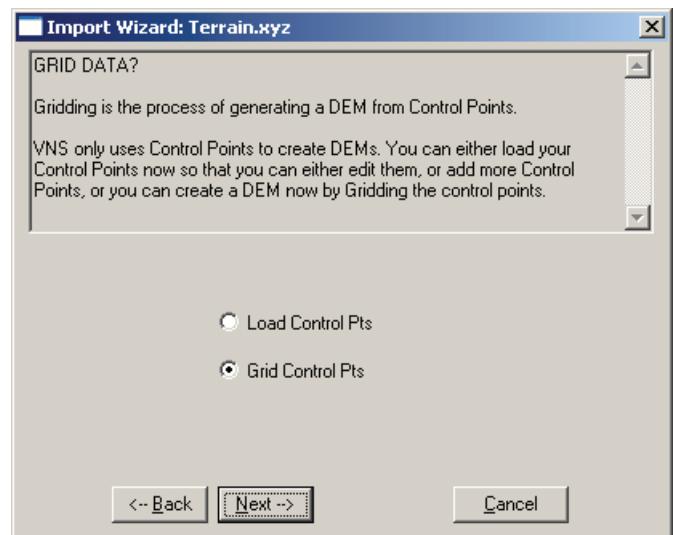
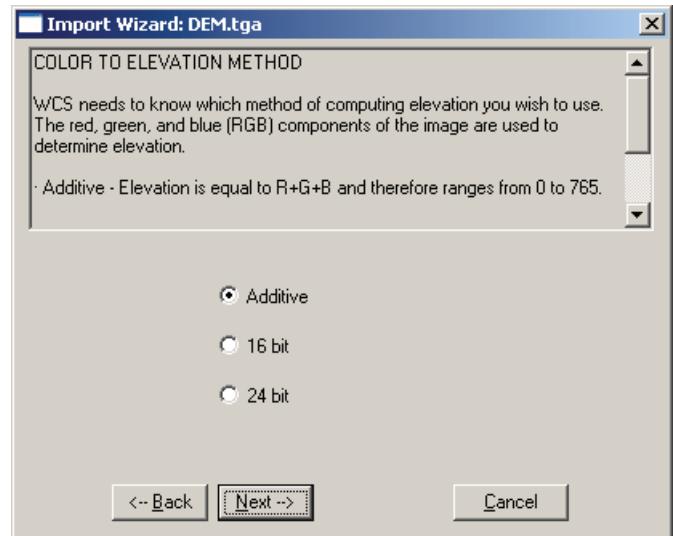
- **Grid Control Pts**

The Import Wizard will attempt to create a DEM from the data and add it to the Project. All gridding choices will be set automatically based on analysis of the input data.

The Control Points will still be added to the Project's database in case you want to regrid later.

Import Wizard Panel flow

The first 4 panels are always encountered in the same order, with the exception of WCS Z-Buffer to Image conversion, where only the first 3 of these are encountered:



Identification - Load As - Output File Type and Name - Coordinate System Summary

The rest of the panel flow depends on the file format and options. Any panels listed in brackets are optional, and depend on the listed condition in italics.

- **ArcASCII:**

Data Positioning - Reference Coordinates - Horizontal Extents - Pre-Processor Settings - NULL Data - Vertical Extents - Output DEMs

- **ArcGrid:**

Reference Coordinates - Horizontal Extents - Pre-Processor Settings - Vertical Extents - Output DEMs

- **Arc Export Grid:**

Data Positioning - Reference Coordinates - Horizontal Extents - Pre-Processor Settings - NULL Data - Vertical Extents - Output DEMs

- **ASCII:**

Data Positioning - Reference Coordinates - Horizontal Extents - Pre-Processor Settings - NULL Data - Vertical Extents - Output DEMs

- **Binary:**

Binary Input Settings - Input Columns, Rows, and Header - Reference Coordinates, Horizontal Extents, Pre-Processor Settings, NULL Data, Vertical Extents, Output DEMs

- **Bryce:**

Reference Coordinates - Horizontal Extents - Pre-Processor Settings - Vertical Extents - Output DEMs

- **DTED:**

Data Positioning - Reference Coordinates - Horizontal Extents - Pre-Processor Settings - NULL Data - Vertical Extents - Output DEMs

- **DXF:**

Reference Coordinates [*Load As Control Points - Grid Data*]

- **GTOPO30:**

Data Positioning - Reference Coordinates - Horizontal Extents - Pre-Processor Settings - NULL Data - Vertical Extents - Output

DEMs

- **Image:**

Horizontal Extents - Pre-Processor Settings - Color to Elevation Method - Vertical Extents - Output DEMs

- **MicroDEM:**

Data Positioning - Reference Coordinates - Horizontal Extents - Pre-Processor Settings - Vertical Extents - Output DEMs

- **NTF DTM:**

No additional panels.

- **SDTS DEM:**

No additional panels.

- **SDTS DLG:**

No additional panels.

- **Shape:**

Shape Options

- **STM:**

Reference Coordinates - Horizontal Extents - Pre-Processor Settings - Vertical Extents - Output DEMs

- **Terragen:**

Reference Coordinates - Horizontal Extents - Pre-Processor Settings - Vertical Extents - Output DEMs

- **USGS ASCII:**

No additional panels.

- **USGS DLG:**

No additional panels.

- **VistaPro:**

Reference Coordinates - Horizontal Extents - Pre-Processor Settings - Vertical Extents - Output DEMs

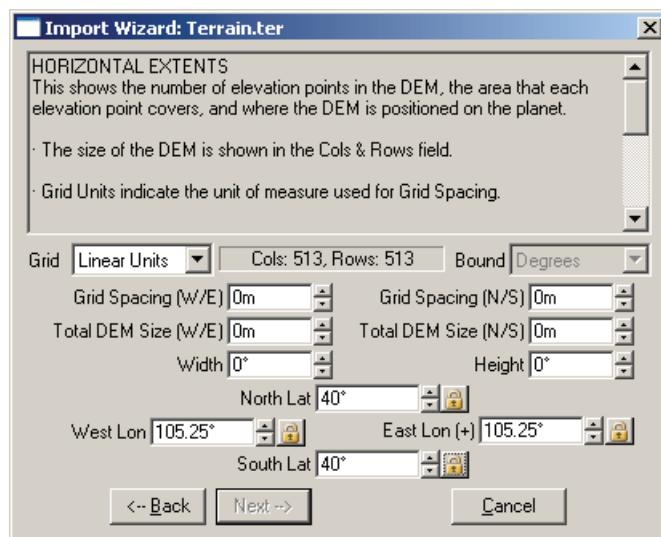
- **WCSDEM:**
Data Positioning - Reference Coordinates - Horizontal Extents - Pre-Processor Settings - Vertical Extents - Output DEMs
- **WCSXYZ:**
Grid Data
- **WCSZBuf (as DEM):**
Reference Coordinates - Horizontal Extents - Pre-Processor Settings - Vertical Extents - Output DEMs
- **WCSZBuf (as Image):**
Horizontal Extents - Pre-Processor Settings - Output Data Scaling - Output DEMs
- **XYZ:**
Grid Data
- **ASCII GPS:**
GPS Step1 - GPS Step 2F [*With Fixed Width Data*] - GPS Step 2D [*With Delimited Data*] - GPS Step 3
- **GPX:**
No additional panels.

Import Wizard Horizontal Extents Examples

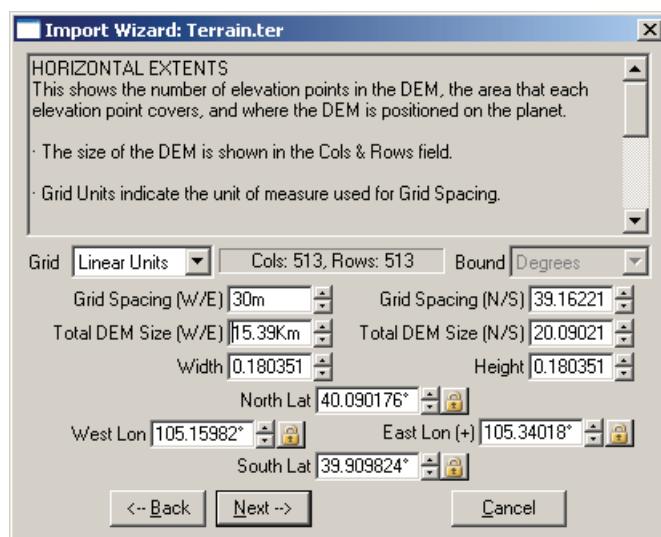
In this section we'll demonstrate how the "locks" feature works.

Centering a DEM at a Given Location

In the first example, we'll load a Terragen-created DEM and position it at Boulder, CO.

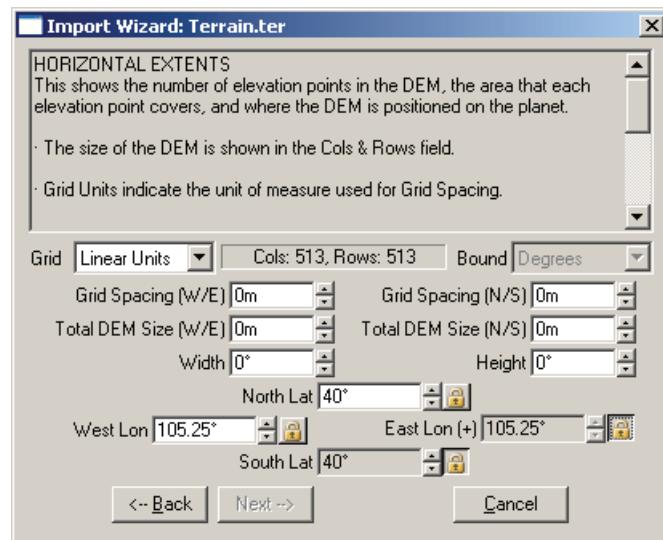


Enter the Lat & Lon values that correspond to the location that will be the center of your DEM. In this case, we'll use 40N & 105.25W, right at downtown Boulder Colorado.

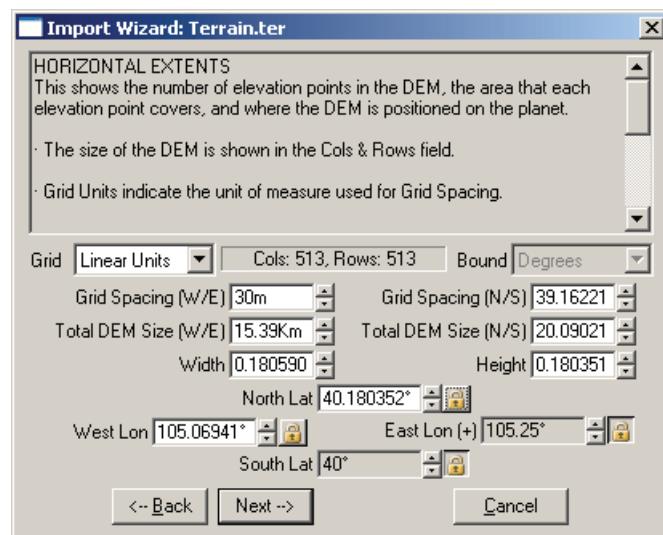


If we leave the locks off, any change in the top 6 fields will cause the computations to be carried out around the center of the Lat & Lon fields, which in this case have been initialized to the location we want. Now enter in a Grid Spacing of 30m in both fields. VNS will recompute the Lat / Lon fields for you. In this case, note that the N/S grid spacing has been automatically set to the closest value to that chosen (in this case just under 40m). This is to be expected with geographic data, as the cells are not square.

Importing a DEM with a Corner Set to a Known Location



Let's load that same DEM, but this time we'll place the SE corner at the given location of 40N & 105.25W. Enter that location in the Lat & Lon fields as shown, and enable the South & East locks.

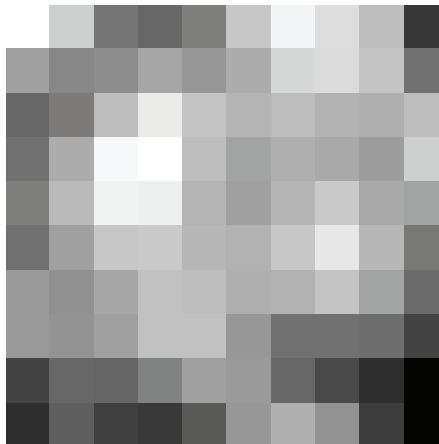


Now once again enter 30m in both Grid Spacing fields. This time, the Import Wizard will only change the North & West fields to reflect the grid spacing you've given. Again, note that the N/S grid spacing has been automatically set to the closest value to that chosen (in this case just under 40m).

Cell Centers & Cell Extents

Both DEMs and images for GIS come in cell center & cell extent flavors. For precise work, you may need to know the difference between the two.

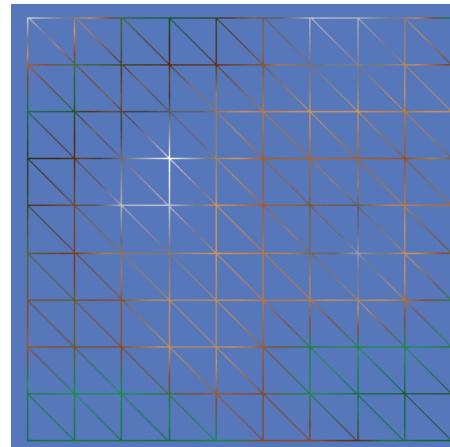
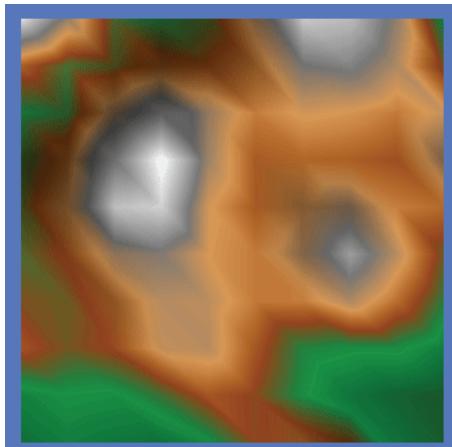
Lets start with a simple 10x10 BMP file to represent our terrain:



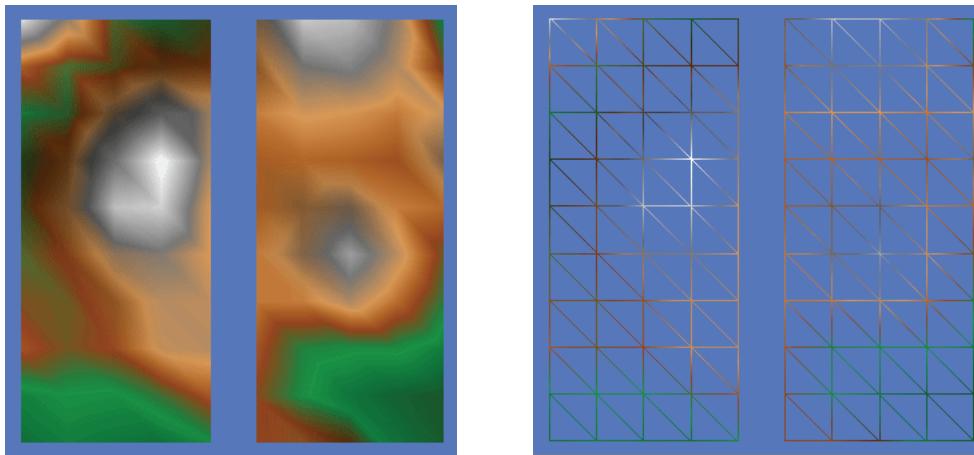
Now, using the Import Wizard, load this file giving it a 30m grid spacing on the Horizontal Extents page, and a 0 to 200 elevation range on the Vertical Extents page.

Our elevation model theoretically covers an area of 300m by 300m. VNS only generates polygons BETWEEN the cell centers though, so we only end up rendering an area of 270m x 270m.

Shaded & Wireframe previews:



Now, suppose our original 10x10 DEM was delivered in an East and West half. Using the same cell centers as before, we'd end up with the following:



When rendered, we'd have a 30m gap between our DEMs.

Note: You Will Always Have Gaps Between Imported Dems Unless Your Dems Share Common Cell Centers.

There are three current exceptions to this rule. USGS 7.5' DEMs (both ASCII & SDTS) can be batch loaded creating a single large DEM. The second exception is with GTOPO30, where a bit of magic happens to fix this. The third is provided with VNS in the form of the DEM Merger, which can now be used to seamlessly “stitch” multiple datasets together. If you’re buying data, to minimize data-processing on your part, it’s important to let your data providers know that you require common cell centers in your data sets.

Note: When VNS breaks up a DEM into tiles itself, it always creates the required overlap.

Georeferenced images can be registered using either cell centers, or cell edges. Some file formats, such as GeoTIFF, will have the correct choice stored in the file. With a file format such as BMP, you’ll have to know which type is meant to be used. If you’re delivered a global image map, with bounds listed as 90N, 90S, 180E, 180W, obviously you’d choose cell edges.

Note: Other than vectors, VNS will not render an area unless a DEM covers that area. This means for instance that if you have a large Landsat image, or a Lake component only the areas that you have DEMs for will render.

UTM Zones

This information obtained from the USGS booklet "Data Users Guide 5 - Digital Elevation Models". This information can also be found in graphical format in Appendix B: Chart of UTM Zones. UTM Zones are based on the Longitude of the data, and are 6 degrees wide. C.M. is the Central Meridian of each zone.

Zone	C.M.	Range	Zone	C.M.	Range	Zone	C.M.	Range
01	177W	180W-174W	21	057W	060W-054W	41	063E	060E-066E
02	171W	174W-168W	22	051W	054W-048W	42	069E	066E-072E
03	165W	168W-162W	23	045W	048W-042W	43	075E	072E-078E
04	159W	162W-156W	24	039W	042W-036W	44	081E	078E-084E
05	153W	156W-150W	25	033W	036W-030W	45	087E	084E-090E
06	147W	150W-144W	26	027W	030W-024W	46	093E	090E-096E
07	141W	144W-138W	27	021W	024W-018W	47	099E	096E-102E
08	135W	138W-132W	28	015W	018W-012W	48	105E	102E-108E
09	129W	132W-126W	29	009W	012W-006W	49	111E	108E-114E
10	123W	126W-120W	30	003W	006W-000E	50	117E	114E-120E
11	117W	120W-114W	31	003E	000E-006E	51	123E	120E-126E
12	111W	114W-108W	32	009E	006E-012E	52	129E	126E-132E
13	105W	108W-102W	33	015E	012E-018E	53	135E	132E-138E
14	099W	102W-096W	34	021E	018E-024E	54	141E	138E-144E
15	093W	096W-090W	35	027E	024E-030E	55	147E	144E-150E
16	087W	090W-084W	36	033E	030E-036E	56	153E	150E-156E
17	081W	084W-078W	37	039E	036E-042E	57	159E	156E-162E
18	075W	078W-072W	38	045E	042E-048E	58	165E	162E-168E
19	069W	072W-066W	39	051E	048E-054E	59	171E	168E-174E
20	063W	066W-060W	40	057E	054E-060E	60	177E	174E-180W

Info About Point Window

The Info About Point Window gives you information about features of your project that pertain to a certain geographic location.

You specify the location you are interested in learning about by clicking with the right mouse button on the location in either a realtime or rendered View. Be sure to click with the right mouse button and not the left. Also you must not have any of the interactive modes turned on at the time and you must not be digitizing a path or vector because those operations may also require use of the right mouse button.

The Info About Point Window will appear at the bottom of the Scene-A-A-Glance, and will tell you which Database Vectors enclose the point where you clicked. For each vector enclosing the point certain useful data will be given.

The Info About Point Window will also inform you of any enabled vector-bounded Components that appear to be active at the clicked location. Components may include Ecosystems, Environments, Area Terraffectors, Lakes, Ground Effects, Snow Effects, Shadows and Thematic Maps. Components will be displayed that are either hard-linked directly to a vector or linked by Search Query (see Search Query Editor). These are the components you will likely find influencing the point where you clicked to either change the coloration, vegetation or elevation of the terrain at that point.

Note: Other Components which might be active at the clicked point are not displayed in the Info About Point Window. Those components are applied not to an area enclosed by a vector, but to a line or a point. Components which are not displayed include Terraffectors, Streams, Foliage Effects, 3D Objects, Labels and Walls.

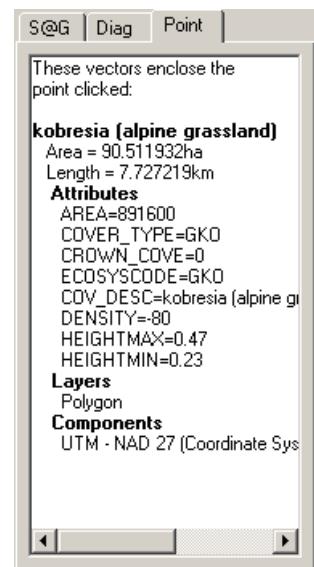
Use the Info About Point Window to understand the qualities of any portion of your project or scene. The information you gain from this window may help you understand what you are seeing in a rendering of the scene. It may help you understand the database that underlies your scene. It may help you convey important information to other people as well. It will certainly help you understand why a scene looks as it does and what information was used by the Renderer to make it look that way. It is an important diagnostic tool which should be used in conjunction with the Diagnostic Data Window.

Opening the Info About Point Window

Before opening the Info About Point Window first make sure that none of the interactive mode buttons are depressed in the main toolbar (Move, Rotate, Scale). Make sure that manipulate View's Camera is also turned off. If you are currently in the process of digitizing (creating) a new vector or path, finish that process before trying to invoke the Info About Point Window. Trying to open the Info About Point Window while any of the above conditions are not satisfied will result in the Info About Point Window not opening and perhaps another function occurring (such as finishing the digitizing process or moving an interactive item).

Open the Info About Point Window by clicking with the right mouse button in a realtime View or a View that has a preview rendering in it. The rendering does not need to be carried to completion for the Info About Point Window to open so long as the scene has rendered sufficiently so you can see the point you wish to click on. Click with the right mouse button, not the left. The left button will not open the window.

The window will open as soon as the point has been analyzed. It may take a few seconds or longer on very large databases.



If you then wish to retrieve information about another point you don't have to close the Info About Point Window. You can simply right-click on the next location and the window will update its contents to describe the new point.

Vectors are listed by their names or labels, whichever one exists (labels have higher priority when both exist). See the Database Editor for more about vectors and their names or labels. Vectors are displayed in black.

Indented beneath each vector is a line that tells the area and length of the vector in hectares and meters. Length is linear length, not splined or smoothed in any way. Area is computed based on the equivalence between degrees of longitude and metric distance at the center of the vector. The area/length line is always shown in grey.

Note: Due to the fast method of calculating vector area, the area value may not be suitable for some precise engineering purposes. If the vector is rather small in latitudinal extent the value will be relatively more accurate than a vector that extends over a wider range of latitude. Vector areas can be either positive or negative. Negative vectors have been created with their points in counter clockwise order as viewed from above. Positive vectors are clockwise. The sign is only important in cases where the topology of the vectors indicates that one vector cuts out a hole within a larger vector. In that case the negative area becomes the hole. Vectors with the correct topology to create island effects can not be created within VNS but may be imported with Shapefiles (see the Import Wizard for more information about Shapefiles). The Info About Point Window does not differentiate between vectors that are positive or negative other than by showing their areas. Both are shown in the window in spite of the fact that a negative vector may actually represent a hole in a positive vector.

If there are any attributes associated with the vector, the word Attributes will appear in black on a line by itself with the same indentation as Area above. Attributes are shown in grey on the following line or lines, one attribute per line, indented a step beyond the word Attributes. The attribute name is shown first, followed by an equality sign (=) and then the actual attribute value. The value may be either numeric or textual as defined in the Database (see the Attributes Page of the Database Editor, for more information about database attributes).

If there are any Components attached to the vector the word Components will appear in black on a line by itself with the same indentation as Area above. Components are shown in grey on the following line or lines, one Component per line, indented a step beyond the word Components. The Component name is shown as it would appear in the Component Library, or in the Scene-At-A-Glance.

Note: On the Vectors page, only those components that are hard-linked to a vector will be listed. To see all the areal components that may apply at the location see the components Page (below). The Component Page of the Database Editor is another place to see the components hard-linked to a vector.

If the vectors belong to any layers, the layer name will be listed under a bold heading of Layers.

Finally, you will see a listing of all the enabled vector-bounded Components that may apply at the clicked location. Only those component types that apply to areas, in other words fill vectors, are shown on the Components Page.

Those component types are:

- **Ecosystem**
- **Environment**
- **Area Terraffector**
- **Lake**
- **Ground Effect**
- **Snow Effect**

- **Shadow**
- **Thematic Map**

Component types which may be linked to a vector but are not shown on this page are:

- **Terraffector**
- **Stream**
- **Foliage Effect**
- **3D Object**
- **Label**
- **Wall**

These component types do not fill areas and hence they are not shown in the Info About Point Window. They either apply along the length of a vector as in the case of Terraffectors, Streams and Walls or apply at discrete vector points as in the case of Foliage Effects, 3D Objects and Labels.

Note: Only enabled components are displayed on the Components Page. This is to aid you in diagnosing the conditions that are causing a rendered scene to look as it does. Disabled components have no effect and so are not shown on this page.

The components shown on this page do not have to be hard-linked to a vector, they may be linked by Search Query instead (see the Search Query Editor).

Note: In the case where one Component is attached to both negative and positive vectors that are topologically linked to form a cutout, the Component will be shown in the Components page even though the clicked point actually falls inside the cutout where the Component does not actually exist or render. This point of possible confusion requires the analysis of vector areas (positive or negative) to resolve.

Component categories are listed in brackets after each named component.

More than one Component of each category may be listed. Each will be attached to a different vector except for the possible exception of Thematic Maps which can have more than one attached to the same vector.

Light Position By Time Window

The Light Position By Time Window is accessed from the Light Editor. It allows you to position your lights based on a particular time and date combination.

Reference Longitude Field

By default, the calculations performed in this window are based on where the sun would be at that time at a reference longitude equivalent to that of the project reference longitude. However, you can over-ride the project reference longitude value and enter another value in this field if it suits better.

Date Dropdown Lists

Use these to set the date

Time Field

Enter the required time in this field

AM/PM Radio Buttons

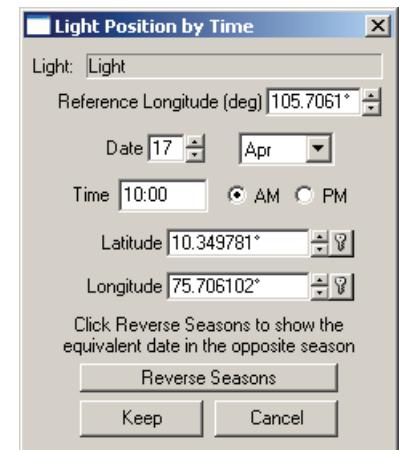
Use these buttons to set whether the time is AM or PM.

Latitude Field

Displays the calculated Latitude of the light based on the other settings in the interface. You have access to the Animation Operations Icon to allow easy animation of this value based on progressive time changes. This makes it very easy to create timelapse animations showing changing light position.

Longitude Field

Displays the calculated Longitude of the light based on the other settings in the interface. You have access to the Animation Operations Icon to allow easy animation of this value based on progressive time changes. This makes it very easy to create timelapse animations showing changing light position.

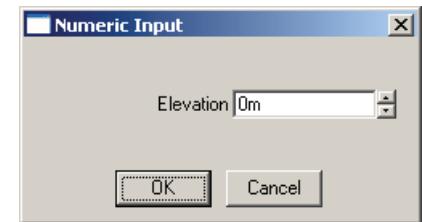


Numeric Input Window

Select the Data Menu's Numeric Entry command (Keyboard Shortcut: ALT+. (period)) to open the Numeric Input window.

Here you can enter a value for the Active Item if it is a parameter. If you're in a hurry and only need to change a single parameter this may be more convenient than opening an Editor and finding the parameter's field.

Note: You can see the Active Item in the Active Item display near the center of the Animation Toolbar



New Project Window

To open the New Project window, select the New command from the File menu.

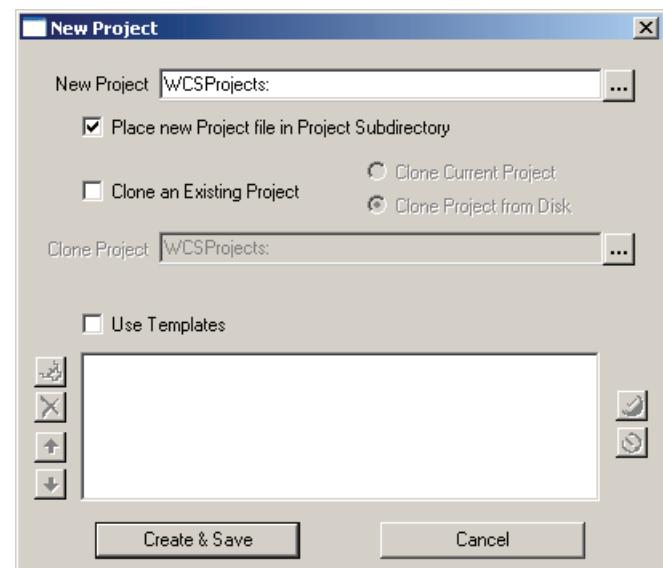
Use the New Project window to create an entirely new Project or clone an existing Project. When you create or clone a Project, VNS creates a new Project file and an associated subdirectory with the same name.

The subdirectory is for other files that may be needed for the Project, which you may create or VNS may generate. You can choose to have VNS put the Project file inside the Project subdirectory if you wish.

Cloning a Project is a quick way to build a new Project based on the settings of an existing Project. This is simpler than using Templates, but less powerful.

Note: When you clone a Project, the DEM files are not copied. Rather, VNS remembers where they are, which is most likely in the Project subdirectory of the original Project. Make sure you don't delete those original DEM files, or your new clone Project will not be able to find its terrain.

Templates let you combine the elements of one or more other Projects into your New project. VNS will update your new Project from the latest versions of the Template Projects every time you load the Project.



New Project Field and Icon

Enter the name of your new Project file into the New Project Field.

Alternatively, you can click the icon to the right to open a file requester where you can navigate to the directory you want to save the new Project file, and enter a name for the new Project file.

Place New Project File in Project Subdirectory Checkbox

Select the Place New Project File in Project Subdirectory checkbox when you want VNS to save the Project file in the Project subdirectory. Otherwise the Project file and Project subdirectory will both be stored in the same directory, usually your "VNSProjects:" directory as set in your Master Paths (see Preferences Window).

Clone An Existing Project Checkbox

If you wish to clone an existing Project, select this checkbox. If you wish to create an entirely new Project, deselect this checkbox.

Clone Current Project/Clone Project from Disk Radio Buttons

If the Clone An Existing Project checkbox is selected, these radio buttons will become activated.

Choose the Clone Current Project radio button when you want to make a copy of the currently loaded Project.

Choose the Clone Project From Disk radio button when you want to select another Project to copy. In that case, the Clone Project field (see below) will become activated and you can use it to specify the Project you wish to copy.

Clone Project Field

If you choose the Clone An Existing Project checkbox and the Clone Project From Disk radio button, you can then use this field to specify the existing Project you wish to copy.

Click the icon to the right to open a file requester where you can locate and select a Project file to copy.

Template Controls

A Template is a building block for new Projects. A Template is itself a Project.

Templates let you create new Projects based on the Components already set up in one or more existing Projects. Any Project can be used as a Template. Up to 15 Template Projects can be used as a basis for starting a new Project.

Note: Template Project files must have Master Paths that match those you normally use on your computer system. If you are using Project files produced elsewhere, load the project and resave it to reset the Master Paths in the Project file to match those in your preferences file. VNS relies on the Template Project's master path to find where its data lives.

Think of each Template as a "theme". You can use separate Templates to store standard landcover data, transportation features, hydrology features, etc. that you may need to reuse in future Projects.

Templates can save a lot of time. They allow you to store and quickly reuse subsets of data commonly used in your Projects. They allow different people to update different aspects of a Project at the same time. Everyone from large organizations to single consultants can benefit by developing and reusing standard Templates.

By changing a Template Project you are automatically updating all other Projects that use the Template.

If a Template has other Templates in it, they won't be loaded when you use the Project as a Template for another Project. However, you may want to use Templates within a Template Project as a reference. For example, if you are creating a Template for Vector data you may want to give it a Template Project with DEM data for reference, to help you set up the Vector data. If you use a Template within a Template project you would typically use the same Template in the derived project. Thus your derived project would have both templates.

Once the Project has been created you can edit the Templates list from the Template Manager.

Synchronizing To Your GIS Database

Whenever you import data with the Import Wizard, you can tell VNS to re-import the data every time the project loads. This is designed for Shape files so you can update a Shape file from your GIS by automatically re-importing it every time you open the VNS Project. That way VNS will always use the latest version of the Shape file. You can even have the Import Wizard in a Template set to automatically re-import data on load.

Use Templates Checkbox

Select the Use Templates checkbox if you want to include Components from Template Projects in the New Project.

Note: You can use the Template Manager to manage Templates in Projects which use them. To open the Template Manager, select the Template Manager command from the File menu.

Template List

The Template list shows all Templates Projects available when you create a new Project.

VNS remembers this list and presents it to you as you last left it, when you last created a new Project. That way you can create a list of standard Template Projects over time. Each time you start a new Project you can choose from your list of Template Projects. Enable and disable the ones you need with the Enable and Disable icons (see below).

VNS saves your Template list in the general preferences file. If you are using the Multi-User mode, VNS saves the list in the preferences file named with your user name. The last user's Template list will also be saved to the general preferences file.

Note: The general preferences file and user preferences files contain the same types of information.

Add Template Icon

Click the Add Template icon to add an existing Project as a Template for the new Project. VNS will add the Project to the Template list on the right.

Remove Template Icon

Select a Template in the list and click the Remove Template icon if you change your mind and want to remove a Project from the Template list.

Raise and Lower Template Loading Order Icons

Use the Raise and Lower Template Loading Order Icons to change the order of Template Projects in the Template list.

Select a Template in the list and click the Raise Template Loading Order icon to move it higher in the list (loads sooner).

Click the Lower Template Loading Order icon to move the selected Template down in the list (loads later).

The order of Template Projects is important. VNS loads Components from Template Projects as the Projects are ordered from top to bottom in the Template list. If Template Projects have items of the same Component type with the same name, the last loaded Template's Component will take precedence.

VNS loads Components from each Template in three steps. First, VNS loads the Template's Image Object Library. Second, VNS loads all the Project's Components that aren't Image Objects, DEMs or Vectors. Third, VNS loads the Project's database of Vectors, Control Points and DEM pointers.

VNS must have an Image Object in memory before a Component that uses the Image Object can load. VNS must have Components loaded before hard linked Vectors can form their linkages (this doesn't matter for dynamically linked Vectors).

A Template with Ecosystems can load first with Ecosystems and their associated Image Objects. A Template with Vectors can load last, with vectors that refer to the Ecosystems in a previously loaded Template. If Vectors are dynamically linked to Ecosystems, then the Vector/Ecosystem Template order doesn't matter.

A Template with DEM pointers does not have to be first since other components don't link to DEMs. The only thing a DEM can link to is a Coordinate System. If a DEM is linked to a Coordinate System, the Coordinate System must be in the same or a previously loaded template.

When you add more vectors to a project, they are loaded after Template-based vectors.

If you create an Ecosystem that's not in a Template and you attach a vector that is in a Template, it won't work.

Once the Project has been created you can use the Template Manager to change the order of any included Templates.

Enable and Disable Template Icons

Select a Template in the list and click the Disable Template icon to disable it without removing it from the Template list. The Project will not include any Components from Disabled Templates. Click the Enable Template icon to re-enable a disabled Template.

Disabled templates are omitted from the project completely. The disabling capability is useful if you have a number of templates to choose from and only want to use one or two in a specific project. Since it is a fair amount of work to build that template list in the first place, it is better to be able to engage only a select portion of them without actually purging others from the list. The program remembers from one creation event to the next which ones were in the list and their disabled state.

Once the Project has been created you can use the Template Manager to enable or disable any included Templates.

Create & Save Button

After you choose the settings for the other controls on the New Project window, you can click the Create & Save button to create a new or cloned Project.

Cancel Button

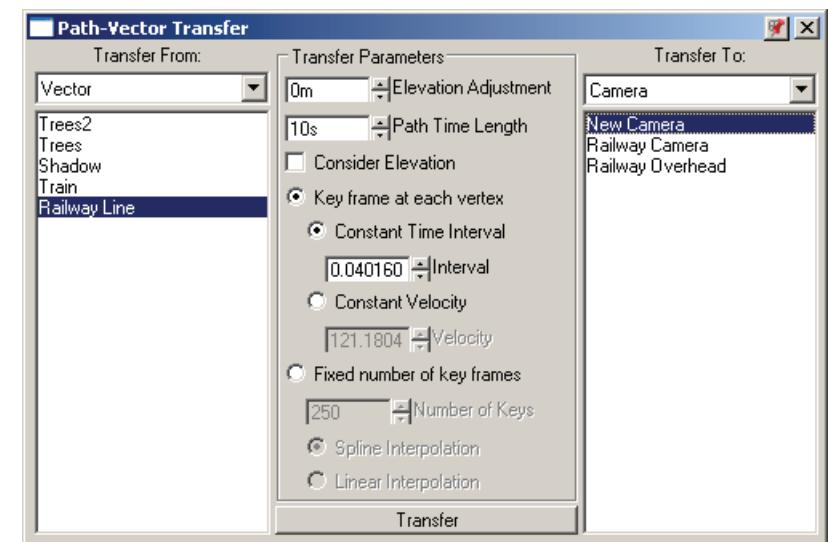
If you decide you would rather not create a new or cloned Project, click the Cancel button to close the New Project window without creating anything.

Path-Vector Transfer Window

The Path-Vector Transfer Window lets you take a source object and translate it into a destination object.

Sources and destinations can be Vectors, sets of Control Points, Camera paths, Camera Target paths, Light paths, Celestial Object paths, 3D Object paths, Wave Model paths or Cloud paths. The source object must already exist in the Project. The destination object can be an existing object or you can choose to create a new object.

For example you can select an imported Vector and turn it into a motion path for a Camera.



Transfer From Section

Transfer From Drop Box

Use the Transfer From drop box to select the type of object from which you wish to transfer. Choose from Vectors, sets of Control Points, Camera paths, Camera Target paths, Light paths, Celestial Object paths, 3D Object paths, Wave Model paths or Cloud paths.

VNS will show you the available objects that match your selection. You'll see them in the Transfer From object list, just below the Transfer From drop box.

Transfer From Object List

The Transfer From object list shows the available objects that are of the type selected in the Transfer From drop box (see above). Click the name of an object to select it for transfer.

Transfer To Section

Transfer To Drop Box

Use the Transfer To drop box to select the type of object you wish to change or create in the transfer process. Choose from a Vector, set of Control Points, Camera path, Camera Target path, Light path, Celestial Object path, 3D Object path, Wave Model path or Cloud path.

VNS will show you the available objects that match your selection. You'll see them in the Transfer To object list, just below the Transfer To drop box.

Transfer To Object List

The Transfer To object list shows the available objects that are of the type selected in the Transfer To drop box (see above). Click the name of an object to select it as a destination for the transfer operation.

Click the line beginning with “New” to create a new object of the type listed. For example, if you’ve selected “Light” in the Transfer To drop box, select “New Light” in the Transfer To object list to create a new Light with a motion path created from the object selected in the Transfer From object list on the left.

Transfer Parameters Section

Once you’ve selected objects in the Transfer From and Transfer To object lists (see above), the appropriate Transfer Parameters appear in the middle of the Path-Vector Transfer Window. The parameters you see depend on the type of objects you’ve selected.

From Vector or Control Points to Path

If you select a Vector or set of Control Points in the Transfer From object list, and a motion path (anything other than “Vector” or “Control Point”) in the Transfer To object list, you will see the following Transfer Parameters.

Elevation Adjustment Field

The Elevation Adjustment field lets you offset the elevation of the resulting path. Enter a positive number to make the path higher than the source Vector. Enter a negative number to make the path lower than the source Vector. Leave it at its default value of zero if you don’t want any elevation offset.

Path Time Length Field

Enter the length of time you’d like for the resulting motion path. If you change the Interval field’s value (see below) VNS will automatically change the Path Time Length field to compensate.

If you change the Path Time Length value and the Constant Time Interval radio button is selected, VNS will automatically change the Interval Field to compensate (see below).

If you change the Path Time Length value and the Constant Velocity Interval radio button is selected, VNS will automatically change the Velocity field to compensate for the change in total path time (see below).

Consider Elevation Checkbox

Select the Consider Elevation checkbox if you’d like the destination motion path to allow elevation changes to affect the distance between key frames or vertices (depending on whether a path or Vector is the “Transfer from” entity).

An output path will have constant velocity in the horizontal direction only if elevations are not considered or a truly constant velocity if the elevations are considered. An output Vector will have equal distances between vertices in the horizontal direction only if elevations are not considered or truly equal distances if the elevations are considered.

Key Frame at Each Vertex and Fixed Number of Key Frames Radio Buttons

Select the Key Frame At Each Vertex radio button if you want the destination motion path to have a key frame at the exact position of each of the source Vector’s vertices.

Select the Fixed Number of Key Frames radio button if you want the destination motion path to have regularly spaced key frames along the path of the source Vector.

Constant Time Interval and Constant Velocity Radio Buttons

The Constant Time Interval and Constant Velocity radio buttons are available if you select the Key Frame at each Vertex radio button (see above).

Select the Constant Time Interval radio button if you want the amount of time between each key frame to be the same. You can set the amount of time in the Interval field (see below). This could cause varying velocities along the path.

Select the Constant Velocity radio button if you want the speed of the path to be the same between each key frame. You can set the velocity in the Velocity field (see below). This could cause varying times between each key frame.

Interval Field

If you select the Constant Time Interval radio button, VNS will use the same amount of time between each key frame. You can specify that amount of time in the Interval Field.

If you change the Interval value VNS will automatically change the Path Time Length field to compensate for the time change in each segment of the path. If you change the Path Time Length value and the Constant Time Interval radio button is selected, VNS will automatically change the Interval field to compensate for the change in total path time.

Velocity Field

If you select the Constant Velocity Interval radio button, VNS will use the same velocity between each key frame. You can specify that velocity in the Interval Field.

If you change the Velocity value VNS will automatically change the Path Time Length field to compensate for the speed change in each segment of the path. If you change the Path Time Length value and the Constant Velocity Interval radio button is selected, VNS will automatically change the Velocity field to compensate for the change in total path time.

Number of Keys Field

The Number of Keys field is available if you select the Fixed Number of Key Frames radio button (see above). Enter the number of key frames you want to have arranged along the shape of the source Vector to create the destination motion path.

Spline Interpolation and Linear Interpolation Radio Buttons

If you select the Fixed Number of Key Frames radio button to create a destination motion path with regularly spaced key frames, you can then choose whether they should be placed based on a linear interpolation or a spline interpolation.

Choose the Spline Interpolation radio button if you want the path's key frame positions to be calculated using splines. This may allow a better representation of curves.

Choose the Linear Interpolation radio button if you want the path's key frame positions to be placed along line segments. This will keep the key frames along the Vector's original line segments.

From Vector or Control Points to Vector or Control Points

If you select a Vector or set of Control Points in the Transfer From object list, and a Vector or set of Control Points in the Transfer To object list, you will see the following Transfer Parameters.

Preserve Vertex Count and Change Vertex Count Radio Buttons

Select the Preserve Vertex Count radio button if you want the Transfer To Vector to have the same number of vertices as the Transfer From Vector. You can then choose if you want to keep the same vertex spacing or space the vertices evenly in the Transfer To Vector, using the Preserve Vertex Spacing or Constant Vertex Spacing radio buttons (see below).

Select the Change Vertex Count radio button if you want the Transfer To Vector to have a different number of vertices than the Transfer From Vector. You can then choose the number of vertices using the Output Vertices field (see below).

Preserve Vertex Spacing and Constant Vertex Spacing Radio Buttons

The Preserve Vertex Spacing and Constant Vertex Spacing radio buttons are available if you select the Preserve Vertex Count radio button (see above).

Select the Preserve Vertex Spacing radio button if you want the distance between each vertex in the Transfer To Vector to be identical to the distance between each vertex in the Transfer From Vector.

Select the Constant Vertex Spacing radio button if you want an equal distance between each vertex in the Transfer To Vector. VNS will space the Vertices equally along the total distance of the Transfer To Vector.

Consider Elevation Checkboxes

There are two Consider Elevation checkboxes. One is available if you select the Constant Vertex Spacing radio button. The other is available if you select the Change Vertex Count radio button.

Select one of the Consider Elevation checkboxes if you'd like the Transfer To Vector to take the Transfer From Vector's elevations into account. This will allow elevation changes to affect the distance between vertices. The output Vector will have equal distances between vertices in the horizontal direction only if elevations are not considered or truly equal distances if the elevations are considered.

Spline Interpolation and Linear Interpolation Radio Buttons

There are two sets of Spline Interpolation and Linear Interpolation Radio Buttons. One is available if you select the Constant Vertex Spacing radio button. The other is available if you select the Change Vertex Count radio button.

Choose the Spline Interpolation radio button if you want the Transfer To Vector's vertex positions to be calculated using splines. This may allow a better representation of curves.

Choose the Linear Interpolation radio button if you want the Transfer To Vector's vertex positions to be placed along line segments. This will keep the key frames along the Transfer From Vector's original line segments.

Source Vertices Display Field

The Source Vertices display field shows the number of vertices in the Transfer From Vector.

Output Vertices Field

The Output Vertices field lets you choose the number of vertices for the Transfer To Vector. It will be available if you selected the Change Vertex Count radio button (see above).

From Path to Path

If you select a motion path (anything other than “Vector” or “Control Point”) in the Transfer From object list, and another motion path in the Transfer To object list, you will see the following Transfer Parameters.

Source First Key Frame Display Field

The Source First Key Frame display field shows the first key frame of the Transfer From path.

Note: You'll see it either as a frame number or a time in seconds, depending on your choice for Time on the Units page of the Preferences Window.

Output First Key Frame Field

The Output First Key Frame field lets you set the first key frame for the Transfer To path.

Note: Enter it as a frame number or a time in seconds, depending on your choice for Time on the Units page of the Preferences Window.

Time Between First and Last Key Frames Fields

The Source Time Length and Output Time Length fields to decide whether to change how long the Copy To path lasts compared to the Copy From path.

Source Time Length Display Field

The Source Time Length display field shows you the amount of time covered by the Copy From path.

Note: You'll see it either as a frame number or a time in seconds, depending on your choice for Time on the Units page of the Preferences Window.

Output Time Length Field

The Output Time Length field lets you set the amount of time covered by the Copy To path.

If you change the Output Velocity field (see below) VNS will change the Output Time Length automatically to compensate.

Note: Enter it as a frame number or a time in seconds, depending on your choice for Time on the Units page of the Preferences Window.

Preserve Relative Velocities and Constant Average Velocity Radio Buttons

Select the Preserve Relative Velocities radio button if you want the velocity between each key frame to be the same.

Select the Constant Average Velocity radio button if you want the speed to be the same throughout the path. You can set the velocity in the Output Velocity field (see below).

Average Source Velocity Display Field

The Average Source Velocity display field shows the average velocity for the Transfer From path.

Output Velocity Field

If you select the Constant Average Velocity radio button, use the Output Velocity field to set a constant velocity for the Copy To path.

If you change the Output Time Length field (see above) VNS will change the Output Velocity field automatically to compensate.

Consider Elevation Checkbox

Select the Consider Elevation checkbox if you'd like the destination motion path to allow elevation changes to affect the distance between key frames. The output path will have constant velocity in the horizontal direction only if elevations are not considered or a truly constant velocity if the elevations are considered.

Transfer Button

Click the Transfer button to copy the "Transfer From" Vector, Control Points or motion path to the "Transfer To" Vector, Control Points or motion path. If the Transfer To item is a Vector or set of Control Points, it will appear in the Database Editor's Objects list and in the Scene-At-A-Glance.

Preferences Window

The Preferences window lets you configure many aspects of Visual Nature Studio.

General Page

The General page lets you select Startup Operations, Status Log Messages and Scene-At-A-Glance display limits.

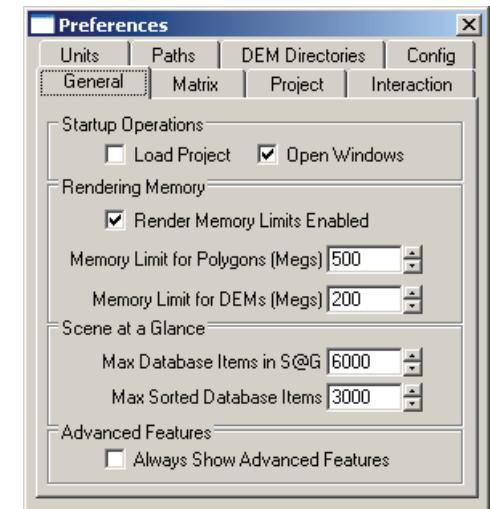
Startup Operations Section

Load Project Checkbox

Select the Load Project checkbox if you want VNS to load the Resume Project automatically when you start the program.

Open Windows Checkbox

Select the Open Windows checkbox if you want VNS to open the windows of a Project when you open the Project. VNS will open the windows that were open when you last saved the Project.



Rendering Memory Limits Section

Render Memory Limits Checkbox

Select this checkbox if you wish to enable Render Memory Limits

Memory Limit for Polygons Field

In this field, enter the number of Megabytes (Mb) used for rendering polygonal objects (3DOs) in your scene. This field is only relevant if Render Memory Limits are enabled (see above)

Memory Limit for DEMs Field

In this field, enter the number of Megabytes (Mb) used for rendering Terrain models (DEMs) in your scene. This field is only relevant if Render Memory Limits are enabled (see above)

Scene-At-A-Glance Display Limits Section

Some operating systems have trouble showing too many items in a “tree view” such as the VNS Scene-At-A-Glance. Because Projects may have huge amounts of Objects in the Database, showing them all in the Scene-At-A-Glance could bring your system to its knees. To prevent this, you can limit the number of Database Objects that will be listed in the Scene-At-A-Glance.

You can always see all of your Database Objects in the Database Editor.

Max Database items in S@G Field

In this field, enter the maximum number of items you wish to be displayed in the Scene-At-A-Glance

Max Sorted Database Items Field

In this field, enter the maximum number of items you wish to be sorted in the Scene-At-A-Glance

Advanced Features Section

Always Show Advanced Features Checkbox

Enable this checkbox if you wish to always see the advanced features in property pages of Editors (see Show Advanced Features Icon).

Matrix Page

Matrix Layout Section

Matrix Layout Icons

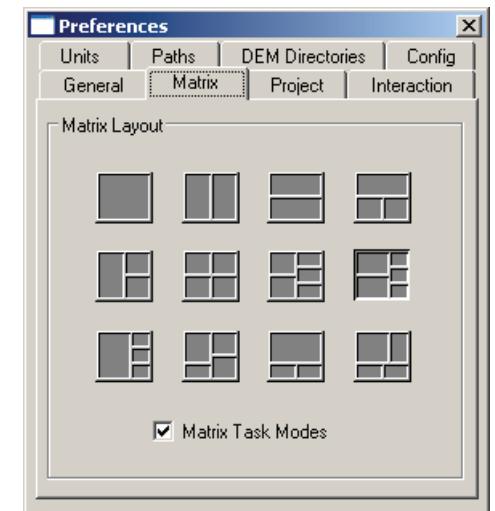
Select the Matrix Layout icon that represents the number and arrangement of cells you want to see in the Matrix.

Matrix Task Modes checkbox

Select the Matrix Task Modes checkbox to make the Editors in the Matrix respond the current Task Mode. When you switch Task Modes, any open Editors in the Matrix that do not belong to the current Task Mode will be hidden. Any open Editors in the Matrix that do belong to the current Task Mode will be shown.

This lets you focus the VNS interface on specific tasks. You can switch between different set of Editors by switching Task Modes.

Deselect the Matrix Task Modes checkbox if you want the Matrix to ignore the current Task Mode. Then when you switch Task Modes VNS will not change the Editors it shows in the Matrix. This can be useful if you only want Task Modes to affect the Scene-At-A-Glance.



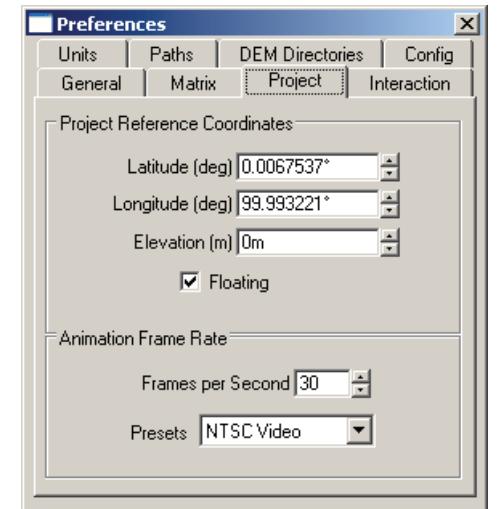
Project Page

Project Reference Coordinates Section

Project Prefs lets you enter Project reference coordinates. These coordinates are latitude/longitude/altitude values.

The Project Reference Coordinates let programs agree where zero is. They provide a way for VNS to put that point at a specific place on the planet. The Project Reference Coordinates also provide a convenient place for VNS to reference texture generation and as an option for referencing vectors.

If you are trying to relate a project area to a coordinate system from an external program such as AutoCAD or MAX, the Project Reference Coordinates give you that ability. They let you put the XYZ zero position from the external program at a specific place on the planet in VNS. Simply set the Project Reference Coordinates to that point on the terrain and any external data you import will be referenced to that spot if you choose.



For textures, the Project Reference Coordinates describe the point where the XYZ texture axes come together and texture coordinates are zero. It is best for textures if the Reference Coordinates are somewhere close to the center of the Project's terrain. If the Reference Coordinates are too far away from the center of the terrain, textures can become skewed.

Latitude Field

This field is provided for you to enter the project reference latitude in degrees. This is only relevant if the Floating checkbox (see below) is deselected.

Longitude Field

This field is provided for you to enter the project reference longitude in degrees. This is only relevant if the Floating checkbox (see below) is deselected.

Elevation Field

This field is provided for you to enter the project reference elevation in meters. This is only relevant if the Floating checkbox (see below) is deselected.

Floating Checkbox

The Project Reference Coordinates are set to be floating when you create a new project. This means they set themselves to be at the middle of your terrain as you add DEM data. Every time you add more DEM data, they will change.

The Project Reference Coordinates will remain floating unless you specifically set them or turn floating off. If you are working with an external CAD or 3D program it's a good idea to turn floating off before you start doing any serious interaction between programs. If the Project Reference Coordinates should change in the middle of a project, your shared reference between programs will be inaccurate.

Animation Frame Rate Section

These are Preferences for the rate of playback when you click the play button on the Animation Toolbar. VNS can play a preview in approximately real time. VNS will skip frames to achieve this.

Note: This is used for setting playback speed when using the Play button on the Animation toolbar. It is also used when performing Frames to Seconds conversion when VNS is displaying time in frames, or when the user enters a value in frames while VNS is displaying time as seconds.

Choose an animation preview rate. Presets let you choose common rates.

Frames per Second Field

This field allows you to set the Frames Per Second value manually.

Presets Dropdown Box

This Dropdown Box lists a series of presets to allow fast selection of the correct Frames Per Second value for your project.

Units Page

The Units page lets you set the units used throughout the program for time, distance, height, latitude and longitude.

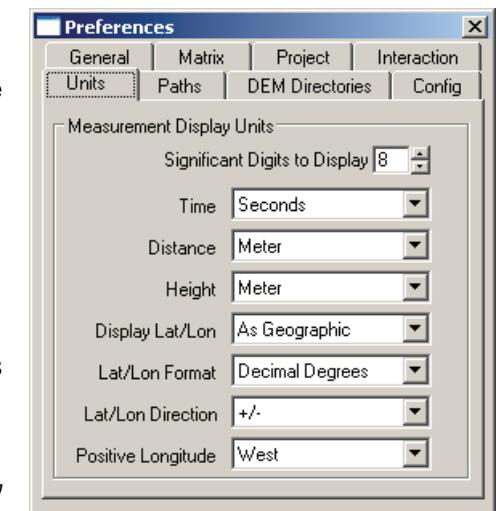
VNS will display the units you choose in each field that uses the units throughout the program.

Measurement Units Section

Significant Digits to Display Field

This field allows you to specify the number of significant digits that will be displayed in numeric fields throughout the program.

Note: Calculations are still performed internally using full precision. The number of significant digits can, however, have an effect on the accuracy of your project if you copy/paste values between display fields, as some rounding will inevitably happen in these situations.



Time Field

You can choose to display time throughout the program in either seconds or frames (See "Animation Frame Rate" above).

Distance Field

You can choose to display distance throughout the program in a variety of English, metric or survey units.

Height Field

You can choose to display height throughout the program in a variety of English, metric or survey units.

Display Lat/Lon Field

You can choose to display latitude and longitude throughout the program in either geographic or projected units. This only matters when the Project's Coordinate System, as set in the Planet Options Editor, is not geographic.

Lat/Lon Format Field

You can choose to display latitude and longitude throughout the program as decimal degrees or degrees, minutes, seconds.

Lat/Lon Direction Field

You can choose to display the direction of latitude and longitude throughout the program as plus/minus (+/-) or N/S and W/E.

Positive Longitude Field

You can choose to display positive longitude as West or East.

Paths Page

The Paths page lets you set the Master Paths and Subordinate Paths VNS uses to find the data for your Projects (see the File Flexibility chapter in your "Using VNS" manual).

Master Paths

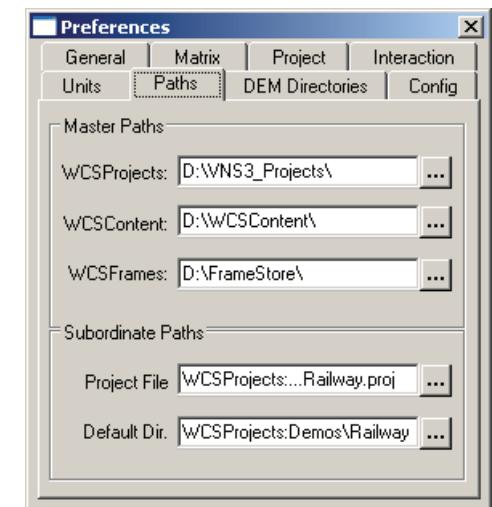
Master Paths are aliases to real places on your hard disk or network. Enter them once here, and then use the aliases everywhere else in the program.

There are two very good reasons to use Master Paths.

- 1) By using Master Paths you can create portable Projects that others can easily open on different computer systems.**
- 2) By using Master Paths you can create Projects that can be easily used for network rendering.**

So remember: USE MASTER PATHS. Why? For project portability and easy network rendering.

Note: For more about Master Paths, see Master Paths - Finding Projects and Components.



Subordinate Paths

The Subordinate Paths on the Paths page let you specify where the Project file and the Project's Default directory live. To make them relative to Master Paths, use a Master Path as the first part of a Subordinate Path. This is highly recommended!

Note: The Default directory is a place to store a variety of files associated with the Project, such as DEM files and Fractal Depth Map files.

Simply enter "WCSProjects:" into the Default Directory field and then the name of the Default directory. If you want your Project to be in the Default directory, put the name of the Default directory after "WCSProjects" in the Default Directory Field.

If you ever have problems with VNS not being able to find a project, simply enter "WCSProjects:" into the Project File field and then the name of the Project. "WCSProjects:" is a stand-in for the Master Path. When VNS looks for your Project file, it will automatically combine the Master Path in the WCSProjects: field with the relative path in the Project File field to create the actual path to the Project.

Then enter "WCSProjects:" into the Default Directory field and then the name of the Default directory. "WCSProjects:" is a stand-in for a Master Path (see above). When VNS looks for your Default directory, it will automatically combine the Master Path in the WCSProjects: field with the relative path in the Default Directory field to create the actual path to the Default directory.

DEM Directories Page

DEM Directories page lets you edit the Directory List. Here you can tell VNS the directories where you want it to search for DEMs during viewing and rendering operations.

The Directory List Editor also is where you set the Default Directory for the Project. The Default Directory is the directory into which VNS will automatically save new DEM Objects and associated files such as Fractal Depth Maps.

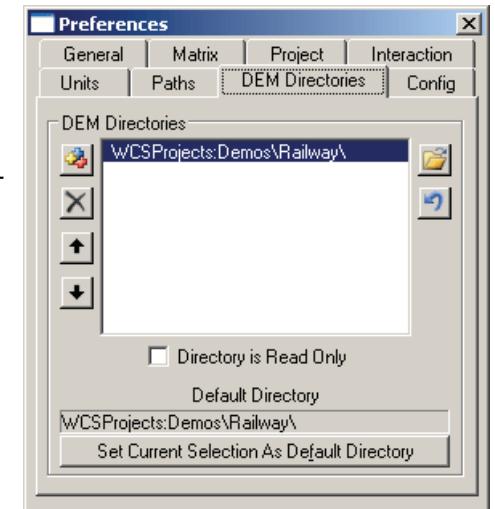
VNS will also use this directory to create Fractal Depth Maps for DEMs that are in other Directories. That way each Project can have its own set of Fractal Depth Maps even when they share DEMs. This is important since Fractal Depth Maps depend on Camera paths, and each Project will likely have different Camera paths.

Directory List

The List area of the Directory List window shows you a list of directories in order of search priority. The topmost entry has the highest search priority, the bottom entry, the lowest.

When VNS needs to locate a DEM file it begins with the first path in the list. If it doesn't find the DEM in that directory it goes on to the second and so on until it either finds the DEM or exhausts all the paths in the list.

You can click on the directory names in the list and use the commands in the buttons at the bottom of the window to make changes to the Directory List. For instance, the Move command moves the selected item to wherever you want it. Swap will exchange the selected item with another item you select. Remove will delete an item from the list if it is no longer needed.



Default Directory Display Field

The Default Directory display field shows the path to the Project's Default Directory (see below).

Set Current Selection As Default Directory Button

Use the Set Current Selection As Default Directory button to choose which of the directories in the list will be the Default Directory.

The Default Directory is where VNS will put new DEMs and related files like Fractal Depth Maps.

You should normally set this to the directory associated with the Project you're using; the directory with the same name as the Project.

For instance when using the GrandCanyon.proj Project you would set the Default to the GrandCanyon directory unless you are importing new DEMs and you want them to go in a different directory. You might want new DEMs to go to a different directory if you are building a library of DEMs for use by various Projects.

