

## TerrainComposer Version 1.0



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## Welcome to TerrainComposer

TerrainComposer is an Unity Extension Tool to make professional Terrain. It has an user friendly GUI interface and its unlimited multi-threading output possibilities makes it a very powerful tool. It is designed to create amazing results in a minimum amount of time.

It uses a system of layers, filters and subfilters. The layers have different outputs and the filters and subfilters are for creating the rules for output. With the filter and subfilter system you can use curves to quickly manipulate the output . It has one system that applies to all different layer outputs. Once you understand the system it becomes very easy to transform one output to the other, because the system allows duplication/swapping of any component.

TerrainComposer is very flexible and can be used for all kinds of terrains and environments. For example flight simulator perspective as well as first person perspective. You can create low detail high performance terrain for example the mobile platform, as well as high detail AAA terrain for high end graphic systems. It supports all terrain resolutions high and low, as well as the support for multi-terrain, which is totally automated. For multi-terrain there are quick buttons that apply settings from one terrain to all terrains. These buttons are in more components like the tree and the object layer, which apply settings for example one tree to all the trees in a layer. The multi editing will save you much time.

The auto generation option makes it very easy to see changes you make directly in the Scene view. This allows for much faster work flow as well as learning curve. The unlimited multi-level placement makes it possible to create endless detailed Scenes, where you for example create a whole city where the outside of the building has a garden with wall and fences and the inside of the building is furnished, and with objects on and around the furniture, etc.

The automatic update feature allows you to use the latest TerrainComposer version with its added features, fixes and documentation.

To make it more practical 'TerrainComposer' will sometimes be abbreviated with 'TC'.

I wish you good luck with TerrainComposer and that it will help boost developing your game leading to a bigger end result while saving you tons of time.

## Getting Started

### Importing TerrainComposer.

1. Open your Unity Project. In Unity Menu select Assets -> Import Package -> Custom Package. Now select the Terrain Composer package from where you have stored it.
2. A new Import Window will appear, click on the 'Import' button.
3. All Terrain Composer files will be imported and compiled, a new menu item "Terrain Composer" should appear under at Unity Menu -> Terrain -> TerrainComposer. A map named 'TerrainComposer' will be added to your project folder.

### Starting TerrainComposer.

1. Select from Unity Menu -> Terrain -> "TerrainComposer". The Terrain Composer window should appear. It behaves like any other Unity window. You can dock it or leave it floating on top.
2. A gameobject is created in the Scene called 'TerrainComposer'. This gameobject contains all the data you create inside the Terrain Composer window, and it is stored with your Scene. If you delete the TerrainComposer from your Scene all the data you created within Terrain Composer will be lost. If this would happen by mistake, there is the possibility to do Undo. Click unity menu "Edit" -> "Undo". If that doesn't work you can reload the Scene. It's best to save your Scene and also separate TerrainComposer project regularly. Once you build your project and don't use TC for runtime, it's best to delete the TerrainComposer object from the Scene, as it saves memory. Before doing this, make sure the TC project is saved.

### Online Updates

TerrainComposer has an auto update feature which looks online for an update once every day (when you start it). With default settings it will automatically update. You can change update settings in TC Menu -> Help -> Update...

The update notes are in the file at the TerrainComposer folder -> TerrainComposer Release Notes.

### Maximal visual Quality

For the maximal visual quality you can use additional terrain shaders. Depending on the shader, these add the ability to use bump/spec splat textures, overlay textures, colormaps and normal maps. You can only use 1 shader for your terrains, so you have choose between them.

### Ats Terrain Shaders

There are a few Ats Terrain Shader. A free shader that adds bump splat texturing, colormap and normal. And two other shaders that adds decals to the terrain. This will work perfectly with TC, and allows you to get the better results, since in TC you can export colormaps and normalmaps from the terrain normal data. You can download Ats at the Asset Store, type 'ats' in the search field.

### TriPlanar Shader

This is a shader that supports bump/spec splat textures. It uses triplanar texture projection that prevent stretching of splat textures vertically. This gives the best texturing for cliffs, hills and mountains.

You can download it for free at:

<http://www.farfarer.com/blog/2011/12/07/unity-terrain-triplanar-texturing/>

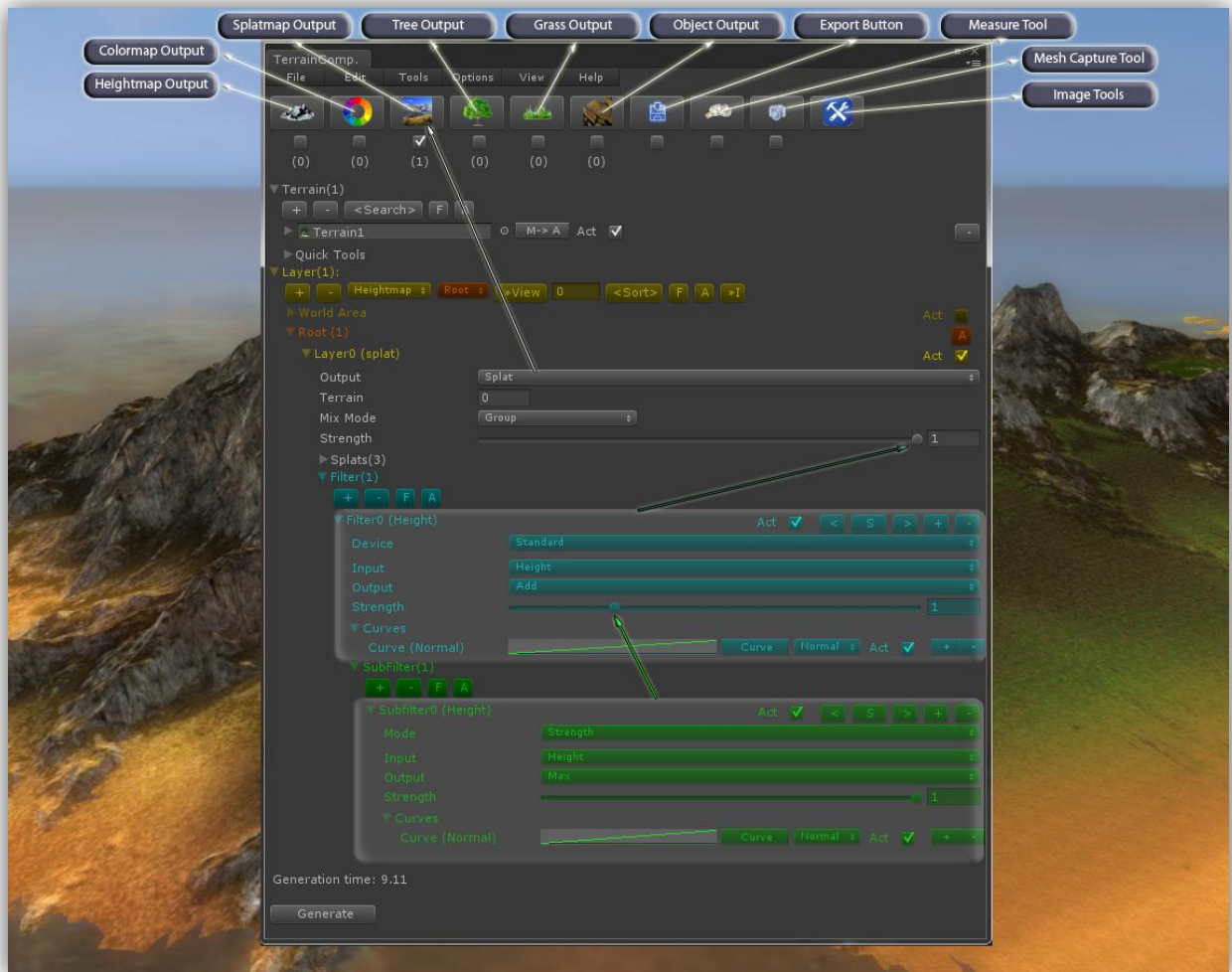
### Relief Terrain Pack

This is another shader that is comparable to Ats terrain shaders, that improves the standard Unity terrain shader. It has many more parameters and options you can set. It's also available at the Unity Asset Store.



## A first Introduction

The picture below is the TerrainComposer window. In the picture at the top you see ten buttons. The first six buttons are the output buttons. They represent the different layer outputs that are generated to the terrains in the TC terrain list. They are the main switches that determine if the terrain will be changed by the layers with that output. If an output button category is inactive there will be no output to this category. With these buttons you can quickly active and deactivate your desired output with generation, without having to disable each layer of this output.

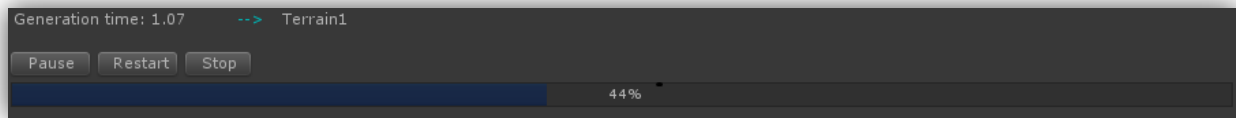


\* An overview of Terrain Composer output buttons and TC layer system with filter and subfilter.

Before you can start generating or setting up layers you need to set up at least one terrain. To setup terrain(s) is explained in the section 'Setup Terrain in TerrainComposer'.

## Generation

With the 'Generate' button at the bottom of the TC window, you can generate your output.

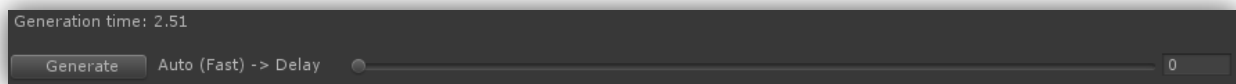


While generating you can see the progress in the progress bar, the generation time and the terrain that is currently generated on. The generate button will be exchanged for three buttons to either pause, restart or stop the generation.

With every generation the whole TC setup is cloned and put into the <Generate> GameObject in the Scene. Every component from the clone is removed that is not active. If a layer output is not active all the layers with that output will also be removed. So the Output Buttons (at the top under the TC menu) are a quick way to enable/disable an output while you don't have to deactivate the layers with this output every time. You can also activate/deactivate each terrain. If a terrain is not active it will be skipped. The more layers, filters and subfilters you use the more time it takes to generate. It's always best to deactivate what doesn't bring a different result. If an error in the loop might occur, you can delete the <Generate> GameObject in the Scene, and the 'Generate' button will be visible again. You can report this error to me so I can fix it. To do this make a screenshot of the error in the console (the description so I can see the line of code where it occurred), and send it to me.

## Auto Generation

You can use the Auto Generate feature to view the changes you make immediately. To enable/disable it shift click the 'Generate' button, now the 'Auto (Fast)' text will appear behind it.



There are 2 modes of auto generation, fast and slow mode. You can switch between them by alt clicking the 'Generate' button. The difference is that the fast mode will generate after the set delay time when you changed/sliced/toggled something, while slow mode will wait with generating until you do nothing for the set delay time. The delay time you can change with the slider. So depending on your system performance and your preferences, you can choose between the 2 modes. If you want to see your output fast you can only activate 1 terrain to speed up generation. What you can also do if you have a high resolution is to make the local area smaller.

## Multi-threading

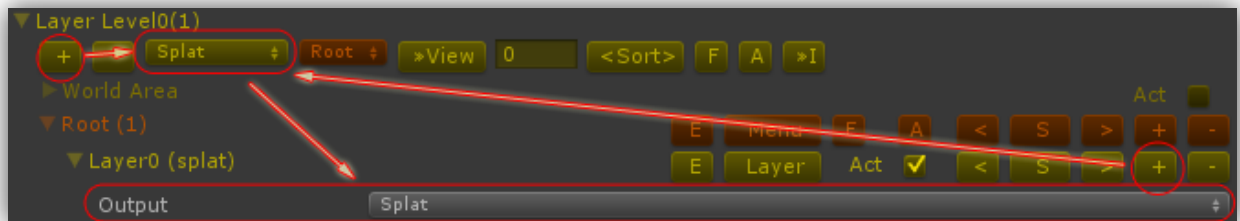
A feature of TerrainComposer is that you can continue working while generating. You can change the generation speed versus working speed in TC menu -> Options -> Generate Settings. You can select the generation speed with 'Generate Step'. It are the rows TC will generate before returning to Unity. The higher the number the faster generation will be but the slower Unity will become. Any changes you make will have effect in the next generation session. You can find the right number for your system performance and your preferences. Also the more components you use it takes longer to generate, so at some point you might want to lower the generation speed.

## Layer Levels, Layer Groups, Layers, Filters and Subfilters

There is a hierarchy inside Terrain Composer: Layer Levels -> Layer Groups -> Layers -> Filters -> Subfilters. A layer level has its own output area and consists of multiple layers arranged in a layer group. The area is a square area in World Space.

### Layers

The Layers (Yellow color) are the main components. A layer will write to its selected output. A layer has six different output options:



1. Heightmap.
2. Colormap.
3. Splatmap.
4. Tree.
5. Grass/Detail.
6. Object.

### Changing a layer output

You can change a layer output by clicking the popup field at 'output' and selecting a different output.

