TerrainComposer Island Tutorial

Table of Contents

Welcome

Hello and welcome to the TerrainComposer Island Tutorial.

This TC Project tutorial is about all Layer outputs.
It also includes exporting raw heightmaps, image height-/slope-/normal maps.

Setting up the Terrains

Let's get started:

- First you need to create 4 Terrains.
- Scroll Down to the Terrain Foldout.
- Terrain Instances --> needs to be on 4.
- Assign Scene Parent --> Terrains GameObject in Scene.
  You can create an Empty GameObject in the Scene, rename it and make it the parent of all terrains you create with TC.
- Choose an asset path were you want to save the terrains in your project.

I used terrain sizes of 1000x250x1000 and the following resolutions for fast generation:
Heightmap -> 256
Splatmap -> 256
Basemap -> 256
Detail -> 512

TerrainComposer has an Auto Generate feature that will generate automatically when you change something in a LayerLevel. This way you can see your results immediately, this improves workflow and learning. For the Auto Generate to work best is to use low splatmap and heightmap resolutions, as this gives faster generation.

- When done with the setup click -> "Create Terrains".
  Now there will appear a red button at the end of each terrain, this happens because the terrains are not fitted together. This is not done automatically. If you would import TC into a existing project that already has terrains, and by adding new terrains you might not want to change the current terrain locations.
- Stitch the terrains together by shift clicking the <Fit All> button.

For the final bake I used these resolutions:
Heightmap -> 2049
Splatmap -> 2048
Basemap -> 2048
Detail -> 1024

This bake you do when you are satisfied with your results and want to see them in high detail. Of course you can choose any resolution based on the performance you want versus detail.

Assigning splat textures

Now you need to assign splat textures, trees and grass. TC is very flexible and you can add or remove those anytime.
You can choose any quantity in each category you wish.

- You can assign splat textures in Terrain Foldout -> Data -> Splat Textures.

I assigned 8 splat textures, you can to do the same or choose a different number. Unity works best with groups of 4 splat textures. The optimum performance is to use 4. For every 4 splat textures Unity uses another alpha map, as each splat texture will be assigned to a color channel (RGBA -> total 4 channels).

These are the types I used:
0. Sand/Ground.
1. Sand2/Ground2 (darker color).
2. Grass (meadows).
3. Forest.
4. Ground3 (darker color).
5. Rock.
6. Rock2.
7. Cliff.

For rock and cliff textures use a higher Tile Size depending on your textures in the range 40-100. You can change tile size if you foldout -> Settings under a splat texture. To lower tiling artifacts and create better looking results at a distance you can raise the tile size of each splat, but the downside of it is that it will lower the detail from close view. You need to find the balance for your preferences. To get fitting splat textures at the border of each terrain you can only use specific tile sizes. These tile sizes work 5,10,20,25,40,50,100 for range to 5-100.

As soon as you change something in the splat settings the <Set> button color will get green, this means the settings in the TC Terrain List are asynchronous with the terrain. You can shift click <Set> to write the new settings to the terrain, or shift click <Get> to get terrain settings into TC Terrain List.

- When done choosing the splat textures shift click <Set All>, this will assign the splat textures to all terrains.

Assigning trees

For trees I used: -> Terrain Foldout -> Data -> Trees.

- 4 types of bushes.
- 6 forest trees.
- 4 palm trees.
- 6 types of jungle plants.

There is 1 setting for trees in the terrain list, and that is 'Bend Factor'. This is the bending that the trees will do on wind. You can create wind with 'WindZones'. The windzone is already in the Scene. Normally you can add windzones with:
Unity Menu -> Component -> Miscellaneous -> Wind zone. In the Unity Documentation is more information how to setup a windzone.

- When done choosing the trees shift click <Set All>, this will assign the trees to all terrains.

Assigning grass

- I used 4 types of grass textures -> Terrain Foldout -> Data -> Grass/Detail.
- When done choosing the grass shift click <Set All>, this will assign the grass to all terrains.

In the 'Scripts' foldout, the 'Neighbors' script is added to each terrain as soon as you click the <Fit All> button. This will automatically assign the neighbor terrains of each terrain. This allows you to have seamless terrain borders in runtime mode. In the editor mode the seams will always be visible.

To save your TC project go to -> TC menu -> File -> Save. The TerrainComposer GameObject in the Scene contains all the TC project data (it is saved with your Scene). It will be saved as a prefab and it will store all the connections to the Assets you made. For connections you made with the Scene like the terrains, it will search for them on loading and if present assign them back. TC saving will only save things you have inside the TerrainComposer window and not your scene. If you delete TerrainComposer GameObject from the Scene, all the TC data of your project will be lost, and TC starts the default setup. If you might do this by mistake you can undo it in the Unity or TC menu. If that doesn't work you can reload your Scene. In the final built it is best to erase the TerrainComposer GameObject from the Scene to free memory, before doing that save it first.

You can use a big terrain under the 4 terrains for far distance (to create a horizon). This you can do later when finished with everything. You can add a terrain to the TC terrain list. Choose a big size like 100000,100,100000depending on camera far clipping plane. Use the lowest resolutions. Name it something like terrain_big. Set 'Terrain Instances' to 1, create the terrain. Assign 1 splat texture, and you can delete it from the TC terrain list again.
Set the terrain transform so that the center of the terrain is on world point (0,0,0). With the above size that would be -50000,-50,-50000. You want the Y position to be lower than 0 because otherwise there might be a z fighting issue. That is when the big terrain will be drawn on top of the other terrains, which we don't want, the terrain must be under the other terrains.

I added mouselook script to the camera and a camera control script. Of course you can use your own camera setup/controller/skybox/image effects, etc.

I used DayLight Water on world position 0,50,0. This you need to make as big as your camera far clipping plane. You can choose custom water from your own assets. Unity free comes with Daylight simple water. In Unity Pro you can use DayLight Water.

