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Introduction

"1.21 Gigawatts!!!"

- Dr. Emmet Brown, Back to the Future

Congratulations! You now own one of the best procedural terrain and landscape generators available on the market. It is the official successor to the powerful GeoControl, which was developed by Johannes Rosenberg in 2006 - and now, it has been comprehensively redeveloped from scratch by Stefan Kraus and Timo Armbruster from BiteTheBytes!

In 2013, BiteTheBytes and Mr. Rosenberg entered a partnership to further maintain and support GeoControl - a powerful procedural terrain generator. GeoControl was renamed to World Creator and in 2014 a more advanced and stable version was introduced, including a new filter system called "sediments."

However, it was clear that a completely overhauled version needed to be developed. A new version would have to be able to utilize new platforms and their features, such as generating the terrain on the GPU, or the capability to have a true 3D real-time view of the terrain throughout the entire design process. The usability and user interface design of this new version needed a new concept and further development as well.

You successfully purchased the result of the complete redevelopment of World Creator for the famous Unity Engine.

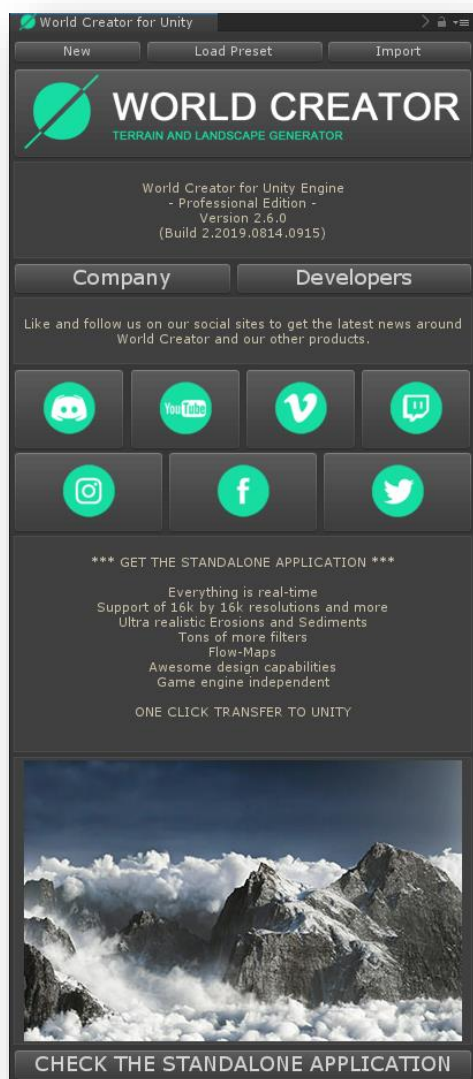
First Contact

“N O P E A C E”

- Captured alien, Independence Day

The World Creator plugin can be found under the Window menu inside the Unity Editor. This opens the World Creator window from which you can create new terrains or edit existing terrains. Several additional features will be explained in detail throughout this documentation.

The **New** button will create a new terrain. You can create and manage multiple terrains within a single scene.



Load Preset allows you to load an existing terrain preset which is stored as an XML data file. It is also possible to save a terrain as a preset (more on presets later). When loading a preset, the terrain is generated automatically.

With **Import**, you can use a heightmap in the form of an image (PNG and JPG) or RAW file (8-bit and 16-bit) which results in an automatically generated Unity terrain. In order to edit it with World Creator, you must set it as an Input Terrain of an existing Unity terrain - which has been created with World Creator within the World Creator window (see Input Terrain).

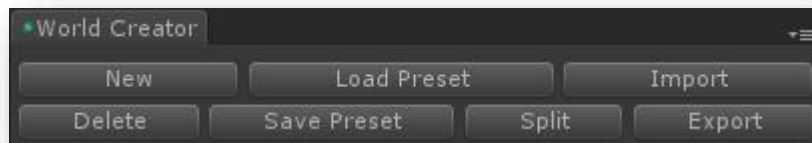
In addition to the terrain asset created, World Creator also attaches an XML data file which is used to store all settings of a terrain created by World Creator. This file is also used while saving temporarily. Every setting you change is stored inside this file. For this reason, each terrain object created with World Creator has a script attached to it which is used to store the file path location. You should not remove or delete that script; or else your terrain settings will be lost. This script has no impact during the game mode.

Each terrain you create with World Creator is a Unity terrain - 100% - which allows you to modify it with the Unity terrain tools or any other editor extension!

HINT

Before you can edit the terrain settings inside the World Creator window, you must select the terrain in the hierarchy list. At the bottom of the World Creator tab is a **Generate** button. Clicking the **Generate** button starts the generation process and your terrain will change depending on the terrain settings you selected.

Let's walk through each setting step-by-step. We will start with the World Creator menu in the World Creator tab as shown here:



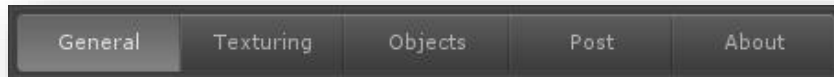
If you want to completely delete a terrain, please use the **Delete** button. This will delete the terrain object, along with the terrain asset, and the attached XML data file.

With **Save Preset**, you can save the terrain settings to a file of your choice. Changing the settings afterwards will still overwrite the temporary XML data file. The preset file you have saved before will not be overwritten while making terrain setting changes.

Use the **Split** button to split your terrain into multiple tiles. The tile slice can be defined in a separate window that will open after clicking on the slice button. Splitting a terrain into smaller areas (tiles) is important because it enables you to stream single tiles during runtime reducing memory bandwidth and increasing performance of your game. This is necessary if you have a very huge terrain which cannot be rendered at once during runtime.

With **Export**, you can save the height map of your terrain as **RAW 8 bit**, **RAW 16 bit**, **PNG**, **JPG**, and **OBJ** files. These formats enable you to import your height map into other applications, such as, 3DS Max, Maya, Blender, Cinema 4D, Mud Box, Terragen, Vue, and more. In addition, other game engines will be able to import your height map.

Below the menu, you will see a toolbar showing the available main setting selections which are important for the entire generation process:



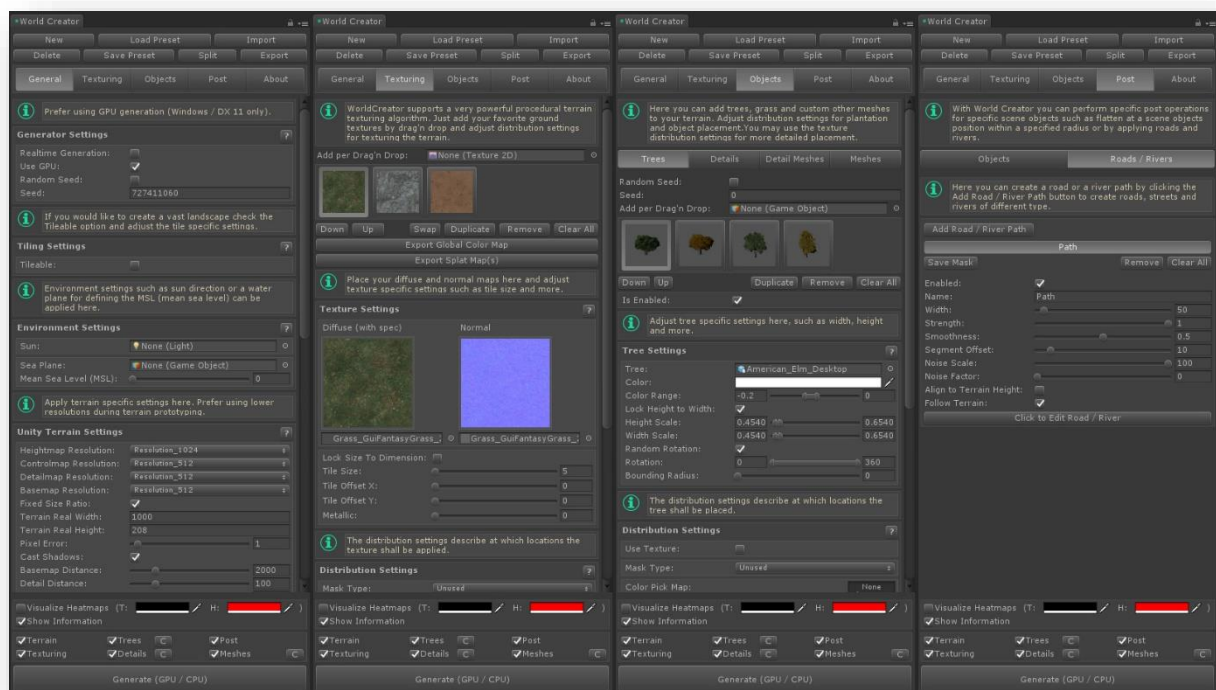
Under **General**, you will see the overall general terrain settings, such as, height map resolution, material, masks, terrain filters, and more.

Under **Texturing**, you will find all texture related settings, such as, texture maps, tile size, distribution settings, and more.

Under **Objects**, you will find all placement and distribution settings for **Trees**, **Details**, **Detail Meshes**, and **Meshes**. Each of these buttons contain further setting options for that object.

Under **Post**, you can create roads and rivers, or perform different post terrain operations, such as flattening terrain at a specific location (good for placing buildings).

About shows some company and product related information such as the version number, edition, links to our website, social sites, partners, and more.



Overview

General Settings

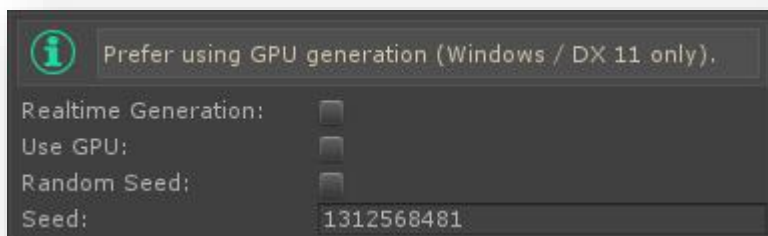
"You aren't afraid of the dark, are you?"

- Riddick, Pitch Black

The **General** button specifically shows all terrain generation settings. Hence, this section is the primary terrain generator - no texturing nor placement - only pure procedural terrain generation.

CPU vs. GPU

The next image shows some global settings that are independent of the terrain object, except for the seed value.



Make sure you have selected the **Use GPU** option if you are running World Creator on a Windows PC with a DirectX 11 capable graphics card. This enables terrain generation using the GPU which is several times faster than on the CPU.

On the Mac / OSX it is only possible to use GPU acceleration if the Compute Shader support was integrated into the Unity Engine.

GPU terrain generation is supported in the Professional version of World Creator only (Windows and a DirectX11 capable graphics card required)

Standard vs. Professional

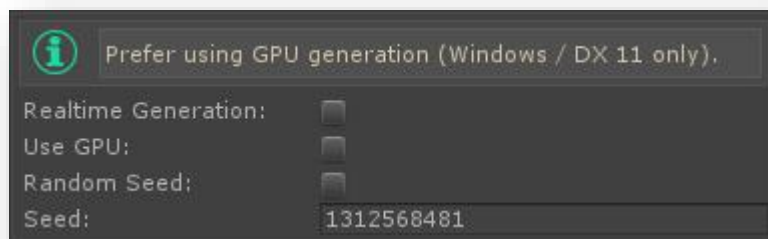
Real-Time Generation

If **Realtime Generation** is enabled (checkbox is checked), every time you change any type of setting within the World Creator window, the terrain is adapted in real time automatically. This option, however, is only available if GPU terrain generation is possible.

This feature enables you to see any changes instantly of your terrain. It also affects the terrain shape only, so no texturing nor planting is yet supported in real-time (we are working on this).

The Seed

The **Seed** Value influences the random number generator and can be set manually.

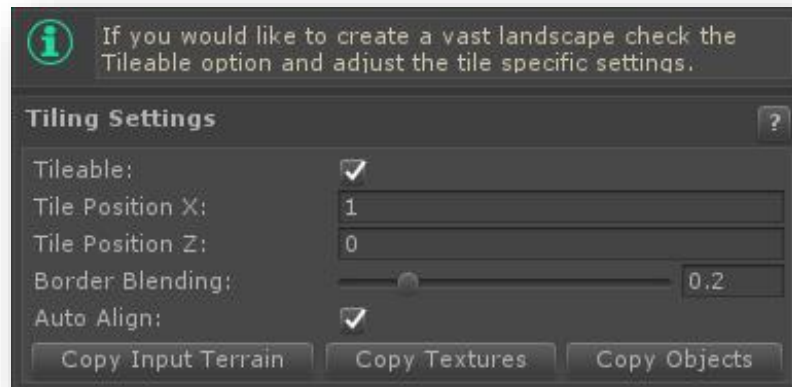


Check the **Random Seed** box if you want to randomly generate a new terrain each time you click on the **Generate** button.

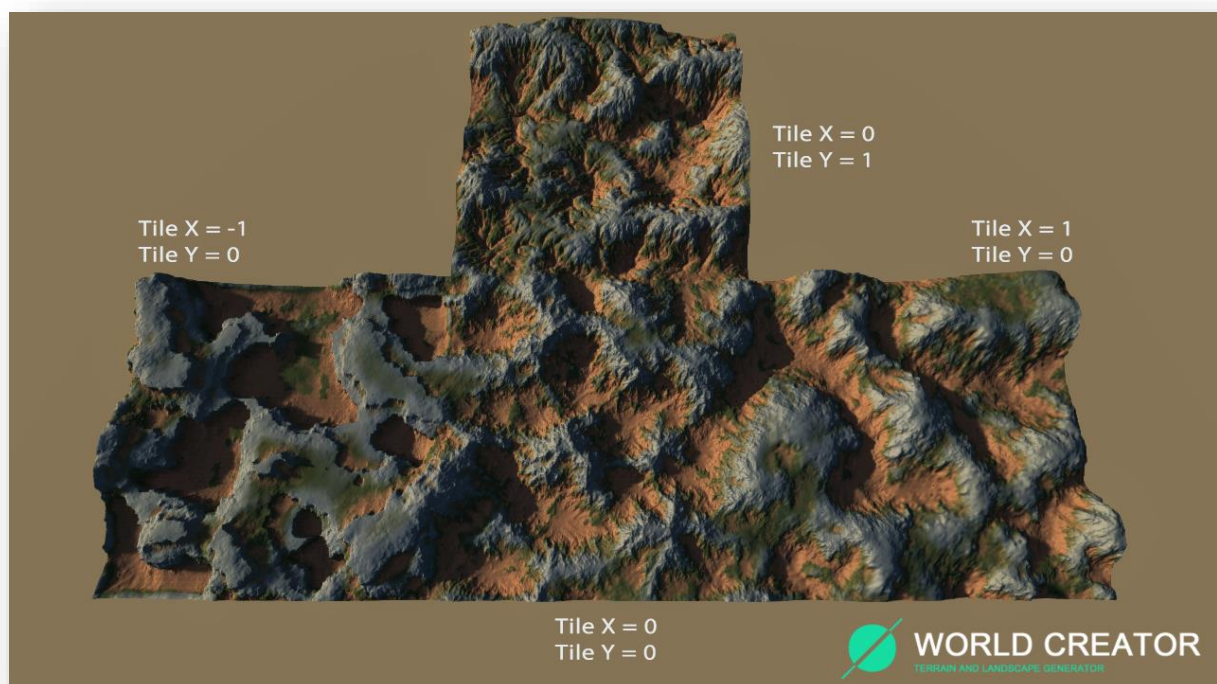
Tiling

This feature can be used to create vastly larger landscapes by creating multiple terrain tiles that fit together along their borders. World Creator's tiling system differs significantly with other terrain generators because it is capable of connecting tiles of different terrain types (e.g. biomes).

The settings for the tiling system are displayed as follows:



If you want your terrain to be considered as a tileable terrain tile, just check the **Tileable** option. You then can tell World Creator which index that tile should have using the **Tile Position X** and **Tile Position Z** values. For both values you can enter negative and positive integer values. Make sure to check the **Auto Align** option – World Creator will then automatically reposition your tile depending on the indices you have entered.



The **Border Blending** can be used to adjust the blending between each terrain tile. The larger the value, the better the tiles will fit along their borders; the smaller the value, the harder the borders will be.