You don't need to change the Default Directory when you import DEMs but it can help keep directory sizes manageable. Large Projects may use many DEMs.

How to choose the Default Directory:

- **Select the desired entry in the list by clicking it with the mouse.**
- **Click the Set Current Selection As Default Directory button.**

You'll see the default directory name in the display field above the button.

Note: If you want to make a directory the Default Directory and it's not in the Directory List, you have to first add it to the list (see "Add" below). Then follow the above outlined procedure. You can later remove the name from the list if you desire, but normally you would want it in the list.

Add Button

Use the Add button to add an entry to the Directory List. If you create a new directory to store DEMs you'll need to add its name to the Directory List in order to use the new directory in the current Project.

If you load a new Database you should check the list to be sure that all the required DEM paths are in the list.

When you load a Project, the Directory List will be loaded as part of the Project file and additions will seldom be required. You should update the list when you Append a Database to the one in memory or you add an item to the Database using the Add command in the Database Editor.

If you receive messages in the Status Log window during Viewing or rendering, something that says VNS is not able to find or open certain DEM files, you should check the Directory List to be sure that all DEM files are located in the directories listed.

How to add an entry to the Directory List:

- **Click the Add button.**

You'll see a standard file dialog.

- **Use the dialog to find the desired directory.**
- **Click the OK button in the file dialog.**

Note: click the Cancel button if you decide to abort the addition.

The new entry will be added to the bottom of the list.

You can change its position in the list with the "Move" and "Swap" buttons (see below).

When VNS looks for Objects, VNS will search the directories in the order they are arranged in the list.

Swap Button

Use the Swap button to interchange two Directory List entries. This will reverse their search priority.

When it looks for DEMs, VNS will search the directories in the order they are arranged in the list. You can put the directories that have the most DEMs toward the top of the list. That way VNS will be more likely to find DEMs after looking in fewer directories. The fewer directories VNS has to look through, the faster it will find the DEMs.

VNS searches very quickly, so this will only make a very slight difference in the context of overall rendering time.

How to swap Directory List entries:

- **Select one of the directories you want to swap by clicking it with the mouse.**
- **Click the Swap button.**

The pointer will change to indicate a swap operation is in progress.

- **Click another directory and the two will be interchanged.**

Note: To cancel a swap operation click on the "Cancel" button at the lower right corner of the window.

Move Button

Use the Move button to move a Directory List entry from one position to another. This will change its relative search priority.

How to move a Directory List entry:

- **Select the list entry you want to move by clicking it with the mouse.**
- **Click the Move button.**

The pointer will change to indicate a copy operation is in progress.

- **Click in the list at the point where you want the new entry to go.**

The entry will be inserted in the list at the position you chose. All lower priority entries will be moved down one position.

Note: To cancel a move operation click on the "Cancel" button at the lower right corner of the window.

Remove Button

Use the Remove button to remove an entry from the Directory List.

There is little harm in having unneeded entries in the list other than the very slight delay entailed every time a directory is scanned for a file.

You might consider building a master list of all DEM directories on your system and using that for all Projects rather than having custom lists for each Project. Do whatever seems best to you.

As a compromise you might sort the master list into the most efficient prioritization for each Project.

How to remove entries from the Directory List:

- **Click the directory you want to remove from the Directory List.**
- **Click the Remove button.**

The directory will disappear from the list and all subsequent directories will move up one position.

Read Only Button

Use the Read Only button to mark a Directory List entry as "Read Only." VNS will then not overwrite DEM files in this path during re-save operations.

Normally when VNS re-saves a DEM file after some operation has been performed on it, the DEM will be re-saved to the same location as the original file, overwriting the original.

If you want to preserve the original you can mark the DEM's directory as read-only. This forces VNS to save the new version in the Default Directory instead of overwriting. You can then remove the read-only directory from the Directory List and VNS will use the new version of the DEM.

You might want to mark a directory as read-only when you are using data from a CD-ROM, since you can't write data to a CD-ROM. By making the directory read-only, VNS will not try to write to it.

Note: If you don't make a CD-ROM directory read only, you will see pesky error dialogs generated by your computer's operating system when you try to save.

If you are not changing your data in any way it doesn't matter if a directory is marked read-only or not.

Note: The "Read Only" command will not apply for the directory that you have chosen to be the Default Directory for a Project, since that's where new Object files will be stored when you create them.

How to protect a Directory List entry from being overwritten:

- **Activate the desired list entry and select "Read Only."**

An asterisk will appear in front of the entry in the list to denote it as "Read Only." If an entry is already set to Read Only, select the Read Only command again to toggle it off.

Load Directory List from Project File Button

The Load Directory List from Project File button lets you load an existing Directory List from another Project file on your hard disk.

When you create a new Project you may wish to use the same Directory List that is used by a different Project. You can use this command to load only the Directory list from the other Project file without loading the rest of the Project.

This makes it easy to use the same Directory List for all Projects as suggested above.

Once again, be sure to save the Project file to preserve any changes to its Directory List.

How to load a Directory List

- **Click the Load button.**

You'll see a standard file requester.

- **Select the Project file which contains the Directory list you desire.**

The new list will load without affecting other Project-related items.

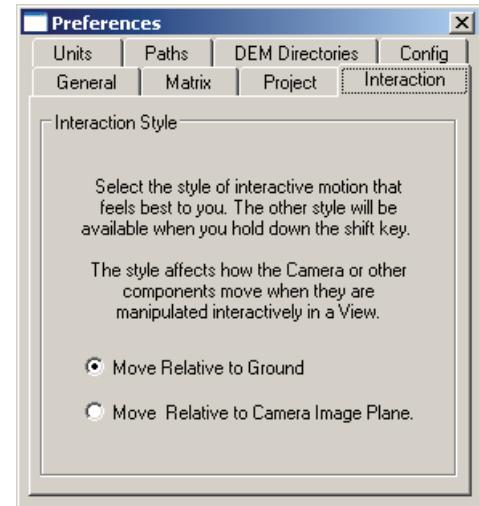
Undo All Directory List Changes in this Window Button

Click the Undo All Directory List Changes in this Window button if you want to revert the DEM Directory list to the state it was in when you last opened the Preferences window.

Interaction Page

The Interaction page lets you select the style of motion VNS will use when you drag Components in a View.

Choose the Move Relative to Ground interaction style for interaction similar to LightWave interaction.
Choose the Move Relative to Camera Image Plane interaction style for interaction similar to MAX.



Config Page

The Configuration page may have several options for troubleshooting, altering program behavior and certain other options as necessary. Most are likely to be options 3D Nature may ask you to change should you need to troubleshoot a problem on your system.

If you are not troubleshooting a problem on your system you should avoid changing most of these Options, adding new Options or deleting Options.

As of this writing, the one exception is the Suppress_Render_Notify Option. You may want to change its value (see below) to choose whether or not to see a requester window after a rendering event.

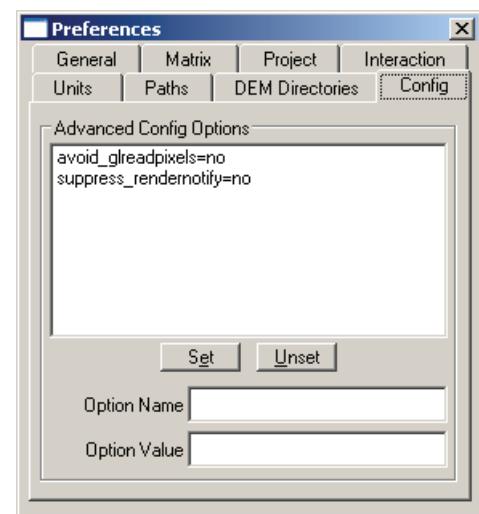
Using the Configuration Options Controls

The options are shown in the Advanced Config Options list. All available Advance Config Options are detailed in Appendix E: Advanced Configuration Options.

To change the name or value of a Config Option, click the Option in the list and change the name or value in the Options Name and Option Value fields. You must click the Set button for the changes to take effect.

To add a Configuration Option, enter the name of the Option in the Option Name field. Give it an appropriate value in the Option Value field. You must click the Set button for the changes to take effect. It is unlikely you will ever need to do this unless you are investigating a problem on your system with 3D Nature.

To remove a Configuration Option, select it in the Options list and click the Unset button. It is unlikely you will ever need to do this unless you are working out a problem on your system with 3D Nature.



Note: VNS will not save these Advanced Config options into the VNS.Prefs file unless you have loaded a project. If you start VNS, change an option and immediately quit, the change will not be resaved. To ensure your changes are saved, make them after you have loaded a Project. Your changes will then be saved into the VNS.Prefs file the next time you save the Project or quit VNS.

Realtime Foliage File Preferences Window

The Realtime Foliage File Preferences Window is from where you adjust parameters relating to both the creation and display of Realtime Foliage Files. Before selecting the Create Realtime Foliage File command from a view's popup menu, it is advisable that you first set suitable parameters for the creation, storage and display of such file(s).

Display Page

File Display Criteria Section

This section allows you to control various aspects of the display of Realtime Foliage files. Be aware that this does not control the realtime display of Foliage Effects, or of standalone 3D Objects.

Distance Criteria

By modifying the Distance Criteria fields, you can optimize the display of Realtime foliage, only to a range of distance values where foliage is visible within your scene. This can result in much improved OpenGL performance without any loss in relevant detail. For example, for a scene where there are many realtime trees being displayed, but in which the camera is near the ground, the Far distance parameter can be set to just beyond the first few trees from the camera. There will be sufficient trees displayed to give a sense of the "forest" beyond, and for you to animate the camera path accurately between trees, but without the OpenGL overhead of displaying several thousand trees on-screen at once.

Near Field

This field defines the closest point from the camera that will be considered for the display of Realtime Foliage Images. No realtime images will display between the camera, and this value.

Far Field

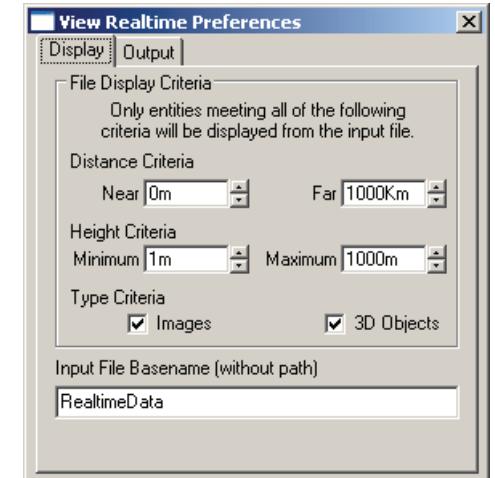
This field defines the maximum distance from the camera that will be considered for the display of Realtime Foliage Images. No realtime images will be displayed beyond this distance from the camera.

Height Criteria

By modifying the Height Criteria fields, you can optimize the display of Realtime foliage, only to a range of relevant foliage heights. This can result in much improved OpenGL performance without any loss in relevant detail. For example, for a scene where there are many thousands of small plants in the foreground (grass, weeds and the like), but none of these plants need representing in OpenGL to gain an accurate sense of the scene, you might set the minimum height field to be 2 meters, so that no understory-type vegetation will display. Trees and other objects over 2 meters high, will display fine.

Minimum Field

This field defines the minimum height that an object must attain before being considered for display in realtime OpenGL views.



Maximum Field

This field defines the maximum height that an object may attain before being considered too tall for display in realtime OpenGL views.

Type Criteria

Images Checkbox

Select the Images checkbox if you wish to view Image Objects that are part of an ecotype, in realtime OpenGL. Deselecting this checkbox will disable the display of image objects stored within the loaded Realtime Foliage file.

3D Objects Checkbox

Select the 3D Objects checkbox if you wish to view 3D Objects that are part of an ecotype, in realtime OpenGL. Deselecting this checkbox will disable the display of 3D objects stored within the loaded Realtime Foliage file.

Input File Basename Field

Enter a base filename into this field to select the realtime foliage file you wish to load when you select the Load Realtime Foliage File command from a view's popup menu. This allows you to generate and store several sets of Realtime files, each with different creation criteria, and select the one you want by entering its basename in this field.

Output Page

File Output Criteria Section

This section allows you to control various aspects of the creation of Realtime Foliage files

Distance Criteria

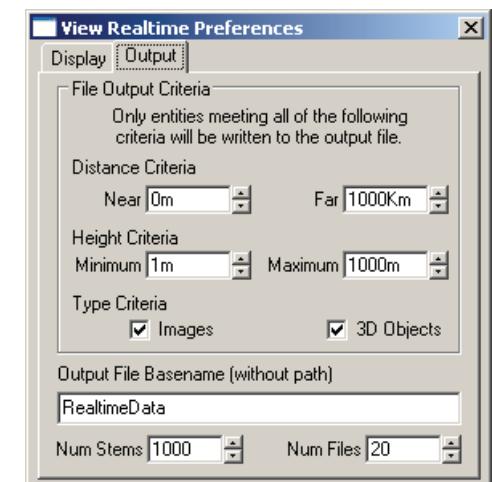
By modifying the Distance Criteria fields, you can optimize the display of Realtime foliage, only to a range of distance values where foliage is visible within your scene. This can result in much improved OpenGL performance without any loss in relevant detail. This can also be achieved by generating more realtime foliage images than necessary in the file, at the expense of generation time, loading time and storage space, and using the display parameters to control which if the images appear in realtime views.

Near Field

This field defines the closest point from the camera that will be considered for the creation of Realtime Foliage Images. No realtime images will be added to the realtime foliage file(s) if they fall between the camera and this value.

Far Field

This field defines the farthest point from the camera that will be considered for the creation of Realtime Foliage Images. No realtime images will be added to the realtime foliage file(s) if they fall beyond this value.



Height Criteria

By modifying the Height Criteria fields, you can optimize the display of Realtime foliage, only to a range of relevant foliage heights. This can result in much improved OpenGL performance without any loss in relevant detail. This can also be achieved by generating more realtime foliage images than necessary in the file, at the expense of generation time, loading time and storage space, and using the display parameters to control which if the images appear in realtime views.

Minimum Field

This field defines the minimum height that an object must attain before being considered for inclusion in a realtime foliage file.

Maximum Field

This field defines the maximum height that an object may attain before being excluded from a realtime foliage file.

Type Criteria

Images Checkbox

Select the Images checkbox if you wish to add Image Objects that are part of an ecotype, into realtime foliage files. Deselecting this checkbox will exclude Image Objects from inclusion in realtime foliage files.

3D Objects Checkbox

Select the 3D Objects checkbox if you wish to add 3D Objects that are part of an ecotype, into realtime foliage files. Deselecting this checkbox will exclude 3D Objects from inclusion in realtime foliage files.

Output File Basename Field

Enter a base filename into this field to define the name used for Realtime Foliage Files generated with this set of preferences. This allows you to generate and store several sets of Realtime files, each with different creation criteria.

Num Stems Field

This field controls the maximum number of stems (individual image objects) that will be stored in one Realtime Foliage File, for optimal loading and display. You are recommended to leave this value at the default unless testing has shown that changing it improves performance.

Num Files Field

This field controls the maximum number of Realtime Foliage Files that will be generated for this set of preferences. You are recommended to leave this value at the default unless testing has shown that changing it improves performance.

Render Control Window

The Render Control window lets you render images and animations. You can open it by clicking the Render Control icon in the Icon Toolbar.

To render, you must first have a Camera (see Camera Editor), Render Job (see Render Job Editor) and Render Options (see Render Options Editor).

The Render Job lets you select a Camera (see Camera Editor) and a set of Render Options (see Render Options Editor). The Render Options let you control how many frames to render, set the frame resolution, choose what Components will be rendered, specify what files will be saved and select other rendering choices.

To render, click the Go button (see below).

Note: If it is open, the Status Log shows errors, warnings, messages and data about the rendering in progress.

Scheduled Jobs List

The Scheduled Jobs list shows all the Render Jobs in your Project.

Note: You can add or remove Render Jobs from the Scene-At-A-Glance.

You can click any Render Job in the list to select it. Information about the selected Render Job is shown on the right side of the window, in the Selected Job section.

You can double-click a Render Job's name in the Scheduled Jobs list to open the Render Job Editor, ready to edit the selected Render Job.

You can change the enabled status and render priority of the selected Render Job using the Scheduled Jobs icons (see below).

Note: You can also enable or disable a Render Job using the Enabled checkbox in the Render Job Editor.

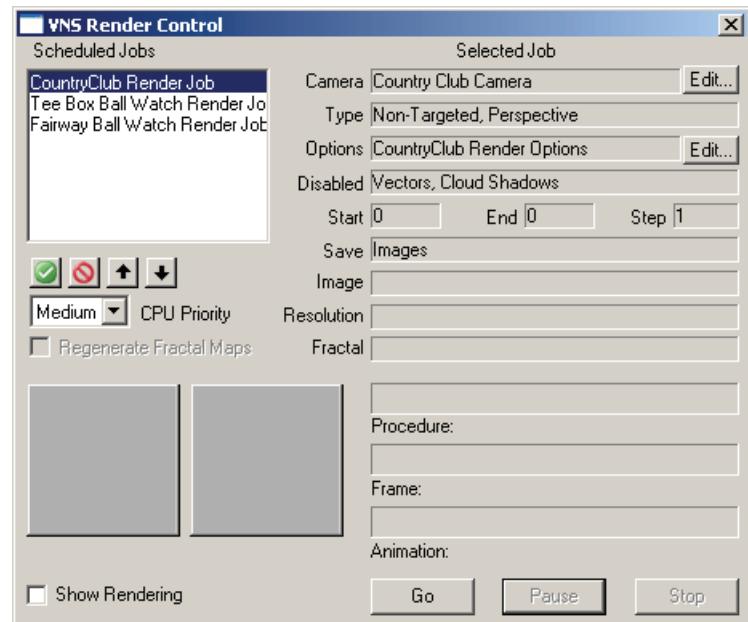
Enabled Render Jobs are shown in black. Disabled Render Jobs are shown in gray. Enabled Jobs will render in order from top to bottom when you click the Go button at the bottom of the Render Control window. Disabled Render Jobs will not render.

Scheduled Jobs Icons

The Scheduled Jobs icons are just below the Scheduled Jobs list. They let you enable or disable a selected Render Job, or change its priority in the Scheduled Jobs list.

Enable Render Job Icon

You can enable a selected Render Job with the Enable Render Job icon. Enabled Jobs will render in order from top to bottom when you click the Go button at the bottom of the Render Control window.



Enabled Render Jobs are shown in black. Disabled Render Jobs are shown in gray.

Note: You can also enable or disable a Render Job using the Enabled checkbox in the Render Job Editor.

Disable Render Job Icon

You can disable a selected Render Job with the Disable Render Job icon. Disabled Render Jobs will not render.

Enabled Render Jobs are shown in black. Disabled Render Jobs are shown in gray.

Note: You can also enable or disable a Render Job using the Enabled checkbox in the Render Job Editor.

Raise Job Priority Icon

Click the Raise Job Priority icon to move the selected Render Job higher in the Scheduled Jobs list. If the Render Job is enabled, moving it higher in the list will increase its render priority.

This will also cause VNS to renumber the Render Priority values of all Render Jobs as seen in the Priority field of each Render Job Editor.

When you click the Go button at the bottom of the Render Control window, VNS will start rendering any enabled Render Job that is highest in the list, and then render the next Render Job in the list and so on, until all Render Jobs in the list have been rendered.

Lower Job Priority Icon

Click the Lower Job Priority icon to move the selected Render Job lower in the Scheduled Jobs list. If the Render Job is enabled, moving it lower in the list will decrease its render priority.

This will also cause VNS to renumber the Render Priority values of all Render Jobs as seen in the Priority field of each Render Job Editor.

When you click the Go button at the bottom of the Render Control window, VNS will start rendering any enabled Render Job that is highest in the list, and then render the next Render Job in the list and so on, until all Render Jobs in the list have been rendered.

CPU Priority Drop Box

The CPU Priority drop box lets you choose how VNS uses your computer's CPU processing power during rendering. You can select a priority of Low, Medium or High for VNS to use when rendering images. This will generally work as described below, but some operating systems are better at this than others.

Note: CPU stands for "Central Processing Unit". If your computer has more than one CPU, VNS will just use one of them. You can run another iteration of VNS to use the other CPU for rendering by setting the Frame Step on each iteration to 2, thus rendering alternate frames on each CPU. With a renderfarm of 5 CPUs, you could manually run 1 iteration on each CPU, and set the Frame Step value to 5. It is, however, easier to manage a VNS renderfarm by using the supplied render control utility, SuperConductor.

Low

Select Low when you want VNS to not interfere with most other programs during rendering. This way you can multitask other programs as if VNS wasn't even running, and yet when you aren't using CPU cycles VNS will grab them and use them to calculate images.

Medium

Select Medium to give VNS the same priority as most other programs. Use this when you're on a deadline and you want VNS to grab its share of CPU cycles. You can still use other programs, but they may slow down somewhat.

High

Select High when you want VNS to have all the CPU cycles it can get. Most other programs will not get any CPU cycles if you choose High, so don't select this option if you need to use your computer for anything else while you render. As a practical matter, this is about the same as choosing Medium and then not using your computer to run other programs.

Current and Last Image Thumbnails

The two thumbnail images show small versions of the frames as you render.

The thumbnail on the left shows an image for the last frame rendered. This will be gray at first. After you've rendered a complete frame, it will appear here. VNS will show the frame number and the amount of time it took to render under the thumbnail.

The thumbnail on the right shows an image for current frame. This will be black when you begin rendering, and will update at major stages of the rendering process.

Show Rendering Checkbox/Rendering in Progress Window

The optional Rendering in Progress window shows a preview of the image as it renders.

Click the Show Rendering checkbox on the Render Control window if you want to open the Rendering in Progress window during rendering.

Click the close gadget on the Rendering in Progress window or deselect the Preview Draw checkbox if you want to close the Rendering in Progress window during rendering.

Important: Having the Render Preview window open will slow rendering. Close it for faster rendering.

Selected Job Section

The Selected Job section shows information about the selected Render Job, including:

- **The Camera**
- **The Camera Type**
- **The Render Options**
- **What is disabled in the Render Options**
- **The Start and End Frames and Frame Step**
- **The base name of the rendered image(s)**
- **Whether a Z Buffer file is also being saved**
- **The resolution and aspect ratio of the image(s)**
- **The Fractal type and depth**

The Selected Job also shows Status bars and information for the current rendering procedure including:

- **The current frame**
- **The entire animation**
- **Estimated times of completion**
- **Elapsed rendering time**
- **The current rendering procedure**
- **The range of frames to be rendered**
- **The number of the currently rendering frame**

Camera Edit Button

Next to the Camera display field is the Camera Edit button. Click it to open the Camera Editor ready to edit the Camera for the selected Render Job (see Render Job Editor). The selected Render Job is the Render Job selected in the Scheduled Jobs list (see above).

This makes it easy to make changes to the Camera settings before you begin rendering.

Options Edit Button

Next to the Options display field is the Options Edit button. Click it to open the Render Options Editor ready to edit the Render Options for the selected Render Job. The selected Render Job is the Render Job selected in the Scheduled Jobs list (see above).

This makes it easy to change any of the Render Options before you begin rendering.

Go Button

Click the Go button to begin the rendering process.

Pause Button

Click the Pause button to temporarily halt the rendering process. Click the Pause button again to restart the rendering process where you left off.

Stop Button

You can abort the rendering by clicking the Stop button.

Scale/Delete Key Frames Window

The Scale/Delete Key Frames window lets you either change or remove key frames.

The window will be ready to act on the Active Item, all Components relating to the Active Item or all animated parameters in the Project. The window lets you choose to affect a single frame, a frame range or all frames.

To open it select the item you want as the Active Item. Then click the Remove Key Frames icon in the Animation Toolbar or the Scale Key Frames icon in the Animation Toolbar. This window can also be invoked from the popup menu associated with the Animation Operations Icon for various items in the program.

If you open it with a Remove Key Frames icon, the Remove Key Frames radio button will be selected.

If you open it with the Scale Key Frames icon the Scale Key Frames radio button will be selected.

Remove Key Frames Radio Button

Select the Remove Key Frames radio button if you want to delete key frames from the Project.

Scale Key Frames Radio Button

Select the Scale Key Frames radio button if you want to change key frame positions in time. You can adjust the frame numbers of existing key frames.

You can scale a single Parameter, all Parameters or a Component category. You can scale a single key frame or all key frames.

Operate On Radio Buttons

Use the Operate On radio buttons to select the items to delete or scale.

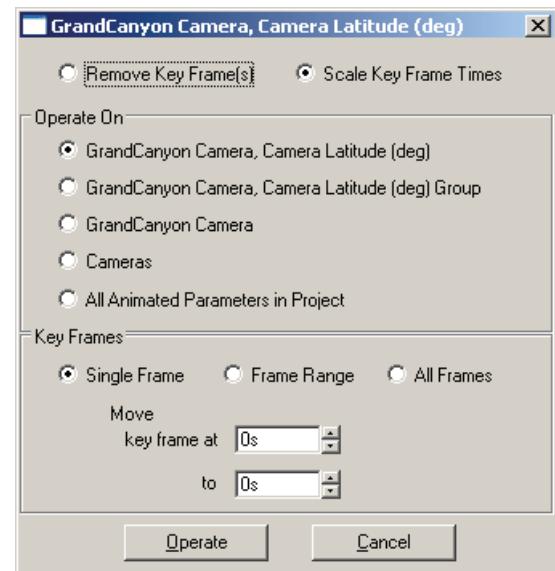
The top four items available here will depend on the Active Item when you opened the window. The Active Item is shown in the middle of the Animation toolbar.

Note: If you choose an item that doesn't have any key framed parameters, no key frame deleting or scaling can be performed.

The bottom radio button lets you select All Animated Parameters in the Project.

Key Frames Controls

The Key Frames controls will change depending on whether you are deleting or scaling key frames, and depending on what Operate On radio button you select.



Single Frame Radio Button

Select the Single Frame radio button to operate on a single key frame for the item(s) in the Operate On section (see above).

For removing key frames VNS will show the current frame but you can change it if you wish.

For scaling key frames VNS will show the current frame in the Key Frame At and To fields. Change the At field to that of an existing key frame and the To field to where you want that key frame moved.

Frame Range Radio Button

Select the Frame Range radio button to operate on a range of key frames for the item(s) in the Operate On section (see above).

For removing key frames VNS will show the current frame range in two fields. Change the first field to the beginning of the range you want to remove and the last field to the end of the frame range you want to remove.

For scaling key frames VNS will show two frame ranges. Enter the first and last frames of the range you want to move in the top two fields. Enter the first and last frames of where you want the first frame range to be moved in the second set of fields. If the size of the range is the same, the frame range will be moved, if it is a different amount, then the range will be scaled up or down as necessary in order to fit.

All Frames Radio Button

Select the All Frames radio button to operate on all key frames in the Project for the item(s) in the Operate On section (see above).

For removing key frames there's nothing else you need to enter here.

For scaling key frames enter the first and last frames of the range where you want to move all the key frames in the Project.

Operate Button

Use the Operate button to delete or scale the designated key frames for the designated items. VNS will do the operation and close the window.

Cancel Button

Select the Cancel button to close the Scale Keys window without making any changes to the key frames.

Scale Vector Elevations Window

You can open the Scale Vector Elevations window by clicking the Scale Vector Elevations button on the Vector Profile Editor.

Use the Scale Vector Elevations window to change the elevation of all the vertices in the Vector Object. You can either multiply all the elevations by a scaling value, or add the same value to all the elevations using the shift value.



Scale Field

To multiply all elevations, enter a number in the Scale field. Use a decimal number less than one if you want to scale the elevations smaller. Use a number greater than one to scale the elevations larger.

After you enter your number the Scale Values button will automatically be selected.

Shift Field

To add or subtract all elevations, enter a number in the Shift field. Use a negative number if you want to subtract from all the elevations. Use a positive number to add to the elevations.

After you enter your number the Shift Values button will automatically be selected.

Operate Button

After you use the Scale or Shift fields (see above), click the Operate button to tell VNS to scale or shift the elevations. You'll see the graph change in the Vector Profile Editor.

Scene Export Window

Select the Scene Export command to open the Scene Export window.

The Scene Export window lets you export scene files and reference DEMs as 3D Objects to supported external 3D programs. Currently supported programs include LightWave 3D, Inspire 3D and 3D Studio MAX.

Export File Format Drop Box

Choose the format you'd like to export. Currently supported formats include LightWave 3D (versions 5.x and before), Lightwave 3D 7.x (for versions and 6.x and later) and 3D Studio.

Note: For Inspire 3D select the LightWave 5.x format.

Export Entity Radio Buttons

Select the Scene radio button if you want to export the scene.

Select the Scene + DEM radio button if you want to export the scene along with downsampled reference DEMs as 3D Objects. The DEM objects will be in LightWave or 3D Studio format, depending on what you selected in the Export File Format drop box (see above). Each exported DEM will be downsampled to fit within the Max Polygons and Max Vertices you select (see below).

Select the DEM radio button if you want to export only downsampled reference DEMs as 3D Objects. The DEM objects will be in LightWave or 3D Studio format, depending on what you selected in the Export File Format drop box (see above). Each exported DEM will be downsampled to fit within the Max Polygons and Max Vertices you select (see below).

Select the Motion Only radio button if you just want to export the Camera Motion Paths for the Cameras in the selected Render Jobs.

Render Job to Export

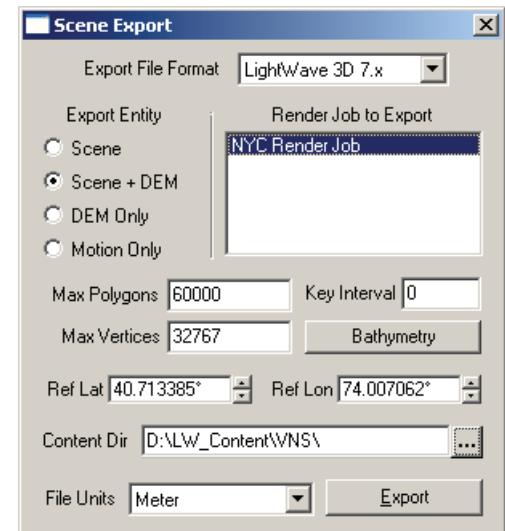
Select a Render Job to export. Render Jobs include a Camera and a set of Render Options.

There must be a Render Job selected. If there is only one Render Job in your Project VNS will select it automatically. Otherwise you have to select one.

Note: You can't export Render Jobs with Planimetric or Orthographic cameras.

Max Polygons Field

Enter the upper limit for exported DEM objects. Certain external 3D programs (e.g.: versions of Lightwave prior to version 6) can only handle a limited number of polygons per object.



Max Vertices Field

Enter the upper limit for exported DEM objects. Certain external 3D programs (e.g.: versions of Lightwave prior to version 6) can only handle a limited number of vertices per object.

Key Interval Field

The Key Interval field lets you specify how often the Camera motion path will have key frames.

Enter 0 (zero) and VNS will use the actual key frames from the Render Job's Camera.

We recommend entering 1 for your last scene export to lock the external 3D program's Camera exactly to the VNS camera. This is important when you are compositing the same scene rendered in both VNS and an external 3D program.

Bathymetry Button

Select the Bathymetry button to allow elevations below sea level to be included in any exported DEM objects. Deselect it to make a flat plane at sea level.

Reference Latitude and Longitude Fields

These Reference coordinates are the VNS Project Reference coordinates, the same as you set on the Project page of the Preferences window.

Make sure they do not change if you are exporting a scene and then importing it again with the Scene Import window.

Content Directory

The Content directory field and file icon lets you tell VNS where to save the exported scene file and DEM objects. Click the file button if you want to use a file requester to navigate to the proper directory for your external 3D program.

File Units Drop Box

Select the units you are using in your external 3D program. Make sure you keep the units consistent when you import and export scene files or things will not match up when you composite the output of VNS with that of the external 3D program.

Export Button

Click the Export button to export the scene file. VNS will export the scene file based on the selected Render Job.

VNS will automatically rotate the planet so that the terrain in your scene is at the top. This makes it easier to work with in an external 3D program, since external 3D Programs deal in flat coordinates and not spherical coordinates.

VNS will save whatever you selected with the Export Entity radio buttons. VNS will limit the maximum polygons and vertices to whatever you specified in the Max Polygons and Max Vertices fields. VNS will include Bathymetry elevations if you selected the Bathymetry button. VNS will use the File Units you selected in the File Units drop box (see above for all of these controls).

You can then import the scene into your external 3D program.

Note: You can find more information on integrating external 3D output into your VNS scenes by referring to Appendix J: Integrating VNS with External 3D Programs.

Scene Import Window

Select the Scene Import command to open the Scene Import window.

The Scene Import window lets you import scenes from supported external 3D programs. Currently supported programs include LightWave 3D, Inspire 3D and 3D Studio MAX.

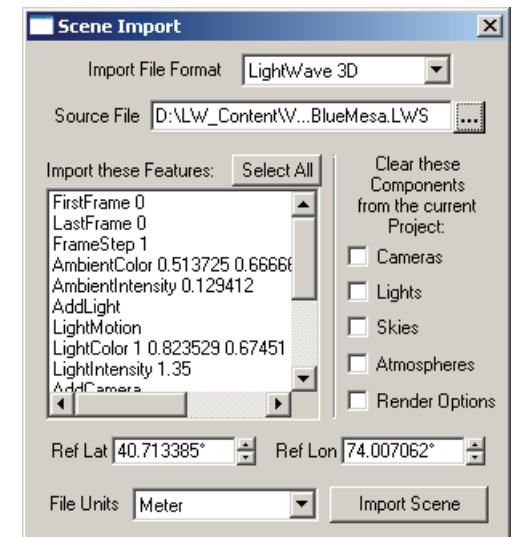
Import File Format Drop Box

Choose the format you'd like to import. Currently supported formats include LightWave 3D and 3D Studio.

Note: For Inspire 3D select the LightWave format.

Source File Field and File Icon

The Source File field and file icon lets you tell VNS what scene file to import. Click the file icon if you want to use a file requester to find the scene file.



Import These Features List

After you select the scene file in the Source File field (see above), VNS will show all possible elements of the scene that you can import. Click to select the elements you want to import.

You can control-click to select multiple elements; shift-click to select a range of elements; or click the Select All button to select all of the elements.

Clear These Components Checkboxes

The checkboxes on the right let you tell VNS to replace any of the items with checkboxes.

If you want the imported scene to replace all Cameras in the current Project, select the Camera checkbox.

If you want the imported scene to replace all Lights in the current Project, select the Lights checkbox.

If you want the imported scene to replace all Skies in the current Project, select the Skies checkbox.

If you want the imported scene to replace all Atmospheres in the current Project, select the Atmospheres checkbox.

If you want the imported scene to replace all Render Options in the current Project, select the Render Options checkbox.

If you don't select a checkbox, VNS will add new items of that type but will not delete existing ones.

Reference Latitude and Longitude Fields

These Reference coordinates are the VNS Project Reference coordinates, the same as you set on the Project page of the Preferences window.

Make sure they do not change if you are exporting a scene and then importing it again with the Scene Import window.

File Units Drop Box

Select the units you are using in your external 3D program. Make sure you keep the units consistent when you import and export scene files or things will not match up when you composite the output of VNS with that of the external 3D program.

Import Scene Button

Click the Import Scene button to import the selected external 3D scene file.

VNS will convert it into a VNS scene using the elements you selected in the Import These Features list. VNS will replace any items in the current scene selected with the checkboxes on the right. VNS will use the units you selected in the File Units drop box.

Note: You can find more information on integrating external 3D output into your VNS scenes by referring to Appendix J: Integrating VNS with External 3D Programs. This section covers use of the Post Process Compositing component.

Shapefile Attribute Window

The Shapefile Attribute Window opens if any of the following checkboxes are selected on the Shape Options Panel of the Import Wizard:

- **Assign DB Names from an Attribute Field**
- **Assign Elevations from Attribute Field**
- **Load Attributes**

For each of these checkboxes that is selected, VNS will open an appropriately named Shapefile Attribute window.

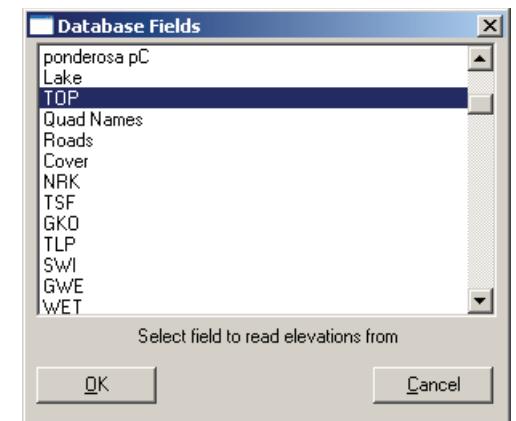
Assign DB Names from an Attribute Field

In this window, select a single attribute field from which to derive Database names for your imported vectors.



Assign Elevations from Attribute Field

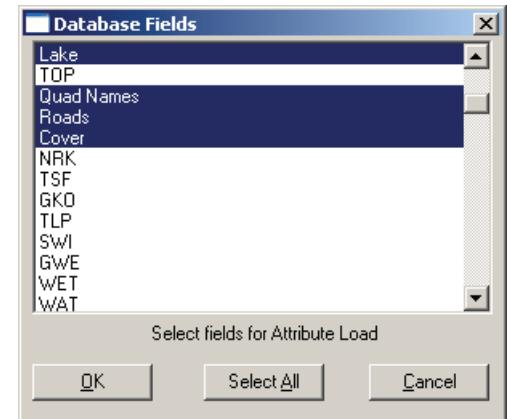
In this window, select a single attribute field from which to derive Database names for your imported vectors.



Load Attributes

In this window, multi-select all the attribute fields that you wish to be associated with your vectors after import.

Use Shift-click to select contiguous entries in the list, and Ctrl-click to select non-contiguous entries, in the same way as you would in a Windows file-requester.



Status Log

The Status Log is an invaluable tool for diagnosing operation and image problems. You can open it by selecting the Status Log command in the View menu or clicking the Status Log icon in the Animation Toolbar. It pops up from the Animation toolbar.

When the Status Log is closed, VNS displays the most recent status message on the right side of the Animation toolbar.

Refer to the Status Log whenever you have a question about what VNS has done. Up to 100 messages are shown in the window. You can use the scroll bar to scroll back through the messages.

The Status Log can be especially helpful when you have problems. Refer to it whenever you have a question about what VNS has done.

If you close the Status Log window, messages will still accumulate. You can see them by opening the window again. It will show up to the last 100 messages.

There are four classes of messages. Each message is preceded by a three-letter abbreviation indicating the message class:

- **Error (ERR)**
- **Warning (WNG)**
- **Message (MSG)**
- **Data (DTA)**

Error Messages

Error messages indicate problems where VNS failed to perform a task. If you see an Error message, you'll want to find out what caused it. For example if an Object file cannot be found or a window cannot be opened or memory allocation fails you will receive error messages.

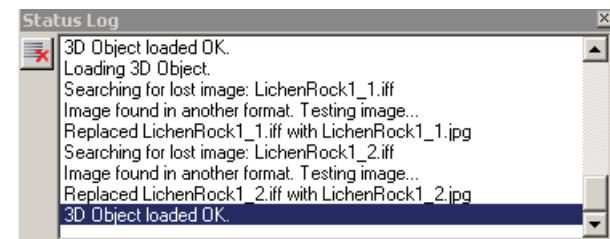
Warning Messages

Warning messages indicate things that might be problems, but may not be. If you see a warning message, you can decide if it is something that needs to be fixed in your Project.

Message Messages

Message messages are informational. For example they tell how many Objects were loaded during mapping; how long it took to render the last frame; and all the frames rendered so far.

You can use the messages to determine if there are problems in rendering.



Data Messages

After each frame or field is rendered a message will be posted to the Status Log telling how long the last frame or field took to render and how much time has elapsed since animation rendering began. You can use the times to compare rendering speeds when using different options (for example, rendering with different Fractal Depth amounts).

Outputting the Log to a file

There is an advanced configuration parameter that can be set to allow you to dump the contents of the Status Log to a textfile. Details of how to achieve this can be found in Appendix E: Advanced Configuration Options.

Template Manager

Templates Section

Template List

The Template list shows all Template Projects available when you create a new Project.

VNS remembers this list and presents it to you as you last left it, when you last created a new Project. That way you can create a list of standard Template Projects over time. Each time you start a new Project you can choose from your list of Template Projects. Enable and disable the ones you need with the Enable and Disable icons (see below).

VNS saves your Template list in the general preferences file. If you are using the Multi-User mode, VNS saves the list in the preferences file named with your user name. The last user's Template list will also be saved to the general preferences file.

Note: The general preferences file and user preferences files contain the same types of information.

Replace Template File Icon

Click the Replace Template File icon to replace a Template in the Template list with an existing Project. VNS will remove the old Template and replace it with the new Project in the Template list on the right.

Note: You can only add new Template Projects or remove Template Projects when you first create a Project with the New Project Window

Raise and Lower Template Loading Order Icons

Use the Raise and Lower Template Loading Order Icons to change the order of Template Projects in the Template list.

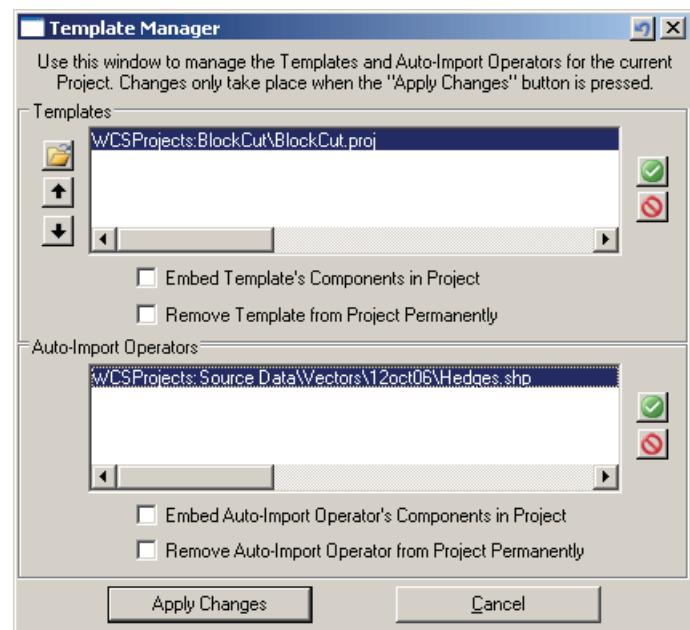
Select a Template in the list and click the Raise Template Loading Order icon to move it higher in the list (loads sooner).

Click the Lower Template Loading Order icon to move the selected Template down in the list (loads later).

The order of Template Projects is important. VNS loads Components from Template Projects as the Projects are ordered from top to bottom in the Template list. If Template Projects have items of the same Component type with the same name, the last loaded Template's Component will take precedence.

VNS loads Components from each Template in three steps. First, VNS loads the Template's Image Object Library. Second, VNS loads all the Project's Components that aren't Image Objects, DEMs or Vectors. Third, VNS loads the Project's database of Vectors, Control Points and DEM pointers.

VNS must have an Image Object in memory before a Component that uses the Image Object can load. VNS must have Components loaded before hard linked Vectors can form their linkages (this doesn't matter for dynamically linked Vectors).



A Template with Ecosystems can load first with Ecosystems and their associated Image Objects. A Template with Vectors can load last, with vectors that refer to the Ecosystems in a previously loaded Template. If Vectors are dynamically linked to Ecosystems, then the Vector/Ecosystem Template order doesn't matter.

A Template with DEM pointers does not have to be first since other components don't link to DEMs. The only thing a DEM can link to is a Coordinate System. If a DEM is linked to a Coordinate System, the Coordinate System must be in the same or a previously loaded template.

When you add more vectors to a project, they are loaded after Template-based vectors.

If you create an Ecosystem that's not in a Template and you attach a vector that is in a Template, it won't work.

Once the Project has been created you can use the Template Manager to change the order of any included Templates.

Enable and Disable Template Icons

Select a Template in the list and click the Disable Template icon to disable it without removing it from the Template list. The Project will not include any Components from Disabled Templates. Click the Enable Template icon to re-enable a disabled Template.

Disabled templates are omitted from the project completely. The disabling capability is useful if you have a number of templates to choose from and only want to use one or two in a specific project. Since it is a fair amount of work to build that template list in the first place, it is better to be able to engage only a select portion of them without actually purging others from the list. The program remembers from one creation event to the next which ones were in the list and their disabled state.

Once the Project has been created you can use the Template Manager to enable or disable any included Templates.

Embed Template's Components in Project Checkbox

Select the Embed Template's Components in Project checkbox if you want to embed a Template's Components into the Project itself. This keeps the Components from the Template "frozen" at their current settings (you can still edit them within the Project). VNS will no longer update these Components from the Template.

Note: This loses the advantages of using the Template. Don't use the Embed Template's Components in Project checkbox unless you're absolutely sure you no longer want to inherit the Component states from Template Project.

Keep in mind that embedding Components will likely change the evaluation order for those Components (see "Raise and Lower Template Loading Order Icons" above). Anything you embed into the project will load last, after Templated Components. Be careful you don't break connections.

VNS will not embed the Template's Components into the Project until you click the Apply Changes button (see below). Before you save the Project, check to make sure you didn't break any of your linkages. If you decide the embedding wasn't a good idea, as long as you haven't yet resaved the Project you can go back to the state the Project was in before you Embedded any Templates by opening the Project again from the Project's actual file (not Resuming).

Remove Template from Project Permanently Checkbox

Select the Remove Template from the Project Permanently checkbox if you want to discard a Template Project from the Project List forever.

Warning: If you do this there is no way to get the Template Project back into the current Project's Templates list.

If you just want your Project to ignore a Template Project, you can disable any Template Project with the Disable Template icon on the right. The Disable Template icon is non-destructive; you can re-enable a Template Project with the Enable Template icon (see above).

Auto Import Operators Section

The Auto Import Operators section shows all Shape file data that is automatically re-imported whenever you load the Project. This allows the Project to inherit any changes you made to the Shape files in external GIS software. You can make changes to the shapefile's attributes or the polygons themselves and the changes will transfer to VNS automatically.

To tag Shape file data so it is automatically auto-imported, select the Re-Import When Project Loads checkbox, on the Output File Type and Name page of the Import Wizard, when you first import the data.

You can tag Shape file data from the Project itself or any of its Template Projects.

Template Auto-Import Operators List

The Template Auto-Import list shows all Shape files that are automatically re-imported whenever you load the Project.

Enable and Disable Auto Import Operator Icons

If you no longer want data from a Shape file to be updated by reloading the Shape file whenever you load the Project, select the Shape file in the Auto-Import Operators list and click the Disable Auto Import icon.

To re-enable automatic updating from the Shape file, select the Enable Auto Import Operator icon.

Embed Auto-Import Operator's Components in Project Checkbox

Select the Embed Auto-Import Operator's Components in Project checkbox if you want to embed the Shape file's Vectors (polygons) and attributes into the Project itself. This keeps the Vectors "frozen" at their current settings (you can still edit them within the Project). VNS will no longer update the Vectors and their attributes by automatically reloading the original Shape file.

Note: This loses the advantages of using automatically updating data. Don't use the Embed Auto-Import Operator's Components in Project checkbox unless you're absolutely sure you no longer want to inherit the Vector states from the Shape file whenever you load the Project.

Keep in mind that embedding the Vectors could change their evaluation order if they were originally from a Template Project (see "Raise and Lower Template Loading Order Icons" above). Anything you embed into the project will load last, after Templated Components. Be careful you don't break connections.

VNS will not embed the Vectors into the Project until you click the Apply Changes button (see below). Before you save the Project, check to make sure you didn't break any of your linkages. If you decide the embedding wasn't a good idea, as long as you haven't yet resaved the Project you can go back to the state the Project was in before you Embedded any Templates by opening the Project again from the Project's actual file (not Resuming).

Remove Auto-Import Operator from Project Permanently Checkbox

Select the Remove Template from the Project Permanently checkbox if you want to discard a Shape file from the Auto-Import List.

However, if you just want to temporarily stop auto-importing a Shape file, you can disable any auto-import Operator with the Disable Auto-Import Operator icon on the right. The Disable Auto-Import Operator icon is non-destructive; you can re-enable an Auto-Import Operator with the Enable Auto-Import Operator icon (see above).

Apply Changes Button

The Template Manager will only make the changes you specified when you click the "apply changes" button in the Template manager.

Because changes you make may disrupt the continuity of your linkages, VNS will save the preferences file and resume from there to apply the changes. VNS will then tell you to check the project before you actually save it. VNS will remind you that you can reload the project (not Resume) to get back to where you were. Do this immediately if your changes didn't work out the way you thought they would.

Cancel Button

If you want to abandon any changes you made to the Template Manager since opening it, click the Cancel button to abandon all changes and close the window.

Terrain Gridder Wizard

The Terrain Gridder Wizard is provided to simplify the creation of Terrain Gridder components. Previously the only way to create these components was by manually entering the relevant data into the Terrain Gridder Editor.

By answering a series of questions and performing a series of simple steps, VNS will create the required Terrain Gridder component for you, and all you have to do is open it, and click the Grid and Save Button.

Note: The Terrain Gridder Wizard does not grid the data for you. You still have to open the Terrain Gridder Editor for the created component, and manually initiate the gridding process. This also allows you to make last minute changes to the gridding settings, such as smoothing, densification and bounds. For more information on these features see the section relating to the Terrain Gridder Editor.

Create a new Terrain Gridder component, and VNS will prompt you as to whether or not you wish to use the Terrain Gridder Wizard.

Note: There is no requirement to use the Wizard. Selecting "No" when prompted will create a new, blank Terrain Gridder component and open the Terrain Gridder Editor ready for you to edit the settings manually.

If you choose to use the Terrain Gridder Wizard (by selecting "Yes" when prompted), then you will be presented with a series of pages so that VNS can gather the required information from you, and create an appropriate Terrain Gridder component.

Terrain Gridder Wizard Panels

Welcome Panel

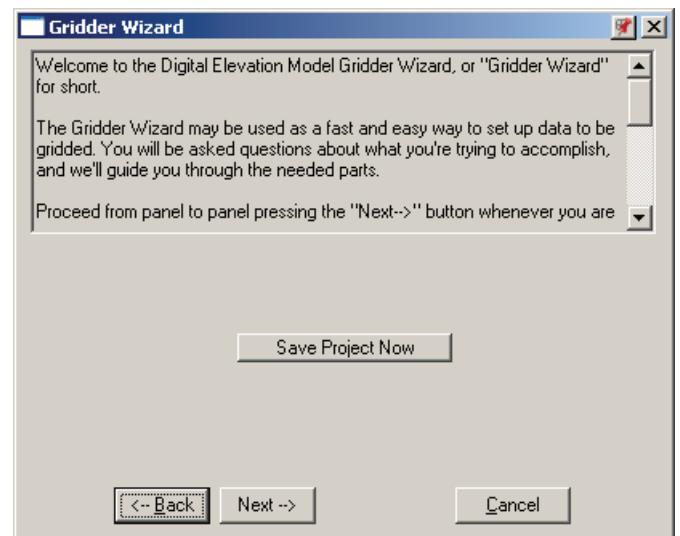
The first panel of the wizard introduces some basic concepts relating to its use. If you are new to VNS, or have never used the Terrain Gridder Wizard before, it is worth reading this information to gain an overview of how the process works.

As with other wizards in the program, you proceed through a series of pages, answering questions and providing information where requested. Once a page has been completed, clicking the Next button allows you to proceed to the next page. If you wish to return to an earlier page and edit settings, clicking the back button will allow you to retrace your steps through the wizard.

At any time, you can cancel out of the wizard process by clicking the Cancel button.

Save Project Now Button

Click this button to tell VNS to save the project before you start selecting options in the Terrain Gridder Wizard. This is a safeguard against power-outage or system crashes, as the project can not be saved while you are proceeding through the wizard itself.



Cancel Panel

if you choose to cancel the wizard at any time, this is the window that will appear.

Cancel Wizard Operation Button

Click this button to confirm that you wish to cancel the Terrain Gridder Wizard.



Data Load Panel

This panel allows you to tell VNS whether or not you have data loaded that you wish to grid.

Data Load State Radio Buttons

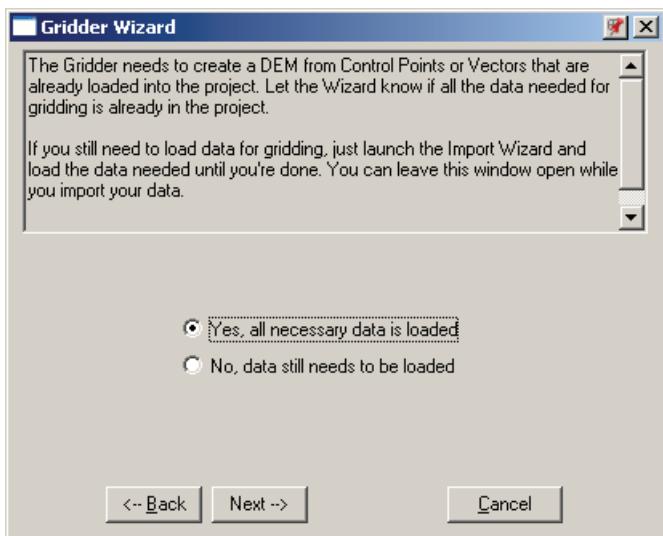
Yes, all necessary data is loaded radio button

If you have the data already loaded, you can select that option and proceed directly to the next panel in the wizard.

No, data still needs to be loaded radio button

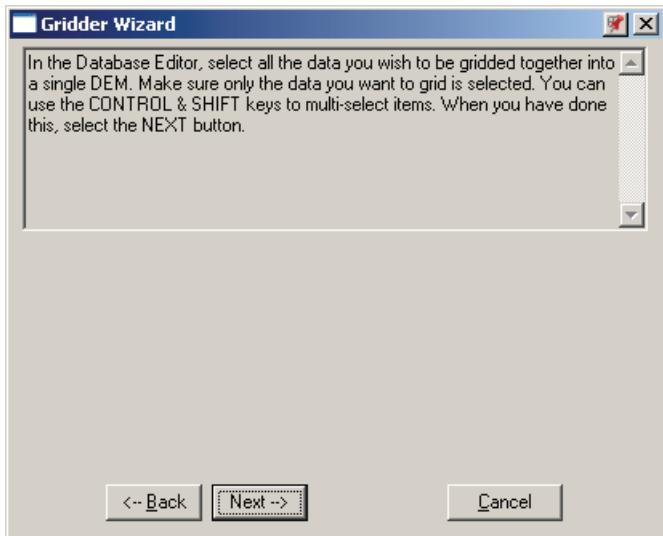
If you do not have the necessary data loaded into VNS, you can use the import wizard or database load controls to bring the required data into VNS, without having to close down the Terrain Gridder Wizard. Once all the data has been loaded or imported, you can select the first option, and proceed to the next panel of the wizard.

Note: Until you select the first of these options, the Next button will be unavailable.



Data Selection Panel

When this panel of the wizard is displayed, VNS will open the Database Editor (if it is not already open), allowing you to select the data sets that you want to include in the gridding operation. Once you have selected them, you can click Next to proceed to the next page of the wizard. VNS will use the information you have provided to auto-configure the Current Filter Page of the Terrain Gridder Editor in order that the created component will grid the correct data.



Coordinate System Selection Panel

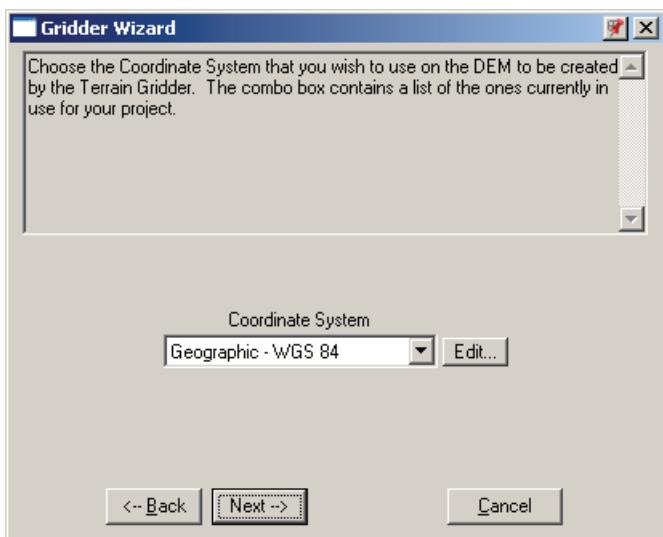
Use this panel to select or create the required coordinate system for the gridding operation.

Coordinate System Dropdown List

Select the coordinate system in which you want the data gridded from the dropdown list provided. This selection will be used to automatically configure the Coordinate System section of the General Page of the Terrain Gridder Editor.

Coordinate System Edit Button

Clicking this button will open the Coordinate System Editor and allow you to edit the currently selected coordinate system.



Bounds Panel

This panel allows you to manually set the bounds of the gridded data. These fields will be automatically completed for you based on the bounds of the data that you selected in the Database Editor when processing the Data Selection Panel of the wizard.

You can, however, override these values and select another area of data to grid.

These values will be used to automatically configure the Boundaries Of Grid section of the General Page of the Terrain Gridder Editor.

North, West, East and South Fields

Enter latitude positions into the North and South fields, and Longitude positions into the East and West fields, to define the boundaries of the region you want to grid.

Set Bounds in View Button

Click the Set Bounds in a View button and then you can draw the shape of the new DEM in a Planimetric View (see Views).

You can use this to draw the shape around your Control Points, or even better, slightly inside the outermost Control Points. This will change the North, West, East and South fields (see below). This will also set the output columns/rows (width/height) to the number of pixels in the View enclosed by what you draw. You can change the values in these fields

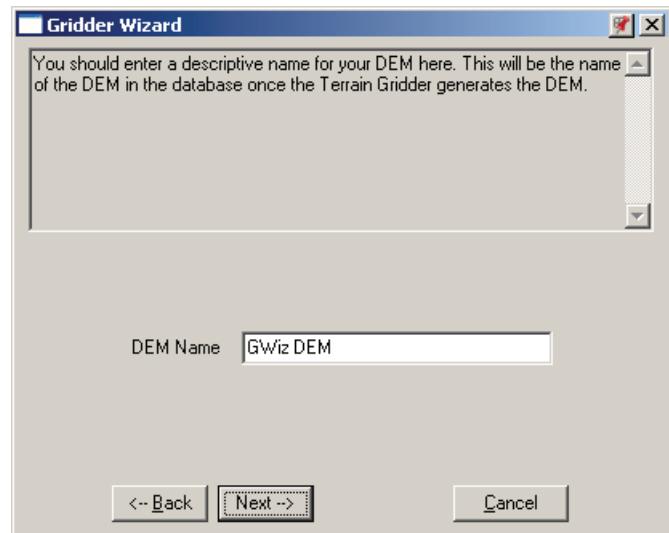
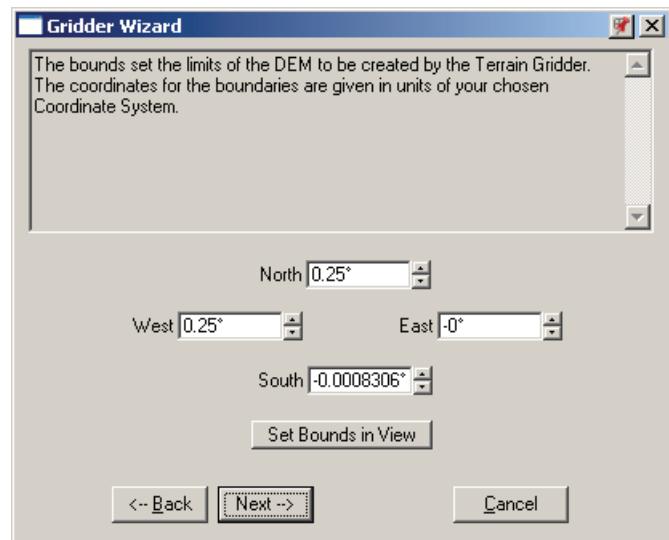
Name Panel

This panel allows you to provide a name for the DEM that the new Terrain Gridder Component will create for you.

This name will be used to automatically configure the Terrain model Name Field on the Output & Filters Page of the Terrain Gridder Editor.

DEM Name Field

Enter your chosen DEM name in this field.

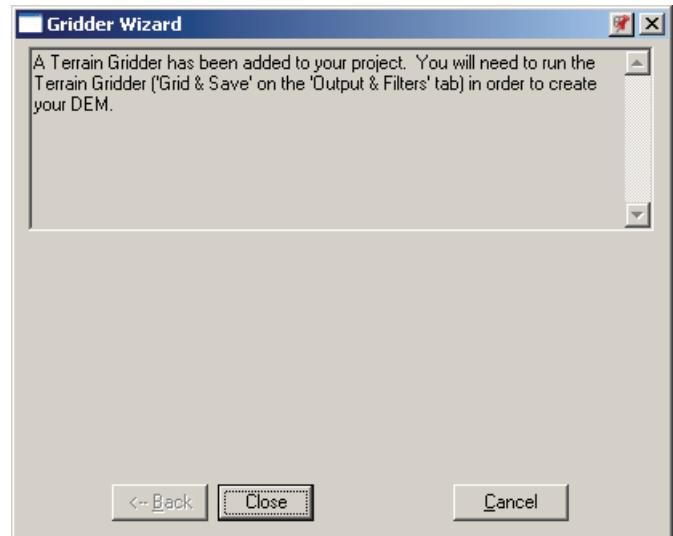


Close Panel

This Panel completes the wizard. Clicking Close will close the Terrain Gridder Wizard and allow you to access the newly created Terrain Gridder component and grid your data.

Note: You may still wish to edit certain values in the Terrain Gridder Editor before gridding your data. The following values especially may need attention in order to produce the required results:

- **Outlying Point Search Region Section**
- **Extrapolate Checkbox**
- **Smoothing Field**
- **Densify Checkbox**
- **E-W Tiles and N-S Tiles Fields**
- **Columns & Rows Fields**



Texture Editor

The Texture Editor lets you edit textures. You can use textures anywhere you see the Texture Operations Icon. For example you can use them for 3D Object Material, Ecosystem, Ground Effect, Snow and other Materials throughout the program. You can use textures to control colors, transparency, luminosity, displacement and much more. You can even mix multiple textured materials with a texture.

You can also look at the textures in the Components included with VNS and see how their textures were created in the Texture Editor. Then experiment on your own with the Texture Editor controls. As you experiment, use this section as a reference.