Starting with Layer Level0

Layer Level, Layer Groups and Layers

A Layer Level consists of Layers which can be grouped in Layer Groups and each Layer Level has its own output area. With area I mean a square area in world space. With TC you can create an unlimited amount of Layer Levels, Layer Groups, Layers, Filters and Subfilters. This tutorial has 1 layer level and 7 layer groups. At the top of each layer level, layer groups and layers there is the Remarks foldout which contains the tutorial text. You can use remarks to type your own text. You can enable/disable remarks in TC Menu -> View -> Remarks.

Layers have a yellow color and layer groups have a brown-orange tint color. They can be labeled with your own text. To do this, double click on their foldout text or click the 'E' button in their interface. You can hide their interfaces with the '»I' button in the layer level interface. You can also hide layers from displaying, you can do this with the '»View' button. There are two popup fields before it. The first one is for if you add a layer it will be that type of output. If click -> '»View' -> Only Selected, then it will only display the layers with the output you select in the first popup field.
The second popup field is for the layer group to which the new layer must be added. This only works if you click the global '+' button. If you click the '+' on the layer interface. The layer will be inserted under the layer where you clicked '+'.

Load/Save Layer Groups and layers

You can load/save a whole layer group and also each layer.

- To save a layergroup click on the 'Menu' button in its interface and a popup menu will appear with open/save.
- To save a layer click the 'Layer' button in its interface and a popup menu with file -> open/save will appear.

Move a layer from one Layer Group to the other

There is another menu option 'Parent' that will appear. With this you can move a layer to another layer group.

Swap buttons

You can use the '<S>' buttons to swap layers/layer groups and components like filters, subfilter and color ranges.
The '<' button will swap with the previous component.
The '>' button will swap with the next component.
The 'S' button you can select the component to swap with. When you click it, it will change in a '?' then you have to select the 'S' on the component you want to swap it with.

Higher Layer Levels

I will go into explaining higher Layer Levels in another tutorial, as it is part of Advanced Object Placement.

Layer Outputs

There are 6 types of Layer Outputs.

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

You can choose/change the output in a layer -> Output. All the outputs are represented by the buttons in the top under the TC menu. There will only by output from layers if their type is activated with their Output Button. Behind each layer level/layer group you see the number of layers it contains between the (...). Under the Output buttons it displays the total layers for that output in the project. You can enable/disable this in TC Menu -> View -> Layer Count.

To create and decorate the Island it is best to work in the order I give at the end of every remarks.

Splat texturing and Colormaps

There are some options when it comes to colormaps and splat texturing. If you have a shader that supports it you can use both. You can create a colormap with TC and export it as an Image (.Png) for every terrain, and use it with your shader. You can texture the terrain with using only splat layers or only color layers. Color layers give you unlimited colors but only 1 detail texture. Because it mixes 3 splat textures the same as you mix red, green and blue if you make a color. Splat texturing is limited in colors. You can also export normal maps with TC and use it with your shader if it supports global normal maps.

Because this is a tutorial I recommend you try to make both splat texturing and colormap. You need to start with the splatmap, because the most is explained in the splatmap section. TC uses the same filter/subfilter system in every layer output, so it only takes 1 time to learn the system, and you can use it for every output. Later when done with all layer groups you can create a colormap and export it.

Reloading project

If you want to put everything back to default you can load TerrainComposer Island. To get the terrains back into the list (if they are in the Scene). You can go to the Terrain List -> shift click <Search>. And the terrains will be added to the list again. This only works when you have them numbered in their scene name. All you need to do after that is shift click <Fit All>.

Start with heightmap layer

We start with creating the heightmap:

- Heightmap -> Go to the heightmap Layer group.

Heightmap Layers

The heightmap layer is for creating/altering the heightmap data of a terrain.

- Activate Heightmap Output Button (the button with the mountain icon).
- Disable other Output Buttons.

--- ISLAND HEIGHTMAP LAYER ---

- Activate this Layer.
- First load Island1.raw to Island4.raw into Filter0.
- Raw File List -> (not loaded) -> 'Open' Go to the heightmap files map:
  -> TerrainComposer Examples -> Island -> Heightmaps -> Island1.raw. Then click the 'Auto Search' button, to automatically load the other 3 Island raw files. Auto search will search on the number behind the file name of the first loaded file.

- Click the 'Generate' button to create the terrains.

Auto Generation

We 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 or 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.

Curves

You can change the curve in filter and see what will change in the terrains heightmap data. If you don't use Auto Generation Mode you have to click Generate each time when you want to view your changes. 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 curve works like this, first the filter reads the input at a certain coordinate x, z in this case in the raw file. 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.

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 the curve to change in this case height from the raw file to another value. There are a few preset lines if you -> click the curve, choose them and see how the output changes. Also try adding some new curve keys and drag them around, you can do this by right click -> choose add Key. Each curve key has its own properties, you can access them by right clicking the curve key. In the popup menu you get set the tangents, make it linear, etc. You can make the total height lower by dragging the end key in the curve lower or you can reduce the filter strength. You can create canyon like landscape by dragging the end key to the left. As it will create a ceiling. You can also create terraces by making terraces in the curve by adding keys, etc. To snap a key of a curve to the grid hold control and drag it near the grid point you want to align it with. Also activate and change the Random Curve and see how the output changes, it will add more roughness to the terrain.

Mixing heightmaps

Now as for a mixing example I included 4 Canyon raw heightmaps as well.

- Load the canyon1.raw into Filter1.
- Make the list length 4 (before 'Auto Search') -> click 'Adjust List'.
- Open -> TerrainComposer Examples -> Island -> Heightmaps -> Canyon1.raw
- Click 'Auto Search' to automatically load the other canyon raw files.

Deactivate Filter0 and activate Filter1 and see what output you will get. Filter1 strength is set to 0.3 because the canyons would be too high and too steep. Now activate Filter0 again. The island heightmap and canyon heightmap are now mixed. To give a filter more mixing power over the other you can regulate this with filter 'Strength'. With every filter you can choose how you want to mix it with the previous filters. You can change that in 'Output', it's standard on 'Add' which means every value that comes out of a filter will be added to the total filter value of a layer. Try to change some different outputs in Filter1 like 'Subtract', 'Change', 'Average' and 'Max'. A filter output of 0 is flat, while an output of 1 is maximum height.