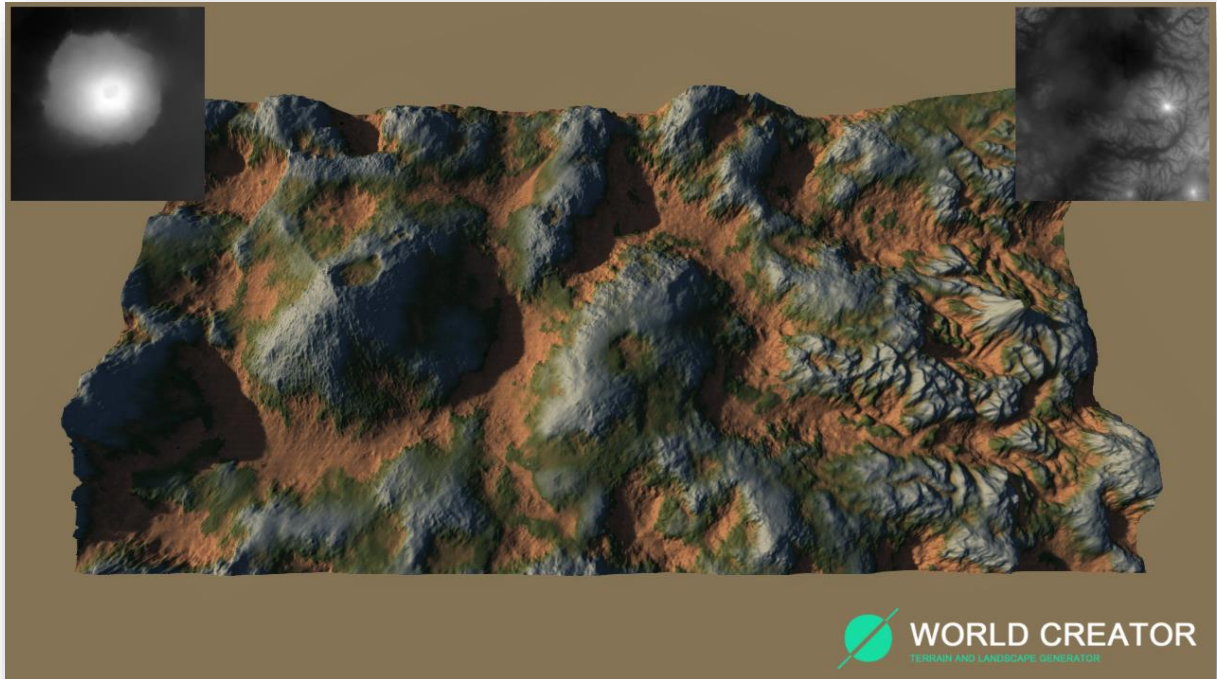
Each tile in World Creator is handled as a single terrain instance. This is because we wanted you to be able to create biomes across your terrain tiles. In addition, you are also more flexible in designing each tile. The drawback is that you would have to setup texturing, objects, and input terrain settings for each tile separately. That is what the **Copy Textures**, **Copy Objects**, and **Copy Input Terrain** buttons are used for. Once clicked, you can click on another World Creator terrain to copy its textures or objects settings.

When working with tiles, make sure to make the following settings identical across all tiles:

- Seed
- Heightmap Resolution
- Terrain Real Width and Terrain Real Height
- General Strength value of the Basic Filter
- Pixel Error

If this is not done, the borders will not fit together correctly. So every time the borders do not fit, make sure to check the above mentioned values!

World Creator's tiling system is also able to handle input terrain data for each tile. When using an input terrain make sure to increase the **Border Blending** value until the terrain looks suitable.



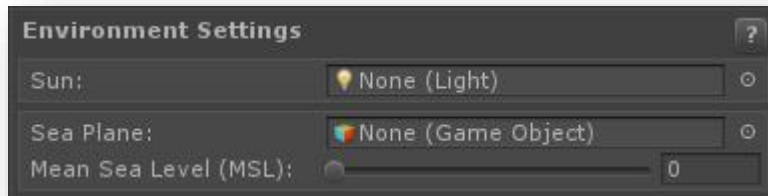
The terrain tile to the left shows the Olympus Mons input terrain (as texture) and the terrain tile to the right shows the Puget Sound input terrain (as texture) – both having been improved with several filters.

The Standard version of World Creator is limited to a total number of three (3) tiles in each direction (e.g. -3 to 3 along X and Z).

Standard vs. Professional

Environment Settings – Sun and Mean Sea Level

World Creator supports Sun and Mean Sea Level (MSL) dependent terrain generation, texturing, and object placement.



Simply drag and drop a Light in the Sun field and/or a Game Object in the Sea Plane field to enable that feature. If you do not have a Sea Plane Object, you also may use the Mean Sea Level (MSL) slider to adjust the desired sea level.

If both fields are set, you can use them for specific terrain generation, texturing, and placement. For example, you may generate a specific type of terrain below the MSL, another type of terrain above the MSL, or texture the areas of the terrain that are not facing the sun differently from the areas that do.

Resolution, Size, and Quality

The following settings affect the resolution, size, and visual quality of the terrain which will be generated.



The **Heightmap Resolution** sets the actual resolution of the terrain. The higher the resolution the more vertices will be used for displaying the terrain and its visual quality will increase accordingly. Be aware that when selecting a higher resolution, more data needs to be processed which causes longer terrain generation times and higher loads on the CPU and GPU.

The Standard version of World Creator is limited to a maximum resolution of 4096 by 4096 pixels. The Professional version supports a maximum resolution of 8192 by 8192 pixels.

Standard vs. Professional

The **Controlmap Resolution** plays an important role in texturing the terrain. It controls the blending of the different terrain textures. The higher the resolution, the sharper the blending, but the longer the generation process while texturing your terrain.



Controlmap Resolution 512



Controlmap Resolution 1024

The **Detailmap Resolution** is important when placing grass, flowers, and other details. A higher resolution results in smaller and more patches of details, but the longer the generation process when placing details.



Detailmap Resolution 512

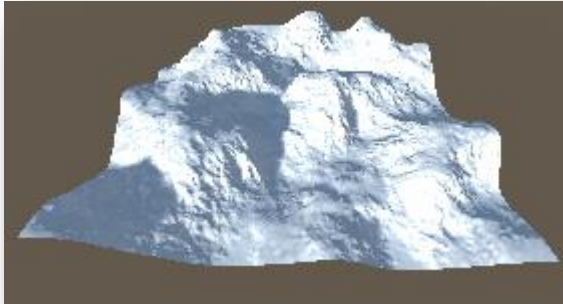


Detailmap Resolution 1024

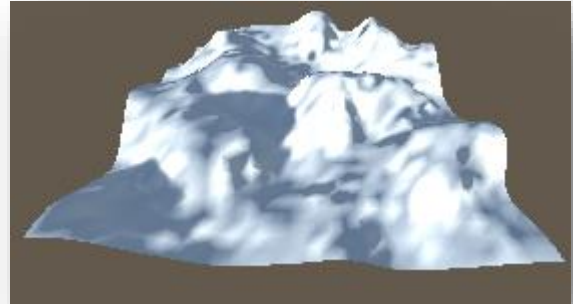
The **Basemap Resolution** describes the resolution of the composite texture used on the terrain when viewed from a distance greater than the **Basemap Distance**.

If **Fixed Size Ratio** is set, the ratio between **Terrain Real Width** and **Terrain Real Height** is kept equal. Uncheck it if you want to set different values for width and height. Both values refer to Unity units. If you set the values for **Terrain Real Width** and **Terrain Real Height** to 1000 by 208, the terrain object which is generated will have a width and length of 1000 as well as a maximum height of 208.

The **Pixel Error** describes the accuracy of the mapping between the terrain maps (height map, textures, etc.) and the generated terrain; higher values indicate lower accuracy, but lower rendering overhead.



Pixel Error of 1



Pixel Error of 15

Cast Shadows indicates whether the terrain will cast shadows. It is important to know that shadowing requires additional adjustments regarding the near and far plane of the camera (also the bias in lighting settings) so as to prevent artifacts.

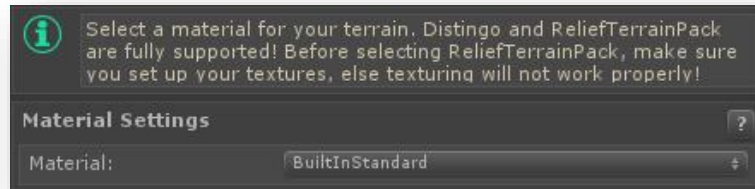
The **Basemap Distance** determines the maximum distance at which terrain textures will be displayed at full resolution. Beyond this distance, a lower resolution composite image will be used for efficiency.

The **Detail Distance** determines the distance from the camera beyond which details will be culled.

The **Detail Density** determines the number of detail objects in a given unit of space. The value can be set lower to reduce rendering overhead.

Material

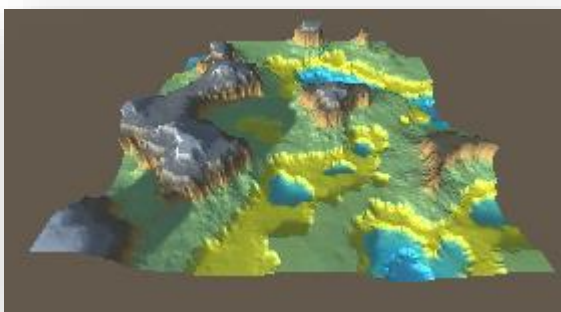
The material affects the visual appearance of the terrain. In addition to the Unity standard terrain materials, World Creator also supports the well-known **Relief Terrain Pack** (short **RTP**) and **Distingo** shader packages.



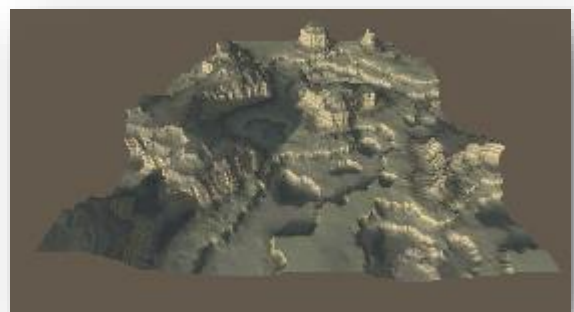
You can select among the following materials:

- Unity Built-in Standard
- Unity Built-in Legacy Diffuse
- Unity Built-in Legacy Specular
- LWRP
- HDRP
- Gradient
- Distingo
- ReliefTerrainPack
- Custom
- LWRP Custom
- HDRP Custom

The Gradient material colors the terrain depending on the terrain height.



Gradient Height Visualization

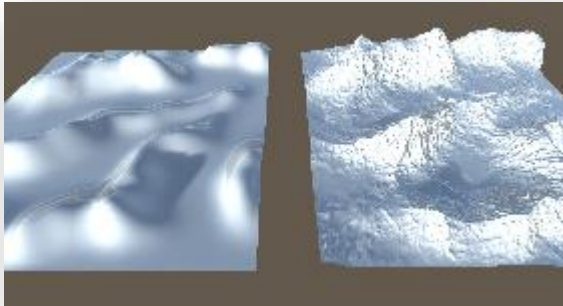


Custom Gradient

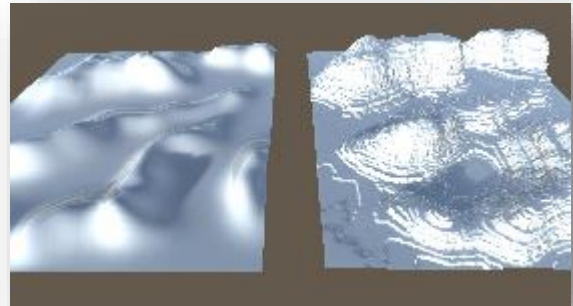
If you would like to use a custom terrain material, please select *Custom* and drag and drop your material into the **Custom Material** field (same for custom LWRP and HDRP materials).

Input Terrain

With the Input Terrain feature, you can enhance an existing Unity terrain with the World Creator filters without changing the basic shape. This feature can also be utilized for tiled terrains.

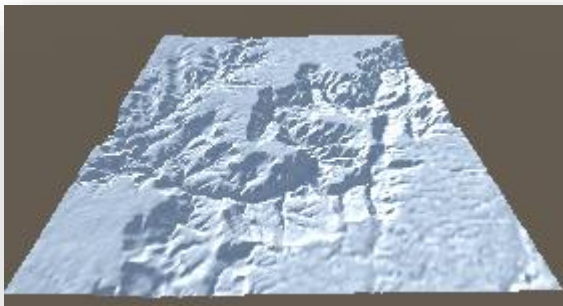


Existing Terrain – Enhanced Terrain Ridged



Existing Terrain – Enhanced Terrain Terrace

Another very good application is to import an existing height map and enhance it with specific World Creator filters (see below the Grand Canyon which was enhanced with the canyon filter of World Creator).



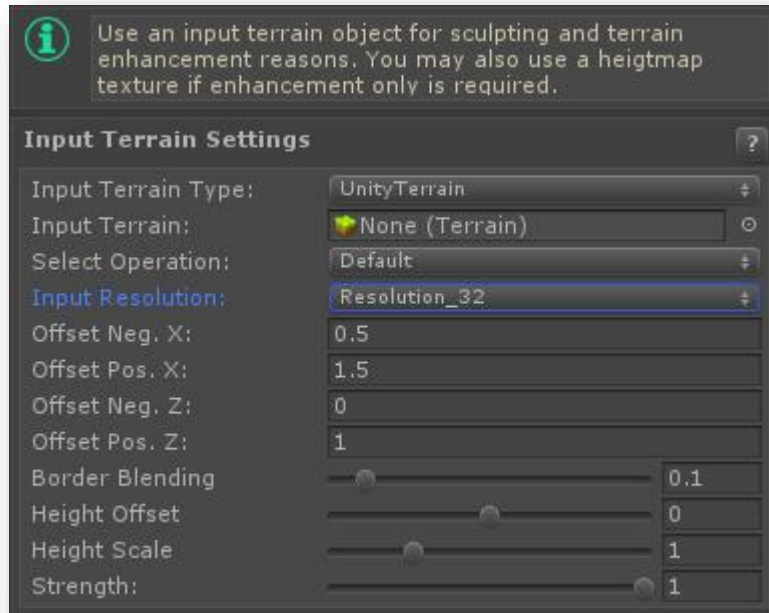
Imported 512 Heightmap



Enhanced with Canyon Filter 1024

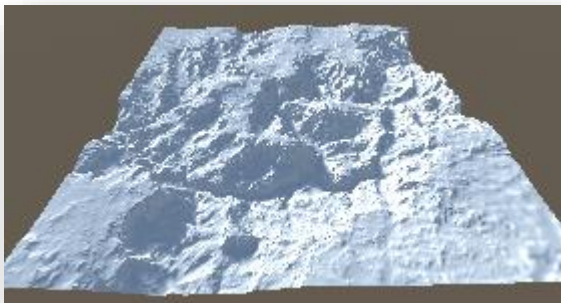
As you can also see, a higher resolution was used during generation which was applied on an imported low-resolution height map of the Grand Canyon without data loss and quality penalties. It is actually quite the contrary as the basic shape is kept and enhanced with this new feature.

There are unlimited possible applications and it is just that simple: **Input Terrain** in, enhanced terrain out!

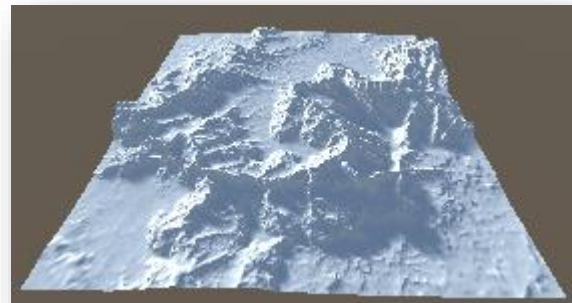


Input Terrain Type lets you select the type of **Input Terrain** that you want to set. Depending on the selected **Input Terrain Type** you either can use a *Unity Terrain* or a *Texture* as **Input Terrain** (use Drag and Drop). Be aware that if you select *Texture* as your type, you will need to apply a heightmap which is a grayscale texture. Those images typically encode 8 bits per channel so it might happen that your terrain will have a visible stair-like effect which is due to the low bit rate. Use a *Unity Terrain* object instead of an image to support 16-bit input values for World Creator – this gives you the best results.

The option **Select Operation** determines the mathematical operation that is used during the generation process. You can choose among *Default*, *Addition*, *Subtraction*, *Inverse Subtraction*, *Average* and *Difference*.

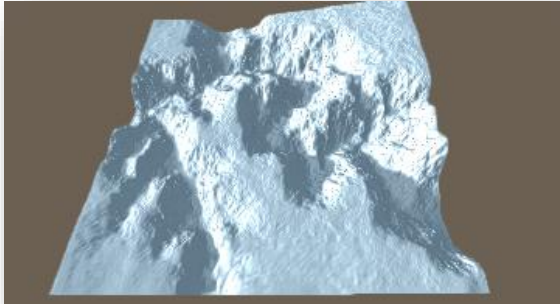


Average

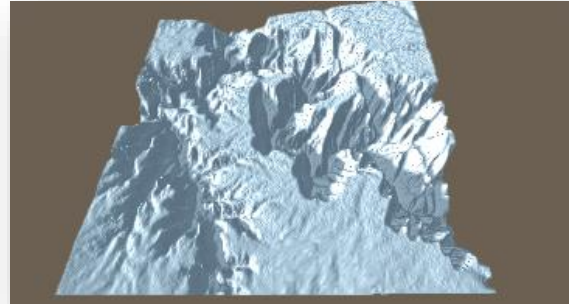


Subtract

The **Input Resolution** lets you decide which resolution of the Input Terrain shall be used by World Creator. The higher the resolution the more the original shape will be taken into account in the final result.