### Changing default output of new layers

The output popup field next to the global '+' button under 'Layer Level0' is for adding new layers. The new layer will have the output selected in this popup field.

### Changing a layer name

You can name each layer. To do this you can double click at the layer foldout text or you can click the yellow 'E' button in the layer interface. This will add a textfield under the layer where you can type the name. To close it again, you can hit enter after editing the text or double click the layer foldout text or click the yellow 'E' button.

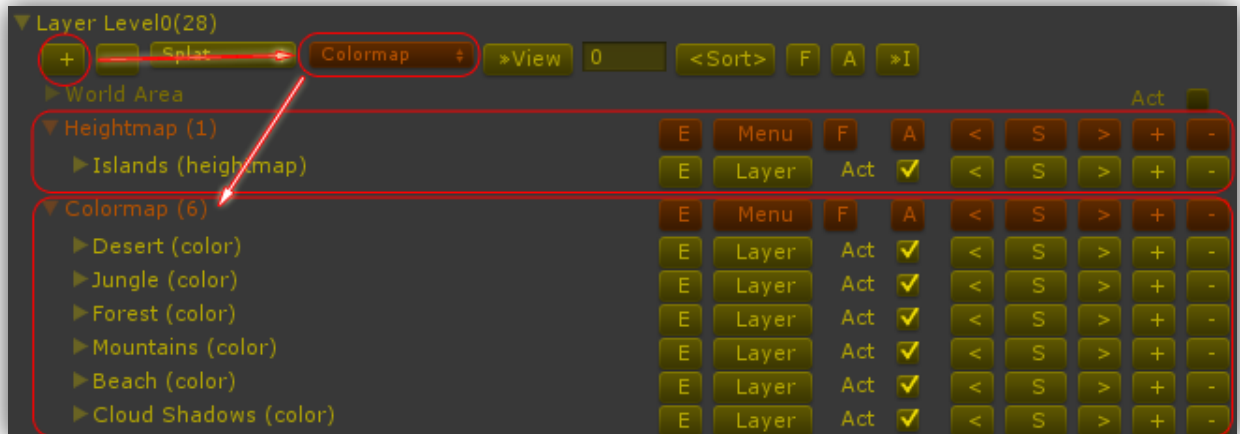
### Load/Save for each layer

You can load/save each layer if you click the yellow 'Layer' button in the layer interface. A popup menu will appear with File -> New/Open/Save.



## Layer Groups

The Layer Groups (brown color) can be used to arrange layers. You can do this any way you want. For example you can arrange them on output. Every layer is counted and the number is displayed between the parentheses behind a layer group foldout text. Also the total amount of layers in a layer level are displayed behind the layer level foldout text. Each layer based on output is also counted and displayed under the output buttons. You can enable/disable this with TC Menu -> View -> Layer Count.



### Adding a new layer to a layer group

To add a new layer to a layer group, you can select the layer group in the brown popup field. The layer will be added to the end of the group. To insert a new layer within a layer group you can click the yellow '+' button at the layer interface. This will insert the layer under the layer where you clicked '+'. Shift click '+' to duplicate a layer.

### Moving a layer to another layer group

To move a layer from one layer group to the other click the yellow 'Layer' button, a popup menu will appear with Parent -> ....., there you can select the layer group where you want to move the layer to. The layer will be moved to the end of the selected layer group. You can use the '<S>' buttons the move the layer to the desired position within the layer group.

### Changing a layer group name

You can name each layer group. This works the same as with naming layers -> Double click layer group foldout text or the brown 'E' button in the layer group interface.

### Load/Save for each layer group

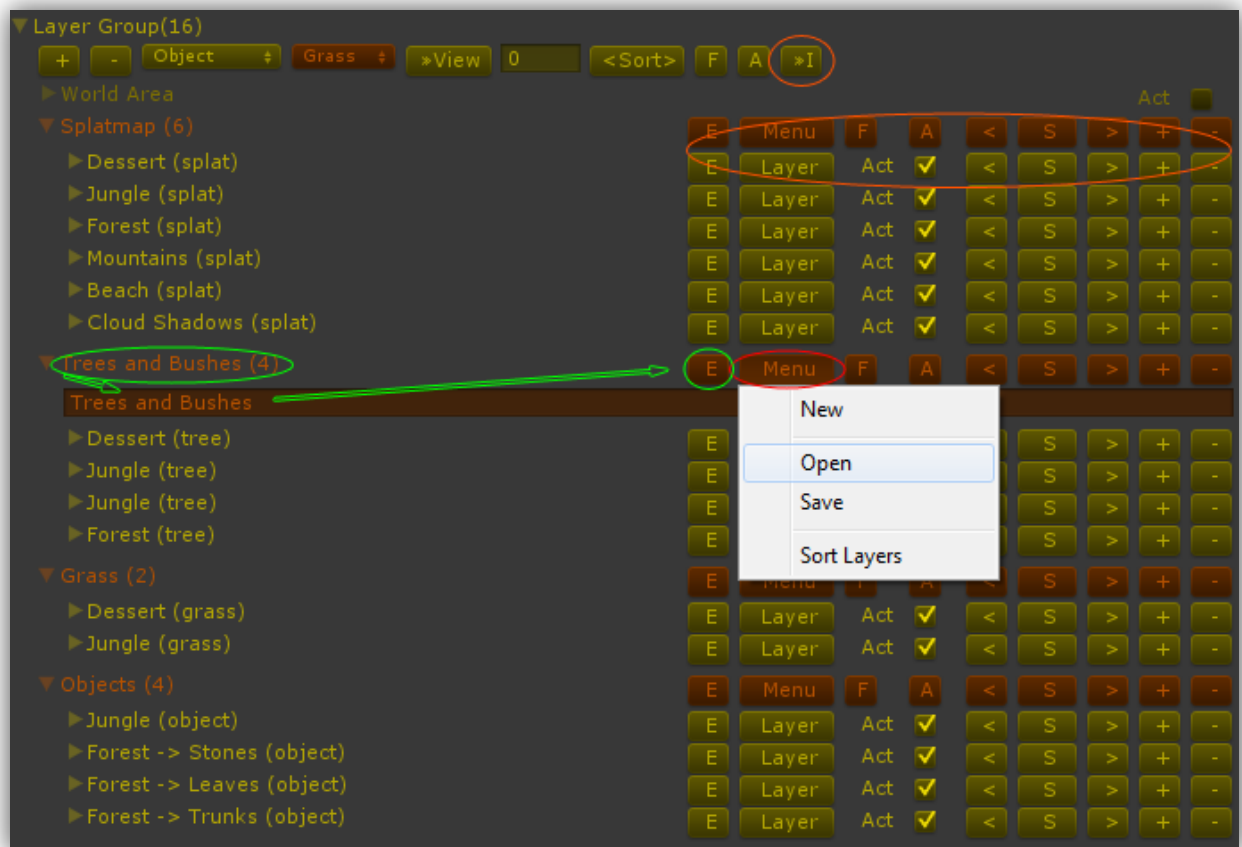
You can load/save each layer group, which will load/save its containing layers. You can do this by click the brown 'Menu' button in the layer group interface, a popup menu will appear with Open/Save.

### Sorting layers in the layer group

You can sort layers based on output in the order which is displayed on the previous page. To do this click the brown 'Menu' button in the layer group interface, choose for 'Sort'. You can undo this.

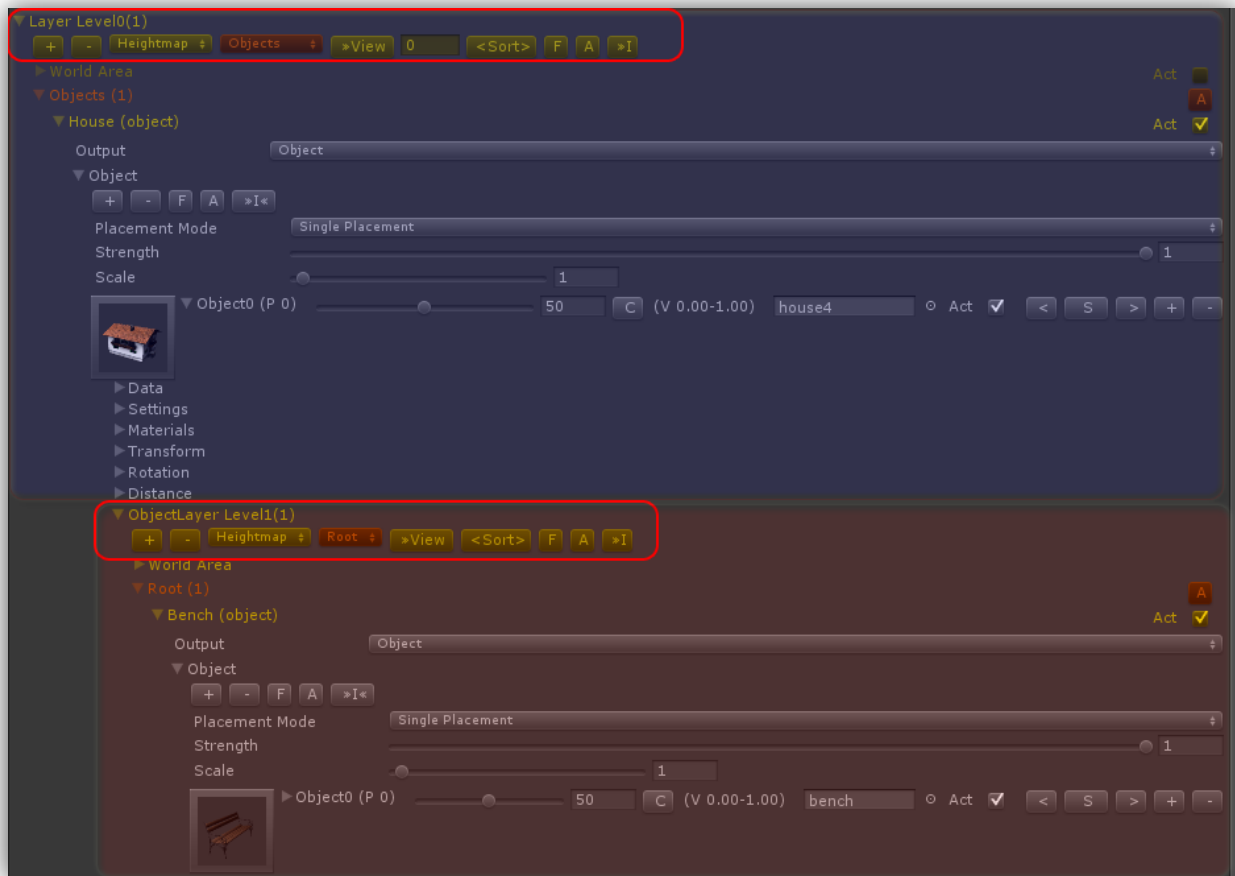
### Hiding layer and layer group interface buttons

To show/hide the layer interface buttons click the '»I' button. To show/hide the Layer group buttons shift click the '»I' button (orange circle). This can be useful for getting a better overlook.



## Layer Levels

Layer Levels consist of layers arranged in layer groups which have their own output area. In the picture you can see that there is Layer Level0 at the top (blue fill color) and another ObjectLayer Level1 at the bottom (red fill color).



## Multi-level placement

This multi-layer level system is used for multi-level placement. You can create a layer level inside an object layer. Then you can give this layer level its own square area (under world area foldout). For example in the picture there is a house selected in the object layer. As soon as the house is placed while generating it will switch over to the ObjectLayer Level1, generating in its defined world area. The pivot of the world area will be the pivot of the house. This example places benches around each house that is placed. And again you can create a layer level within the bench object that places objects on or around the bench, like papers, bottles, stones, vegetation etc. You can do this to an unlimited amount of levels. As soon as the world area is generated TC will return to its previous layer level and continue generation from there on.

## Viewing Layer Levels

A layer level can be moved to the top view (zoom) so that you can get a better overlook. To do this you can shift click the yellow '»View' button at the layer level you want to zoom or enter the layer level number next to the '»View' button at layer level 0. The return to layer level0 you can shift click the '»View' button again or enter number 0 next to the button.

## Component Interface Buttons

To prevent deleting or changing data by mistake. A security is built in for clicking some kind of buttons. If a button has '<...>' around it, you need to hold the 'shift' key while clicking the button. Otherwise it will not work. For the erasing '-' button you need to hold the 'control' key, while clicking the button. And buttons with '-...-' around them you also have to hold control for them to work. Of course there is also Undo/Redo available if you want to undo a deleted component. Undo/Redo is in the TC menu under 'Edit', and you can use Undo/Redo from the Unity menu which does the same.

The '>' before a button, means this button has more clicking options. A normal click and a shift click. The operations are often related to each other but a little different in execution.

Each major component like layer groups, layers, filters, subfilter and color ranges have interface buttons like:



The 'swap up' button. To swap between this component and the previous component.