Stitch Tool

If you create your own 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. Change the border length and see how it influences the stitching, 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.

Click 'Stitch' to make seamless borders. To reset the Stitching you can click 'Generate' again. You don't need to do stitching with the raw heightmaps, as they already stitch right. Only in the editor mode you will see a seam. If you go to runtime mode there is 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.

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.

Setting curves to default

To continue with the Island with the default heightmaps, deactivate Filter1 again, and set the curve of Filter0 to 'Default', by clicking the 'Curve' button. A popup menu will appear, choose -> line -> default. Or you can control click the 'Curve' button.

Generating high resolution

- Now we want to set the heightmap resolution of each terrain to max 2049 to create nice heightmap detail. For performance reasons you can choose a lower resolution.
- To do this go back to the Terrain List, pick a terrain (doesn't matter which one). Go to Data -> Resolutions. Higher the heightmap resolution to 2049 (the <Set> button color will get green).
- Shift click <Set All>, and choose 'yes' to apply the resolution to all Terrains.

The heightmap data is reseted again. If Auto Generate is on, it will automatically regenerate again. If you want to go out of Auto Generation and want to see the progress bar you can shift click 'Generate'. This time generation will take longer because of the higher resolution. When the resolution is 2x times higher it takes 4x times longer to generate.

Continue with splat texturing

Now we can continue to splat texturing. To keep good overview, every component foldout can be closed. We can close this layer and the 'Heightmap' layer group.

- Continue with the Splatmap Layer Group.

Splatmap Layers

The splat layers are for texturing the terrain.

How does generation works

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.

- Enable Splat Output (the button with the scenery icon), and Disable all other Output buttons.

Activate/deactivate components

To activate/deactivate all the layers in the layer group you can use the 'A' button in the layer group interface.

Unfold/fold components

To unfold/fold all the layers in the layer group you can use the ‘F’ button in the layer group interface.

Start with Desert Splat Layer

First start with all layers deactivated.

- Start with the Desert Splat Layer.

--- DESERT SPLAT LAYER ---

- Activate this Layer.
- You can use Auto Generate or Manual Generation based on your preference.
- Choose splats which you assigned to the terrains, like:
  - Sand.
  - Sand2.
  - Rock.
  - Cliff.

You can add/remove/swap splats or change the splat by changing the splat number (next to the texture). With Layer -> 'Terrain' you can choose the terrain to get the splat textures from (if you assigned different splat textures to the terrains).

If you want fast output you can only activate Terrain4, since it outputs mainly on this terrain.

Splat value ranges

You can change the strength of each splat with the slider, click the 'C' button to center the value. The splat strengths are relative to each other so dragging them all high or low would give the same result. Change them around to see how it works. You can also activate/deactivate each splat.

Mix rate

With mix rate you can set the mixing between splats when transitioning from one splat to the other. You can see in the curves next to it how the mixing will be, 0 is no mixing, while 1 is mixing all the way. Try mix rate 0-1, Zoom in on the terrain up close and see how it behaves. You can set the mix rate between two splats individually, by changing 'Mix Mode' --> Single. You can enable/disable mix curve display in TC Menu -> View -> Mix Curves.

Filters and Subfilters

You can Activate/Deactivate each Filter/Subfilter or change the curves to see what will happen to the output.

This layer contains three filters. Filter 0 is reading the Steepness (Slope or Angle) from the terrain. With each Filter you can choose different types of input:

- **Height** is reading the height of the terrain.
- **Direction** is reading the normal of the terrain.
- **Steepness** is reading the slope/angle of the terrain.
- **Image** is reading from an image, with its coordinates relative to the terrain coordinates or how you set the mode in the Image settings.
- **Random** is choosing random value between 0-1. You can create a similar effect in each Filter by setting the 'Random Curve' while it will still be related to the input. For example if the input is on Height and the Random Curve has a horizontal line at 0.25. A value from 0-0.25 will be added or subtract from the input value each step.
- **Random Range** is choosing a random value between 0-1 or it chooses 0. With each step in generation one random number will be chosen between 0-1000. You can set the 'Range Start' and the 'Range End'. If the random number is in that range the output will be 0-1 (random) and when outside the range the output will be 0. This can be used to space things out.
- **Always** is choosing the value which you have selected in 'Position' (which will get visible if you choose 'Always').
- **Current** will read the total filter value, which is the value of all previous filters in this layer, this you can use to create rules which apply to all previous filters. I use this in Filter2.
- **Max Count** which only works in subfilters. It will give output until it reaches 'Max Count', this for example you can use for placing a maximum amount of trees for a Layer.
- **Raw Heightmap** which reads from a .raw 16bit grey scale image file.

Deactivate Filter1,Filter2 and the subfilters of Filter0. Try different types of filter input. With image you can select an image for it like the 'Cloudmap' image, and see what kind of texturing patterns you can create with this. In the image settings you can change things like tilling, offset and rotation.

Filter for choosing the splat texture

So based on the filter output value the filter selects a splat texture. Each splat texture has its value range, you can see this next to the 'C' button at the splat textures in the layer, e.g. (V 0.00-0.25). So if a filter has value 0.1 as output it will choose this splat. By setting the splat strength lower/higher you increase/decrease its value range. You can see the range is changing if you change the splat strength.

- Set Filter0 to default again. Activate it's subfilters.

Subfilter for setting the alpha channel

While a filter is choosing a splat texture, with a subfilter you can choose the alpha value of that splat texture. Also you can choose the alpha with Filter -> 'Strength' and Layer -> 'Strength'. You can use the Filter 'Strength' if you want to change the maximum alpha range of a Filter. And Layer 'Strength' will change the maximum alpha range of all the filters within a Layer. If there are no subfilters created within a Filter, the subfilter total will be 1 by default. So the alpha will be 100%.