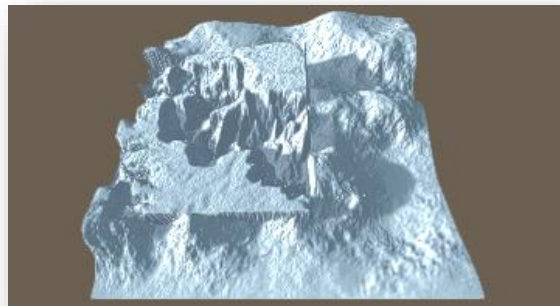


Resolution 32

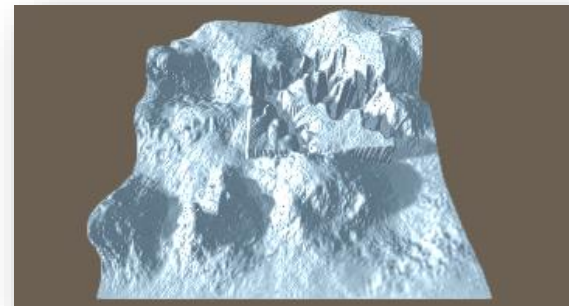


Resolution 128

With the **Offset values (Neg, Pos X / Z)** you can transform the Input Terrain when applied to the result.

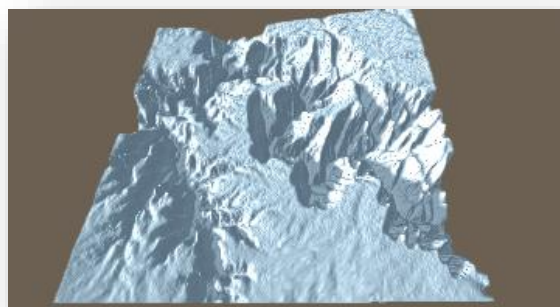


Downscale and Translate

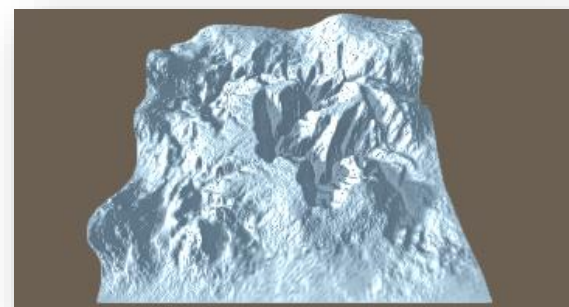


Downscale and Translate

The **Border Blending** performs a simple blending operation along the borders between the Input Terrain and the World Creator generated terrain. If you Terrain is not tileable, then please set this value to 0 to achieve the best possible result.

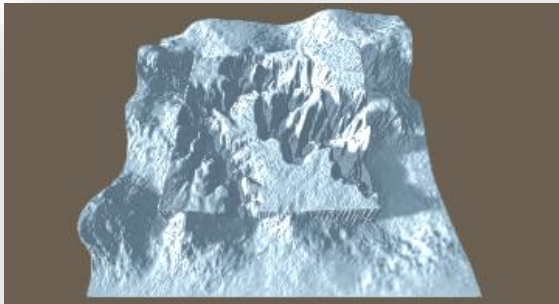


Border Blending 0

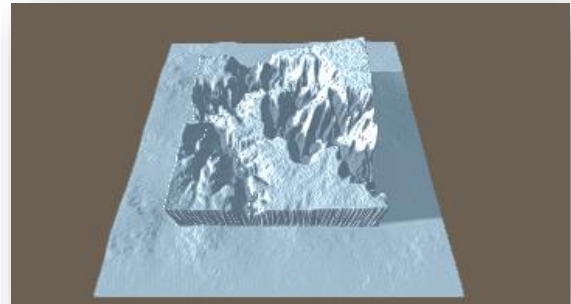


Border Blending 0.75

The **Height Offset** can be used to offset the height / elevation values of the Input Terrain relatively to the generated terrain. With **Height Scale** you can scale the height / elevation values of the Input Terrain.

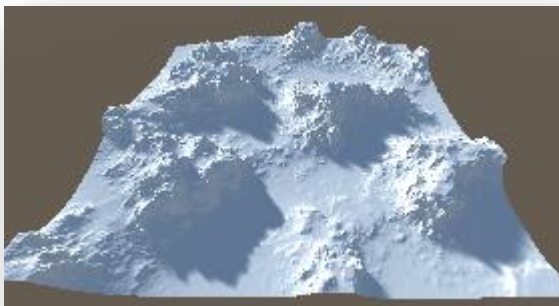


Standard

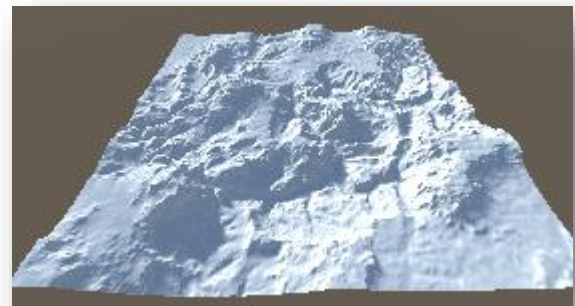


Height Offset and Height Scale set to 1

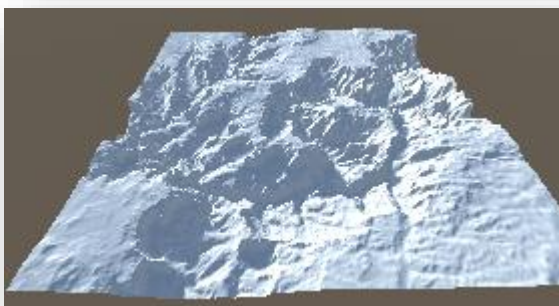
The **Strength** indicates how strongly the Input Terrain influences the terrain filters and therefore, the generation process. The higher it is; the stronger the Input Terrain's shape is kept.



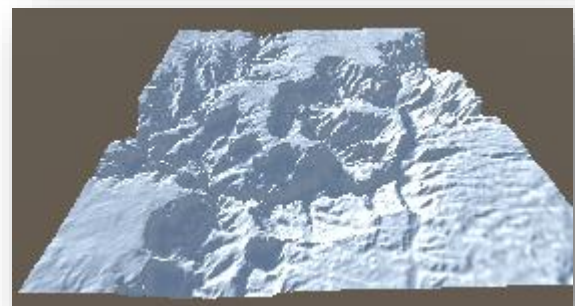
Strength 0% - Full Basic



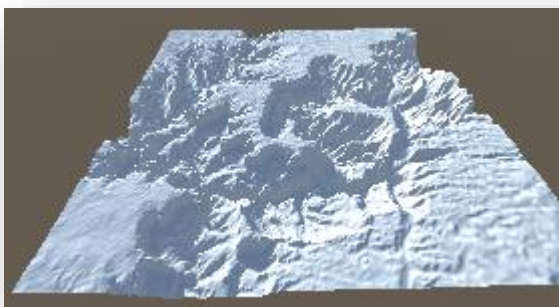
Strength 25% - 75% Basic, 25% Input Terrain



Strength 50% - 50% Basic, 50% Input Terrain



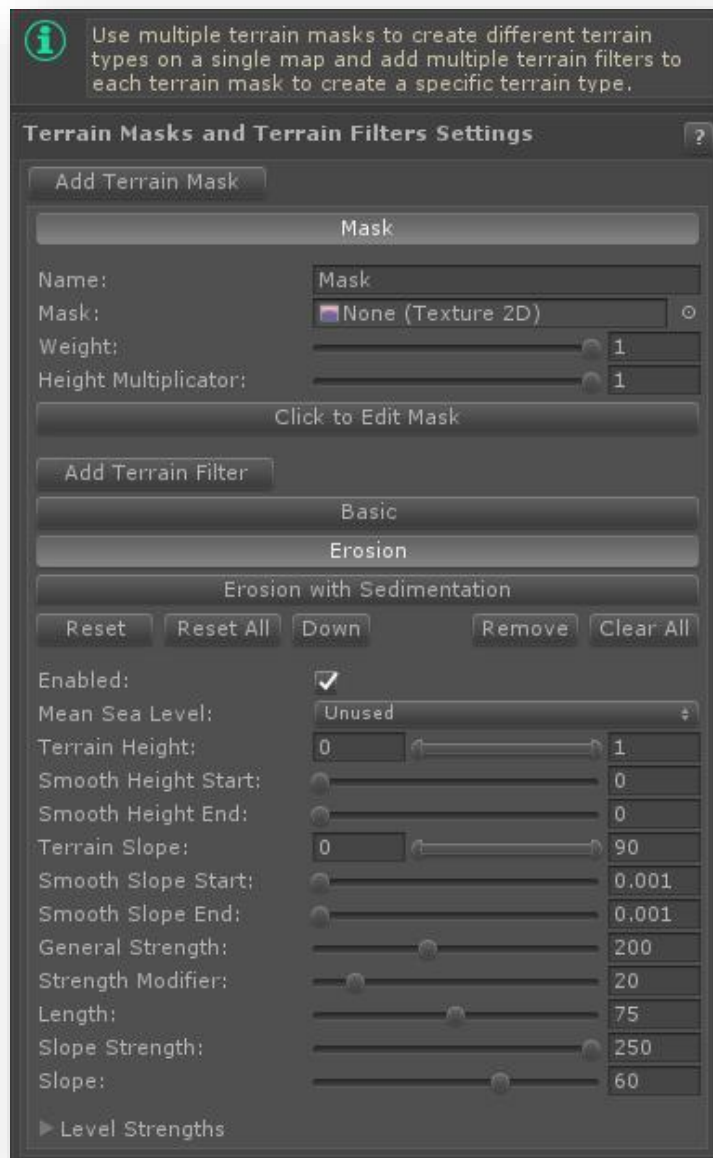
Strength 75% - 25% Basic, 75% Input Terrain



Strength 100% - Full Input Terrain

Terrain Masks and Terrain Filters

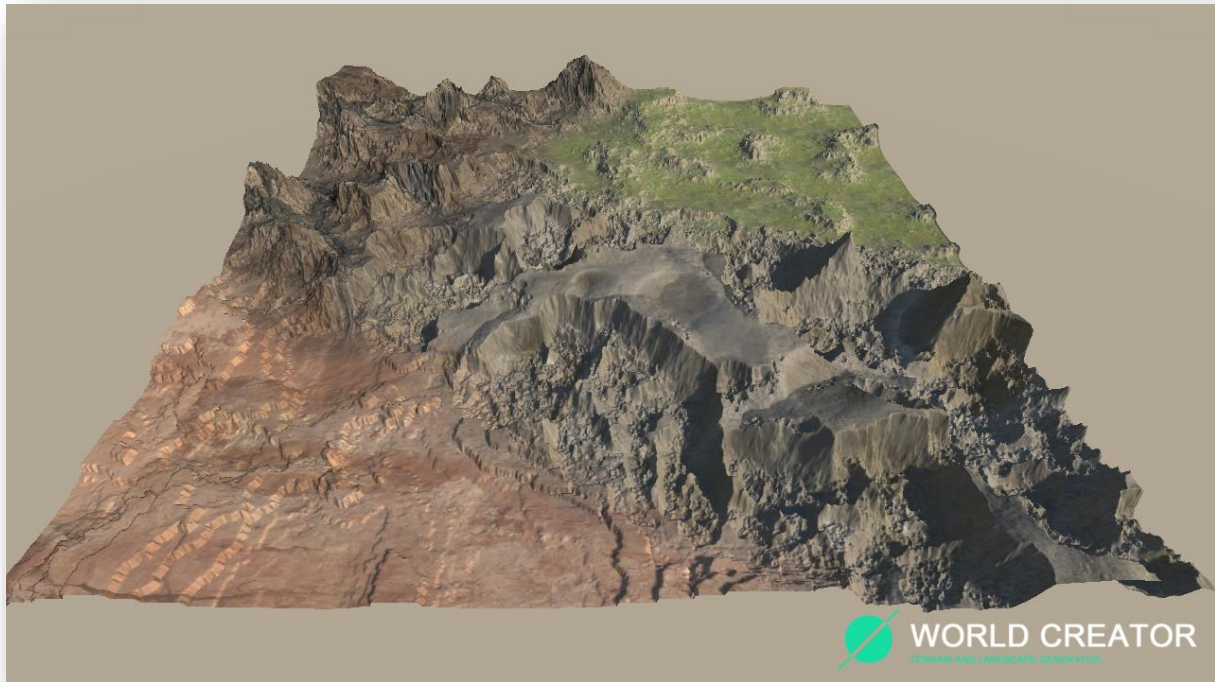
The well-known layer-based filter system of GeoControl has been largely adapted and improved upon in World Creator.



Basically, all modifiers that directly affect the terrain are contained in so called **Terrain Filters** (short filter) which can be combined with each other and further grouped into **Terrain Masks**. Every terrain modifier is a filter - regardless if it is used for applying erosion, sedimentation, or just to flatten the entire terrain. That is how this version is completely different from GeoControl / World Creator 1. The previous versions made a distinction between pre and post filters and therefore were limited in their capabilities.

The **Terrain Masks** are also new to World Creator. Primarily, they are used to create different terrain types on a single terrain map – a unique feature compared to other procedural terrain and landscape generators.

Using the Terrain Masks enables you to have deserts, canyons, terraces, and any other type of terrain applied to your map. The same masks then can be used for landscape generation such as texturing and object placement.



Multi-Terrain Type Sample

With **Add Terrain Mask**, you create a new mask and add it to the list of masks. It is recommended to set a proper mask **Name** which describes the mask usage (e.g. Canyon Area). The most important part about masks is the **Mask** Texture property which is used to identify the affected area. Make sure to apply a readable Texture (applies to all masks, see Unity documentation). It should also be a grayscale image. The higher the grayscale intensity (e.g. white for 100% intensity), the more terrain filters are affected by the mask.

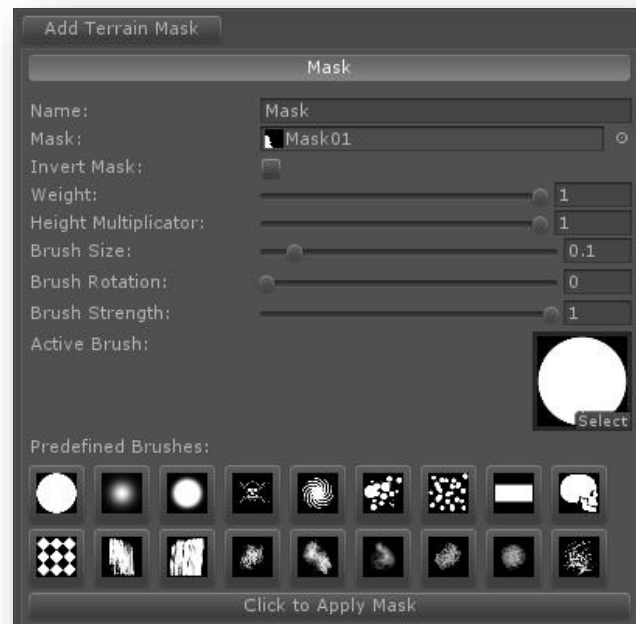
When applying a mask texture to the top-level mask (that is the first mask in the list), keep in mind that black areas of the mask texture will result in flat terrain without affecting any further filters! This is because the basic filter will not create any random number values.

HINT

The **Weight** property indicates how strongly the mask influences the generation of the terrain at the specified locations defined by the mask.

Use the **Height Multiplier** to adjust the terrain height at the specified locations defined by the mask.

With the **Click To Edit Mask** button, you can paint directly on your mask:



Brushes are grayscale images and World Creator ships with a default set of brushes that are located in the World Creator/Resources/Brushes folder. You can add your own brushes at any time by copying them into that folder. World Creator will list them automatically.

The **Brush Size** is a percentile value of the original image size. **Brush rotation** depicts the rotation while drawing on the terrain. **Brush Strength** indicates how strongly the brush is applied while painting.

When you are done with painting, use the **Click to Apply Mask** button. You may also just press the **Generate** (or **Confirm** button while in real-time mode) button.

The **Add Terrain Filter** button opens a new window where you can select among all available terrain filters. You can extend the list of terrain filters at any time by purchasing new terrain filter packs inside the asset store. Just place the DLL file of the downloaded filter pack into the Filters folder of your World Creator asset directory.

Reset causes the selected filter's properties to return to their default values. **Reset All** causes all current filters to return to their default values.