There is no reasonable way to document every possible texture combination or application. The possibilities are far too vast. The goal of this manual is open your eyes to some of the possibilities and to help spark your own inventiveness as you explore the power of the VNS Texture Engine.

As you create new textures, don't forget to save them! You can save them as Texture Components. That way you can reuse them in other projects, and share them with other VNS users.

Opening the Texture Editor

To open the Texture Editor, click the Texture Operations Icon throughout the program. There is a Texture Operations Icon next to each parameter that you can control with a texture.

Texture Editor Main Sections

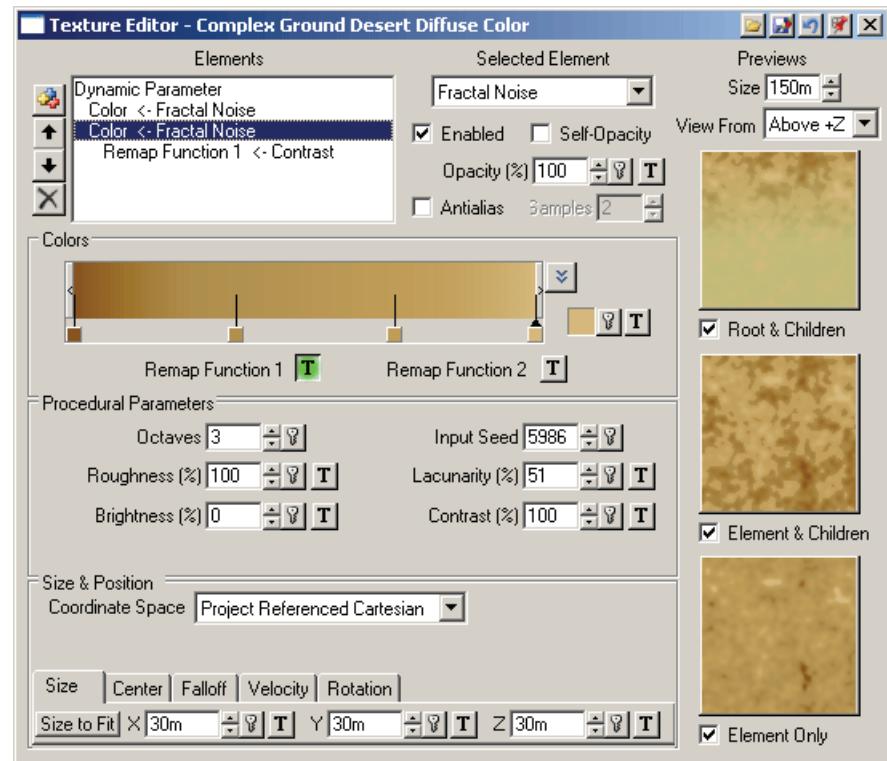
The Texture Editor is divided into three main sections:

- **Elements Section**
- **Current Element Controls Section**
- **Previews Section**

The Elements section lets you see all the Elements in the texture; add or delete Elements; enable or disable Elements; control opacity for the current Element; and control antialiasing for the current Element.

The Current Element Controls section lets you adjust the parameters for the current Element. You can animate many of these parameters.

The Previews section lets you see the texture as you work. It has three preview displays to simultaneously show different aspects of the texture. You can choose to view the texture from any angle, or mapped onto several 3D Objects.



Elements Section

The Elements section is at the top of the Texture Editor. Here you'll see the following controls:

- **Elements List**
- **Elements List Icons**
- **Elements Drop Box**
- **Enabled Checkbox**
- **Self Opacity Checkbox**
- **Opacity Percentage Field and Texture Icon**
- **Antialias Checkbox**
- **Samples Field**

When you select an Element in the Elements list, VNS will display appropriate controls for that Element in the area below the Elements section.

What is an Element?

An Element is a part of the overall texture. It can be an Image Object or a procedural texture.

Image Objects are pictures or animations. They are resolution-dependent: if you zoom in on the texture too far, you will eventually see the pixels that make up the image texture. You can load them via the Image Object Library.

Procedural textures are mathematically-defined patterns. For example, a procedural brick texture is made up of separated, offset rectangles. These textures are resolution-independent: you can zoom in on the texture an infinite amount and you will never see pixelation in the pattern, as the pattern is generated mathematically.

Combining Elements

By combining Elements, you can create very intricate, detailed textures. You can layer Elements on top of each other using transparency, and you can create "child" Elements. Child Elements can appear inside of parts of "parent" Elements, modulate elements of parent Elements or control the way other Elements are composited together.

The Elements list lets you keep track of all the Elements in the texture. With it you can combine Elements with virtually unlimited flexibility.

Left-justified Elements in the list are "Root" Elements. You can have more than one Root Element in the list, and you can layer them by controlling their opacity. Root Elements that are higher in the list take priority. Root Elements that are lower in the list will only be seen if the ones above them have areas of at least partial transparency.

Indented Elements are called "Child" Elements. Any Element that has one or more indented Elements directly below it is called a "Parent" Element. Child Elements modify Parent Elements. You can use Child Elements to change the patterns of Parent Elements, and even fill parts of the patterns with new patterns.

Because Child Elements can also be Parent Elements of their own "children," you can create textures of great complexity and detail. You can create believable, detailed textures with just a single Root Element that has one or two Child Elements. Or you can combine many layers of Root Elements, each with many levels of Child Elements, to create virtually any texture you can imagine.

As you create new textures, keep in mind that the more complex your combination of Elements, the more likely your texture will take longer to render. The trick is to combine Elements in the simplest way to create a believable texture. Use as few Elements as possible, but as many as you need.

Elements List

The Elements list shows all the Elements in the texture. You can select any Element as the current Element by clicking it in the list. When you do, the Current Element Controls Section below the Elements section will show the controls for the current Texture Element.

To add a new Root Element to the list, click the Add icon next to the list. To add a child Element to the list, click any of the T icons in the Texture Editor. Root Elements are left justified in the list. Child Elements are indented below their parent Elements.

Elements that are enabled are shown in black. Elements that are disabled are shown in gray.

VNS renders the top Root Element first. Other Root Elements will only be seen if the root textures above them have reduced opacity. Root textures are much like painted layers of glass. Wherever one layer is clear or at least semi-transparent, you will be able to see the paint on the next layer below.

You can make a Root Element partly transparent with the Opacity controls, by using a child Texture Element to control Opacity, with Self-Opacity, or by using a child Texture Elements to control compositing. You can even animate a Root Element's opacity to dissolve to the next Root Element's texture.

Elements List Icons

The icons to the left of the Elements list let you add, delete or rearrange the Elements in the list.

Click the Add Texture icon  to add a new Root Element to the Elements list.

Click the Delete Texture icon  to remove the currently selected Element from the list.

Note: Removing an Element will delete the Element, all its parameter settings and all its child Elements. If you just want to temporarily disable the Element, deselect the Enabled checkbox. That way the Element and its settings will still be stored in case you want to use it later.

Click the up or down arrow icons to move the currently selected Element up or down in the list. Keep in mind that Elements higher in the list are rendered first, and those lower in the list will only be seen where the higher ones are less than 100% opaque. The up and down arrow icons let you move any Root Element so that it will be rendered before the ones lower in the list.

Elements Drop Box

The Elements drop box lets you select the current Texture Element type. You can choose from these options:

- **Planar Image**
- **Cylindrical Image**
- **Spherical Image**
- **Front Projection**
- **Environment Map**
- **UV Mapped Image**
- **Stripes**
- **Soft Stripes**
- **Single Stripe**
- **Single Soft Stripe**
- **Wood**
- **Marble**
- **Brick**
- **Dots**
- **Fractal Noise**
- **MultiFractal**
- **Hybrid MultiFractal**
- **Turbulence**
- **F1 Cell Basis**
- **F2 Cell Basis**
- **F2mF1 Cell Basis**
- **F1 Manhatten**
- **F2 Manhatten**
- **F2mF1 Manhatten**
- **Pebbles**
- **Add**
- **Subtract**
- **Multiply**
- **Composite**
- **Contrast**
- **Darken**
- **Lighten**
- **Levels**
- **Skew**
- **Bell Curve**
- **Square Wave**
- **Sawtooth**
- **Steps**
- **Linear**
- **Gamma**
- **Bias**
- **Gain**
- **Custom Curve**
- **Maximum**
- **Maximum Switch**
- **Minimum**
- **Minimum Switch**
- **Threshold**
- **Dynamic Parameter**
- **Gradient**
- **Object Type**

Not all Elements apply to both 3D Object Materials and Terrain Texturing. The drop box will show only those Elements that apply.

When a Element type is not appropriate, it will not be shown. For example, when the current Element is being used as a remap function, the list will be much shorter. This is because only some of the texture Elements can work as remap functions.

The texture Elements fall into these groups:

- **Image Object Texture Elements**
- **Either/Or values**
- **Gradient values**

- **Two Value process**
- **Filters (one value)**
- **A Or B**
- **Based on a Dynamic Parameter**

Some Texture Elements fall into several groups, depending on how their parameters are set.

Image Object Texture Elements

There are four ways to use Image Objects as Texture Elements:

- **Planar Image**
- **Cylindrical Image**
- **Spherical Image**
- **Front Projection**
- **Environment Map**
- **UV Mapped Image**

Note: You can load and edit Image Objects with the Image Object Library. You can also load them directly from the Texture Editor.

Planar Image

A Planer Image Element applies an Image Object to a single plane. For a 3D Object this can be along the X, Y or Z axis. For the terrain you can also use any axis. To project the image onto the terrain from overhead use the z axis.

Cylindrical Image

A Cylindrical Image Element wraps an Image Object around the X, Y or Z axis. This is only available for 3D Object texturing.

Spherical Image

A Spherical Image Element wraps an Image Object around two axes simultaneously. This is only available for 3D Object texturing.

Front Projection

A Front Projection Element projects an Image Object onto the scene like the light from a movie projector. The Image Object is revealed anywhere you have applied the texture to a 3D Object or the terrain.

Note: The Image Object is projected from the Camera. If the Camera is moving, the projected Image Object will also move.

Environment Map

The Environment Map Element type is most suitable for providing “pseudo-reflections” on surfaces, when used to drive the Diffuse Color channel of a material. The selected image is mapped onto a large sphere that surrounds the object, and each surface is mapped with the portion of the image that would be reflected on that surface if the object were truly reflective.

Note: Unlike Front Projection Maps, the selected image is not projected from the camera - if the camera or object moves, the image mapping will distort and change as if the object were reflecting a global Environment - hence the name. You can use the Panoramic Camera type (see Camera Editor) to generate a panoramic view of your scene for use as an Environment Map. You can use this to generate reasonably accurate "reflective" surfaces without actually having to enable reflections. This type of map is sometimes referred to as a "Reflection Map" in other 3D software.

UV Mapped Image

A UV Mapped Image Element projects an image onto an object similarly to the way in which a Planar Image Element does so. The difference is the coordinate space used to perform this projection.

Planar Images are projected using XYZ cartesian coordinates, whereas UV Mapped Images are projected using UVW coordinates. UVW coordinates were developed for use in spline (curve) based models, where instead of a set of discreet points in an XYZ cartesian space, the model is defined by UVW coordinates of control points defining spline curves. This coordinate system has the necessary information to allow accurate mapping of organic or non-planar surfaces.

The difference in output is that UV Mapped Images follow the curved surfaces of objects, rather than having a discrete axis of projection. The latter feature of Planar Image Maps causes them to show "smearing" where the object surface is parallel to the axis of projection.

The UV Mapped Element is, in fact, a shortcut to a Planar Image Map Element using a UVW Coordinate system. You can achieve the same results whichever method you choose to use.

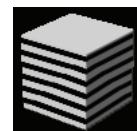
Note: This Element will only be available in 3D Object material Components that are part of a model that had UVW mapping information embedded within it. The object types that can support UV Mapping, and that are also supported by VNS are Lightwave 6.x or later (.LWO), 3DStudio (.3DS), and Alias Wavefront Objects (.OBJ).

Either/Or Value Texture Elements

Either/or texturing lets you create textures with distinct, hard patterns. The patterns use two colors, and give you areas that are either one color or the other. VNS gives you several kinds of either/or texturing:

- **Stripes**
- **Single Stripe**
- **Brick**
- **Dots**

For more detailed texturing you can fill either of the color areas with other textures. For example, you can fill the red area of a brick texture with several shades of red in a Fractal Noise pattern to simulate the rough surface of real brick.



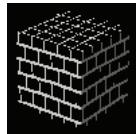
Stripes

The Stripes Element is useful for any texture that needs alternating bands of two colors, such as wood siding.



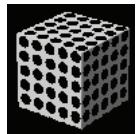
Single Stripe

Single Stripe is useful for any texture that needs a single stripe, such as a stripe on a road, smoke or waterfalls. Combine several Single Stripe textures for multiple road stripes or more complex smoke and waterfall patterns.



Brick

The Brick Element is useful for any texture that needs rectangular patterns, such as a brick wall or checkerboard.



Dots

The Dots Element makes a pattern of dots which can be inline or offset from row to row like round bricks.

If you select the 3D checkbox it will have different dot sizes depending on where the textured plane intersects the texture space. If you deselect the 3D checkbox to get a 2D dot pattern you will need to specify an axis of alignment.

Select the Quantize Output checkbox if you want to create circles of different colors. You can even fill different circles with different textures.

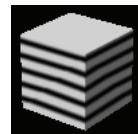
Crop circle example: You can use the Dots Texture Element on an Ecosystem Material Gradient Driver texture and make different ecosystems to fill the circles and a different one for the background.

Gradient Value Texture Elements

Gradient value texturing lets you create textures with soft patterns. The patterns are based on colors with a gradated mix of the colors in between. VNS gives you these choices for gradient value texturing:

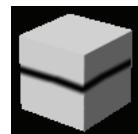
- **Soft Stripes**
- **Single Soft Stripe**
- **Fractal Noise**
- **MultiFractal**
- **Hybrid MultiFractal**
- **Turbulence**
- **F1 Cell Basis**
- **F2 Cell Basis**
- **F2mF1 Cell Basis**
- **F1 Manhatten**
- **F2 Manhatten**
- **F2mF1 Manhatten**
- **Pebbles**

For more detailed texturing you can fill the color areas with other textures.



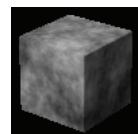
Soft Stripes

The Soft Stripes Element is useful for any texture that needs alternating bands of two colors, with built-in antialiasing between them.



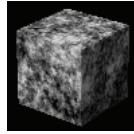
Single Soft Stripe

Single Stripe is useful for any texture that needs a single antialiased soft stripe, such as tire wear on a road, smoke or waterfalls. Combine several Single Soft Stripe textures for multiple road stripes or more complex smoke and waterfall patterns.



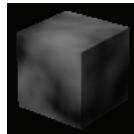
Fractal Noise

The Fractal Noise Element is useful for any texture that needs alternating spots or streaks. Fractal Noise is great for adding apparent detail or dirt to almost any texture. Since Fractal Noise is so useful, when you add a new Texture Element Fractal Noise is the default.



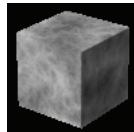
MultiFractal

The MultiFractal Element is similar to the Fractal Noise Element, but with more emphasis on higher frequencies in the pattern. It is useful for adding alternating spots or streaks to a texture.



Hybrid MultiFractal

The Hybrid MultiFractal Element is a combination of the Fractal Noise and MultiFractal Elements. It gives you another option for creating alternating spots or streaks to add apparent detail to a texture.



Turbulence

The Turbulence Element uses the absolute value of fractal noise. It's similar to Fractal Noise but looks puffier, more like clouds.

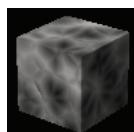


F1 Cell Basis

The F1 Cell Basis Element is useful for any texture that needs a honeycomb or crumpled pattern, like choppy wave patterns on water.

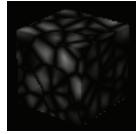
Field pattern example: You can use the F1 Cell Basis Texture Element on an Ecosystem Material Gradient Driver texture and make different ecosystems to fill the areas and background. This is handy for making irregular agricultural field patterns.

There is a Quantize checkbox for Cell Basis Elements. This lets each cell have a different color from the color gradient or a different level of gray. For example, quantizing is nice for making flagstones with distinctly different colors or patterns from stone to stone. Or use it when modulating an Area Terraffector's Elevation parameter to create a formation with irregular blocks of different heights.



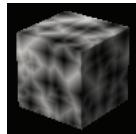
F2 Cell Basis

The F2 Cell Basis Element is similar to the F1 Cell Basis texture, but with a more dissected appearance.



F2mF1 Cell Basis

The F2mF1 (F2 minus F1) Cell Basis Element is the difference between the F2 Cell Basis and F1 Cell Basis Elements. With remap Elements, F2mF1 Cell Basis can create hard edged textures like flagstone paths or stone walls.

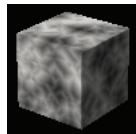


F1 Manhatten

The Manhatten Elements are similar to the Cell Basis elements except they create rectilinear shapes instead of the cellular flagstone or wave-like shapes created by the Cell Basis functions.

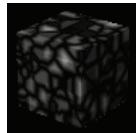
If you rotate a Manhattan Element 45 degrees and use a remap function or the Quantize Output checkbox to limit it to blocky shapes, you can create a city-like texture. Hence the name.

City textures may be useful for Ground Effects and Ecosystem Ground Overlays.



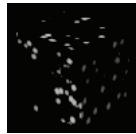
F2 Manhatten

The F2 Manhatten Element is similar to the F1 Cell Basis texture, but with a more dissected appearance.



F2mF1 Manhatten

The F2mF1 (F2 minus F1) Manhattan Element is the difference between the F2 Manhatten and F1 Manhatten Elements.



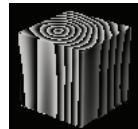
Pebbles

The Pebbles texture creates spherical shapes scattered randomly in groups. This is useful for things like gravel, stream bed pebbles and bubbles.

Either/Or Value or Gradient Value Texture Elements

There are two Texture Elements that can be either/or gradient in nature, depending on sharpness setting.

- **Wood**
- **Marble**



Wood

The Wood Element simulates the growth ring patterns in wood. Viewed from the end you can see the tree rings. Viewed from the side you can see wood grain patterns. The Wood Element is useful for any texture that needs these multi-color ring patterns. You can create a wide variety of wood types with this Element as a starting point.



Marble

The Marble Element simulates the swirled patterns in marble and other rocks. It is useful for any texture that needs these swirling patterns. You can create a wide variety of rock types with this Element. It has also been used with great success to create interesting Cloud Models (see Cloud Model Editor)

Two Value Process Texture Elements

- **Add**
- **Subtract**
- **Multiply**
- **Composite**

Add

The Add Element lets you add colors or Texture Elements. It will add Colors together. This gets interesting when you replace colors with other Texture Elements. For example, you can add Fractal Noise to an Image Object to give the image a paper or rock texture.

Subtract

The Subtract Element lets you subtract colors or Texture Elements. It will subtract Colors. This gets interesting when you replace colors with other Texture Elements. The Subtract Element can also create a stenciled effect.

Multiply

The Multiply Element lets you multiply colors or Texture Elements. It will multiply Colors. This gets interesting when you replace colors with other Texture Elements.

Composite

The Composite Element lets you combine colors or Texture Elements. It mixes Colors or Texture Elements based on a Mask percentage. If you use another Texture Element for the Mask Percentage, that Element will control the mixing.

Filter Texture Elements (One Value)

- **Contrast**
- **Darken**
- **Lighten**
- **Levels**
- **Skew**
- **Bell Curve**
- **Square Wave**
- **Sawtooth**
- **Steps**
- **Linear**
- **Gamma**
- **Bias**
- **Gain**
- **Custom Curve**

Contrast

The Contrast Element lets you adjust the contrast of the Selected Color or its Texture Element. Using a Contrast of 50 leaves the Color or Element unchanged. Values below 50% decreases contrast, while values above 50% increases contrast.

The Median Percentage lets you adjust the brightness value around which the contrast is increased or decreased.

Darken

The Darken Element lets you decrease the brightness of the Selected Color or its Texture Element.

Lighten

The Lighten Element lets you increase the brightness of the Selected Color or its Texture Element.

Levels

Levels is useful as a texture applied to works much like the level control in paint or image processing programs. It lets you control the low, mid and high ranges of a color or image. This is good for contrast stretching for texture images or as a different way to control Gamma.

To use it, add the an image Element as a texture to the Level's color. Then use the Low, Mid and High percentage controls to modify the image.

Skew

The Skew Element lets you shift the contrast of the Selected Color or its Texture Element. A Mask Percentage of zero has no effect. Higher values scale the contrast using the Median controls.

Bell Curve

The Bell Curve Element is most useful when used as a Remap function. It allows you to change the values of the Color gradient based on a sine wave shape. You can control and animate the sine wave.

Square Wave

The Square Wave Element is most useful when used as a Remap function. It allows you to change the values of the Color gradient based on a square wave shape. You can control and animate the square wave.

Sawtooth

The Sawtooth Element is most useful when used as a Remap function. It allows you to change the values of the Color gradient based on a sawtooth wave shape. You can control and animate the sawtooth wave.

Steps

The Steps Element is most useful when used as a Remap function. It allows you to change the values of the Color gradient based on a stepped square wave shape. You can control and animate the stepped square wave. This can reduce colors in a texture like a posterization effect.

Linear

The Linear Element is most useful when used as a Remap function. It allows you to change the values of the Color gradient based on a linear gradient. You can control and animate the gradient. The default values won't change anything. By increasing the frequency you can create a narrow band of transition from one value to another. By increasing the phase you can move that narrow filter wherever you like. This lets you create masks and control the softness of the mask edges for smooth rendering without requiring extra antialiasing.

Tip: For example, you can use a Linear Element as a remap function on fractal noise, and then fill the Color A and Color B colors of the Fractal Noise Element with two different images, to blend the two images. Try this with images of ground cover or asphalt and see how this lets you use actual image textures on the terrain while reducing visible tiling.

Gamma

The Gamma Element is most useful when used as a Remap function. It allows you to change the values of the Color gradient based on a curve. You can control and animate the gamma curve.

Bias

The Bias Element is most useful when used as a Remap function. It allows you to change the values of the Color gradient based on a curve. This is similar to Gamma, but expressed as a percentage. You can control and animate the bias curve.

Gain

The Gain Element is most useful when used as a Remap function. It allows you to change the values of the Color gradient based on an S-curve. This is similar to Gamma, but with a two stage curve. You can control and animate the gain curve. This gives you another way to control contrast.

Custom Curve

The Custom Curve Element is most useful when used as a Remap function. It allows you to change the values of the Color gradient based on a curve. This is similar to Gamma and the other remap elements, but by clicking the "Edit Curve" button you are taken into a familiar profile editing interface that allows you to edit the curve manually, rather than by adjusting element-specific parameters to achieve the curve you require. This is the most versatile of the remap curve functions, and approximates the Curves feature in image-manipulation programs such as Adobe Photoshop.

A Or B Texture Elements

- **Maximum**
- **Maximum Switch**
- **Minimum**
- **Minimum Switch**
- **Threshold**

Maximum

The Maximum Element combines the areas of the colors or Texture Elements that have the highest luminance value. This can create really nice tile patterns for floors, wallpaper and other designs.

Maximum Switch

The Maximum Switch Element mixes the colors or Texture Elements based on the highest of separate Switch Parameter values. This can be similar to the Maximum Element (see above), but can be based on values derived from other Texture Elements. Maximum Switch can create really nice tile patterns for floors, wallpaper and other designs.

Minimum

The Minimum Element combines the areas of the colors or Texture Elements that have the lowest luminance value. This can create really nice tile patterns for floors, wallpaper and other designs.

Minimum Switch

The Minimum Switch Element mixes the colors or Texture Elements based on the lowest of separate Switch Parameter values. This can be similar to the Maximum Element (see above), but can be based on values derived from other Texture Elements. Minimum Switch can create really nice tile patterns for floors, wallpaper and other designs.

Threshold

The Threshold Element mixes the colors or Texture Elements based on the highest of separate Parameter values. This is remarkably similar to the Maximum Switch Element (see above). Threshold can create really nice tile patterns for floors, wallpaper, flagstone and other designs.

Dynamic Parameter Texture Elements

There are four texture elements whose effects are based on the type of input they receive from another variable in the program. Hence the reason why they are described as being based on Dynamic Parameters. A change in the parameter will result in a change in the texture output. The four elements are as follows:

- **Dynamic Parameter**
- **Gradient**
- **Include/Exclude**
- **Object Type**

Dynamic Parameter

These were formerly known as Terrain Parameters until their scope was expanded beyond using them just on Terrain. From the Texture Editor you can alter the way a Texture Element is applied to the terrain or 3D Object Materials based on a selection of Dynamic Parameters, including:

- **Elevation**
- **Relative Elevation**
- **Slope**
- **North Deviation**
- **East Deviation**
- **Latitude**
- **Longitude**
- **Z Distance**
- **Angle From Camera**
- **Water Depth**
- **Vector Slope**

For textures applied to the terrain, Slope refers to terrain slope. For textures applied to 3D Objects, Slope refers to the object polygon's slope. Overhanging 3D Object polygon slopes will be treated as 90 degree slopes.

Note: You can check the slope of terrain or 3D Object polygons by clicking the area you're interested in and reading the Slope field in the Diagnostic Data window.

For Dynamic Parameter texture elements used in Post Process Events (see Post Process Editor), the list is expanded to include the following additional parameters:

- **Reflectivity**
- **Illumination**
- **Luminosity**
- **Hue**
- **Saturation**
- **Value**
- **Red**
- **Green**
- **Blue**

Gradient

This element is not very interesting by itself but if used in the right places it can be very useful. Use the gradient to vary some parameter over a distance in space. You could use it to turn on or off another texture along a terraffector vector by applying it to the opacity channel of one of the textures. For instance you could have a paved road turn into a dirt road at some distance, Y, along the vector by using a gradient aligned to the Y axis at a center on Y of the distance along the vector. It can be animated so you could show the paved part growing "over" the dirt part. Other examples might be to use it to decrease the size of stone blocks from the bottom of a building to the top to make the building look taller like the Romans did, or to use the gradient to vary the amount of another texture's rotation on an axis from one end of the object to the other.

Include/Exclude

Again, an element which on its own is not much use, but when combined with other texture elements can be amazingly powerful. Use this element to restrict the application of other texture elements to only certain areas of your scene, by defining components to include or exclude from the selection.

This Element type is most powerful when used in the Post Process Editor to control intensity.

Object Type

As with the Include/Exclude element, the Object Type element is an element which on its own is not much use, but when combined with other texture elements can be amazingly powerful. Use this element to restrict the application of other texture elements to only certain areas of your scene, by defining object types to include or exclude from the selection. The specific object component can not be selected using this element, but all objects of a particular type (e.g. all Lakes, all 3D Objects, all Cloud models) can be selected easily using this element type.

This Element type is most powerful when used in the Post Process Editor to control intensity.

Enabled Checkbox

You can disable or enable any Element. To enable an Element, select it in the Elements list and then select the Enabled Checkbox. To disable a Component, deselect the Enabled checkbox.

As you design a texture, it can be useful to disable and enable an Element to see the effect the Element has on the texture.

Any disabled Element will also disable its child Elements. Child Elements are indented from parent Elements in the Elements list.

Note: disabling a child Element has the same effect as deselecting its T icon in the parent Element.

Self Opacity Checkbox

For an overview of how Opacity works, see "Opacity Percentage Field and Texture Icon" below.

Note: Opacity is the opposite of transparency. If something is more opaque, it is less transparent. If something is more transparent, it is less opaque.

For Procedural Textures

The Self Opacity checkbox lets you determine if the color or value of a Texture Element itself helps determine its own opacity.

Self Opacity works with the Opacity Field and Texture Icon (see below).

For any texture that has colors, wherever there is more of right-most colors from the gradient in the texture, the more opaque the texture will be at that spot. Wherever there is more left-most colors from the gradient, the more transparent the texture will be at that spot.

For any texture that has values from 0 to 100%, the opacity at any point will be derived from the value at that point. Zero percent will be transparent and 100% will be opaque. Values in between will be gradated levels of transparency.

For example the since the Stripes Element only has two values where there is either stripe or no stripe, it will be 100% transparent or 100% opaque when you select the Self Opacity checkbox. Since the Soft Stripes Element has a soft edge where the values gradate between the stripe and non stripe areas, there will also be a gradient of opacity when you select the Self Opacity checkbox.

For Image Object Textures

Image Objects With Alpha Channels

To use an Image Object alpha channel to control opacity, you must have the "Self Opacity" checkbox selected in the Texture Editor. Do this for any texture Element that uses the Image Object. Then the alpha channel will be used to calculate the self opacity amount for the texture Element.

If you have self-opacity disabled VNS will composite the Image Object on black based on its alpha channel. If you don't want to use the alpha channel to control opacity, and you don't want the alpha channel to turn parts of the image black, you can disable an Image Object's alpha channel in the Image Object Library.

If you apply an image object as an ecosystem texture with tiling turned off or with lat/lon bounds turned on, VNS will restrict the region to which the image is applied. In that case enable self-opacity to keep non-image regions of the ecosystem from becoming black. Disable self-opacity if you want the image-covered area to stand out, with black non-image areas.

Image Object Transparency Range

The color RGB 0,0,0 black won't be transparent in and of itself. But if you change the Transparency settings on the Image Object Library's Color page, all of the area that is within the Max and Min color range will become black in the rendered image. You probably don't want that to happen, so you should probably avoid changing the Transparency settings on the Color page to avoid any complications.

For an image you are going to use as a texture, the only reason to modify the color settings in the Image Object Library is to flip red, green or blue channels, or use a formula. However for most uses of Image Objects as Textures, this will not be a common need.

Opacity Percentage Field and Texture Icon

The Opacity Percentage field lets you set or animate the selected Texture Element's opacity. The Texture icon lets you control the selected Texture Element's opacity with another Texture Element.

Note: These work with Self Opacity (see above). Opacity values from the Opacity Percentage field or from an applied texture are multiplied by any self-opacity value, based on zero to 100 percent range for either.

How Opacity Works

Controlling opacity gives you one way to mix textures or parts of textures. You can control opacity for each texture Element in the Texture Editor's Element list.

Note: Opacity is the opposite of transparency. If something is more opaque, it is less transparent. If something is more transparent, it is less opaque.

Root Texture Elements are like layers of glass. If the top Root Texture Element in the Elements list is not fully opaque, you'll see the next Root Texture Element showing through the first Root Element's transparent areas. For any Root Texture Elements that are fully opaque, you won't see the effects of any other Root Texture Elements listed below it in the Elements list.

For Ecosystem texturing, if there is no next Root Texture Element, you'll see the ecosystem color showing through the transparent areas.

For 3D Objects, if there is no next Root Texture Element, you'll see the material's color, which you can set in the 3D Object Material Editor.

For Child Elements, you'll see the parent's value showing through the transparent areas.

Antialias Checkbox

Select the Antialias checkbox to tell VNS to antialias the current Texture Element. Antialiasing is good for reducing stairsteps on hard contrasting lines and eliminating flickering during animations. VNS will antialias by the amount you set in the Samples field (see below).

Deselect the Antialias checkbox for faster rendering.

Hint: Use an appropriate scale when creating a texture. If your details are smaller than needed, you will add to the need for antialiasing. Adding antialiasing with extra sampling to cure this could increase rendering time without increasing the quality of the image.

Note: For Fractal Noise and Cell Basis Elements, the more Octaves you use, the more potential aliasing you'll get. Don't use more Octaves than you need. Fractal Noise has some built-in antialiasing but more might be needed if there are too many octaves.

Samples Field

The Samples value controls the amount of antialiasing VNS will use when you select the Antialias checkbox for a Texture Element (see above).

Use integers only (no decimals). A value of one results in no antialiasing. Two is the minimum amount of antialiasing, and is the default value. The larger the value, the longer the texture will take to render. Use higher numbers only if you have to.

You will be able to see the effect of this setting in the Preview displays. Adjust the Samples value until the edges become smooth.

Current Element Controls Section

The controls for the current Element are shown below the Elements section. The current Element is the one selected in the Elements list in the upper left corner of the Texture Editor.

Image Object Section

When the current Element is an Image Object Element, you'll see the Image Object section. Image Object texturing lets you take images or animations and apply them to 3D object materials or the terrain.

VNS gives you four kinds of image texturing: Planar Image, Spherical Image, Cylindrical Image and Front Projection. You can select any of these Elements from the Selected Elements drop box.

When the current Element is one of the Image Object Elements, you'll see the Image Object section with these controls:

- **Image Object Drop Box**
- **Edit Image Object Button**
- **Width Height and Colors Display Fields**
- **Image Object Thumbnail**

All image texture types share basically the same controls. Not all the controls apply to each image texture type. Any control that doesn't apply will be disabled.

Image Object Drop Box

The Image object drop box lets you select any Image object to use in the Texture Element.

You can load and edit images and animations for use as Image Objects from the Image Object Library.

You can also load a new image from the Texture Editor by selecting "New Image..." in the Image Object drop box. VNS will open a file requester. Select the new image and click the Open button in the file requester. VNS will load the new image as the base image for a new Image Object. It will appear everywhere in the program where Image Objects are listed, including the Image Object Library.

Edit Image Object Button

Click the Edit Image Object button to open the Image Object Library. It will open, ready to edit the Image Object you selected in the Image Object drop box (see above). The Image Object Library lets you manage your Image Objects including controlling memory usage, speed of loading, color, sequencing and dissolves.

Width, Height and Colors Display Fields

The Width field shows how wide the Image Object is in pixels. The Height field shows how tall the Image Object is in pixels.

The Colors field shows how many 8 bit bands of color there are in the Image. A 24 bit image will have three bands. The Colors field will also indicate if the Image Object has an alpha channel.

Image Object Thumbnail

The Image Object thumbnail shows a scaled preview picture of the Image Object selected in the Image Object drop box (see above). The thumbnail is rather small and is not antialiased, so may appear very grainy. You can see what the image orientation is, which makes it easier to match the sizes of the texture Element to create a matching aspect, whether it be tall or wide.

Image Settings Section

When the current Element is an Image Object Element, you'll see the Image Settings section.

Possible Image Object Elements include Planar Image, Spherical Image, Cylindrical Image and Front Projection Elements. You can select any Element from the Selected Elements drop box.

When the current Element is one of the Image Object Elements, you'll see the Image Settings section with these controls:

- **Width and Height Tiling Checkboxes**
- **Width and Height Flip Alternates Checkboxes**
- **Width and Height Wrap Fields**
- **Reverse Width and Height Fields**
- **Negative Image Field**
- **Pixel Smoothing**

Width and Height Tiling Checkboxes

Select the Width Tiling checkbox to cause the Image Object to repeat along its width.

Select the Height Tiling checkbox to cause the Image Object to repeat along its height. Repeating images can be useful for patterns like basket weave or brick images.

If you want the Image Object to appear just once, don't select either checkbox.

Width and Height Flip Alternates Checkboxes

For tiled Image Objects you can choose to flip the alternate tiled images along either axis. To do so, select the Flip Alternates checkbox next to the axis you want to flip, either Width or Height. Flipping the alternate tiled images causes every other image to be reversed along the axes you select.

This can help reduce patterning in the texture.

Width and Height Wrap Fields

When you use the Cylindrical Image and Spherical Image Elements, the Width and Height Wrap fields let you control how much of a cylinder or sphere the Image Object will cover. A value of 100% puts the seam for the axis at the back of the object. Lesser percentages widen the seam, and reduce the percentage of the circumference that the Image Object covers.

For the Cylindrical Image Spherical Image Element, you can control the wrap percentage around the width, and you can select tiling for the height if you wish. For the Spherical Image Element you can control the wrap percentages around both the width and height.

Spherical and Cylindrical Elements do not preview correctly no matter which View From option you select in the Previews section. This is due to the preview display rendering technique, which pays off in speed for every other Texture Element. To see how Cylindrical Image and Spherical Image Elements will look, render them on the actual object you're texturing, in a View. You can use Region Rendering to speed up the preview rendering.

Reverse Width and Height Checkboxes

Select the Reverse Width checkbox to flip the Image Object along its width. Select the Reverse Height to flip the Image Object along its Height. Selecting these can be useful for an Image Object of text for a sign if it appears to be upside down or backwards when you texture it on a 3D Object. Simply reverse one or both axes of the image to fix the problem.

Note: To rotate the image to other orientations use the rotation controls described in the Size & Position section below.

Negative Image Checkbox

Select the Negative Image checkbox to invert the colors of the Image Object. The image will then appear like a photographic negative.

Pixel Smoothing Checkbox

Select the Pixel Smoothing checkbox to apply pixel smoothing to the Image Object. This is useful for making displacement textures out of Image Objects without getting stair-stepping.

Note: You can displace terrain with Image Objects by applying a texture to the Elevation field of an Area Terraffector (see Area Terraffector Editor) or the Effect Intensity field of a Terraffector (see Terraffector Editor).

Colors Section

The Colors Section appears when the current Texture Element is a procedural pattern that uses colors.

Note: When the Texture Element is a procedural pattern modifying a value, such as transparency, the Values section will appear instead. Thus the same Texture Element may have a Colors Section or a Values section depending on what the Element is modifying.

The Colors section gives you a gradient on which you can create multiple colors. You can edit the colors, fill each color with child Texture Elements, or control remapping of the colors with other Texture Elements.

The Colors section gives you these controls:

- **The Color Gradient**
- **The Selected Color Controls**
- **Remap Function 1 and 2 Texture Icons**

Note: The Remap Function icons are only shown for those Texture Elements that can use them. The Repeat field is only shown for Element types which use wave shapes that can be repeated.

The Color Gradient

Many procedural patterns have multiple colors. You can create colors by clicking in the Gradient.

Note: If the gradient colors are nearly the same you won't see much in the previews until you edit the colors.

The Color Gradient shows the colors in your texture Element. Click a Color Pin to select a color. Double-click a Color Pin or click the Color Well to open the Color Editor where you can edit the selected color. Click on the gradient to add a new pin with a random color. Control-click to add a new pin with a color duplicating the color previously at that spot in the gradient.

Initial Colors

VNS creates colors randomly. You can edit the colors to be whatever you need.

Selected Color Controls

Color Well

The Color Well shows the color of the selected Color Pin. You can click the Color well to edit the Color in the Color Editor. This is the same as double-clicking a Color Pin.

Texture Icon

Instead of using a color for part of a procedural pattern, you can use another Texture Element. Select a Color Pin in the Gradient to select a color. Then click the T icon next to the color well to replace that color with another Texture Element. This lets you add new patterns inside either color area of a Texture Element, for added detail.

VNS will show the new Texture Element in the Elements list, as a child of the Texture Element who's color you are texturing. The Current Element Controls section will change to show the controls for the child Texture Element.

Note: You can set the Element's opacity to less than 100% to blend the new Element's colors with the parent's color.

The default Texture Element is Fractal Noise, but you can select any Texture Element you prefer from the Selected Element drop box.

Position in Gradient Field

The Position in Gradient field shows the percentage along the Gradient for the Selected Color. You can move the color's pin to the left by decreasing this number or to the right by increasing this number. You can also drag the pin along the Gradient with the mouse.

Blend Drop Box

The Blend drop box lets you choose the rate of change between the Selected Color and the color to its left in the gradient.

These are easiest to visualize if you try them and see what they look like in the gradient.

You can change the blending by selecting different blend types from the Blend Drop Box. If you have more than one color in the gradient, use the following choices to decide how the gradient blends the colors together.

Sharp Edge

Choose "Sharp Edge" if you want an instant change with no gradient.

Soft Edge

Choose "Soft Edge" to create a gradient that turns into the color to the left 1/10 of the way toward that color's pin.

Quarter Blend

Choose "Quarter Blend" to create a gradient that turns into the color to the left 1/4 of the way toward that color's pin.

Half Blend

Choose "Half Blend" to create a gradient that turns into the color to the left 1/2 of the way toward that color's pin.

Full Blend

Choose "Full Blend" to create a smooth gradient that turns into the color to the left at that color's pin.

Fast Increase

Choose "Fast Increase" to create an accelerated gradient that gets closer to the previous color faster, and turns into the color to the left at that color's pin.

Slow Increase

Choose "Slow Increase" to create an decelerated gradient that gets closer to the previous color slower, and turns into the color to the left at that color's pin.

S-Curve

Choose "S-Curve" to create a narrower gradient between the pin and the previous color's pin and leaves more of the original colors along the gradient in between.

Repeat Field

The Repeat field appears in the Colors section for several Texture Elements, but it is really a part of the Procedural Parameters. Use it to add more waves for those Texture Elements based on a wave shape, including Bell Curve, Square Wave and Sawtooth (see the Procedural Parameters Section below).

Remap Function 1 and 2 Texture Icons

The Remap Functions allow you to use another Texture Element as a filter, to change the values of the current Texture Element. It's called "Remap" because it "remaps" every value at every point in the original Texture Element to a new value, based on the values in the new Texture Element you are using to do the remapping.

This lets you alter the look of one Texture Element based on the values from another Texture Element. You can get a variety of different changes by choosing different types of Texture Element to use in the Remap function. In fact, many of the Texture Elements are best used with the Remap Function.

Note: The Remap Function icons are only shown for those Texture Elements that can use them.

For those Texture Elements that support them, VNS lets you use two Remap Functions. VNS evaluates Remap Function 1 first, and then Remap Function 2.

Note: The Remap Functions are not directly related to any Colors with which they happen to line up in the interface.

Values Section

The Values Section appears when the current Texture Element is a procedural pattern that uses 2 values, from 0 to 100, rather than colors.

Note: When the Texture Element is a procedural pattern that uses one or two 2 colors, and when the Element is modifying either a 3D Object Material color, an Ecosystem color or the color of a parent Texture Element, the Colors section will appear instead. Thus the same Texture Element may have a Values Section or a Colors section depending on what the Element is modifying. In the preview Displays, Texture Elements modifying values are shown as gray-scale images. Lower values are indicated as darker areas and higher values as lighter areas.

The two values are called Low and High. You can substitute other Texture Elements for areas in the pattern normally covered by either value. You can control remapping of the values with other Texture Elements.

The Values section gives you these controls:

- **Low and High Fields**
- **Low and High Texture Icons**
- **Remap Function 1 and 2 Texture Icons**

The Remap Function icons are only shown for those Texture Elements that can use them.

Low and High Fields

The Low field shows the value used by part of the pattern. The High fields show the value used by the other part of the pattern. For gradient Element types there will be a gradient of values between the low and high value.

Low and High are just suggestive labels. They define the range of output values. You can actually have a higher value in the Low field if you wish to invert the texture pattern.

Low and High Texture Icons

Instead of using a single value for part of a procedural pattern, you can use another Texture Element. Click the Low Texture Icon to substitute another Texture Element in the areas of the pattern normally covered by the Low value. Click the High Texture Icon to substitute another Texture Element in the areas of the pattern normally covered by the High value. This lets you add new patterns inside either area of the original Texture Element, for added detail.

VNS will show the new Texture Element in the Elements list, as a child of the Texture Element who's High or Low values you are texturing. The Current Element Controls section will change to show the controls for the child Texture Element.

The default Texture Element is Fractal Noise, but you can select any Texture Element you prefer in the Selected Element drop box.

Remap Function 1 and 2 Texture Icons

The Remap Functions allow you to use another Texture Element as a filter, to change the values of the current Texture Element. It's called "Remap" because it "remaps" the values at every point in the original Texture Element, based on the values in the new Texture Element you are using to do the remapping.

This lets you alter the look of one Texture Element based on the values from another Texture Element. You can get a variety of different changes by choosing different kinds of Texture Elements to use in the Remap function. In fact, many of the Texture Elements are best used with the Remap Function.

Note: The Remap Function icons are only shown for those Texture Elements that can use them.

For those Texture Elements that support them, VNS lets you use two Remap Functions. VNS evaluates Remap Function 1 first, and then Remap Function 2. They are not directly related to the Low and High value fields they happen to line up with in the interface.

Procedural Parameters Section

When you select a procedural Texture Element in the Elements list, VNS will show the Procedural Parameters section. The Parameters shown will vary depending on the Element you select.

Brightness and Contrast Percentage Fields

Many of the Elements have Brightness and Contrast Percentage fields. Their range is from zero to 100%.

For Elements with a Colors Section

The Brightness and Contrast Percentage fields lets you limit the gradient. They work without actually changing the Color values in the Color Editor.

Normally, each Texture Element has a continuous gradient of colors available to it, from the left edge of the Gradient to the right edge. Texture Elements with soft edges will use the intermediate values to create the softness.

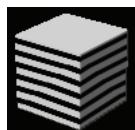
If you Set the Brightness control to zero and Contrast to 100, this gradient will be unchanged.

Lowering the Contrast Percentage discards the right end of the gradient, making less of the gradient the right side available. This gradually narrows the amount of the gradient that is available to the Texture Element. Think of it as a narrowing window onto the gradient.

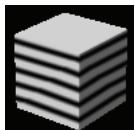
However, you can slide the "window" by raising the Brightness Percentage. The higher the Brightness Percentage, the more the "window" of available colors moves to the right side of the gradient, and the less of the left side will be available. Raising the Brightness Percentage discards more and more of the left end of the gradient, making less of the gradient the left side available.

For Elements with a Values Section

For Texture Elements that don't have color, the Brightness and Contrast will adjust the gradient between the Low Percentage and High Percentage fields in the Values section. This works similarly to the way Brightness and Contrast work with Colors (see above), but with the gradient of values between the Low and High Percentages.



Stripes and



Soft Stripes

When you select the Stripes or Soft Stripes Elements, you will see these Parameters:

- **Center Percentage Field**
- **Width Percentage Field**
- **Brightness and Contrast Percentage Fields**

Note: You won't see any stripes in the Preview displays if your preview direction and alignment axes are such that the stripes are parallel to the screen. If you are aligning a single stripe Element to a vector on the terrain, make sure you select the 'Vector Aligned' Coordinate

Space and select the X Texture Axis radio button. For example, you'd want to do this if you were creating patterns for a Terraffector™ road to simulate road stripes or tire wear.

Center Percentage Field

The Center Percentage field lets you offset the stripes pattern. A percentage of zero or 100 will center the pattern in the preview display. Any other percentage between zero and 100 will offset the pattern.

The Center Percentage is a percentage of the value in the Size field for the axis that's selected with the Texture Axis radio buttons. You'll find these controls in the Size & Position section.

Width Percentage Field

The Width Percentage field lets you set the relative width of the right-most color to the left-most color in the gradient. Enter any value between zero and 100. Increase the percentage to make the right-most color wider and the left-most color narrower.

The Width Percentage field is the amount of the left-most color as a percentage of the value in the Size field for the axis selected with the Texture Axis radio buttons. You'll find these controls in the Size & Position section.

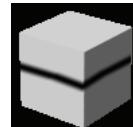
For the Stripes Element, at a Width Percentage of zero the B Color will inhabit a thin line and the left-most color will inhabit its maximum possible width. At a percentage of 50, the left-most color and right-most color will have the same width. At a percentage of 100, the left-most color will inhabit a thin line, and the right-most color will inhabit its maximum possible width.

For the Soft Stripes Element, you will need to set width to 100% for the colors to have the same width. Any percentage below 100 will make the colors on the left side of the gradient wider and the right side of the gradient narrower. This is due to the way soft stripes are calculated.

Note: If you want to have more than 50% of the color on the right side of the gradient, swap the colors on each side of the gradient and use a width less than 100.



Single Stripe &



Single Soft Stripe

The Single Stripe & Single Soft Stripe Texture Elements have the same controls as the Stripes & Soft Stripes Elements (see above). They also have these controls:

- **Length Percentage Field**
- **Offset Field**

Note: If you are aligning a single stripe Element to a vector on the terrain, make sure you select the 'Vector Aligned' Coordinate Space and select the X Texture Axis radio button. For example, you'd want to do this if you were creating patterns for a Terraffector™ road to simulate road stripes or tire wear.

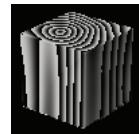
Length Percentage

The Length Percentage field lets you create dashed lines. A value of 100 percent will give you a solid line. Any value less than 100 percent will give you a dashed line. Greater than 50 percent will give you dashes that are longer than the spaces. A value of 50 percent gives you equal line and space lengths. Values less than 50 percent give you dashes that are shorter than the spaces.

Offset (in meters)

The Offset field lets you move the stripe. You can move the stripe further using the Offset field than you can with the Center Percentage field. This is because the Center Percentage only allows movement within one stripe width.

The Offset field lets you move the stripe any distance in meters. You can use positive or negative numbers.



Wood

When you select the Wood Element, you will see these Parameters:

- **Frequencies Field**
- **Turbulence Percentage Field**
- **Ring Width Percentage Field**
- **Sharpness Field**
- **Brightness Percentage Field**
- **Contrast Percentage Field**

The default sizes for the Wood Element create a very fine pattern. Make the Previews Size smaller to see the grain. The Texture Axis radio buttons in the Size and Position section let you determine if you see the grain edge-on or end-on.

Frequencies Field

The Frequencies field lets you set how many noise frequencies there are in the wood pattern. Each new frequency adds more noise at twice the highest previous frequency. More frequencies of noise perturbing the ring pattern give you more detail in the pattern.

The useful range is 0 to 10.

The Frequencies value only has an effect if there is some percentage of Turbulence (see below).

Turbulence Percentage Field

The Turbulence percentage field lets you adjust the amount of noise added to the ring pattern. The noise makes the pattern more complex. This will only have an effect if there is some above-zero value for Frequencies (see above).

Ring Width Percentage Field

Use the Ring Width Percentage field to adjust the width of each ring in the wood pattern. Smaller numbers create more rings in narrower, tighter patterns.

Ring Width is a percentage of the texture sizes for the two axes that are unselected in the Texture Axis radio buttons.

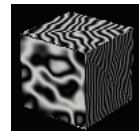
Sharpness Field

The Sharpness field lets you make the ring pattern sharper or softer. Larger numbers make sharper transitions between rings. Smaller values make softer transitions. This only affects one side of the rings; the other side is always sharp.

The default value is 3.

Brightness and Contrast Percentage Fields

See the beginning of the Procedural Parameters section, above.



Marble

When you select the Marble Element, you will see these Parameters:

- **Frequencies Field**
- **Turbulence Percentage Field**
- **Vein Width Percentage Field**
- **Sharpness Percentage Field**
- **Brightness and Contrast Percentage Fields**

Select different Texture Axis radio buttons in the Size and Position section to see the marble pattern from either the front or on-edge.

Frequencies Field

The Frequencies field lets you set how many frequencies there are in the marble pattern, in octaves. Each new octave adds a new frequency at twice the highest previous frequency. More octaves equals more wavelengths of noise perturbing the swirling pattern, giving you more detail in the pattern.

The useful range is 0 to 10.

The Frequencies value only has an effect if there is some percentage of Turbulence (see below).

Turbulence Percentage Field

The Turbulence percentage field lets you adjust the amount of noise added to the swirling pattern. The noise makes the pattern more complex. This will only have an effect if there is some above-zero value for Frequencies (see above).

Vein Width Percentage Field

Use the Vein Width Percentage field to adjust the width of the veins in the marble pattern. Smaller numbers create more veins in narrower, tighter patterns.

Vein Width is a percentage of the texture size for the axis selected with the Texture Axis radio buttons.

Sharpness Percentage Field

The Sharpness field lets you make the swirling pattern sharper or softer. Larger numbers make sharper transitions between veins. Smaller values make softer transitions.

The default value is 5.

Brightness and Contrast Percentage Fields

See the beginning of the Procedural Parameters section, above.



Brick

When you select the Brick Element, you will see these Parameters:

- **RowShift Percentage Field**
- **XZ Mortar Percentage Field**
- **Y Mortar Percentage Field**
- **Brightness and Contrast Percentage Fields**

The default sizes for the Brick Element makes square bricks. Change the size of one or all axes in the Size and Position section if you want to make them asymmetric.

Note: Brick is a 3D texture; bricks have a depth Element. Every other row of bricks is offset by the amount in the RowShift percentage field in all three axes. With no Center offset, you may see only every other row of bricks. This is because the offset fills alternate brick rows with mortar. To completely see a typical brick wall face you must offset the X and Z Center by some amount. An offset of a quarter of the size along the axis is sufficient. You'll find X and Z Center controls in the Size & Position section. For a typical brick of about nine inches (roughly 23cm) in length, try X and Z Center values of .05 meters (5cm). That's 25 percent of 23cm.

RowShift Percentage Field

Use the RowShift Percentage field to adjust the offset between each row of bricks. This works in three dimensions along all three axes.

XZ Mortar Percentage Field

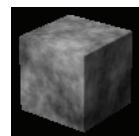
Use the XZ Mortar Percentage field to adjust the width of the mortar along the X and Z axes (the vertical mortar lines).

Y Mortar Percentage Field

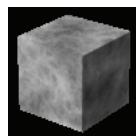
Use the Y Mortar Percentage field to adjust the width of the mortar along the Y axis (the horizontal mortar lines).

Brightness and Contrast Percentage Fields

See the beginning of the Procedural Parameters section, above.



Fractal Noise &



Turbulence

- **Octaves Field**
- **Input Seed Field**
- **Roughness Percentage Field**
- **Lacunarity Percentage Field**
- **Brightness and Contrast Percentage Fields**

Note: The Turbulence Element uses the absolute value of fractal noise. It's similar to Fractal Noise but looks puffier, more like clouds.

Octaves Field

The Octaves field lets you specify the number of separate noise frequencies. Each octave is twice the frequency of the previous octave, but you can compress or expand the frequency distance between octaves with the Lacunarity field (see below).

Different numbers of Octaves create different texture characteristics. The time penalty for extra unneeded octaves is minimal because VNS limits sampling to the octaves that are larger than a pixel. This means you can specify more Octaves than get used if you want to, without suffering extra rendering time for Octaves that aren't used. But you may want to specify fewer Octaves depending on the look you need. Experiment.

Note: For Fractal Noise and Cell Basis Elements, the more Octaves you use, the more potential aliasing you'll get. Don't use more Octaves than you need. Fractal Noise has some built-in antialiasing but more might be needed if there are too many octaves.

Input Seed Field

The Input Seed field lets you specify the starting number VNS uses when generating fractal noise. There is no right number. Different numbers produce different results. You can use any number from zero to 999999.

When you use more than one Fractal Noise Element in a texture it is a good idea to give them different input seeds. That way features don't "line up" and you can minimize recognizable repetitive patterns in the texture.

Roughness Percentage Field

The Roughness Percentage field lets you increase the weight of high frequencies in the noise.

Higher values increase high frequencies in the noise. This makes the smaller details more apparent. Lower values decrease high frequencies in the noise, making smaller details less apparent.

High roughness can be useful for rocky textures.

Lacunarity Percentage Field

The Lacunarity Percentage field lets you stretch or compress the frequency interval between octaves (see above). This lets you vary the fractal noise pattern. You can also use it to avoid repetitive patterns in the noise.

At a value of 50%, each octave will be twice the frequency of the previous octave. This can potentially show repetitive patterns in the noise.

Values less than 50 compress the frequency intervals between octaves. Values above 50 stretch the frequencies. By compressing or stretching the interval between the octaves, you can avoid regular patterns in your turbulence.

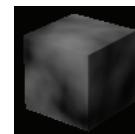
It's best to avoid even multiples of 25. The default value is 51.

Brightness and Contrast Percentage Fields

See the beginning of the Procedural Parameters section, above.



MultiFractal &



Hybrid MultiFractal

- **Octaves Field**
- **Input Seed Field**
- **Roughness Field**
- **Lacunarity Percentage Field**
- **Brightness and Contrast Percentage Fields**
- **Offset Field**

The MultiFractal and Hybrid MultiFractal Texture Elements have the same controls as Fractal Noise and Turbulence (see above), with the addition of an Offset field.

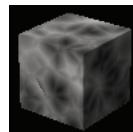
Offset Field

The Offset field lets you adjust multi-fractality. The higher the value of the offset field, the more it makes darker areas smoother, with less high frequency noise, while lighter areas will become more detailed with more high frequency noise. In practice, raising the Offset value produces the appearance of increased contrast.

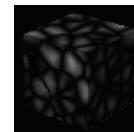
The useful range is from one to five.



F1 Cell Basis,



F2 Cell Basis,



F2mF1 Cell Basis

The F1 Cell Basis Element is useful for any texture that needs a honeycomb or crumpled pattern, like choppy wave patterns on water. The F2 Cell Basis Element is similar, but with a more dissected appearance. The F2 minus F1 Cell Basis Element is the difference between the two. For all three textures you'll see these controls:

- **Octaves Field**
- **Brightness and Contrast Percentage Fields**

Octaves Field

The Octaves field lets you add higher frequencies of the Cell Basis pattern. This gives you smaller subdivisions of detail.

The default value is one. This is the smallest value you can use. Each additional integer value doubles the subdivision. For less change, use decimal values.

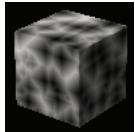
For fastest rendering turn off the 3 Dimensional checkbox in the Size and Position section, when appropriate. For example, textures you apply to the terrain, like a flagstone walkway, can be two dimensional.

Different numbers of Octaves create different texture characteristics. The time penalty for extra unneeded octaves is minimal because VNS limits sampling to the octaves that are larger than a pixel. This means you can specify more Octaves than get used if you want to, without suffering extra rendering time for Octaves that aren't used. But you may want to specify fewer Octaves depending on the look you need. Experiment.

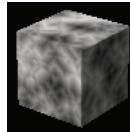
Note: For Fractal Noise and Cell Basis Elements, the more Octaves you use, the more potential aliasing you'll get. Don't use more Octaves than you need. Fractal Noise has some built-in antialiasing but more might be needed if there are too many octaves.

Brightness and Contrast Percentage Fields

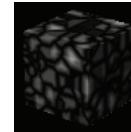
See the beginning of the Procedural Parameters section, above.



F1 Manhatten,



F2 Manhatten,



F2mF1 Manhatten

The F1 Manhattan Element is useful for any texture that needs a rectilinear, man-made pattern, like city blocks, or circuit diagrams. The F2 Cell Basis Element is similar, but with a more dissected appearance. The F2 minus F1 Cell Basis Element is the difference between the two. By rotating the texture 45 degrees and applying some sort of quantization or levels remapping, you can achieve very defined rectilinear shapes.

For all three textures you'll see these controls:

- **Octaves Field**
- **Brightness and Contrast Percentage Fields**

Octaves Field

The Octaves field lets you add higher frequencies of the Cell Basis pattern. This gives you smaller subdivisions of detail.

The default value is one. This is the smallest value you can use. Each additional integer value doubles the subdivision. For less change, use decimal values.

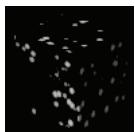
For fastest rendering turn off the 3 Dimensional checkbox in the Size and Position section, when appropriate. For example, textures you apply to the terrain, like a flagstone walkway, can be two dimensional.

Different numbers of Octaves create different texture characteristics. The time penalty for extra unneeded octaves is minimal because VNS limits sampling to the octaves that are larger than a pixel. This means you can specify more Octaves than get used if you want to, without suffering extra rendering time for Octaves that aren't used. But you may want to specify fewer Octaves depending on the look you need. Experiment.

Note: For Fractal Noise and Cell Basis Elements, the more Octaves you use, the more potential aliasing you'll get. Don't use more Octaves than you need. Fractal Noise has some built-in antialiasing but more might be needed if there are too many octaves.

Brightness and Contrast Percentage Fields

See the beginning of the Procedural Parameters section, above.



Pebbles

The Pebbles Texture Element lets you create spherical shapes scattered randomly in groups. This is useful for things like gravel, stream bed pebbles and bubbles.

The Pebbles are created in groups within areas, called "cells". You can control aspects of the pebbles and the cells with these controls:

- **Pebble Size Percentage Field**
- **Density Percentage Field**
- **Coverage Percentage Field**
- **Cell Size Percentage Field**
- **Brightness and Contrast Percentage Fields**

When you select the Pebbles Texture Element, you'll also see the 3 Dimensional checkbox appear in the Size & Position section. Select the checkbox for a three dimensional Pebbles texture. Deselect the checkbox for a two dimensional Pebbles texture.

The two dimensional version will render faster and is useful for texturing the terrain. It will have more pebble density and more of the same size pebbles.

The three dimensional version takes longer to render. It will give you more irregularity in pebble size and less density, and is better for 3D Objects.

Pebble Size Percentage Field

The Pebble Size Percentage field lets you adjust the size of the pebble shapes. A size of 100% makes one pebble fill up a cell. Smaller Pebble Size percentages allow more than one pebble in a cell, and can keep the pebbles from overlapping so much.

Having more than one pebble in a cell lets the pebbles form in separated clusters.

Note: There is no actual user-control for number of pebbles in a cell, but the Density Percentage field has an effect on it (see below).

Density Percentage Field

The Density Percentage field lets you make pebbles closer together or farther apart. When you increase the Density Percentage, VNS creates more pebbles with a given space.

Coverage Percentage Field

The Coverage Percentage lets you determine how much empty space there is in the pebble pattern. Increase the Coverage Percentage value to fill in empty areas with more pebble shapes. Decrease the Coverage Percentage to create more empty space between groups of pebbles.

In some cases, this works best if your Pebble Size is less than 100% (see above).

Cell Size Percentage Field

The Cell Size Percentage field lets you change the size of the area that contains a collection of pebbles. By changing the Cell Size Percentage, you will also change the sizes of the pebbles themselves.

The Cell Size Percentage field is a percentage of the sizes along all three axes. If you deselect the 3 Dimensional field in the Size and Position section, the Cell Size Percentage field is a percentage of the X and Y axes.

Note: By increasing pebble size and decreasing cell size, you can get a higher density of pebbles.

Brightness and Contrast Percentage Fields

See the beginning of the Procedural Parameters section, above.

Composite, Darken, Lighten

These Elements all have a single Procedural Parameters field: the Mask Percentage field. There's also a related Texture icon.

Mask Percentage Field and Texture Icon

For The Composite Element, the Mask Percentage field lets you control how much the Color on the left side of the Gradient or its Texture Element mixes with the Color on the right side of the gradient or its Texture Element. A value of 50% will mix Colors equally. Larger values make the right side of the Gradient more dominant while smaller values make the left side of the Gradient more dominant. A value of zero will result in the right side of the gradient being selected while a value of 100 will result in the left side of the gradient being selected.

For the Lighten Element, the Mask field lets you control the brightness of the left side of the gradient or its Texture Element. A value of zero will leave the left side of the gradient unchanged. Larger values make the left side of the gradient lighter. A value of 100 will turn the left side of the gradient to white. The default value is 25.