You can use subfilters to perform an unlimited possibilities in mixing different filters/layers based on different input types (Height/Steepness/Image/etc).

- Activate Filter0 -> Subfilter1.

Mixing filters with use of subfilters

Now you notice that there is no splat output until a certain height, this is set up in the curve of the subfilter, which works exactly the same as the curves of a filter. Play with the curve to see how it works. When you want to mix different filters don't use random curve or random output in a subfilter because if you mix you want to use opposites curve lines to create perfect blending. When random is on, alphas are randomly chosen so you can't mix them, with getting a splat total that is not higher than 1. This is important because a total splat value that exceeds 1 with splatmap texturing (with colormap it can exceed 1) will give over bright texturing. Mixing filters and layers with setting strengths higher than 1 or curves higher than 1 can give over bright texturing. So you need to make sure the splat total is always 1. If you want to add shadow effect later then the splat total can be lower than 1. You can use 'Random Range' for mixing also. For example if you want to mix two filters, you need to create a subfilter for each in subfilter of filter0 you put random range on 0-500 and in the subfilter of filter1 on 500-1000. If you want to mix 2 filters together without subfilters, you need to set the strength of each to 0.5. Or you can use 'Average' output in both filters. This will normalize to total filter value to 1.

Measuring splat values on a terrain with the measure tool

You can measure the splat total of the Terrain with the 'Measure Tool', also you can measure height, steepness and normal of the terrain. TC uses normalized input values between 0 and 1. You can use the converter in measure tool to convert the height (in Unity units) or steepness to normalized values.

- Activate Filter0 -> Subfilter0. Now you notice that on a certain steepness there is no output.
- Activate Filter1 and its subfilters.

Mix two filters with use of subfilters

Filter0 and Filter1 will be blending perfectly, you can measure this with the measure tool, to see if the splat total is 1. The subfilters of Filter1 give the exact opposite subfilter values compared to the subfilters of Filter0. To create this is very simple, you don't have to do this manually with all kind of calculating, etc.

I will show you how to do it:

- Deactivate Filter1.
- Clone Filter0 (shift click '+' on Filter0). Now a new filter will appear, which is Filter1, and the old Filter1 will be Filter2.
- All you have to do is invert the curve line in the subfilters of Filter1. At the subfilters curve click -> 'Curve' -> 'Line' -> 'Invert'.
- It's almost good, but you have to set Subfilter1 output to 'Min'. In many cases you only have to invert the curve lines. Now you can change Filter1 anyway you want to get two different mixes. Of course you can deactivate Filter0 to see how filter1 changes.

Continue with the Jungle Splat Layer

- Delete Filter1 again by control clicking '-'. Set everything to default again.
- Activate Filter0, Filter1 and Filter2.

I will explain more about Filter2 and its subfilter in the next layer.

- Continue with the Jungle Splat Layer.

--- JUNGLE SPLAT LAYER ---

- Activate this layer.
- Activate Terrain2 (also you can activate Terrain4 or all terrains based on performance).
- Choose splats which you assigned to the terrains, like:
  - Grass.
  - Forest.
  - Rock.
  - Cliff.
  - Rock2.

Filter0 -> 'Strength' is on 0.7, and Filter1 -> 'Strength' is on 0.3. This gives perfect blending as the strength total of the filters is 1.

Filter2 -> 'Type' is on 'Current', and the -> 'Output' is on 'Change'. Filter2 changes the alpha of the chosen splat textures of the previous filters. It's subfilter rule is that it will only output from the image green color channel.

Create rules based on image and its color range

This is set up with the color range component, which is also in the colormap layers and it's used in the tree layer also to choose tree colors. So a green pixel of 255 gives maximum splat alpha, green pixel 128 -> splat alpha 0.5, green pixel 0 -> splat alpha 0. You use a color range that goes from one color to the other, in this case from black to green. You can also set it to 1 color mode by enable toggle 'One'. Or you can invert its output by enabling toggle 'Inv'. And you can add more color ranges, etc. The range between two colors will be normalized from 0-1 and the curve next to the colors will be evaluated with the color position if it's within the range. It's best to experiment with it to see how it works.

- If you change Filter2 -> 'Strength' to a lower value, you will notice that it will paint also on the black color. This is because the changing strength of the filter becomes less.

Continue with the Forest Splat Layer

- Continue with the Forest Splat Layer.

--- FOREST SPLAT LAYER ---

- Activate this Layer.
- Activate Terrain1 and Terrain3 (or all terrains based on performance).
- Choose splats which you assigned to the terrains, like:
  - Ground2.
  - Forest.
  - Ground3.
  - Rock.
  - Cliff.

- Continue with to the Mountains Splat Layer.

--- MOUNTAINS SPLAT LAYER ---

- Activate this Layer.
- Activate Terrain1 and Terrain3 (or all terrains based on performance).
- Choose splats which you assigned to the terrains, like:
  - Ground3.
  - Rock.
  - Cliff.
  - Rock2.

The subfilter of Filter2 is set to give output on the black color and will fade out when it reaches a red, green or blue color. I inverted the subfilter curve to get this result.

- Move over to the Beach Splat Layer.

--- BEACH SPLAT LAYER ---

- Activate this Layer.
- Activate all Terrains.
- Choose splats which you assigned to the terrains, like:
  - Sand/Ground.
  - Sand2

Change output levels

This layer contains only 1 filter. Filter0 input is on 'Height' and output on 'Change'. There are two levels you can choose with 'Change' -> 'Filter' and 'Layer'. Filter level is that only the values of previous filters will be changed in its layer. While 'Layer' level is changing the values of the previous layers. With the subfilter the rules are created, that it will paint until the height is 0.22 and fade out until 0.28. So this is changing (overlaying) the previous layers.