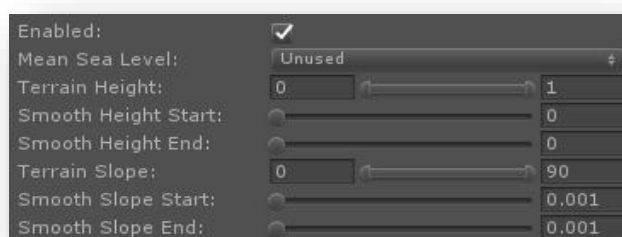
With the buttons **Down** and **Up**, you can change the order of the selected mask / filter within the Filters list. **Remove** will delete the selected mask / filter from the Filters list. **Clear All** removes all masks / filters from the Filters list - except for the top-level terrain mask and the Basic filter.

The step by step execution of the terrain generation process happens mask by mask, filter by filter, from top to bottom. Different ordering results in different terrain.

Terrain Masks are available in the Professional version of World Creator only!

Standard vs. Professional

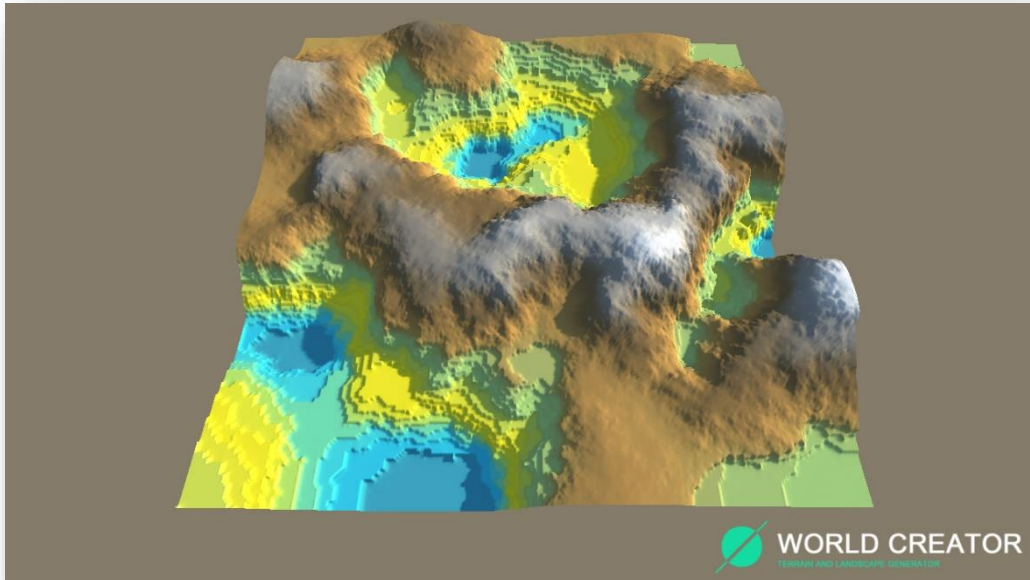
Each **Terrain Filter** has its own properties which may be adjusted to modify how the filter influences the generation of the terrain. Except for the Basic Filter, all Terrain Filters have the following very important settings available:



With **Enabled**, you can make a filter active or inactive. If enabled, the terrain filter will be used in the generation process; otherwise, it will have no effect during terrain generation.

The **Mean Sea Level** option selected determines whether or not, as well as how, World Creator should use the **Sea Plane** or **MLS** values set in **Environment Settings** above. Selecting an option other than **Unused** (e.g. **Below** or **Above**) will cause the Environmental Settings to be observed during generation. The minimum and maximum extents of the Terrain Height will be set according to the selected Mean Sea Level option.

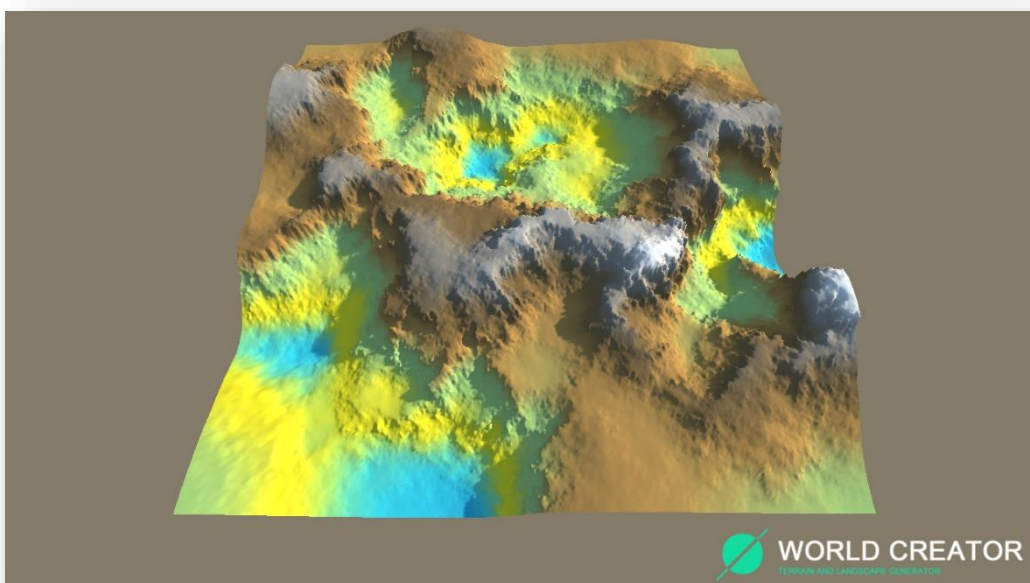
With the **Terrain Height** value – which is a normalized value in range of 0 and 1 where 1 is the maximum elevation value of the terrain - you can specify a height range that is considered for the selected filter. That means the terrain filter will only affect the terrain generation within this range.



Terrain Height Dependent Terrain Filter Sample

Use the **Smooth Height Start** and **Smooth Height End** values to adjust how softly or rapidly the filter's effect is blended into the terrain at the lowest and highest values.

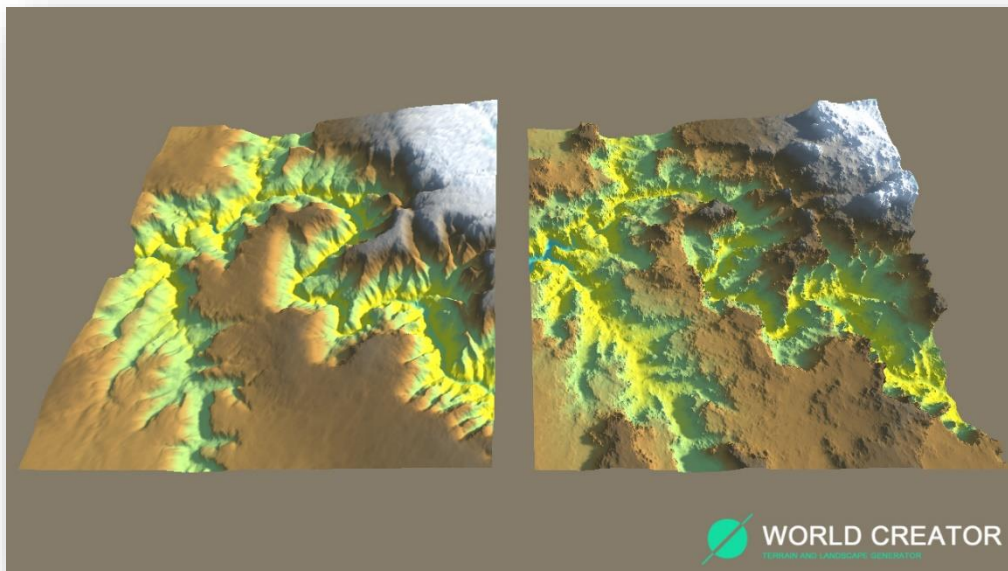
In Addition to **Terrain Height** and **Smooth Height Start / Smooth Height End**, you also have the option to take the **Terrain Slope** and **Smooth Slope Start / Smooth Slope End** into account. The selected filter will only be applied within the specified slope range in degrees.



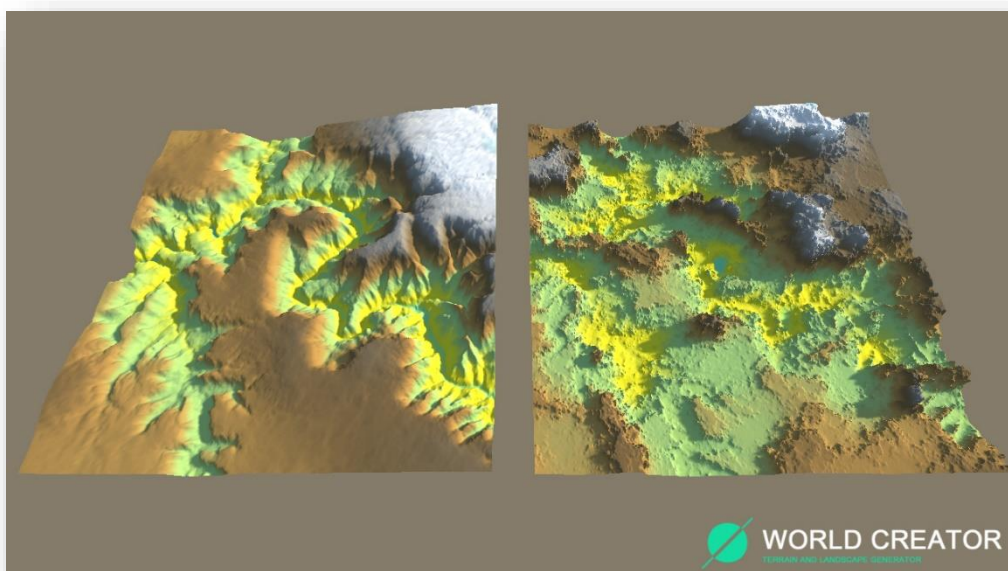
Terrain Slope Dependent Terrain Filter Sample

The Level Strengths have a direct impact on resolution strength per generation step and have a large effect on terrain granularity and shape. If you select a height map resolution of 512, there are 9 generation steps that have to be performed for each terrain filter. The higher the resolution, the more required generation steps there are. A generation step is always a power-of-two - starting at a resolution of 2 (2, 4, 8, 16, 32, 64 and so on).

Changing the base values may result in different terrain types - the possibilities are truly unlimited (see the two images below).

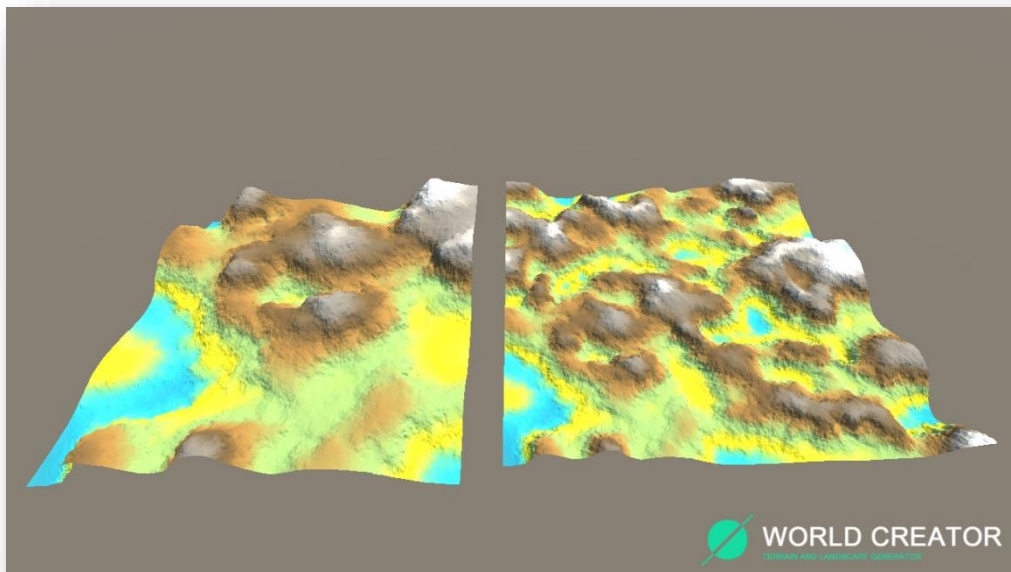


Different Level Strength Values



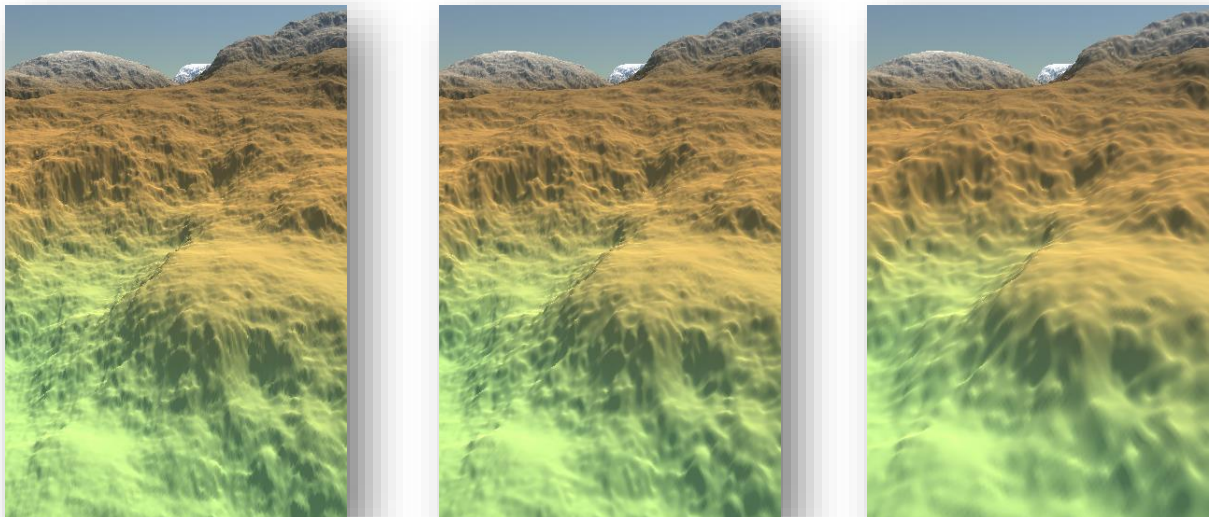
Different Level Strength Values

You would also use the Level Strengths to create a larger area for your terrain. All you have to do is set the Level Strength value of Level Strength 8 to 0. They will then be four times larger than previous.



Smaller area (left), Level Strength 8 set to 0 results in larger area (right)

The Level Strengths values also control the noise strength at a particular resolution level. To remove noise on higher levels, you must reduce the Level Strength (e.g. smoothing per resolution level):



Standard (left), Level Strength 4096 set to 0 (mid), Level Strength 2048 set to 0 (right)

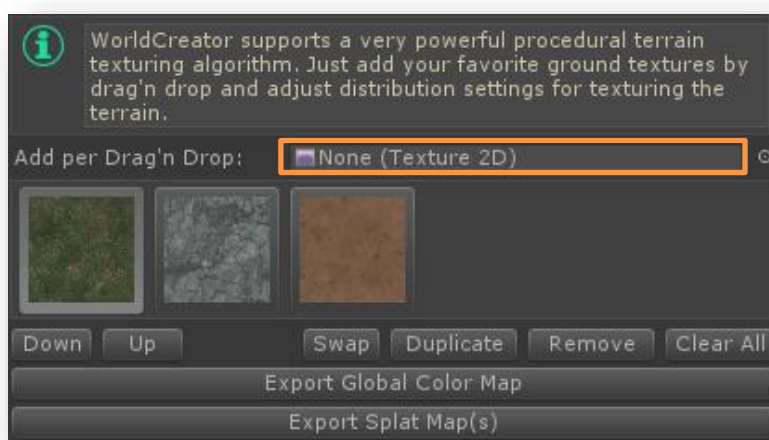
Texturing

"Don't worry, it's not a threat to you."

- Marla, *Fight Club*

With the latest version of World Creator, new options have been introduced which enable you to texture your terrain according to a variety of criteria.

To add a new texture, select a texture of your choice inside your assets folder and drag and drop it into the field labeled as **Add per Drag'n Drop**:



With **Down** and **Up**, you can change the layer (or priority) of a selected texture (in order from left to right). World Creator uses a layer-based texturing technique which means that a texture with a higher priority completely overlaps another texture with lower priority; so textures that overlap due to their distribution settings are not blended together unless you explicitly want that result. This leads to beautifully blended textures and perfect results.

With **Swap**, you can switch positions of two textures only - without switching the other texture and distribution settings associated with them.

With **Duplicate**, you can create a copy of the currently selected texture along with its texture and distribution settings.

Remove will delete the selected texture from the list and **Clear All** removes all textures from the list.

Export Global Color Map creates a PNG image file to be imported and utilized in other applications for basic terrain coloring. The color map is based upon the applied textures in your current configuration.