For the Darken Element, the Mask field lets you control the brightness of the left side of the gradient or its Texture Element. A value of 100 will leave the left side of the gradient value unchanged. Smaller values make the left side of the gradient darker. A value of zero will turn the left side of the gradient to black. The default value is 75.

For all of these Texture Elements, you can create very interesting patterns when you use a Texture Element to control the Mask Percentage. This is because a Texture Element can have different values of masking in different areas of the pattern, allowing variations of compositing, lightening or darkening from one area to another.

Contrast

The Contrast Element lets you adjust the contrast of the left side of the gradient or its Texture Element using these controls:

- **Contrast Percentage Field**
- **Median Percentage Field**

Contrast Percentage Field

A Contrast of 50% leaves the left side of the gradient color or Texture Element unchanged. Values below 50% decreases contrast, while values above 50% increases contrast.

For increasing contrast, small values above 50 work best. This is very sensitive.

Median Percentage Field

The Median Percentage lets you adjust the brightness value around which the contrast is increased or decreased.

Skew

The Skew Element is most useful when used as a Remap function. The Skew Element lets you stretch and compress the contrast of the Low value for non-color Texture Elements, or the left side of the gradient or its Texture Element for colored Texture Elements, using these controls:

- **Mask Percentage Field**
- **Median In Percentage Field**
- **Median Out Percentage Field**

For Texture Elements with Colors, Skew adjusts the values of each band of the color, so it may change the colors.

The way VNS skews the contrast is by using the Median In Percentage value as the starting position for a "handle" that then moves to the Median Out Percentage value. This lets you drag all the left side of the gradient or Texture Element values proportionately around the "handle" toward the Median Out Percentage value, skewing the contrast.

If the Median In Percentage is higher than the Median Out Percentage, the values above the Median In Percentage will be stretched, while values below the Median In Percentage will be compressed.

If the Median In Percentage is lower than the Median Out Percentage, the values above the Median In Percentage will be compressed, while values below the Median In Percentage will be stretched.

For example, suppose the Median In Percentage is set to 50% and the Median Out Percentage is set to 25%. Then the original Texture values that ranged from 50% to 100% will be proportionately stretched so they range between 25% and 100%. The original Texture values that ranged from 0% to 50% will be compressed so they range between 0% and 25%.

Mask Percentage Field

The Mask Percentage field lets you control the mix between the skewed values and the original Texture Element values. A Mask Percentage of zero has no effect, and will use the original left side of the gradient color or Texture Element. Higher values allow more of the skewed values to be combined with the original left side of the gradient color or Texture Element. A Mask Percentage of 100 will use only the skewed values.

The default value is 50%.

Median In Percentage Field

The Median In Percentage field lets you set the mid point around which the original Texture values will be stretched or compressed toward the Median Out Percentage value.

Median Out Percentage Field

The Median Out Percentage field lets you set the mid point toward which the original Texture values will be stretched or compressed from the Median In Percentage value.

Bell Curve, Sawtooth

The Bell Curve and Sawtooth Elements are most useful when used as Remap functions. They allow you to change the values of the gradient based on a sine wave (Bell Curve Element) or sawtooth wave (Sawtooth Element). You can control and animate the wave shape with these controls:

- **Amplitude Percentage Field**
- **Shift Percentage Field**
- **Frequency Field**
- **Repeat Field**
- **Phase Percentage Field**
- **Phase Scale Field**
- **Skew Percentage Field**
- **Lower Clamp Percentage Field**
- **Upper Clamp Percentage Field**

To see the wave, select the Element Only checkbox in the Previews section. VNS will show you the wave's shape in the Element Only Display whenever you select a Bell Curve or Sawtooth Element in the Elements list.

By using various combinations of Amplitude, Shift and Frequency you can use any portion of the wave form.

Amplitude Percentage Field

The Amplitude Percentage field lets you adjust the height of the wave shape. The range is from zero percent to 100%.

The default Amplitude Percentage value is 50%. With the default Shift Percentage of 50%, the wave itself will describe a shape that sweeps from zero percent to 100 percent, and back to zero percent. This fits a complete bell curve between zero and 100 percent.

Shift Percentage Field

The Shift Percentage field lets you move the wave shape up or down in value.

Frequency Field

If you have multiple waves using the Repeat field (see below), changing the frequency changes the spacing between the waves. Decimal values are OK.

The Frequency field also lets you make the wave narrower (higher values) or wider (lower values).

Repeat Field

The Repeat field is in the Colors section, but is really a part of the Procedural Parameters. Use it to add more waves.

You will only see the extra waves if the Frequency field value is greater than one (see above).

Phase Percentage Field

The Phase Percentage field lets you move the wave toward the right. Values are from zero to 100.

If you need a larger than 100% phase shift, use Phase Percentage in combination with Phase Scale (see below).

Phase Scale Field

The Phase Scale field multiplies the value in the Phase field to create the final Phase offset to the right. It's especially useful when you need a larger than 100% phase shift, such as when you have a Frequency value higher than 1 and you want to move the narrow wave to a specific position beyond 100% phase shift.

Skew Percentage Field

Use the Skew Percentage field to cause the wave to lean. The default value of 50% creates a symmetrical waveform. Values below 50% will cause the wave shape to lean to the left, while values above 50% will cause the wave shape to lean to the right.

Note: Values of zero or 100 percent will give you hard edges, but could cause aliasing problems. It's better to use values just above zero or just below 100 if you want hard looking edges without excessive aliasing. Use the Preview displays as a guide. If it looks pixelated there, then it probably will in your renderings too).

Lower Clamp Percentage Field

The Lower Clamp Percentage field lets you set a lower value limit for the curve. Any values below this will be rounded up to the value you set here.

Upper Clamp Percentage Field

The Upper Clamp Percentage field lets you set an upper value limit for the curve. Any values above this will be rounded down to the value you set here.

Square Wave

The Square Wave Element is most useful when used as a Remap function. It allows you to change the values of the Color gradient based on a square wave shape. You can control and animate the square wave with these controls:

- **Amplitude Percentage Field**
- **Shift Percentage Field**
- **Frequency Field**
- **Phase Percentage Field**
- **Phase Scale Field**
- **Width Percentage Field**
- **Lower Clamp Percentage Field**
- **Upper Clamp Percentage Field**

To see the wave, select the Element Only checkbox in the Previews section. VNS will show you the wave's shape in the Element Only Display whenever you select a Square Wave Element in the Elements list.

Amplitude Percentage Field

The Amplitude Percentage field lets you adjust the height of the wave shape. The range is from zero percent to 100%.

The default Amplitude Percentage value is 50%. With the default Shift Percentage of 50%, the wave itself will describe a shape that jumps from zero percent to 100 percent, and back to zero percent. This fits a complete square wave between zero and 100 percent.

Shift Percentage Field

The Shift Percentage field lets you move the wave shape up or down in value.

Frequency Field

If you have multiple waves using the Repeat field (see below), changing the frequency changes the spacing between the waves. Decimal values are OK.

The Frequency field also lets you make the wave narrower (higher values) or wider (lower values).

Repeat Field

The Repeat field is in the Colors section, but is really a part of the Procedural Parameters. Use it to add more waves.

Phase Percentage Field

The Phase Percentage field lets you move the wave toward the right. Values are from zero to 100.

If you need a larger than 100% phase shift, use Phase Percentage in combination with Phase Scale (see below).

Phase Scale Field

The Phase Scale field multiplies the value in the Phase field to create the final Phase offset to the right. It's especially useful when you need a larger than 100% phase shift, such as when you have a Frequency value higher than 1 and you want to move the narrow wave to a specific position beyond 100% phase shift.

Width Percentage Field

The width Percentage field lets you narrow the width of the square wave without changing the frequency.

Lower Clamp Percentage Field

The Lower Clamp Percentage field lets you set a lower value limit for the square wave. Any values below this will be rounded up to the value you set here.

Upper Clamp Percentage Field

The Lower Upper Clamp Percentage field lets you set an upper value limit for the square wave. Any values above this will be rounded down to the value you set here.

Linear

The Linear Element is most useful when used as a Remap function. It allows you to change the values of the Color gradient based on a linear gradient. You can control and animate the gradient.

The default values won't change anything. By increasing the frequency you can create a narrow band of transition between the lower clamp value on the left and the upper clamp value on the right. By increasing the phase you can move that narrow filter wherever you like. This lets you create masks and control the softness of the mask edges for smooth rendering without requiring extra antialiasing.

- **Amplitude Percentage Field**
- **Shift Percentage Field**
- **Frequency Field**
- **Phase Percentage Field**
- **Phase Scale Field**
- **Lower Clamp Percentage Field**
- **Upper Clamp Percentage Field**

To see the gradient, select the Element Only checkbox in the Previews section. VNS will show you the gradient's shape in the Element Only Display whenever you select a Linear Element in the Elements list.

Amplitude Percentage Field

The Amplitude Percentage field lets you adjust the slope of the linear gradient. The range is from zero percent to 100%.

The default Amplitude Percentage value is 50%. With the default Shift Percentage of 50%, the gradient itself will describe a shape that sweeps from zero percent to 100 percent. This fits a complete linear gradient between zero and 100 percent.

Shift Percentage Field

The Shift Percentage field lets you move the gradient shape up or down in value.

Frequency Field

The Frequency field lets you make the gradient narrower (higher values) or wider (lower values). Decimal values are OK.

Phase Percentage Field

The Phase Percentage field lets you move the gradient toward the right. Values are from zero to 100.

If you need a larger than 100% phase shift, use Phase Scale (see below).

Phase Scale Field

The Phase Scale field multiplies the value in the Phase field to create the final Phase offset to the right. It's especially useful when you need a larger than 100% phase shift, such as when you have a Frequency value higher than 1 and you want to move the narrow gradient to a specific position beyond 100% phase shift.

Lower Clamp Percentage Field

The Lower Clamp Percentage field lets you set a lower value limit for the gradient. Any values below this will be rounded up to the value you set here.

Upper Clamp Percentage Field

The Upper Clamp Percentage field lets you set an upper value limit for the gradient. Any values above this will be rounded down to the value you set here.

Steps

The Steps Element is most useful when used as a Remap function. It allows you to change the values of the Color gradient based on a stepped square wave shape. You can control and animate the stepped square wave. This can reduce colors in a texture like a posterization effect.

- **Amplitude Percentage Field**
- **Shift Percentage Field**
- **Steps Field**
- **Phase Percentage Field**
- **Phase Scale Field**
- **Skew Percentage Field**
- **Lower Clamp Percentage Field**
- **Upper Clamp Percentage Field**

To see the wave, select the Element Only checkbox in the Previews section. VNS will show you the wave's shape in the Element Only Display whenever you select a Steps Element in the Elements list.

Amplitude Percentage Field

The Amplitude Percentage field lets you adjust the height of the stepped square wave shape. The range is from zero percent to 100%.

The default Amplitude Percentage value is 50%. With the default Shift Percentage of 50%, the wave itself will describe a shape that jumps in steps from zero percent to 100percent, and back to zero percent. This fits a complete stepped square wave shape between zero and 100 percent.

Shift Percentage Field

The Shift Percentage field lets you move the stepped square wave shape up or down in value.

Steps Field

The Steps field lets you adjust the number of steps in the Stepped Square Wave.

Phase Percentage Field

The Phase Percentage field lets you move the wave toward the right. Values are from zero to 100.

If you need a larger than 100% phase shift, use Phase Scale (see below).

Phase Scale Field

The Phase Scale field multiplies the value in the Phase field to create the final Phase offset to the right. It's especially useful when you need a larger than 100% phase shift.

Skew Percentage Field

Use the Skew Percentage field to cause the wave to lean. The default value of 50% creates a symmetrical waveform. Values below 50% will cause the wave shape to lean to the left, while values above 50% will cause the wave shape to lean to the right.

Lower Clamp Percentage Field

The Lower Clamp Percentage field lets you set a lower value limit for the curve. Any values below this will be rounded up to the value you set here.

Upper Clamp Percentage Field

The Lower Upper Clamp Percentage field lets you set an upper value limit for the curve. Any values above this will be rounded down to the value you set here.

Gamma

The Gamma Element is most useful when used as a Remap function. It allows you to change the values of the Color gradient based on a curved gradient. You can control and animate the gradient with these controls:

- **Amplitude Percentage Field**
- **Shift Percentage Field**
- **Gamma Field**
- **Lower Clamp Percentage Field**
- **Upper Clamp Percentage Field**

The Gamma Element does the same thing as the Bias Element (see below) but using traditional Gamma values, such as those used to adjust computer monitors. If you're familiar with these values, use the Gamma Element. Otherwise you might want to use the Bias Element due to the wider scale of its percentage-based useful range.

To see the curved gradient, select the Element Only checkbox in the Previews section. VNS will show you the curve's shape in the Element Only Display whenever you select a Gamma Element in the Elements list.

Amplitude Percentage Field

The Amplitude Percentage field lets you adjust the height of the curve. The range is from zero percent to 100%.

The default Amplitude Percentage value is 50%. With the default Shift Percentage of 50%, the wave will go from zero to 100%. This fits a complete curve between zero and 100 percent. Use a combination of Amplitude and Shift to extract any portion of the curve you wish to use.

Shift Percentage Field

The Shift Percentage Field lets you shift the values in the curve up or down. The range is from zero to 100 percent. The default value is 50%.

Lower percentages shift the values of the gradient downward. With the other Procedural Parameters set at their default values, this will cause more of the Parent Element's left side of the gradient Color to show through.

Higher percentages shift the values of the gradient upward. With the other Procedural Parameters set at their default values, this will cause more of the Parent Element's right side of the gradient to show through.

Gamma Field

The Gamma Field lets you alter the shape of the gamma curve. The range is from zero to 100, but the useful range is from .1 (one tenth) to 5. The default value is 2.

You can use the gamma curve to brighten or darken the colors gradated between the A and B colors of the Parent Element.

Any value below one is a curve with a depression. Lowering the Gamma value makes the curve more pronounced. Values less than 1 cause middle tones to darken.

Any value above one is a curve with a bump. Raising the Gamma value makes the curve more pronounced. Values higher than one brighten mid-tones.

A value of one is a straight line rather than a curve. With the other Procedural Parameters at their default values, the Gamma Element will then have no effect.

Lower Clamp Percentage Field

The Lower Clamp Percentage field lets you set a lower value limit for the curve. Any values below this will be rounded up to the value you set here.

Upper Clamp Percentage Field

The Lower Upper Clamp Percentage field lets you set an upper value limit for the curve. Any values above this will be rounded down to the value you set here.

Bias

The Bias Element is most useful when used as a Remap function. It allows you to change the values of the Color gradient based on a curved gradient. This is similar to Gamma, but expressed as a percentage. You can control and animate the gradient with these controls:

- **Amplitude Percentage Field**
- **Shift Percentage Field**
- **Bias Percentage Field**
- **Median Percentage Field**
- **Lower Clamp Percentage Field**
- **Upper Clamp Percentage Field**

The Bias Element does the same thing as the Gamma Element (see above) but with percentage values. If you're familiar with Gamma values, you might want to use the Gamma Element. Otherwise use the Bias Element due to the wider scale of its percentage-based useful range.

To see the curved gradient, select the Element Only checkbox in the Previews section. VNS will show you the curve's shape in the Element Only Display whenever you select a Bias Element in the Elements list.

Amplitude Percentage Field

The Amplitude Percentage field lets you adjust the height of the curve. The range is from zero percent to 100%.

The default Amplitude Percentage value is 50%. With the default Shift Percentage of 50%, the wave will go from zero to 100%. This fits a complete curve between zero and 100 percent. Use a combination of Amplitude and Shift to extract any portion of the curve you wish to use.

Shift Percentage Field

The Shift Percentage Field lets you shift the values in the curve up or down. The range is from zero to 100 percent. The default value is 50%.

Lower percentages shift the values of the gradient downward. With the other Procedural Parameters set at their default values, this will cause more of the Parent Element's left side of the gradient to show through.

Higher percentages shift the values of the gradient upward. With the other Procedural Parameters set at their default values, this will cause more of the Parent Element's right side of the gradient to show through.

Bias Percentage Field

The Bias Percentage Field lets you alter the shape of the Bias curve. The range is from zero to 100%. The default value is 25%.

You can use the gamma curve to brighten or darken the colors gradated between the A and B colors of the Parent Element.

Any value below 50% is a curve with a depression. Lowering the Bias value makes the curve more pronounced. Values less than 1 cause middle tones to darken.

Any value above 50% is a curve with a bump. Raising the Bias value makes the curve more pronounced. Values higher than one brighten mid-tones.

A value of 50% is a straight line rather than a curve. With the other Procedural Parameters at their default values, the Bias Element will then have no effect.

Lower Clamp Percentage Field

The Lower Clamp Percentage field lets you set a lower value limit for the curve. Any values below this will be rounded up to the value you set here.

Upper Clamp Percentage Field

The Upper Clamp Percentage field lets you set an upper value limit for the curve. Any values above this will be rounded down to the value you set here.

Gain

The Gain Element is most useful when used as a Remap function. It allows you to change the values of the parent Element's Color gradient based on the Gain Element's S-curved gradient. Gain is similar to the Gamma Element, but with a two stage curve. You can control and animate the gradient with these controls:

- **Amplitude Percentage Field**
- **Shift Percentage Field**
- **Gain Percentage Field**
- **Median Percentage Field**
- **Lower Clamp Percentage Field**
- **Upper Clamp Percentage Field**

To see the curve, select the Element Only checkbox in the Previews section. VNS will show you the curve's shape in the Element Only display whenever you select a Gain Element in the Elements list.

Amplitude Percentage Field

The Amplitude Percentage field lets you adjust the range of change. The default value of 50% gives you a normal range. Higher values create a more disparate mix between the Parent Element's A and B colors, with fewer intermediate colors. Lower values create a more equal mix between the Parent Element's A and B colors with more intermediate colors.

Use a combination of Amplitude and Shift to extract any portion of the curve you wish to use.

Shift Percentage Field

The Shift Percentage Field lets you shift the values in the curve up or down. The range is from zero to 100 percent. The default value is 50%.

Lower percentages shift the values of the gradient downward. With the other Procedural Parameters set at their default values, this will cause more of the Parent Element's left side of the gradient to show through.

Higher percentages shift the values of the gradient upward. With the other Procedural Parameters set at their default values, this will cause more of the Parent Element's right side of the gradient to show through.

Gain Percentage Field

The Gain Percentage Field lets you alter the shape of the Gain curve. The range is from zero to 100 percent. The default value is 25%.

Any value below 50% is an S-curve with a boost at the left and a cut on the right. Lowering the Gain value makes the curves more pronounced. This curve reduces number of colors between the A and B colors of the Parent Element.

Any value above 50% is an S-curve with a cut on the left and a boost on the right. Raising the Gain value makes the curves more pronounced. This curve increases the number of colors between the A and B Colors of the Parent Element.

A value of 50% is a straight line rather than a curve. With the other Procedural Parameters at their default values, the Gain Element will then have no effect.

Lower Clamp Percentage Field

The Lower Clamp Percentage field lets you set a lower value limit for the curve. Any values below this will be rounded up to the value you set here.

Upper Clamp Percentage Field

The Upper Clamp Percentage field lets you set an upper value limit for the curve. Any values above this will be rounded down to the value you set here.

Custom Curve

The Custom Curve Element is most useful when used as a Remap function. It allows you to change the values of the parent Element's Color gradient based on a user-definable gradient. You can control and animate the gradient with these controls:

- **Amplitude Percentage Field**
- **Shift Percentage Field**
- **Edit Curve Button**
- **Lower Clamp Percentage Field**
- **Upper Clamp Percentage Field**

Of these, the most powerful is the Edit Curve button, allowing you, as it does, to manually edit the points that make up the remap function graph.

To see the curve, select the Element Only checkbox in the Previews section. VNS will show you the curve's shape in the Element Only display whenever you select a Custom Curve Element in the Elements list.

Amplitude Percentage Field

The Amplitude Percentage field lets you adjust the range of change. The default value of 50% gives you a normal range. Higher values create a more disparate mix between the Parent Element's A and B colors, with fewer intermediate colors. Lower values create a more equal mix between the Parent Element's A and B colors with more intermediate colors.

Use a combination of Amplitude and Shift to extract any portion of the curve you wish to use.

Shift Percentage Field

The Shift Percentage Field lets you shift the values in the curve up or down. The range is from zero to 100 percent. The default value is 50%.

Lower percentages shift the values of the gradient downward. With the other Procedural Parameters set at their default values, this will cause more of the Parent Element's left side of the gradient to show through.

Higher percentages shift the values of the gradient upward. With the other Procedural Parameters set at their default values, this will cause more of the Parent Element's right side of the gradient to show through.

Edit Curve Button

Click on the Edit Curve Button to open the Edit Custom Curve Window, which will provide you with the necessary controls for editing the curve to your required settings.

Lower Clamp Percentage Field

The Lower Clamp Percentage field lets you set a lower value limit for the curve. Any values below this will be rounded up to the value you set here.

Upper Clamp Percentage Field

The Upper Clamp Percentage field lets you set an upper value limit for the curve. Any values above this will be rounded down to the value you set here.

Maximum, Minimum

The Maximum and Minimum Elements have no Procedural Parameters.

The Maximum Element combines the areas of the A and B colors or Texture Elements that have the highest luminance value.

The Minimum Element combines the areas of the A and B colors or Texture Elements that have the lowest luminance value.

Both Maximum and Minimum can create really nice tile patterns for floors, wallpaper and other designs.

Maximum Switch, Minimum Switch

The Maximum and Minimum Switch Elements give you these controls:

- **Switch A Percentage Field and Texture Icons**
- **Switch B Percentage Field and Texture Icons**

The Maximum Switch Element mixes the gradient colors or Texture Elements based on the highest of the two Switch Parameter values. Wherever the Switch A value is higher, VNS will use the left side of the gradient color or Texture Element. Wherever the Switch B value is higher, VNS will use the right side of the gradient color or Texture Element.

The Minimum Switch Element mixes the A and B colors or Texture Elements based on the lowest of the two Switch Parameter values. Wherever the Switch A value is lower, VNS will use the left side of the gradient color or Texture Element. Wherever the Switch B value is lower, VNS will use the right side of the gradient color or Texture Element.

Use the Texture icons to derive Switch A or Switch B values from other Texture Elements. That way, VNS will be intermingle the Parent Element's A and B colors or Texture Elements based on areas where the other Switch A or B Texture Elements have either the highest (Maximum Switch) or lowest (Minimum Switch) values.

Maximum Switch and Minimum Switch can create really nice tile patterns for floors or wallpaper designs.

Switch A Percentage Field and Texture Icon

Set a value, or use a texture to control the Switch A values.

Switch B Percentage Field and Texture Icon

Set a value, or use a texture to control the Switch B values.

Threshold

The Threshold Element mixes the gradient colors or Texture Elements based on the highest of separate Threshold and Sample Parameter values.

- **Threshold Percentage Field**
- **Sample Percentage Field**

Wherever the Threshold Percentage value is higher, VNS will use the left side of the gradient color or Texture Element. Wherever the Sample Percentage value is higher, VNS will use the right side of the gradient color or Texture Element.

This is remarkably similar to the Maximum Switch Element (see above). It is included in the VNS Texture Element set for those who are familiar with using this functionality via the Threshold metaphor.

Use the Texture icons to derive values from other Texture Elements. That way, VNS will intermingle the A and B colors or Texture Elements based on areas where the other Texture Elements have the highest values.

Threshold can create really nice patterns for floors, wallpaper, flagstone and other designs.

Threshold Percentage Field

Set a value, or use a texture to control the Threshold Percentage values.

Sample Percentage Field

Set a value, or use a texture to control the Sample Percentage values.

Dynamic Parameter

The Dynamic Parameter Element (Formerly known as Terrain Parameter Element) lets you mix gradient colors or Texture Elements based on Rules-of-Nature™ and other channels of data drawn from your scene. You will see the following controls:

- **Input Low Field**

- **Input High Field**
- **Parameter Drop Box**

Input Low and High Fields

The Input Low and High fields let you control how the gradient colors or textures are mixed together. VNS will sample the value of the dynamic parameter at every point on the terrain or 3D Object, and apply the gradient colors based the dynamic parameter value and the values in the Input Low and High fields.

Remember that the colors in the gradient can also be other Texture Elements. Thus the Dynamic Parameter can mix between Texture Elements based on the values of one of the Rules-of-Nature™ or other relevant values.

Note: You can see the values for any of these Rules-of-Nature™ at any point on the terrain. To do so, render a preview in a View and click in the View. You'll see the values for the spot you clicked displayed in the Diagnostic Data Window. Click in several places to see the limits of a possible range of values between the two positions you clicked. You can also hold down the mouse button and move the mouse over a View to see a continuous readout of values.

When Input Low is less than Input High, colors on the left side of the gradient appear anywhere the dynamic parameter is at or below the Input Low value, colors on the right side of the gradient appear anywhere the dynamic parameter is at or above the Input High value. In between there will a mix of colors along the gradient.

You can invert the gradient by putting a higher value in the Input Low field. If Input Low and High are reversed then the output colors will also be reversed.

Decimals are allowed in the Input Low and Input High fields for all of the Rules-of-Nature™. The Elevation, Relative Elevation, Latitude & Longitude Rules-of-Nature™ can accept negative numbers.

The following Dynamic Parameters are available for all Texture operations:

- **Elevation**

Enter an elevation into the Input Low field. This should be the elevation, in meters above sea-level, below which you want to see the left-most gradient color or texture. For elevations above this value, VNS will start mixing gradient colors. Enter an elevation into the Input High field. This should be the elevation, in meters, above which you want to see the right-most color or texture. VNS will mix Colors or their textures in a gradient for points that are between the two elevation values you entered.

- **Relative Elevation**

Enter a relative elevation value into the Input Low field. This should be the relative elevation value below which you want to see the left-most gradient color or texture. For places on the terrain that have relative elevations above this value, VNS will mix gradient colors. Enter a relative elevation value into the Input High field. This should be the relative elevation value above which you want to see the right-most gradient or texture. VNS will mix gradient colors between the two elevations you entered.

You can force the left-most color or its texture to appear in drainages by setting Input Low to the highest relative elevation value you find along a drainage. You can force the right-most color to appear on ridges by setting Input High to the lowest relative elevation value you find along a ridge. To get a sharp edge between colors with no mixing in between, you can set Input Low and

Input High to the same value.

- **Slope**

For terrain texturing, enter a terrain slope into the Input Low field. This should be the slope, in degrees, below which you want to see the left-most gradient color or texture on the terrain. For slopes steeper than this value, VNS will start mixing gradient colors. Enter a slope into the Input High field. This should be the slope, in degrees, above which you want to see the right-most gradient color or texture on the terrain. VNS will mix gradient colors or their textures for points that are between the two slope values you entered.

For 3D Object Material texturing, the slope is measured on the object's own polygons, not the terrain below the object. You can read the object's polygon slope and aspect in the diagnostic window by clicking the object. Inverted slopes (slopes greater than 90 degrees) are seen as 90 degrees.

- **North Deviation**

Enter a North Deviation amount into the Input Low field. This should be the deviation, degrees from north, below which you want to see the left-most gradient color or texture. For slope directions larger than this value, VNS will start mixing gradient colors. Enter a slope deviation into the Input High field. This should be the deviation, in degrees from north, above which you want to see the right-most gradient color or texture. VNS will mix gradient colors or their textures for points that are between the two deviation values you entered.

For example, you can restrict the left-most gradient color to appear only on slopes facing south. The angles that control this parameter are the direction in which the terrain slopes. A south facing slope is 180 degrees from north. East and west are both 90 degrees from north. So to have a texture gradate on slopes that are east to south facing you would enter 90 for Input Low and 180 for Input High. This will create a mirrored gradient on the west to south facing slopes.

- **East Deviation**

This is similar to North Deviation, but with an eastern reference direction. Enter a slope deviation amount into the Input Low field. This should be the deviation, degrees from east, below which you want to see the left-most gradient color or texture. For slope directions larger than this value, VNS will start mixing gradient colors. Enter a slope deviation into the Input High field. This should be the deviation, in degrees from east, above which you want to see the right-most gradient color or texture. VNS will mix gradient colors or textures in a gradient for points that are between the two deviation values you entered.

For example, you can restrict the left-most gradient color to appear only on slopes facing east. The angles that control this parameter are the direction in which the terrain slopes. A south facing slope is 90 degrees from east. North and south are both 90 degrees from east. So to have a texture gradate on slopes that are east to south facing you would enter 0 for Input Low and 90 for Input High. This will create a mirrored gradient on the east to north facing slopes.

- **Latitude**

Enter a latitude into the Input Low field. This should be the latitude, in degrees, below which you want to see the left-most gradient color or texture. For latitudes greater than this value, VNS will start mixing gradient colors. Enter a latitude into the Input High field. This should be the latitude, in degrees, above which you want to see Color B or texture. VNS will mix Colors or

textures in a gradient for points that are between the two latitude values you entered.

- **Longitude**

Enter a longitude into the Input Low field. This should be the longitude, in degrees, below which you want to see the left-most gradient color or texture. For longitudes greater than this value, VNS will start mixing gradient colors. Enter a longitude into the Input High field. This should be the longitude, in degrees, above which you want to see the right-most gradient color or texture. VNS will mix colors or textures in a gradient for points that are between the two longitude values you entered.

- **Z Distance**

Enter a Z Distance into the Input Low field. This should be the Z Distance, in meters, below which you want to see the left-most gradient color or texture. For Z Distances greater than this value, VNS will start mixing gradient colors. Enter a Z Distance into the Input High field. This should be the Z Distance, in meters, above which you want to see the right-most gradient color or its texture on the terrain. VNS will mix Colors or textures in a gradient for points that are between the two Z Distance values you entered.

For example, you can restrict the left-most gradient color Texture Element to appear only in the foreground. This can eliminate a lot of distant texture aliasing problems.

- **Angle From Camera**

Surfaces perpendicular to the camera heading have an “Angle From Camera” value of 90 degrees. Surfaces parallel to the camera heading have an “Angle From Camera” value of 0 degrees. Enter an Angle from Camera in degrees into the Input Low field. This should be the angle below which you want to see the left-most gradient color or texture. For angles greater than this value, VNS will start mixing gradient colors. Enter a Angle from Camera in degrees into the Input High field. This should be the angle above which you want to see the right-most gradient color or texture. VNS will mix colors or their textures in a gradient for points that are between the angles you entered.

- **Water Depth**

Enter a water depth into the Input Low field. This should be the water depth, in meters of depth below water surface, below which you want to see the left-most gradient color or texture. For water depths greater than this value, VNS will start mixing gradient colors. Enter a water depth into the Input High field. This should be the water depth, in meters of depth below water surface, above which you want to see the right-most gradient color or its texture on the terrain. VNS will mix colors or their textures in a gradient for points that are between the two water depth values you entered. Use of negative water depth values will allow you to have texturing for a distance above the waterline, but linked to it, so that if water level is animated over time, the texturing above that line will be modified accordingly.

For example, you can drive the Diffuse Intensity of a Beach material based on negative water depth. As negative water depth values increase (i.e. move away from 0), you can have the diffuse intensity rise. This will simulate the darkening of terrain around the edges of lakes and rivers. Combined this with Specularity driven by the same texture element, and you can also simulate the increase in glossiness due to increased moisture levels.

- **Vector Slope**

Enter a Vector Slope percentage into the Input Low field. This should be the slope percentage below which you want to see the left-most gradient color or texture. For slopes greater than this value, VNS will start mixing gradient colors. Enter a slope into the Input High field. This should be the slope percentage above which you want to see the right-most gradient color or texture. VNS will mix colors or their textures in a gradient for points that are between the slopes you entered.

For example, you can restrict a the left-most gradient color or Texture Element to appear only where the slope is shallow, to simulate calmer water on gentle stretches of a Stream.

The following Dynamic Parameters are only available for Texture operations used in Post Process Events:

- **Reflectivity**

Enter a Reflectivity amount into the Input Low field. This should be the Reflectivity % value, below which you want to see the left-most gradient color or texture. For Reflectivity values larger than this value, VNS will start mixing gradient colors. Enter a Reflectivity amount into the Input High field. This should be the Reflectivity % value, above which you want to see the right-most gradient color or texture. VNS will mix gradient colors or their textures for points that are between the two deviation values you entered.

- **Luminosity**

Enter a Luminosity amount into the Input Low field. This should be the Luminosity % value, below which you want to see the left-most gradient color or texture. For Luminosity values larger than this value, VNS will start mixing gradient colors. Enter a Luminosity amount into the Input High field. This should be the Luminosity % value, above which you want to see the right-most gradient color or texture. VNS will mix gradient colors or their textures for points that are between the two deviation values you entered.

- **Hue**

Enter a Hue amount into the Input Low field. This should be the Hue value, in degrees around the color wheel, below which you want to see the left-most gradient color or texture. For Hue values larger than this value, VNS will start mixing gradient colors. Enter a Hue amount into the Input High field. This should be the Hue value, in degrees around the color wheel, above which you want to see the right-most gradient color or texture. VNS will mix gradient colors or their textures for points that are between the two deviation values you entered.

- **Saturation**

Enter a Saturation amount into the Input Low field. This should be the Saturation % value, below which you want to see the left-most gradient color or texture. For Saturation values larger than this value, VNS will start mixing gradient colors. Enter a Saturation amount into the Input High field. This should be the Saturation % value, above which you want to see the right-most gradient color or texture. VNS will mix gradient colors or their textures for points that are between the two deviation values you entered.

- **Value**

Enter a Value amount into the Input Low field. This should be the Value % value, below which you want to see the left-most

gradient color or texture. For Value values larger than this value, VNS will start mixing gradient colors. Enter a Value amount into the Input High field. This should be the Value % value, above which you want to see the right-most gradient color or texture. VNS will mix gradient colors or their textures for points that are between the two deviation values you entered.

- **Red**

Enter a Red channel intensity amount into the Input Low field. This should be the intensity of the Red channel (between 0 and 255), below which you want to see the left-most gradient color or texture. For Red Channel values larger than this value, VNS will start mixing gradient colors. Enter a Red channel intensity amount into the Input High field. This should be the intensity of the Red channel (between 0 and 255), above which you want to see the right-most gradient color or texture. VNS will mix gradient colors or their textures for points that are between the two deviation values you entered.

- **Green**

Enter a Green channel intensity amount into the Input Low field. This should be the intensity of the Green channel (between 0 and 255), below which you want to see the left-most gradient color or texture. For Green Channel values larger than this value, VNS will start mixing gradient colors. Enter a Green channel intensity amount into the Input High field. This should be the intensity of the Green channel (between 0 and 255), above which you want to see the right-most gradient color or texture. VNS will mix gradient colors or their textures for points that are between the two deviation values you entered.

- **Blue**

Enter a Blue channel intensity amount into the Input Low field. This should be the intensity of the Blue channel (between 0 and 255), below which you want to see the left-most gradient color or texture. For Blue Channel values larger than this value, VNS will start mixing gradient colors. Enter a Blue channel intensity amount into the Input High field. This should be the intensity of the Blue channel (between 0 and 255), above which you want to see the right-most gradient color or texture. VNS will mix gradient colors or their textures for points that are between the two deviation values you entered.

Parameter Drop Box

Select the Rules-of-Nature™ or other Parameter that you want to use to limit the application of the current Texture Element onto the terrain. Then set the actual limits using the Input Low and Input High fields (see above).

Gradient

This texture element has no definable parameters as such, but is used as follows:

The gradient is applied from -1/2 size to +1/2 size from the center coordinate value on the chosen axis. So if aligned to X, and X size is 2m, and X center is 3m, it will apply the gradient from 2m to 4m on the X axis. If you want the gradient reversed use 180 degree rotation on one of the other axes.

Include/Exclude

This texture element allows you to apply other texture elements only to certain components within your project.

Include/Exclude Items Radio Buttons

Select the Include Radio Button to have the current texture affect only the items in the Include/Exclude List.

Select the Exclude radio Button to have the current texture affect all items in the scene apart from those in the Include/Exclude List.

Include/Exclude List

This is where a list of included/excluded components is built. Items in this list are either included or excluded from this texture's effects, depending upon which Radio Button is selected.

Add Include/Exclude Items Icon

Clicking this icon will bring up a list of all items of the selected class. If there are no items of the selected class in the scene, you will receive a message warning you of such. To avoid this, before adding a new item, make sure you have selected the correct class of item from the dropdown list at the bottom of the editor window.

Remove Include/Exclude Items Icon

Clicking this icon will delete the currently selected item from the Include/Exclude list. If there are no items currently selected, you will receive a message warning you of such.

Add New Items of this Class Dropdown List

Clicking this dropdown list will present you with a list of available item classes (Lakes, Ecosystems, Cloud Models etc.) Select the class of object you wish to add to the list before clicking the Add Include/Exclude Items Icon.

Object Type

This element allows you to apply other texture elements only to certain categories of component within your project.

Include/Exclude Items Radio Buttons

Select the Include Radio Button to have the current texture affect only the items in the Include/Exclude List.

Select the Exclude radio Button to have the current texture affect all items in the scene apart from those in the Include/Exclude List.

Include/Exclude List

This is where a list of included/excluded components is built. Items in this list are either included or excluded from this texture's effects, depending upon which Radio Button is selected.

Add Include/Exclude Items Icon

Clicking this icon will bring up a list of all items of the selected class. If there are no items of the selected class in the scene, you will receive a message warning you of such. To avoid this, before adding a new item, make sure you have selected the correct class of item from the dropdown list at the bottom of the editor window.

Remove Include/Exclude Items Icon

Clicking this icon will delete the currently selected item from the Include/Exclude list. If there are no items currently selected, you will receive a message warning you of such.

Add New Items of this Class Dropdown List

Clicking this dropdown list will present you with a list of available item classes (Lakes, Ecosystems, Cloud Models etc.) Select the class of object you wish to add to the list before clicking the Add Include/Exclude Items Icon.

Size & Position Section

- **Coordinate System Dropdown List**
- **Lat/Lon Bounds Checkbox**
- **Map Set button**
- **Texture Axis Radio Buttons**
- **Size To Fit Button**
- **Size XYZ Fields and Buttons**
- **Center XYZ Fields and Buttons**
- **Falloff XYZ Fields and Buttons**
- **Velocity XYZ Fields And Buttons**
- **Rotate XYZ Fields and Buttons**
- **Texture Axis Radio Buttons**
- **3 Dimensional Checkbox**

Controls in this section let you adjust the dimensions and shape of a texture cell, offset its center position, create a moving texture, rotate the texture, diminish the texture's strength in relation to its center, align texture Elements to a vector (you can use this with terraffectors to make road stripes), restrict an image texture to certain latitude and longitude boundaries (you can use this with aerial photography) and define the coordinate system in which the texture is applied.

Coordinate System Dropdown List

The Coordinate System dropdown list allows you to select a coordinate system in which to apply the texture element. The available Coordinate Systems are as follows:

- **Object Cartesian**

Used by 3D objects in previous versions, available only for 3D objects, clouds, wave models.

- **World Cartesian**

A homogeneous coordinate space for entire planet with no seams, XYZ origin at center of planet.

- **Project Referenced Cartesian**

Used by ecosystems and all non-3D object textures in previous versions. XYZ origin at Project Reference Coordinates, coordinates curve to follow surface of planet.

- **Vector Aligned**

Replaces "Align to Vector" checkbox. Available for 3D objects as well as terrain. It is available for Texture Elements that have a pattern that can be aligned to a Vector. Choosing this coordinate space will cause the texture to align with the Host Vector. This works best when the texture is applied to an Ecosystem that is selected for a segment in a Terraffector's Profile or approach slope.

For example, by using a texture with the Single Stripe Element in an Ecosystem used for a Profile segment, the stripe will follow the Vector to which the Terraffector is applied. This is great for adding a stripe down the center of a Terraffector highway. By using a layered series of single stripe Elements you can create a series of road stripes including the white line on the both sides, two yellow stripes in the middle of the road, and even tire track and oil slick areas. Make sure you choose Vector Aligned coordinate space for all the Texture Elements.

- **Georeferenced Image**

Replaces "Geographic Bounds" checkbox. Available for 3D objects too.

- **Render Image Unity Scale, Ignore Z**

Used by front projection textures and post process events by default.

The texture element will be scaled so that the entire view or rendered output represents a 1m by 1m section of texture space. If your selected element is an image and you wish it to completely cover the rendered image, you should set its scale in X and Y to 1m each.

- **Render Image Unity Scale**

As for Render Image Unity, Ignore Z, but with Z scale value taken into account.

- **Render Image Pixels, Ignore Z**

Another option designed for post process events.

The texture element will be scaled so that each pixel in the view or rendered output represents a 1m by 1m section of texture space. If your selected element is an image and you wish it to completely cover the rendered image (at 640 by 480 pixels), you should set its scale in X and Y to 640m and 480m respectively.

- **Render Image Pixels**

As Render Image Pixels, Ignore Z, but with Z scale value taken into account.

- **Object Vertex UVW Map**

Available only if the texture is applied to a 3D object and has at least one UV map.

Maps may be selected from the dropdown list that appears to the right of the coordinate system dropdown list when Object Vertex UVW Map is selected.

- **Object Vertex Colors**

Available only if the texture is applied to a 3D object and has at least one Color Per Vertex map.

Maps may be selected from the dropdown list that appears to the right of the coordinate system dropdown list when Object Vertex UVW Map is selected.

Texture Axis Radio Buttons

Click the X, Y or Z radio button to align the texture along the X, Y or Z axis. Not all Element types require alignment but those that do will not show the texture correctly unless the correct axis is chosen.

The XYZ space is different for Ecosystems and 3D objects. The way you set the Size and Position section's Texture Axis radio buttons for a texture Element will differ, depending on whether you are creating a texture for an Ecosystem or for a 3D object.

For Ecosystems, here's what the X, Y and Z alignments mean: X is longitude, Y is latitude and Z is elevation. X is the axis along a line from east to west, which is also called longitude. Plus X is toward the east. Y is the axis along a line from North to South, which is also called latitude. Plus Y is toward the north. Z is the axis along a line from down to up, which is also called elevation. Plus Z is up.

For 3D objects, here's what the X, Y and Z alignments mean: X is left to right; Y is up and down; and Z is front to back. X is the axis along a line from left to right or east to west. Plus X is toward the east (right). Y is the axis along a line from down to up. Plus Y is up. Z is the axis along a line from front to back or south to north. Plus Z is towards the North.

For the Stripes and Planar Image Elements, the alignment axis is perpendicular to the stripes or image plane. For Cylindrical and Spherical Image Elements, the alignment axis is the axis the texture will wrap around.

Size To Fit Button

This button is only enabled for textures applied to 3D Materials, and for textures used in Terrain Generators.

Clicking this button will set the scale of your texture to a suitable scale for the 3D Material or DEM to which you are going to apply it. This will not always be absolutely correct in all cases, but if in doubt, it is a good place to start from.

Size XYZ Fields and Buttons

The Size X, Y and Z fields let you change the size of the selected Texture Element in the Elements list. You can change the size separately for each axis, in meters. This lets you stretch a texture along any axis for a different look.

The Y and Z axes have different meanings for 3D Object and Terrain Textures (see Texture Axis Radio Buttons, above).

By using the Keyframe controls you can animate these values over time.

By using the Texture controls you can drive these values with other texture elements. The output of the texture is not in % as it normally is but in the units of the value you are texturing.

The available range of the output is the same as the range available for the item to which you are applying a texture. For instance a Size texture cannot have values less than or equal to 0.

Example: You might drive the X size value of a texture with a Dynamic Parameter of Elevation to have the texture become larger as elevation increased.

Center XYZ Fields and Buttons

The Center X, Y and Z fields let you offset the selected Texture Element along any axis. You can move the texture any distance in meters.

The Y and Z axes have different meanings for 3D Object and Terrain Textures (see Texture Axis Radio Buttons, above).

For 3D Object textures the coordinate system is relative to the object's coordinate system, regardless of where it object is placed in the scene and how it is rotated and scaled.

For ecosystems the origin of the coordinate system is the Project Lat, Lon and Elev reference coordinates. You must set them close to the position of the DEMs in your scene in order for many texture types to scale correctly. Set these values in the Preferences window, available from the Prefs menu. You can find appropriate latitude and longitude values to use by clicking the center of your terrain in a View and reading the latitude and longitude in the Diagnostic Data Window. The elevation value is not critical. Setting it to 0 is fine.

By using the Keyframe controls you can animate these values over time.

By using the Texture controls you can drive these values with other texture elements. The output of the texture is not in % as it normally is but in the units of the value you are texturing.

The available range of the output is the same as the range available for the item to which you are applying a texture.

Example: You might drive the center values of a texture with a Dynamic Parameter of Elevation to have the texture shift and skew as elevation increased.

Falloff XYZ Fields and Buttons

The Falloff X, Y and Z fields let you adjust texture falloff along any axis. This works by percentage per meter. For example, with a falloff of 100 percent per meter along the X axis for an Ecosystem Texture, the texture will only appear for 1 meter before fading out. To figure

what the right gradient value should be, take the distance in meters over which you want to fade the texture and divide it into 100.0. For instance to fade a texture over 200 meters, divide $100/200 = .5$ or half of one percent per meter.

The Y and Z axes have different meanings for 3D Object and Terrain Textures (see Texture Axis Radio Buttons, above).

By using the Keyframe controls you can animate these values over time.

By using the Texture controls you can drive these values with other texture elements. The output of the texture is not in % as it normally is but in the units of the value you are texturing.

The available range of the output is the same as the range available for the item to which you are applying a texture.

Example: You might drive the Falloff values of a texture with a Dynamic Parameter of Vector Slope % to have the texture falloff more as the vector became more steep.

Velocity XYZ Fields and Buttons

The Velocity X, Y and Z fields let you animate texture velocity along any axis, in meters per second. This is handy for textures simulating things like flowing lava, blowing smoke and falling water.

Note: Since you can also animate other Texture Element Parameters, there are many ways to create moving textures in VNS.

The Y and Z axes have different meanings for 3D Object and Terrain Textures (see Texture Axis Radio Buttons, above).

By using the Keyframe controls you can animate these values over time to allow texture velocity to change throughout the animation.

By using the Texture controls you can drive these values with other texture elements. The output of the texture is not in % as it normally is but in the units of the value you are texturing.

The available range of the output is the same as the range available for the item to which you are applying a texture.

Example: You might drive the X velocity value of a texture with a Dynamic Parameter of Vector Slope to have the texture move faster as slope increased.

Rotate XYZ Fields and Buttons

The Rotate X, Y and Z fields let you reorient the current Texture Element, in degrees. This is more flexible than the Texture Axis radio buttons, but takes slightly longer to render.

Note: If you just want to change the axis of a texture, use the Texture Axis radio buttons (see above) for faster rendering.

The Y and Z axes have different meanings for 3D Object and Terrain Textures (see Texture Axis Radio Buttons, above).

By using the Keyframe controls you can animate these values over time.

By using the Texture controls you can drive these values with other texture elements. The output of the texture is not in % as it normally is but in the units of the value you are texturing.

The available range of the output is the same as the range available for the item to which you are applying a texture.

Example: You might drive the Y Rotation value of a texture with a Dynamic Parameter of Elevation to have the texture twist as elevation increased.

3 Dimensional Checkbox

All the Texture Elements are 3 dimensional. That means they create patterns in three dimensional space. However, you can force some of them to be two dimensional for faster rendering. For those Texture Elements, you'll see the 3 Dimensional checkbox.

Select the 3 Dimensional checkbox to tell VNS to use the normal three dimensional version of the texture. This will take longer to render, but will show true 3D patterns based on the 3D position of the terrain or 3D Object.

Deselect the 3 Dimensional checkbox to tell VNS to use a two dimensional version of the texture. This will render faster, but will collapse the pattern into a 2D image projected onto the terrain or 3D Object.

The same Texture Element can look very different in its 2D or 3D version. If you have any doubts which you should use, try them both and see how it looks.

Previews Section

The Previews section lets you see how your texture looks. You can choose to view it from different angles or mapped onto 3D shapes. You can adjust the size of the preview and the perspective from which to view the texture.

You can see three different Preview displays to simultaneously see the entire texture and different parts of the texture as you work.

Size Field

The Size field lets you set the size the Preview displays show, in meters. If you want to preview an entire forest, set the size to that of your forest. If you want to preview a few bricks for a wall, set the size to that of a few bricks. You can change the value in the size field at any time, to zoom the preview displays in or out on your texture.

It is important to design your textures with the preview size set to an appropriate value. This will let you make sure your resulting textures will have enough detail, but not so much detail as to dampen rendering performance or cause undue aliasing problems.

View From Drop Box

The View From drop box lets you select an appropriate orientation for the preview.

If you preview the texture from a perspective that is perpendicular to the one from which the texture is being applied, you may only see a solid color or streaks. Make sure you are looking from an appropriate perspective.

If the Preview display doesn't look right, you may have the wrong "View From" perspective selected in the Preview section, or the wrong texture axis selected in the Size and Position section for one or more Texture Elements.

The XYZ space is different for Ecosystems and 3D objects. The way you set the Preview "View From" perspective (and the "Texture Axis" for a texture Element) will differ, depending on whether you are creating a texture for an Ecosystem or for a 3D object.

Ecosystem Perspectives

For Ecosystem textures you can select any of these choices:

- **East +X**
- **North +Y**
- **Above +Z**
- **West -X**
- **South -Y**
- **Below -Z**
- **Cube**
- **Sphere**

For Ecosystems, you'll generally want to choose the Above view so you can see how the texture will look applied to the ground.

For Ecosystems, X is longitude, Y is latitude and Z is elevation.

X is the axis along a line from east to west, which is also called longitude. Plus X is toward the east.

Y is the axis along a line from North to South, which is also called latitude. Plus Y is toward the north.

Z is the axis along a line from down to up, which is also called elevation. Plus Z is up.

3D Object Perspectives

For 3D Object textures you can select any of these choices:

- **Right +X**
- **Top +Y**
- **Rear +Z**
- **Left -X**
- **Bottom -Y**
- **Front -Z**
- **Cube**
- **Sphere**

For 3D Objects choose whatever is appropriate. The default view is to look from the front (from the south), which is also referred to as negative Z axis. A view from another perspective might be useful depending on what you are texturing. There are also choices to see the texture projected onto a 3D cube or sphere.

Remember that these views are in object coordinate space, not world coordinates so if an object is rotated in the scene these view directions are before the rotation.

For 3D objects, X is left to right; Y is up and down; and Z is front to back.

X is the axis along a line from left to right or east to west. Plus X is toward the east (right).

Y is the axis along a line from down to up. Plus Y is up.

Z is the axis along a line from front to back or south to north. Plus Z is towards the North.

Spherical, Cylindrical, Environment and UV image Elements must be rendered to be seen properly and will not display correctly in the Preview displays. Do not judge Spherical, Cylindrical, Environment or UV Image Elements by the way they look in the Preview displays!

Root & Children Display

The Root and Children display shows the resulting texture including all Elements that are enabled (or shown in black) in the Elements list. This is where you can see what effect child Elements have on the root Element. The only Element type that will not be correctly shown are those classed as Dynamic Parameter Elements (Dynamic Parameter, Gradient, Include/Exclude, Object Type). There is no way to see these elements in effect except by rendering.

Element & Children Display

The Element and Children display shows the current Element and any child Elements it may have that are enabled.

Parent & Children Display

The Parent & Children Display shows the parent of the currently selected Element and any child Elements that it may have that are enabled. This display will only appear in the middle preview window, and then only when The Element Only display is enabled and the selected Element is a Filter Element.

Element Only Display

The Element Only display shows the current Element. For some of the filter Elements, you'll see a graph representing the value variation for the Element.

Filter Element Graphs

When a Filter Element is displayed as a graph in a preview window (Element Only or Element & Children), you can predict its effect by looking at the gray bars that have appeared below and to the left of the relevant preview window(s).

Imagine that the horizontal axis represents texture values from the parent element ranging from 0 to 1 (black to white, hence the bar). The vertical axis represents The remapped texture values after the filter has been applied (again ranging from 0 to 1 or black to white).

For any particular value of a texture element, you can therefore read across the horizontal axis until you reach the value in which you are interested, read up until you meet the graph line, then across to the left until you reach the vertical axis, at which point you can read off (approximately) the value to which your original value will be mapped.

The grayscale bars can be used to help you visualize this. Just remember the following, and remap functions will become a lot more predictable to you:

- **The bars represent texture values.**
- **Values run from 0 (Black) to 1 (White).**
- **When associated with a gradient bar, texture values of 0 correspond to 0% on the gradient (far left), and texture values of 1 correspond to 100% on the gradient (far right).**
- **The horizontal axis of the preview graph represents the texture values before remapping.**
- **The vertical axis of the preview graph represents the texture values after remapping.**
- **The graph line represents the relationship between input and output values.**

If you are familiar with the “Curves” function in Photoshop, then the Filter Elements should cause you little concern as they are directly analogous to that function.

Timeline Editor

The Timeline Editor lets you graphically edit animated parameters. You can open it by selecting the Timeline icon for any animatable parameter in any of the Editors; in the Animation Toolbar when an animatable parameter is the Active Item; or from the Animation Operations Icon wherever you see one in the interface.

TimeLines are graphs that show Parameter values plotted against time. You can move the spline knots to change the animation.

The TimeLine Editor makes it easy to fine-tune your animations.

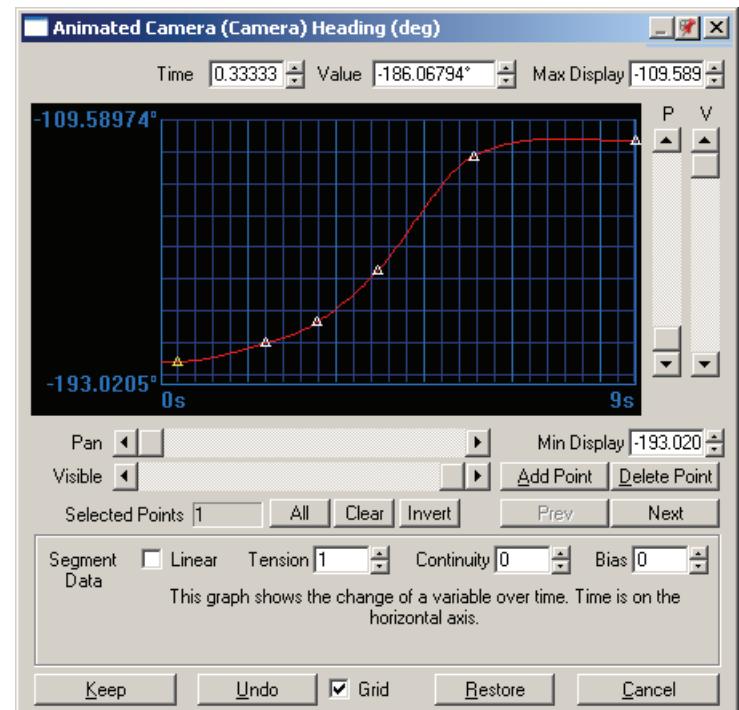
Note: TimeLines may be familiar to you as "Motion Graphs" or "Envelopes" from other 3D programs.

Time/Frame Field

The Time/Frame field shows the time (in seconds) frame of the current key frame. You can change it by typing the number for a different frame.

You can also change the frame by holding down the control key and dragging the current key frame left or right in the graph.

Whether this field is labelled Frame or Time, depends upon the Time selection you have made on the Units page of the Preferences Window.



Value Field

The Value field shows the parameter value at the current key frame. You can change it by typing a different value.

You can also change the value by dragging the current key frame up or down in the graph.

If you click the All button to select all the points, you can then enter a number in the Value field and VNS will add it to all the key frame values.

Max/Min Display Fields

The Max Display field lets you adjust the Parameter value represented by the top of the graph. The Min Display field lets you adjust the Parameter value represented by the bottom of the graph. Both of these values are in effect when the Vertical Pan slider is at the bottom of its travel and the Vertical Visible slider is at the top of its travel. You can scan higher values in the graph by sliding the Vertical Pan slider upwards. You can zoom into the graph for more resolution by sliding the Vertical Visible slider downwards.

For the Max Display field, enter a number greater than the highest value you'd like to see. For the Min Display field, enter a number which is less than the lowest value you'd like to see. VNS will adjust the graph accordingly.

Graph

The Graph area shows the Parameter value on the Y axis and time on the X axis. VNS will display the changing value of the current Parameter as a line, with small triangles representing key frames. Any selected key frames will be yellow, the rest white. Click any triangles to select it. Shift click to select more than one. You can drag the selected key frames up or down to change their Parameter values, or control-drag them left or right to change the frames they're on.

You can also select key frames using the Selected Points buttons or the Prev/Next buttons (see below).

You may add key frames directly on the graph (see "Add Key" below).

You can add a grid to the graph by selecting the Grid checkbox (see below).

Vertical Pan Slider

The Vertical Pan slider lets you scan the graph upwards to show higher or lower values (see Max/Min Display fields above).

Vertical Visible Slider

The Vertical Visible slider lets you zoom into the graph on the Y axis to see more resolution in the Parameter values (see Max/Min Display fields above).

Horizontal Pan Slider

The Horizontal Pan slider lets you scan the graph left or right to show higher or lower frames. When the Horizontal Visible slider is all the way to the right, the Horizontal Pan slider will have no effect.

Horizontal Visible Slider

The Horizontal Visible Slider lets you zoom into the graph on the X axis to see more resolution in time. When you slide it clear to the right you can see the entire animation. When you slide it to the left you will see less of the animation but more detail in the graph. You can use the Horizontal Pan slider to pan through the higher res graph display.

Prev Button

Click the Prev (Previous) button to jump to the next lower key frame, if there is one, for the Active Parameter.

The next lower key frame will become the Current Frame and all values associated with that frame will be set in all frame fields in any open windows. Any open Views will be updated. The new active point will be highlighted in yellow on the graph.

When this button is disabled there is no previous key frame for the Active Parameter.

Next Button

Click the Next button to jump to the next higher key frame, if there is one, for the Active Parameter.

The next key frame will become the Current Frame and all values associated with that frame will be set in all frame fields in any open windows. Any open Views will be updated. The new active point will be highlighted in yellow on the graph.

When this button is disabled there are no key frames for the Active Parameter beyond the Current Frame.

Add Point Button

Click the Add Point button to add a key frame at anywhere on the graph.

After you click the Add Point button, click on the point where you want to add a key frame. VNS will create a new key frame at the frame selected. The parameter value will be that of the spline at that frame before the new Key was added. You can change the value in the Value field (see above) or by dragging the point interactively in the graph if you wish.

Because of the way splining works, adding a key frame at a point will modify the splined values on either side of the added point slightly even though the value at the point itself remains unchanged.

Delete Point Button

Click the Del Point button to delete the current key frame. If you then change your mind, click the Undo button.

Selected Points Display Field

The Selected Points display field shows how many key frames are currently selected. You can click a key frame (white triangle) in the graph to select it.

Shift-click to select more than one key frame. You can also select key frames with the selection buttons (see below), or the Prev/Next buttons (see above).

Selection Buttons

The selection buttons let you select or deselect key frames.

All Button

Click the All button to select all the key frames.

Clear Button

Click the Clear button to deselect all the key frames.

Invert Button

Click the Invert button to select the key frames that aren't currently selected, and deselect the key frames that are currently selected.

Segment Data Section

The Segment Data section lets you control the segment of the graph to the left of the currently selected point.

Linear Checkbox

Use the Linear checkbox to tell VNS not to spline (fit a curve) from the previous key frame to the current key frame. Instead of a smooth curve, VNS will create a straight linear segment in the graph.

You can use the Linear checkbox to stop a motion in one place for a length of time. However this technique does not ensure motion deceleration and acceleration into and out of the still segment. For smoother motion you should consider using the Tension controls described below.

You can enable or disable the Linear checkbox for every key frame individually.

Tension Field

Use the Tens (Tension) field and buttons to adjust the Tension or tightness of splined curves and to allow for ease in/out of splined effects.

Set the desired value in the field or adjust with the arrow buttons. Use a value of 1.0 for smooth ease in or ease out of an effect. Values greater than 0 will tighten the spline at the key frame, less than 0 will flatten it. The limits are -5 to +5, although you should avoid values above 1 or below -1 if you are exporting motion paths to external 3D programs which may not be able to recognize wider values.

Use this adjustment sparingly. It can create velocity anomalies and S-shaped splines so always check the results in the TimeLine graph.

Continuity Field

Use the Cont (Continuity) command to adjust the Continuity of splined curves. Set the desired value in the field or adjust with the arrow buttons. Values greater or less than 0 will cause discontinuity at the key frame. The limits are -5 to +5, although you should avoid values above 1 or below -1 if you are exporting motion paths to external 3D programs which may not be able to recognize wider values.

Use this adjustment for special effects where sharp breaks in motion are desired and always check the results in the TimeLine graph.

Bias Field

Use the Bias command to adjust the Bias or skew of splined curves.

Set the desired value in the field or adjust with the arrows. Values greater than 0 will offset the maximum curvature of a spline to the higher side of the key frame, less than 0 will offset it to the lower side. The limits are -5 to +5, although you should avoid values above 1 or below -1 if you are exporting motion paths to external 3D programs which may not be able to recognize wider values.

Use this adjustment sparingly. Like Tension and Continuity, it can create velocity anomalies so always check the results in the TimeLine graph.

Lower Edge Controls

Keep Button

Click the Keep button to close the TimeLine window and keep changes.

The TimeLine window will close and all changes made since the window was opened will be preserved.

You do not need to close the TimeLine window for changes to take effect, they are effective immediately. If you want to close the TimeLine window and lose any changes you've made, click the Cancel button (see below).

Undo Button

Click the Undo button to throw out the last change you made in the Timeline Editor.

Grid Checkbox

Use the Grid button to turn on and off the grid overlay in the TimeLine graph. Sometimes the grid is useful for seeing subtle changes in a graph. Other times it gets in the way and slows graph redraws. Enable it or disable it as you please. It won't affect the graphed values one way or the other.

Restore Button

Click the Restore button to go back to the key frames and Parameter values that were in effect when you opened the Timeline Editor.

Cancel Button

Click the Cancel button to close the TimeLine Editor and undo most changes. The TimeLine Editor will close and changes made since the window was opened will be canceled.

Note: You can delete key frames by clicking the Remove Key Frames icon in the Animation toolbar to open the Delete Key Frames window.

Only the key frames for the appropriate Effects Parameter Class will be affected by the action. If changes were made from other windows affecting this Parameter Class while this window was open, they too will be lost when you select Cancel here.

If you want to close the window and keep all your changes, click the Keep button instead (see Keep above).

Vector Editor

The Vector Editor gives you the ability to modify the active Vector Object. You can see the result of your changes interactively in the Views.

Note: You can also edit Vector Objects directly in a View using the icons in the Icon Toolbar. The Vector Editor also gives you access to the Vector Profile Editor for interactively editing the elevations of vertices.