The 'swap/copy button. By clicking it the 'S' will change in '?'. This is for swapping the component with another component of its own kind. If you click another 'S' button of the same kind component, the components will be swapped. For copying click and hold the 'alt' key. Now the button text will change in '\*S\*'. By clicking on a '+' button (on a component of its own kind) while holding the 'alt' key the component will be pasted.



The 'swap down' button. To swap between this component and the next component.



The 'add' button. Clicking this button will add another component. Holding 'shift' key while clicking will duplicate the component.



The 'erase' button. Control clicking this button will erase the component.



The 'foldout' button. Clicking this will fold/unfold the child components of this component. Shift clicking will invert the foldout of the child components.



The 'activation' button. Clicking this will activate/deactivate the child components of this component. Shift clicking it will invert the activation of the child components.

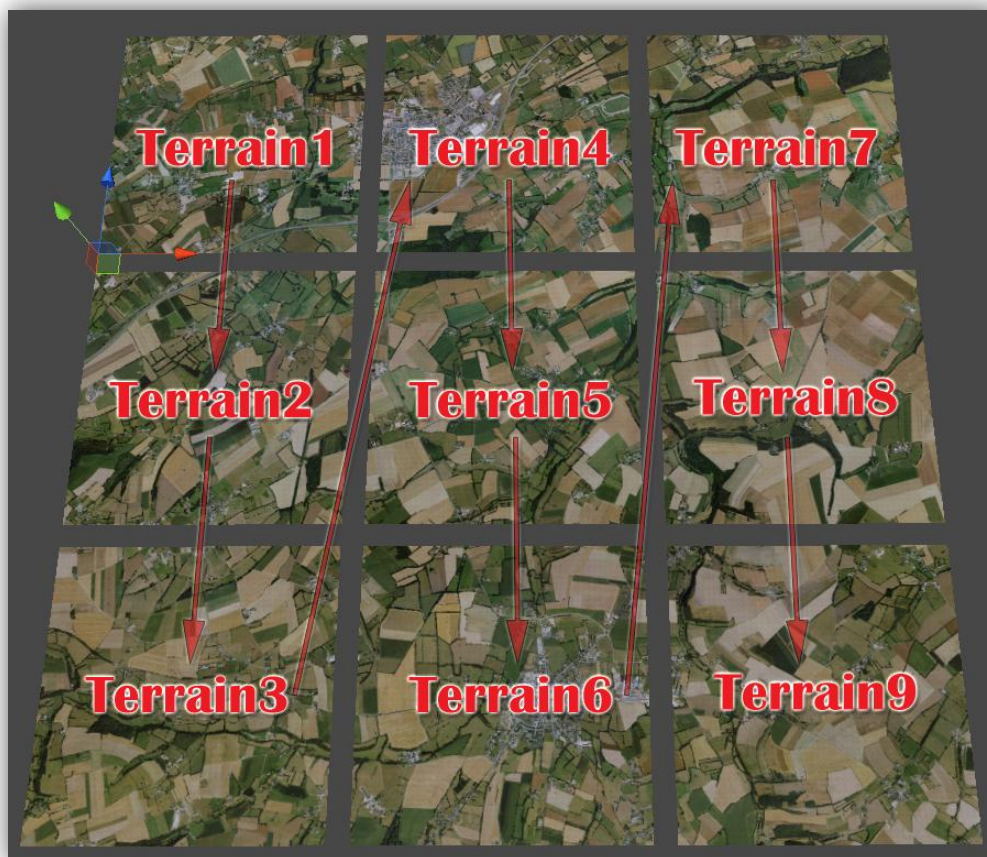


The 'interface display' button. Clicking this will hide/show the child components interface buttons. Shift clicking in a tree and object layer will hide/show the preview buttons.

## Setup Terrain in TerrainComposer

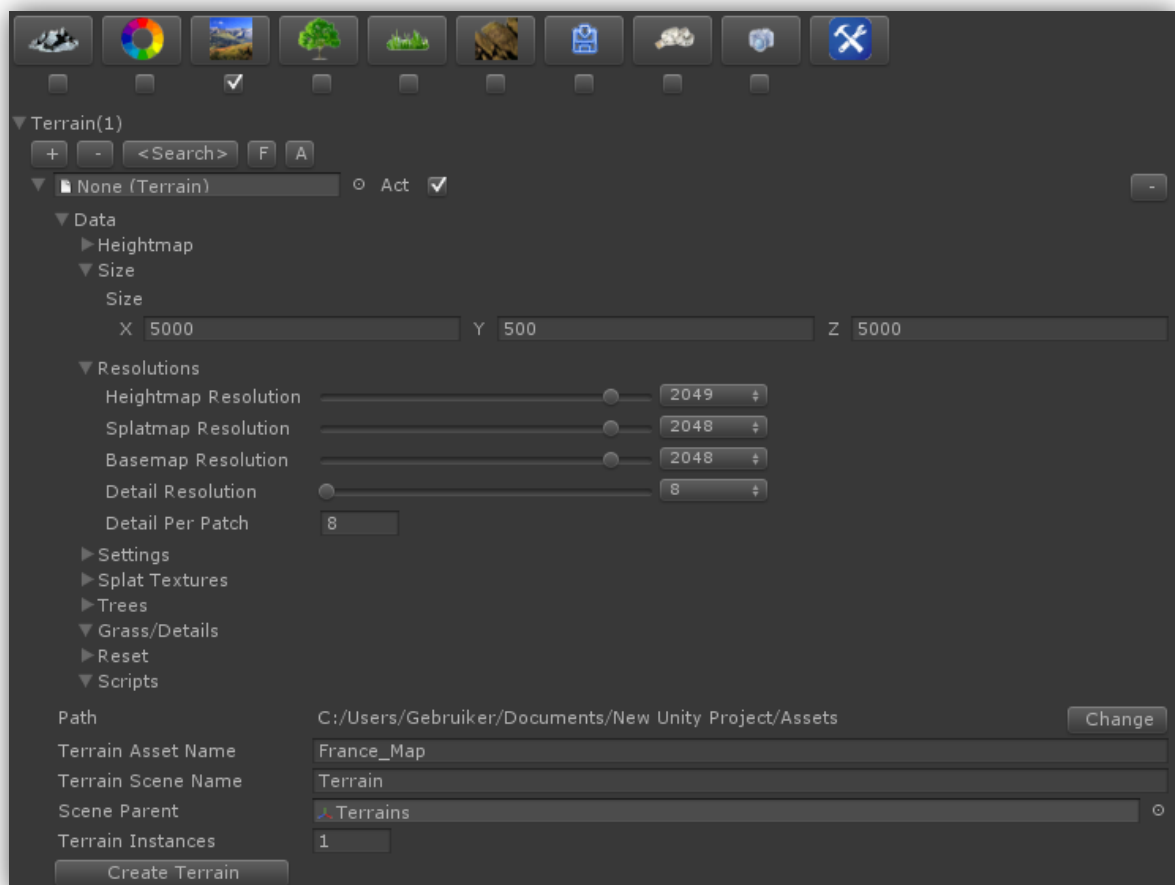
### Unity Terrain in TerrainComposer

1. If you don't have a terrain in your Scene you can create it with TerrainComposer. You can also do it still manually and then drag it into the terrain slot in TC. But TC is much faster, it will do most of the work for you. But there's absolutely no difference TC makes to the standard Unity Terrain. It uses Unity Terrain just like you would do manually.
2. If you already have terrains in your scene, TC has an auto search terrain feature, that makes it possible to get all the terrains from you Scene into TC. Your terrains need to be numbered in the right order at the end according to the TC tile system (see picture).
3. TC uses a square tile system (2x2,3x3,4x4,etc). And the tile system works in the order from top to bottom, from left to right. There's an auto fit feature that will place all your terrain tiles together into one big terrain, by clicking the <Fit All> button while holding the 'shift' key. For the auto fit feature to work all the terrains must be present. It doesn't work when you have for example 3 terrains. It must be  $2 \times 2 = 4$  terrains,  $3 \times 3 = 9$  terrains,  $4 \times 4 = 16$  Terrains etc. You can resize the terrain tiles and fit them together again with the <Fit All> button.



## Creating new Unity Terrain(s) in TerrainComposer

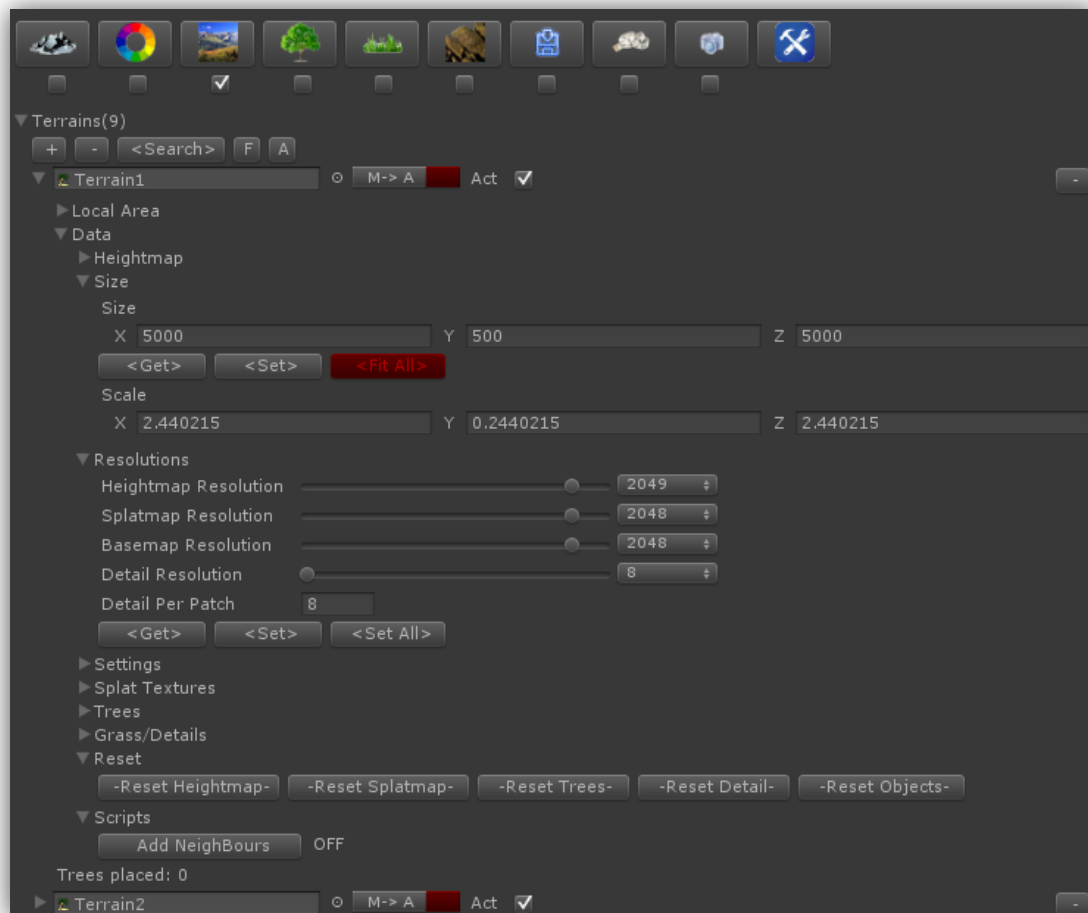
1. To create a new terrain go to the TC Terrain foldout. Another terrain can be added to existing ones by clicking the '+' button. The numbering will be automatically started from the last terrain. So if there are 4 terrains, the next terrain(s) that will be created will start with number 5.
2. Choose your desired size and resolutions.
3. Choose a Path where the terrain data should be stored in your project.
4. Choose the Terrain Asset Name for the name of the terrain data. The terrain number will be automatically added to the end of the name also if you create multiple terrain instances.
5. Choose a Scene Parent GameObject (optional), to parent the terrain to in the Scene.
6. Choose the terrain name for your scene. Also here the terrain number will be added to the terrain(s).
7. Choose how many terrains you want to create in 'Terrain Instances'.
8. Click the 'Create Terrain' button to create the terrain(s). Now all the terrain data is created in your project, and you will see the terrain(s) appear in the Scene.
9. If you have created a .Raw heightmap with an outside application, you can import it by choosing TC Terrain List -> Data -> Heightmaps. The resolution needs to be the same as the terrain heightmap resolution. You can also import heightmaps directly into a filter, and then there's no resolution restriction.