Perlin curve

I use a perlin curve in the filter. With a perlin curve you can create more variation in texturing, perlin is more advanced as random. Random creates noise, but perlin creates cloud alike noise which can be detailed, zoomed and scrolled. Try changing these settings and see what will change. You can also learn quickly how perlin behaves by going to the 'Image Heightmap Tool'. You can do this by clicking the blue tool button -> Image Heightmap Tool or go to TC Menu -> Tools -> Image Heightmap Tool.

There is also a random curve to give a little variation at the edges of the perlin.

- Continue with the Cloud Shadow Splat Layer.

--- CLOUD SHADOWS SPLAT LAYER ---

- Activate this Layer.
- (Activate all Terrains).

This layer creates a cloud shadow effect on the terrains, which creates more realism. Good lighting is very important and plays a huge role in realistic looking terrain or any 3d scene.

Variation in splat total values to create dark light effect

The rules of this layer are almost the same as the Beach Layer. Again Filter0 output is on 'Change' and Change Level on 'Layer'. The input is on 'Current', the splat values of the previous layers will be used as input. Only the alpha of those splat values will be changed. In the subfilter we use a cloud image to lower the alpha which will create shadows on the terrain. Now the splat total will vary, it will be lower on darker parts and higher on bright parts, and it should not exceed 1. You can use the measure tool to check this.

The layer 'Strength' is on 0.5, which will decrease the strength of all the filters in a layer by 2.

- Put layer -> 'Strength' on 1. Now you can see the effect much better, but this is too much. Change the scale settings of the image in subfilter -> settings -> 'Scale X' and 'Scale Y'.

Image settings

There are the following settings in 'Image':

- **Flip X** will mirror the image horizontal.
- **Flip Y** will mirror the image vertical.
- **Auto Scale** will automatically stretch the image over an area depending on the 'Image Mode' with Scale X and Scaly Y you can control the scaling (tilling) over the area.
- **Image Mode** -> **Terrain**, the image will be stretched over each terrain, you can also use an image for every terrain, by making the image list as long as the terrain list.
  -> **Multi Terrain**, the image will be stretched over the total terrain tile (what we use now).
  -> **Area**, the image will be stretched over the local or world area. You can read more about areas in the documentation.
- **Clamp**, when on it returns black color if the coordinates are out of the image boundaries, otherwise it will repeat the image.
- **Offset X**, moves image output to the right (positive value), and to the left (negative value).
- **Offset Y**, moves image output up (positive value), and down (negative value).
- **Rotate**, with Rotate you can rotate the image output.
- **RGB**, when off only a grey scale value will be read. When on all the color (RGB) channels will be read from the image. This you need in Colormap layers if you want to texture a satellite image to the terrain.
- **Color Range**, can add single colors and color ranges. If the pixel of the image is in range between the 2 colors the output will be positive (value depends on the curves). Otherwise the output will be 0.

Try some settings and see how it behaves.

Image Filter Tool

There is a special tool for to see how a color range will influence the image. The 'Image Filter Tool'. You can go to it by clicking on the blue tool button in the top or go to TC Menu -> Tools -> Image Filter Tool. In the left texture box you can select the input texture (which you normally put into a filter or subfilter). And in the right is the output that the color range will produce. You can add color ranges and click 'Generate Texture' to see the output.

Load/Save color range

You can save the color range with 'Menu' -> Save. And load it into Filter/Subfilter color range with 'Menu' -> Load. You can also copy each component with the middle 'S' Button ('<S>'). If you want to copy the component, alt click on the 'S' button. The button text will change into '*S*', which means the component is copied. To paste it alt click on the same kind of a component its '+' button. This works for every component which has those buttons -> LayerGroups, Layers, Filters, Subfilters, Color ranges, etc.

Generate high splatmap resolution

- Put the layer strength about 0.4, and make any changes until you are happy with the final results.
- Now we are ready to generate into a high resolution. Go out of Generate Auto Mode (if you are in), by shift clicking 'Generate'. Go to resolutions foldout in 1 of the terrains in the terrain list. Set splatmap resolution to 2048 (or lower based on your preferences). Set basemap resolution to 2048 (for high resolution at a distance) or 1024. Shift click <Set All>, and confirm with a yes.
- Make sure all terrains are active.
- Click 'Generate'. Now the high resolution texturing will be generated, this may take some time.

- Continue with the LayerGroup -> 'Trees and Bushes'.

Tree Layers

The tree layers are for placing trees and vegetation on the terrain.

Here again you have the same filter/subfilter system for the rules of placement.

Counting Trees

TerrainComposer has the feature to count the number of placed trees for every layer and every tree within the layer. The total trees placed on the terrain, you can find in the terrain list if you foldout -> 'Data'. The placed number will be displayed at the end of the layer/tree or object -> (P .....).

- Enable Tree Output (the button with the tree icon), and Disable all other Output buttons.

Changing area step mode

- For the Tree layers you can use Auto Generation again. Since step mode of local area is on automatic it will run over the terrain with the 2048 resolution, we can use a lower resolution that will be faster. A 2048 resolution and placing a tree for every step would create a maximum of 2048x2048 = 4.194.304 trees on 1 terrain, which is too much. A 512 resolution will be fine, detailmap is on this resolution. Set the step mode of the local area on detailmap by click the 'M -> A' button next to the terrain, it will automatically foldout the local area. choose 'Step Mode' -> Detailmap, shift click <Set All>. Now the button text will change to 'M -> D', this is a quick way to see the step mode for each terrain. The 'M' is for the area size, 'M' means the maximum area size is selected, while 'C' means you selected a custom area size.

When you placed too much trees you can always reset it by choosing a lower density and generate again. Or you can reset them in the terrain list -> Data -> Reset -> -Reset Trees- (control click to reset for that terrain, control shift click to reset for all terrains).

- Start with the Desert Tree layer.

--- DESERT TREE LAYER ---

- Activate this layer.
- Activate Terrain4.
- Choose bushes which you assigned to the terrains, like:
  - Bush1 to Bush4.
  Or any tree to your liking. I used 4 types of bushes.