Open the Vector Editor by double-clicking a Vector in the Scene-At-A-Glance. You can also use the Edit button on the Database Editor.

The Vector Editor shows values for the active Vector in the database, which you can select in the Database Editor's object list, in the Scene-At-A-Glance or by alt-clicking a Vector in a View.

Note: Selecting a new vector while the Vector Editor is open will cause the vector Editor to update to reflect the values of the newly selected vector. You do not need to close and re-open the vector editor if you wish to change the focus to another vector.

There are three main areas in the Vector Editor:

- **Top Controls**
- **Pages**
- **Bottom Buttons**

Top Controls

Name Display Field

The Name display field shows the name for the Vector Object. You can't edit it here but you can edit it in the Database Editor

Horizontal Units Drop Box

The Width and Height fields on the Extents page will be shown in the units you choose here, as will the X and Y fields in the Selected Points section.

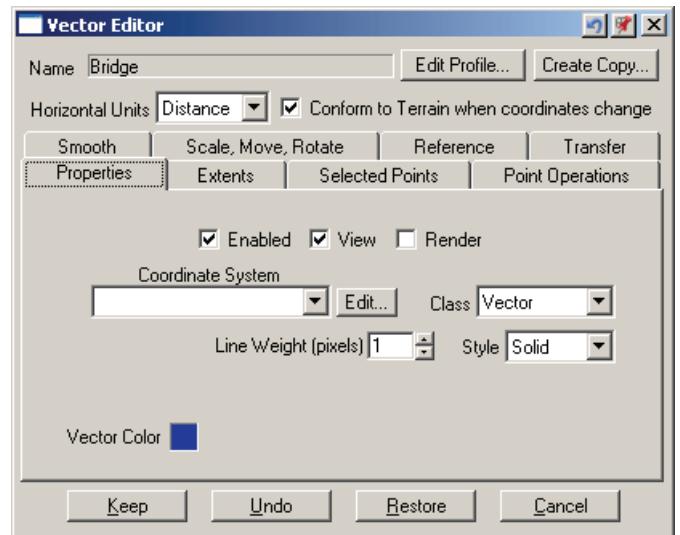
Conform to Terrain when Coordinates Change Checkbox

When selected, any points that you create or edit anywhere in the program will be automatically conformed to the underlying terrain. If you're trying to reshape the elevations of your vector (as with the Vector Profile Editor, below), you may find it self-defeating to have this setting on.

Note: You can conform existing Vectors using the Conform button on the Extent page in the Database Editor.

Edit Profile Button

Click the Edit Profile button to open the Vector Profile Editor.



Create Copy Button

Click the Create Copy button to make a new vector that is a copy of the active Vector. VNS will ask you for a new label. The copy then becomes the Active Vector.

Pages

There are eight pages:

- **Properties Page**
- **Extents Page**
- **Selected Points Page**
- **Point Operations Page**
- **Smooth Page**
- **Scale, Move, Rotate page**
- **Reference Page**
- **Transfer Page**

The pages give you sets of controls for numerically editing aspects of the Vector and its vertices (points).

Properties Page

The Properties page lets you edit a variety of properties for Vectors and Control Points. The Properties page lets you edit many of the same parameters as on Properties page of the Database Editor, plus a few more.

Enabled Checkbox

Click the Enabled checkbox to enable or disable the active Vector. Disabling it will disable both the View and Render checkboxes (see below).

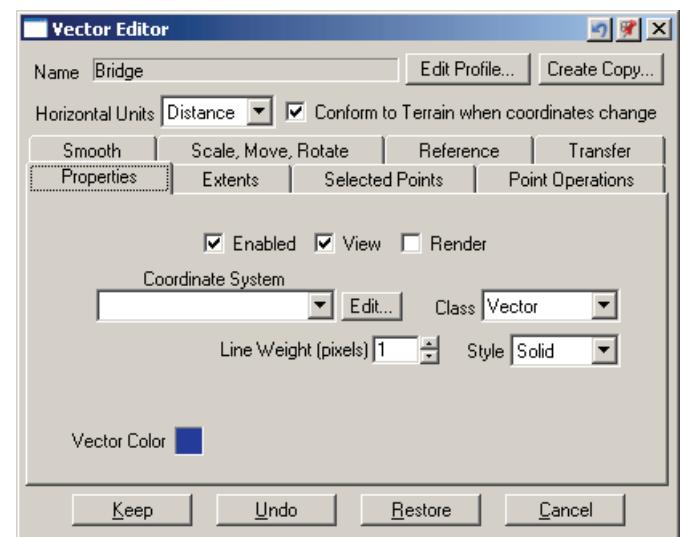
Disabled Vectors are not available for use with attached Components, and therefore the Components will not appear at the Vector location.

Selecting the Enabled checkbox will allow you to enable the View or Render checkboxes individually.

Note: In the Database Editor's Objects List and the Scene-At-A-Glance, enabled Objects are black and disabled Objects are gray.

View Checkbox

Select the View checkbox to display the Vector in realtime OpenGL Views. Deselect the View checkbox to prevent the Vector from appearing in Views.



The View checkbox is only available if the Enabled checkbox is selected (see above).

Render Checkbox

Select the Render checkbox if you want to see the Vector in preview and final renderings. Deselect the Render checkbox if you want to prevent the Vector from appear in renderings. The Vector will still be available for controlling any attached Components, it just won't appear as a visible Vector in renderings.

The Render checkbox is only available if the Enabled checkbox is selected.

Note: To see Vectors in your rendered images the Render Vectors checkbox must also be selected on the Misc page of the Planet Options Editor for the Render Options you are using in the current View or Render Job.

Coordinate System Drop Box and Edit Button

Where possible, VNS will create and select the proper Coordinate System for you when you import Vector and Control Point data. The Coordinate System drop box lets you select a different Coordinate System for the data should that be necessary.

Note: Be careful, using an inappropriate Coordinate System may cause the data to appear at the wrong place on the planet, and at the wrong size and shape.

If there is no Coordinate System showing in the drop box, the data will use the Coordinate System selected in the Planet Options Editor for the Project. If there is no Coordinate System showing in the Planet Options Editor, the Project will use Geographic-WGS84.

If a non-geographic Coordinate System is selected in the Planet Options Editor, VNS will consider it geographic for rendering and only use its datum and ellipsoid in geographic form. In that case, if there is no Coordinate System showing in the Vector Editor's drop box, the Vector Editor will also use the Project's datum and ellipsoid but consider it geographic and show the Vector or Control Point Registration Coordinates as geographic.

Class Drop Box

Use the Class drop box to change an Object's Class. Every Object in the Database belongs to a "class." The class determines how the Object will be treated by Views and the Renderer.

There are three classes of Objects:

- **Terrain**

Vectors and Control Points cannot be Terrain class.

- **Vector**

Select Vector class for Vector Objects that you want to be rendered as lines or points. Vectors may be colored, shaded and even hazed. They are used to represent an unlimited array of Objects from streams and roads to the footprint of an Object that will be rendered in another program and combined with VNS renderings.

- **Control Points**

Control Points are elevation points VNS can use to grid new DEMs with a Terrain Gridder.

You can change Vector class to Control Points class and vice versa.

Line Weight Field

Use the Line Weight field to set the pixel thickness of the Vector for Views and rendering. This only matters if you have selected the View checkbox or Render checkbox for the Vector (see above).

Enter the desired weight in pixels or use the up and down arrow buttons to increase or decrease the weight one pixel at a time.

You may wish to vary the line weight to obtain consistent proportions if you increase the resolution of your rendered images. Consider increasing it for print resolution images.

Style Drop Box

Use the Style drop box to select the line or point style for displaying the Vector in a Realtime View.

This only affects the Realtime View displays. Point Style Objects will be represented by individual shapes at the Vector's vertices. Line style Objects will have the vertices connected with the selected line style.

When you render an image, all line styles will be rendered as solid lines and all point styles as simple points.

You can choose from eight options:

Point Styles:

- **Point**
- **Circle**
- **Square**
- **Cross**

Line Styles:

- **Solid**
- **Dotted**
- **Dashed**
- **Broken**

The current style will appear in the drop box.

Vector Color Well

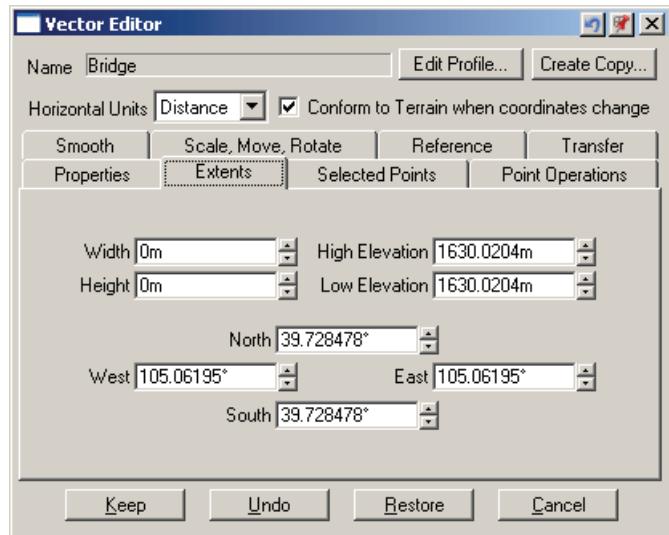
The Color well lets you see the color of Vector Objects. Click on the well to open the Color Editor, allowing you to change the color of the selected vector.

Extents Page

Extents are the outside edges of an imaginary box drawn to include the Vector Object in 3D space.

They include the values you see in the Database Editor. You can't modify them there. Here you can modify them to stretch or shrink the Vector Object in either axis.

If you change the N, S, W, E, bounds in the Object Extents section, VNS will update the Database Editor display of those bounds. You can also change the width, height and elevation range of the Vector's extents.



Selected Points Page

The Selected Points page lets you work with the active Vector Object. You can select points, see how many points there are and how many are selected, and change the Vector's position.

Selection Radio Buttons

There are four radio buttons for selecting points in the active Vector:

- **All Points Radio Button**

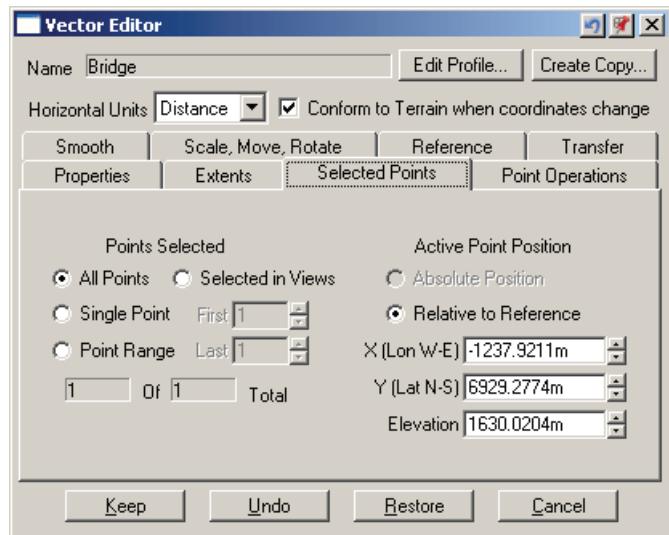
All Points is default when you select a new object in the Database Editor or in Views. Select the All Points radio button when you want all the vertices in the Vector to be selected for editing.

- **View Selected Radio Button**

Select the View Selected radio button when you want any vertices you select in a View to become the active vertices for editing. In Views when you select an object all points are selected, but if you select a subset of points in a View, the Vector Editor will change to select the View Selected radio button.

- **Single Point Radio Button**

Select the Single Point radio button when you want to operate on a single vertex as selected using the First Point field. Views will update to show the selected vertex. Any other vertices will be deselected.



- **Point Range Radio Button**

Select the Point Range radio button when you want to select a range of vertices. You can specify the range using the First and Last fields. Views will update to show the selected points. Any other selected points will be deselected.

Number of Points Display Fields

The two fields separated by the word "of" show how many points are selected, and how many total points there are in the active Vector Object.

Absolute/Relative Radio Buttons

The Absolute and Relative radio buttons change the meaning of the X (Lon W-E), Y (Lat N-S) and Elevation fields.

Absolute is from the geographic origin point which is 0 latitude, 0 longitude at sea level. Select the Absolute radio button when you know the latitude and longitude where you want to put the active Vector Object. You can then enter the latitude and longitude directly into the X (Lon W-E) and Y (Lat N-S) fields.

Relative is from whatever Reference Point location is selected on the Reference page (see below). You can then use the X (Lon W-E), Y (Lat N-S) and Elevation fields to offset the active Vector Object from that location.

Note: If the Horizontal Units drop box in the Global Controls (see above) is set to anything other than degrees, VNS will select the Relative radio button and the Absolute radio button will be ghosted.

X (Lon W-E), Y (Lat N-S) and Elevation fields

The X (Lon W-E), Y (Lat N-S) and Elevation fields let you move the active Vector Object. You can move it to a specific latitude and longitude location or offset it from a location you select on the Reference page (see Reference page below), depending on whether the absolute or Relative radio button is selected (see above).

The X and Y fields reflect the horizontal units you chose in the Horizontal Units drop box in the Global Controls section (see above). Anything but degrees will automatically put you in relative mode.

The Elevation field reflects the elevation units you chose in the Elevation Units drop box in the Global Controls section (see above).

Reference Page

The Reference Point is the point around which the Vector will rotate or scale if you rotate or scale the Vector. The Reference page lets you set the Reference point to some existing positions:

- **Arbitrary**

If you drag the reference point in a View, VNS will select the Arbitrary radio button automatically. The values for the place where you dragged the Reference Point will show up in the Latitude, Longitude and Elevation fields. You can change the values in the fields to move the Reference Point if you wish.

- **Vector Origin**

Select the Vector Origin radio button to place the Reference Point at the first vertex in the Vector. The Vector Origin is first point created in the Vector Object.

- **Vector Center**

Select the Vector Center radio button to place the Reference Point halfway between north and south, and halfway between west and east as shown in Object Extents above.

- **Active point**

Select the Vector Center radio button to place the Reference Point at the last vertex you selected in the Active Vector Object.

- **Selected Point center**

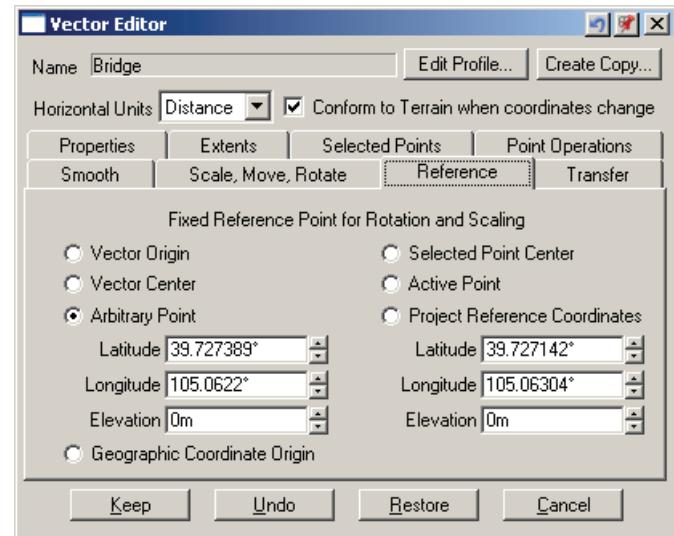
Select the Vector Center radio button to place the Reference Point halfway between extents of any selected vertices in the Vector Object.

This works if the All Points radio button is selected in the Active Points section (then it's the same as Vector Center); the Point Range radio button is selected; or the Map Selected points radio button is selected (in that case the actual selected points can be discontinuous).

- **Geographic Coordinate Origin**

Select the Vector Center radio button to place the Reference Point at zero latitude and zero longitude at sea level.

Note: Sea Level is the surface of the Project Coordinate System's Ellipsoid, which is an elevation of zero. You can see the Project's Coordinate System in the Planet Options Editor.



- **Project Coordinates**

Select the Vector Center radio button to place the Reference Point at the Project Coordinates.

You can set the Project Coordinates in the fields below the Project Coordinates radio button, and in the Preferences Window where they are called the Reference Coordinates. If you're an architect, you will want to set the Reference Coordinates to the zero point for your project.

Scale, Move, Rotate page

The Scale and Move page lets you scale, move and rotate the selected Vector. All procedures can happen in one pass. VNS calculates scaling, rotating and shifting, in that order.

Scale

You can scale the Longitude, Latitude or Elevation extents of the Vector Object. Select the button for the axis you want to scale and enter an amount in the adjacent fields. Scaling will then occur when you click the Operate button.

Scaling uses the units you selected using the Global Controls for Horizontal units and Elevation units at the top of the window (see above).

Scaling happens around the reference point you selected on the Reference page (see above).

The Preserve X/Y checkbox (located under Rotate but applicable to Scale) keeps the aspect of the extents the same. If you scale the X (Longitude) by a certain amount, VNS will automatically scale the Y (Latitude) by the same amount. When the Preserve X/Y checkbox is selected, the Y (Latitude) field will be unavailable for user entry.

Shift

You can move the Longitude, Latitude or Elevation of the Vector Object. Select the button for the axis you want to move and enter an amount in the adjacent fields. Shifting will then occur when you click the Operate button.

Shifting uses the units you selected using the Global Controls for Horizontal units and Elevation units at the top of the window (see above).

Rotate

You can rotate the Vector Object at the Reference Point around the z axis (looking down). Select the Rotate button and enter an amount of rotation in degrees in the adjacent field. Rotation will then occur when you click the Operate button.

Rotation happens around the reference point you selected on the Reference page (see above).

Point Operations Page

The Point Operations page lets you work with the individual vertices in a Vector Object.

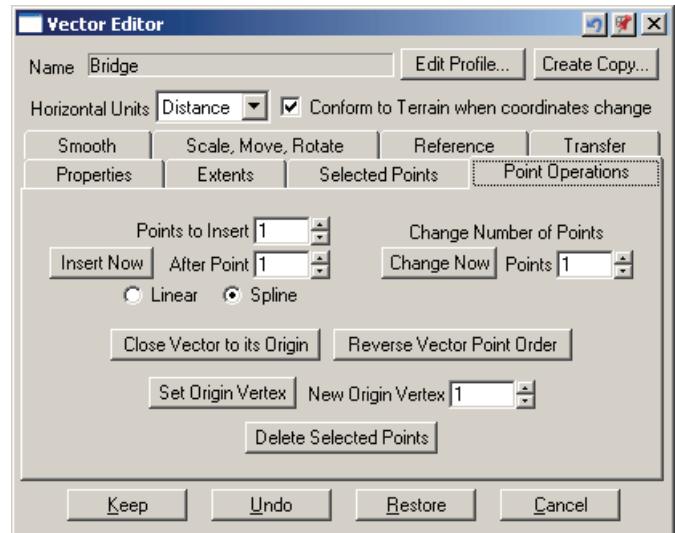
Points Field

The Points field shows the number of points in the active Vector Object.

You can add or subtract points by entering a different number of points and clicking the Interpolate button (see below).

The Points field is ghosted when the Map Selected radio button is selected in the Active Points section, because you can't interpolate over discontinuous points.

The Points field is ghosted when a single point is selected because there's no reason to interpolate a single point.



Insert Button

Click the Insert button to insert points. VNS will insert the number of points you enter into the Insert Points field (see below). VNS will insert the points after the point you specify in the Insert After field (see below).

When you insert points, VNS will spread points evenly along a straight line if the Linear radio button is selected, or a spline curve if the Spline button is selected. Spline curves use zero tension, continuity and bias based on points surrounding the inserted points.

VNS takes the distance between the "Insert after" point and the next point and spaces the new points evenly within that distance.

It will be ghosted if the Insert After field is set to the last point or larger.

Insert Points Field

Lets you set the number of points you will insert into a line segment when you click the insert button (see above).

Insert After Field

Insert After is the number of the point after which new points will be inserted when you click the Insert button (see above).

You can't insert after the last point or before the first point. You must insert between two existing points.

You can see the number of the current point in the First field in the Active Points section. You can enter that number in the Insert After field to insert after the selected point in a View.

The Insert After field will automatically track the current point as you select points in Views, but you can also change it manually.

If you select last point in the Active Vector Object, the Insert button will be ghosted.

Change Now Button

Use of this button and its associated numeric field lets you change the number of vertices in the active Vector Object. This function operates on all the points in the Vector.

To add or subtract points for the Active Vector, enter a different number of points into the Points field and click the Change Now button VNS will resample the Vector Object to have the new number of points.

Note: If you want to smooth the new points along a curve, use the controls on the Smooth page (see below).

VNS tries to spread the points in the same concentration as the original points. When you add points VNS won't move the original points. If you decrease points VNS will move the original points.

The Change Now button is ghosted when the Map Selected radio button is selected in the Active Points section, because you can't interpolate over discontinuous points.

This function is sensitive to the type of interpolation selected in the radio buttons below the Insert button (either linear or spline).

Close Vector to its Origin Button

The Close to Origin button closes Vectors by creating a new point at end of object that duplicates first point. This is useful if you are creating a race track using a Terraffector.

Note: If you then change the Origin Vertex (see above) that new point will no longer be where you need it to be to close the vector. You will have to manually delete the old one if it matters, and click Close to Origin to create a new end point.

Don't use the Close to Origin button unless you need to see a closed vector in a view, or render a closed vector. This is not necessary for area Components since VNS will close vectors automatically when you render.

VNS will add a new point each time you click the Close to Origin button.

Reverse Vector Point Order Button

Reverse Point Order reverses the order of the points in the active Vector Object. You can use it to reverse a motion path after changing the motion path into a Vector Object using the buttons on the Transfer page.

If you want to see your stream vectors displayed high to low from left to right in the Vector Profile Editor and you drew a stream vector uphill instead of downhill, you can flip it here.

New Origin Vertex Field

The New Origin Vertex field lets you change which point is considered the first point of the object. Points stay in the same place but VNS draws the Vector starting on the origin point.

To change the first point, enter the point you want to make the first point for the Vector and then click the Set Origin Vertex button.

Changing the Origin Vertex is best when used with Vectors that surround an area that you treat as a closed shape (such as a Vector describing the shape of a lake).

Delete Selected Points Button

Click the Delete button to delete selected points. You can select points in the Active Points section (see above) or interactively in Views.

Smooth Page

The Smooth page lets you align the vertices of a Vector Object along a curve. You can also evenly space the vertices within a Vector Object.

These operations can be useful for roads, motion paths and other applications. Smoothing and Even Spacing apply to all the points in the Vector.

Note: Smoothing does not happen when you interpolate on the Points page but you can do it here on the Smoothing page.

Smooth Vector Button

To smooth the active Vector Object, select any combination of the X, Y, Z checkboxes, enter a smoothing percentage, and click the Smooth Vector button.

X (Longitude), Y (Latitude), and Z (Elevation) Checkboxes

You can Smooth along any axis by selecting any combination of the X, Y and Z checkboxes.

Smoothing Percentage Field

The smoothing percentage field lets you adjust the amount of smoothing. A percentage of zero, does nothing while 100% creates a straight line.

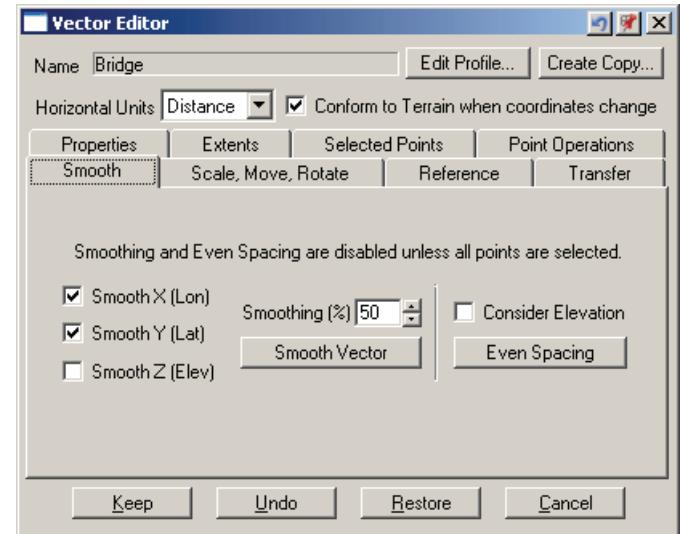
Even Spacing Button

Click the Even Spacing button to spread the vertices evenly along the path of the active Vector Object. It works like velocity distribution works for motion paths (see the Camera Editor).

Consider Elevation Checkbox

Select the Consider Elevation checkbox when you want the Even Spacing button to consider elevation so the same distances really apply between points. Otherwise the same distances apply only in 2d when viewed in a Planimetric view.

Use the Consider Elevation checkbox primarily when working on motion paths. You won't need to use it if you are doing non-elevation-dependent procedures such as outlining an area terraffector on steep terrain.



Transfer Page

The Transfer page lets you transfer the parameters of a Vector to another object in your scene, or vice-versa.

Copy from Active Vector Button

Click this button to open the Path-Vector Transfer Window. From there you will be able to control the transfer of information between components. The window will open with the current vector already selected in the "Transfer From" list.

Copy to Active Vector Button

Click this button to open the Path-Vector Transfer Window. From there you will be able to control the transfer of information between components. The window will open with the current vector already selected in the "Transfer To" list.

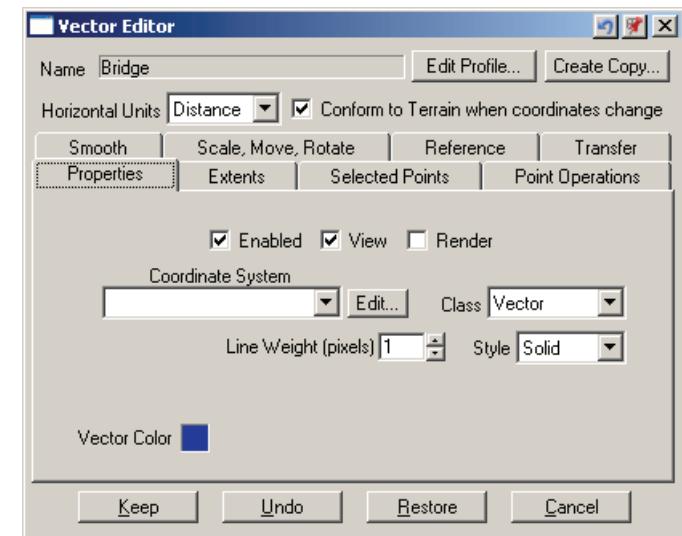
Bottom Buttons

Keep/Cancel Buttons

VNS makes changes immediately. You don't have to click the Keep button to keep them. Click the Keep button to close the Vector Editor. This is the same as clicking the close gadget in the window's border.

Click the Cancel button to undo all changes and close the window. This is the same as clicking the Restore button (see below) and closing the Vector Editor.

The Vector Editor tracks when you select a different Vector or add a new one. If you change to a new Vector before canceling changes you made to the current Vector, VNS will lose ability to cancel changes to the current Vector with the Cancel button.



Undo Button

The Undo button lets you undo the last change you made to the Active Vector in the Vector Editor or interactively in Views. It will work until you select another Vector Object.

This is the same as using the Undo Last Edit icon in the Icon toolbar.

Restore Button

Click the Restore button if you want to reset the Vector to the state it was in when it was last activated. To activate a Vector, click it in the Database Editor, alt-click to select it in a View or hit the Create Copy button (see above) to copy the active Vector (this will create a copy and make the copy the Active Vector).

Vector Profile Editor

The Vector Profile Editor lets you adjust the elevation of the vertices in the selected Vector. You can see the Vector Elevation graphed against the elevation of the terrain.

Select a Vector to edit in the Scene-At-A-Glance or Database Editor. You can then open the Vector Profile Editor by clicking the Edit Profile button on the Vector Editor or the Profile button on the Database Editor.

Note: You can open the Vector Editor by double-clicking a Vector Object in the Views or by selecting a Vector in the Database Editor and clicking the Edit button.

Parameter Display Section

Name Display Field

The Name display field shows the name of the Vector you're editing.

Vertex Distance Display Field

The Vertex Distance display field shows the distance from the first point in the Vector to the point you last selected in the graph.

Terrain Elevation Display Field

The Terrain Elevation display field shows the elevation of the terrain underlying the point you last selected in the graph.

Vertex Elevation Field

The Vertex Elevation field shows the elevation of the point you last selected in the graph. You can drag the point up or down with the mouse to change its elevation or enter a new elevation into the Terrain Elevation field.

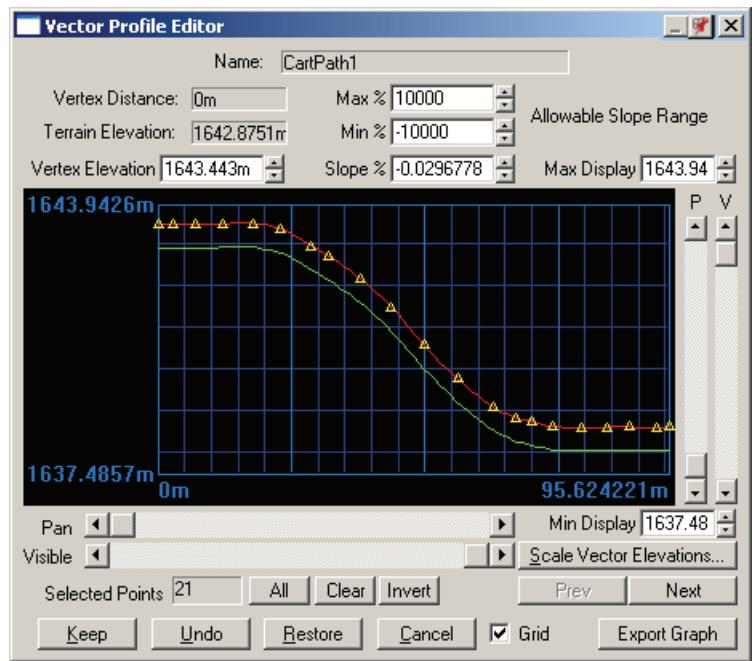
Allowable Slope Range Max and Min Percentage Fields

The Allowable Slope Range Max and Min percentage fields let you limit the slope of the Vector.

For example you could limit the maximum and minimum slope of a highway Vector to keep the highway from becoming too steep.

Slope Percentage Field

The Slope Percentage field shows the slope percentage at the point you last selected in the graph.



Graph Area Section

In the Vector Profile Editor you can raise or lower each point in the Vector Object by dragging points up and down with the mouse or entering new elevations in the Elev field. The Vector is shown in red and the underlying terrain is shown in green.

Scale Vector Elevations Button

You can raise or lower all the Vector Elevations together by clicking the Scale Vector Elevations button to open the Scale Vector Elevations Window.

Max Display Field

The Maximum Display field lets you specify the high Y limit for the graph. The Y axis shows the value change created by the Vector Profile.

Min Display Field

The Minimum Display field lets you specify the low Y limit for the graph. The Y axis shows the value change created by the Vector Profile.

Graph Area

The Graph display shows the Vector graphed against the underlying terrain. You can interactively edit the points on the graph.

The X and Y values are both measurements in real units. The X axis of the graph shows distance. The Y axis of the graph shows elevation. You can select the units on the Units page of the Preferences Window.

You can click any point to select it. Shift-click to select more than one. You can drag selected points in the Y axis with the mouse.

Vertical P (Pan) Slider

Use the Vertical Pan slider to go up or down in the Graph when you've zoomed in with the Vertical Visible slider. The Y axis shows the elevation change created by the Vector Profile.

Vertical V (Visible) Slider

Use the Visible slider to zoom in and out on the Y axis of the Graph display. The Y axis shows the elevation change created by the Vector Profile.

Horizontal Pan Slider

Use the Horizontal Pan slider to go left or right in the Graph when you've zoomed in with the Horizontal Visible slider. The X axis of the graph shows a distance from the Vector.

Horizontal Visible Slider

Use the Horizontal Visible slider to zoom in and out on the X axis of the Graph display. The X axis of the graph shows a distance from the Vector.

Selected Points Display Field

The Selected Points display field shows the number of Vector points that are currently selected. Click a Vector point in the graph to select it. Shift-click to select more than one.

Use the following buttons for more selection/deselection options.

All Button

Click the All button to select all points in the Vector.

Clear Button

Click the Clear button to deselect all points in the Vector.

Invert Button

Click the Invert button to select all unselected points and deselect all selected points.

Previous Button

Click the Previous button to select the previous point in the Vector.

Next Button

Click the Next button to select the next point in the Vector.

Lower Edge Controls

Keep Button

Changes apply immediately when you make them. The Keep button lets you close the window without losing your changes.

Undo Button

The Undo button lets you throw away the last change you made in the Vector Profile Editor. Use this as a way to undo a single change when experimenting.

Grid Checkbox

Click the Grid checkbox to toggle a grid display in the graph.

Export Graph Button

Clicking this button will open the Vector Profile Export window. This allows you to create a graphical output of your vector profile in Adobe Illustrator format.

Restore Button

The Restore button lets you deliberately throw away all the changes you made since you last opened the Vector Profile Editor. Use this as a way to undo changes when experimenting.

Cancel Button

The Cancel button lets you close the window and deliberately throw away all the changes you made since you last opened it. This is like the Restore button (see above) but it also closes the Vector Profile Editor.

Vector Profile Export

The vector Profile export window allows you to define parameters such as color, line weight and scales for the export of your vector profile as an Adobe Illustrator file.

Note: If you select a different vector to the one that was selected when you opened the Vector Profile Export window, the contents of the Vector Editor will update to reflect the change, but the Vector Profile Export window will not honor the change. If you want to export the profile of the newly selected vector, you must close and re-open the Vector Profile Export window.

Units Section

This section of the editor allows you to define your horizontal and vertical graph units, as well as the units embedded in the exported Adobe Illustrator file.

Distance Axis Units Dropdown List

This dropdown list allows you to select appropriate horizontal units for your graph. For instance, if you were outputting the graph of one hole on a golf course, you might want to select Meters. If however you were visualizing a 40 mile hiking trail, you might choose Kilometers or Miles.

Elevation Axis Units Dropdown List

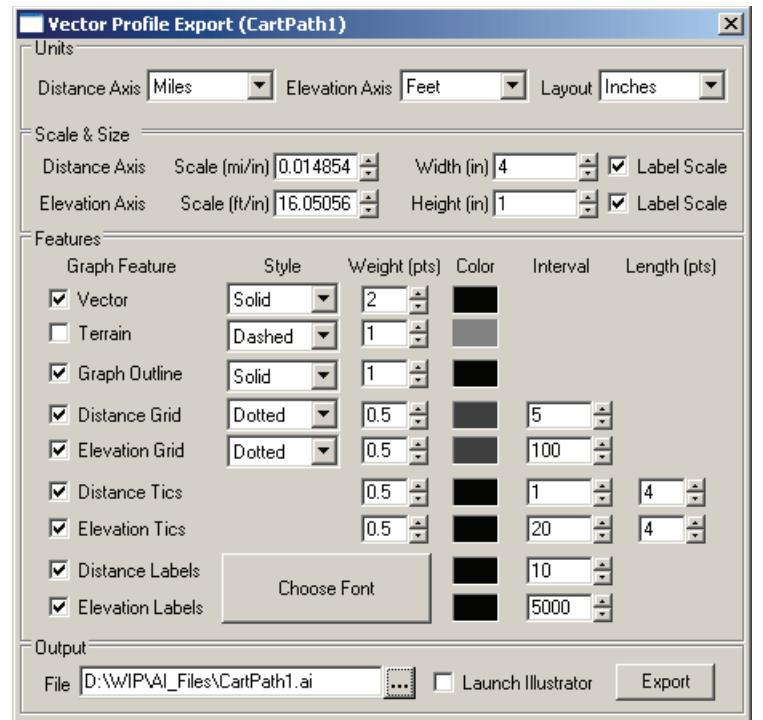
This dropdown list allows you to select appropriate vertical units for your graph. For instance, if you were outputting the graph of one hole on a golf course, you might want to select Centimeters or Millimeters, to vertically exaggerate any changes in slope. If however you were visualizing a 40 mile hiking trail, you might choose Meters or Feet.

Layout Axis Dropdown List

This dropdown list allows you to select appropriate scaling units for your graph. For instance, if you wanted your output file to use a scale of 1 Kilometer to 1 Inch for the horizontal axis, you would select Kilometers in the Horizontal Units, and Inches as the Scaling or Layout units.

Scale & Size Section

This section of the editor is where you define the numeric relationship between Horizontal and Scale or Layout units. Based on your selections from the dropdown lists above, the unit-based relationship (meters/inch, or Miles/Centimeter) of the axis fields will have been defined for you. You can enter values into the Axis Scale fields (forcing VNS to calculate appropriate dimensions for your graph) or the graph dimension fields (forcing VNS to calculate appropriate axis scaling values)



Distance Axis Scale Field

Into this field, enter the number of Horizontal units per Layout unit. Any number entered in this field will cause an automatic recalculation of the Width Field.

Elevation Axis Scale Field

Into this field, enter the number of Vertical units per Layout unit. Any number entered in this field will cause an automatic recalculation of the Height Field.

Width Field

Into this field, enter the required output width of the graph in Layout units. Any number entered in this field will cause an automatic recalculation of the Distance Axis Scale Field.

Height Field

Into this field, enter the required output height of the graph in Layout units. Any number entered in this field will cause an automatic recalculation of the Elevation Axis Scale Field.

Distance Scale Label Checkbox

Select this checkbox if you wish the Horizontal axis of your graph to be labelled with its scaling factor.

Elevation Scale Label Checkbox

Select this checkbox if you wish the Vertical axis of your graph to be labelled with its scaling factor.

Features Section

This section of the interface contains controls that allow you to select which of the graphical features (for example, outlines, grids & labels) are output to Adobe Illustrator format. It also contains controls for the line, tic and label styles, weights & colors. By using different combinations of these effects, you can create a wide range of graph types.

Graph Feature Checkboxes

These check boxes allow you to define which graph features will be included in your output file.

Vector

Select this checkbox to have the Vector appear in the graphical output.

Terrain

Select this checkbox to have the Terrain appear in the graphical output.

Graph Outline

Select this checkbox to include the bounding box of the graph in the graphical output.

Distance Grid

Select this checkbox to include a distance grid in the graphical output. The grid interval is set using the Interval Fields (see below)

Elevation Grid

Select this checkbox to include an elevation grid in the graphical output. The grid interval is set using the Interval Fields (see below)

Distance Tics

Select this checkbox to include distance tics (markers) in the graphical output. The tic interval is set using the Interval Fields (see below)

Elevation Tics

Select this checkbox to include elevation tics (markers) in the graphical output. The tic interval is set using the Interval Fields (see below)

Distance Labels

Select this checkbox to include distance labels in the graphical output. The label interval is set using the Interval Fields (see below)

Elevation Labels

Select this checkbox to include elevation labels in the graphical output. The label interval is set using the Interval Fields (see below)

Style Dropdown Lists

These checkboxes allow you to define the type of line style used for the selected graph feature. These lists are not available for Tics or Labels, as they are not relevant to those types of graphical elements.

Solid

Choose Solid to have the selected element drawn in unbroken lines.

Dashed

Choose Dashed to have the selected element drawn in dashed lines.

Dotted

Choose Dotted to have the selected element drawn in dotted lines.

Broken

Choose Broken to have the selected element drawn in broken lines (dot-dash-dot-dash).

Weight Fields

These fields allow you to define the weight of Lines and Tics using points as units. These fields are not available for Labels, as they are not relevant to that type of graphical elements.

Color Selectors

These fields allow you to define the colors of graphical elements. Clicking a color well will open the Color Editor, allowing you to choose an appropriate color for the selected element.

Interval Fields

These fields allow you to define the intervals at which Grids, Tics and Labels are drawn. Enter a value relevant for the selected element.

Length Fields

These fields are only available for Tics, and allow you to define the length of the Tics using points as units.

Choose Font Button

Clicking this button will open a requester, allowing you to manually enter the name of a font for use in your exported .AI file.

Output Section

This section of the editor allows you to define the output location for the exported file, and the button for launching the export process itself.

Output Filename Field

This field will display the path and filename of the exported graph. You can enter the text manually or click the Output File Browse Icon to browse for the location using a file requester.

Output File Browse Icon

Click this button to open a File Save dialog box. This will allow you to define the location and filename of the exported graph.

Launch Illustrator Checkbox

Selecting this checkbox will cause VNS to automatically launch Adobe Illustrator as soon as export is completed. The exported file will be loaded ready for further editing or integration into or export to another document.

Export Button

Click this button to export the configured Adobe Illustrator file.

Version Window

The Version window opens whenever you start the program. You can also open it from the Help Menu.

At the bottom you can see information about your copy of Visual Nature Studio. Below that you can set up and access Multiple User Mode.

In the Tips area you can see handy tips for using Visual Nature Studio.

The Version window also gives you an easy way to open the Resume Project. When you start the program, the Resume Project is a convenient way to continue with the last Project you were using at the state it was in when you last quit VNS.

Information Area

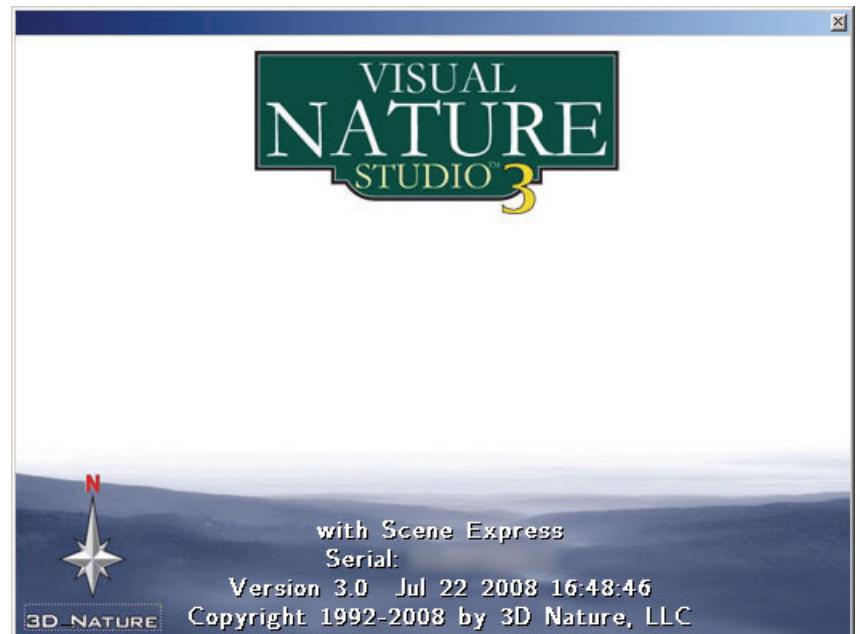
The Information Area shows the version number, date, serial number and copyright information for the version of Visual Nature Studio you are running.

You will need to know the serial number when you register the program. You will also need to know the serial number if you contact 3D Nature, LLC for technical support.

Clicking on the Version splash screen or waiting for a short while will cause the screen to change, displaying a number of buttons:

- **Tips**
- **Tutorials**
- **Existing Projects**
- **New Projects**
- **Users**

Clicking on one of these will display the corresponding page.



Tips

Click on the Tips Button to take you to the Tips page of the Version Window. The Tips section shows a useful insight for using Visual Nature Studio.

More Tips Button

Click the More Tips button to see another tip.

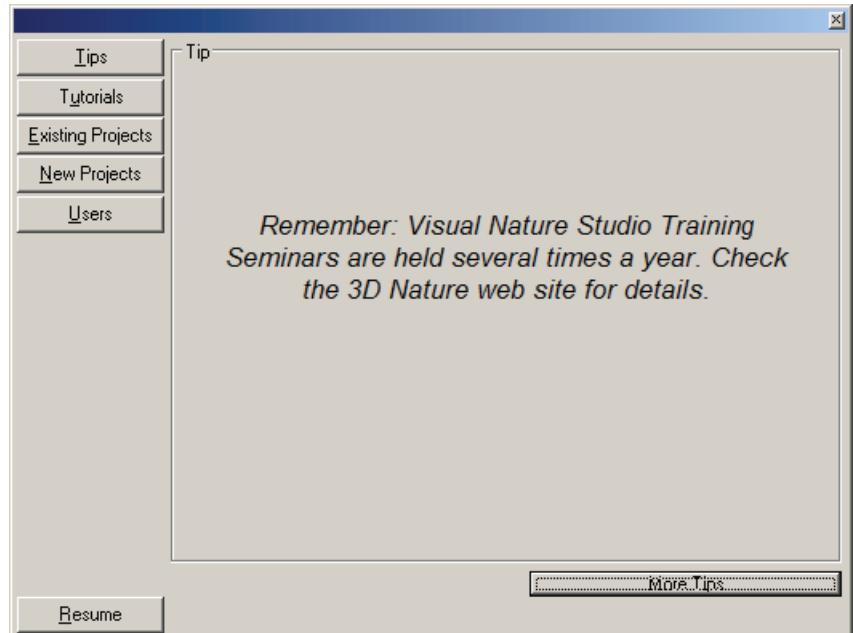
Resume Button

Click the Resume button to close the Version window and open the special "Resume" file. This file is saved every time you save your project, and when you quit VNS by selecting the Quit command.

This is a handy way of immediately opening the Project you were last working on, in the state it was in when you last saved. When you next save it, VNS will save it under its file name, as well as resaving it into the Resume File.

If you are not using the Multiple User Mode, VNS will save the Resume file as "VNS.prefs". If you are using Multiple User Mode, VNS will save the Resume file with the current user name appended to the front of that file name. That way each user will have a separate Resume file. The Resume file also stores individual user preferences. Clicking the Resume button is the same as selecting the Open Resume File command in the File Menu.

Note: When the Version window first opens, you can invoke the Resume button immediately by hitting the space bar, even while the full-color image is displayed.



Tutorials

Click on the Tutorials Button to take you to the Tutorials page of the Version Window. From here you can preview and load any of the installed tutorial files on your system. A number of tutorials are provided with VNS 3 and installed when you install the product. Any new tutorials that you download and install will become accessible through this interface.

Resume Button

Click the Resume button to close the Version window and open the special "Resume" file. This file is saved every time you save your project, and when you quit VNS by selecting the Quit command.

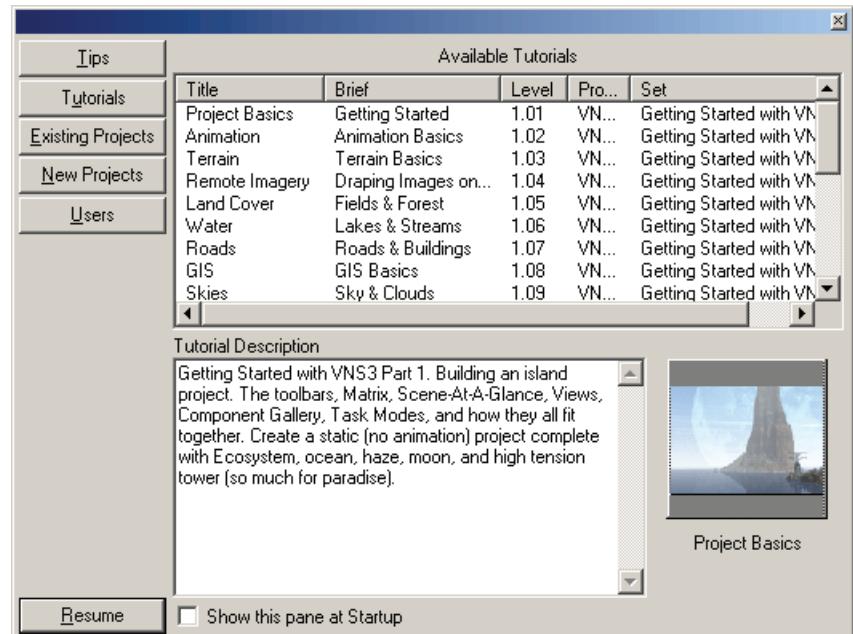
This is a handy way of immediately opening the Project you were last working on, in the state it was in when you last saved. When you next save it, VNS will save it under its file name, as well as resaving it into the Resume File.

If you are not using the Multiple User Mode, VNS will save the Resume file as "VNS.prefs". If you are using Multiple User Mode, VNS will save the Resume file with the current user name appended to the front of that file name. That way each user will have a separate Resume file. The Resume file also stores individual user preferences. Clicking the Resume button is the same as selecting the Open Resume File command in the File Menu.

Note: When the Version window first opens, you can invoke the Resume button immediately by hitting the space bar, even while the full-color image is displayed.

Show This Pane At Startup Checkbox

Enabling this checkbox will force VNS to display the Tutorials page at startup, rather than the Tips Page.



Existing Projects

Click on the Existing Projects Button to take you to the Existing Projects page of the Version Window. From here you can preview and load any of the existing project files on your system. A number of demo projects are provided with VNS 3 and installed when you install the product.

Resume Button

Click the Resume button to close the Version window and open the special "Resume" file. This file is saved every time you save your project, and when you quit VNS by selecting the Quit command.

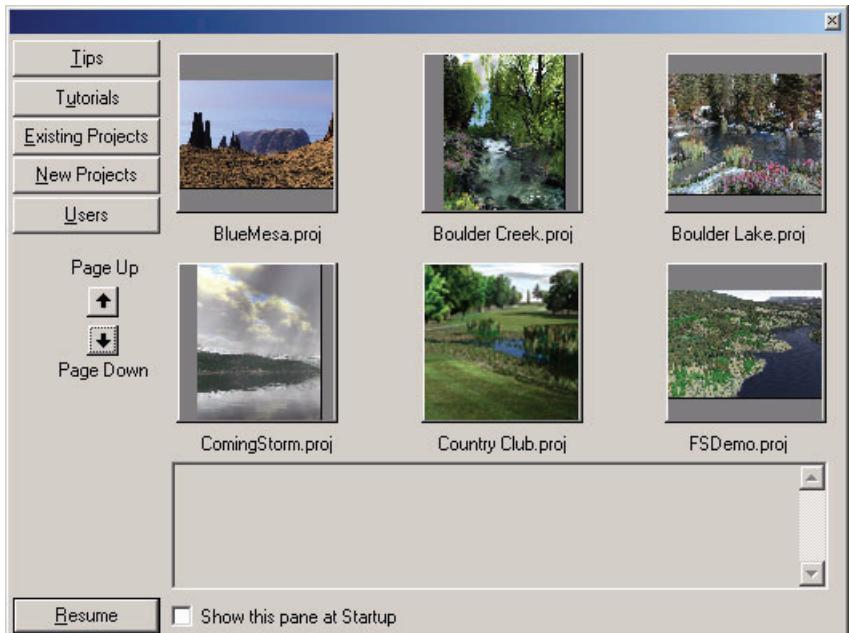
This is a handy way of immediately opening the Project you were last working on, in the state it was in when you last saved. When you next save it, VNS will save it under its file name, as well as resaving it into the Resume File.

If you are not using the Multiple User Mode, VNS will save the Resume file as "VNS.prefs". If you are using Multiple User Mode, VNS will save the Resume file with the current user name appended to the front of that file name. That way each user will have a separate Resume file. The Resume file also stores individual user preferences. Clicking the Resume button is the same as selecting the Open Resume File command in the File Menu.

Note: When the Version window first opens, you can invoke the Resume button immediately by hitting the space bar, even while the full-color image is displayed.

Show This Pane At Startup Checkbox

Enabling this checkbox will force VNS to display the Existing Projects page at startup, rather than the Tips Page.



New Projects

Click on the New Projects Button to take you to the New Projects page of the Version Window. From here you can use the supplied interface to quickly generate a completely new project from a series of component-based building blocks.

Resume Button

Click the Resume button to close the Version window and open the special "Resume" file. This file is saved every time you save your project, and when you quit VNS by selecting the Quit command.

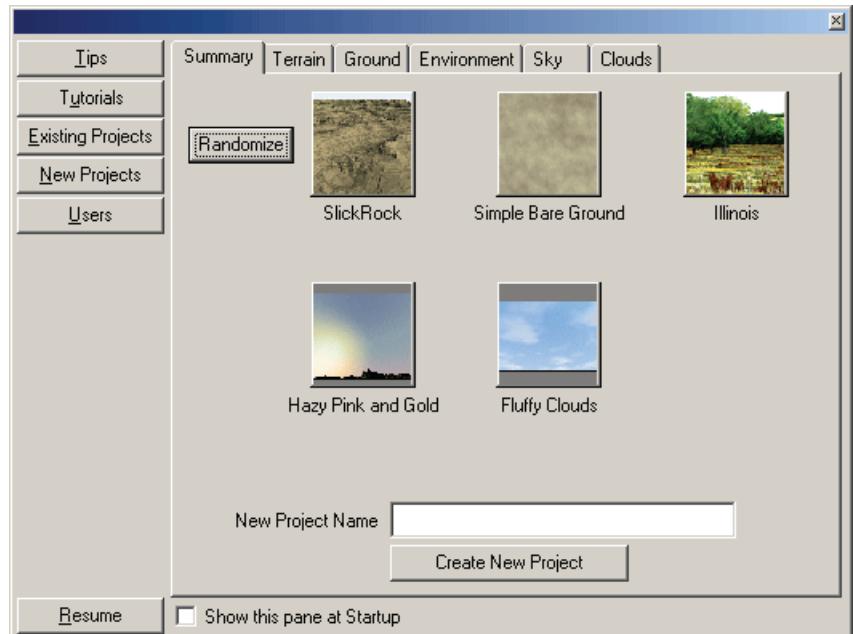
This is a handy way of immediately opening the Project you were last working on, in the state it was in when you last saved. When you next save it, VNS will save it under its file name, as well as resaving it into the Resume File.

If you are not using the Multiple User Mode, VNS will save the Resume file as "VNS.prefs". If you are using Multiple User Mode, VNS will save the Resume file with the current user name appended to the front of that file name. That way each user will have a separate Resume file. The Resume file also stores individual user preferences. Clicking the Resume button is the same as selecting the Open Resume File command in the File Menu.

Note: When the Version window first opens, you can invoke the Resume button immediately by hitting the space bar, even while the full-color image is displayed.

Show This Pane At Startup Checkbox

Enabling this checkbox will force VNS to display the New Projects page at startup, rather than the Tips Page.



Users

The users page is where you configure VNS to work in multiple user mode. VNS is capable of remembering the settings of many users, and storing each in a separate prefs file. What this means to the user is that they can share a machine with other users, without having to spend time resetting their view prefs, matrix layout, and resume file every time they return to the machine.

Another application of this mode is to set up a number of “users” to represent a number of different areas of business application. For example, you might have a “user” called “Civil Engineering”, one called “Land Planning”, one called “Architecture”. Each could access different content and have different settings to the others, specific to your needs.

To enable multi-user mode:

1) select the checkbox marked “Multiple User Mode”

The dropdown list should be activated.

2) Select “New User...” from the list

A dialog will appear in which you can enter a new user name. This must be no more than 63 characters in length.

The new user prefs file will be a copy of the existing VNS.prefs file in your application folder. Each new user created in this way will have a new prefs file created for them with a filename <Username>.prefs, where <Username> is the name you entered in step 2.

To delete a user from the list, select Remove Current User from the File menu. The next time you run VNS, or select the Users page of the startup screen, the deleted user will no longer be available from the dropdown list.

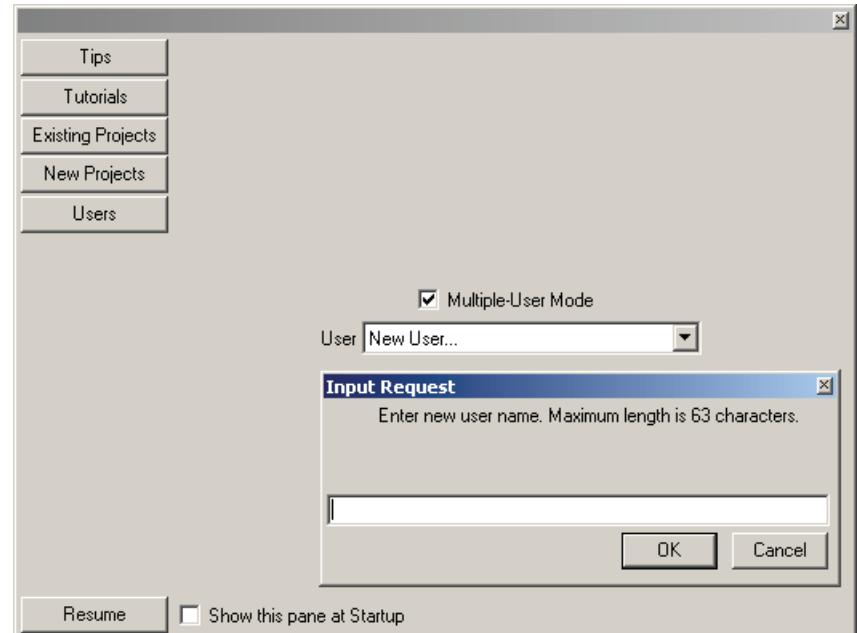
Note: Deleting a user's prefs in this way will delete all settings they may have had, including the Resume file for the project they were last working on. VNS will warn you that this operation is can not be undone before it allows you to proceed.

Resume Button

Click the Resume button to close the Version window and open the special “Resume” file. This file is saved every time you save your project, and when you quit VNS by selecting the Quit command.

This is a handy way of immediately opening the Project you were last working on, in the state it was in when you last saved. When you next save it, VNS will save it under its file name, as well as resaving it into the Resume File.

If you are not using the Multiple User Mode, VNS will save the Resume file as “VNS.prefs”. If you are using Multiple User Mode, VNS will save the Resume file with the current user name appended to the front of that file name. That way each user will have a separate Resume file. The Resume file also stores individual user preferences. Clicking the Resume button is the same as selecting the Open Resume File command in the File Menu.



Note: When the Version window first opens, you can invoke the Resume button immediately by hitting the space bar, even while the full-color image is displayed.

Show This Pane At Startup Checkbox

Enabling this checkbox will force VNS to display the Tutorials page at startup, rather than the Tips Page.

View Preferences Window

The View Preferences window lets you control what you see in Realtime OpenGL depictions and in preview renderings. You can control both of these separately for each View (see Views).

The View Preferences window gives you a handy interface for changing multiple View Options and Render Options for the selected View. This may be more convenient than using the Matrix Popup Menus. Due to operating system limitations the Matrix popup menus only let you change one selection at a time.

The options in the View Preferences window are the same options you'll find in the Matrix Popup Menus, in the Realtime Options Submenu and the Render Options Submenu submenu.

Note: There are a few items in these submenus that are not available in the View Preferences window.

On most of the pages you'll see two columns of checkboxes. The column labelled "Realtime" are the View Options. These let you select what you see in Realtime OpenGL for the selected View. They are the same options you'll find in the Matrix popup menu's View Options submenu.

The column labelled "Render" are the Render Options. These let you select what you will see in preview renderings for the selected View.

Note: To render a preview rendering in a View, select any View and then select the Render Preview icon in the Icon toolbar or the "Render a Preview" command in the Matrix popup menus.

You can also edit the Render Options in the Render Options Editor. You can select a different set of Render Options for the View in the Select Options Set submenu in the Matrix popup menus.

Changing the Render Options in the Render Options Editor, in the View Options submenu or in the View Preferences window all do the same thing. Changing them in one place will change them everywhere else.

Whenever you activate a different View window, the View Preferences window will show the selections you've made for that View.

General Page

All Views Section

The All Views section lets you change some options that apply to all the Views in your Project.

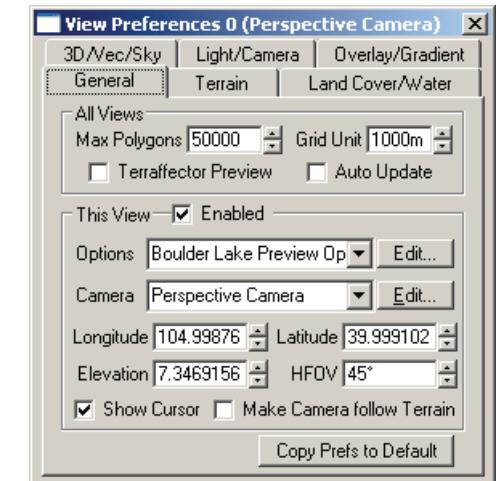
Max Polygons Field

The Maximum Polygons field lets you specify the number of polygons shown in OpenGL Realtime Views. VNS will show this number of polygons in each open OpenGL View.

If your Realtime Views are updating sluggishly, decrease this number. If your Views don't have enough detail, increase this number.

The faster your computer and the more capable your OpenGL graphics card, the more polygons you will be able to work with comfortably.

If you have several Views open, VNS will use this amount of polygons in each View. For faster overall OpenGL redraw speed, open fewer Views, or temporarily disable some (see below).



Grid Unit Field

The Grid Unit field lets you specify the size of the grid on the ground plane in OpenGL Realtime Views.

The Grid is a reference that is particularly useful in Overhead and Planimetric Views. You can use it to judge the relative size of terrain features.

Note: To see the Grid through the terrain, select the Terrain Transparency checkbox in the Realtime column on the View Preference window's Land page. This makes the terrain semi-transparent so you can partially see through the terrain to the reference Grid below.

Terraffector Preview Checkbox

Select the Terraffector Preview command to see the effect of Terraffector and Area Terraffector terrain displacement displayed in OpenGL real time Views.

Auto Update Checkbox

Select the Terraffector Preview AutoUpdate command when you want VNS to refresh OpenGL real time Views after you make a change to any Terraffector or Area Terraffector.

This View Section

Enabled Checkbox

Select the Enabled checkbox when you want the OpenGL realtime View to react to changes you make. Deselect the Enabled checkbox when you want to freeze the OpenGL realtime View in its current state, ignoring changes you make to your scene.

It can be useful to temporarily disable a View to speed up the refreshing of one or more other Views you may be using. Don't forget to re-enable the View when you want it to show the current state of your Project.

Options Drop Box and Edit Button

The Options drop box lets you select a different set of Render Options to use for the View.

Click the Edit button if you would like to open the Render Options Editor ready to edit the View's Render Options. You can also edit many of these options on the various pages of the View Preferences window itself.

Camera Drop Box and Edit Button

The Camera drop box lets you select a different Camera for the View. Each View always shows what a Camera sees.

You can click the Edit Camera button if you would like to open the Camera Editor ready to edit the View's Camera. For convenience, you can also edit some of the Camera's parameters using the fields below the Camera drop box.

Longitude Field

You can enter a value into the Longitude field to change the View Camera's east/west position. The maximum value is 1,000,000 degrees and the minimum value is -1,000,000 degrees (more than several thousand orbits in the positive or negative directions).