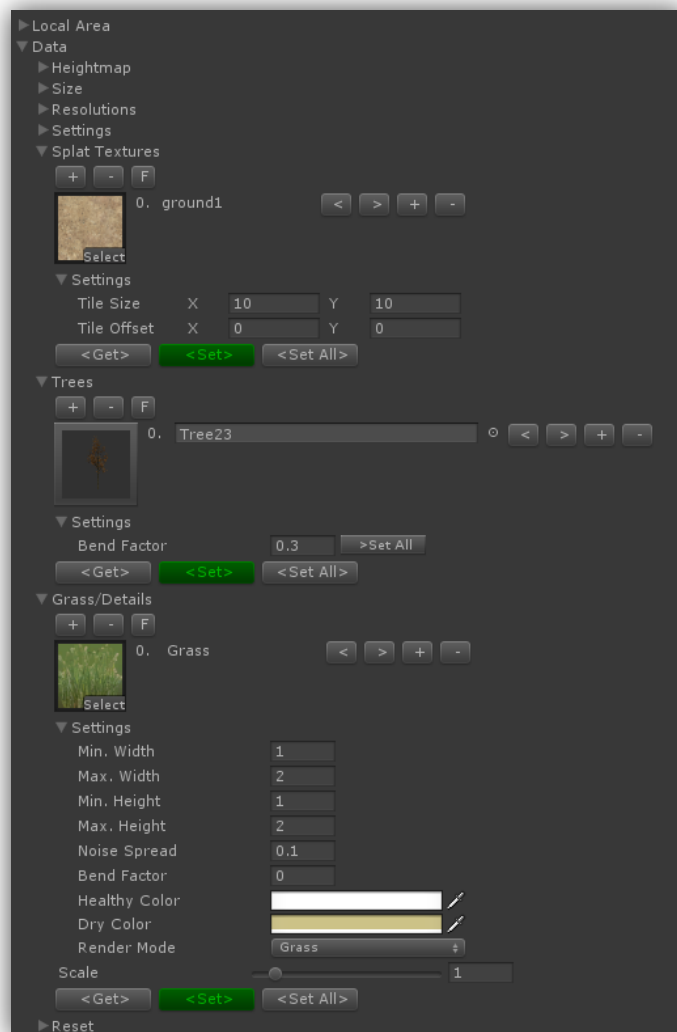
## Terrain options in TerrainComposer

1. Once you created the terrain with TC, new options will appear. If you have more terrains in TC then the buttons '<Set All>' and '<Fit All>' will appear. By shift clicking these buttons the setting of that particular foldout will be set to all the terrains in the list.
2. Also the '<Get>' and '<Set>' buttons will appear. With these buttons you can read/write (synchronize) the information with the terrain in the Scene. If you already had a terrain in the Scene or you would manually change the terrain in the Scene, you can get the settings from the terrain by shift clicking '<Get>'. If you change information in TC then you need to shift click the '<Set>' button to write the changes to the terrain in the Scene. The '<Set>' button color will get green if the information between the two are not synchronous, so you can either click '<Get>' or '<Set>'.
3. The Scale is the scale between terrain size and heightmap resolution.
4. Under the 'Reset' foldout you can reset heightmap, splatmap, trees, grass/detail and placed objects to zero by holding the control key and clicking the desired button. If you want to do this for all terrains shift control click.
5. Under the 'Scripts' foldout you can add custom scripts to the terrain in the Scene. The Neighbor script is for multiple terrains. This will automatically set every terrain neighbor of all the terrains, making a seamless border.



## Assigning Splat textures to your Terrain

1. Every terrain needs splat textures, for the splat and color layer to work you need to assign them. These are the textures that are used to decorate your terrain. The optimal performance would be to use not more than 4 splat textures, because for every 4 splat textures Unity creates another Alpha map.
2. For the creation of a splatmap use normal splat textures like: ground, grass, dirt, rock, etc. For the creation of a colormap use the Red/Green/Blue textures in that order on the first three splat texture slots. The mix of those 3 makes it possible to render any color on the terrain, which makes it possible to paint any picture on the terrain (like satellite images).
3. Adjust the Tile size of each splat Texture to look optimal, for ground/grass/dirt I recommend keeping it at the low side 15-50, and for rock/cliff textures you can choose higher Tile settings like 50-500. It all depends on your personal preferences and what type of landscape you want to make. If you want close detail or far away detail, etc.
4. Once you're done with assigning the splat Textures and the Tile sizes, shift click '<Set>' to transfer these settings to the terrain in your Scene. If you shift click '<Set All>', all the terrains in the TC Terrain List will be set to these splat settings.



## Assigning Trees/Grass and detail meshes to your Terrain

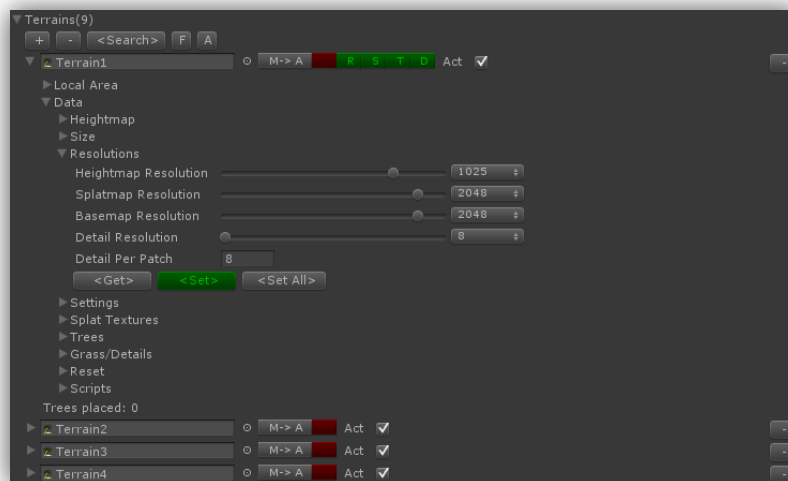
### Trees

1. You can assign trees at the Trees foldout, this works the same as the Splat foldout, here you can add your trees from your project. There must be at least one tree added for the tree layer to work.
2. Click '<Set>' to transfer the data to the terrain in your Scene.

### Grass/Detail meshes

1. You can assign grass/detail meshes at the Details foldout, this will also work the same way. There must be at least one detail assigned for the grass layer to work.
2. You can choose between textures and meshes. For textures assign the texture field, for meshes you have to assign the terrain in the Scene manually.
3. To my opinion the best and fastest performance is to set Render Mode to -> Grass, this will not let the grass face the camera always.
4. Click '<Set>' to transfer the data to the terrain in your Scene.

## Asynchronous Terrain Messages



If a setting in the TC terrain list is not synchronous a green colored button will be added to the end of the terrain, so you can see it easily and correct it. The 'R' button is for asynchrone Resolutions, the 'S' for asynchrone Splat Textures, the 'T' button for asynchrone Trees and the 'D' button for asynchrone Grass/Details. If you click the buttons it will automatically foldout to where you can click the '<Get>' or '<Set>' button to remove the message button.

If you have multiple terrains active, for the tile system to work you need to click '<Fit All>' button. If the tile system is inactive it will be indicated by the red button behind the terrain. The tile system will break after clicking the '<Search>' button, so you have to click it again.

## Terrain Settings

These are the same settings which you can set with Unity terrain. The difference is you can set higher values, and you can set them for the editor mode as well as runtime mode. You can change the max settings in TC Menu -> Options -> Terrain Max Settings. You also have the option to apply it to all terrains, which saves a lot of time. Keep in mind to not set the settings too high for Editor mode, especially the grass distance, it might crash Unity.

### Base Terrain

#### Pixel Error

Controls the amount of allowable errors in the display of Terrain Geometry. This is essentially a geometry LOD setting; the higher the value, the less dense terrain geometry will be.

#### Heightmap Maximum LOD

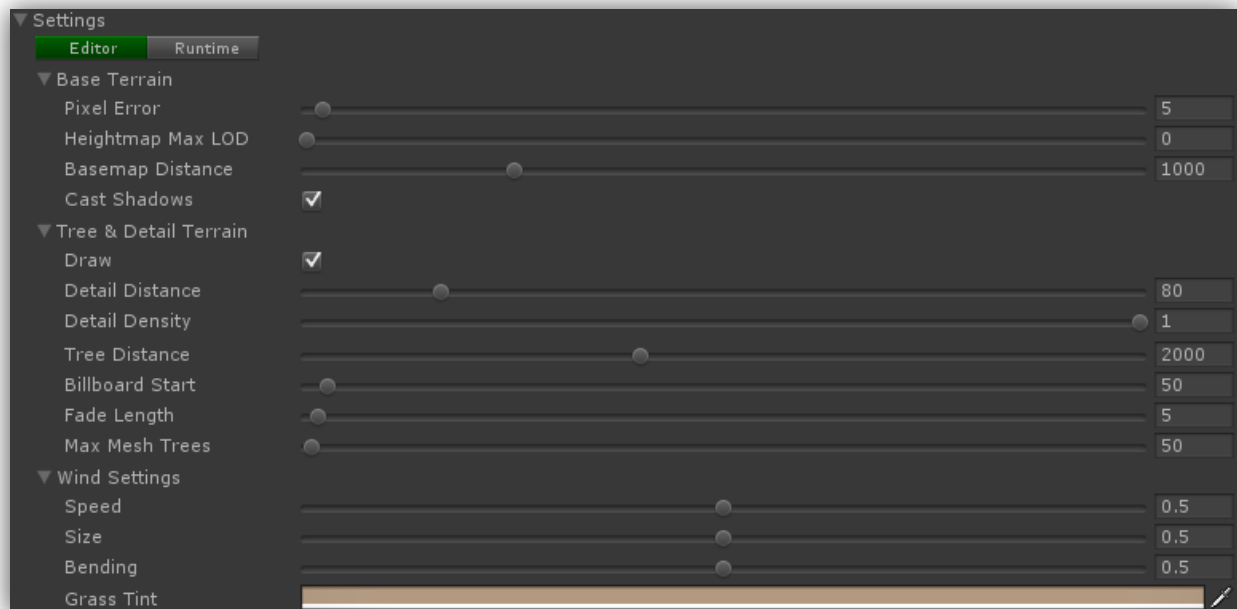
Lets you essentially lower the heightmap resolution used for rendering. This can be used on low end cards to never display the highest lod terrain. A value of 0 means always showing highest detail. A value of 1 means the triangle count will be reduced to 1/4th. The heightmap resolution will be halved for width and height.

#### Base Map Distance

The distance that Terrain Textures will be displayed in high-resolution. After this distance, a low-resolution composited texture will be displayed.

#### Cast Shadows

Should terrain cast shadows?



## Tree & Detail Settings

### Draw

If enabled, all trees, grass, and detail meshes will be drawn.

### Detail Distance

Distance from the camera that details will stop being displayed.

### Tree Distance

Distance from the camera that trees will stop being displayed. The higher this is, the further-distance trees can be seen.

### Billboard Start

Distance from the camera that trees will start appearing as Billboards instead of Meshes.

### Fade Length

Total distance delta that trees will use to transition from Billboard orientation to Mesh orientation.

### Max Mesh Trees

Total number of allowed mesh trees to be capped in the Terrain.

## Wind Settings

### Speed

The speed that wind blows through grass.

### Size

The areas of grass that are affected by wind all at once.

### Bending

Amount that grass will bend due to wind.

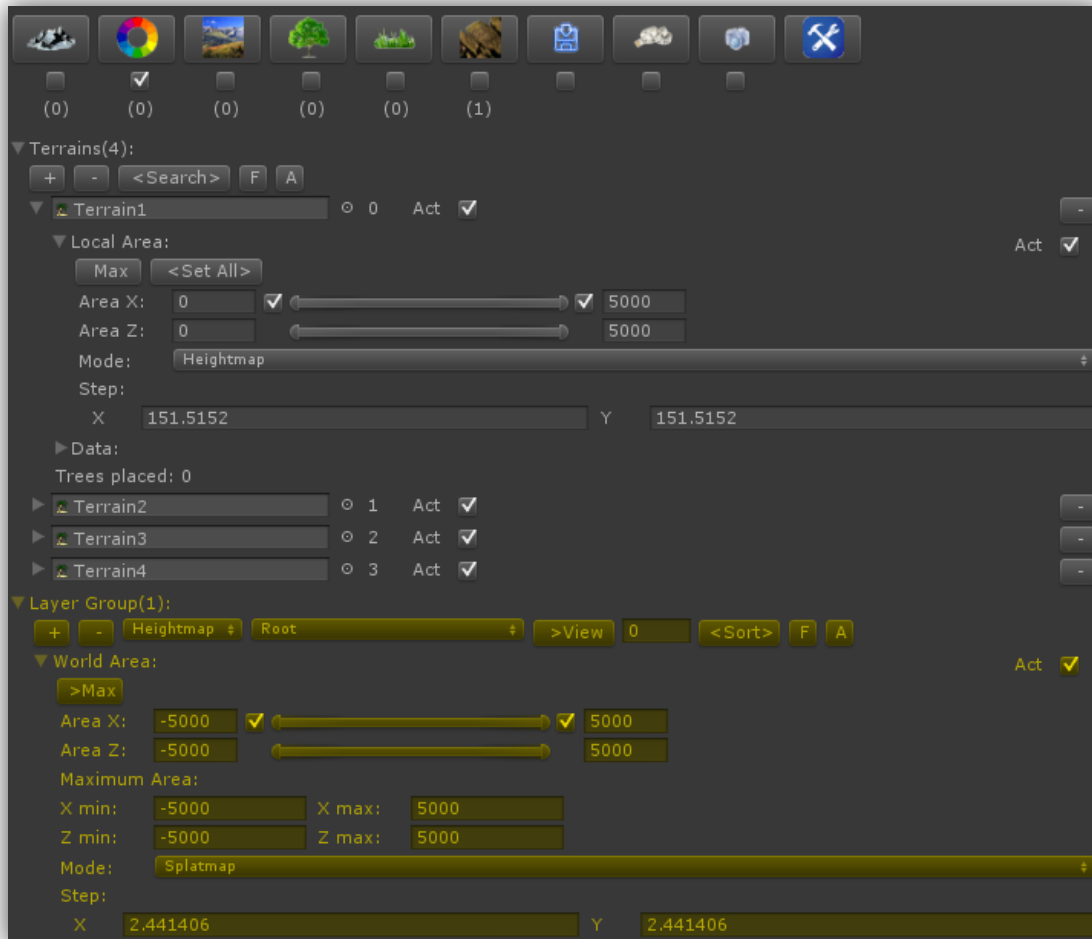
### Grass Tint

Overall tint amount for all Grass and Detail Meshes.