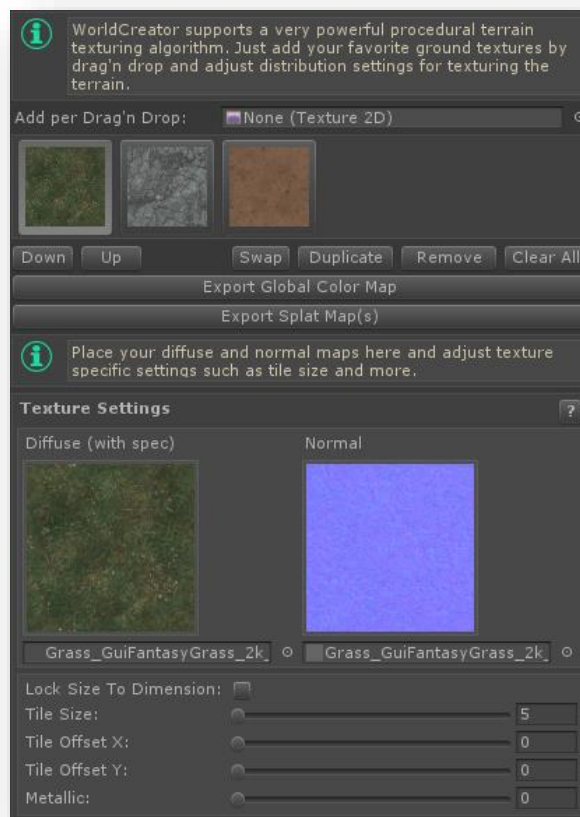
Export Splat Map(s) creates a PNG image file which contains red, green, blue, and alpha channel distribution information for a specific texture.

Texturing is further classified into:

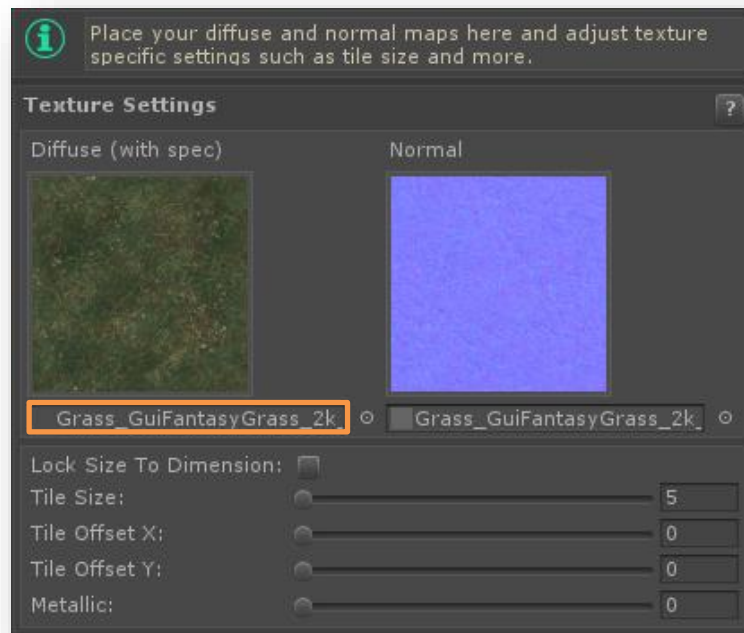
- Texture Settings
- Distribution Settings

Texture Settings

Here, you may edit the selected texture's diffuse and normal maps as well as specific material settings such as the **Tile Size**, **Tile Offset**, and **Metallic** values.



To change an already applied texture, simply drag and drop another texture of your choice from the assets folder into the appropriate field (see image below).



Depending on the material you have selected, some settings may or may not be visible:



If **Lock Size To Dimension** is checked, the texture image's dimensions will be mapped to the dimensions of the terrain without tiling (useful for global color maps).

The **Tile Size** determines the size of the tiles used during texture mapping. The larger this value, the larger the texture image being mapped is - relative to the terrain dimensions.

The **Metallic** value allows you to control the *micro-surface detail* or smoothness across a surface (see Unity Documentation).

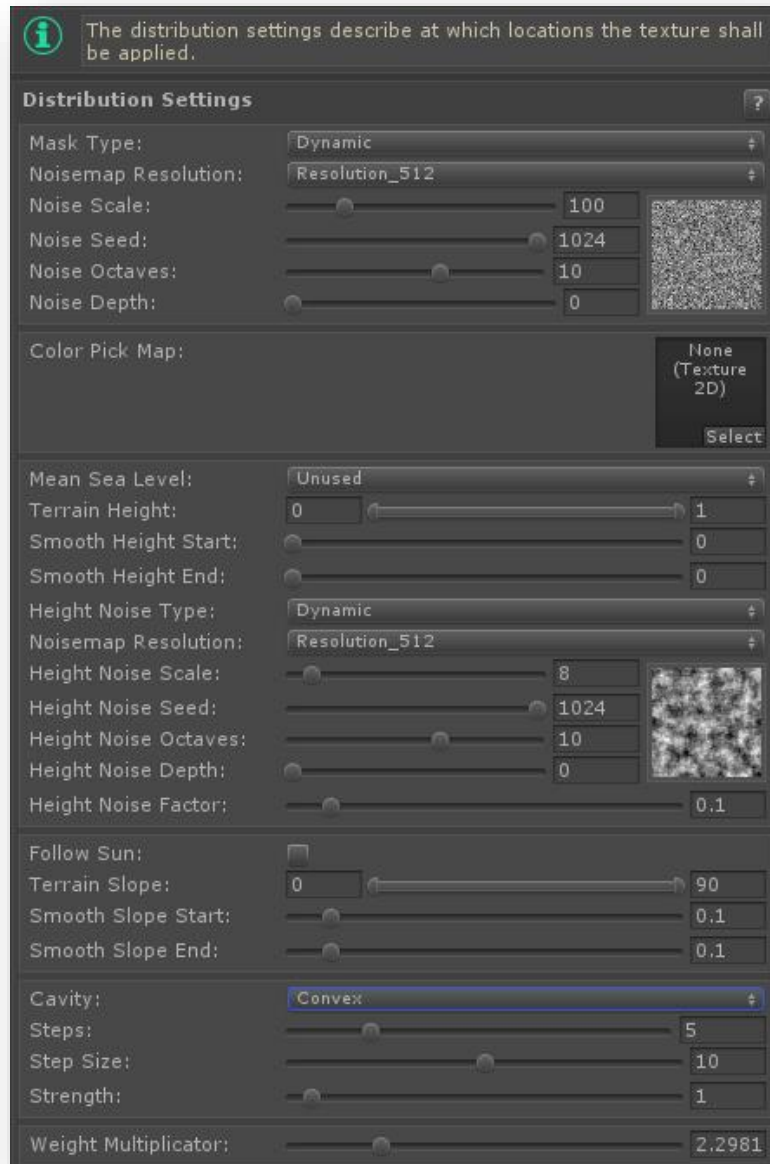
Tile Offset X and **Tile Offset Y** allows you offset the texture position.

If you select the Relief Terrain Pack material the settings for tile size, tile offset, and metallic must be adjusted using the RTP script component. Same for normal maps!

HINT

Distribution Settings

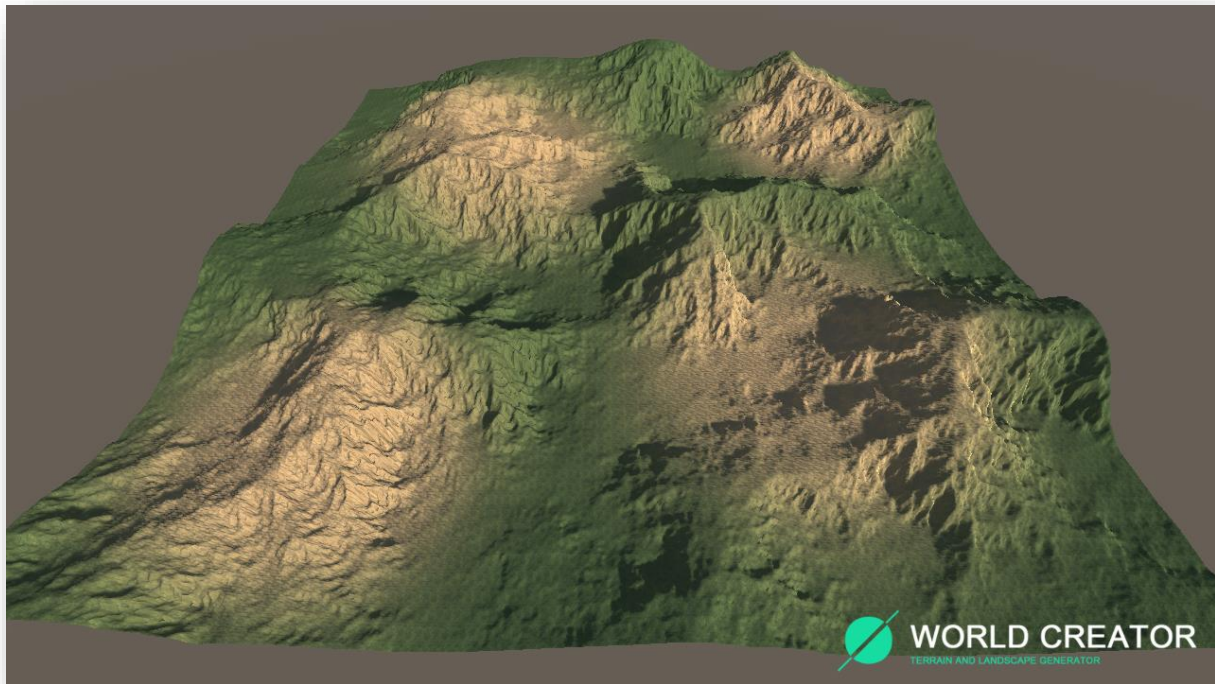
The distribution settings play a crucial role in realistic terrain texturing:



Masks can be used to enable mask dependent texturing. Keep in mind that masks should be grayscale images. Areas with high intensity have more effect on blending than areas with low intensity. Additionally, you may use the integrated dynamic Perlin noise map generator by selecting **Dynamic** under **Mask Type**. There is also a selection called **RoadRiver** which lets you apply a texture to a created Road or River (see Post Operations).

When selecting a **Static** Mask and after dragging and dropping a mask into the field provided, you will see some important values you can adjust. **Invert Mask** inverts the mask colors. The **Mask Threshold** controls the surrounding area of the more intense color value. You can use it to cull less intense areas. **Mask Contrast** lets you adjust the contrast of the mask.

The image below shows an example of using texture masks.

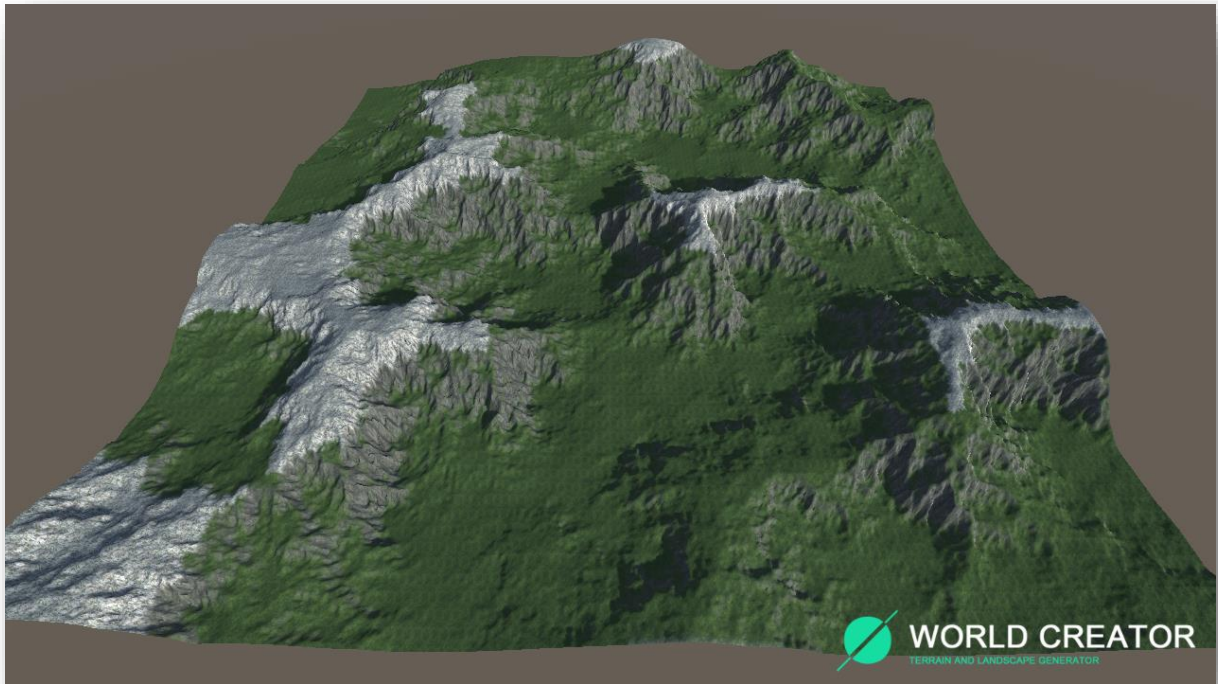


As you can see a single mask was applied to two different textures. The first texture does not invert the mask but the second does, resulting in perfect blending.

If a **Color Pick Map** is set, you can select a color which will be used as a look-up-color to apply the selected texture according to the location of the selected color in the **Color Pick Map**. This feature is useful if you apply a satellite image to the terrain and want to texture it or place objects depending on a specific color.

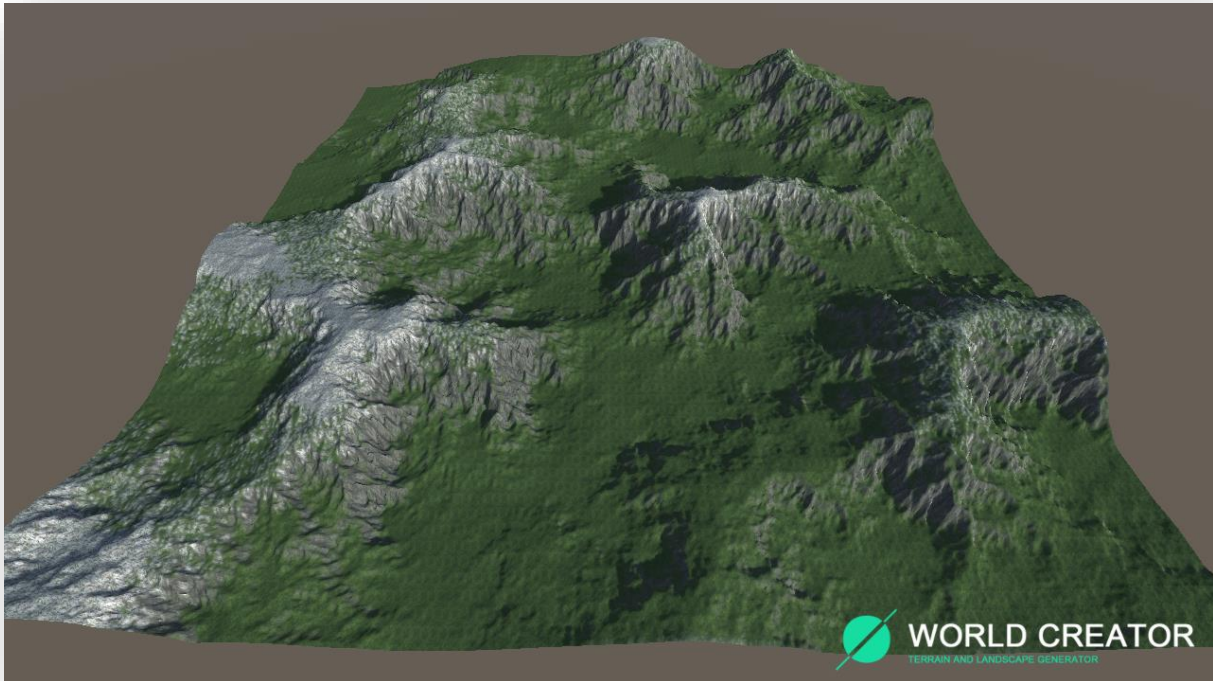
The **Mean Sea Level** option can be used to tell World Creator that this texture should be blended either **Below** or **Above** the specified Mean Sea Level (which can be adjusted under **General**). Selecting one of the possible values actually just locks the Terrain Height to the specified Mean Sea Level.

The **Terrain Height** specifies what height range the texture is used in. Use the **Smooth Height Start** and **Smooth Height End** value to smooth the terrain height ranges. To prevent the height value from forming a noticeable and visually unappealing border, you also have the option of assigning a **Height Noise Map** by dragging and dropping (you must select **Static** for Height Noise Type) an image into the provided field. The **Height Noise Factor** value defines the strength of the **Height Noise Map** during generation. This value can be used to create irregular and more natural looking transitions.