Camera Longitude is how far the Camera is east or west of the prime meridian, which passes through Greenwich, England. It's measured in degrees and is compatible with the longitude markings on standard maps and globes.

By default, VNS uses a positive longitude as west of the meridian and negative longitude as east. This is due to the fact that much of the high quality DEM data available is for the Western hemisphere. You can change this on the Units page of the Preferences Window if you wish.

VNS supports continuous longitudinal motion up to 1,000,000 degrees (approximately 2,777 complete orbits) in both positive and negative directions. Longitude position may be expressed as either positive or negative ($-5^\circ = 355^\circ$) based on the 360° full circle.

Camera Altitude, Camera Latitude and Camera Longitude together define the Camera's position in 3-D space. They are all members of the Camera Group. When you change the Camera Longitude without changing the Camera Altitude, the Camera will naturally move at a fixed orbital distance from the earth rather than shooting out into space.

Note: This is the same as changing the Longitude field on the Position & Orientation page of the Camera Editor for the View's Camera.

Latitude Field

You can enter a value into the Latitude field to change the View Camera's north/south position. The maximum value is 90.0 degrees (north pole). The minimum value is -90.0 degrees (south pole).

Camera Latitude is how far the Camera is north or south of the equator. It's measured in degrees and is compatible with the latitude markings on standard maps and globes.

Camera Altitude, Camera Latitude and Camera Longitude together define the Camera's position in 3D space. They are all members of the Camera Group. When you change the Camera Latitude without changing the Camera Altitude, the Camera will naturally move at a fixed orbital distance from the earth rather than shooting out into space.

Note: This is the same as changing the Latitude field on the Position & Orientation page of the Camera Editor for the View's Camera.

Elevation Field

Maximum: 1,000,000 kilometers

Minimum: -6,362.683195 kilometers (the center of the earth)

Camera Altitude is the height of the View's Camera. It's measured in the elevation units you select on the Units page of the Preferences Window, above or below sea level.

Note: The elevations in DEM files are also relative to sea level. Sea Level is the surface of the Project Coordinate System's Ellipsoid, which is an elevation of zero. You can see the Project's Coordinate System in the Planet Options Editor.

Camera Altitude, Camera Latitude and Camera Longitude together define the Camera's position in 3-D space. They are all members of the Camera Group.

Note: This is the same as changing the Elevation field on the Position & Orientation page of the Camera Editor for the View's Camera.

Horizontal Field of View (HFOV) or Width Field

The Horizontal Field of View or Width field lets you zoom the Camera's "optics" in or out like a zoom lens on a real camera. For most Camera types the field will show Horizontal Field of View. For Planimetric or Orthographic Cameras it will show View Width.

Horizontal Field of View provides the illusion of closeness and distance without changing the spatial relationship of objects in the image. The maximum value is 179.9 degrees and the minimum value is .0001 degree.

Note: This is the same as changing the Horizontal Field of View field on the Lens page of the Camera Editor for the View's Camera.

View Width lets you specify how wide an area the Planimetric or Orthographic Camera will display, using the Distance units you set on the Units page of the Preferences Window.

Show Cursor Checkbox

Select the Show Cursor checkbox to enable the crosshairs that show where you last clicked in the OpenGL realtime View. Deselect the Cursor command to hide the crosshairs.

Make Camera Follow Terrain Checkbox

Select the Make Camera Follow Terrain checkbox if you want the Camera to stay at the same elevation above the terrain when you move it interactively in a View.

This will not affect the Camera's elevation if you change the Camera position numerically within the Camera Editor.

Note: This is the same as selecting the Interactive Elevation Follow Terrain checkbox on the General page of the Camera Editor.

Copy Prefs to Default Button

Click the Copy Prefs To Default Button to copy the current settings in the View Preferences to those that are applied by default whenever a new view using this type of Camera is created.

Terrain Page

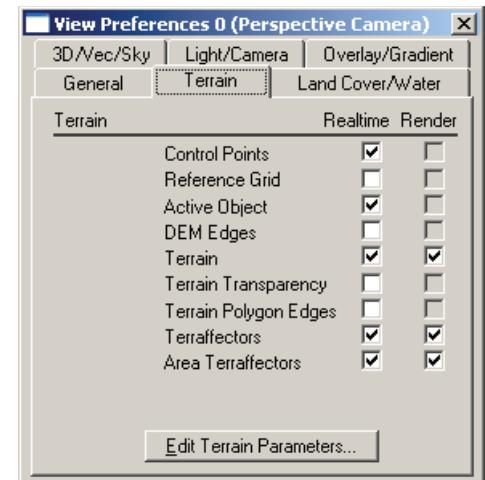
The Terrain page lets you choose what terrain items to see in Realtime Views or rendered previews.

Control Points

Select the Control Points checkbox to see Control Points in the Realtime View. You'll see Control Points shown as dots if there is just one point, or connected lines if there are multiple points.

You can create Control Points with vector tools. They're vectors. Different from vectors only because by default the VNS Terrain Gridder will only consider enabled Control Points when gridding DEMs.

Control Points are not available for rendered previews.



Reference Grid

Select the Reference Grid command to see the Reference Grid in the Realtime View. You'll see the Reference Grid shown as a grid subdivided at whatever interval you set in the Grid Unit field, on the General page of the Preferences window. Since it appears beneath the terrain, it may help to make the terrain transparent in OpenGL (see Terrain Transparency below).

The Reference Grid is not available for rendered previews.

Active Object

Select the Active Object checkbox to see the Active Item in the Realtime View. The Active Item is shown in yellow.

The Active Object is not available for rendered previews.

DEM Edges

Select the DEM Edges checkbox to see each DEM shown with highlighted edges. This makes it easy to see where each DEM begins and ends.

DEM Edges are not available for rendered previews.

Terrain

Select the Terrain checkboxes to see the Terrain in the Realtime View or preview rendering. You'll see all enabled DEMs shown as a shaded OpenGL shape. You can enable and disable DEMs in the Scene-At-A-Glance or the Database Editor.

Terrain Transparency

Select the Terrain Transparency checkbox to make the terrain have less opacity. You can then see through the terrain to see things that might otherwise be obscured such as distant terrain, Celestial Objects or the Camera's Target if it has one.

Terrain Transparency is not available for rendered previews.

Terrain Polygon Edges

Select the Terrain Polygon Edges checkbox if you want to see just the edges of the terrain polygons. This gives the OpenGL display a wireframe look.

Terraffectors

Select the Terraffectors checkboxes to see all enabled Vectors that are attached to Terraffectors. You'll see them as Vectors in the Realtime View.

You'll see Terraffectors as displaced, textured terrain in rendered previews.

Note: If you want to see the terrain actually displaced by Terraffectors in the realtime OpenGL View, select the Terraffecter Preview and Auto Update checkboxes on the General page (see above).

Area Terraffectors

Select the Area Terraffectors checkboxes to see all enabled Vectors that are attached to Area Terraffectors. You'll see them as Vectors in the Realtime View.

You'll see Area Terraffectors as displaced, textured terrain in rendered previews.

Note: If you want to see the terrain actually displaced by Area Terraffectors in the realtime OpenGL View, select the Terraffecter Preview and Auto Update checkboxes on the General page (see above).

Edit Terrain Parameters Button

Click the Edit Terrain Parameters button to open the Terrain Parameter Editor. There you can set the Fractal Depth and other terrain-related parameters.

Land Cover/Water Page

The Land Cover/Water page lets you choose what texturing, foliage and water items to see in Realtime Views or rendered previews.

Land Cover

Ground Components

Select the Ground Components command to see all enabled, vector-bounded Ground Effect Components.

You'll see them as Vectors in the Realtime View.

Other Foliage

Select the Other Foliage checkbox to see foliage from Ecotypes. Ecotypes appear in Ecosystems used in Environments, Color Maps and Terraffectors or attached to Vectors, and to foliage on Lake and Stream Beaches.

This is only available for rendered previews.

Foliage Effects

Select the Foliage Effects checkboxes to see all enabled Foliage Effects. You'll see them as Image Objects or 3D Objects in the rendered View. Objects will appear at every vertex of attached Vectors.

You'll see them as Vectors in Realtime Views. See the next item (RT Foliage Images) for more information on seeing them as actual images.

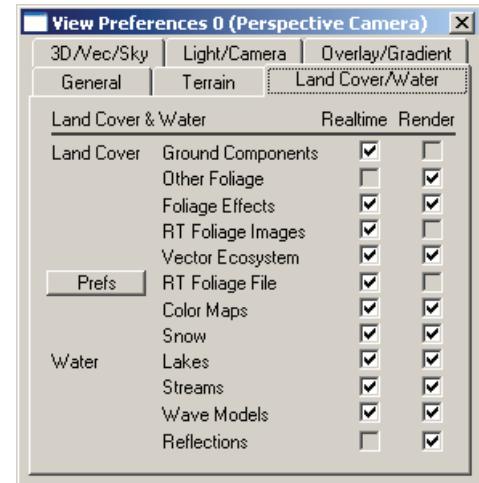
RT Foliage Images

Select the RT Foliage Images Checkbox to enable Realtime Foliage in OpenGL views. Deselecting this checkbox will prevent all realtime foliage from displaying in the OpenGL view.

Vector Ecosystems

Select the Vector Ecosystems checkboxes to see all enabled Ecosystems that are attached to enabled Vectors. You'll see them as areas of Image and 3D Object foliage in the rendered View. In order to see any Ecotype foliage you'll also need to select the Other Foliage checkbox.

You'll see them as Vectors in Realtime Views. See the next item (RT Foliage File) for more information on seeing them as actual images.



RT Foliage File

Select the RT Foliage File checkbox to see Realtime Foliage displayed in OpenGL. All Foliage Effects display by default. To display the foliage objects in Ecotypes, you must first create a realtime foliage file. You can do this by selecting the Create Realtime Foliage File command from the Realtime Options Submenu.

Deselecting this command will hide all realtime foliage from displaying in the OpenGL view, with the exception of enabled Foliage Effects with their Preview checkboxes selected.

Color Maps

Select the Color Maps checkboxes to see all enabled Color Maps. In preview renderings you'll see them rendered onto the terrain (see Color Map Editor).

You'll see them as semi-transparent rectangles the terrain in Realtime Views, indicating the boundaries of the Color Maps. This is most useful in Planimetric Views for seeing the areas covered by the Color Maps.

Note: Depending on how they are configured, you can see some Color Maps draped onto the terrain if you enable the Ecosystem Map checkbox in the Overlay page (see below).

Snow

Select the Snow checkboxes to see all enabled Vectors that are attached to a Snow Effect. You'll see them as Vectors in the Realtime View.

You'll see Snow Effects as a color or texture in rendered previews.

Water

Lakes

Select the Lakes checkboxes to see all enabled Lakes. You'll see them as water surfaces in the Views.

Streams

Select the Streams checkboxes to see all enabled Streams. You'll see them as water surfaces that follow their attached Vector elevations in the rendered View.

You'll see them as Vectors in Realtime Views.

Wave Models

Select the Wave Models checkboxes to see all enabled Wave Models. You'll see them as displacement on Lakes and Streams in the rendered View.

You'll see them as Vectors in Realtime Views, if vector bounded, and the sources will be displayed as small blue W symbols, whether the wave source is vector bounded or not.

Reflections

Select the Reflections checkbox to see any reflections in Lakes and Streams. You can set the amount of reflection separately for each body of water in the Lake and Stream Editors.

This is only available for rendered previews.

3D/Vec/Sky Page

The 3D/Vec/Sky page lets you choose what 3D Object, Vector and Sky-related items to see in Realtime Views and rendered previews.

3D Objects

3D Objects

The 3D Object checkbox lets you see 3D objects as colored, textured shapes in rendered previews. Select it to see 3D objects. Deselect it to hide 3D objects.

It's useful to hide 3D objects when you want the rendered preview to update faster and you are working on something other than 3D objects.

Note: To see a 3D object it must be enabled. You can enable a 3D object from the 3D Object Editor. You can enable or disable all 3D objects on the Enabled 1 page of the Render Options Editor.

In Realtime Views, 3D Objects will be hidden, shown as boxes or shown in detail, depending on your choice for each 3D Object in the 3D Object Editor.

Walls

The Walls command lets you see vector controlled wall effects in rendered previews.

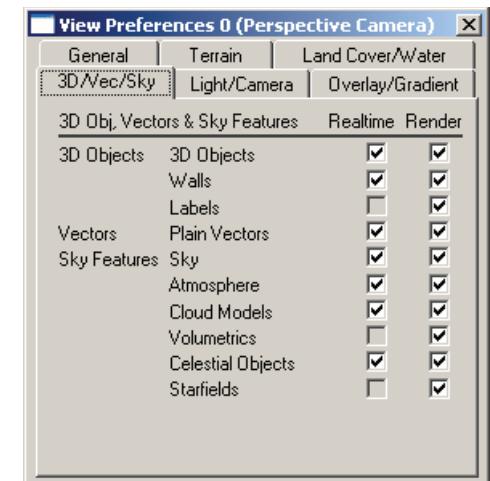
Vectors

Plain Vectors

The Plain Vector checkboxes lets you choose whether to see Vectors that are enabled for rendering in your preview renders or Realtime Views. Select it to see any Vectors that are enabled for rendering. Deselect it to disable Vector rendering.

Each Vector will be shown in the color it is set to in the Database Editor.

These checkboxes apply to vectors that are set to be visible in a View. You can set this in the Database Editor or the Vector Editor.



Sky Features

Sky

Select the Sky checkbox to see enabled Skies in the rendered View.

Select the checkbox in the Realtime column to see a Sky color in Realtime OpenGL Views. The color is derived from the top gradient on the Color Gradients page of the Sky Editor. If you deselect the checkbox VNS will use a black background in OpenGL Views.

Atmosphere

Select the Atmosphere checkboxes to see enabled Atmospheres for haze, fog or volumetric effects in the rendered View.

In Realtime Views VNS will visualize Atmospheres with linear Haze. If you are using a different type of Haze or a Volumetric Atmosphere, make sure you do a preview render to get a better idea of what it will look like.

Cloud Models

Select the Cloud Models checkboxes to see any enabled Cloud Model clouds in the rendered View.

In Realtime Views VNS will show a cloud plane.

Volumetrics

Select the Volumetrics command to see any enabled Volumetric effects in the rendered View.

Celestial Objects

Select the Celestial Objects checkboxes to see all enabled Celestial Objects in the rendered View.

In Realtime Views VNS will show each Celestial Object as an OpenGL sphere.

Starfields

Select the Starfields checkbox to see all enabled Starfields in the rendered View.

This is not available for Realtime Views.

Light/Camera Page

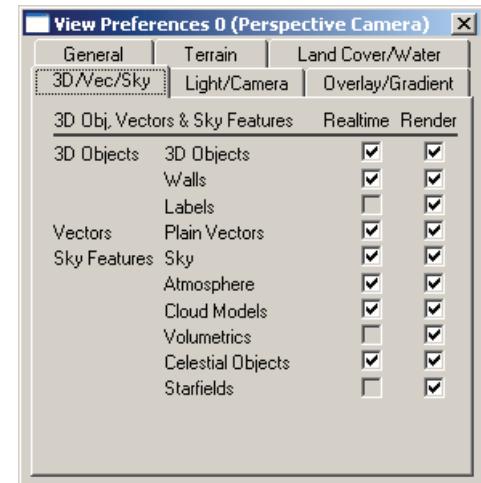
The Light/Camera page lets you choose what Light and Camera-related items to see in Realtime Views and rendered previews.

Light and Shadow

Lights

Select the Lights checkboxes to see the light from all enabled Lights in rendered previews.

Realtime Views will also show the Lights as shapes. Omni-directional Lights are shown as spheres. Spotlights are shown as cones. Parallel Lights are shown as cylinders.



Cloud Shadows

Select the Cloud Shadows checkbox to see all enabled Cloud Shadows in rendered previews. In order to see shadows on the terrain you must also have an enabled Shadow Component to receive them.

This is not available for Realtime Views.

Terrain Shadows

Select the Terrain Shadows checkbox to see all enabled Shadow Components in rendered previews. Shadow Components can receive shadows from clouds, 3D Objects, Image Objects and terrain. Shadow Components can also cast shadows from Image Objects and terrain.

3D Object Shadows

Select the 3D Object Shadows checkbox to see all enabled 3D Object Shadows in rendered previews. In order to see shadows on the terrain you must also have an enabled Shadow Component to receive them.

This is not available for Realtime Views.

Camera

Cameras

The Cameras checkbox lets you choose whether to see Cameras in real time previews. Select it to see Cameras. Deselect it to hide Cameras.

You will see any Cameras that are within the view area. Cameras are shown as rectangular shapes with spreading triangles depicting their Horizontal Field of View.

Note: You won't see the Camera that is actually creating the view itself.

This is not available for rendered previews.

Targets

The Targets checkbox lets you choose whether to see Camera Targets in real time previews. Select it to see Targets. Deselect it to hide Targets.

You will see any Targets that are within the view area for all targeted Cameras that are enabled. Targets are shown as 3D crosses.

This is not available for rendered previews.

Image Boundaries

Depending on the size of the View window, a View may show extra image area that won't get rendered. The Image Boundaries checkbox lets you choose whether to see crop lines to show the portion of the View that will actually be rendered. The crop lines will show the actual aspect of the image based on the Width and Height fields on the Size & Range page of the Render Options Editor.

Preview rendering will honor the crop lines and render only the area of the View that is based on the image size you specify in the Render Options. The aspect will be the same but the image size will be limited to fit within the View.

Using the Image Boundaries saves preview rendering time and gives you a more accurate idea of your actual image area. We recommend leaving the Image Boundaries enabled.

Depth of Field

The Depth of Field checkbox lets you choose whether to see areas of the scene in and out of focus, as set on the Lens page of the Camera Editor, in your preview renders. Select it to enable Depth of Field rendering if Depth of Field is enabled in the Camera Editor. Deselect it to disable Depth of Field rendering.

Depth of Field takes extra rendering time. You can save preview rendering time by temporarily disabling it when you are working on other aspects of your scene.

This is not available for Realtime Views.

Multi-pass Antialiasing/Motion Blur

The Multi-pass Antialiasing/Motion Blur checkbox lets you choose whether to see Multi-pass Antialiasing and Motion Blur, as set on the Lens page of the Camera Editor, in your preview renders. Select it to enable Multi-pass Antialiasing and Motion Blur rendering if they are enabled in the Camera Editor. Deselect it to disable Multi-pass Antialiasing and Motion Blur rendering.

Multi-pass Antialiasing takes extra rendering time. You can save preview rendering time by temporarily disabling it when you are working on other aspects of your scene.

Note: Motion Blur doesn't take much extra rendering time but it depends on Multi-pass Antialiasing to work.

This is not applicable to Realtime Views.

Render Diagnostic Data

Select the Render Diagnostic Data checkbox if you want VNS to generate the complete set of data used by the Diagnostic Data Window when you render. You can then click on a preview rendering in the View and read a variety of useful information in the Diagnostic Data Window about the point where you clicked.

Rendering Diagnostic Data uses extra memory but doesn't take significant extra time. Normally you'll want to leave this checkbox selected for diagnosing Preview Renders. If you're short on memory consider unchecking it.

This is not available for Realtime Views.

Overlay Gradient Page

The Overlay/Gradient page lets you add detail to the terrain in Realtime OpenGL Views. These are not available in rendered previews.

Overlay

Contours

Select the Contours checkbox to see lines drawn at specific elevations in the manner of a contour map. Each contour line represents an elevation.

You can adjust the elevation spacing of the lines in the Contour/Gradient Interval field, on the bottom of the Overlay Gradient page.

Contours work best if you zoom into the map using the Horizontal Field of View or View Width field on the Lens page of the Camera Editor for the View's Camera.

In a contour map the lines get closer together where slopes are steeper and farther apart where slopes are more gentle. A series of curves in adjacent lines can indicate the location of a ridge or valley. This can be useful, for example, if you're digitizing a stream and want the stream to follow a valley.

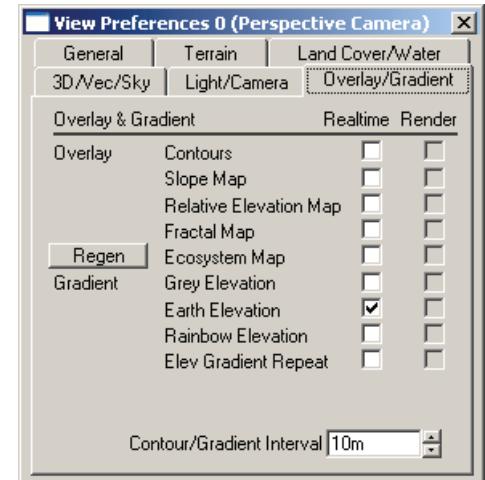
Note that the resolution of your contours is dependent on the max polygons setting on the General page, and ultimately on the underlying cell resolution of your terrain.

Slope Map

Select the Slope Map checkbox to see a grayscale gradient depicting slope. Darker shades indicate flatter terrain. Lighter shades indicate steeper terrain.

Relative Elevation Map

Select the Relative Elevation Map checkbox to see a visual depiction of the Relative Elevation data for your DEMs. This can give you an idea of the convexity or concavity of the terrain. VNS uses this information when placing Ecosystems using the Rules of Nature. You can edit the Rules of Nature for each Ecosystem in the Ecosystem Editor.



Fractal Map

Use the Fractal Map checkbox if you want to see what the Fractal Maps look like. Use it after you've generated Fractal Maps. The View will show the Fractal Maps that correspond to the enabled DEM files, if any depth maps exist.

Note: To create Fractal Depth Maps for your enabled DEMs, click the Create Fractal Maps button in the Terrain Parameter Editor.

Lighter colors indicate areas of your scene that are close to the Camera path and will be rendered at higher fractal depths. Darker shades are farther from the Camera path and will be rendered at lower fractal depths.

Areas of your scene that will not be rendered will be drawn in black. This makes it easy to see what areas will be rendered and what areas will not be rendered because they are out of the viewing area or because you have enabled backface culling.

Note: Backface culling means VNS doesn't render polygons that face away from the Camera. You can enable or disable backface culling from the Terrain Parameter Editor.

If there are areas of very light color it indicates that higher Fractal Depth settings would be advantageous for best quality renderings. Consider increasing the Fractal Depth value. You can increase the Fractal Depth setting on the Fractals page of the Render Settings Editor.

Increasing Fractal Depth will increase rendering times, so only increase it as much as is needed to create the level of rendering quality your Project requires. When you change the Fractal Depth value you do not have to create new Fractal Depth Maps.

If you change Parameters that affect the Camera, Target, Terrain or Render parameters, you will need to create new Fractal Depth Maps. Or you may want to regenerate new Fractal Depth Maps with a different maximum pixel size or frame step. Whenever you generate new Fractal Depth Maps you can use the Fractal Map checkbox again to view the new version of the Fractal Maps in the View.

Ecosystem Map

Select the Ecosystem Map checkbox to see Ecosystems mapped onto the terrain in the selected Realtime OpenGL View. VNS will show their Diffuse Colors. This can give you a quick idea of where each Ecosystem will appear.

VNS will show any Ecosystems applied with Environments or Color Maps. If you have a Color Map enabled and set to "Color by Polygon" on the General page but not set to match Ecosystems to any colors on the Ecosystems page, VNS will show the actual colors of the color map in the Realtime OpenGL View. This lets you see draped images in the OpenGL View. This lets you see draped images in the OpenGL View.

Note: The Ecosystem map checkbox will not show vector-bounded Ecosystems. You can see the vectors controlling vector-bounded Ecosystems by selecting the Vector Ecosystems checkbox on the Vegetation/Water page.

You can regenerate the Ecosystem Map overlay by clicking the Regen button (see below).

Regen Button

If you are using an Ecosystem Map overlay (see above) and you add more Ecosystems or change your existing Ecosystems you will need to update the Ecosystem Map overlay to reflect your changes.

To do so, click the Regen button to the left of the Ecosystem Map checkbox.

Gradient

Gray Elevation

The grey palette is a standard grey scale gradient. Lighter shades are higher in elevation than darker shades.

Earth Tone Elevation

The earth palette uses gradients of natural-looking colors to indicate elevation. This creates a natural-looking preview that is useful for slope analysis.

Rainbow Elevation

The Rainbow color palette uses gradients of bright colors to indicate elevation. This is useful for slope analysis and to make features more pronounced.

Gradient Repeat

Gradient Repeat uses a repeating gradient to represent elevations. The result is a pseudo-contour map with contour interval specified in the Contour/Gradient Interval field, which is on the bottom of the Overlay Gradient page.

Lighter shades represent higher elevations within each dark to light gradient band.

Contour/Gradient Interval Field

The Contour/Gradient Interval field lets you set the elevation interval for the Contours and Elevation Gradient Repeat options which are also on the Overlay/Gradient page (see above).

Appendix A: A Lesson In Geography

Geographic Coordinate System

- **Longitude**
- **Latitude**
- **Ellipsoids and Geoids**
- **Ramifications for VNS Users**
- **Animation Considerations**
- **Planimetric View Considerations**

When early explorers set out to discover new lands in their wooden sailing ships they needed some way to keep track of where they were in relation to their home port. They needed a global coordinate system that worked well on a spherical planet. The system they and their cartographers devised is now known as the Geographic Coordinate System. It divides the globe into degrees of arc around the planet's circumference.

Longitude is the term for the measurement in the east-west direction parallel to the equator and latitude is the measurement north and south from the equator to the poles.

As accurate measurements became increasingly important, it was discovered that the Earth was not spherical, but actually a slightly oblated sphere, or Ellipsoid. Later still it was found that the gravitational potential of this Ellipsoid did not coincide with the surface of the Ellipsoid itself, hence another term had to be devised to define this new standard. This was referred to as the Geoid.

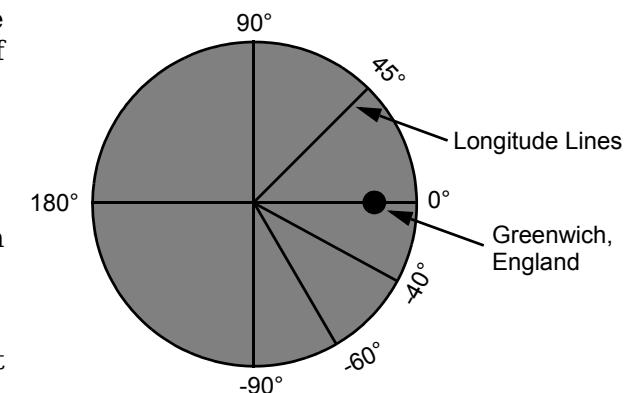
These issues have ramifications on the way in which you pre-process your GIS data, and how you visualize it in VNS. If unfamiliar with the concepts and terminology surrounding these geographical and geodesic issues, you are highly recommended to read this Appendix thoroughly.

Longitude

Think of the globe in cross-section, sliced along the equator and looking down on it from the north pole. The Earth would appear as a circle. If you draw a line outward from the center of the circle to the rim you would be drawing a line of longitude. Now if you measure off and draw 359 more such lines, each one equally spaced around the rim of the circle, you would have laid out 360 degrees of longitude. In geometry and geography arcs are measured in degrees.

There are 360 degrees of longitude around the whole Earth. Each of the lines of longitude in reality is a plane, not a line, that slices the Earth from the north pole to the south. It is only when viewed from either pole that they appear as lines. They are called meridians.

Longitude planes do form a line at their intersection with the Earth's surface. It is a line that arcs from pole to pole in a due north-south direction. These are called longitude lines and can be seen on many globes and maps.



There is one special longitude line, designated arbitrarily as “zero degrees longitude.” It runs right through Greenwich, England on its north-south course. From this line all other lines of longitude are referenced as either east or west longitude depending on whether they lie to the east or west of this special line. Thus most of Europe and Asia are east longitude and North and South America are west longitude.

The longitude lines are numbered according to their degrees of arc from the Greenwich meridian. Contrary to some conventions, VNS considers positive to be west and negative to be east of Greenwich internally, but you can choose to display it in either way in the interface via the Units page of the VNS Preferences Window. The following diagram is labelled using VNS’ internal convention of Positive West, Negative East.

Since most of us seldom venture out on the high seas in small boats these days, we have little need to consider our longitude position from moment to moment. If we wanted to though we could. At any given moment we are positioned at some longitude coordinate. Right now as this manual is being written, north of Brisbane, Australia, the computer hard disk on which it is stored is almost on the one hundred and fifty-third degree of longitude East of Greenwich. Actually it is a little bit west of that line, which brings up the next question: How do we achieve more accuracy in our geographic coordinate system?

Since there are only 360 degrees spread around the entire circumference of the planet each degree covers quite a wide piece of terrain. In fact a degree is about 69 miles or 111 kilometers wide at the equator. For the purposes of navigating in VNS we need much finer measurements than that.

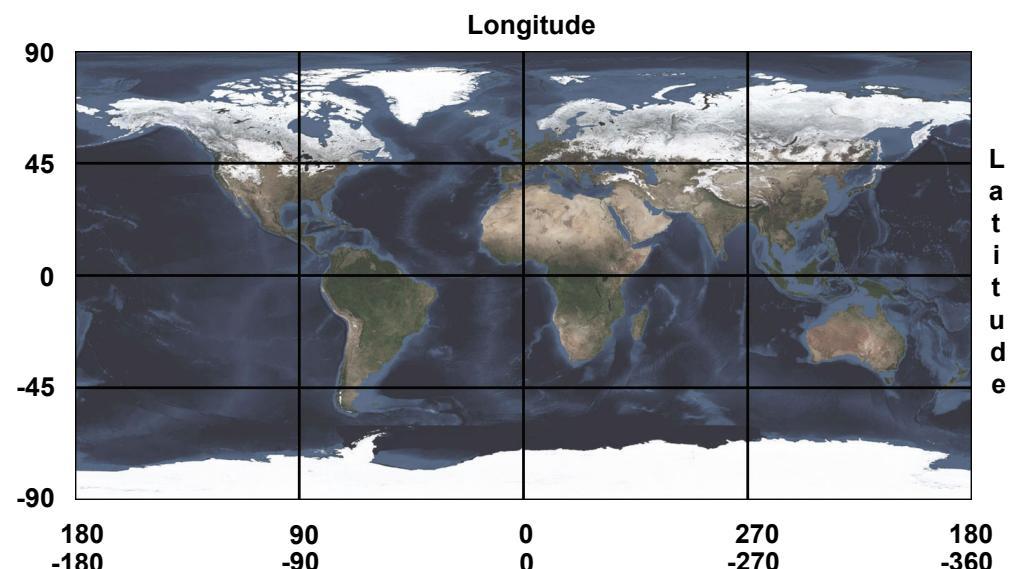
In traditional navigation each degree is sub-divided into 60 units called arc-minutes. Each arc-minute is one sixtieth of a degree in width. They in turn are sub-divided into 60 arc-seconds. Thus there are 60×60 (3600) arc-seconds in a degree.

Much of the terrain data supplied with VNS is sampled at intervals of 3 arc-seconds or 1/1200th of a degree. Using the 111km width per degree we see that the sample interval is roughly 92.5 meters at the equator. The data is frequently referred to as 90 meter data although it is technically a misnomer for reasons that will be discussed soon.

VNS lets you use your choice of latitude and longitude units, either degrees/minutes/seconds or the more easily negotiated system of degrees and decimal fractions. Degrees/minutes/seconds relate to decimal degrees using this formula:

$$\text{decimal degrees} = \text{degrees} + \text{arc-minutes}/60 + \text{arc-seconds}/3600$$

You can select the format you prefer on the Units page of the Preferences window, using the Lat/Lon Format drop box. VNS will then do the conversion for you.



L
a
t
i
t
u
d
e

180
-180

90
-90

0
0

270
-270

180
-360

There is one other significant item to note about lines of longitude before we move on to discuss latitude. Notice that lines of longitude converge toward the poles. They become closer together and actually intersect at either pole. A degree of longitude is not the same width everywhere. In fact it is continuously diminishing from the equator to the poles where it becomes zero.

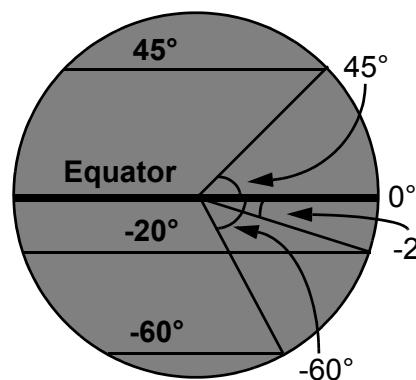
This fact has given cartographers, people who make maps, fits for hundreds of years. There is no way to accurately represent a sphere on a flat piece of paper. Various projection systems have been devised to accomplish the task but inevitably, no matter what projection system is used, distortions occur. Most maps are precisely accurate only in a very small area for this reason.

Likewise it is problematic to convert VNS' longitude/latitude coordinates to those of other 3-D modeling programs. Such conversions are only valid when working in a limited area of the globe.

Latitude

In some ways, latitude is simpler to understand than longitude. Instead of 360 degrees, the Earth is divided into 180 degrees of latitude. There are 90 degrees between the equator and each pole. North is considered positive and south negative probably because most early cartographers lived in the northern hemisphere.

Once again envision the Earth in cross-section but this time cut from pole to pole along a plane of longitude. The equator will be represented by a horizontal line through the middle of the exposed surface created. Now divide the circumference in 90 equal steps from each pole to the equator. A line drawn through each step parallel to the equator will represent a line of latitude.



As before, in reality we are only seeing one dimension of a two-dimensional plane that runs parallel to the equatorial plane. Notice that the lines of latitude become vertically closer together as they approach the poles even though the distance along the circumference of the planet is the same between each plane. Lines of latitude are the lines formed by the intersection of latitude planes with the surface of the Earth. If you were to view the same drawing from the north pole instead of in cross-section you would see the latitude lines as concentric circles.

Because latitude lines are parallel to the equator they are called parallels of latitude. The distance between two latitude degree lines along the circumference of the Earth is always the same anywhere on the planet: approximately 69 miles or 111 kilometers.

The same sub-division rules apply for latitude as for longitude. Again we use decimal degrees of latitude in VNS instead of the minute/second system for ease of computation.

To illustrate, this manual is being written at a latitude position of 27.3576 degrees South.

VNS uses the latitude/longitude system for setting camera, focus and sun positions. To set up a scene that shows the view I enjoy from my back deck, place your camera at S27.3575 latitude and E152.9497 longitude. The altitude is about 54 meters above sea level. The mountains to the west run north-south and begin at around E152.87 degrees longitude so set that as your focus longitude with the same latitude and altitude as the camera.

In VNS, the coordinates of the sun represent the point on the Earth at which it is directly overhead. That of course varies with the time of day and season of the year.

Ellipsoids and Geoids

For many hundreds of years, man has wondered about the Earth on which we live: its size, its shape, and from what it is made.

Once the majority if scientific thinkers had adopted a spherical model of the earth (Anaxinemes, an early Greek philosopher, strongly believed that the earth was rectangular in shape), efforts were made by a number of individuals to determine the exact circumference of the earth, at the very least as an aid to mapping.

A number of measurements were made and by calculation, a number of results were obtained. Plato, for example, came up with the figure of 40,000 miles for the circumference, whilst Archimedes suggested 30,000 miles. Both were "educated guesses", and it was not until Eratosthenes, a Greek scholar and philosopher in Egypt, that geometrical calculations were applied to accurate measurements, resulting in a value of 25,000 miles. This value was remarkably accurate considering that the currently accepted (World Geodetic System) value for the circumference of the Earth is 24,901 miles!

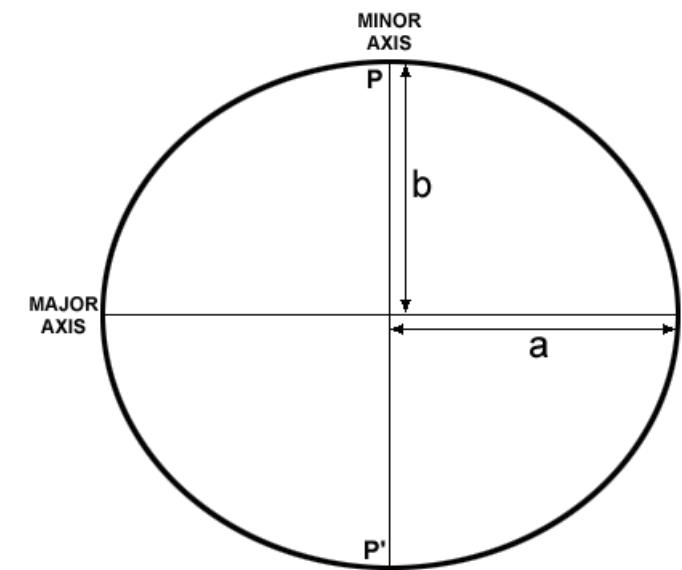
We now know that the Earth is not a sphere, but a Ellipsoid: bulging slightly at the equator and flattened at the poles. Because of this, the geometrical figure used to approximate the shape of the Earth is an Ellipsoid of revolution. An Ellipsoid of revolution is the form that would be created if you rotate an ellipse around its shorter axis:

An Ellipsoid is uniquely defined by specifying two dimensions, or variables: The radius at the equator is referred to as the Semi-Major Axis (or designated by the letter a), the amount of flattening is defined by a variable f , which is a measure of how closely the Ellipsoid matches a perfect sphere. VNS actually has you specify (according to GIS industry convention) the inverse flattening value, which is $1/f$. That flattening value is directly proportional to the semi-minor axis. A semi-minor axis that is equal to the semi-major axis makes for a perfect (non-flattened) sphere, and thus a flattening value of 0.

VNS allows you to also define the Semi-Minor axis of the Ellipsoid (that which runs perpendicular to the equatorial or Semi-Major axis) used for each of your project coordinate systems. If you specify either semi-minor dimension or inverse flattening, VNS will automatically calculate the other corresponding value for you. So, an Ellipsoid is a regular surface defined by mathematical computations. A Geoid on the other hand is more abstract, but no less important. A number of different Ellipsoids are used to map data, and you must be aware of which one is being used for the data you are trying to visualize.

The Geoid coincides with that surface to which the oceans would conform over the entire Earth if free to adjust to the combined effect of the Earth's gravitational pull and centrifugal forces generated by its rotation. As a result of an uneven distribution of the Earth's mass, the Geoidal surface is irregular and since the Ellipsoid is a regular surface, the two will not coincide. The distance between the two is referred to as the geoid height and does not exceed 100m anywhere on the Earth's surface.

ELEMENTS OF AN ELLIPSE



a = One Half of the Major Axis = Semi-Major Axis

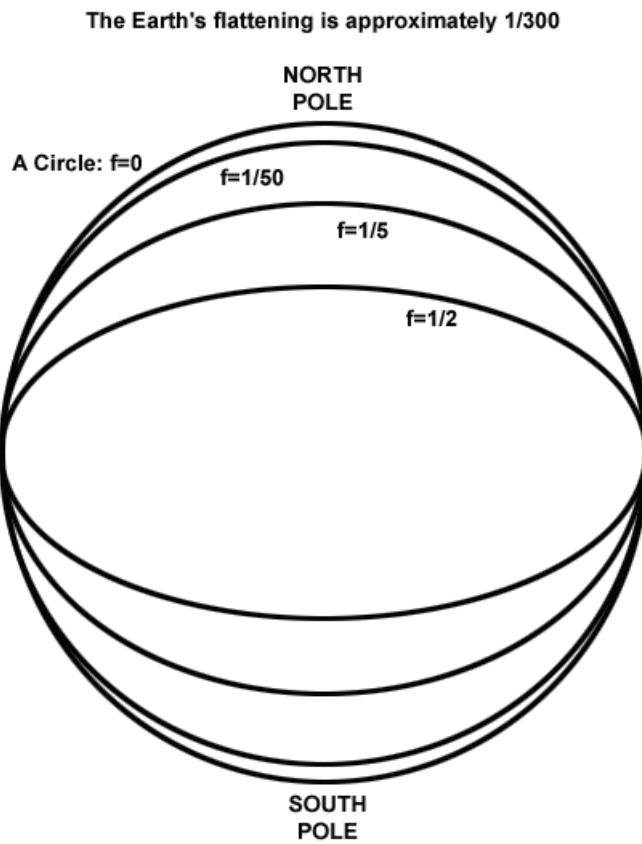
b = One Half of the Minor Axis = Semi-Minor Axis

f = Flattening = $(a-b)/a$

PP' = Axis Of Revolution of the Earth's Ellipsoid

P = North Pole of resultant Ellipsoid

P' = South Pole of resultant Ellipsoid



The Geoid is also the surface along which gravitational potential is everywhere equal, and to which the direction of gravitational pull is always perpendicular. This is particularly relevant since optical instruments containing leveling devices are often used to make geodetic measurements. When properly adjusted, the vertical axis of the instrument should align with the direction of gravity, and therefore perpendicular to the Geoid. The angle between this line (sometimes referred to as "the vertical") and the perpendicular to the Ellipsoid (sometimes referred to as "the normal") is defined as the "deflection of the vertical".

An Ellipsoid is therefore a simplistic approximation of a Geoid. This is because it is very difficult to accurately measure the gravity field (which dictates the theoretical sea level) of the planet everywhere, and even more difficult to perform 3D visualization calculations using such a complex model.

The center of an Ellipsoid may be shifted about in the X, Y and Z directions to make it better line up with the Geoid surface in a particular part of the world. This shifting usually makes the alignment correspondingly worse in other parts of the world. An Ellipsoid, combined with some X, Y and Z shifts (delta values) comprise a Datum. A Datum is therefore usually only useful for accurate measurements in the region of the world where it was intended to be used. Typically, a datum has one 'sweet spot', where the Ellipsoid and Geoid surface more or less align perfectly. This location is known as the fundamental point, and is usually documented by the creator of the Datum definition.

There have been numerous attempts at designing the 'best' Ellipsoid, and even more definitions of Datums. VNS currently knows about nearly 50 Ellipsoid definitions and well over 350 Datums. Because each Ellipsoid is an approximation of the Geoid, and each datum is optimized for a particular location, there is no "right" Ellipsoid or datum. However, whether you know it or not, each piece of geospatial data (terrain, image, point measurement or linear feature) was measured in the real world against a Datum, with its associated Ellipsoid.

Ramifications for VNS Users

In order to accurately align pieces of data from multiple sources, VNS must know the Datum/Ellipsoid each was measured against. VNS can then automatically translate them all into a common frame of reference ensuring proper alignment. Internally, VNS actually translates all other Datum/Ellipsoid combinations into the World Geodetic System 1984 Datum/Ellipsoid (currently believed to be the most accurate wide-area Datum) before translating them again into the user-specified rendering Ellipsoid. The rendering Ellipsoid is defined in the Default Coordinate System, found in the Planet Options.

In short, though it may help, you need not actually understand all of this. All you really need to know is what Datum (and Projection!) your data uses and its units of measurement, and provide this information to VNS. It will take care of the rest.

Animation Considerations

When setting up a single still scene in VNS you may use either the plus and minus 180 degree longitude notation or the full 360 degree notation. The results will be the same view.

However when animating it makes a difference which system you use. If you wish to move the camera from one side of the planet to the other, VNS must determine which way to go around the Earth. You should use a continuously increasing or continuously decreasing sequence of longitude values to move the sun, Camera or Celestial Objects in a continuos rotation around the planet. If you are displaying longitude with directional notation (like W105.0°) you should increase or decrease the degree value but leave the W symbol.

You may go around the Earth as many times as you like in either direction. Just keep adding or subtracting 360 degrees for each full rotation. This same injunction applies for the focus position and the sun.

Planimetric View Considerations

Always bear in mind, when using the Planimetric Camera for a View, that distances and sizes of objects may be deceiving. This is especially true when the map covers a large portion of the world.

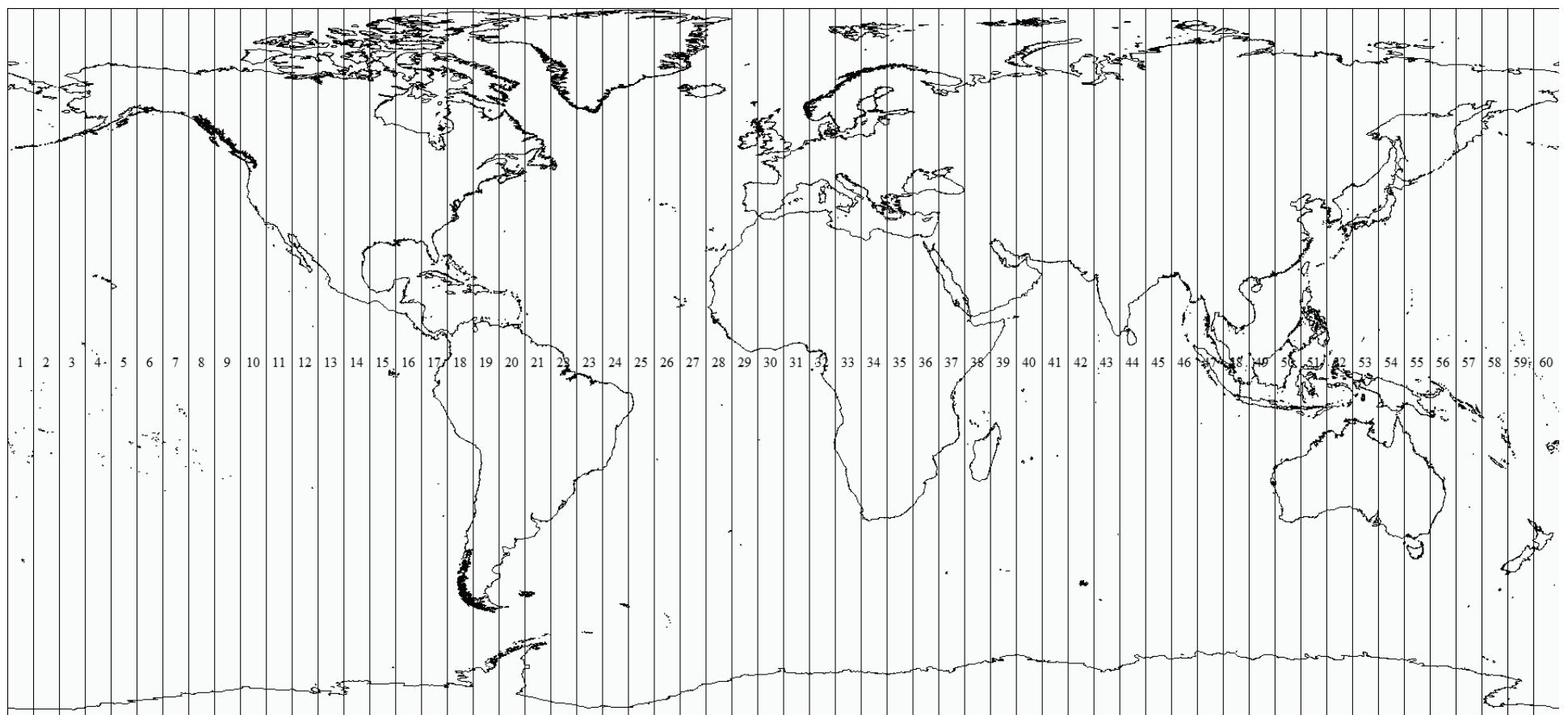
Remember that the map scale is accurate only over a very small area. VNS computes the appropriate scale at the equator. Elsewhere the horizontal (east-west) axis is stretched. Greenland and Antarctica will appear too large.

Appendix B: Chart of UTM Zones

UTM stands for “Universal Transverse Mercator” and is an industry-standard projection system for terrain data. VNS supports some forms of data in UTM coordinates, but in order for the data to be correctly interpreted, it is important that you know in which UTM zone it is located, as you will have to provide this information to the Import Wizard.

If you are unsure, you can use the image below to locate in which zone the data falls.

Note: VNS supports Terrain, raster and vector data in UTM coordinates.



Appendix C: Obtaining Geospatial Data

VNS uses landscape data files as the basis for pictures and animations. VNS can read a wide variety of DEM and vector data formats. The program includes some areas of fairly high-resolution data derived from a USGS data set. The entire Earth is also provided at a low resolution suitable for viewing the entire planet.

For your convenience, we have listed many free and commercial sources for additional data on our web site:

<http://3DNature.com>

By the way, if you locate any sources of data that may be useful to other VNS users we would appreciate hearing about them. These things change constantly and our current information may not be the most complete or up-to-date. With your help we can do a better job of serving all of our esteemed users (yourself included) in the future.

3D Nature would be happy to refer you to providers of VNS contract services and technical consultation (beyond the operation of VNS).

Web Page: *<http://3DNature.com>*
Email: *VNSinfo@3DNature.com*
Phone (303) 659-4028
Fax: (303) 904-9533

Appendix D: Supported Units

These are the tables of units and suffixes recognized by VNS 3. These can sometimes be found appended to a numeric quantity in a smart unit-converting numeric field. These can also be added by the user to perform numeric entry in a unit other than the default display unit. Some are not that useful, and have awkward or non intuitive suffixes.

Not all of these can be selected as a default display unit (horizontal or vertical) in Prefs. Prefs will only display those units listed between Millimeter and US Survey Feet.

Note: When using these units in any text entry box or numerical field, the value entered should be suffixed by the short form in quotes, rather than the full name. VNS will only accept the short form listed in the left-hand column of the following tables.

SI Units		Imperial or "English" units		More exotic units	
xu	X Unit	in	Inch	fur	Furlong
A	Angstrom	ft	Feet	ch_g	Chain Gunter
mu	Millimicron	yd	Yard	ch_r	Chain Ramden
u	Micron	rd	Rod	li_g	Link Gunter
mm	Millimeter	mi	US Statute Mile	li_r	Link Ramden
cm	Centimeter	ft_uss	US Survey Feet (not Common Feet)	fath	Fathom
dm	Decimeter			naut_b	British Nautical Mile
m	Meter			naut	International Nautical Mile
Km	Kilometer			lg_b	British Nautical League
Mm	Megameter			lg	League
				mil_	Mil
				rop	Rope
				cb	Cubit
				AU	Astronomical Unit
				ly	Light Year
				pc	Parsec

Appendix E: Advanced Configuration Options

Visual Nature Studio supports the use of a number of advanced configuration options. Should you choose or require to use any of them, they are entered into the Config screen of the Preferences Editor:

To enter a new config option, type its name into the “option Name” box, and its value into the “Option Value” box, then click the “Set” button.

To modify an existing option, click on its entry in the list, modify the text in the “option Value” box and click the “Set” button.

To remove an existing option, click on its entry in the list and click the “Unset” button.

In order for changes to any Config options to take effect, it will be necessary to have a project loaded, exit and restart VNS.

Options are of three types:

Boolean

The value for options of this type is either Yes/No, or 1/0. In most cases, the absence of the option in the Advanced Config list is equivalent to a value of No/0, so it is likely that you will only ever have to set this value to a positive (Yes/1)

- **avoid_GLreadpixels**

This option is an old OpenGL troubleshooting switch retained from when WCS 5 was first released. At the time, some GL-compliant graphics cards caused unexpected display errors with WCS whenever a GLReadPixels call was made in the code. This switch was added to help solve these problems. It is highly unlikely you will ever have to activate this switch.

- **suppress_rendernotify**

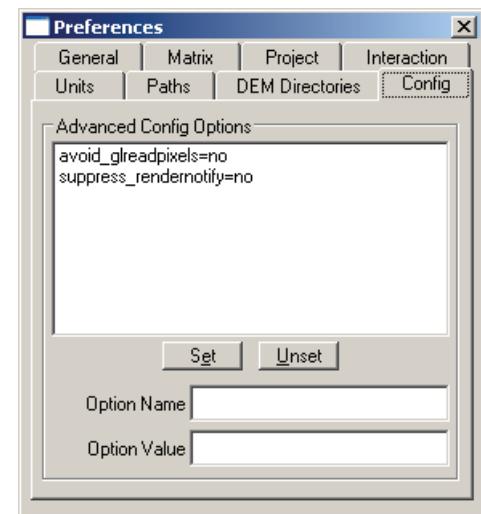
This option suppresses the small rendertime window that appears after each render (preview or full). If you are performing a lot of test renders, it can become irritating to have to close the rendertime window after each preview. Enabling this config option will prevent the program from reporting rendertime to you after a render.

- **view_title_show_ro_name**

By default, VNS displays the name of the view’s camera in the titlebar of a view window. If you also wish to display the name of the render option set in use, enable this advanced option.

- **inhibit_forestry**

Inhibits the Forestry Edition, even if your hardware key is authorized for it.



- **wintitle_decoration_small**

This forces the "small" window titlebars, such as VNS normally shows on displays of 1024x768 resolution. Accepts values indicating true or false. Any other values that aren't recognized as true or false revert to "auto" behaviour, where a screen height of 768 pixels determines the operation.

- **list_DEMs**

Reports the name and frame number of each DEM rendered as it renders. Designed to help in debugging render errors, as it can identify a corrupt DEM that may be causing crashing.

- **GE_Absolute**

Changes the altitude type of Scene Express generated KML files from relativetoground to absolute, which forces Google Earth to place Objects and foliage at specified elevations, rather than its default, which is to place them at a specified elevation relative to the underlying terrain. This option is not recommended for general use.

Presence

The value for options of this type is irrelevant. Simply adding the value to the config list will activate the effects of the option - there is no need to enter any associated option value.

- **suppress_diagnosticwin**

This option suppresses the diagnostic data window that appears after each render (preview or full). The diagnostic windows can always be called up by hitting F4, regardless of the setting of this config option.

- **suppress_retain_diagdata**

This option suppresses the requester that asks the user if they would like to retain diagnostic data when cancelling a preview render.

- **suppress_plan_ambient**

All planimetric camera views automatically get a little extra ambient light so that even the 'dark side' of a planet will still be visible. Unfortunately, this tends to reduce the contrast of the lit areas. Enabling this option will disable the addition of this ambient light i.e. the dark side of the planet will be completely dark in Planimetric views.

- **suppress_startupwin**

This option suppresses the startup window containing Tip, Tutorials, User Control and so forth.

- **UseLocale**

Forces the Post Process Text Overlay to use the locale that is specified by the ANSI code page obtained from the operating

system. In other words, if you are using Date and/or Time variables in a Text Overlay Post process event, they will honor the locale-specific formats set in Control Panel > Regional Settings.

- **zcomp_elevs**

Indicates that the ELEV file data will be compressed with the ZLIB (zip) algorithm to reduce file size. Useful in reducing the disk space occupied by large numbers of DEM files in very large projects.

- **strip_relel**

Strips relel data from ELEV files during saving. VNS will automatically regenerate and re-add the relel data the next time the ELEV file is loaded. Can be useful in reducing the disk space occupied by large numbers of DEM files in very large projects.

- **GenPRC**

Used when saving to Raw image format. Enables writing of a .prc file which contains the lat/lon/elev of the Project Reference Coordinates, relative to which the Lat/Lon Raw channels are recorded.

Value

The value for these options will either be a numeric or string value applicable to the option in question. The specifics will be listed in the description of these options.

- **glbench_testframes**

By default the built in OpenGL benchmarking routine performs 10 tests of OpenGL speed and averages the results. This advanced config option can be used to change the default number of iterations from 10 to another number, The Value for this option is a positive integer (any whole number greater than 0 is acceptable).

- **log_file**

The existence of this option will write the contents of the VNS status log (usually accessed when necessary through the VNS interface) to an external ASCII text file. The Value is a string value of the path and filename for the log file,

e.g. C:\Documents\VNLog.txt.

- **GE_ElevMod**

This value is a global elevation modifier for all 3D Objects and Foliage in Google Earth files generated by Scene Express. This modifier will be applied to the elevation of 3D object and Foliage entities in the exported KML file when using the default (relative to ground) elevation method ie: when GE_Absolute (see above) is not set.

- **netscript_permit_addr**

By specifying an IP address in this field, you restrict remote control of VNS to the machine with the listed IP address. This may be

used to specify the IP address or Hostname of a Render Controller machine running the SuperConductor executable, although due to the nature of hostname resolution, an IP address is more strongly recommended. The Value for this option is an IP address (e.g. 192.168.111.10). Network rendering is disabled unless this value is set.

- **netscript_port_num**

This entry allows you to specify the port address over which a Render Controller machine running the SuperConductor executable will communicate with the render node machine. The Value for this option is any valid (unused) TCP port address (anything from 1 to 65536). Port number 4242 is the default port used by SuperConductor.

Appendix F: Command Line Options

The following command line keywords supported by are all case insensitive and can occur in any order. Many are booleans, where the mere presence of the keyword enables it.

Several require arguments to follow in the form of keyword=<blah>. If the argument text has spaces or other 'suspicious' punctuation, it's best to put it in quotes as in keyword="blah blah blah" or even keyword="C:\blah\blah\blah". Quotes can be made part of the keyword argument data by escaping them with a backslash: keyword="I like \"quote\" characters."

The order in which they are listed is the order in which they are checked and handled. This means, that you can specify PROJECT=blah.proj and RENDER in a batch file, for example, and it'll make sure the project is loaded before it tries rendering, no matter what order you list the args on the command line.

- **ENGINEONLY**

Suppresses the "Hardware Key Not Found" warning requester on startup in the event that you intend to run the executable as a remote render engine and do not wish to visit the computer to click on "OK".

- **SUPPRESSRENDERNOTIFY**

Similar to the "suppress_rendernotify" advanced config option, this suppresses the Render Time Notification dialog for this program run only. This setting does not 'stick' - it is not saved anywhere like the Advanced Config option is.

- **LOGFILE**

Similar to advanced config option, like SUPPRESSRENDERNOTIFY, above. This setting does not 'stick' - it is not saved anywhere like the Advanced Config option is.

Example: Logfile="C:\VNSlog.txt"

- **NOVIEWS**

Prevents any OpenGL realtime Views from opening during project load. Useful if a project is partially corrupt or configured in some way that opening the views might crash the program.

- **WCSPROJECTS**
- **WCSCONTENT**
- **WCSFRAMES**

These set the various Master Paths from the command-line. Changes made to these settings will be saved when the program exits.

eg: VNS.exe WCSProjects="c:\Projects" WCSContent="c:\WCS\Content Files" WCSFrames="c:\Framestore"

- **PROJECT**

Specifies a project that should be loaded automatically once the program starts.

This is a default argument. If text is found after the VNS.exe on the command-line, and it cannot be identified as one of the recognized keywords, it is assumed to be a project name:

eg: VNS.exe WCSProjects:RMNP.proj

- **AUTOQUIT**

Exits the software when rendering is complete. Only useful with RENDER (below)

- **RENDER**

Instructs VNS to begin rendering immediately upon startup. Handy for running batch render regression testing scripts and other stuff.

- **PREFSFILE**

Instructs VNS to use a particular prefs file when it initializes. This is most useful in renderfarms containing multiprocessor machines. See the Frequently Asked Questions section of Appendix H: SuperConductor, for more information on how this might be relevant.

eg: VNS.exe PREFSFILE="MyRenderEngine.prefs"

- **SOFTLICENSE**

Instructs VNS to start in network-shared dongle mode. This is used for the network floating licenses that are purchased by some educational establishments.

Appendix G: HTML Tutorial format

It is our hope that the information in the following Appendix will provide users with a methodology by which they can create their own tutorial files and have them appear in the new, standardized tutorials interface.

Inside the WCS/Help folder, there is a Tutorials folder. Inside the Tutorials folder, there are subfolders for each installed tutorial. This allows add-on tutorials to be packaged in a self-extracting zipfile that installs by creating its own subfolder and extracting all of its files to that subfolder. This ensures no filename collisions between multiple tutorials.

It is acceptable for tutorial sets to create a uniquely-named common files folder in the Tutorials directory to store data (clip art, buttons, etc) that are common to all tutorials in a set. As long as this 'common files' directory does not have the requisite identifying marks (described later) it will not be identified as a Tutorial and will not be displayed in the Tutorials listing.

When VNS 3 was installed, a "Common" folder of nearly 200 images was installed automatically. This folder contains web-ready versions of every button or icon in the product. This means, when you come to create your own tutorials, the contents of this folder can be used to ensure consistency and to reduce the amount of time spent creating web-optimized raster files for inclusion in your html.

In order to identify directories as containing tutorials, the application will check for an index.html file. If it is present, it will examine the HTML headers of the file looking for the TITLE and certain META tags, and grabbing the contents of the ones it is interested in.

Metadata include:

- **TITLE**

Appears in the "Title" column of the Tutorial interface

- **PRODUCT**

The product to which the tutorial most applies (WCS or VNS)

- **ABSTRACT_SHORT**

Brief abstract (less than one line, displayed in multi-line listings)

- **ABSTRACT_LONG**

Longer abstract (paragraph length, displayed when a tutorial is selected for closer examination)

- **THUMB**

Name of thumbnail file (small image in some application-supported format that can be used to give users a quick glimpse at the cool results they will derive from the tutorial).

- **LEVEL**

Some numeric classification (0-10) of difficulty.

- **PRIORITY**

This field controls the order in which tutorials appear by default in the abstract and icon sections of the Tutorials page of the startup window. The tutorial with the highest number in this field will automatically show in the lister. It will not be selected, and this field has no effect on the order in which items appear in the list. However, it will allow the user to immediately load that tutorial by clicking on the (already displayed) thumbnail.

- **KEYWORDS**

Used in the future for searching. Search engine not yet implemented.

- **SET**

For different tutorials that come in a set, this could be used to identify their commonality, as they would all say "Cloud Basics" for example.

We have provided blank templates on your VNS 3 DVD. They will be installed to a folder called "Templates" inside the Help\Tutorials folder. The files are called "TemplateIndex.html", "TemplateNav.html" and "TemplateBody.html". By entering your own content and renaming these files appropriately, and using them in conjunction with the common image files, new tutorial material can be created quickly and easily.

Appendix H: SuperConductor

SuperConductor is 3DNature's open source render controller. It uses industry standard communication channels (IP sockets) to pass render data to a number of machines in a networked environment. Each client machine (or node) that is running the VNS render engine will be able to receive communicate via SuperConductor without user intervention. This should provide you with the facility to manage multiple render jobs across multiple machines from one central location.

On your VNS program DVD, you will find a folder containing SuperConductor files, and the SuperConductor tutorial. We suggest that you carefully follow the supplied tutorial, which will give you a clear overview of how to configure both SuperConductor to manage the render jobs, and VNS so that it can "see" the SuperConductor process from across a network.

Some Frequently Asked Questions about SuperConductor:

- **"Do I have to license SuperConductor?"**

No. The product is Open Source and freely distributable.

- **"Is there a limit to the number of client machines supported?"**

No - your purchase of VNS allows you to install the product on as many machines as you choose. Machines without a dongle (or hardware key) will only operate as render engines, but even so, are accessible from SuperConductor as long as the necessary setup has been performed.