## Local Area and World Area

### Customize output Areas and Jump Steps

TerrainComposer has the feature built in, to use custom square areas. It is used with multi-level placement and I can be useful if you only want to output to a certain area to see quick results, as a bigger area takes more time to calculate. TC support two area modes, Local Area and World Area.



### Jump Steps

An area can be setup with different step modes. The Step is the distance jump in Unity units that TC makes within its generation loop (x is the x-axis, y is the world z-axis). That this is customizable, is needed for faster performance in generation as well as for placing objects that need more placement precision. It's not an option to put the step mode to -> custom -> 0.1 always, because it would take too long to generate. Standard the mode is on automatic, which will automatically select the highest resolution from the categories of the active output buttons.



## Local Area

The Local Area mode restrict the area to the borders of its terrain. However with multi level placement there is only World Area, because for correct generation on multiple terrains. For example you place a building through layer Level0 and for layer level1 you have an Area of 512x512 Unity units. You want to place trees around the building. But if the building would be placed near the border of the current terrain, at where the level1 area would exceed the border of the current terrain, there would be no placement.

In local area mode TC will generate each terrain one by one, by starting with the terrain in the top of the TC Terrain List, to all the way down. If you deactivate a Terrain it will be skipped. It is very usefull with multiple terrains to only activate one terrain and disable the rest between final setup, to lower generation waiting time.

You can select a local area in every terrain in the list. The local area setup is displayed behind each terrain with the 'M -> A' buttons. This is useful to see quickly how it is setup, sometimes generation goes not as you wish, and this is the first thing you have to check. 'M' means maximum area, 'C' custom area. 'A' means automatic step mode. If you want to generate over the whole terrain area from a custom area, click the 'max' button. If you use multiple terrains and you want to use the Local Area of the terrain for the rest of the other terrains (including Step Mode), shift click '<Set All>'.



## World Area

The World Area mode has no boundary limitations. It can run outside the terrain boundaries also where there is no terrain next to it, this options might be needed for object placement. So you don't need a terrain to place objects. However most of the time you don't want to set the world area bigger than the total size of your combined terrains.

To have all the freedom you want, you can change the max boundaries of the area yourself, by setting the Maximum Area values. By clicking the '>Max' button the area will automatically be set to the maximum you defined. To calculate the maximum area of your combined terrains shift click '>Max' button. And by clicking it again without holding shift, will set the area to the maximum.



# The Generation System

## Introduction

Because TerrainComposer uses a generation system that works the same for every output you can duplicate a layer with its rules, change the new layer output, and go from there on with the rules which are already there.

For example you created a tree layer for placing forests on your terrain. Now if you want to place grass at where you placed the trees, you can duplicate the layer, change the layer output to grass, and the same rules are already there. And then you can make small modifications for the rules to fit your need. Or if you want to place rocks in your forest, you just change layer output to object and go from there on. Another example if you make colormaps and splatmaps, you can just duplicate your color layers and change them to splat layers or vice versa.

## Layers Outputs

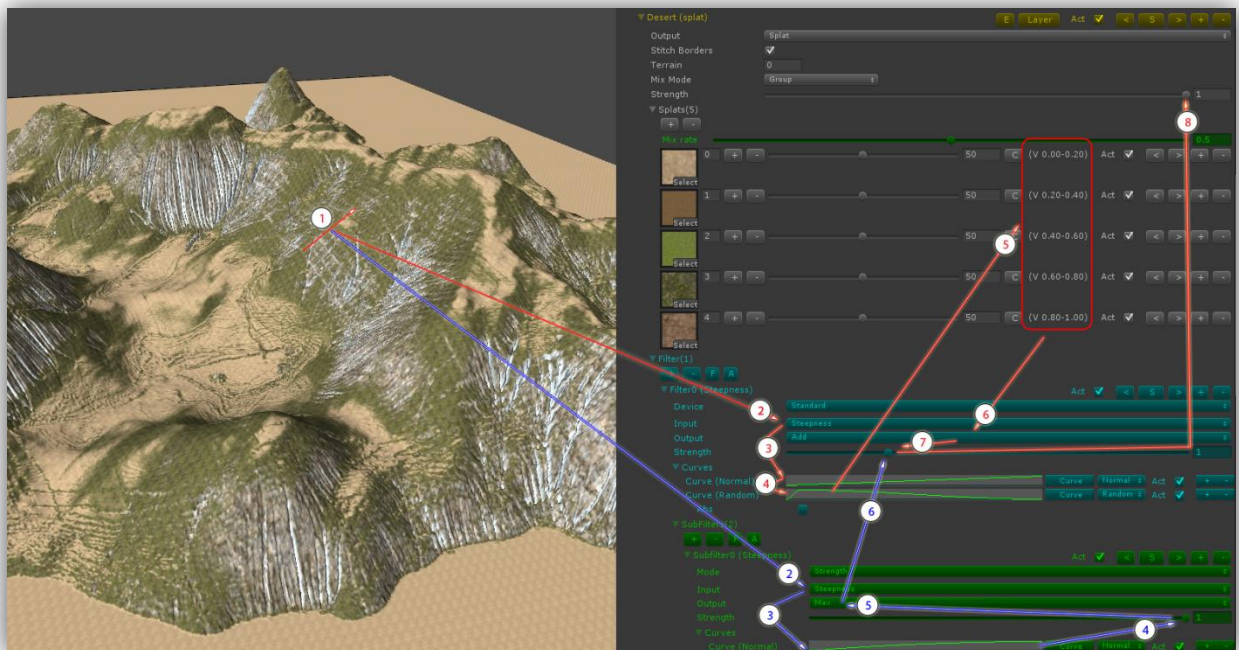
All layer outputs are explained in the Island Tutorial documentation.



## Filters and subfilters

Each layer has its filter system, where you can add an unlimited amount of filters (blue color). And every filter has its subfilter system, where you can add an unlimited amount of subfilters (green color). With filters and subfilters you can create the rules for how each layer generates its output.

The picture is an example of a splat layer with a filter and subfilters. The filter is for selecting the splat textures in the layer, while a subfilter is for the alpha channel of the splat textures selected by the filter. For each filter and subfilter you can choose an input parameter, for example parameters from the terrain like height, steepness and normal or certain colors or color ranges from an image, etc. TerrainComposer works with normalized values with a range from 0 to 1. The filter in the picture reads the normalized steepness from the terrain, 0 degrees steepness is normalized to 0, 45 degrees is normalized to 0.5, while maximum steepness of 90 degrees is normalized to 1. This is done because then you can use each input parameter the same way and also because the Unity curve editor default curves have ranges from 0-1.



Here follows the sequence from the picture how a filter and subfilter get their output value from their chosen input.

### Filter from input to output

1. The filter reads the steepness for example 45 degrees from the terrain at certain coordinate.
2. The read 45 degrees will be normalized to an input value 0.5.
3. The normal curve is active and will be evaluated at time 0.5. Because the curve is linear going from 0.0 to 1.1, the filter value will stay 0.5.
4. The random curve is active and will be also evaluated at time 0.5. You can't see it on the picture but this is about 0.14. Because this is a random curve a random value between -0.14-0.14 will be chosen and added to the filter value. Let's say 0.1, so the filter value now is  $0.5 + 0.1 = 0.6$ .
5. Because mix is on 0.5, splat 2 and splat 3 are chosen, and are added with each alpha of 0.5..
6. The splat2 and splat3 alpha values will be added to the filter value, how much is depending on the next step.

7. The strength of the filter influences how much alpha value will be added for the selected splat to the layer value. A strength of 0.5 will decrease the chosen alpha by 50%. While strength of 1 is a 100%. The strength of the filter is linked with the subfilter value as well as the layer strength.
8. The layer strength will decrease/increase all the strength of its filters inside the layer. A layer strength of 0.5, will decrease them by 50%. This you can use to mix 2 layers.

### Subfilter from input to output

1. The subfilter reads the steepness of terrain at the same coordinate, which is 45 degrees.
2. The read 45 degrees will be normalized to an input value of 0.5.
3. The normal curve is active and will be evaluated at time 0.5. Because the curve line is deviating from a linear line from 0.0-1.1, the subfilter value changes to 0.75.
4. The subfilter strength will determine how much influence the subfilter value has on the filter strength. If it's on 0.5, then it will only influence the filter strength for a max deviation of 50%.
5. This filter contains 2 subfilters (only the first subfilter is visible on the picture). The output is on 'max', so the if the value of subfilter0 is bigger than the value of subfilter1, subfilter0 value will be chosen.
6. The subfilter value will change the filter strength, because it is 0.75. The filter strength (1) will become  $1 * 0.75 = 0.75$ .

The layer strength is on 100% so the total output value of this layer is splat 2 ->  $0.5 * 0.75 = 0.375$  and splat 3 also 0.375. To see how it works its best to experiment with it, you can use auto generation to quickly see any changes you make.

### Filter and subfilter use in a layer

Here is a short overview of what each filter and subfilter in the different layer outputs are for:

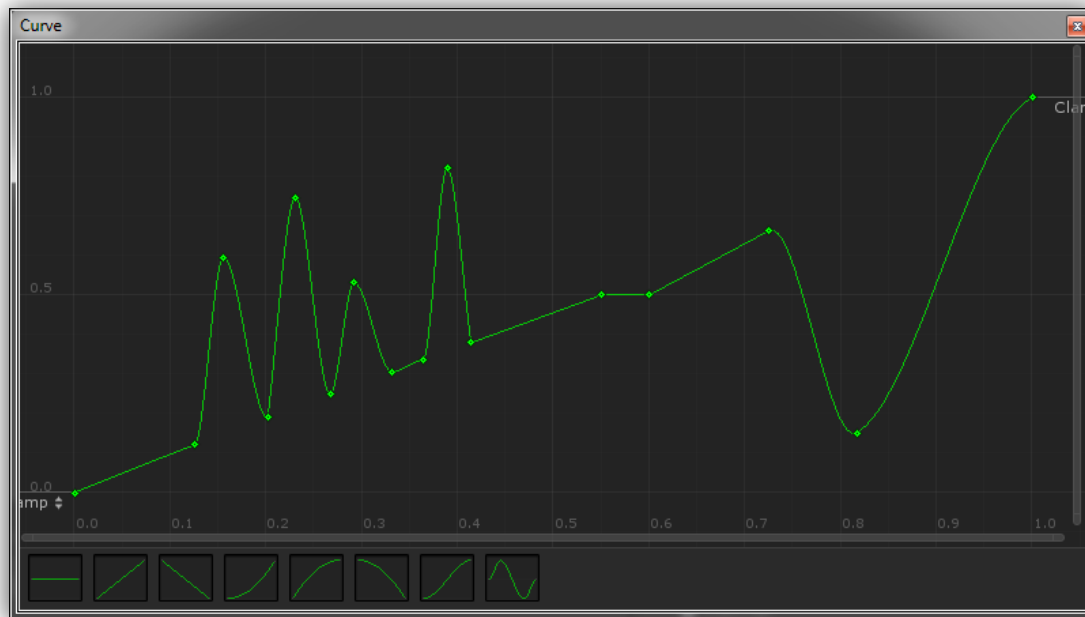
	Filter	Subfilter
Heightmap Layer	Height	Height
Color Layer	Color	Alpha
Splat Layer	Splat Texture	Alpha
Tree Layer	Tree	Placement Density
Grass Layer	Grass	Placement Density
Object Layer	Object	Placement Density

### Layer Strength, Filter Strength and subfilter value

The subfilter value, filter strength and layer strength are linked. Which means that with subfilter value you can influence the total filter strength. With layer strength you will influence the total filter strength of each filter in the layer. A filter without subfilters has a default subfilter value of 1, that will always give 100% height, alpha or density (based on the layer output).

## Curves

In each filter and subfilter you can add/remove curves. At the moment there are 3 types, a 'normal' curve, a 'random curve' and a 'perlin curve'. A 'normal' curve will change the input data. A 'random'



and 'perlin' curve will be added or subtracted from the input data. Here a random range will be chosen from 0 to the vertical value you set. It will also randomize negative values in the same range. if you want only positive values to be added enable -> Curve Abs.

### Deviate the output with a curve

You can use a curve to change an input value to another value. A curve works like this, first the filter/subfilter read its input value. Then that value will be the 'time' that will be evaluated in the curve, which will give a new value if the curve line isn't going linear from key 0.0 to key 1.1. There are two variables in each curve, the 'time' which is on the horizontal axis and the 'value' which is on the vertical axis. You can use the curves in filters and subfilter to give all kinds of effects as well as for mixing filters and layers.