- Click 'Gerenerate' or use auto generation.
- With the Layer -> 'Strength' you can lower the density of the trees. This can also be done with subfilters.

Filter for choosing trees, subfilter for density

With splat layers a filter will choose a splat, with tree layers a filter will choose a tree. The subfilters are for the tree density. The density can also be influenced with filter and layer strength.

Filter0 is on random, it will randomly select a tree from the list in the layer. You can see the placed number of trees behind each tree. You can enable/disable tree and object count display in the TC Menu -> View -> 'Placed Count'. Any filter rule or more filters can be used to change the choosing of trees. With subfilters you can change the density. A subfilter total of 0 is no placing, while 1 is maximum density. You can also space out trees by using the 'Random Range' subfilter, and choose a range between 0-1000. 0-100 means place a tree once in a ten, 0-50 once in a twenty, 0-10 once in a hundred, etc. If you want to select once in a twenty with using random range 0-50, you have to make sure the normal curve is disabled or put its line level (horizontal) on 1, so the subfilter output will be either 0 or 1.

You can set the value range of each tree, which will influence the selecting. This also works the same as with the splat layer.

- Try different filter and subfilter setting and see how the output changes.
- With the Layer -> 'Scale' you can adjust the scale of all the trees in the layer.

Tree parameters

Change the scale of each tree to your preference. Under the foldout of the trees is information and options for each tree:

Data The mesh information about the tree. Here you can see how many vertices and triangles a tree has.

Scale Here you can set the scale range of each tree. The width slider is linked to the height slider, you can enabled/disable this with the left and right toggle. With 'Unlink' you can select how much the width can deviate from the selected height when generating. 0 is no deviation while 1 is 100 percent deviation. Try different unlink settings, and see how it behaves.

Distance Here you can choose a minimum distance between placing this tree relative to itself, to other trees or objects. There are more distance levels you can choose from (This option is also in object layer).
This, only this tree.
Layer, the trees (which have also 'Layer' distance level) in the Layer.
LayerLevel, the trees and objects in the LayerLevel (which also have 'LayerLevel' distance level).
Global, all trees and objects (which also have 'Global' distance level).
With this you can make sure that trees and objects don't overlap each other.

Include Scale, will include the scale into the minimum distance for the tree/object. Where A scale of 1 is default. For example if you have a minimum distance of 10, and while generating a tree is placed with scale 0.5, the minimum distance will be set to 5. If the scale of the placed tree is 2, the minimum distance will be 20.
Include Scale Group, will include the main scale into minimum distance for this tree layer/object layer.

Color Range Here you can choose the color ranges for the tree. The color between 1 range is randomly chosen. This will be the color of the placed tree.

Set All buttons

There is a '>Set All' button with every option. Clicking this will set the settings to only active trees in the layer, while shift clicking it will also set the settings to inactive trees. If you clicked it by mistake you can use the 'Undo' feature.

Tree filter for scale, tree subfilter for tree color

With every tree there is a filter and subfilter system. With a filter you can select the scale within the scale range of each tree, with subfilters you can select the color range number for each tree. For example it is possible to choose for bigger bushes on the ground and with higher height they will become smaller and more pale in color. I use a cloudmap image in Tree Scale Filter0 to create the bush size. It creates areas of bigger and areas of smaller trees. The range goes from a black pixel (lowest scale) to a white pixel (highest scale). In the Tree Color Subfilter0 I use the height as input for the colors. You can try set it on random and click '>Set All' to apply the filter system to all trees in this layer, to see how it will change the tree coloring.

- Continue with the Forest Tree Layer.

--- Forest Tree Layer ---

- Activate this layer.
- Activate Terrain1 and Terrain3
- Choose bushes/trees which you assigned to the terrains, like:
  - Bush1 to Bush4
  - Tree1 to Tree6
  Or any tree to your liking. I used the 4 types of bushes again and 6 kinds of forest trees.

- Click 'Generate' or use auto generation.
- You can also use the value system with trees and make 1 tree more dense than the other, Activate/Deactivate each tree, etc.

- Make it to your liking setting all the tree scales right and selecting the right tree density.

- Continue with the Jungle Tree Layer.

--- Jungle Tree Layer ---

- Activate this layer.
- Activate Terrain2 and Terrain4.

- Choose bushes/trees which you assigned to the terrains, like:
  - Bush1 to Bush4.
  - Jungle1 to Jungle10.
  Or any tree to your liking. I used the 4 types of bushes again and 10 kinds of jungle trees and vegetation.
  If you are selecting the trees and raising its number you can shift click '+' to choose 1 number higher than the previous tree or you can put in the number in the int field. You can also duplicate/erase/swap/copy paste each tree, like every other component, with the '<S> +-' buttons.

- Click 'Generate' or use auto generation.

- I used the cloudmap in Subfilter0 to create the empty space in between, by using a color range. Try different settings, by changing the colors in the color range and see how it behaves. You can also see this is the Image Filter Tool how the result will be.

- Make it to your liking setting all the tree scales right and selecting the right tree density.

- Continue with the Jungle2 Tree Layer.

--- JUNGLE2 TREE LAYER ---

- Activate this layer.
- Activate Terrain2 and Terrain4.
- Choose trees which you assigned to the terrains, like:
  - Palm1.
  - Palm2.
  Or any tree to your liking. I used the 2 types of palm trees.

- Click 'Generate' or use auto generation.

- You can create as much layers as you want. I used this layer to place some palm trees in the middle of the dense parts.

- Make it to your liking setting all the tree scales right and selecting the right tree density.

- Continue with the Objects LayerGroup.

Object Layers

The object layers are for placing objects on the terrain.

Here again you have the same filter/subfilter system for the rules of placement. Filters are for choosing the objects while subfilters are for the placing density.

The placed objects are also counted and displayed behind the layer and each object.

- Enable Object Output (the button with the brown stones icon), and Disable all other Output buttons.
- For the object layers you can use auto generation again.