- **"If SuperConductor is using IP addresses to find the render nodes, can it take full advantage of multi-processor machines, or am I going to have to operate VNS on those machines manually?"**

You will not have to manually operate any render nodes if you configure them and SuperConductor properly. SuperConductor uses IP (Internet Protocol) to communicate, but it does so using IP sockets. An IP socket is a combination of an IP address and a port number. So, for example, if you had a dual processor machine whose IP address was 192.168.1.100, you could still get SuperConductor to manage 2 instances of VNS on that machine, as long as they were installed to separate folders (ie: had separate prefs files) and as long as you specify different port numbers for each in the advanced configuration interface. That way, as far as SuperConductor is concerned, there are two client nodes available with different sockets. The alternative would be to initialize two copies of VNS from the same folder, but with different prefs files, by using the command line PREFSFILE argument. For more information, Appendix F: Command Line Options (see page 1067).

- **"Can I use SuperConductor to manage any other rendering software I use, such as 3D Studio Max or Lightwave?"**

Not as yet. See <http://www.super-conductor.org> for more information on how you can access the source code and modify SuperConductor to suit your own, in-house purposes. There is also a list of features we would very much like to see in the product, and are always interested to hear from anyone who would like to help develop SuperConductor further.

Appendix I: Keyboard Shortcuts

A large number of the features of Visual Nature Studio can be invoked by pressing a key on the keyboard rather than selecting a menu item.

Command	Keystroke	Command	Keystroke	Command	Keystroke
New Project	Ctrl N	View Database	Alt D	Matrix Layout: Two & Three	Alt Shift 6
Open Project	Ctrl O	View Image Object Library	Alt J	Matrix Layout: TWO & Three	Alt Shift 7
Save Project	Ctrl S	View Component Library	Alt L	Matrix Layout: One & Three	Alt Shift 8
Save Project As	Alt S	View Component Gallery	Alt M	Matrix Layout: Column Split	Alt Shift 9
Import Wizard	Ctrl I	View Status Log	Alt G	Terrain Task Mode	Ctrl 1
Import Scene	Ctrl Shift I	View Last Rendered Image	Alt [Land Cover Task Mode	Ctrl 2
Export Scene	Ctrl Shift X	View Image From Disk	Alt]	Water Task Mode	Ctrl 3
Scene Express	Ctrl Shift E	Terrain Generator	Alt F	Sky Task Mode	Ctrl 4
Open Resume File	Alt 0	DEM Interpolator	Alt P	Light Task Mode	Ctrl 5
Open Recent Projects 1-6	Alt 1 to Alt 6	Path-Vector Transfer	Alt H	3D Object Task Mode	Ctrl 6
Prefs: General	Ctrl P	Numeric Entry	Alt .	Vector Task Mode	Ctrl 7
Prefs: Matrix Layout	Ctrl -	Matrix Layout: Single	Alt Shift 0	Render Task Mode	Ctrl 8
Prefs: Units	Ctrl =	Matrix Layout: Double Tall	Alt Shift 1	Render Control	Alt R
Prefs: File Paths	Ctrl E	Matrix Layout: Double Wide	Alt Shift 2	Copy Component	Ctrl C
Prefs: DEM Directory List	Ctrl D	Matrix Layout: Triple Top	Alt Shift 3	Paste Component	Ctrl V
Select User	Alt U	Matrix Layout: Triple Left	Alt Shift 4	Goto Frame Number	Ctrl G
Quit	Ctrl Q	Matrix Layout: Quad	Alt Shift 5	Close Active Window	Ctrl W

The following controls are only available if there is an open and active viewport in one of your matrix cells:

Command	Keystroke	Command	Keystroke	Command	Keystroke
Manipulate View's Camera	Spacebar	Make Key	Enter	View Preferences	?
Move Mode	1 or M	Open Diagnostics	F4	Realtime Foliage File Preferences	/
Rotate Mode	2 or R	Set Render Area	F5	Zoom In	+
Scale/Zoom Mode	3 or S	Constrain Render	F6	Zoom Out	-
X Axis Lock	4 or X	Save Displayed Image	F7	Joystick: Drive Mode	j
Y Axis Lock	5 or Y	Clear Preview Render	F8	Joystick: Multiaxis/Slide Mode	J
Z Axis Lock	6 or Z	Render Preview	F9	OpenGL Benchmark	&
Abort Render	Esc	View Refresh	v	Display OpenGL Version Info in Status Log	g

The following control is available if there is an open and active view or editor in the interface:

Command	Keystroke
Interactive Reference Manual	F1

Appendix J: Integrating VNS with External 3D Programs

Visual Nature Studio gives you amazing terrain and 3D object visualization and animation power without the need for external programs. But when you need specific features of a dedicated 3D modeling and animation package, you can combine the advanced terrain rendering of VNS with 3D programs in several flexible ways.

3D Object Importing and Rendering

VNS can load and render 3D Objects in WCS/VNS, LightWave 5.x, Lightwave 6.x, Lightwave 7.x, 3D Studio, Alias Wavefront OBJ and DXF 3D Object file formats (see 3D Object Editor). This is great for static objects or simple animated objects including buildings, dams, vehicles, highway dividers, utility poles, 3D foliage and much more.

Image Sequences and Compositing

You can integrate VNS images and animations with complex animated 3D Objects such as moving characters, animals and machinery through the use of an external 3D program.

Just about any 3D animation program can use image sequences in the background. By using a sequence of VNS images in the background of a 3D program you can render 3D Objects over your VNS scenes. For example, it's easy to fly a spaceship down a canyon or in front of a mountain.

VNS supports RLA output for 3D compositing in popular compositing programs (see Render Options Editor). This lets you combine the output of VNS with the output of a wide variety of 3D animation programs. This compositing can even be performed within VNS using the Composite Post Process Element (see Post Process Editor).

VNS also gives you the ability to use image sequences from other programs anywhere within your scene, as animated Image Objects. You can use Image Objects as backgrounds; foliage in Foliage Effects and Ecotypes; Celestial Objects in the sky; and within textures on the terrain or 3D Objects. You can use Image Objects to place animated waterfalls, characters, foliage, signs and much more directly into your VNS scenes.

Scene Import and Export

But what if you want to fly behind the mountain? Or what if you want objects on the ground that stay put on the terrain? To do either of these you need a way to match the camera paths of both programs exactly. VNS does this by importing and exporting the camera path in the format of popular 3D programs. VNS can also export the terrain as a reference object, and import or export an entire scene file complete with lighting, frame numbers, and more.

Note: VNS currently directly supports LightWave 3D 5, 6 & 7 and Inspire 3D from NewTek, Inc. and 3D Studio MAX from Discreet, in as much as your VNS scenes can be exported to these programs by using the Scene Export Window and data from such programs can be brought into VNS by using the Scene Import Window. Other programs may be supported in the future, but be aware that depth aware output files (i.e. RLA or RPF) from ANY 3D program can be used in the Post Process compositor. Due to the possible scale and offset issues, 3D Nature can not guarantee that this will work as expected in all cases.

These processes allow you to combine the top notch terrain quality rendered by VNS with the equally excellent 3D object modeling and animation from popular 3D programs.

If your project requires that your motion path be created or modified in the external 3D program VNS allows you to bring the path back into VNS using the Scene Import Window. The following sections describe how to use VNS with an external 3D program.

Note: For motion paths the limits for Tension, Continuity and Bias values are -5 to +5 in VNS (see Timeline Editor). However you should avoid values above 1 or below -1 if you are exporting motion paths to external 3D programs which may not be able to recognize wider values. There is an exception: If you are exporting every frame as a keyframe (with the Scene Export window's Key Frame Interval field set to 1) then you can use the full range of Tension, Continuity and Bias values that VNS supports. Similarly, if a Camera's Center X and Center Y parameters are not set to 50%, misregistration of your data will occur when the scene is exported to your external 3D program.

Post Process Compositing Event

By using a Post Process component containing a Composite Event, in combination with an image sequence that either has depth data embedded within it (such as RLA or RPF) or that has a corresponding sequence of VNS Z-Buffer files, compositing can now be performed entirely within VNS. This is now the preferred method of compositing.

The other major advantage of this method, is that unlike the plugin-based solution, the Post Process Compositor allows "Deep Compositing" i.e. Compositing with reflections. This means that as your Max-rendered 'plane flies across your VNS-rendered lake, it can now reflect in the water's surface!

This should add a new level of realism to output from an external 3D product integrated with VNS.

Compositing Using The Post Process Composite Event Type

The process required to use this method is identical regardless of the external 3D program that you choose to use. This is one of the reasons why this is now the preferred compositing method in VNS. The following description of steps therefore gives only an overview of the process involved. Any specific warnings related to scene setup and export remain as valid for this process as for the plugin-based compositing process.

This is now the recommended way of performing compositing with scenes rendered in VNS and we recommend you take the time to understand how it operates, and how to set it up. We think you will agree that once mastered, it is a lot faster and simpler to setup than before, and produces more impressive results. It also allows compositing to be performed with a wider range of 3D programs, such as 3D Studio VIZ, which does not itself have the ability to run Z-Buffer compositing plugins.

Note: For this form of compositing to work, Pixel Fragments must be enabled on the Misc page of the Render Options Editor.

Deep Compositing

"Deep Compositing", possible with RPF files made with "Render Occluded" turned on, can have more than one pixel stored at each XY position in the image. In this way, Max objects that are located behind other Max objects will still have their pixels stored in the RPF, and these otherwise non-visible entities can appear in reflections. (Think undersides of animals standing on far shore of lake -- invisible from viewer's perspective, but visible from reflections off of lake surface.)

As yet, we have no way of extracting deep pixel data from LW to do this, but you'll still get great compositing and reflections.

After Reflections

We do not recommend running a Composite operator without the "Before Reflections" setting turned on. In this state it will attempt to composite against the flattened 2D image VNS produces.

The Compositing Process itself

- 1) Create your scene in VNS.**
- 2) Open the Scene Export Window using the Export Scene command in the Project menu.**
- 3) Set up the Scene Export window.**
- 4) Load the exported scene into your chosen external 3D application.**
- 5) Animate those elements that you wish to composite using the tools provided in your chosen external 3D application.**

You can use the VNS-exported data to more accurately reference the components to be composited and ensure that correct depth information will be generated at rendertime.

- 6) Disable all unnecessary geometry in your external 3D program and render your output image sequence.**

The product-specific issues are as follows:

3DSMax: this should be a sequence of RLA or RPF files with the following channels enabled:

- **RGB (implied)**
- **Z**
- **Alpha**
- **Weight**
- **Mask**

Enabling “Render Occluded” for your objects will allow accurate Deep Compositing to be performed at the expense of increased rendertime.

Lightwave: Use the “Extended RLA” Image Filter Plugin (supplied with Lightwave) to generate a numbered RLA sequence, in which case the Depth Channel should be selected for output. Alternatively, use the ZBUF.p (Lightwave version 5.x or earlier) or 3DN_ZBuf.p (Lightwave version 6.x or later) plugins to generate VNS-compliant Z-Buffer files (along with corresponding images saved in a standard image format) when the scene renders.

- 7) In VNS, load the rendered image sequence(s) into the Image Object Library**

Remember to setup your sequence settings correctly (see Image Object Library).

8) In your Render Options for your final VNS render, create and add a Post Process Component.

This Component should have one Event, of type "Composite".

When you select Composite as the type, it will warn you that the best results are obtained when "Before Reflections" is turned on. Click Yes to let it turn on Before Reflections.

9) On the "Detail 1" tab for the Composite Event, select the Image (Sequence) you set up in the Image Object Library.

If this is an RPF or RLA file, all the data necessary will be found in that file.

If this is any other type of 2D image file format (BMP, TGA, IFF, PNG, etc.) VNS will also look for a corresponding file in the same directory with a .zb suffix instead of the image's usual suffix, and try to load that as an IFF-ZBUF to get the necessary ZBUF data.

10) Click "Render" and wait for VNS to complete the render job.

The image data rendered in your external program should be seamlessly composited into your VNS-rendered terrain and foliage at rendertime.

If "Before Reflections" is enabled for the Composite Post Process event, then you will see composited elements in reflective surfaces.

Appendix K: Applications in GIS

- **GIS Overview**
- **Importing Vector Polygon Data**
- **Importing Terrain Data**
- **Working with Large Numbers of Vectors and Components Using Layers**
- **Creating Time Slices**

GIS Overview

The need for realistic visual simulation of geographically oriented data is growing. VNS has powerful features that let you display your geo-referenced data in ways that can enhance understanding of complex ecological relationships. VNS can show not only the natural world but also the impacts of human development and resource management. VNS can show what the landscape looks like today and with suitable models it can project both forward and backward into time.

With their tendency toward very large data sets, GIS (Geographic Information System) applications can become difficult to manage. In this section we will offer additional tips for managing large data sets and point out some of the tools particularly appropriate for GIS work. These VNS features work together: Attribute importing, Coordinate Systems, Thematic Maps, Search Queries, Dynamic Linking, Templates and the Multi-user mode.

Importing Vector Polygon Data

Polygons are vector objects which enclose regions of geographic space. They are commonly used in GIS work to delineate areas of specific vegetation. Polygons normally do not overlap but their edges coincide with adjacent polygons. Thus a complete set of polygons completely covers a map with every point in the map enclosed within one and only one polygon.

Polygon coverages generated in GIS software, image analysis software, or digitized from paper maps can be imported into VNS and used effectively to control vegetation by way of Ecosystems.

Coverages of this sort should be in either DXF or preferably ArcView Shape file format.

Shape files allow greater automation of the Ecosystem setup process by allowing any number of fields from the originating Shape Database file to be used to control coverages in VNS.

It starts with your GIS database. There you have a database with attributes attached to polygons in layers. VNS lets you visualize these attributes quickly using several types of automation. If you change the database in your GIS, you can quickly update VNS to stay synchronized with your data.

Import your Vector data with the Import Wizard, accessible from the File menu. The Import Wizard will ask which Vector attributes you want to include. Make sure you select the ones you want to use to control aspects of the scene within VNS.

Matching VNS Ecosystems and Ecotypes to your GIS Database

In this brief example we'll demonstrate the strategy of combining Templates, Thematic Maps, and Dynamic Linking with Search Queries.

Suppose you have imported some terrain in one projection, and a shape file in another projection complete with forestry attributes with a GIS database that looks like this:

Name or Label	Attribute/Value	Attribute/Value	Attribute/Value	Attribute/Value	Attribute/Value
Vec1	Eco Spr/Pine	Dom Ht 40.0	Sub Ht 25.0	Dom Dens 60.0	Sub Dens 30.0
Vec2	Eco Spr/Pine	Dom Ht 70.0	Sub Ht 50.0	Dom Dens 30.0	Sub Dens 10.0
Vec3	Eco Spr/Pine	Dom Ht 25.0	Sub Ht 15.0	Dom Dens 40.0	Sub Dens 20.0
Vec4	Eco Pine/Spr	Dom Ht 5.0	Sub Ht 0.0	Dom Dens 200.0	Sub Dens 0.0
Vec5	Eco Fir/Spr	Dom Ht 60.0	Sub Ht 35.0	Dom Dens 50.0	Sub Dens 30.0
Vec6	Eco Fir/Spr	Dom Ht 40.0	Sub Ht 25.0	Dom Dens 70.0	Sub Dens 20.0
Vec7	Eco Fir/Spr	Dom Ht 25.0	Sub Ht 20.0	Dom Dens 90.0	Sub Dens 10.0

In this database there are seven Vectors. Each has attributes for two ecosystems, a dominant ecosystem height, a dominant ecosystem density, a subdominant ecosystem height, and a subdominant ecosystem density.

There are three different ecosystems defined with the Eco attribute. In each ecosystem there are two species reported, a dominant and a sub-dominant one. Each has its average height in feet and density in stems per acre. In this simple example each system has only two species of concern.

Let's look at how easy it is to create VNS Ecosystems and Ecotypes that match this database.

1) Create an Ecosystem in VNS.

Before we create the second and third Ecosystems, we'll set up the first Ecosystem. Then you can create two more Ecosystems, copy and paste the settings from the first Ecosystem, and change the second two Ecosystems from there.

2) Give the Ecosystem an Overstory Ecotype and suitable Ground Overlay material.

3) To match the first Ecosystem in the database, Spr/Pine, create two Foliage Groups in the Overstory Ecotype.

Create one Foliage Group with some representative spruce images and the other with some representative pine images.

The order of the groups is important since the first one in the list will correspond with the dominant species and the second group with the sub-dominant species. Make sure the Spruce group is at the top of the list.

4) Configure the Ecotype Editor.

Because the Ecotype Editor is configurable, we need to establish where the height and density absolute values occur.

Since our database specifies heights and densities for each group separately, set the controls on the general page of the Ecotype Editor to "Absolute Height is in Foliage Group" and "Absolute Density is in Foliage Group."

Since our database specifies the average height of the group, select "Second Height is +/- %." That will make the heights average to the main height and the second height field will be a percentage variation greater or less.

Set the density to "Density is per Unit Area" and select Acre as the units.

On the Ecotype page now you find that the height and density fields are disabled. Go to the Groups page to see the values you will be working with. Here you find "Group Height," "Group Ht Range (+/-%)" and "Group Density (Stems/Area).

Since both group height and density will be controlled with Thematic Maps the only value to complete is the Range %. For this example lets say that the range is plus or minus 20%. Set this value for both of the groups.

If you are using foliage dissolve to minimize rendering time be sure to set reasonable values in the Group Height fields. This value will be used to determine when the ecotype begins to fade out in the distance.

Note: The largest of the group values will be used for the computation, any smaller values in other groups will have no effect.

5) Set up a Thematic map to control Foliage Group Height.

In the dominant Foliage Group's Group Height controls, select the "Create Thematic Map" command from the Thematic Map Operations icon.

VNS will create a new Thematic Map and open its editor. Change the name of the Thematic Map to "Dominant Height."

Go to the Data page and select the field "Dom Ht." in the Mapped Attributes drop box.

6) Attach a Search Query to the Thematic Map.

Go to the General page of the Thematic Map Editor. Select "New Search Query" from the Dynamic Link drop box in the Database Linkage section.

VNS will create a new Search Query and open the Search Query Editor.

The purpose of this query is to select which vectors the Thematic Map will get its height data from. This can be a very general query since we are going to use this same Thematic Map to control all the heights of all the dominant species groups for all the Ecosystems in this hypothetical project.

The most general expression for the query that will give us results is that the field "Eco" simply exists. Set up the query for that expression and test it using the "Select Items Now" button to see that it does indeed select all 7 vectors in the Database Editor. Change the name of the Search Query to "Eco Field Exists".

7) Match Height Values.

There is one more thing you must do before using this query to control tree heights. The database is reporting heights in feet and VNS needs them in meters.

On the Data page of the Thematic Map set the Channel 1 Data Multiplier to the number of meters per foot which is .328. Now the Thematic Map will report the values correctly to the Ecotype renderer. You are always responsible when using Thematic Maps to make sure the data gets delivered in the units the Renderer expects.

8) Set up a Thematic map to control Foliage Group Density.

Repeat the Thematic Map creation process for the dominant species' Group Density. Link your new Thematic Map to the same Search Query "Eco Field Exists" and select "Dom Dens" as the data attribute.

Name the new Thematic Map "Dominant Density". Since the density is already being reported in Stems per Acre, the same as the units you selected in the Ecotype editor, you don't need the Data Multiplier to be other than the default value of 1.

9) Set up Thematic Maps to control the subdominant Height and Density.

Now to save effort, create copies of the two thematic maps and name the height copy "Subdominant Height" and the other "Subdominant Density".

Edit them and select the attribute "Sub Ht" for the first and "Sub Dens" for the second.

All other values can remain the same. They use the same Search Query for dynamic linkage and the subdominant height multiplier is .328 just like the dominant height multiplier.

Back in the Ecotype editor, select the subdominant group in the list. That should be Pine for the first ecosystem.

Click the Thematic Map Operations icon next to the Group Height field and Choose Link Thematic Map command. In the list that appears select "Subdominant Height" and hit the "Add Items" button.

Do the same for the subdominant density linking to the appropriate Thematic Map.

Set up the individual images for each Foliage Group.

10) Create two more Ecosystems as we discussed in step 1.

11) Copy the first Ecosystem's settings to the second Ecosystem.

For the second Ecosystem we can copy the first Ecotype and paste it into the second Ecosystem and then reverse the order of the groups since in this Ecosystem, pine dominates. To copy Ecosystems you can drag and drop from the source to the destination Ecosystem in the Scene-At-A-Glance, or use the Scene-At-A-Glance popup menus commands for Copy and Paste.

12) Copy the second Ecosystem and paste it into the third Ecosystem.

Copy the second one and paste it into the third Ecosystem and replace the pine group with a fir group.

Note: If this were an actual Project, this would be a good time to save these groups as components so they are easy to load.

You can now copy the first Ecotype by using the copy command from the Overstory Ecotype icon's commands. The Overstory Ecotype icon is on the Ecosystem Editor's Material and Foliage page.

Change the Ecosystem Editor to edit the second Ecosystem and select Paste from the Overstory Ecotype icon's commands. Then select Edit Ecotype from the same menu.

Since the second Ecosystem has the same species as the first there are just a few changes you need to make. Because the order of species dominance is reversed, go to the Groups page and select the bottom group (Pine). Click the UP arrow button to the right of the group list. Now for both groups, reassign the Thematic Maps for both height and density since the new topmost (dominant) group will be attached to the subdominant Thematic Maps.

You will end up making four changes. From each Thematic Map button for each group select "Change Thematic Link" from the popup menu. From the list that then appears select the opposite map. For instance if the existing link is to the Dominant Height map, select Subdominant Height. The second Ecosystem is done.

For the third Ecosystem we can copy the second Ecotype since it is nearest in definition to the third. Once copied, open the Ecotype Editor, go to the Groups page and change the name of the dominant (topmost) group to "Fir". Go to the Objects page and replace the pine images with fir images. The Thematic Maps don't need to be changed, they are already linked correctly.

13) Set up Dynamic Linking.

One more thing to make your life easier: use Dynamic Linking to attach Ecosystems to Vectors. A search query for the first Ecosystem would have an expression something like "Eco" attribute equals "Spr/Pine". You will need three search queries, one for each Ecosystem in this example database.

14) Create a Template.

Once you have a series of Ecosystems built it might be a good move to make a template out of them so that they can be built into any new projects you create. That would save a whole lot of work, assuming you tend to use the same ecosystems repeatedly and your database attribute table has the same design from project to project. You might want to build a number of different templates for different types of environments.

To make a template out of your current project, clean out everything but the ecosystems that you want templated. From S@G delete entire component categories. You might leave an Environment if these Ecosystems are going to be placed by Rules of Nature as well as by vectors, but in a typical scenario for GIS, rules of nature aren't used much. Remove the DEMs and vectors from the project as well.

When the project is cleaned of non-essentials, save the Project under a new name, for instance "Eco Template".

15) Using a Template.

To invoke the template on a new project, open the New Project window (CTRL+N). Check the box that says "Use Templates". Use the Add Template button and file requester to select the template project file you just saved. Give the new project a name and hit "Create & Save". Your new Project is now all ready for you to add some new database entities. If you are using Dynamic Linkage to couple your Ecosystems with vectors you can render as soon as your data is imported.

Importing Terrain Data

The Import Wizard lets you import data that is already gridded or import data as Control Points. You can grid Control Points into a digital elevation model (DEM) using the Terrain Gridder Editor within VNS.

If your terrain data is not gridded, it will need to be gridded within VNS. Please refer to the next chapter, Appendix L: Applications in Architecture and Engineering, for instructions.

Working with Large Numbers of Vectors and Components Using Layers

Since GIS practitioners work for the most part with real-world scenarios involving complex patterns of vegetation and many different specific combinations, Ecosystems should be high on your list of VNS tools to master.

Typically, it is practical to resolve the millions of potential vegetation combinations down into perhaps one or two hundred of the most common in the study area. For each of these you will create an Ecosystem in VNS and assign it to one or more coverage polygons. When VNS renders, the terrain within each polygon will be clothed in the appropriate Ecosystem. Keep in mind that we use the term Ecosystem to describe everything VNS draws - from the base color of the terrain to the types, mix and heights of vegetation species. The combination of Vector Objects (polygons) and Ecosystems will probably provide the most comprehensive and flexible approach for GIS purposes.

There are instances however, when Color Maps will better suit the purpose. If your source of vegetation data is remote-sensed imagery or if your GIS software can output a bitmapped color representation of polygons, then a Color Map might be simpler to use. Try both approaches and see which you like best. Chances are you will quickly settle on one or the other but don't be afraid to combine the two techniques.

For example, if you have imagery that shows current vegetation but wish to depict proposed modifications in selected areas, you might use a Color Map to create a background vegetation context and Ecosystems to overlay modifications in the areas of interest.

Whether you are using Ecosystems controlled by Color Maps or Vectors you must first create the Ecosystems in the Ecosystem Editor.

A useful technique when working with large numbers of Effects and polygons is to name the Effects the same as Layers in the Database. Then you can use the Add Components by Layer command in the Database Editor to assign all of your Ecosystem Components at once. You will need to do some advance planning to make this work to best advantage.

1) In your GIS software create a database field that will contain the type of vegetation. Be as specific as you need to be but limit the description to 24 characters.

You can use names that are easy to understand or that have a lot of information encoded into them. Each name will be correlated with a VNS Ecosystem later. VNS doesn't care how you name them but there is a 24 character limit for Ecosystem and Effect names.

2) Fill in the vegetation field for every polygon in your vegetation coverage.

3) Create a prototype Project in VNS that contains one Ecosystem for each type of vegetation.

Name the Ecosystems with the exact same names (same names, same spelling, same punctuation) as you used to define vegetation types in the GIS software.

Save the prototype Project. It should not have any vector or terrain data.

4) Export the vegetation coverage from your GIS software, preferably as a Shape file, being sure to include the database field that contains the vegetation type.

5) If it isn't already loaded, load the prototype Project that contains the Ecosystems into VNS.

6) Import the vegetation coverage into VNS.

If asked, specify the database field that contains the vegetation type. You will end up with Vector Objects in VNS that correspond to the polygons you had in the GIS software. Each object will be a member of a Layer of the same name as the vegetation type.

7) On the Database Editor's Comp page, click the Add Effects by Layer button.

VNS will then search for any Effects that have the same names as Layers in the Database and attach those Effects to the objects in that Layer. Easy and fast!

8) Import some terrain.

9) Render a picture and visualize your work.

Even if you are not capable of generating a Shape file, most of the above techniques will still work, it will just require more effort to set up the Layer system.

Creating Time Slices

Visualizing the fourth dimension of ecology is often the most difficult. Planners need to do so in order to balance present needs and demands on our natural resources against those of the future. VNS makes envisioning future scenarios as easy as the present.

To add a future time slice to the Project created above:

1) In your GIS program create a series of polygons with an associated database vegetation field for the future scenario.

VNS doesn't care if the polygon shapes and sizes are the same or different from those of the first scenario, that decision is left up to you.

2) Export a Shape file and give it a different name from the one above.

3) Import the Shape file into VNS as you did above, selecting the vegetation field as Layers during the import process.

If you need to add more Ecosystems to describe the future scenario you can do it either now or at any earlier stage in the process.

4) Use the Add Effects by Layer button again to assign Ecosystems to the new vectors.

Note: there can be only one Ecosystem assigned to any one vector so even if the polygons were the same between time slices, you would still need to have duplicate vector objects for each slice.

5) Add a suitable number of Render Scenarios to your project.

The number of scenarios should reflect the number of time slices in your project. Name the Render Scenarios appropriately, for example "Past", Present & "Future", or "2000BC", "1000BC", "0AD", "1000AD" & "2000AD".

6) Add the relevant components to the Controlled Items List of each Render Scenario.

First select the Class of component from the dropdown list, then use the Add/Remove Controlled Item icons to manage which components in that class are added to the Controlled Items List. Since disabling a vector will disable for rendering any attached ecosystem, in this case, you do not have to add both the ecosystems and their controlling vectors to the list. Either will have the same effect (assuming your vectors themselves are not enabled for rendering), it is simply redundant to add both, although it will cause no inherent problem.

7) Edit the Enabled State Graph for the controlled items in each Render Scenario.

Use the Add/Remove Point icons and Time Field to edit the times at which enabled state changes will occur in each scenario. The changes will apply to all components in the Controlled Items List. Hence the reason why you require a number of scenarios equal to the number of time slices in your project.

8) Add the Render Scenarios to the project's Render Job

For more information, see the Render Job Editor.

9) Render

You could of course create separate VNS Projects for each time slice but it makes it easier to modify Ecosystems, should that be necessary, if they are all in one Project. The enabled/disabled state of components due to Render Scenarios is applied regardless of keyframed parameters in those components.

For example, you may have an ecosystem whose foliage height is keyframed to increase from 0m to 1m over 10 seconds. Disabling this ecosystem at 2 seconds and re-enabling it at 5 seconds through the use of a Render Scenario, would cause the foliage to grow from 0m to 0.2m high, disappear, then reappear at a height of .5m, and continue to grow for a further 5 seconds, ending up 1 m tall.

Appendix L: Applications in Architecture and Engineering

The most serious issue facing architects using VNS is integrating VNS with an external 3D program to render buildings and structures. That topic is covered at length in an earlier chapter (see Appendix J: Integrating VNS with External 3D Programs).

Architects and engineers will most likely be using CAD software to create plans. Elements from these drawings can be imported into VNS to use as terrain or for controlling placement of roads and landscape materials. CAD drawing elements can be imported in the form of DXF files. That subject is also covered earlier in this chapter but there are a few points worth mentioning specifically for the benefit of architects and engineers.

- **VNS supports AutoCAD R13 or earlier versions of the DXF standard.**
- **The supported entity types in DXF files are Points, Polylines, LWPolylines and Lines.**

Imported files should not contain polygon entities as these will create duplicate Vector vertices or Elevation Control Points. Only entities in the Entities section of the file will be imported.

Note: VNS also supports DXF Polygon Mesh, Polyface Mesh and, 3D Face formats for importing 3D Objects, along with 3D Studio and LightWave 3D object formats.

- **Polylines or Points which are to be imported as a terrain will need to be gridded.**

This can be done automatically for you if you import using the Import Wizard.

Note: To open the Import Wizard select the Import Wizard command from the File menu.

- **Elevations for gridding terrain can be derived from the Points and Polylines themselves if they contain elevation information. Otherwise you should name the vectors according to their elevations.**

VNS can derive elevations from the name or label fields of an object as well as from the vertices. Automatic gridding of DXF data during import can only occur if there is elevation information for each vertex.

- **Set the horizontal and vertical units correctly when importing.**

VNS needs to know what the data units are in order to scale things correctly relative to the size of the globe.

- **Set Reference Coordinates if placement at the correct global position is important.**

VNS can only determine correct Sun Light positions based on date and time if the terrain model is in the correct geographic position. You don't need to be absolutely precise but the closer the better.

- **Import terrain controlling data separately from other vector data if you plan to have VNS grid the terrain automatically.**

Vertices of non-terrain data, or inappropriate vertex elevations will cause anomalies in the grid.

Following are some pointers to help you make good use of Terraffectors in your visualizations.

- **Use Terraffectors to represent roads and highways.**

Any type of road or highway can be depicted by applying a Terraffector to the centerline vector (see Terraffector Editor). The tutorials earlier in this manual explain how to create basic Terraffectors. There are examples illustrating roads in the sample Projects included on the VNS DVD which will give you a clearer idea of how Terraffectors work.

- **Use Terraffector segment priority to overlap roads at intersections.**

Special settings are required to assure that where Terraffector roads intersect they behave correctly. Use the Priority fields for each Cross-section Profile segment (see Cross-Section Profile Editor) and the Approach Slope Priority to control which part of the roads' geometry, roughness and coloring prevails where roads intersect. For profile segments, the Priority field applies to the segment left of the selected profile point. If there is a point at zero distance (far left in the profile graph), set its priority to the same value as the next point to its right.

Typically, you would use a higher priority for the road's pavement, a lower priority for the shoulder, and lower yet for the Approach Slope. The priorities of the Terraffectors themselves should be the same so that the two roads can interact. Of course if two intersecting road vectors use the same Terraffector, you only need to change the priorities of one Effect Profile and Approach Slope.

There are some excellent examples of this sort of component supplied with the product.

- **Use a Terraffector and a Point Vector to create cul-de-sacs**

A Vector Object with its Style set to Point, Circle, Square or Cross can create circular features using Terraffectors. The Effect Profile for the attached Terraffector defines the radius of the Effect, in this case the cul-de-sac pavement. You can place Vector points at the center of each cul-de-sac or use separate vectors for each one. Set the priority of the cul-de-sac's Approach Slope lower than the priority of the pavement of the incoming road.

- **Use Foliage Effects to control placement of landscape materials.**

Foliage Effects let you precisely place each tree specimen and control its height and image (see Foliage Effect Editor). Also use Foliage Effects to place other landscape items such as large rocks, lamp posts, street signs, and so on.

Appendix M: Theory and Practice of Image Management

The term 'Image Management' is a broad one, attempting to encompass the concepts of dealing with the problems and requirements surrounding the large images typically involved in complex VNS projects. Specifically, numerous high-resolution images typically consume vast amounts of memory - so much so that you may run out of available memory. In this case, memory refers to either real RAM or operating-system supplied Virtual Memory, or swap files. In any case, memory is always at a premium, you can never have too much.

Computers built using 32-bit processors and designs (like the PowerPC, Intel Pentiums and AMD Athlons) have a practical maximum of 4Gb of RAM available to them. This is compounded by the fact that most operating systems (including all consumer versions of Microsoft Windows) limit how much memory a single program can use. For example, even if you have 4Gb of RAM, and an additional 2Gb of swap file, Windows 2000 or XP will only allow VNS to use up to 2Gb of memory. This simplistic explanation glosses over the numerous technical reasons for this problem, and some specialty workarounds and expansion techniques. Suffice it to say that for our purposes, VNS will be able to store less than 2Gb of data in memory at once.

Users of VNS 1 quickly found this limitation frustrating. GIS and remote-sensing projects frequently include imagery datasets in the hundreds of megabytes. It is not uncommon to encounter color image mosaics that themselves are several gigabytes in size. The trouble arises when one needs to load the entire image into memory in order to drape it onto the terrain - you run out of memory. A slightly different problem occurs when you want to produce a rendering of a small area, and you have a very large image drape that covers that area - and much more. The logical approach would be to crop out a small region from the large image, keeping only the imagery that coincides with the area of interest. This technique is explained in our NLCD tutorials. With the NLCD datasets, each image file contains an entire state at 30m resolution. For states like Rhode Island, this is not problematic, but larger states like Colorado, tipping the scales at 362 million pixels or about 1Gb of 24-bit RGB data, this is a problem. However, the process of cropping an image while preserving its georeferencing is either difficult, or requires additional costly tools. Storing and keeping track of the many subset images you create with this technique incurs additional headaches.

The solution was to add additional intelligence to VNS itself, so that it could create, track, access and dispose of temporary subsets of the image automatically. Finally, one can simply add an enormous full-size georeferenced image to your project, and proceed without necessarily worrying about how much memory it consumes. In a perfect world, this would be all there was to the matter. In reality, VNS will perform this difficult task better if lent a bit of human wisdom and insight.

When is Image Management useful?

Image Management is useful anywhere a large image is used, but only part of the image might be needed, or at least, only part of the image is needed at any one time. When VNS renders a landscape, it loads each DEM file, renders the terrain contained within the DEM, then discards the DEM file from memory and moves on to another area. Image Management attempts to bring this same piecemeal methodology to a large image that in reality is stored as one file. Image Management is not useful in situations where the entire image must be loaded and used in a short period of time, such as when an image is used as a repeating texture, or as a foliage object. In these cases, the image will be fully loaded into memory anyway, ignoring the Image Management settings for the image in question. Fortunately, images used in this manner are not usually so large and unwieldy as to require Image Management.

Strips and Tiles

See the Image Loading and Saving topic for a more complete discussion of file formats, their native storage types, and the corresponding advantages and disadvantages.

Image files are typically stored in one of two ways, as one large block of pixels, with the pixels stored in rows sweeping from one side of the image to the other, from the top to the bottom (or the reverse), known as strips. The alternative is to break the image down into many small sub-images (tiles), and store each one in a small block, again scanning each block from left to right, top to bottom. Storing the image internally as tiles makes the task of finding and loading a particular region much faster and easier, whether the image is compressed or not. Storing the image as strips makes the task slightly more difficult if it is not compressed, as software can usually predict where in the file the desired data resides, and quickly skip to it and read it without any trouble. Stripped images that are compressed pose a more difficult problem. Unless the file format has special indexing (like TIFF) it may be cumbersome for the reader to locate the needed data within the file and access it quickly. Additionally, the reader may be required to load more data than it needs and then discard much of it, leading to lower efficiency.

For example, to load a single 256x256 pixel tile from a stripped image, it may be necessary to find, load and decompress all 256 full-width rows that the tile covers. In an image that is 20000 pixels wide, this is 5 million pixels being loaded, decompressed and then discarded as unnecessary. When the next tile over to the right is needed, the same 256 full rows must again be read, and the same amount of excess pixels will again be discarded.

Tile Memory

Image Management works by considering each candidate image as a set of small rectangular or square pieces, or tiles, whether the image file on disk is stored that way or not. The heart of Image Management is limiting how many of these little pieces are actually in memory at once. Whenever VNS needs to fetch a sample of image data from an image, it checks to see if the image in question is currently under the control of the Image Management system. If so, it will load a small piece of image (a tile) from the on-disk copy of the image file, and then obtain the data it needs from the tile. Fetching tiles from the disk takes a certain amount of time, so it is most efficient for the tile to remain in memory once it has been loaded, in order that requests for other samples within the same region can be fulfilled without reloading the tile. Eventually the collection of tiles will grow to the point where they consume quite a bit of memory and begin to defeat the purpose of Image Management. Image Management specifies a maximum amount of memory that should be used for storing tiles at any one time. Each tile is sorted by how long it has been since VNS obtained any data from it, and before a new tile is loaded, VNS checks to see if loading the new tile would exceed its budget for tile memory. If this is the case, VNS will dispose of one or more not-recently-used tiles in order that it may load a new tile without exceeding the memory cap.

This memory allotment is for all images that are under the control of Image Management. As rendering proceeds through an area covered by a particular image, the in-memory tiles (known as the Tile Cache) will fill up with tiles from that image. When rendering moves on to another geographic region in the scene, tiles from images covering that area will start to migrate into the Cache, displacing older tiles from past regions. If multiple images cover a given region, the tile cache will fill with a mix of images, possibly causing tiles to be displaced faster.

Choosing a Maximum Image Memory Size

The VNS Image Management system will make a recommendation for a Maximum Image Memory Size based upon the images you select for Management. Knowing how this number is calculated will help determine if it is appropriate, or should be increased (or decreased!).

The underlying assumption is that rendering progresses across a region in a swath of moderate width like a wave moving across the landscape from the camera to the horizon. Depending on how an image is oriented relative to the terrain, this zone of rendering may move across, down or diagonally through each draped image. The goal of Image Management is to preserve enough tiles in memory that once a tile is loaded, it is not unloaded until it will no longer be needed. Therefore, the Tile Cache must hold sufficient tiles to cover the entire ‘leading edge’ of the zone where rendering takes place. This is because rendering may take place at any spot along this zone. Additionally, capacity for a whole second row of tiles is helpful, as rendering will bridge the seam between tile rows at some point, requiring data from both the current and next row of tiles. The Image Management system will estimate the memory requirements for the worst-case scenario, two diagonal strips of tiles crossing your image.

If there are multiple Managed images in the project, Image Management will calculate and present the estimates for the largest image, assuming that those settings will suffice for the other smaller images as well. Additionally, when there are more than one Managed images in the project, the estimate will initially be double that required for the largest image. Two assumptions drive this suggestion. First, multiple files immediately reinforce the desire to minimize disk access. Secondly, two images may in fact be two layers coinciding in the same area, requiring both of them to be accessible at the same time. Adding a third Managed image (and subsequently more beyond three) will not correspondingly triple the estimate, but will cause it to increase by approximately 10% of the requirements of the largest image for each addition. This number is derived from the assumption that numerous Managed images in a project may represent a set of georeferenced images blanketing a region. In this situation, there is often a small amount of overlap between images, necessitating additional Tile Cache to keep everything required in memory until it is truly no longer needed.

Depending on how correct these assumptions may or may not be to the project in question, the estimate presented by the Image Management system may or may not appropriate. Knowing the rules used to choose this number will allow an educated choice of the actual Maximum Image Tile Memory parameter. Choosing this value wisely will allow VNS to smoothly work with vast numbers of hi-res images without noticeable performance degradation. Improper use of this parameter will cause rendering to slow as the software valiantly hauls small pieces of image data into memory over and over, an undesirable condition known as “Cache Thrash”.

Choice of Tile Dimensions

Some file formats (TIFF) are available in versions that themselves store data in tiles internally. Some formats (ECW) may not actually store data this way, but act like they do so, and perform very efficiently under this assumption.

The image’s internal storage arrangement can be determined by examining the Internal Tile Size fields in the Image Management tab. If an image is tiled, you will see dimensions such as 100x100, 128x128, 256x256, etc. These dimensions need not be identical in the X and Y axes, and need not be round numbers or powers of two, but often one or more of the above criteria will apply. ESRI software likes to write TIFF tiles that are powers of two (64, 128, 256) in dimension, and equal on both axes. VNS does not have any practical restrictions on tile sizes. If an image is stripped it will report an X dimension equivalent to the width of the whole image, and a Y dimension of 1 pixel, or occasionally a small number of pixels. ECW files will pretend to be written with internal tile dimensions of 256x256. Because ECW files will efficiently satisfy requests for any tile or strip dimensions, you can alter these settings with little adverse effect.

If the file format actually stores its data in tiles, it is beneficial to configure the Image Management settings for that image to match the internal tile dimensions of the file. This allows VNS to create an in-memory tile by loading one and only one tile from the file. A misalignment in sizes will cause VNS to have to load several tiles, keeping some data and discarding some, in order to create one in-memory tile. Data is computationally expensive to load (and decompress) and should not be wantonly discarded if possible.

If the image is stored stripped, other rules apply. It is helpful to minimize the number of tiles across the image, though too low of a number is also harmful. A tile width of 1024 or so may perform better than 256 pixels for stripped images. If the strip height is greater than 1, it is beneficial to ensure that the in-memory tile height is an even multiple of the strip height. This eliminates any situations where a loaded

strip extends vertically off of the tile and some image data must then be discarded, only to be reloaded and the other portion discarded when creating the next row of tiles.

The default in-memory tile size is always a naive 256x256 pixels. Often this will work fine, but careful tuning of this dimension may increase image access efficiency. To try a different tile size, switch the Tiling radio button from Auto to manual, and enter the desired tile size in the numeric fields next to the Manual radio button. In many cases however (small jobs), the effort of tuning these settings may not translate into great enough performance boost to warrant the trouble. Those pushing the limits of memory usage may benefit most from these suggestions.

Automatic Enabling of Image Management

In order to use Image Management, an Image Management tab must be added to the image in the Image Object Library. This creates a dilemma when adding new large images to the project, as VNS must completely load the image and create a thumbnail for it before it can be added. If the image is too large to fit in memory, it will not succeed in loading, and the opportunity to then add an Image Management tab will be denied. Fortunately, any large image that supports Image Management will automatically create an Image Management tab and defer loading of the image and creating a thumbnail. To VNS, the definition of a Large image is one whose dimensions exceed 1600 pixels in either direction. This may cause VNS to accidentally recommend Image Management for some images that don't need it, but it allows massive images to be added with Image Management. The Image Management controls can be easily removed or disabled on images that falsely trigger automatic Image Management.

Thumbnails

If a large image is added to the project and Image Management is automatically enabled for it, the full image will not initially be loaded, and a thumbnail will not be generated for it. Instead, a recognizable red and white checkered Stand-In Image thumbnail will be generated for the image. This thumbnail will appear everywhere in VNS where the real thumbnail would have shown. If you require a more accurate thumbnail created from the real image data, you must endure a loading of the complete image. This can be accomplished by viewing the image from the Image Object Library (by double-clicking it in the Images list, or clicking on the Stand-In Image thumbnail). This will invoke the Image Viewer window, which will efficiently display the whole image without having to load the whole image at once. Viewing a Managed Image may be a slow process, and therefore a progress bar with cancel button will be displayed. Once the entire image has been loaded and displayed, a new thumbnail will be generated and will replace the Stand-In everywhere. If the load is cancelled before the entire image is displayed, the thumbnail will not be updated. Clicking the Update Thumbnail button for a Managed Image will present a requester explaining this situation and asking if it should proceed with displaying the whole image to update the thumbnail. The appearance of the thumbnail never impacts the actual rendering at all.

File Formats

Some file formats are designed to simplify the task of quickly accessing just a small portion of the image. Some formats, by design or simply through oversight, make this task difficult or impossible. The following is a brief listing of the file formats that currently support Image Management, and the relative merits or problems associated with the format. They are listed generally in order of preference, from best to worst.

- **ECW**

ECW is a proprietary format created by the makers of ERMapper. It is designed for remote-sensing applications, and uses Wavelet compression to achieve very high compression ratios, though it does alter/lose some detail in the process (known as lossy compression). It does not store palette-based imagery (like NLCD data), but can store 24-bit color or 8-bit monochrome

imagery. ECW can contain georeferencing data right in the image file (like GeoTIFF), no world file or PRJ file is necessary. ECW is designed for rapid efficient access to any portion of the image at any time. ECW pretends like it is a 'tiled' image format (as opposed to storing the data in strips), though it is not documented how it actually stores the data internally. Freely available programs and plug-ins can write the ECW file format, but are limited to creating files containing no more than 500Mb of (uncompressed) data. A 24-bit RGB image of 13000 pixels by 13000 pixels is approximately 500Mb of data, and an 8-bit monochrome image of 23000x23000 pixels is approximately 500Mb. In order to write ECW images from source images larger than 500Mb, one must purchase software such as ERMapper or plug-ins for other GIS and imagery applications.

- **TIFF/GeoTIFF**

TIFF is an open, documented file format, originally designed by the desktop-publishing industry. It became popular in the GIS and remote sensing fields because of its solid and extensible design, and good lossless compression. TIFF can store palette-based images, 8-bit monochrome or 24-bit color images. TIFF has some support for rapid access to portions of the image, allowing the data to be stored internally as either horizontal strips, or grid-like tiles. Most non-GIS programs like Photoshop store images using the stripped method. GIS-aware programs such as those from ESRI and others may offer the option of storing the images as strips or tiles. Image Management works more efficiently with images stored as tiles. Freely available utility programs such as geotifcp.exe can be used to convert a TIFF image between tiled and stripped form. TIFF has three compression methods: LZW, ZIP and JPEG. Most programs will read LZW-compressed images, but not as many will write them, as the writing of LZW images is covered by a patent. The ZIP algorithm has sprung up to replace LZW, as it achieves the same or better compression, and is not patented. Newer software will read and write ZIP compression (Photoshop 5 and earlier cannot). LZW and ZIP are lossless. JPEG compression combines the (lossy) high compression ratios of JPEG with the other advantages of TIFF, essentially embedding one or more small JPEG images into the TIFF file. TIFF images can have accompanying TFW and PRJ files to hold their georeferencing information, or they can embed the georeferencing data within the file itself, at which point it is known as a GeoTIFF. Editing a GeoTIFF image in a non-GeoTIFF-aware program like Photoshop will destroy the GeoTIFF information. Free utility programs such as geotifcp.exe can be used to add or copy the Georeferencing information within a GeoTIFF file.

- **BMP**

BMP is a basic image file format designed by Microsoft for use with its Windows operating system. It has many confusing versions and variations. The 24-bit variation (the only one supported by VNS) does not support any compression at all, making it a large and unwieldy file format. In addition, it does not facilitate rapid access to subsets of the whole image, though it does not especially hinder it either. There are no provisions for storing georeferencing data directly in the BMP file, though separate world files (.BPW) and PRJ files are commonly used for this task. BMP is at heart a stripped file format.

- **JPEG**

JPEG is a very well thought out file format designed by a committee of image compression experts. It offers varying compression ratios that trade image quality for size. JPEG is always slightly lossy, meaning the image you load is slightly inferior to the image you originally saved. This has adverse effects for raster data that will be used for quantitative analysis, but is fine for imagery that will be draped purely for its visual contributions. JPEG supports 8-bit monochrome and 24-bit color images, but does not support palette-based imagery. JPEG does not have any methods of storing georeferencing information directly in the image file, so world files (.JGW) and PRJ files are commonly used for this task. One of the few things the JPEG design committee did not anticipate is the desire of GIS and remote-sensing users to rapidly and efficiently access small portions of the whole image. Certain design considerations of JPEG mean that in order to access any part of the image, the reader must start at the beginning of the file and read and decompress the entire image up to the point where the desired data is located. The reader need not keep

all of the intervening data around, so it is still possible to access small parts of the image without consuming vast amounts of memory, but the process is much slower than with other file formats. Due to the large amount of remote-sensed imagery currently available in JPEG form, Image Management support is available for JPEG, but with the caution that it may be more efficient to convert to other file formats where possible. The upcoming GeoJPEG2000 file format may alleviate this limitation by offering many advantages of the ECW file format in an open standard. Using the GeoTIFF file format with the tiled storage method and the JPEG compression option would offer the same benefits, but few applications support all the necessary options to create such files. Geotifcp.exe should be capable of converting to and writing such files.

At this time, no other VNS-supported file formats are good candidates for Image Management, either because of their rare usage in GIS and remote sensing fields, or because of technical design limitations that would make them perform poorly in these circumstances. Therefore, these four formats are the only formats that will perform Image Management.

Appendix N: Scene Express Export Formats

Scene Express can output to a number of different file formats. Some are included in the basic Scene Express distribution, some are only available as paid add-ons to the basic functionality. All are listed here for reference purposes.

The export formats fall into four groups:

Realtime Formats

- **VRML (Virtual Reality Modeling Language)**
- **VTP (Virtual Terrain Project)**
- **NV (NatureView)**
- **Google Earth**
- **FLT (OpenFlight - Optional)**

Rapid Prototyping Formats

- **STL (Stereo Lithography - Optional)**
- **VRML-STL (Stereo Lithography as VRML - Optional)**

3D Integration Formats

- **3DS (3D Studio)**
- **LWS (LightWave)**
- **FBX**

Other Export Formats

- **WCS/VNS**
- **GIS**

Realtime Formats

Realtime export, more than any other type, is subject to inherent limitations and overheads from which other types of export do not suffer. That is to say that realtime export, by its name (and very nature) should aspire to playing back on the target client machine in "realtime"!

With today's advances in affordable graphics hardware, even an entry level graphics workstation should have little trouble manipulating several hundred thousand textured polygons at framerates in excess of 15 fps (frames per second). This is generally considered to be the minimum framerate at which playback can be labelled as "realtime".

However, there are still tenets that must be applied:

- **One should attempt under all circumstances to minimize the complexity of both terrain models and 3D Object model exported. The lower the detail of the models, the faster the framerate.**
- **The same applies to foliage flipboards or crossboards - the greater the number of these present in the scene, the slower the playback will be. By offsetting realism with a reduced foliage density and a suitably selected foliage culling distance, one can normally find an acceptable compromise between realism and interactivity.**
- **One should keep texture resolution to a minimum, wherever possible.**
- **One should test output at various resolutions to see the point at which framerates start to drop below acceptable levels.**
- **One should always target output to the client machine on which the realtime demo will be run. If you are sending the file on CD to a client who you know has minimum access to fast graphics hardware, then the content will have to be less detailed than the equivalent output for a client who is running the latest and most expensive graphics hardware!**

Suffice to say that except in the case of the most simple of projects, export will involve a little more trial-and-error testing than simply clicking an export button.

If your scene is particularly complex, or has high-density, high-coverage foliage, then it is recommended that you clone your project before export. Then you can optimize the cloned project within VNS for the output that is required. Since the export controls only allow the filtering of foliage by height, reducing density and/or coverage values will help increase the speed of playback.

Note: Not all of the features listed in some file format descriptions are automatically created by Scene Express. Their presence in a list simply represents that functionality in the file format standard itself, rather than specific export functionality within Scene Express. Some external editing of the exported file may be necessary to access all aspects of a particular featureset.

VRML (Virtual Reality Modeling Language)

Description

VRML is the longtime international standard for 3D content on the World Wide Web. In essence VRML is the format or language that is used/required for 3D interactive worlds. It specifies how such worlds should be described so as to work smoothly on the web as interactive 3D content.

The VRML format can be used in either human readable text format form or in a compressed (non human readable) format. As the compressed format (often seen as worldname.wrl.gz or worldname.wrz) makes for smaller file sizes and faster downloads, it is more commonly seen on the Internet. Scene Express supports the export of either compressed or uncompressed VRML content.

History

The VRML standard was first adopted back in October 1994 (codenamed Labyrinth) and has since undergone several version updates (VRML 1.0 in 1994, VRML 2.0 in 1996, VRML97 in 1997, VRML200x in 2000 and most recently the X3D Draft Specification) to enable more complex and interactive content to be displayed. For a more thorough description of the VRML standard (tech docs) take a look at the VRML International Standard which can be found on the Internet at:

<http://www.web3d.org/x3d/specifications/vrml/>

Features

- **Navigation**

Many control options - walk, fly, examine or none (Contact and Cortona also support proprietary 3rd-person avatar modes)

- **Viewpoints**

Pre-defined camera positions

- **Models**

Primitives (box, sphere, cone, cylinder), extrusions, indexed face set (mesh), line set, point set, elevation grid and text (Contact and Cortona also support proprietary spline and NURBS geometry)

- **Materials**

Diffuse color, specular, emissive, ambient, shininess, transparency, color per vertex

- **Sound**

Fully spatialized 3D audio in WAVE or MIDI format

- **Textures**

Support for JPEG, GIF, PNG and MPEG1 video. (Contact and Cortona also have proprietary support for Flash, RealMedia, AVI, multi-texturing and environment mapping)

- **Lighting**

Directional, point or spotlight

- **Special Nodes**

Background, switch, hyperlink (anchor), billboard and fog

- **Performance**

LODs (levels of detail), visibility distance culling (Contact also supports BSP trees, cells and portals). Despite these optimizations, performance can be poor on certain systems with certain viewers.

- **Collisions**

Collision detection between user and objects (As of version 4, Cortona supports object to object collision detection)

- **Animation**

Animate position, rotation, scale, points, color and much more. Scope for many separate animations in one world all with different time lines and triggered by different events. Almost every attribute can be animated!

- **Sensors**

Sense user activity such as touch, drag (plane, cylinder and sphere), time, proximity, visibility (Contact and Cortona also have proprietary support for key sensors and drag 'n' drop sensors)

- **Scripting**

Interfaces directly with Javascript, Java, the web browser and any programming language residing on the client/server

- **Routes**

Scripts, animations and object properties can be "wired" together in an infinite number of ways to create any effect

- **Compact**

Extremely small file size with GZip compression

- **Modular**

References external textures, models, scenes and scripts

- **Extensible**

If the core VRML nodes aren't enough you can create your own nodes using Prototypes

- **Other**

Cortona supports full-screen mode and 3D stereo with the right hardware. They can also both be embedded in either a web page or a stand-alone application with full control of the scene graph and 3D engine from C++, java, javascript and vbscript.

Performance & Limitations

Performance of VRML is, on the whole, only maintained at a reasonable level through loss of realism in the form of low resolution textures and terrain. High polygon numbers and dense foliage have a severe impact on the realtime nature of exported content and filesizes for realistic scenes are prohibitively large (even with compression)

Terrain models are limited to a certain number of cells, which equates to a square terrain mesh of 126 by 126 cells in size, and no texture may exceed 256 by 256 pixels in size, on older viewers. This can result in asymmetrical texture pixels, as texture output for terrains must be square. Multiple terrain tiles can exist in one VRML project, so you are not inherently limited by the format in terms of the absolute area of terrain that can be exported at a particular cellsize. The exported region will be divided into as many tiles as are necessary to make sure that the values provided for the terrain dimensions (in cells) are observed. Performance will decrease accordingly, as there are more entities (terrain tiles) and polygons (cells) to manipulate in realtime.

Note: more recent versions of the VRML standard support textures upto 2048 pixels in size. Check the documentation that ships with your viewer utility for the standards it supports.

Different VRML viewer utilities will give different levels of performance on the same system with the same scene.

Textures with Alpha channels on foliage billboards may cause severe performance restrictions.

PNG and JPEG formats are supported for terrain textures. Only PNG images can be used as foliage objects, and although VRML supports flipboards and crossboards for foliage objects, performance of scenes using crossboards will be much slower than with flipboards.

The export controls in Scene Express do not allow export of all the above features to VRML, but since the VRML file created is text-based, extra content and functionality can be built into the scene by hand or by using a more specialized VRML creation product.

Implementation Issues

Level of Detail controls are excellent for optimizing playback, but be aware that the more Levels Of Detail you embed in the VRML scene, the larger your filesize.

The same applies to 3D Object geometry, and foliage objects which must be defined in terms of VRML code in the main .wrl or .wrz file.

Note: Since VRML is a text-based language, the files compress very well. Use of the GZip-based compression routines available through the General Page of the Scene Exporter Editor will reduce file size considerably, but may not be supported in some older viewer utilities. This will have the benefit of reducing download times for web-distributed content, as the scene is decompressed once downloaded to the client machine, as well as reducing server disk load.

A number of free VRML browser utilities are available on the Internet, some of which are listed below:

- **ParallelGraphics Cortona**

<http://www.cortona3d.com>

Cortona is available for PC, Apple Macintosh, Apple Macintosh OS X, and PocketPC Platforms.

- **FreeWRL**

<http://www.crc.ca/FreeWRL>

FreeWRL is only available for the Linux platform.

There are also a number of standalone VRML viewers, such as DeepExploration (<http://www.righthemisphere.com>) that can be located throughout the worldwide web. In general, these are not designed specifically to view VRML, so although performance may exceed some of the web browser plugins, the functionality is often not as extensive.

VTP (Virtual Terrain Project)

Description

An open-source format developed for the support of common GIS databases in realtime visual form.

History

Developed originally in 1997 by Ben Discoe, although as the project has grown, others have joined to lend a hand with areas such as Linux ports, and so forth. Many changes have been facilitated over the years, and the format support is quite extensive now.

Features

The VTP software itself falls into 3 areas - Viewer, Terrain Creation and Editing, and Building Extraction. The open source nature of the codebase means that different people have implemented and extended areas of the VTP standard to fulfil their own requirements. The format itself supports the embedding of a wide range of geoclassified and object-based data, and even supports the automatic creation of entities such as roads with correct road markings, from certain types of input data.

The Viewer allows editing of scenes, movement of foliage and creation of simple terrain features such as fences of various types.

For more information on the VTP standard and the potential that exists, visit:

<http://www.vterrain.org>

The full VTP distribution is available for free upon e-mail application to the development team. Details exist on the VTP website at the address above.

Performance & Limitations

Performance using the VTP viewer utility is good, and highly configurable, offering a wide array of different LOD variants, and being supplied with a variety of example datasets. Framerates are generally higher than the same scene in VRML format, especially for large terrain tiles with hires texture map drapes.

VTP content exported from Scene Express may be loaded into VTBuilder to add, remove and edit features, should this prove useful. This allows content to be quickly and accurately created by VNS from data that may not be directly supported by VTBuilder itself, then merged with an existing VTP project.

Terrain export is always 1 tile, with equal numbers of rows and columns. The number of rows and columns is limited to a (power of two plus one) cells in each direction ie: 1025 x 1025, 257 x 257 etc. This will result in non-square terrain cells in the output if the selected area for export is not itself square.

Texture Export resolution is locked to a (power of two) pixels ie: 1024, 256, 128 etc. However, textures can be different numbers of pixels in width and height, so in most cases an approximation of square texture pixels can be achieved.

BMP and PNG formats are supported for terrain textures. Only PNG images can be used as foliage objects, and VTP only supports cross-boards for foliage objects.

Implementation Issues

VTP files are not as self-contained as VRML or similar files. The output is best presented direct from disk, for example at trade-shows or client demos, or via CD-ROM or DVD formats, as proof-of-concept or final product delivered to the end-client.

NV (NatureView)

Description

The NatureView format is a proprietary format developed by 3D Nature LLC to provide very fast realtime output, to be played in the freely distributable NatureViewer utility.

History

Developed specifically for this product, it has no history prior to this software release.

Features

At time of release, it's featureset is similar to the VTP file format, but continued future development is assured.

Performance & Limitations

For the output that is supported by Scene Express, NatureView has the best performance of any of the realtime format's listed here.

Implementation Issues

NV files don't require the elaborate subdirectory structure that is required by VTP. NV can also handle an entire zipped archive of its scene file and dependent files, and extract the data automatically and transparently. This greatly facilitates web distribution.

Google Earth

Description

Google Earth is a proprietary virtual globe program that maps the earth by the superimposition of images obtained from satellite imagery, aerial photography and GIS 3D globe. It is available under three different licenses: Google Earth, a free version with limited functionality;

Google Earth Plus (\$20 per year), which includes additional features; and Google Earth Pro (\$400 per year), which is intended for commercial use.

History

Google Earth was originally called Earth Viewer, and was created by Keyhole, Inc, a company acquired by Google in 2004. With the input of development funds from Google, the program has undergone a series of radical advancements from the original implementation, too numerous to list here. For more information, visit:

<http://earth.google.com>

Features

- **Whole Earth Digital Elevation data**

Based on NASA's SRTM data

- **Whole Earth Imagery cover**

At varying resolutions (from 15m to 15cm per pixel, depending on area)

- **3D building and feature support**

User submissions now supported through the use of Google Sketchup, a 3D modeling program available in both free and commercial versions, that exports to Google Earth's KML format.

- **Traffic Speed Monitoring**

At loops located every 200 yards in real-time

- **Google Street View**

Provides 360° panoramic street-level views and allows users to view parts of selected cities and their surrounding metropolitan areas at ground level.

- **Google Sky**

Allows mapping of night-sky features and zooming capability using images acquired by the Hubble Space Telescope.

- **Geographic Web**

Integrates locations in Google Earth with Wikipedia and Panoramio entries.

- **Sun View**

Sun position can now be viewed from any location on earth based on date and time. Sunset and sunrise colors are simulated, along with star movement pre-sunrise and post-sunset.

- **Layer Support**

Google Earth also features many layers as a source for information on businesses and points of interest, as well as showcasing the contents of many communities, such as Wikipedia, Panoramio and YouTube.