## Tree Colors from an Image

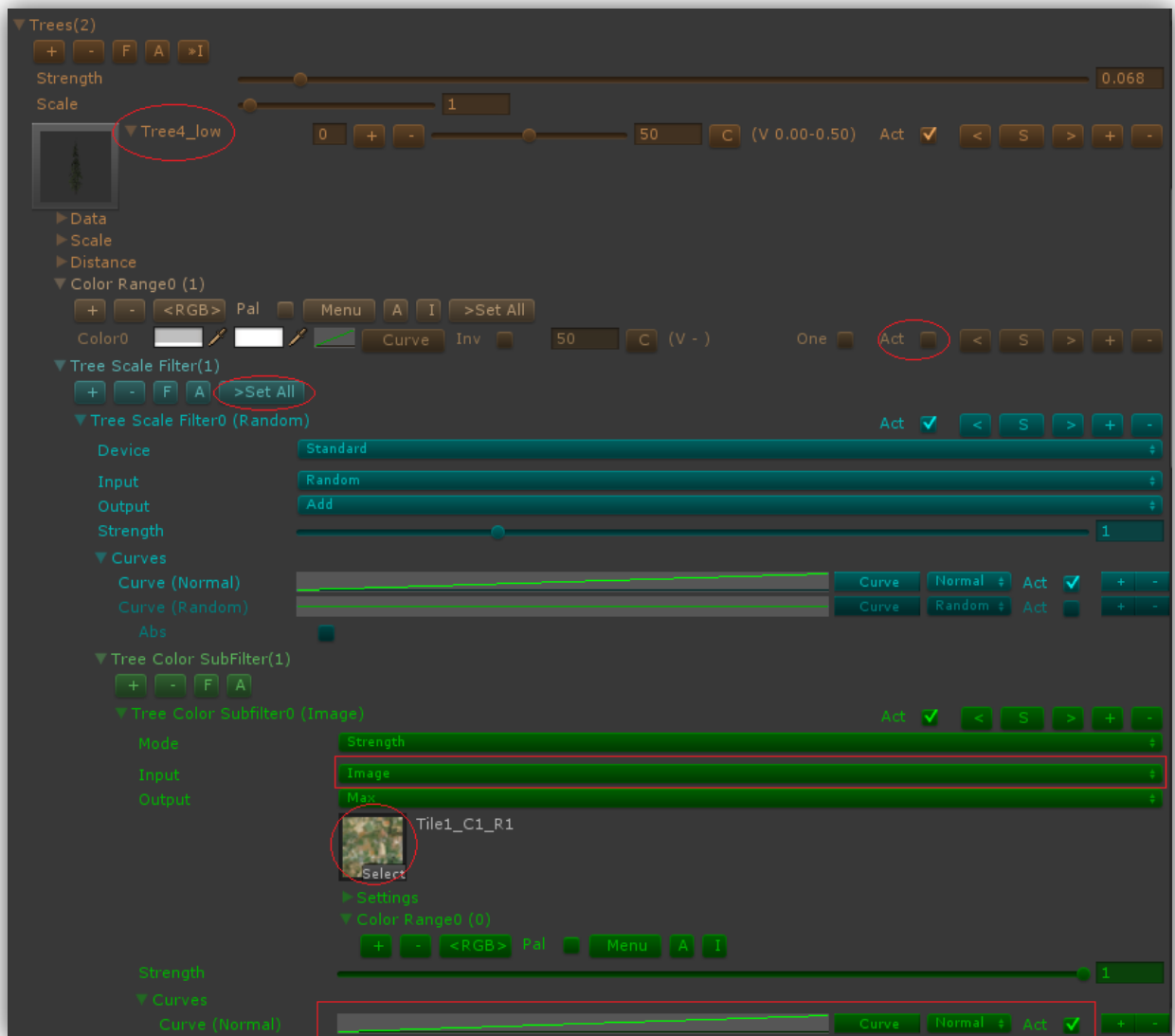


In these two example screenshots, I use a satellite image to color the trees. This can give very good looking results. The satellite image I used is included.

## Setting up tree layer for tree colors from image

To setup a tree layer for this:

1. Unfold a tree in the tree layer.
2. Deactivate or erase color0 from 'Color Range0'.
3. Unfold the 'Tree Color Subfilter'. This under the Tree Scale Filter.
4. Change Input from 'Random' -> Image.
5. Assign your image.
6. You can use the normal curve to make the colors brighter (higher curve key0) and darker (lower curve key1).
7. Click '>Set All' at the 'Tree Scale Filter' if you want to apply this for all active trees in the layer. Shift click to apply to all trees.



## Generate Settings

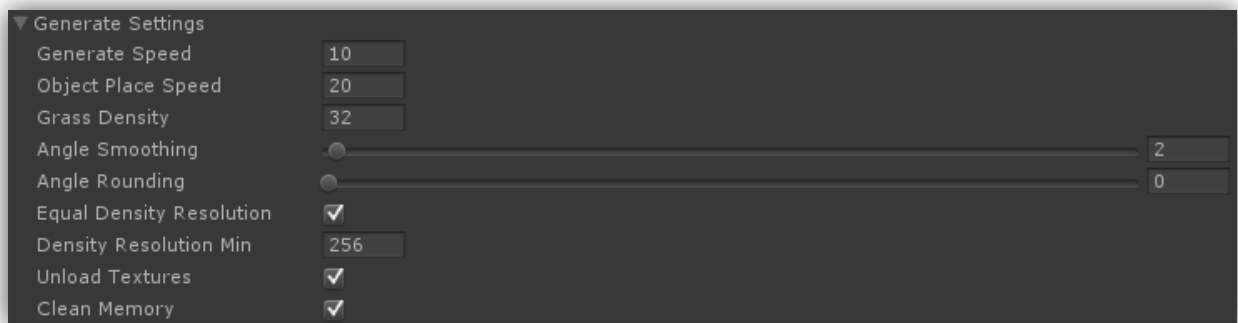
With generate settings you can adjust the speed of generation and set different parameters for generation. To display generate settings go to TC Menu -> Options -> Generate Settings.

### Generate Speed

This is the speed of generation. Because it uses multi-threading you can set the speed of generation vs. speed of Unity editor. The generate speed are the number of rows TC will generate before returning to Unity.

### Object Place Speed

This is the speed for object placement. This is the number of objects that can be maximum placed in a row before returning to Unity. It works the same way as Generate Speed.



### Grass Density

This is the default max value that will be assigned for grass. If this value is too high there will be empty gaps in placement.

### Angle Smoothing

This is the square area size on the terrain that is read with 'Steepness'. A higher value will give more smoothing with texturing. TerrainComposer calculates angle from multiple terrains at the borders, so you get seamless texturing at the borders.

### Angle Rounding

If you get a dark-light pattern in texturing with 'Steepness' then you can set the Angle Rounding to about 50. Unity GetHeight function has 1% deviation. I only noticed this with texturing a terrain that was straight going up with 30 degrees. It might be needed in rare cases.

### Equal Density Resolution

This is for placing grass, trees and objects. With this enabled you will always get the same density of placement with every resolution if it the resolution is the same or above 'Density Resolution Min'. With this setting disabled, the density will increase x4 if you double the resolution. To get more placement higher the 'Density Resolution Min'.

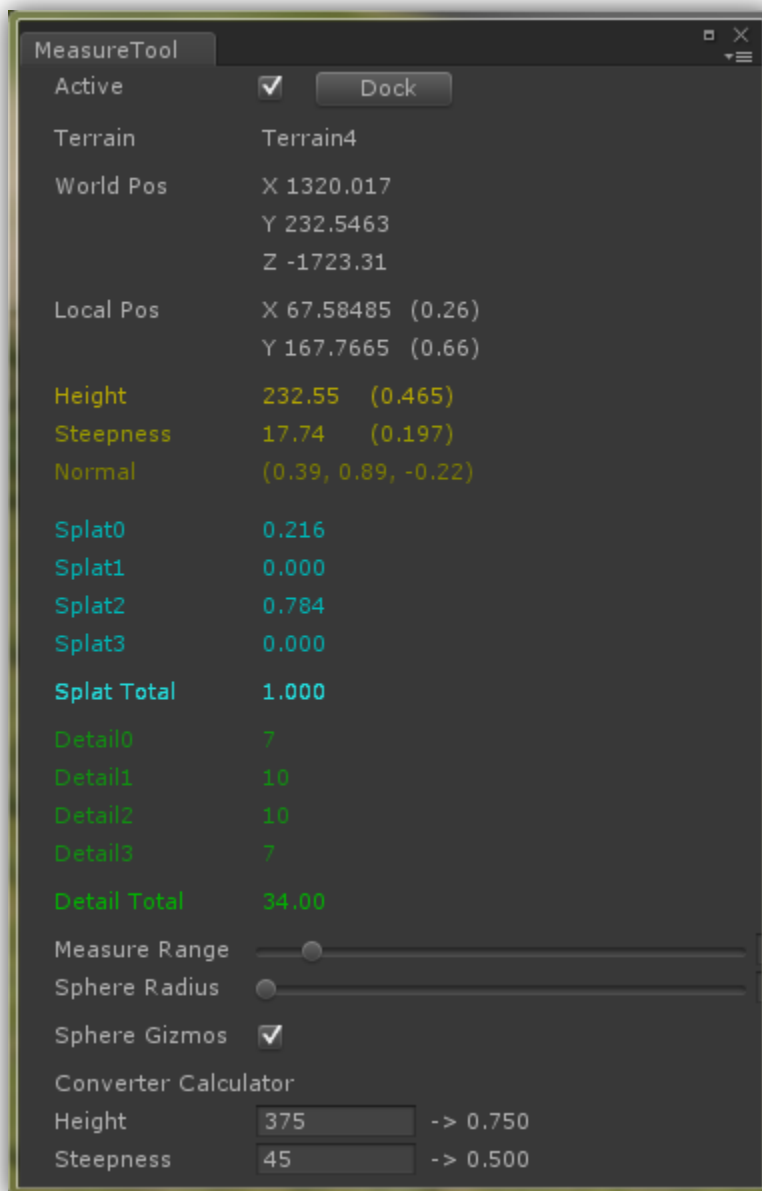
### Unload Textures and Clean Memory

These options attempt to keep the memory more clean, by doing manual garbage collection after each generation.

## Tools

### Measure Tool

With the measure tool you can measure terrains. The terrain will be measured at the mouse pointer in the Scene view. You can measure the height, steepness and normal of a terrain. The normalized height and steepness is displayed behind them between the parentheses. You can use the measure tool to create rules in the filters and subfilters by visually measuring terrain height and steepness. If you want to freeze at a certain position to read the values, hold control and right click at that position. Now 'locked' will appear behind the values, control right click again to unfreeze again. The splat values are also measured including the splat total value. With splat texturing this should be always 1 (when higher you get over bright texturing), except if you use shadows with splat texturing on your terrain.



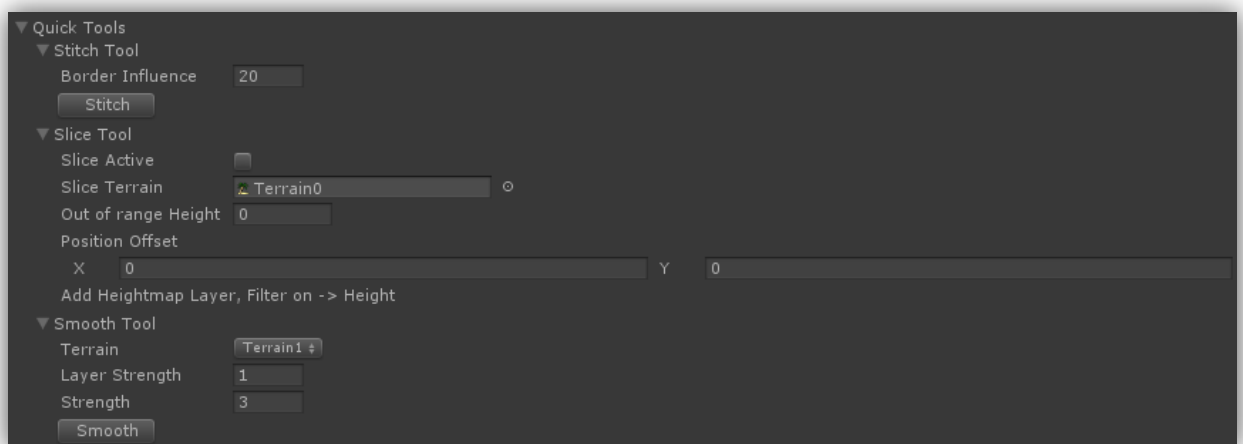
The grass/detail is also measured (green color). There is also a converter calculator if you want to know the normalized values of height and steepness, you can enter them there, and the normalized value will be displayed behind it.