In the above image, a snow texture was used at a certain height. One can easily see that the transitions are very hard and abrupt.

The image below shows that a **Height Noise** Map was added and the **Height Noise Factor** adjusted. The transitions are now significantly irregular and look more natural.



Use the integrated Perlin noise map generator to create a Height Noise map by selecting Dynamic for Height Noise Type.

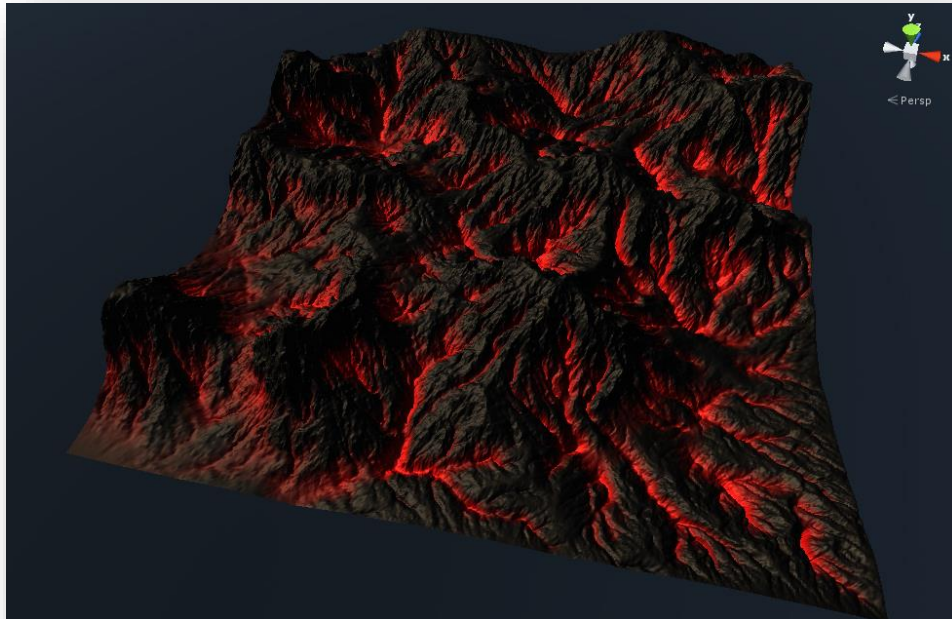
HINT

It is more comfortable to use a dynamically created noisemap for such a reason. With **Dynamic** selected for **Height Noise Type** you can create a noisemap on the fly by adjust the **Noisemap Resolution**, **Height Noise Scale**, **Height Noise Seed**, **Height Noise Octaves**, **Height Noise Depth** and the **Height Noise Factor** values. A preview window shows you how each value affects the result.

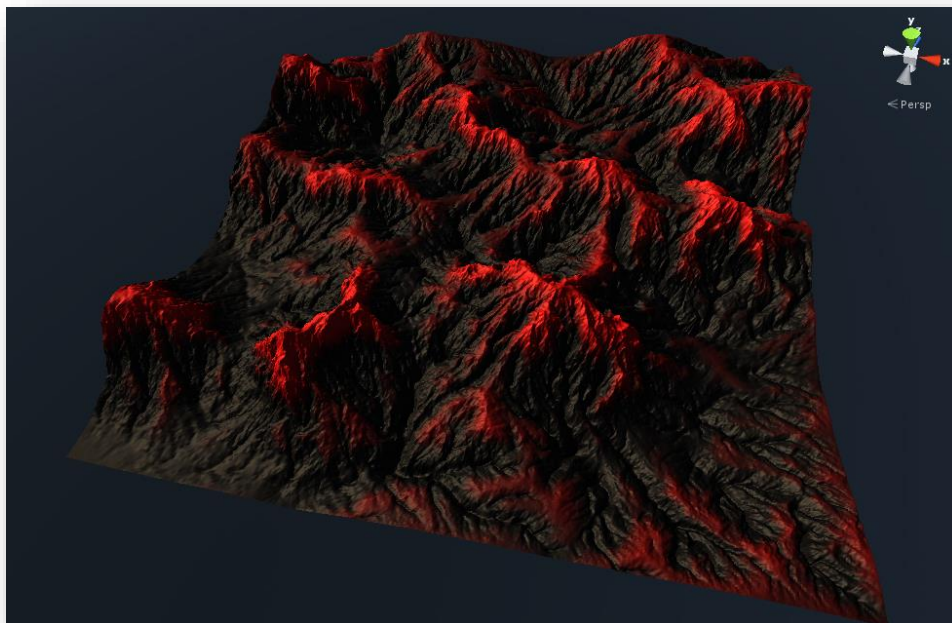
Follow Sun will let you to texture your terrain depending on the sun light direction. **Invert Sun Direction** will texture the terrain on the shadowed parts. In addition, you can use the **Follow Sun Smoothness** to further adjust how textures appear.

The **Terrain Slope** specifies from which angle the texture is used. The angle transitions can also be stretched with the **Smooth Slope Start** and **Smooth Slope End** values.

The **Cavity** is used to generate maps of concavity and convexity (e.g. potholes). Created maps do not intersect – one pixel cannot be convex and concave at the same time.

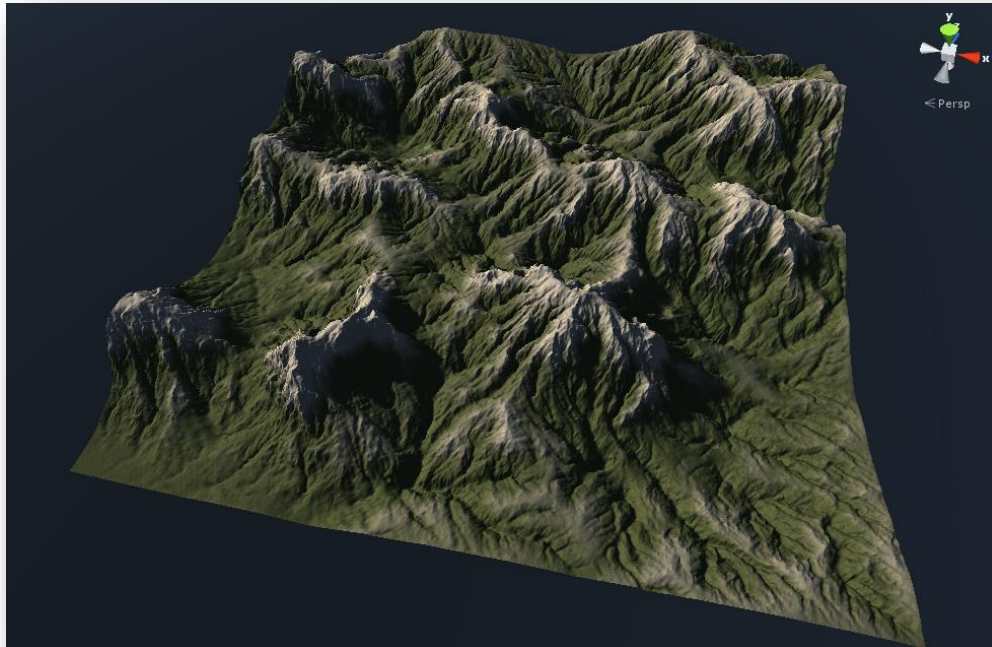


Concave



Convex

The **Cavity** can be used to create stunning texturization and object placement. For example, you could tell World Creator to use a rock texture at concave locations on the terrain and to use a snow texture at convex locations on the terrain giving you the following result:



Combining the cavity with an Erosion filter makes the terrain look incredibly realistic! Another good example would be to place specific vegetation objects such as trees and grass only inside concave areas – the possibilities are unlimited!

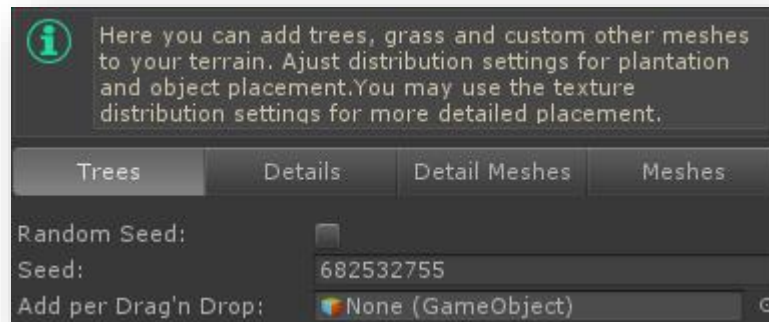
The **Weight Multiplier** defines how strongly the texture is blended. This value is especially important if multiple textures overlap due to their settings.

Objects

"Follow the white rabbit."

- Morpheus, The Matrix

Another new feature in World Creator is the ability to distribute trees, grass, flowers, objects such as stones, stumps, and more on the terrain according to specific criteria.



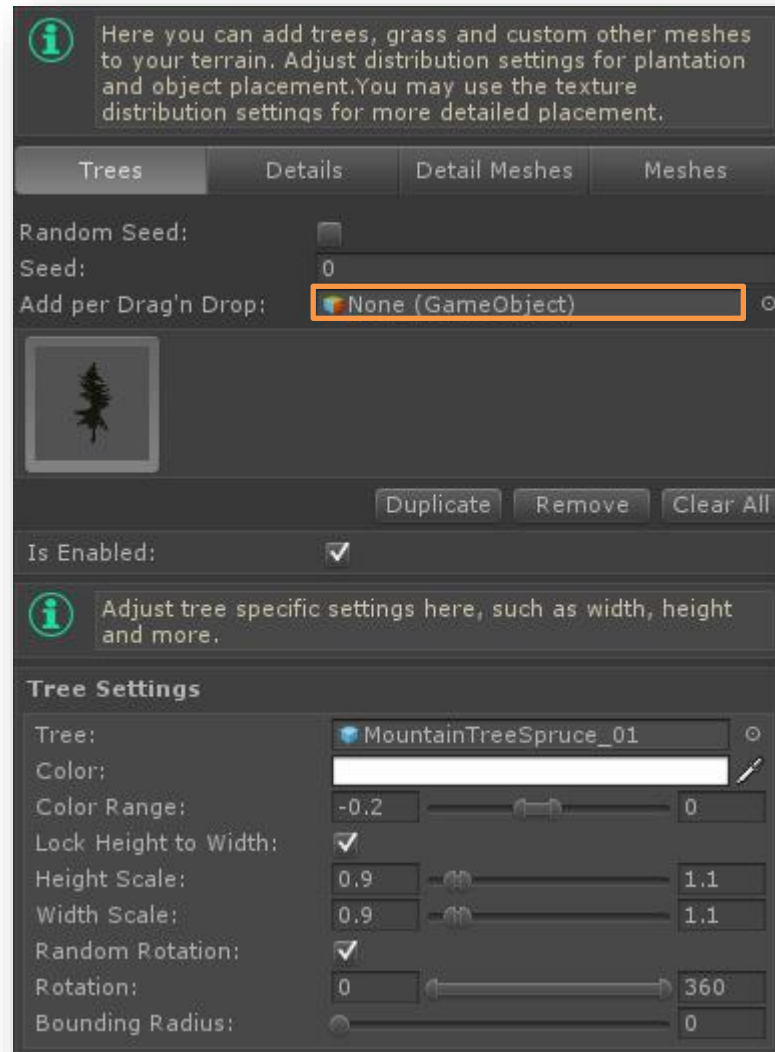
In the Objects section, a distinction is made between the following:

- Trees
- Details
- Detail Meshes
- Meshes

All objects have the settings Random Seed, Seed and Add per Drag'n Drop in common. If the Random Seed option is set, the position of the respective objects will change with every generation. The Seed value is only visible if Random Seed is not selected. This serves as starting value for the random number generator and causes different position calculations for the respective objects. If you want to add a new item to a specific category, drag an asset from your project directory and drop it in the corresponding field.

Trees

World Creator supports both SpeedTree trees and Unity trees.



Simply drag a tree of your choice and drop it into the field identified above and its settings will become visible.

Again, you can subsequently replace the tree by dragging and dropping one into the **Tree** field. With the **Duplicate** button you can quickly clone the selected tree and adjust its settings afterward.

The **Remove** button deletes the selected tree and **Clear All** removes all trees from the list.

With **Color** and **Color Range** you can modulate the coloring of the tree. The **Lock Height to Width** option causes the relationship between **Height Scale** and **Width Scale** to remain the same. These two ranges of values define the width and height of a tree, i.e., every tree that is placed will be scaled differently inside the defined value ranges.

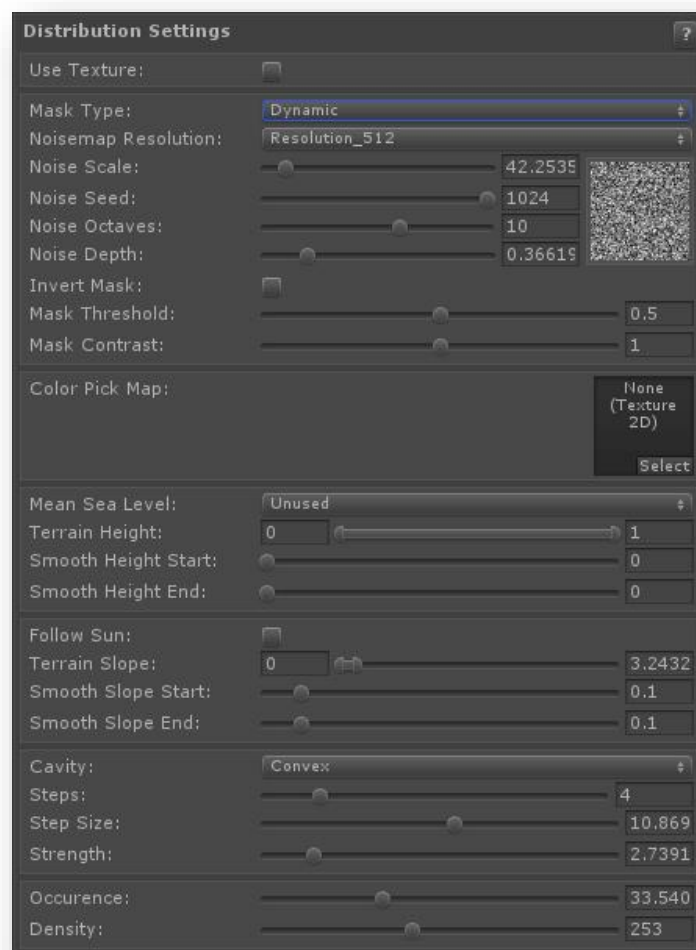
The **Random Rotation** option causes trees to be rotated randomly within the specified value range in **Rotation**. Therefore, every tree will be aligned differently.

Unity trees do not support the ***Random Rotation*** option; however, you can use this option for SpeedTree trees.

HINT

Bounding Radius can be used to prevent the overlapping of trees when generating the terrain. Note that no other objects will be placed within the specified radius either.

The settings for the distribution of trees are as follows:



It is possible to use already placed textures to simplify the distribution. For example, it makes sense to place certain trees or grasses only on grass textures. Simply check the **Use Texture** option and select a texture of your choice and the distribution will be applied.

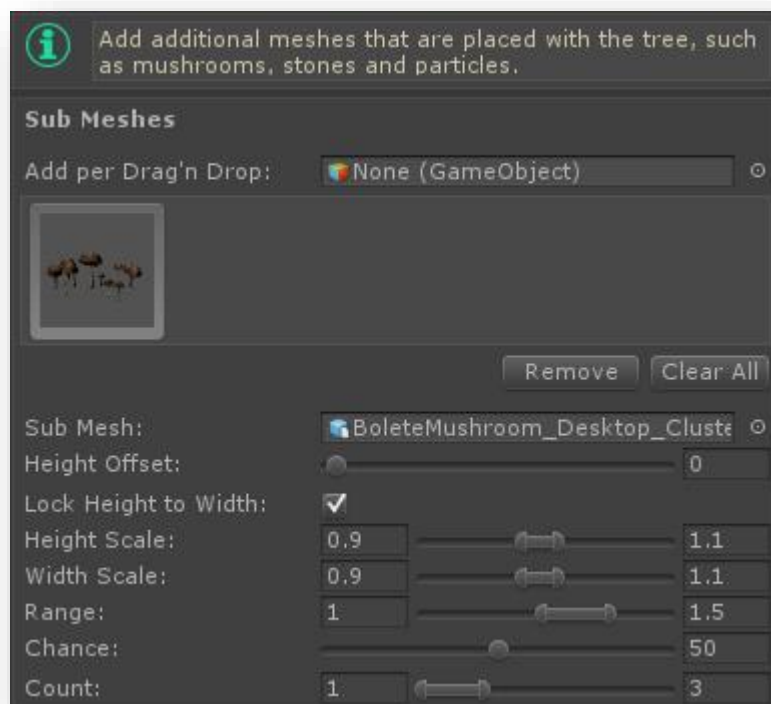
Again, you can work with masks here if you own the Professional version. It works exactly like the textures and applies to all objects: trees, details, detail meshes, and meshes.