When you placed too much objects you can always reset it by choosing a lower density and generate again. Or you can reset them in the terrain list -> Data -> Reset -> -Reset Objects- (control click to reset for that terrain, control shift click to reset for all terrains).
This only works if you have it assigned to a parent GameObject in the Scene. Use empty GameObjects for this since resetting and replacing will clear every child object in the parent.

- Start with the Desert Stone layer.

--- DESERT STONES LAYER ---

- Activate this Layer.
- Activate Terrain4.
- Choose different types of stones you want to place, or other objects to your liking.
- Here you can again change the total scale in each layer, also the density with Layer 'Strength'. You can also set the scale of each object and the unlink of the Y and Z axis relative to the X axis.

Object parameters

If you foldout an object there are many options and there's information about the object:

Data The information of the mesh, it is also displayed how many objects can be combined into 1 mesh, this can be automatically done by TC. And I recommend using this option for static objects, because it will increase performance. If you are using Unity's Lod System then you have to disable the combining meshes, because when meshes are combined, in runtime the combined group will all act as 1 mesh (this will save many draw calls), so you can't transform them individually anymore, only in Edit mode. So use combine meshes only for static objects (objects that don't move or rotate in runtime).

Settings **Parent**, here you can choose the parent GameObject. Also I recommend always using this, it makes it easier to manage the placed objects.
Clear Parent, automatically erases all the objects in the parent when starting with generation. You can erase them manually by shift click <Clear> button.
Combine Meshes, this will automatically place objects (combine max amount) into a new GameObject and add a 'CombineChildren' script to the new GameObject, this will combine the meshes at runtime.
Combine Name, here you can choose the name of the new GameObject the objects are placed in, a number will automatically be added to the end of the name.
Place Max, you can choose the maximum amount of this object that can be placed.
Create Layer Level, this will create a layer level within this object. The LayerLevel has its own area, and with this feature you can generate any output in/on/around the placed object. It goes to unlimited levels. More about it in a next tutorial.

Materials You can choose more main materials for each object, and let TC randomly select them with placement.

Transform **Scale**, the scale range of the object, with unlinking on the Y and Z axis.
Rotation, the rotation range of the object.
Position, the position range of the object.
Include Terrain Height, this will include the terrain height.
Include Terrain Rotation, this will include the terrain rotation.
If you click the axis buttons 'X', 'Y' or 'Z', it will reset it to default. The 'L' button will activate/deactivate linking toggles.

Rotation **Rotation map**, for precise rotation where rotation is stored in an image. More about this with the next tutorial.
Rotation steps, if you want an object to only rotate in step of degrees. For example if you have rotation range of Y axis 0-180, and 'Rotation Step Y' on 45. Only the following rotations will be selected -> 0,45,90,135,180.
Look At Parent, this is for multi-level placement when you want that the placed object its rotation is toward its parent object. For example you can place a building and then create a Layer Level, and an object layer inside it that places benches around the building. If look at parent is on, the benches will be facing the building. Then you can select rotation step on 90, so the benches are in line.

Distance For minimum distance between objects, this works the same as in the tree layers.

Set All buttons

In each group there is the '>Set All' button again, to set the settings to all active objects or with shift click to all objects.

- Try different object, filter and subfilter settings until you like the output. Also check out the Scene how the objects are grouped.

- Continue with the Forest Stone Layer.

--- FOREST STONES LAYER ---

- Activate this Layer.
- Activate Terrain1 and Terrain3.
- Choose different types of stones you want to place, or other objects to your liking.
- Put the distance of the stone objects and tree object so that the trees won't be placed inside a rock. To do this choose for both the distance level 'Global', and enable include the scales. It is best to have the trees and objects to the right scale when you import them. For example that a tree is not as big as the island or small as grass when you assign it (with scales on 1).

- Continue with the Jungle Leaves Layer.

--- FOREST LEAVES LAYER ---

- Activate this Layer.
- Activate Terrain1 and Terrain3.
- Choose different types of leaves or little objects you want to place, or other objects to your liking.
- Again you can use distance to sparse out objects and make sure they are not placed on top of each other.

- Continue with the Forest Trunk Layer.

--- Forest Trunk Layer ---

- Activate this Layer.
- Activate Terrain1 and Terrain3.
- Choose different types of trunks or other objects you want to place.
- Again you can use distance to make sure objects are not placed on top on each other. You can use layer strength for density.

- Continue with the Jungle Stone Layer.

--- Jungle Stones Layer ---

- Activate this Layer.
- Activate Terrain2 and Terrain4.
- Choose different types of Stones or other objects you want to place.

- Continue with the Grass Layer Group.

Grass Layers

The grass layers are for placing grass on the terrain.

Filters are for choosing the grass while subfilters are for the grass density.

When the density of the grass is too high there will be gaps with placement. You can change the overall density in the TC Menu -> Generate Settings -> Grass Density. The range is from 0-255. The default value is on 32.

- Enable Grass Output (the button with the green grass icon), and Disable all other Output buttons.
- For the grass layers you can use auto generation again.

When you placed too much grass you can always reset it by choosing a lower density and generate again. Or you can reset it in the terrain list -> Data -> Reset -> -Reset Grass/Detail- (control click to reset for that terrain, control shift click to reset for all terrains).

You can change the total scale of the grass in the terrain list -> Grass/Detail -> Scale. The scale slider will adjust the width and the height for the grass in the list. Shift click <Set All> to apply it to all terrains. It will set the scale slider to 1 again while updating the scale of the grass on the terrains in the Scene.

- Start with the Desert Grass Layer.

--- Desert Grass Layer ---

- Activate this Layer.
- Activate Terrain4.
- Choose different types of grass which you assigned to the terrain.
- The mix rate works the same as with splat layers, a mix of 0 will create space between each kind of grass, while a higher mix rate will mix the grass kinds together. If you want more precise control over each grass kind placement, you can do this with using more grass layers, and pick each grass separately in each layer.

Notice that the grass line is about where the stone line is, you can change this with the subfilters.

- Continue with the Forest Grass Layer.