## Quick Tools

### Stitch Tool

If you create multiple terrains and there are seams at the border of the terrains you can use the Stitch Tool. This is located in Quick Tools foldout -> Stitch Tool. You can choose the stitch length in 'Border Influence', this length is in Unity units. Depending on the fitting of the heightmaps you need to choose a value. If they almost fit a low value will give the best results. If they do not fit at all a higher value is needed.

The 'Stitch' button will execute the stitch. Remember that in the editor mode you will always see a seam, even if the terrains fit perfectly. If you go to runtime mode there should be no seam visible. In the heightmap layer you can enable 'Stitch Borders'. Which will automatically stitch the terrains after generating. The border length is read from the Stitch Tool.



### Slice Tool

With the slice tool you can spread one terrain over more terrains. To do this:

1. You have to create the terrains (terrain tiles) in the TC Terrain List where you want to spread your slice terrain over.
2. Drag the terrain you want to slice in the 'Slice Terrain'.
3. The slice terrain height is measured at the same position where the terrains are, so you need to move the slice terrain over the terrain tiles (in the Scene View).
4. Add a heightmap layer (when not already there), with filter on height. Enable Height Output button.
5. Enable 'Slice Active'. The 'Generate' button text will change into 'Slice', click it. To return to generate mode again, deactivate 'Slice Active'.

### Smooth Tool

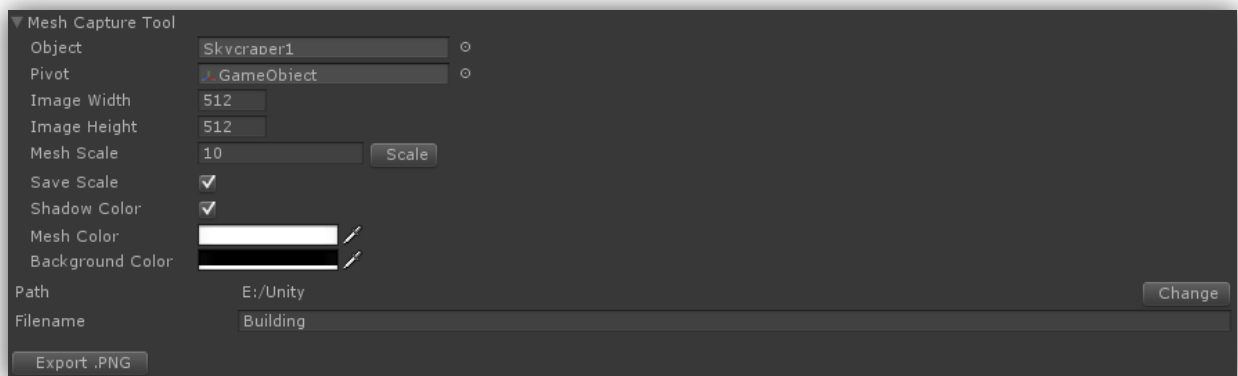
There is also a Smooth Tool located in Quick Tools, this is for smoothing the terrain. You can select the terrain you want to smooth as well as the strength. For example if you choose 3 it will smooth the terrain 3 times. In the heightmap layer is also the smooth toggle. If you enable this it will automatically smooth the terrain after generation, with the value from 'Layer Strength' in the Smooth Tool.

## Mesh Capture Tool

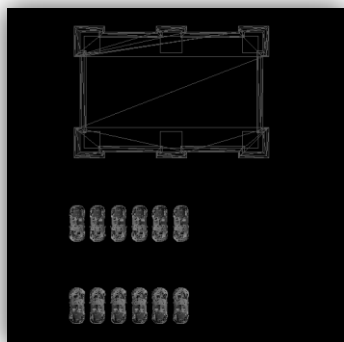
With the Mesh Capture Tool you can make a top view wireframe image of 3d models in your Scene. This is about the same view as selecting 'wireframe' display in Scene View and Scene Gizmo on top (in Unity). The difference is that the mesh capture tool will capture an exact scale. The image can be used for filters and subfilters (in Input -> Image).

To make a top view image of meshes:

1. Enable the mesh capture tool, click the camera button at the top, or go to TC Menu -> Tools -> Mesh Capture Tool.
2. The 3d models you want to make an image for have to be in the Scene.
3. Drag the GameObject that has the mesh into 'Object'.
4. If you want to make an image of more meshes these GameObjects containing the meshes must be children of the GameObject in 'Object', and you must place them all relative to each other and to the right scale in the Scene View.
5. You can choose a manual pivot. It's easy to use an empty GameObject, position it in the Scene View, and drag it into 'Pivot'. If the 'Pivot' is left empty, the pivot will be the pivot of the GameObject in 'Object'.
6. You can choose the image resolution.
7. You can choose the zoom scale, this scale you should also use when assigning the image to a filter/subfilter.
8. You can choose the mesh color and the background color.
9. Choose a path and filename.
10. Click 'Export .PNG'.



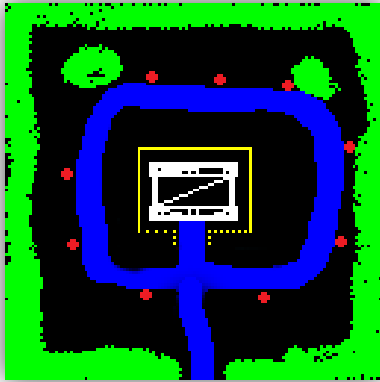
For example if you want to place buildings and you want to design a surrounding for the building, trees, bushes, benches and other objects. You can make the image of the top view of the building with the mesh capture tool and use it as a start (see picture).



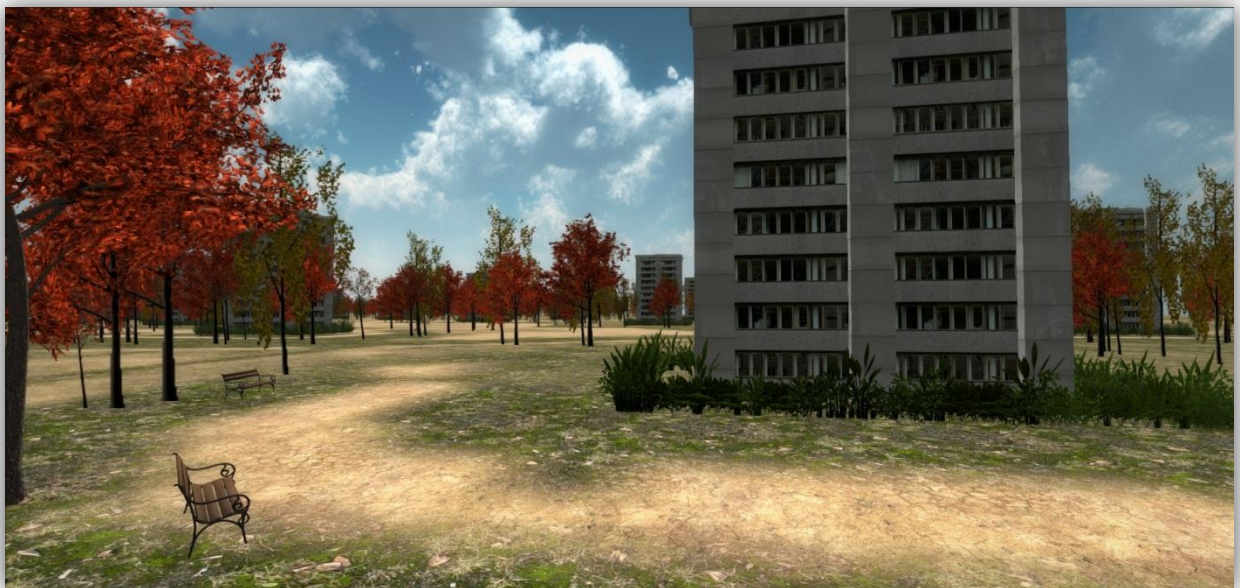
- \* An example image of a top view 3d model building with parked cars created with the mesh capture tool.



The mesh capture tool is especially useful when using multi-level placement. Here again in the example image the building is the part that is created with the mesh capture tool. This then is used to design the garden around the building. You can assign any color to anything in TC, so the colors you use is totally up to you.



I used the white color for the building (not used for placement). The yellow color for the vegetation around the building (tree layer), the blue color to make a path (splat layer), the green color to place trees (tree layer) and the red color to place benches that face the building (object layer). In the picture below you can see the end result created with TC of this simple design.

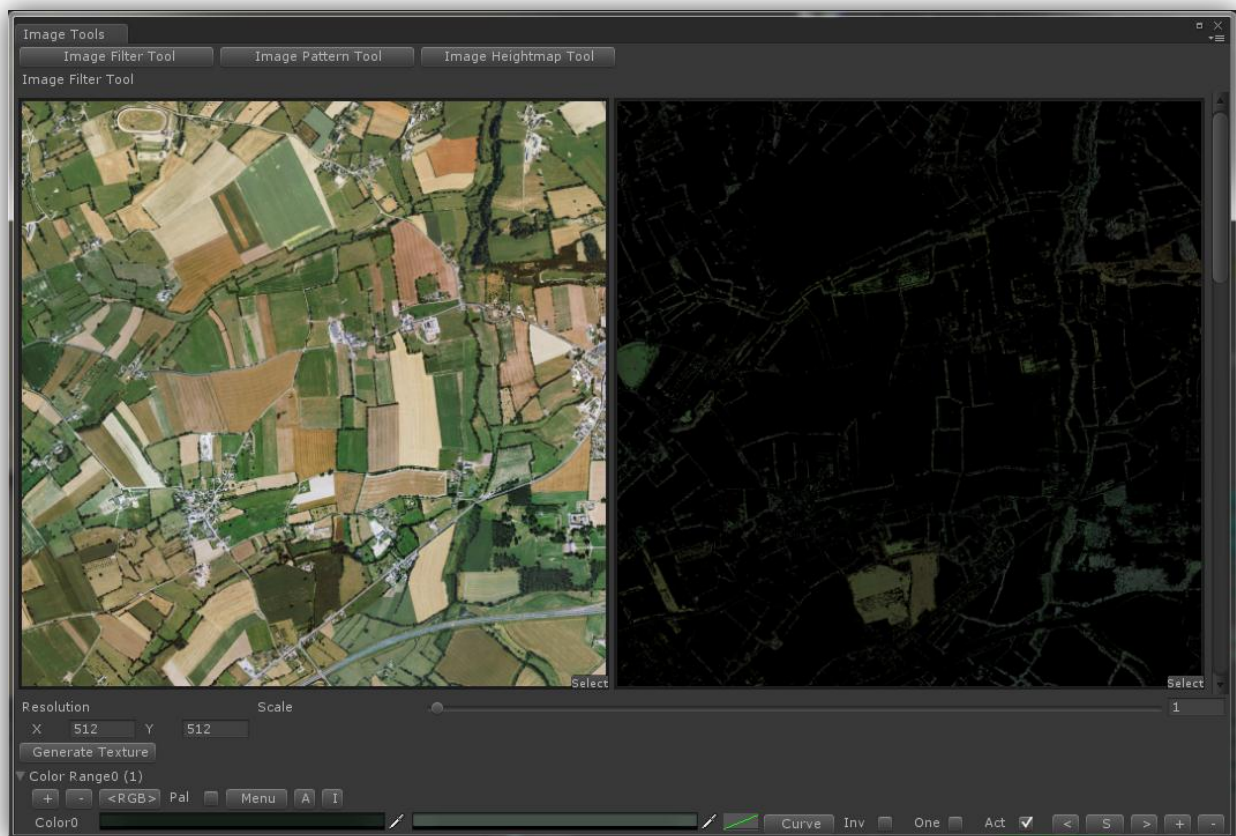


## Image Filter Tool

The Image Filter Tool can be used to visualize the output you get with using color ranges as condition rules with an image. This is the same output you would get with using 'Image' input in filters/subfilters with using the same color ranges.