A **Color Pick Map** can be chosen to create a mask based on a custom color value which has been checked against the color map. When working with satellite images, this may help you to distribute a texture depending on a specific color value.

Terrain Height, **Smooth Height Start**, and **Smooth Height End**; and **Terrain Slope**, **Smooth Slope Start**, and **Smooth Slope End** have the same meaning as discussed in **Texturing** above.

The **Occurrence** is the frequency expressed as a percentage value. The higher the value, the higher the frequency of trees being placed. Directly related to it is the **Density**. The higher the value, the closer the trees will be placed relative to each other.

In addition, you can apply other objects (or sub meshes) to a single tree: mushrooms, flowers, or even particles such as falling leaves.

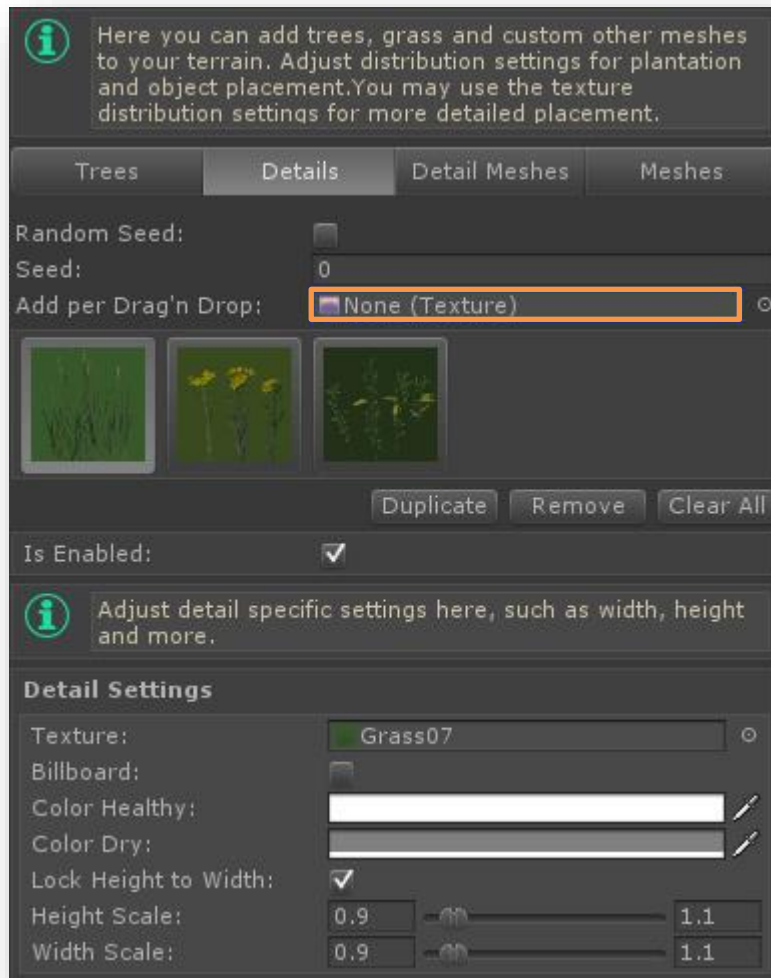


Use the **Height Offset** to offset the object along the y-axis of the tree. With the **Range** you can set object placement within a specific range relative to the tree center.

Chance indicates the probability a placement shall occur using a percentage value and **Count** indicates the number of objects to be placed within the specified range.

Details

Details are, for example, grasses and flowers. They are usually set as textures.



Just drag a texture of your choice into the field identified above and the settings will become visible.

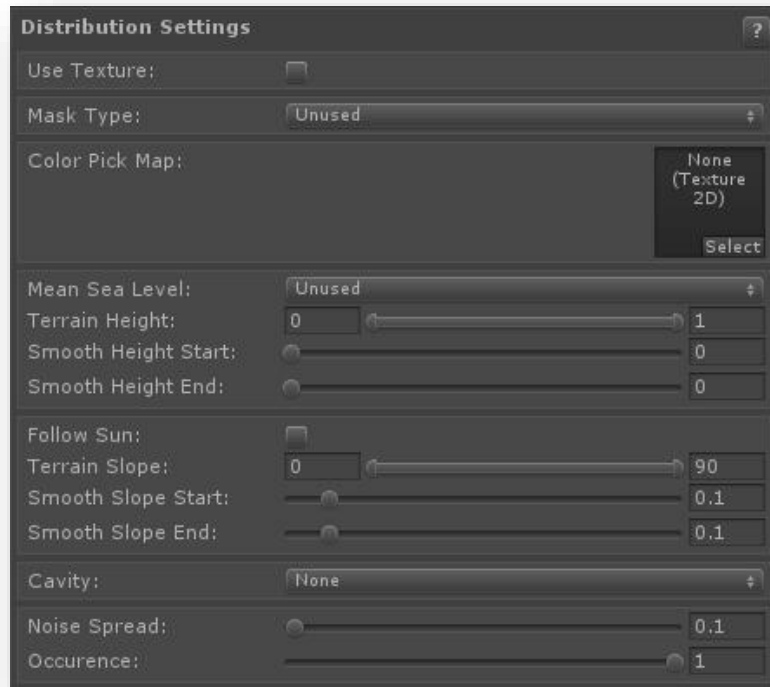
Again, you can subsequently replace the texture by dragging and dropping one into the Texture field. With the Duplicate button, you can quickly clone the selected detail and adjust its settings afterward.

The Remove button deletes the selected texture and Clear All removes all textures from the list.

The Billboard option specifies whether the grass is always oriented toward the camera or not. Color Healthy and Color Dry allows you to define two color values which will be used to modulate the coloring of the object.

The Lock Height to Width option corresponds to the same function as in the Trees section above.

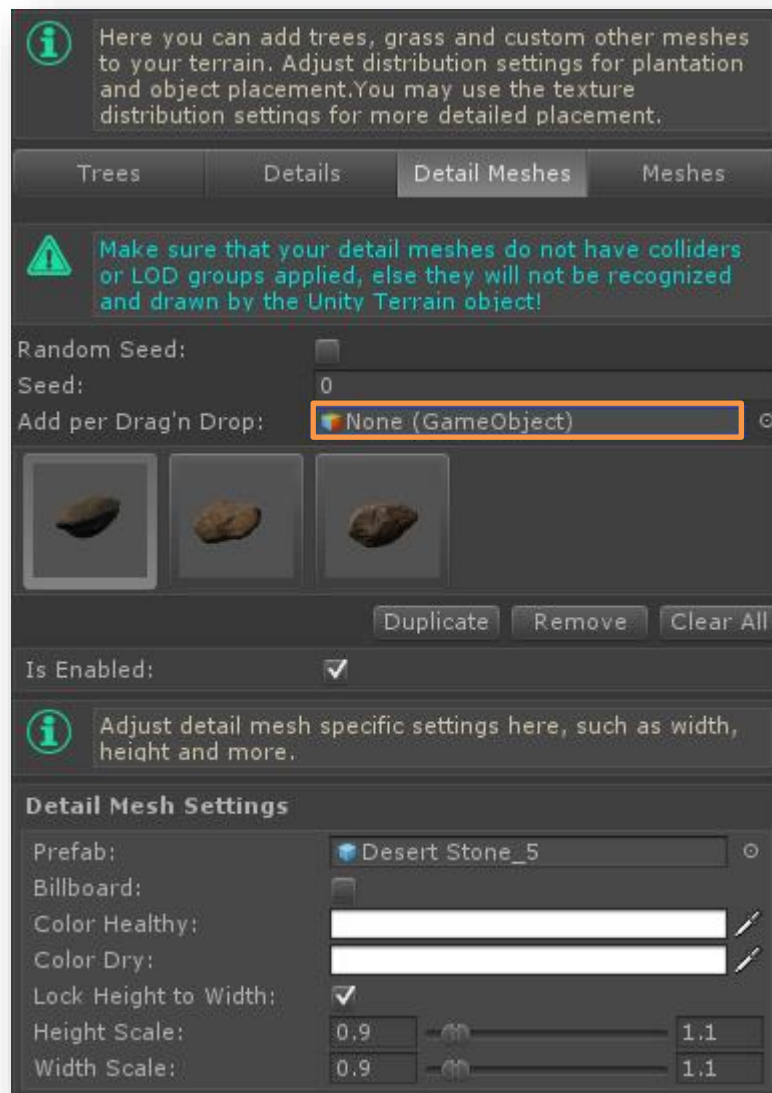
The settings for the distribution of the **Details** are as follows:



The Distribution Settings of **Details** are similar to other Distribution Settings already mentioned above - except for the **Noise Spread**. The higher this value, the greater the variations in respective areas.

Detail Meshes

This type of object is used to populate the terrain with low-detail 3D objects; in other words, objects that have a low polygon count and less complex materials are **Detail Meshes**.



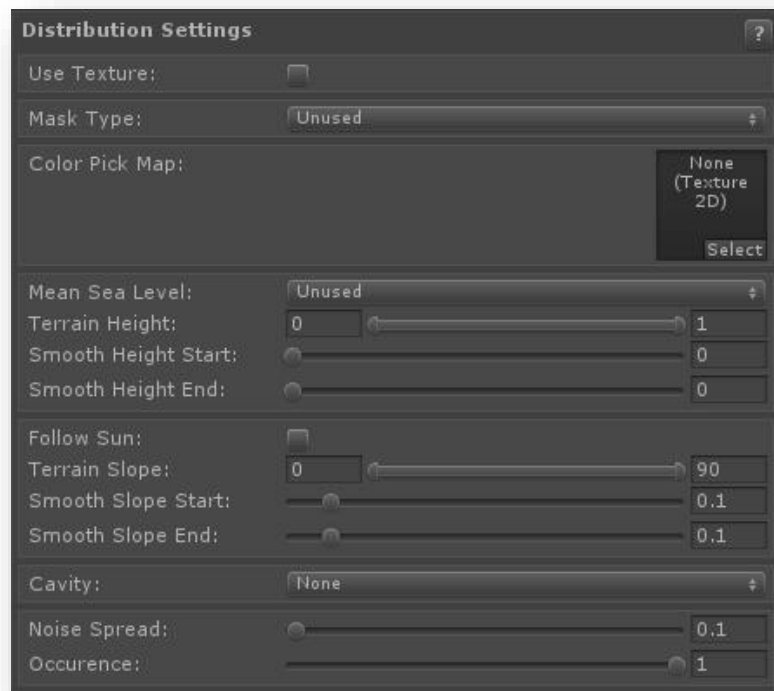
Simply drag and drop an asset of your choice into the field identified above and the settings will become visible.

The other settings match those previously discussed (see **Trees** and **Details**).

Detail meshes should not have colliders or LOD groups applied, else they will not be recognized and drawn by the Unity terrain object!

HINT

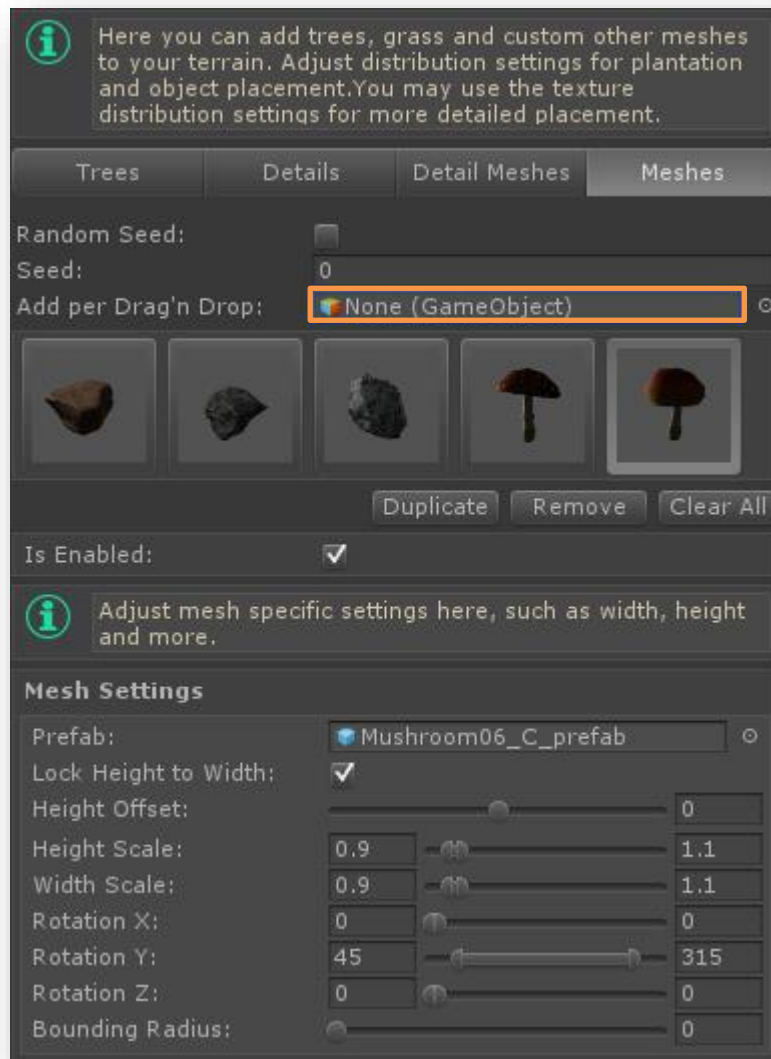
The settings for the distribution of the **Detail Meshes** are as follows:



These are identical to the settings in **Details**.

Meshes

Sometimes, it is necessary to add high-quality 3D Objects to the terrain. That is when placing meshes is necessary.



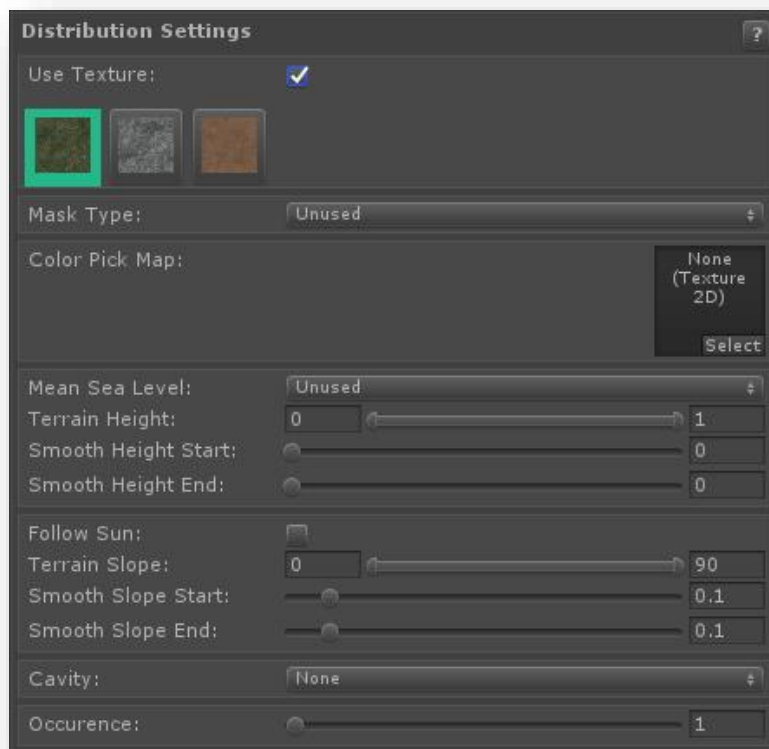
Again, most of the settings are identical to those of the other three Object types; newly added settings are the **Height Offset**, **Rotation X**, **Rotation Y**, and **Rotation Z** values.

The **Height Offset** places the object at the specified value along the Y-Axis (height). Sometime you may want to stomp and object into the ground.

Rotation X, **Rotation Y**, and **Rotation Z** cause the object to be oriented randomly between the defined value ranges. This prevents identical object orientation; it works like the Random Rotation used for tree placement.

Bounding Radius can be used to prevent overlapping of meshes when generating the terrain. Note that no other objects will be placed within the specified radius either.

The settings for the mesh's distribution are as follows:



The Distribution Settings for Meshes are identical to those previously described. In this case, however, be careful with the **Occurrence** setting! The performance level can drop quickly if you have used too many high quality assets.