- **Flight simulator**

Since Google Earth v4.2, a flight simulator has been included as a hidden feature. Depending on the system, it can be accessed by pressing Control+Alt+A, Control+A, or Command+Option+A. After this feature has been activated at least once it appears under the tools menu. Since v4.3 the option is no longer hidden by default. Currently the F-16 Fighting Falcon and the Cirrus SR-22 are the only aircraft that can be used, in addition to a few airports.

- **Google Earth Plus**

For a \$20 per year subscription fee, Google Earth Plus also offers the following features:

- **GPS integration: read tracks and waypoints from a GPS device. A variety of third party applications have been created which provide this functionality using the basic version of Google Earth by generating KML or KMZ files based on user-specified or user-recorded waypoints. However, Google Earth Plus provides direct support for the Magellan and Garmin product lines, which together hold a large share of the GPS market. The Linux version of the Google Earth Plus application does not include any GPS functionality.**
 - **Higher resolution printing.**
 - **Customer support via email.**
 - **Data importer: read address points from CSV files; limited to 100 points/addresses. A feature allowing path and polygon annotations, which can be exported to KML, was formerly only available to Plus users, but was made free in version 4.0.2416.**
 - **Higher data download speeds**
- **Google Earth Pro**

For a \$400 annual subscription fee, Google Earth Pro is a business-oriented upgrade to Google Earth that has more features than the Plus version. The Pro version includes add-on software such as:

- **Movie making.**
- **GIS data importer.**
- **Advanced printing modules.**

These used to cost extra, in addition to the \$400 fee, but have recently been included in the package. As of January 2008 Google Earth Pro is being updated to have over 400 extra features, the version's cost has been announced to be \$1030 USD.

Performance & Limitations

Performance is good. On any reasonably specced system, the OpenGL and DirectX implementations are responsive. Navigations is simple and intuitive.

Terrain resolution is limited, and elevation accuracy varies by country and has no error margin displayed or available. Bathymetry data is absent (although a colorscale approximating sea floor depth is "printed" on the spherical surface). Errors sometimes occur due to the technology used to measure the height of terrain; for example, tall buildings in Adelaide cause one part of the city to be rendered as a small mountain, when it is in fact flat. The height of the Eiffel Tower creates a similar effect in the rendering of Paris. Also, elevations below sea level are presented as sea level; i.e. Salton City, California; Death Valley; and the Dead Sea are all listed as 0 m when Salton City is -38 m; Death Valley is -86 m; and the Dead Sea is -420 m.

Image resolution is variable, inconsistent in age, and unpredictably so. The image data can be seen from squares made when DigitalGlobe Coverage is enabled. The date next to the copyright information is not the correct image date. Zooming in or out could change the date of the pictures. Most of the international urban image dates are from 2004 and have not been updated. However, most US images are kept current.

Place name and road detail vary greatly from place to place. They are most accurate in North America and Europe, but regular mapping updates are improving coverage elsewhere.

The "Measure" function shows that the length of equator is about 40,030.24 km, giving an error of -0.112% compared with the actual value of 40,075.02 km Earth; for the meridional circumference, it shows a length of about 39,963.13 km, also giving an error of -0.112% compared with the actual value of 40,007.86 km.

The Arctic polar ice cap is completely absent from the current version of Google Earth, as are waves in the oceans. The geographic North Pole is found hovering over the Arctic Ocean and the tiling system produces artifacts near the poles as the tiles become 'infinitely' small and rounding errors accumulate.

Cloud cover and shadows can make it difficult or impossible to see details in some land areas, including the shadow side of mountains.

Some images have been intentionally pixelated to ensure compliance with (rapidly evolving) right-to-privacy laws.

Currently, every image created from Google Earth using satellite data provided by Google Earth is a copyrighted map. Any derivative from Google Earth is made from copyrighted data which, under United States Copyright Law, may not be used except under the licenses Google provides. Google allows non-commercial personal use of the images (e.g. on a personal website or blog) as long as copyrights and attributions are preserved.

Implementation Issues

Errors in Terrain resolution or elevation can not be efficiently edited - while the Scene Express add-on allows export of terrain data to Google Earth format, Google Earth itself provides no way in which to replace its default terrain model with a user-supplied one.

Since foliage is implemented as labels, load times for large foliage stands can be prohibitive, as well as affecting performance negatively.

Data is not encrypted and easily converted to other formats, making data security an issue.

Data is compressible (using the ZIP algorithms) and distributable over the web.

Despite these limitations, Google Earth is a popular choice for realtime browsing and navigations and many people already have the free viewer installed locally reducing the size and dependency of distributables.

FLT (OpenFlight - Optional)

Description

Openflight (.flt) files are written in a database format used to store realtime content. Often heavily utilized by military and flight simulator software, it has, in some marketplaces become the de-facto standard. It supports a well-documented Application Programming Interface (API) which makes it an extensible format, allowing 3rd-party development of supporting applications. Data is stored in tree structures built from nodes. these fall into one of three distinct types: Container nodes, Geometry nodes, and Vertex Nodes.

History

Developed by MultiGen-Paradigm Inc, which itself was created when MultiGen Inc. (founded in 1986 in San Jose, CA) and Paradigm Simulation, Inc. (founded in 1990 in Dallas, TX) merged in the September of 1998.

MultiGen-Paradigm was acquired by Computer Associates International in 2000 and continues to operate as an independent, wholly owned subsidiary.

Features

OpenFlight offers (amongst other features)

- Variable Level of Detail (LOD) control**

As with other realtime formats, Level Of Detail is a feature in the OpenFlight format. LOD is controlled through the use of Container nodes - a LOD control that is a property of a particular container will be applied to all geometry and vertices within that container.

- Degrees of Freedom**

A set of controls allowing motion of a particular object or objects to be limited in one or more axis of rotation, or translation. Often referred to in other 3D Applications as Constraints.

- Instancing**

Instancing is the ability to define all or part of a database once, then reference it one or more times while applying various transformations. OpenFlight supports internal and external instancing with operations such as Rotate, Translate, Scale, and Put.

- Replication**

Replication instances a subtree of the database several times, applying a transformation each time.

- **Bounding Volumes for Realtime Culling**

Bounding volumes can be used by the application to determine if a particular subtree of the database is in view. A bounding volume can be a box, a sphere, or a cylinder. Each group node can have only one bounding volume. The volume normally encompasses the full geometric extent of the group nodes children, including any instances and replications.

- **Light Points & Light Point Strings**

Point lights consist of point geometry (vertices) that render as if they are lights, but do not illuminate their surroundings. For example, office windows on a distant building, or runway landing lights. Lights can be manipulated singly (Light Points) or as groups (Point Light Strings)

- **Texture Mapping**

OpenFlight supports eight textures per polygon or mesh as well as eight UV values per vertex.

- **Transparency**
- **Sound**

Performance & Limitations

Performance of OpenFlight files is generally good, with high detail levels maintained at an acceptable framerate. Host applications tend to be costly and intensive, both in terms of learning curve and hardware requirements.

Implementation Issues

OpenFlight files are used in some of the world's most powerful Virtual Reality Simulators. Apart from the general caveats regarding implementation of realtime content, there are few other things to say about this format. Individual host applications will have their own set of restrictions and suggestions, which should be adequately covered in their own user-documentation, and support resources.

This format is not used in web content, and as such, filesize is not so much an issue as the content will not require Internet Streaming. However, there is a free FLT viewing utility available from the Open Scenegraph project:

- **Open Source FLT Viewer**

<http://www.openscenegraph.org>

Rapid Prototyping Formats

These formats were developed for rapid prototyping of engineering designs. Unless you wish to create solid physical models of your terrain meshes for visitor center displays etc, these options are going to be of little interest.

STL (Stereo Lithography - Optional)

Description

A format developed for the definition of rapid-prototypable solid models. It converts the solid model surfaces into triangular planar facets with an orientation vector to define the outside of the model. This format was selected because almost all CAD systems already have faceting engines for the purpose of high speed rendering and it lends itself well to cross sectioning algorithms.

History

Originated and established by 3D Systems, Inc. of Valencia CA. It has become the de-facto standard probably because it was the first published interface specification for rapid prototyping and it worked! It was created in 1988 by Alberts Consulting Group under contract for 3D Systems, Inc.

It comes in two different versions - ASCII and binary. Binary is the preferred format for general use because it is more compact. The ASCII format is intended for diagnostic purposes for programmers and ambitious rapid prototypers.

Features

The format is simple and unambiguous, with support only for triangular polygons. That is not to say that topologically incorrect objects can be defined in a "correct" manner with respect to the STL syntax, but that the syntax itself is unambiguous. It is probably the most widely supported format for use in rapid prototyping and other engineering and CAD/CAM programs.

Implementation Issues

Since the format does not support the indexed storage of vertex information, filesizes can become very large. In addition, apart from coordinate information, no other attributes of the polygons that make up the model are stored (for example, UV Map or color information). These issues are usually expected in a Rapid-Prototyping environment, and do not inherently represent limitations.

Scene Express exports binary or ASCII STL export.

- **DeskArtes View Expert (Freeware):**

<http://www.deskartes.com/>

VRML-STL (Stereo Lithography as VRML - Optional)

Description

A variant of VRML designed to be used in rapid-prototyping environments. It is viewable in standard VRML viewers, but is not optimized for web usage. Features such as embedded LOD are missing, and the geometry has to be checked and (where necessary) modified, to make it legal for use in STL-compliant rapid prototyping machines.

History

As per VRML above.

Features

As per STL above.

Implementation Issues

As per STL above.

Since this export format is essentially a VRML file, any of the already-listed VRML viewing utilities should be able to process and display VRML-STL output.

3D Integration Formats

The integration of the 3DNature product range with external 3D Applications has always been an issue for animators who wished to use the advanced terrain rendering tools available in VNS with the advanced texturing, lighting, and animation tools available in high-end animation products such as 3DS Max, Lightwave, Maya and Softimage. To this end, a series of implementations have been put in place over the years to support this ideal. First with Scene Export to Lightwave and 3DSMax and compositing via the z-buffer plugins, then later via RLA and RPF support along with the Composite Post Process procedures.

Scene Export and RLA/RPF/Z-buffer support remains for those who wish to use it, and who do not have access to Scene Express. Scene Express, however, allows export of VNS scenes to a number of other 3D formats, complete with foliage, and other integrated 3D and vector features, which was a major limitation in earlier integration tools.

3DS (3D Studio)

Description

An old, but well-supported file format, the 3DS format is supported by a wide range of 3D applications, most notably 3D Studio Max. Models are built from trigons (triangular polygons) only.

History

Since 1994, 3D Studio (then for DOS) has been used to create special effects for motion pictures. Originally owned by Autodesk (makers of AutoCAD), 3D Studio was eventually developed into 3D Studio Max, the flagship of the Kinetix, and later Discreet line of software products. Now owned and developed by Autodesk, the software has established itself as one of the favorites amongst 3D Professionals.

Limitations

The 3DS format has limitations on the number of vertices that can be contained within an object, thus terrain (and other polygonal) entities will be either tiled or decimated to conform to that requirement. Choices relating to tile dimensions in the exporter interface will also be constrained by these format limitations.

There are no inherent LOD controls in the 3D Studio format, as it was not intended for realtime use. However, it is used in many game development environments as an intermediate format, and as such, the controls relating to texture, and mesh resolutions present in Scene Express provide good levels of control over the potential performance of such objects in a realtime (game) engine.

Textures can be of any size and in PNG, JPEG or TIFF formats. Foliage objects can be in PNG or TIFF formats, and can only be exported as crossboards.

Implementation Issues

Depending upon the target use of the exported data, performance may not be a serious issue. In general, more traditional 3D animation products such as 3D Studio Max and Lightwave were not really designed to handle the sort of number of trees usually created in a VNS scene. Since the foliage is present in the scene as crossboards with clip or transparency mapped foliage images, the OpenGL overhead (although not as high as if those trees were polygonal) will still be considerable with high density foliage, as will the rendertimes involved.

Some effort will therefore have to be made prior to export to make sure that the scene is suitably edited to reflect the sort of foliage overhead that your 3DS Scene can handle. If this is for rendered stills, then it is likely some substitution of foreground crossboards for 3D polygonal trees will be necessary. If the export is for game use, then it is likely that some thinning of foliage will be necessary to enable realtime playback in the game engine. Only you, as the user of the exported data, will be able to adequately decide to what extent you feel happy loading the scene with image-based foliage.

LWS (LightWave)

Description

Similar to 3DS, but slightly more recent. Supports the use of Trigons, Quads and n-gons (polygons with more than four sides).

History

The precursor(s) to LightWave 3D were Videoscape 3D and Aegis Modeler 3D. Released on the Commodore Amiga platform in 1988, they soon built up devoted followings in the user community. In 1990, version 1 of LightWave shipped with the (Amiga-based) Video Toaster, but it was not until version 3.5 in 1994 that a standalone version of LightWave was available to the general public. Now on version 9.5 (previewed at Siggraph 2008), the program has an extremely well-developed and mature toolset that has been taken up by many post-production and special effects houses.

Limitations

The lack of embedded LOD controls might be considered a limitation, but in other respects, the LightWave format suffers from few limitations. Since the update to the LightWave object standard with version 6.0 of the product, there are no longer any limits (in the LWO2 standard supported by Scene Express) on the numbers of points or polygons in the object, texturing support is good, and object filesizes are well optimized.

Implementation Issues

Depending upon the target use of the exported data, performance may not be a serious issue. In general, more traditional 3D animation products such as 3D Studio Max and LightWave were not really designed to handle the number of trees usually created in a typical VNS scene. Since the foliage is present in the scene as crossboards with clip or transparency mapped foliage images, the OpenGL overhead (although not as high as if those trees were polygonal) will still be considerable with high density foliage, as will the rendertimes involved.

Some effort will therefore have to be made prior to export to make sure that the scene is suitably edited to reflect the sort of foliage overhead that your LightWave Scene can handle. If this is for rendered stills, then it is likely some substitution of foreground crossboards for 3D polygonal trees will be necessary. If the export is for game use, then it is likely that some thinning of foliage will be necessary to enable realtime playback in the game engine. Only you, as the user of the exported data, will be able to adequately decide to what extent you feel happy loading the scene with image-based foliage.

FBX

Description

FBX is a complete 3D scenefile description format, capable not only of providing geometry information, but also information about lighting, materials, atmosphericics, animation data and so forth, as well as 2D, audio and video media elements. As such it provides an ideal intermediary format for the exchange of data between a range of 3D applications that support it.

History

Originally developed as a proprietary format by Kaydara for use in their Filmbox suite of products, the specification was then purchased by Alias, the makers of Maya, and is now owned and developed by Autodesk (under the name MotionBuilder), who acquired the technology when they bought out Alias.

Limitations

None that are relevant. The same limitations apply to FBX as to any other 3D file format when discussing its applicability to terrain and foliage visualization.

Implementation Issues

Native support for the FBX format is not universally included with 3D software. However, more products are being shipped with import and/or export capabilities.

There are also a range of plugins available for the major software products which allow the import and export of FBX data.

More information can be obtained from the FBX website:

<http://usa.autodesk.com/adsk/servlet/index?id=6837478&siteID=123112>

Other Export Formats

This section described the other export formats available in Scene Express which do not easily fall into one of the already described categories. These formats are included to allow data interchange between software products, rather than with the aim of creating a whole new data set for exclusive use in software other than VNS.

WCS/VNS

Description

This output format is the native one that WCS and VNS use internally. Terrain files are exported as .elev format (3D Nature's proprietary elevation model format), and vector entities are exported as .db files to be imported to a new database.

GIS

Description

This output format tells Scene Express to export your terrain model as an ESRI gridfloat, texture map as a GeoTIFF and your vectors as shapefiles. This is designed for easy interchange of terrain and vector data between VNS and 3rd Party GIS software. Some or all of the data may have been created or positioned from scratch in VNS, and the GIS exporter provides a centralized interface through which one can export to common GIS formats.

History

Not entirely relevant in this particular case, since the GIS output is not a "format" so much as a type of data. The formats themselves are defined by ESRI as part of their ongoing development of the ArcGIS and earlier suites of software. Shapefiles and ESRI terrain grids are widely accepted standards in the GIS industry. GeoTIFFs are a commonly accepted format for the exchange of geospatially-aware aerial and satellite photography.

Appendix O: Tips

These are the tips which appear in the Version Window when you start the program or open the Version Window from the Help menu.

- Holding down the SHIFT and CONTROL keys while getting diagnostic info from a rendered image will display the X and Y coordinates within the image instead of the RGB/HSV values. This tip does not work with diagnostic info from GL Views.
- When digitizing, you can click in other GL Views, rendered Views, or even registered colormap images to place points.
- If you click the Sample Color from Image checkbox the Color editor you can grab colors from any image in VNS, any GL View or any color well.
- Double-click anywhere in a rendered image to automatically open the appropriate editor for the area or item you clicked on. This will only work if Render Diagnostic Data is checked in the Enabled2 section of your Render Options.
- ALT-click any object in a GL View to make it the Active Object.
- Control-click in a GL View to place the Active Object at the location you click (if the object supports this capability).
- ALT-triple-click an object in a GL View to make it the Active Object and open the appropriate editor.
- Hitting the ? key in a GL View will open the View Preferences for that View.
- Adjust your GL display redraw speed by setting the Maximum Polygons in the General tab of the View Preferences.
- Lightwave users: Hitting F9 in a GL View will render a Preview in that View.
- Lightwave users: Hitting the return key in a GL View will open the Make Keyframe requester.
- The small Play Animation button at the right edge of the time scrollbar is often overlooked.
- If you need to abort an operation in progress and the progress bar and abort button are obscured, try pressing the Escape key.
- Holding down the Spacebar in a View will switch you into Manipulate Camera mode until you release the spacebar.
- Pressing the F1/Help key in any window will attempt to open the online reference manual to the page appropriate for that window.
- Experiment with the Load Fast and Keep in Memory Long options in the Image Object Library. If you have the memory to spare, these can reduce and speed up image loading operations during rendering.
- Most editor windows have an Undo all changes in this window button in the titlebar.
- Click on the Status Log [ALT+G] button on the lower toolbar to see the most recent messages from the Status Line.
- The Lock Active Item button on the lower toolbar will prevent the Active Item from changing inadvertently. If you can't get the Active Object to change, check to see if it is on.
- Your Render Options can have a different Frame Rate than the rest of your project. This would allow you to use several Render Options to produce NTSC (30fps), PAL (25fps) and film (24fps) versions of the same animation.
- For reducing network traffic when using a large number of Render Engines, set your Temp Path in your Render Options to a local drive.
- You can now output the same rendered image to multiple image formats automatically. See the File Output section of the Render Options Editor.
- You can now automatically add the preferred extension to your rendered images with the Add Extension checkbox in the File Output section of the Render Options.
- If your camera is looking down onto the terrain and trees are disappearing into the ground or steep hillsides, try checking the Render From Overhead checkbox in the Misc section of the Render Options.
- The Render Editor [ALT-R] can now schedule and consecutively render several Render Jobs in the same project. This is useful for 'multi-camera' action shots.
- Setting the CPU Priority in the Render Editor to Low is good for letting VNS render in the background while you continue to use your computer.

- Leaving the Show Rendering checkbox on in the Render Editor significantly slows down rendering. Turn it off when you are not using it.
- The Selected Job area of the Render Editor is good for checking that your render settings are correct before beginning a long render. You can use the Edit buttons next to the Camera and Options to further verify and correct settings.
- You can view time in VNS in either Frames or decimal seconds. Select your preferred type in the Units section of the Preferences window [CTRL =].
- Displaying large numbers of database items in the Scene at a Glance can be very slow, so VNS allows you to limit the number of items visible. This is controlled with the Max Database Items in S@G field in the General page of the Preferences window [CTRL-P].
- If you wish, you can prevent VNS from hiding inappropriate windows when switching task modes by turning off Matrix Task Modes in the Matrix Section [CTRL -] of the Preferences window.
- You can change your Project's Animation Frame Rate in the Project section of the Preferences window without damaging any key-frames!,
- Experiment with the two different styles of GL View Interaction in the Interaction section of the Preferences window. Users familiar with other 3D or CAD software may find one or the other more comfortable.
- If your project (or a project received from another VNS user) cannot find and load its DEMs or other components, check the DEM Directories [CTRL D] and Paths [CTRL E] sections of the Preferences window.
- If you move image files around, VNS will automatically search the directories it knows about to try to find them. If it cannot find them, it will ask you to locate them, and will remember that location for future searches.
- Customize VNS to your preferred working methods by selecting your favorite Units and notations in the Units section [CTRL =] of the Preferences window.
- VNS's file menu will list the names of the last six projects you worked on for quick and easy access.
- The import wizard is your friend. It will automatically attempt to recognize and help you load any types of data files it understands.
- The import wizard cannot directly work with files that are .ZIPped, .GZipped, .TARred, BINHEXed or otherwise compressed or archived. You will need to extract or decompress these files before using them in VNS.
- You can select multiple DEMs, Vectors and Control Points in the Database editor to perform the same operation to all of them.
- You can conform multiple vector objects or control points to existing terrain with the Conform to: Terrain button in the Database editor.
- If you have 2D vector objects or control points with no actual elevation, but have the elevation in the Name, Label or a Layer, use the Conform To: Name, Label and Layer buttons in the Database editor.
- If you can't find data that you've imported, try checking where it ended up with the North, South, East and West extents fields in the Database editor to see if you made errors while importing.
- You can do amazing things with images in the Image Object Library. Be sure to at least skim the reference documentation to appraise yourself of its capabilities.
- Make sure you check often for Online Updates at the 3D Nature Web Site. Bug fixes, improvements, optimizations, tutorials, components and more!,
- If a window gets buried behind others, select it in the Window menu to bring it back into view.
- You can set up and save common Gridding settings in a Terrain Gridder component.
- If you suspect that your GL View is not showing the most up-to-date information, try using the Force redraw keyboard shortcut (v) to redraw all GL Views.
- Create and save components from the projects you make so you can reuse them in future works, or swap them with other VNS users. Take credit for your work! Fill in the Email field so users of your component know who the creator was.
- It's a good idea to put usage and customization instructions into a Component's description when you Sign and Save it.
- The Library Browser area in the Component Library window will allow you to select multiple components from another project file and import them into your current project. This only works with project files from the same version of VNS.

- You can adjust the relative sizes of the upper and lower Scene at a Glance lists by grabbing and dragging the bar that separates them. The changes will be saved with your preferences.
- You can drag and drop items between the two Scene at a Glance lists.
- Clicking the Expand Scene at a Glance button at the top right of the upper list will widen the lists for better visibility and operation.
- You can grab and drag the right edge of the Scene at a Glance to make it bigger. Toggle back to the original size with the Expand Scene at a Glance button at the top right of the upper list.
- Try out the Show only enabled items and Show only animated items filter buttons at the top of the Scene at a Glance.
- You can clone an existing item in the Scene at a Glance with the Add or clone selected item button at the top.
- Some categories of items in the Scene at a Glance allow you to Enable or Disable the whole category.
- Task Modes allow you to reduce user interface clutter by hiding windows that are not appropriate for the Task Mode you are currently in. You can create new cameras from the View section of a GL View's popup menu.
- You can have several GL Views using the same camera, but with different Realtime items enabled.
- Typically all GL Views default to using a common Render Options but you can change this with Select Option Set in the View's popup menu.
- You can save a rendered image or a GL view to a file with the Save Displayed Image popup menu item. Rendered images can be saved in several formats. GL Views can only be saved in Window's 'native' format, BMP.
- When turning off Show Preview from a View's popup menu, answer 'Yes' to preserve diagnostic data. This will allow you to switch back to the Preview render by reselecting the Show Preview menu item.
- If you want to quickly change the Active Object or parameter numerically without opening its editor, try the Numeric Entry [ALT .] window.
- Keep your camera from running into the ground as you move it by turning on the Interactive Elevation Follow Terrain checkbox in the Camera Editor. There is a shortcut to this 'Make Camera Follow Terrain' in the General tab of the View Preferences.
- Orthographic cameras have no perspective. A mountain in the distance appears the same size as a mountain close up.
- Planimetric cameras flatten the world out for making maps.
- Overhead cameras always look straight down.
- Panoramic cameras will create a 360-degree cylindrical panoramic image, automatically stitched together, for each frame in your animation.
- The Horizontal View Arc controls how many radial segments VNS will render for a Panoramic camera.
- Selecting Realistic Lens Distortion on a camera will introduce curvature more like a real camera, but less like conventional 3D visualization software.
- Multipass Antialiasing and Motion Blur can add significantly to your render time, and should be used carefully.
- Depth-of-field can be a very convincing effect if used in small amounts. Large amounts can take a very long time to calculate.
- Camera Velocity distribution keeps your camera going a constant speed throughout your animation, with an optional ease-in and ease-out to start and stop. This can result in your animation timing appearing very different.
- Cameras can be instructed to target either the center or origin of a 3D Object.
- Any targeted or Align to Path camera can still look away from its target or path by using the Heading, Pitch and Bank controls.
- Make your camera automatically bank through your animation with the Create Bank Keys button in the Camera Editor. You can even tweak the banking manually.
- If you use Field Rendering, make sure you understand and use the proper Field Dominance for your playback device or your animation may jitter badly.
- You can quickly view images in any of VNS's supported formats with the View/View Image/From Disk... item in VNS's main menus.
- You can quickly view the last image you rendered with the View/View Image/Last Rendered... item in VNS's main menus.
- Key shortcuts can greatly increase your VNS proficiency. Most menu items list their shortcuts, and most icons will display their shortcuts in their captions if you leave the mouse motionless over them. There is a list of key shortcuts available in the online help.
- Priority and Evaluation Order are very important when you have multiple Terraffectors that overlap.

- You can use a texture to control the amount of effect of Terraffectors, and the amount of Roughness, for some very powerful techniques.
- You can rotate the whole planet and change its size in the Planet Options component. Default sizes for all our solar system's planets are provided, or you can set your own.
- The cross-section profile of a linear (non-Area) Terraffector is mirrored symmetrically on both sides of the vector it is attached to.
- Never use Variable Fractal Depth when making an animation. It will result in polygon sizes changing, and trees and foliage appearing and disappearing. Use Fractal Depth maps instead.
- Constant Fractal Depth is rarely used in animation, but is very helpful for making maps where you want uniform detail and foliage density throughout the whole landscape.
- Backface Culling can speed up rendering for stills, but in an animation it may result in trees disappearing as the terrain they stand upon disappears beyond a ridge.
- Maximum Fractal Depth can be controlled by a texture or a raster image, allowing for very powerful and precise control over level-of-detail in your terrain.
- Displacement mapping can be achieved on land or water by using a texture to modulate a Terraffector or by using a Roughness texture on the Waves in the Water Material of a Lake or Stream.
- Terrain morphing can be simulated by using an animated texture to modulate a Terraffector on existing terrain or even on a perfectly flat DEM.
- For subtle or dramatic effects, you can adjust the ambient light coming from the sky and from the ground separately in the Atmosphere component.
- Small amounts of haze and fog can greatly increase realism of natural scenes.
- You can use any image you like as a Celestial object and tint it to a new color if you wish.
- A good sky gradient can greatly affect the feel of a scene. Experiment in the Sky Editor.
- You can use textures to control clouds to make patterns or even shapes, images or logos appear in the clouds,
- You can use multiple Starfield components together with different densities and images to create a varied night sky.
- Starfields can sprinkle any image around your sky - not just stars.
- You can make a Celestial object automatically follow a light.
- Distant lights always point at the center of the planet and have no falloff.
- You can recreate the lighting conditions of a real place and time with the Set Position By Time button in the Light component.
- Using multiple shadows of different resolution in a scene is the key to good shadow results.
- You can set a 3D Object to be invisible but still cast a shadow if you plan on rendering and compositing the object using another 3D rendering program.
- Snowline feathering can make much more realistic snow regions and animated snowline changes.
- You can set the Snow Cannot Cover this Ecosystem checkbox on an Ecosystem component to keep areas such as roads and parking lots snow-free.
- Use textures and material gradients to vary the density and height of vegetation for extremely realistic results.
- Use the Distance Dissolve (and Dissolve Color) controls in EcoTypes and Foliage Effects to lessen the amount of distant foliage VNS must render with little noticeable difference.
- Foliage Effects and Ecosystem EcoTypes can now use Images and 3D Objects.
- When planting 3D Object vegetation, use the rotation variation (typically just the Y axis) for greater apparent variety.
- When placing Image object vegetation, use the Random Flip X option for greater apparent variety.
- Ecosystems with Constant Density (Stems per Unit Area) will give you accurate vegetation densities regardless of your fractal depth, but will take considerably longer to render.
- Double-clicking most image thumbnails will open the image in a separate window.
- Color Maps can be set to Color by Pixel (good for draping photos, but unable to control vegetation) or Color by Polygon (each polygon is a single color from the image, and can control vegetation growth).

- Color Maps with Randomize Edges turned on have rougher, more natural borders.
- You can automatically snap a Color Map to a DEM or set of selected DEMs in the Image Library's Georeference tab.
- Turning Luminous Colors on in a Color Map will allow you to pick unaltered color samples out of the rendered image to set up Ecosystem matching.
- You can automatically snap a Color Map to a DEM or set of selected DEMs in the Color Map editor.
- The order of Ecosystems in an Environment or in a Color Map component is very important when more than one Ecosystem could conceivably be placed at a given location.
- In the Color Map editor, you can easily grab an entire range of colors from an image to match to an Ecosystem.
- SHIFT-clicking the More Tips button will open the online reference manual to show all of the tips.
- You can digitize from any image that has geographic bounds (like a Color Map or bounded Texture Image) if you open the image for viewing from the Image Object Library or by double-clicking a thumbnail where it is displayed.
- Increase the Environment's Distant Foliage Intensity if you don't want small distant foliage objects to disappear.
- Use Image Object Distance Dissolve in the Ecotype or Foliage Effect Editors to speed up rendering if you have a lot of foliage in the scene.
- Use Constant Density Ecotypes to spread foliage more evenly between near and far parts of the scene.
- Use textures to create patterns of foliage.
- Turn on Render from Overhead in Render Options when the camera is oriented downward. It offsets foliage Z values slightly so that 2D foliage doesn't get clipped by the terrain.
- Celestial Objects can be linked to one or more Lights. An instance of the Object will appear at the position of each linked Light.
- Use Planimetric GL Views and rendered previews for the most accurate digitizing.
- To make a halo around a Celestial Object, attach it to a Light and in the Sky Editor set the second pin of the Toward and Away from Light Color Gradient to about 5% or less. Make the color of the first pin lighter than the color of the second pin.
- Use Foliage Effects to make floating signs, billboards and labels. Set the Effect's Elevation to the height above the terrain you want the sign or label.
- Hold down the SHIFT key to temporarily switch Interactive Style between Relative to Ground and Relative to Camera.
- Hit the ENTER key while a View is activated to create a key frame.
- VNS keeps track of key frame positions internally in units of seconds and fractions of a second. You can change the frame rate at any time without destroying the actual time positions of key frames.
- Each set of Render Options has its own independent frame rate so you can have one Render Job to record for film and another for video. Both animations will be the same playback length in real time.
- Use Connect mouse mode when you digitize to create rows of evenly spaced trees, fence posts or telephone poles. You can control the spacing between each point.
- Using Foliage Effects to place multiple 3D Objects will save both memory and time when using shadows but their shadows will not be as detailed as when you use 3D Objects attached directly to a vector.
- To export the whole planet as either a LightWave 3D or 3D Studio file, set the Reference Latitude to 90 degrees and the Reference Longitude to 0 degrees. That will prevent the planet from being rotated during export.
- You can sample Color Map Ecosystem Match Colors directly from the Color Map image. You can even sample a range of colors by dragging the mouse over the area to match.
- A good way to get realistic material colors is to sample them from a photograph. The Color Editor lets you sample single colors or color aggregates from any image you can view in VNS.
- Colors can be sampled from displayed images, rendered images, image thumbnails and color wells within VNS.
- When the Color Editor is open and set for sampling colors from images, clicking other color wells will sample the color well's color.
- Better textures will usually result if the Project Reference Coordinates are somewhere near the center of the terrain.
- You can set the style of interactive motion you prefer on the Interaction page of the Preferences window. LightWave users should find Relative to Ground to be most familiar. MAX users may prefer Relative to Camera.

- Hit [CTRL G] to jump to any frame in your animation.
- [ALT .] will open the Numeric Input requester for the Active Item.
- Holding the SHIFT key while hitting the Select button in the Layers section of the Database window will add Database Objects that match the selected layer to the selected list of Objects. Holding the CONTROL key while clicking will subtract selected items.
- Minimizing the VNS application while it renders can result in noticeable speed increases.
- When importing DTED files, try feeding the un-GZIPped .tar file straight to the Import Wizard without un-tarring it. You can even multi-select a number of TAR files all at once.
- The Measure tool on the Toolbar can give you straight line and great-circle measurements in views and renderings.
- Remember: Visual Nature Studio Training Seminars are held several times a year. Check the 3D Nature web site for details.

Appendix P: Data Compression Information

Many files received from the Internet or other data supply sources may be compressed to reduce storage requirements and speed data transfer. These files can usually be identified by their filename extension, typically .ZIP or .TAR or .GZ or something similar. VNS cannot read this data until it has been decompressed into its original form.

Visit the following web sites to obtain the various programs necessary to decompress the files typically associated with their file extensions:

- **GZIP (.GZ - Freeware)**

<http://www.gzip.org>

- **Unzip/Zip/WiZ (.ZIP - Freeware)**

<http://www.info-zip.org>

- **UnTGZ (.TGZ/.TAR/.GZ - Freeware)**

http://www.t-st.org/untgz_f.htm

- **7Zip (.7Z/.ZIP/.GZ/.BZ2/.TAR - Freeware)**

<http://www.7-zip.org>

- **WinRAR (.RAR/.ZIP/.GZ/.TGZ/.BZ2/.7Z - Commercial)**

<http://www.rarlab.com>

Additionally, the following websites may be helpful in learning more about compression and archiving software:

- **Compression FAQ (large, complex)**

<http://www.faqs.org/faqs/compression-faq/part1/preamble.html>

- **Quick reference to compressors and their file extensions:**

<http://www.faqs.org/faqs/compression-faq/part1/section-2.html>

Glossary

24 bit

Computer images are stored at varying color depths. The more color depth the more different colors that the image can contain. A bit is the smallest unit of memory available on a computer. It can have a value of 1 or 0. 24 bit images contain 24 bits of information for every pixel, eight each for red, green and blue color components. This allows a total number of colors equal to 2 to the 24th power or 16,777,216 different colors. This is near the limit that the human eye can discern. 24 bit imagery is the standard for professional computer artwork, although you may find 32 Bit files sometimes. These contain an Alpha Channel. (See also: Alpha Channel, Channel, Image, Pixel)

3D Object

In VNS, the term 3D Object refers to mesh data in Lightwave (.lwo), 3D Studio (.3ds), Alias/Wavefront OBJ (.obj) or AutoCAD DXF (.dxf), that has been imported into a VNS scene. You can texture and render these objects within VNS and even manipulate their position, rotation, scale and vertices. (See also: Object, Texture)

Aliasing

Also referred to in Computer Graphics circles as "Jaggies", aliasing is an artifact of the process by which images are created in a computer. Because the computer is working with a discrete number of rectangular units (or Pixels) on the screen, diagonal lines of any sort have to be created from a series of horizontal or vertical segments. This leads to noticeable steps in areas where there are diagonal boundaries between two contrasting shades, or where the computer is trying to represent sub-pixel detail. In animations, aliasing causes flickering, shimmering and other unpleasant artifacts. The process devised to overcome this problem is referred to as Antialiasing (See also: Antialiasing, Artifact, Pixel, Sub-Pixel)

Alpha Channel

The channel that stores transparency information in an image or animation is called the alpha channel. (See also: 24 bit, Channel)

Animation

VNS renders single images but they can be compiled into a moving sequence using professional video recording equipment or special computer software (and sometimes hardware). Once compiled into an animation, the individual images are no longer separate and are called frames. Animation refers both to the final moving imagery and the effort required to make it. VNS provides all the tools you need to create animated image sequences in either AVI or Quicktime formats. (See also: AVI, Frame, Quicktime)

Antialiasing

The process invented to reduce the visible effect of aliasing in computer-generated imagery. It works by "smoothing" diagonal lines by using a range of colors between the two that originally caused the aliasing. VNS 3 supports antialiasing in both Pixel Fragment and Multi-pass forms. Pixel Fragment rendering is new to VNS 3 and is the recommended antialiasing method. Multipass antialiasing is still available should Pixel Fragments prove insufficient or if you wish to apply motion blur to your rendered animations. (See also: Aliasing, Motion Blur, Multipass, Pixel Fragment)

Artifact

In computer graphics terminology, an artifact is any kind of visual anomaly that should not have been visible in the image. These can range from those caused by errors in the software or hardware of the machine, or from limitations in the manner by which images must be realized on a computer screen. The most common form of artifact is caused by the latter and is referred to as aliasing. (See also: Aliasing, Image)

AVI

Stands for Audio Video Interleave - An animation file format, most commonly found on the PC platform, but platform-independent. They require some sort of Movie Player software to view them. AVI files can be compressed or uncompressed (Raw data) - if compressed, in addition to viewing software, you must have also installed the necessary codec or codecs on your system (See also: Animation, Codec).

Background Image

VNS can composite an image behind the terrain it renders. It could be an image of clouds, a star field, another planet or anything else. This is called a background image. Background images can also be composited in front of the terrain or embedded in the terrain with the simultaneous use of Z Buffers. (See also: Compositing, Image, Z-Buffer)

Bitmap

When VNS renders an image it stores the color information for each pixel as it renders in a number of computer memory arrays. These are called bitmaps or together, the Bitmap. Each bitmap contains 1 channel of information. (See also: Channel, Image, Pixel, Render)

Camera

In 3D computer graphics the point of observation, the viewpoint is referred to as the Camera or Camera Point. It is the point in space from which you look at a scene. It can be animated along with the Target to create the sensation of motion. VNS supports multiple camera types, multiple cameras in a scene, and can create effects associated with real cameras such as lens distortion, motion blur and depth of field. (See also: Depth Of Field, Motion Blur, Target)

Channel

A channel of information is a set of per-pixel values representing aspects of the scene being visualized. The most common are the 3 channels found in 24 bit images: R (or the red channel), G (or the Green channel) and B (Or the Blue channel). Next most common would be the A channel (Alpha, or transparency). VNS supports writing additional channels of information to certain image formats that support it. These include channels such as distance (Z, or Z-buffer), Illumination, Elevation, Slope etc. Some channels may or may not be available for export, depending on the file format chosen. (See also: 24 bit, Alpha Channel, Pixel, Z-Buffer)

Codec

This word is short for Compressor/Decompressor and is a small piece of software designed to allow the compression and decompression of image sequences by animation software. For the most part they compress in a similar way to that in which JPEG compresses an image file. This loss of data (relative to the original source images) can result in visible artifacting in the resultant animation stream. (See also: Animation, Artifact, AVI, JPEG)

Color Maps

Images that are used to control the placement of color and texture on a landscape are called Color Maps. Each pixel in the Color Map represents a certain area on the elevation model. In most cases, the best results are gained if your Color Maps are at least the same resolution as the underlying terrain data. (See also: Image, Pixel)

Component

Any effect that can be saved as a stand-alone file for use in VNS is called a component. In versions of WCS prior to version 5, these were generally referred to as effects.

Compositing

The process by which multiple sets of image data are combined to form a single animation in which the elements within the various sets appear to integrate seamlessly with each other. In VNS this function uses Z-Buffer data and is provided as a Post Process. (See also: Image, Post Process, Z-Buffer)

Conifer

Trees that bear their seeds in cones and have needles rather than leaves are called conifer trees. Usually they do not shed all their needles seasonally so they look much the same in winter as in summer. Their shape tends to be conical.

Contour

Elevation data can be expressed on a map as a series of lines, each line being at a constant elevation. The lines are called contours and an area with contoured elevations is called a contour map. Contours are also known as Isolines.

Database

VNS keeps track of the names and drawing characteristics of all the DEM and Vector Objects in a scene. It does so by use of a Database which is stored as part of the Project file. The Database can also be saved separately. The Database contains the Vector Objects. It does not contain the actual DEM Objects, but it knows where to find the DEM files. (See also: DEM, Object, Project, Vector)

Datum

Any set of numeric or geometric constants from which other quantities, such as coordinate systems, can be defined. There are many types of datum, but most fall into two categories: horizontal and vertical. (See also, Ellipsoid, Geoid, Projection, Appendix A: A Lesson In Geography).

Deciduous

Trees which shed their leaves once a year are called deciduous. They tend to have crown shapes that are ovoid or spherical and branch patterns that are more irregular than conifer trees.

DEM

For computer terrain modeling the basic unit of data is the Digital Elevation Model or DEM. It consists of a grid of regularly spaced points with an elevation value for the terrain at each grid point. (See also: DTM)

Depth Of Field

An effect seen in real world cameras, where the focal length of the lens and other associated parameters cause only a certain portion of the scene to appear in focus. Objects become increasingly blurred as they increase in distance from this “zone of focus”. VNS can simulate this effect. (See also: Camera, Parameter)

Digitizing

The process of creating a Vector Object by placing points in geographic space. (See also: Vector)

Directory List

VNS can retrieve DEM data from anywhere on your computer system or network when it needs DEM data for display and rendering. To help it find the data there is a list of directories that tells VNS where to look. This is called the Directory List and is an essential part of VNS's operation. You can edit the Directory List on the DEM Directories page of the VNS preferences. (See also DEM)

Displacement Map

A Displacement Map is a texture used to shift the vertices or points in a mesh by varying degrees based on the values stored in the texture. VNS supports displacement for DEMs and 3D Objects. (See also: 3D Object, DEM, Texture, Vertex)

Dongle

Also known has a “hardware key,” it is a device connected to a computer that allows hardware-protected software to function.

DTM

Stands for Digital Terrain Model. Another (interchangeable) term for DEM (See also: DEM)

Dynamic Parameter

There is a special group of parameters, previously referred to as Terrain Parameters, which have now been extended and renamed. They are now referred to as Dynamic Parameters, and can be used to control the placement of textures through the texture editor interface. (See also: Editor, Parameter)

Ecology

The study of relationships between organisms and their environment is called ecology. Interestingly it is derived from the Greek word, oikos, which means house.

Ecosystem

An ecosystem to biologists is an interrelated group of organisms, both animal and plant, and their environment. An ecosystem includes the rocks, minerals, soil, bacteria, fungi, vertebrates, worms, grass, trees, shrubs, water, wind and sunlight and the interactions between all the organisms and their environment. In VNS we use the word Ecosystem loosely to mean one type of land cover, whether it be trees of various kinds, tundra, rock, or whatever.

ECW

An image format developed by ERMapper. ECW files are compressed using wavelet compression techniques that are far less lossy than JPEG while still reducing filesize. ECW files can be georeferenced. (See also: Georeference, JPEG)

Editor

There are many windows in VNS. Those that let you edit or modify any VNS component are called Editor windows. (See also: Component)

Ellipsoid

Since the Earth is not spherical, to make accurate measurements of features on the earth's surface, we have to use a more accurate model. The Earth bulges at the Equator and is flattened at the Poles. The effect is slight, but enough to have caused the ellipsoid to be adopted as the figure to approximate the Earth's shape.

An ellipsoid is a regular surface defined by mathematical computations. It is uniquely defined by specifying two dimensions, or variables: The radius at the equator is referred to as the Semi-Major or Equatorial Axis (or designated by the letter a), the amount of flattening is defined by a variable f, which is a measure of how closely the ellipsoid matches a perfect sphere. The value of f is determined by the following formula: $(a-b)/a$, where b designates the Semi-Minor axis (or that running perpendicular to the equatorial axis). (See also: Datum, Geoid, Projection, Appendix A: A Lesson In Geography).

Fractal

Anything which is similar to itself at all different scales is said to contain fractal properties. A landscape is to some extent a fractal surface in that at different scales of resolution you can see the same shapes. For instance a coastline seen from space has a scalloped appearance. From an airplane you see the same shapes although you are seeing the scallops within the scallops that you saw from space. When you stand on the beach and look down at your feet you see the same shapes left behind in the sand by the last wave.

Since digital elevation models are not perfect representations of the terrain down to the last grain of sand, we make use of their fractal properties to generate data at finer and finer granularities to fill in the missing detail. This is called fractalizing the terrain model.

Frame

Animations, like movies, are composed of a series of individual images flashed on the screen so fast that they blur into a moving picture. Every image in the animation or movie is called a frame. The speed at which the animation is displayed is called the frame rate. (See also Animation, Image)

Geographic Information System (GIS)

A new branch of computer science is emerging. It is the science and technology for representing data of all kinds in the form of two and three dimensional maps for spatial analysis. The data can be anything from the layout of transportation systems to demographics. The computer and software that displays and analyzes spatially-referenced data is called a Geographic Information System.

Geography

Geography is the science that studies the spatial arrangement of features on the Earth. The features include topography, landforms, climate, soil, vegetation, population, culture, industry, agriculture, and anything else that has a spatial distribution over the Earth. Sometimes the arrangement of the features themselves is referred to as the geography of an area.

Geoid

The Geoid coincides with that surface to which the oceans would conform over the entire Earth if free to adjust to the combined effect of the Earth's gravitational pull and centrifugal forces generated by its rotation. As a result of an uneven distribution of the Earth's mass, The geoidal surface is irregular but it is also the surface along which gravitational potential is everywhere equal, and to which the direction of gravitational pull is always perpendicular. (See also, Datum, Ellipsoid, Projection, Appendix A: A Lesson In Geography).

Georeference

A georeferenced file is one in which extra data (or "metadata") defines the position in 3D space (usually using a defined "real world" model) of that file. This is a common feature of much aerial and satellite photography which are often provided in GeoTIFF format. Georeferencing can be provided to certain of the other image file formats through the use of a "world file". The world file can be identified, as it will have the same filename as the image to which it refers, but a different extension (made up from the first and last letters of the image file extension, followed by a "w"). For example, the world file for a JPEG image file would have a .JGW extension. The worldfile for a TIFF image file would have a .TFW extension and so on. WCS does not automatically read or use GeoTIFF or World file georeferencing, but VNS does. (See also: GeoTIFF, Image)

GeoTIFF

A form of TIFF image that contains georeferencing information. Images of this sort "know" where they are located on the planet when loaded into software that can read the georeferencing information. VNS automatically reads and uses GeoTIFF or World file georeferencing. (see also: Image, TIFF)

Grayscale

A term applied to images which only contain 1 channel of color information. When viewed, they consist of a series of shades of gray, hence the name. (See also: Channel, Image)

HDR

Standing for “High Dynamic Range”, an HDR image is one in which not only are the color values of each pixel recorded, but also the luminance value. Thus each pixel has a measure not only of its hue, but also of its “brightness” or ability to illuminate other objects in the scene. If you think of an image of a sunlit sky - the sun itself will be represented as white, since the highest RGB value that can be set on a 24 bit display is RGB 255, 255, 255 or white. In fact, the sun has a much higher value than other white objects in the scene and an HDR image can capture this information. So, an HDR image can be used to accurately light a 3D scene. The pioneering work in this field was done by Professor Paul Debevec, and further information may be found at his website <http://www.debevec.org>. VNS supports output of this type of image for use in other 3D programs as a lightprobe or illumination map. (See also: 24 bit, Image, Pixel)

Horizon

The horizon is the point at which sky meets land in a view. VNS will compute where the theoretical horizon should be. It will be independent of any terrain features and will be rendered using the color set at 50% in the color gradient in the Sky Editor. (See also Editor, Nadir, Zenith)

IFF-ILBM

IFF stands for Interchange File Format and is the standard for many types of files on the Amiga computer. ILBM stands for Interleaved Bitmap and is a special kind of IFF file designed for pictures. The IFF-ILBM standard was designed by Electronic Arts, Inc., the makers of Deluxe Paint and pioneers in the computer graphics industry. (See also: Image)

Image

A picture rendered by VNS using all of the Motion, Color and Ecosystem Parameters, Render Settings, DEM and Vector objects is called an image or a rendered image. In more general computer terms, it is a collection of pixels, each of which contains a certain number of channels of information, depending upon the image format. (See also: Channel, DEM, Ecosystem, Parameter, Pixel, Render, Vector.)

Interactive

Adjusting Parameters such as the Camera position, sun location and haze distances by dragging an icon across the screen with the mouse is called interactivity or interactive modification of the Parameter. (See also: Camera, Parameter)

JPEG

Standing for Joint Photographic Experts Group (the group who devised the format), the JPEG format is an image type that uses lossy compression to reduce image size. When saving a JPEG, a compression rate is chosen and detailed data is discarded from the image file, reducing filesize. This can result in artifacts appearing in the JPEG, relative to the original source. (See also: Artifact, Image)

Key Frame

Special frames of an animation that are used as control points or knots on a splined motion curve are called key frames. You set the values you want honored at the key frames and all values at frames in-between key frames are automatically generated by VNS. These in-between frames are often referred to as “Tweens”, and the process of generating them, “Tweening”. (See also: Animation, Frame)

Latitude

The distance north or south of the equator measured as an angle or arc is called the latitude. It is measured in degrees with 0 being at the equator, 90 being at the north pole and -90 being at the south pole. (See also: Appendix A: A Lesson In Geography)

Layers

Layers in VNS follow the CAD convention rather than the drawing or paint program convention. They are groups of Database Objects not separate image planes. A Database Object can belong to multiple layers. (See also: Database)

Longitude

The distance east or west of Greenwich England measured as an angle or arc is called the longitude. Longitude is referred to as east or west depending on which way around the globe it is measured from Greenwich. The United States is west longitude, Asia is east. (See also: Appendix A: A Lesson In Geography)

Map

A map is a two dimensional projection of geographic information. It can be thought of as a view looking down on the Earth. North is generally at the top of a map. Objects like roads, streams and boundaries are represented by lines on a map. Terrain elevation information can be shown as contours, shaded relief or a gray-scale. (See also: Contour, Grayscale, Projection, Shaded Relief)

Material

A material is a collection of surface attributes organized into Channels (Diffuse Color, Reflectivity, Specularity etc). By changing the settings in these channels and by applying textures to them, a range of complex surfaces can be simulated for use on terrain models and 3D Objects. (See also: Channel, Texture)

Mesh

A mesh is a surface comprising of polygons. (See also: Polygon)

Motion Blur

When using a real motion picture camera, very fast-moving objects become blurred as they pass through the field of view. This is due to the camera's inability to "freeze" the motion because the shutter is open for too long, and the object moves a finite distance in that time. Motion blur is simulated in 3D animation software by calculating the distance moved by the object and blending together a number of "in between" positions to create the finished frame. VNS supports motion blur but only if using multipass antialiasing. (See also: Antialiasing, Frame, Multipass)

Motion Path

The movement of either the Camera or Target in VNS is considered to be along a motion path and is defined in terms of key positions through which a smooth curve is interpolated.

Morph

To morph means to change. In animation, it means to change from one value or set of values to another. This allows the rendered images to change over time.

Multipass

A type of rendering where the image is rendered multiple times, each time with a very slight offset. These separate passes are then combined to reduce antialiasing in the final image. (See also: Antialiasing, Image, Render)

Nadir

In VNS, the Nadir is the point in space directly below the camera. If your terrain did not exist, the nadir would be the portion of sky you would see directly beneath your feet! You can think of it as the diametric opposite of Zenith. It will be independent of any terrain features and will be rendered using the color set at 100% in the color gradient in the Sky Editor. (See also Camera, Editor, Zenith).

Object

In VNS the word Object has a specific meaning. It is anything represented in the Database which will be seen in rendered images or maps. Objects include three categories, Vectors, Control Points and DEMs.

Vector objects represent such things as roads, streams, boundaries and the outlines of DEMs. Control Points are elevation values. DEMs are the terrain elevation data.

The word Object alone does not refer to 3D Objects, which consist of mesh data imported from another software product. (See also: 3D Object, DEM, Vector)

Parameter

Parameters are values that you can change. Many of them can be varied over time, using key frames (see above) to create animations. Parameters are stored in the Project file. (See also: Dynamic Parameter, Project)

PICT

The PICT format is the native image format on Apple Macintosh computers. It was developed in 1984 by Apple to store either raster or vector imagery in one format. VNS supports loading and saving of this format, but only in Raster form. There is no support in VNS for the vector form of PICT. (See also: Image, Raster, Vector)

Pixel

A Pixel is the smallest on-screen piece of computer images. It is rectangular and can be square or elongated, depending on the display format. Each pixel is a single color, but may contain other channels of information as well. Multiple pixels together make up a complete image. It is from this concept of a “picture element” from which the name Pixel was drawn. (See also: Channel, Image)

Pixel Fragment

A rendering method designed by 3D Nature which calculates the lighting and rendering of the scene using sub-pixel elements (or Pixel Fragments). Once they have all been evaluated, these Pixel Fragments are combined to determine the final pixel color. This provides antialiasing without the render time of multipass rendering techniques. (See also: Antialiasing, Multipass, Pixel, Render, Sub-Pixel)

PNG

PNG (pronounced “ping”) stands for “Portable Network Graphics”, a format for storing raster images on computers. The nicest feature of PNG (although there are many) is it’s compression which is proprietary and lossless, in other words, there is no loss of data integrity but a reduction in filesize. This is in contrast to the lossy compression used by JPEG, for example. (See also: Image, JPEG)

Polygon

Polygons are surfaces defined by the placement of 3 or more vertices. 3-point polygons are sometimes referred to as Trigons, and these are the kind used to create meshes in VNS. Polygons with 4 points are referred to as Quads and are used in programs that support Subdivision Surface modeling tools. Polygons with more than 4 points are referred to as n-gons and are not supported by all 3D products. VNS will render 3D objects comprising of quads and n-gons, but render errors may occur where the polygons are non-planar (ie: not completely flat). Trigons are by their very nature flat, and so should always render as expected. (See also: 3D Object, Polygon, Vertex)

Post Process

Any effect that is applied to an image after it has been rendered is referred to as having been applied “in post”, or as a Post Process. VNS now provides you with Post Process components that can be used to create special effects in your rendered output. (See also Component, Image)

Project

A project includes Components, Vector Objects, the Database, Preferences, interface configuration information, the paths to any DEMs needed by the Project, and the names of any other files and directories that VNS uses to create a scene, image or animation. A project is stored in a Project file, frequently with the suffix “.proj.” DEM data is stored in separate files that can be used by many projects. Optional files are also stored separately. (See also: Component, Database, Digital Elevation Model, Vector.)

Projection

Also known as “Map Projection”, this is a mathematical model that transforms the location of features on the Earth’s curved surface to locations on a two-dimensional surface. There are many different types of map projection, but they all distort distance, area, shape, direction or some combination thereof.

Quicktime

Quicktime is a multimedia development, storage, and playback technology from Apple. Quicktime files combine sound, text, animation, and video in a single file. Using a Quicktime player that either comes with a Web browser or can be downloaded from Apple or the browser company, you can view and control brief multimedia sequences. VNS supports the export of animations to the Quicktime Movie format directly. (See also: Animation)

Raster

Raster, or bitmapped images are images in which the image data is defined by discrete areas of color (and possibly other information) called pixels. These pixels store channels of information in a 2D array of pixels called bitmaps. Hence, "Bitmapped Image". They are in contrast to vector images that store their information in a mathematical, resolution-independent manner. (See also: Bitmap, Image, Pixel, Vector)

Relative Elevation

Relative Elevation is information about the concavity (valleys) and convexity (ridges) of a terrain model. VNS uses the Relative Elevation information to help determine where Ecosystems will be placed on the landscape according to Rules-of-Nature™. Relative Elevation is a channel of information, viewable in diagnostic displays, and can also be used as a Dynamic Parameter in the texture editor. (See also: Channel, Dynamic Parameter)

Render

Render means to create an image using the Objects, Parameters and Render Settings in VNS. Actually VNS creates the image, all you need to do is hit the Render button. An image file will be saved to your hard drive when rendering is complete. To render an animation you tell VNS to render a sequence of images or as an animation format such as AVI or Quicktime. You lay out the Parameters in advance using VNS's many windows, editors and interactive features. (See also: Animation, AVI, Editor, Image, Interactive, Parameter, Quicktime)

RLA

A raster image format originally defined by Alias/Wavefront. It has now been extended to support multiple channels of information. This format is supported by VNS both for import and export, and can be used in Post Process compositing. (See also: Channel, Compositing, Image, Post Process)

RPF

A new version of RLA, allowing multiple channels of information to be stored in one image file. VNS supports the import of RPF images for use in Post Process compositing. (See also: Channel, Compositing, Image, Post Process, RLA)

Rules-Of-Nature™

This is a method by which VNS distributes foliage and texturing on the terrain in a natural manner. For example, Rules-of-Nature™ can be used to control the maximum slope at which an ecosystem will "grow" or to tell the program to put more of a particular type of ground cover in valleys than on ridges. You can use these rules to simulate the effects of environment on foliage distribution. The foliage restrictions that Rules-of Nature™ use are particularly powerful when combining multiple Ecosystems into an Environment, as each ecosystem can grow in a particular ecological niche. With careful application of the Rules-of-Nature™, multiple ecosystems can automatically grow in natural distributions across the terrain.

Shaded Relief

Shaded relief is a way of showing a three-dimensional terrain model in a map or image. The shading simulates shadows that would be cast by the sun in the real world making the map appear 3D. Usually the light source is from the top left, or top right of the map so shadows fall on the lower sides of ridges. (See also: Image, Map)

Spline

Curve fitting is important in the creation of motion paths and other animated effects in VNS. Splines are smooth curves connecting the control points (key frames) constructed out of segments of cubic curves. (See also: Key Frame)

Sub-Pixel

Any detail in an image that is smaller than a single pixel in the rendered output is referred to as sub-pixel detail. Sub-pixel data in animations can result in artifacts. (See also: Artifact, Image, Pixel, Pixel Fragment, Render)

Target

In Visual Nature Studio an image is created by focusing the imaginary Camera (the viewpoint) at a point in space. That point is called the Target. It can be anywhere on, above or below the terrain, at the center of the Earth or out in space. It can be animated along with the Camera to create the sensation of motion. You can also assign a 3D Object in your scene as a Camera Target (See also: 3D Object, Camera)

Terraffector™

Terraffectors are displacement effects unique to VNS. Applied along a Vector, a Terraffector can change the shape of the terrain and at the same time apply new Ecosystem texturing on either side of the Vector. This lets you easily create roads, dams, stream beds, building sites and more. An Area Terraffector is another form of Terraffector that affects the terrain inside the shape of a Vector. Use them for things like mountains, lake beds and building sites.

Texture

A texture is a pattern, applied to the channels within a material. Textures allow complicated coloring of surfaces without requiring additional polygons to represent minute details. They are of two types: Procedural and Image-based. Procedural textures are mathematically-generated and of infinite resolution, while image-based textures are of finite resolution, based on the number of pixels in the source image. (See also: Channel, Material, Pixel)

TGA

An acronym (and file extension) for Targa images. This is a 24 bit image standard developed by Truevision for use on their 24 bit display adapters. A raster format, it stores color (and potentially Alpha) information in a lossless uncompressed format. (See also: 24 bit, Alpha Channel, Image, Raster)

TIFF

An acronym for "Tagged Image File Format". This is a raster image format, developed in 1986 by an industry committee chaired by the Aldus Corporation (now part of Adobe Software). Microsoft and Hewlett-Packard were among the contributors to the format. One of the most common graphic image formats, TIFF files are commonly used in desktop publishing, faxing, 3-D applications, and medical imaging applications. It is capable of storing images in lossless format, either compressed (using an algorithm known as LZW) or uncompressed. VNS supports both import and export of TIFF imagery, with or without georeferencing. Some types of TIFF have georeferencing information embedded within the file structure. These are referred to as GeoTIFFs. (See also: Image, GeoTIFF, Raster)

Topography

Topography is a general word used when talking about terrain elevations in an area. It means the elevation values of an area rather than a single point.

True Color

Sometimes 24 bit graphics are referred to as true color. It means that they are nearly as high in resolution as the human eye can distinguish. In actuality the real color spectrum is continuous but for computer use we sample the spectrum only often enough to fool the eye.

You may also see 16 bit graphics referred to as "true color." Even though there are fewer colors represented, 16 bit color is often good enough for onscreen representation of images. VNS renders in 24 bit color (unless outputting to HDR format, in which case the output is greater than 24 bit!), but some graphics cards let you use a 16 bit approximation of images and interface elements for faster display performance.

There are display cards that allow less than 16 bit color. Eight bit color is common. We highly recommend 24 bit color displays when using Visual Nature Studio. (See also: 24 bit, Channel, Grayscale, HDR)

U.S. Geological Survey (USGS)

The branch of the United States government responsible for assembling and disseminating maps and map data is the Geological Survey. They are a branch of the Department of the Interior. Most governments have something similar and they are a good place to start when looking for digital terrain data.

UTM

UTM stands for "Universal Transverse Mercator." It's a system of global position measurement similar to latitude and longitude. Unlike Latitude and Longitude it works in meters measured north and east within the nearest of a series of 60 standard reference zones. If you are using UTM coordinates, you must know the appropriate zone number for your data. (See also: Appendix B: Chart of UTM Zones)

Vector

Mathematicians define a vector as something with magnitude and direction. We use a more tangible take-off on that: a line, a point, a series of connected lines, or a series of disconnected points that represent some feature of interest on the landscape. Vectors are used in VNS to represent roads, trails, streams, boundaries, buildings, cities and the like.

Vertex

A vertex is a point. Vertices are used to define the corners of polygons, and thus define surfaces (either DEM or 3D Object). (See also: 3D Object, DEM, Polygon)

Z-Buffer

Distance information from the camera or viewer is generated by many 3D modeling programs including Visual Nature Studio. The information is used to determine which objects are rendered in front of which others and which are obscured. The distance information can be stored and written out to a hard disk when rendering is complete. The array of distance information is called a Z-Buffer. Z is the distance axis when rendering, hence the name.

Z-Buffers can be used to merge two separate images together in VNS. While one image is rendering, the Z information it is generating is compared to the Z-Buffer of the second image. Wherever the second image has lower Z values the second image is placed in front of the image currently being rendered and vice versa. This process is known as compositing and in VNS 3 can be performed as a Post Process event.

There are now a number of different image formats that can store this sort of information in their file structures. VNS supports RLA and RPF, both of which can include information other than just color on a per-pixel basis. (See also: Compositing, Pixel, Post Process, Render, RLA, RPF)

Zenith

Technically the zenith is the point in the sky directly overhead. It will be independent of any terrain features and will be rendered using the color set at 0% in the color gradient in the Sky Editor.(See also: Editor, Horizon, Nadir)