To start it:

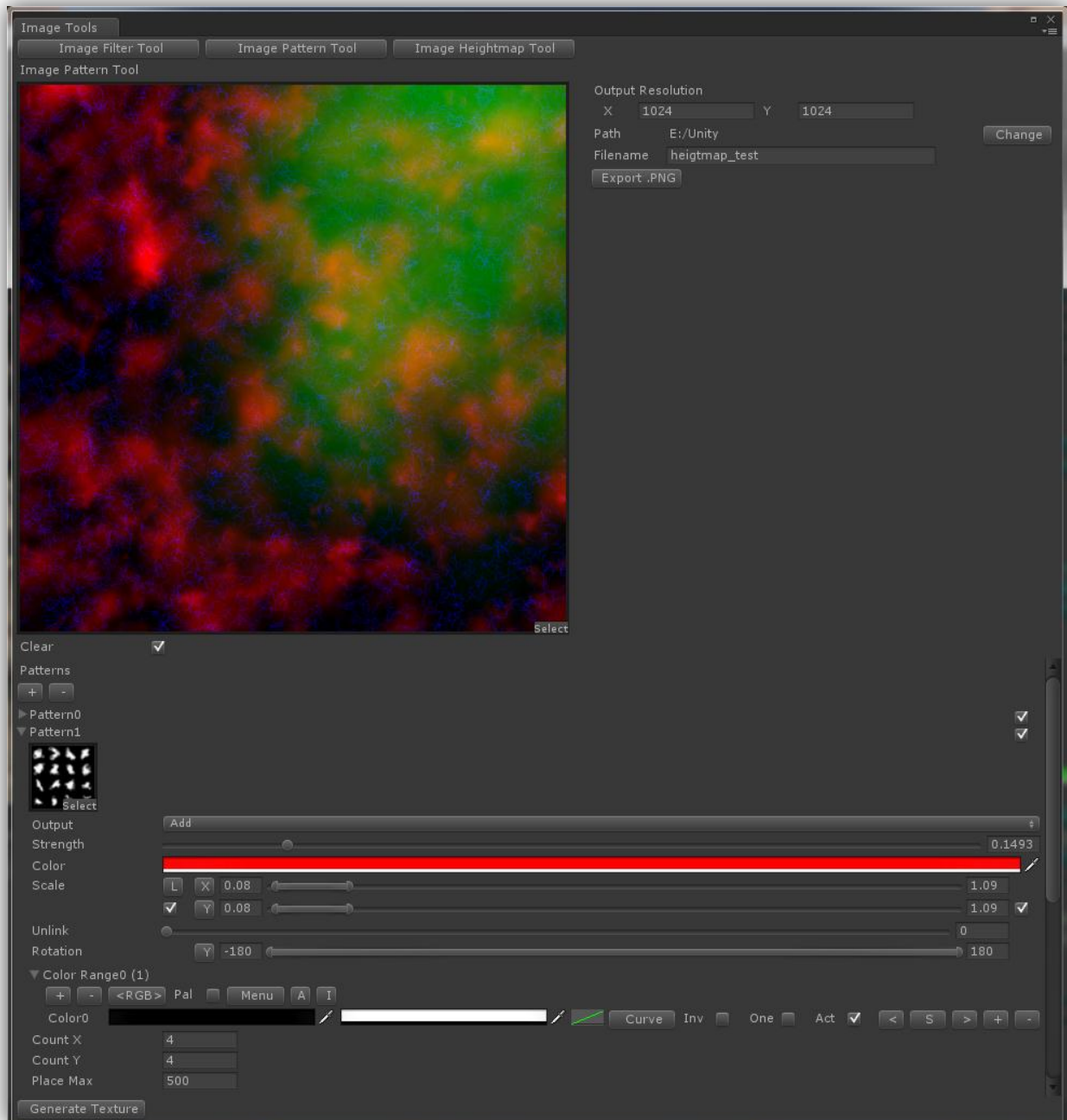
1. Click the blue tool button at the top, and select 'Image Filter Tool' button in the 'Image Tools' window. Or go to TC Menu -> Tools -> Image Filter Tool.
2. Select the image you want to use in the left texture box.
3. Add color range(s), and pick your condition colors. You can zoom in on the image with the 'Scale' slider. And move around with the horizontal and vertical scroll bars.
4. Click 'Generate Texture' button. The filtering result will be displayed at the right texture box.
5. You can load/save the color ranges. To do this click the 'Menu' button (above the first color of the color range), a menu will appear with Open/Save. If you have 1 color range you can copy and paste it directly into your filter/subfilter. Alt click on 'S' of the color range interface button. Alt click on the '+' on your image color range in your filter/subfilter.



This tool is very useful for example when using satellite images where you want to choose a certain color range for placement of something. Like for the placement of trees in the example picture, because you see the preview you can fine-tune the output. In my second video on Youtube, you can see this tool in action.

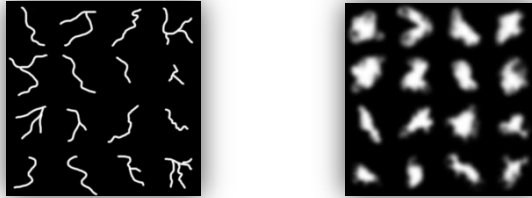
## Image Pattern Tool

The Image Pattern Tool can be used to create all kind of images, which can be used for heightmap creation as well as texturing the terrain, or for placed rules, etc. It's based on input images that are painted with a different scale and rotation a chosen amount of times. You can also use multiple images in 1 image and split it in for example 4x4, which I did in the example pictures. You can add multiple images (patterns) and can use a color for each pattern. I used 3 patterns in the example picture, each one on a different color channel (RGB).

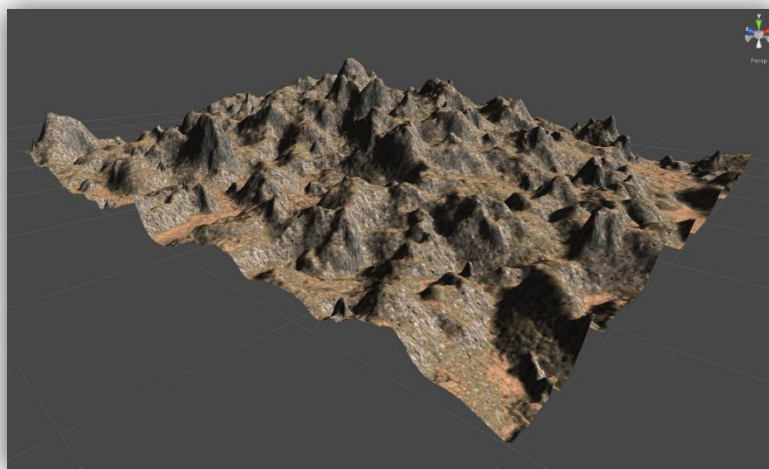


How it works:

1. Click the blue tool button at the top, and select 'Image Pattern Tool' button in the 'Image Tools' window. Or go to TC Menu -> Tools -> Image Pattern Tool.
2. You can choose an output resolution for your output texture, as soon as you change it the 'Change' button will appear, click it if you want it to take effect.
3. You can add/erase patterns with the '+' and '-' button under 'Patterns'.
4. You can select the picture in the texture box. I used these two images.



5. The 'Count X' is for how many images you have on a column, in this case 4. The 'Count Y' is how many images you have on a row, in this case also 4.
6. You can pick the scale range and rotation range, they will be randomly chosen within the range when generating the texture.
7. The scale y is linked to scale x, with unlink you can weaken the link strength. This works the same as with tree scale.
8. You can select an output, like Add, Subtract, Max, Min, etc. Also the strength of the output.
9. You can pick the color for the output, so it will change the color from the input texture to the color you chose. If you want it to be the same, leave it on white.
10. Add a color range to select color ranges from the input picture. If you want it to be draw completely add 1 color range, with first color black and second color white. Without a color range, it will not paint anything.
11. Choose how many times it has to be drawn in the output texture with 'Place Max'.
12. With 'Clear' you can erase the output texture each time you click 'Generate Texture'.
13. Click 'Generate Texture'.
14. Adjust and generate until you are happy with the result.
15. Select a path and filename and click 'Export .PNG'.
16. Now you can use the image in a filter/subfilter.

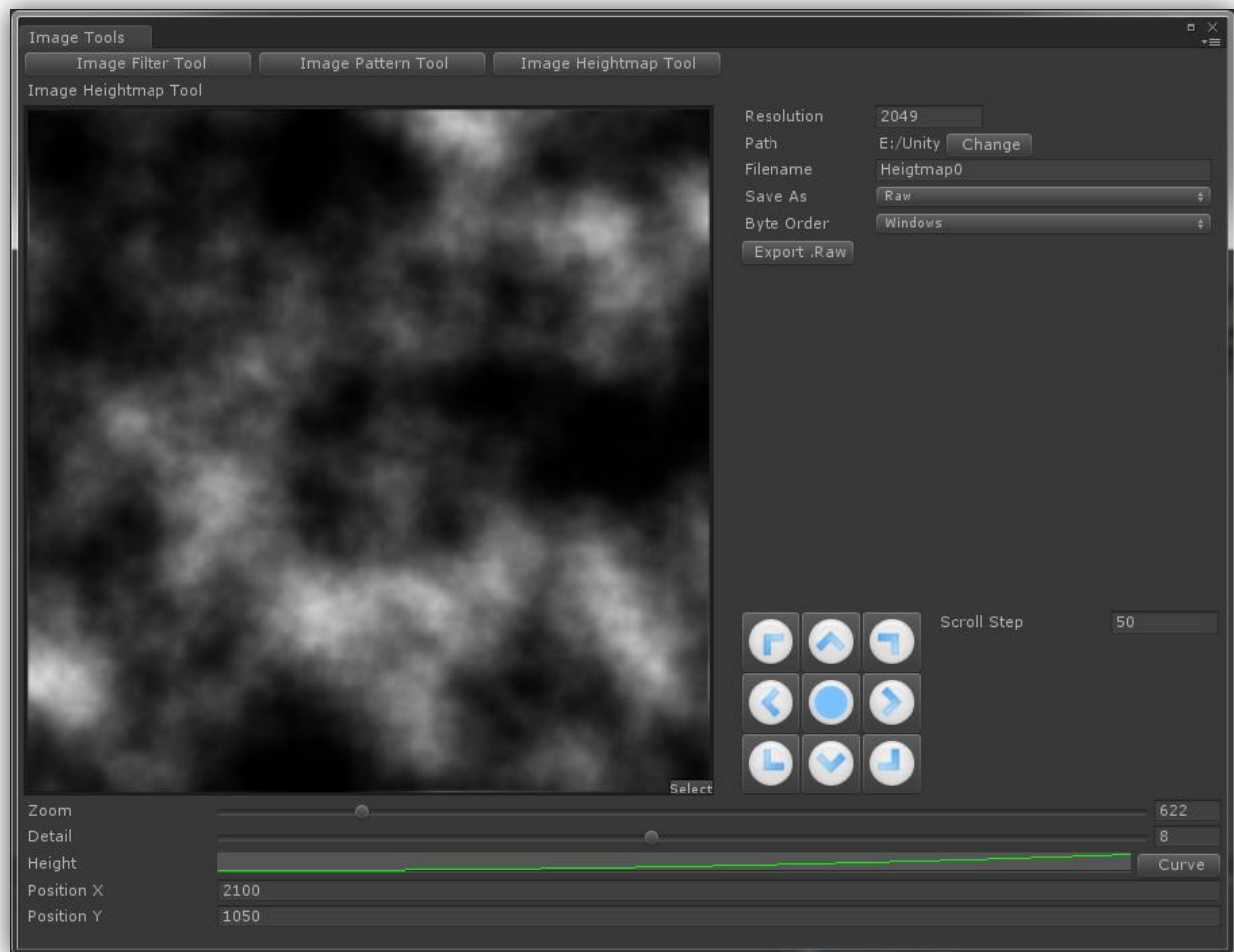


\* Heightmap made with using the image (on the previous page) made with the image pattern tool. I use 1 heightmap layer and 3 filters (one for every color ) with input on 'Image'.



## Image Heightmap Tool

The Image Heightmap Tool can be used to make heightmaps and images. You can export them as 16bit raw files or as png images. If you are going to use it to make a heightmap, I recommend using the raw export, as it has more precision. Using an image with a heightmap layer gives a blocky result because of the 8bit. Because of this the terrain needs to be smoothed afterwards. This tool uses a perlin function, and it is the same as is used in perlin curves in filters/subfilters. The preview image will be updated immediately after changing something. This is very handy to see the end result, you can also use this tool to learn how perlin works and what can be done with a curve.



How it works:

1. Click the blue tool button at the top, and select 'Image Heightmap Tool' button in the 'Image Tools' window. Or go to TC Menu -> Tools -> Image Heightmap Tool.
2. Select your resolution. For heightmaps it's best to use the same resolution that Unity terrain supports like 34,65,129,257,513,1025,2049,4097. Always use  $(2^n)+1$ . You can use a higher resolution for raw and spread it over more terrains.
3. With 'Zoom' you can zoom in and out depending on the scale you want.
4. With 'Detail' you can add more detail.
5. The curve works exactly the same as the normal curve in filters and subfilters.
6. The position can be changed with 'Position X' for horizontal and 'Position Y' for vertical. You can also scroll in all directions with the arrow buttons (white-blue). The speed you can set in scroll step. If you hold shift while clicking the buttons, the speed will be 3x faster.
7. If you alt click the middle button, the position will be randomized. To reset the position to 0,0 control click the middle button.
8. You can choose path and filename. Save it as an image or raw. Click 'Export .Raw'.

## Tips

### Performance

- For fast performance it's best to use 'lower' resolution output first as it saves generating time. If you double the resolution the size will be 4 times bigger so generation time takes 4 times as long. Another option is use high resolution and a smaller area.
- Use auto generation.
- Terrain Composer has the ability to continue working while generating. It returns to Unity after a number of rows have been calculated. You can change this number in generate settings -> Generate Step. Depending on the speed of your PC and your preferences, you can higher or lower the number. The best is to find the number that you can still work decently in Unity while giving the maximum generation speed. The higher the number the faster generation will be and the slower Unity will get while generating.

### Realism

- To get realistic looking mountains and rocks and avoid tiling artifact. You can set higher tile size for those splat textures in the Terrain. It all depends on the distance vs. detail, so you need to find a balance between close and far view.