--- Forest Grass Layer ---

- Activate this Layer.
- Activate Terrain1 and Terrain3.
- Choose different types of grass which you assigned to the terrain.

- Continue with the Jungle Grass Layer.

--- Jungle Grass Layer ---

- Activate this Layer.
- Activate Terrain2 and Terrain4.
- Choose different types of grass which you assigned to the terrain.

This was the last layer. You can experiment with this tutorial any way you want, like adding/erasing layers, filters, subfilters, etc or changing settings.

Now you can do the Colormap layers. You can also go to the Export Layer Group where you can export normal maps, heightmaps and slope maps images of the terrains. There is also explained how to export the terrain data to a raw image file.

Colormap Layers

The color layers are for making a colormap for the terrain.

If you have a shader that supports colormaps you need to export it to an image and then you can use the image in the shader as a colormap.

- Enable Color Output (the button with the palette icon), and Disable all other Output buttons.
- Assign in the terrain list -> Data -> Splats Textures:
  Red Ground texture to slot 1.
  Green Ground texture to slot 2.
  Blue Ground texture to slot 3.
  Shift click <Set All>.
- Make sure step mode of local area is on automatic on each terrain:
  Terrain list -> Local Area -> Step Mode -> Automatic.

You can use auto generation, it is best to start with a low splat resolution of about 128/256, for fast performance, later you can increase it.

- Start with the Desert Color Layer.

When finished with all the color layers you can export the colormap of each terrain to an image.

--- DESERT COLOR LAYER ---

- Activate this Layer.
- Activate all terrains.
- The colors are already created. You can add/erase/change/value colors and you can save/load each color range.

A filter is for choosing the colors, while subfilters are for the alpha channel.

- Change color around and see how it behaves.

You can create more Color Ranges this layer contains 2. In every filter you can select from which color range you want to choose colors. Filter -> Color Output -> Color Range...

- Continue with the Jungle Color Layer.

--- JUNGLE COLOR LAYER ---

- Activate this Layer.
- With the shift click <RGB> button the first three colors will be red, green and blue. You can undo this. The 'Pal' toggle displays a small pallet image where you can choose colors from with the color picker. Of course you can also change a color by clicking it, and using Unity color menu.

- Continue with the Forest Color Layer.

--- Forest Color Layer ---

- Activate this Layer.
- Continue with the Mountains Color Layer.

--- Mountains Color Layer ---

- Activate this Layer.
- Continue with the Beach Color Layer.

--- Beach Color Layer ---

- Activate this Layer.
- Continue with the Cloud Shadows Color Layer.

--- Cloud Shadows Color Layer ---

- Activate this Layer.

Generate high resolution

- Now you can generate high resolutions. Go out of Generate Auto Mode (if you are in), by shift clicking 'Generate'. Go to resolutions foldout in 1 of the terrains in the terrain list. Set splatmap resolution to 2048 (or lower based on your preferences). Set basemap resolution to 2048 (for high resolution at a distance) or 1024. Shift click <Set All>, and confirm with a yes.
- Make sure all terrains are active.
- Click 'Generate'. Now the high resolution texturing will be generated, this may take some time.

Exporting colormaps:

- Activate the 'Export Output' button. This will put TC into the export mode.
- The 'Generate' button text will change into 'Export .Png'.
  You can choose the path were you want to save the images and choose a filename.
- You can change the total color output, color curve or color curves for every RGB channel by enabling 'Color advanced' above the generate button. This is useful when you have all the layers finished and want to saturate/desaturation/darken/brighten, etc the end result.
- Click 'Export .Png' and the images will be exported.

- Deactivate the 'Export Output' button again if you want to return to generate mode.

Exporting Layer Group

This LayerGroup contains the layers for exporting:

- **Normal map**.
- **Height map**.
- **Slope map**.

To export these outputs you need to activate and export the layers one by one.
You can open the layers in a project by clicking 'Layer' button on a layer interface display,
File -> Open (click) -> Output Maps.

To export the terrains heightmap to a raw file:

- Activate Heightmap Output button.
- Activate Export Output button.
- Only activate terrains will be exported and visible in the export list.
- Choose a path/filename for each terrain.
- Once you choosen the first path/file you can shift click <Auto Assign>.
  This will automatically select a path/name for the rest of the terrains.
  It will choose the same path as the last path you assigned and the file name will be the terrain name.
- Click 'Export. Raw'.

--- NORMAL MAP EXPORT LAYER ---

To export normal maps:

- In Terrain list -> Local Area -> Set 'Step Mode' to 'Automatic'.
  Shift click <Set All> if you want to export for multiple terrains.
- Make terrains splatmap resolution the same as heightmap resolution-1.
  Shift click <Set All> if you want to export for multiple terrains.
- Only activate terrains will be exported.
- Activate Colormap Ouput button, deactivate other outputs.
- Activate Export Output button.
- Choose a path and a filename.
- Click 'Export .Png'.

--- HEIGHT MAP EXPORT LAYER ---

To export height maps:

- In Terrain list -> Local Area -> Set 'Step Mode' to 'Automatic'. Shift click <Set All> if you want to export for multiple terrains.
- Make terrains splatmap resolution the same as heightmap resolution-1. Shift click <Set All> if you want to export for multiple terrains.
- Only activate terrains will be exported.
- Activate Colormap Ouput button, deactivate other outputs.
- Activate Export Output button.
- Choose a path and a filename.
- Click 'Export .Png'.

--- SLOPE MAP EXPORT LAYER ---

To export slope maps:

- In Terrain list -> Local Area -> Set 'Step Mode' to 'Automatic'. Shift click <Set All> if you want to export for multiple terrains.
- Make terrains splatmap resolution the same as heightmap resolution-1. Shift click <Set All> if you want to export for multiple terrains.
- Only activate terrains will be exported.
- Activate Colormap Ouput button, deactivate other outputs.
- Activate Export Output button.
- Choose a path and a filename.
- Click 'Export .Png'.