Visualizers and More

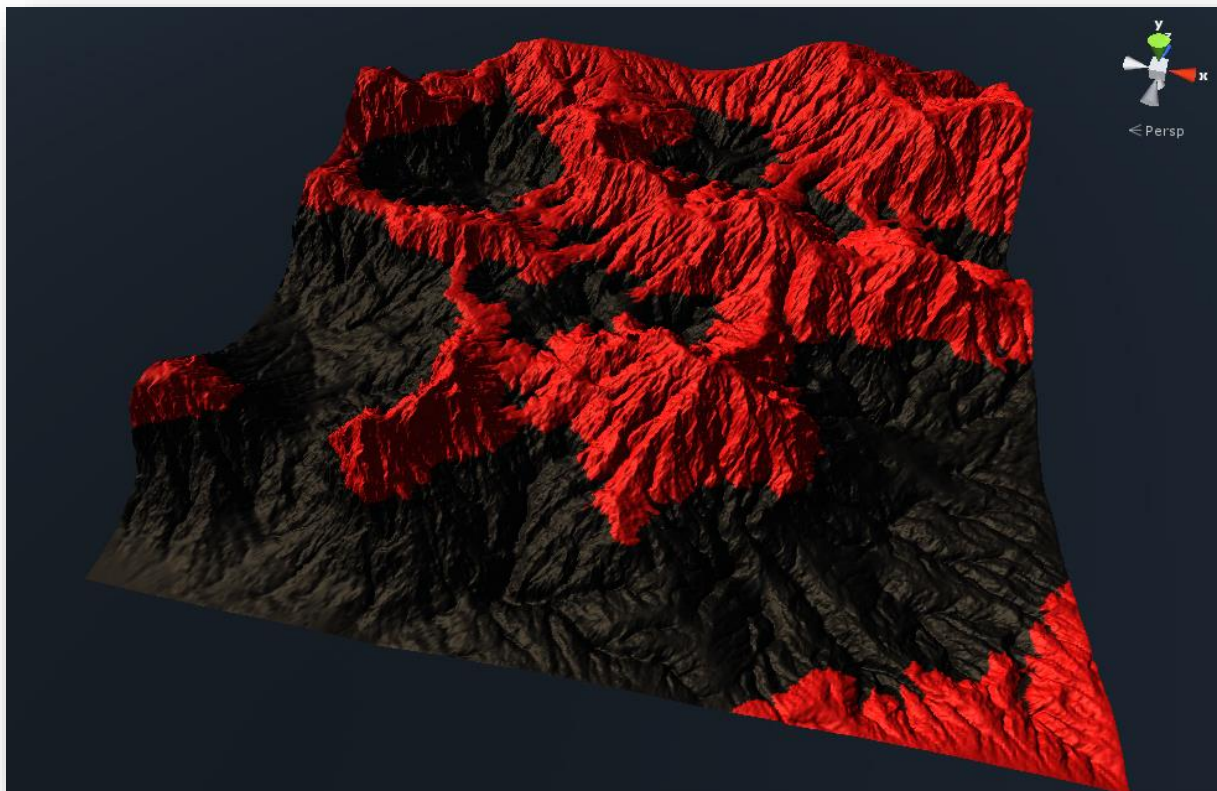
"How's about now?"

- Tom Cruise, *Minority Report*

To assist you during your terrain design, World Creator has an integrated real-time heat map visualizing system. This is used to quickly show you the affected areas of a current operation; such as filter settings, texture, and object distribution. Just check the **Visualize Heatmaps** checkbox to make the heat map visible on your terrain.



The heat map's color encoding shows you which areas are affected by the operation:



When **Visualize Heatmaps** is enabled, the current visible heat map can be exported by pressing the **Export** button.

HINT

With **Show Information**, you can toggle the information boxes which give you interesting hints while working within the World Creator window.

Post Operations

"The things I'm going to do for my country."

- Vin Diesel, Triple X

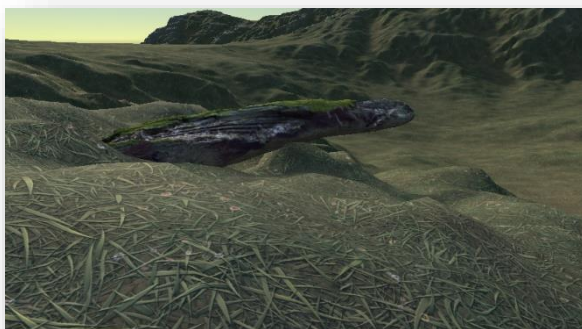
Post operations are performed as a final step. You can use them to flatten specific areas on your terrain - depending on another Game Object that you have added to the scene (e.g. a building), or to create roads and rivers by drawing paths onto the terrain.

Objects

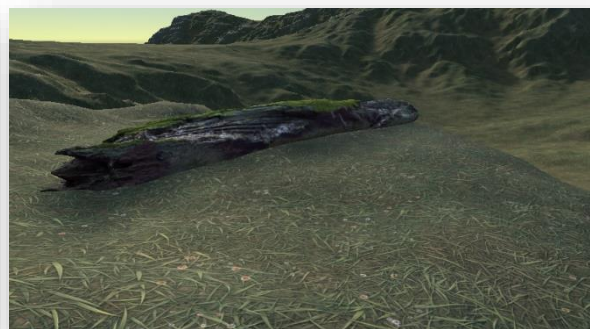
It is sometimes useful to be able to flatten the terrain at a specific location with a specific radius. The most common usage might be when you are placing buildings; however, it works for placing stones, or whatever else you have in mind as well.



Simply drag and drop a Game Object into the **Add per Drag'n Drop** field in order to be able to select and adjust a post operation for that object on your terrain.

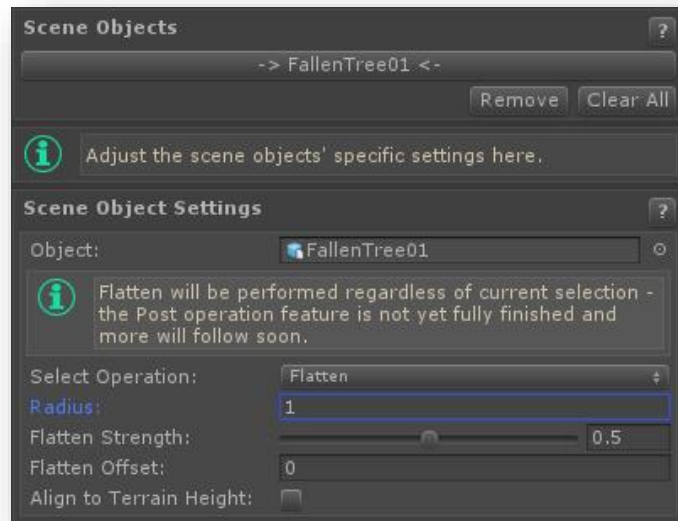


No Post Operation



With Post Operation (Flatten)

Once a Game Object is added, you can choose an operation (e.g. Flatten) and adjust the operation's settings.



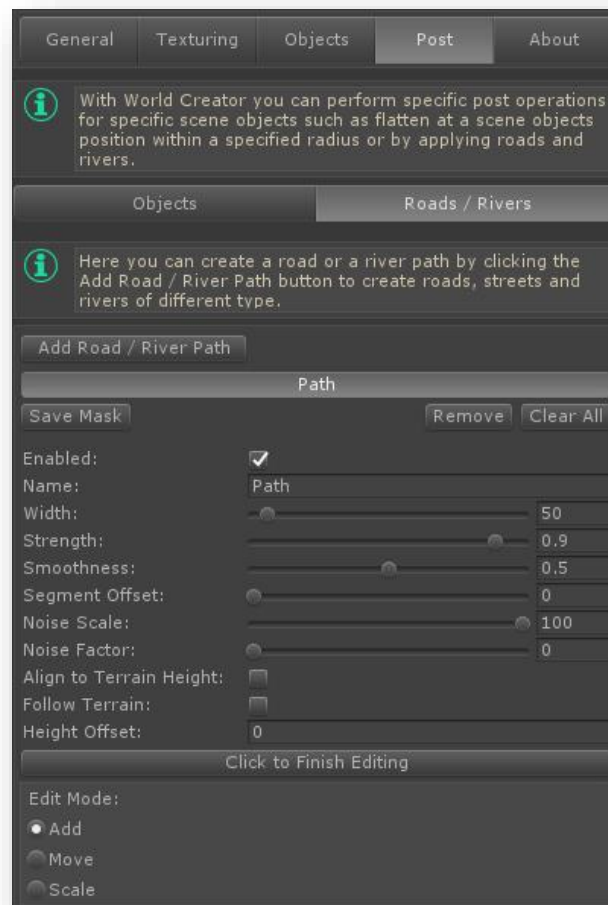
The **Radius** specifies a maximum distance from the object's location; and within this radius, the terrain is affected by the operation.

Flatten Strength indicates how strongly the operation will be applied. **Flatten Offset** can be used to offset the location on the terrain where the operation will be used (with respect to radius).

Align to Terrain Height will align the object to the terrain. This is sometimes useful if you are generating with different seed values.

Roads and Rivers

With World Creator, you can also create roads and rivers - which means that your terrain will change height values along a specified path. The current implementation does not create a road mesh, nor a river mesh; it just deforms the terrain along paths, which can then be adjusted. The creation of meshes for roads and rivers will be implemented in another update - making this feature even more powerful!



Click on the **Add Road / River Path** button to create a road / river path. With **Remove**, you can delete the path from the list of paths; and with **Clear All**, you can remove all paths from the list. You may also save a mask of your path which might be useful for a variety of reasons.

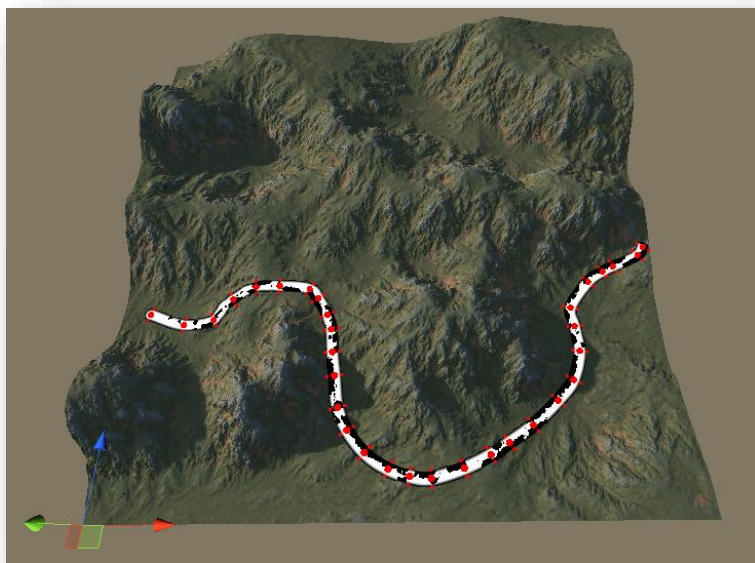
With **Enable**, you can activate/ deactivate the path. World Creator will not take that path into account when regenerating the terrain. If you want to name your path, simply enter a name in the **Name** field. The **Width** determines the width of your path, and **Strength** determines how strongly the path affects the surrounding terrain. **Smoothness** lets you smooth the path along its borders and with **Segment Offset** you can specify the number of segments used to create the path – the more segments you have, the more accurate it will be.

The **Noise Scale** can be used to change the noise values created along the path borders and the **Noise Factor** increases the noise weight – which is good when you are creating dirt tracks (e.g. Western style).

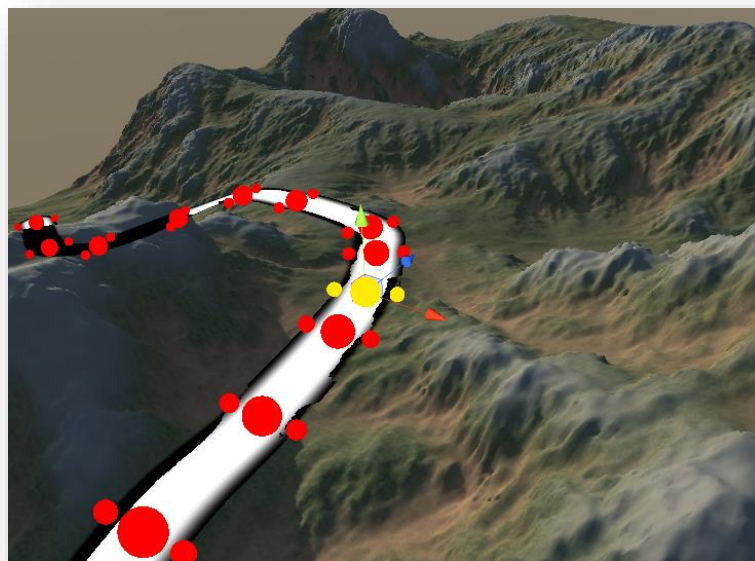
With **Align to Terrain Height**, you can tell World Creator that the path should always align to the current terrain height – very useful when generating with various seed values. **Follow Terrain** causes the path to follow the current terrain height.

The **Height Offset** value can be used to offset the height of the entire path. You could use this to easily create rivers.

To edit a path, click on the **Click to Edit Road / River** button (in the above image it is saying **Click to Finish Editing** – same button just different text). Make sure to select **Add** while in Edit Mode. Now, just click on the terrain to create the path. When finished, press the **Generate** button or click the **Click to Finish Editing button**.



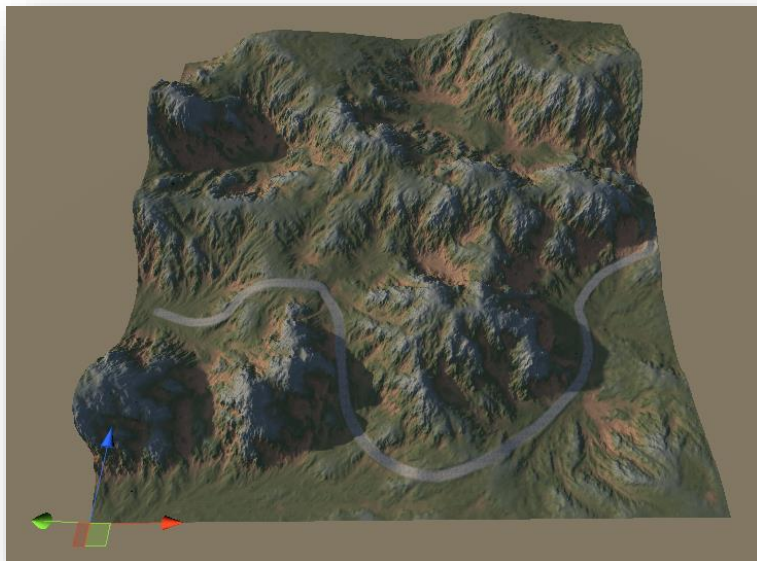
While in Edit Mode, you may also select **Move** or **Scale** to further move / scale each point along the path:



While holding down the Left-SHIFT key and clicking on the terrain, you can also delete the last point you have placed.

After you have created your path, you can specifically texture or place objects on that path.

For example, switch over to texturing and select a texture you want to apply specifically along your path. Now select RoadRiver as Mask Type and a list of available paths will appear. Select the path you want the texture to be applied to and press Generate.

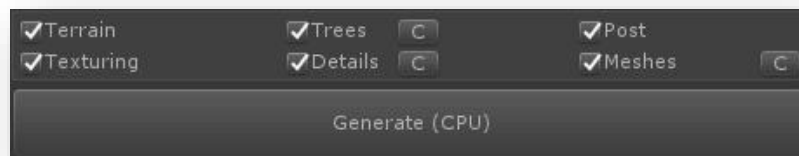


Terrain Generation

"The speed of light sucks!"
- John Carmack, id Software

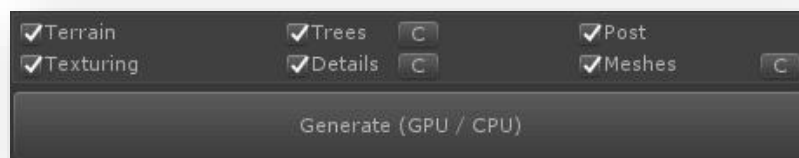
Depending on whether you own the Standard or the Professional version of World Creator, you may choose between either CPU generation or GPU generation.

If you choose the CPU, you will see the following image at the bottom of the World Creator window:



Generate (CPU) creates the terrain and the landscape using the CPU only. In addition, all cores of your CPU are used during the generation process (Multi-Threading). The better the CPU, the faster the generation process is in general.

If you choose the GPU, you will see the following image at the bottom of the World Creator window:



Generate (GPU / CPU) creates the terrain using the GPU. The landscape is created by using the CPU. This is actually a mix of GPU and CPU terrain generation. If you own a DirectX11 or OpenGL 4.3 graphics card, this kind of terrain generation is recommended. It is the fastest possible for both terrain and landscape generation. Please, remember that the Unity Engine currently supports GPU access only on Windows PCs.

The **C** labeled buttons can be used to **C**lear (remove, delete) the generated content from the terrain indicated by the checkbox and label left of the button.

During prototyping, it can be useful to create the terrain step-by-step to save time. For example, if you think the terrain has the shape you were looking for, you can continue with texturing your terrain by checking the **Texturing** box. After Texturing, you may continue with planting **Trees** and so on.