

Installation

If you have MapMagic 1 asset installed it's recommended to remove it before installing MapMagic 2.

MapMagic 2 requires .NET 4.x API Compatibility Level enabled in Editor. The compatibility level could be switched in Edit -> Project Settings -> Player -> API Compatibility Level -> .NET 4.x

MapMagic is installed the way any other Unity asset does.

If MapMagic is your first asset and you are not familiar with the installation procedure you can refer Unity manual ([Asset Store](#) and [Asset Packages](#)) to find out how it's done, or follow these steps:

- Open [MapMagic page](#) at the Unity Asset Store site.
- Click Add To My Assets button.
- Run Unity Editor, make sure you are using .NET 4 compatibility level.
- Open the Asset Store window (Windows - Asset Store), log into your account, and open up your assets list by clicking My Assets button at the top of the window. 
- Find MapMagic 2 in the list, and click Download.
- Once the asset is dowloaded, the Download button will be replaced with the Import one.
- Clicking Import button will open up an import window after a while. Make sure that all of the checkbox are enabled if you want to install the full version. You can unckeck some folders if you'd like to:
 - Demo: the demo graphs, scenes, textures, meshes that take up most of the space of MM asset. MapMagic will work fine without these assets.
 - Compatibility: compatibility packs for MicroSplat, MegaSplat, Vegetation Studio Pro and CTS.

These folders could be imported anytime later from the AssetStore window.

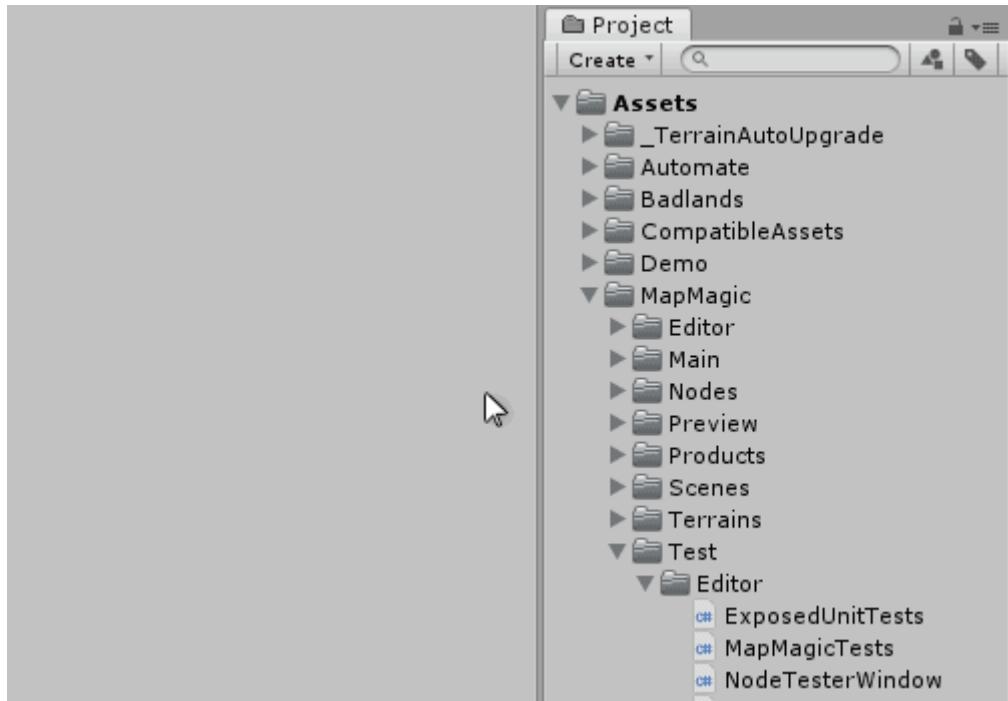
- Click Import button and wait for the asset to be imported. After this, Assets/MapMagic folder will be created in your project. You can then rename the folder or move it inside the other, it does not affect the asset operation.

Quick Start

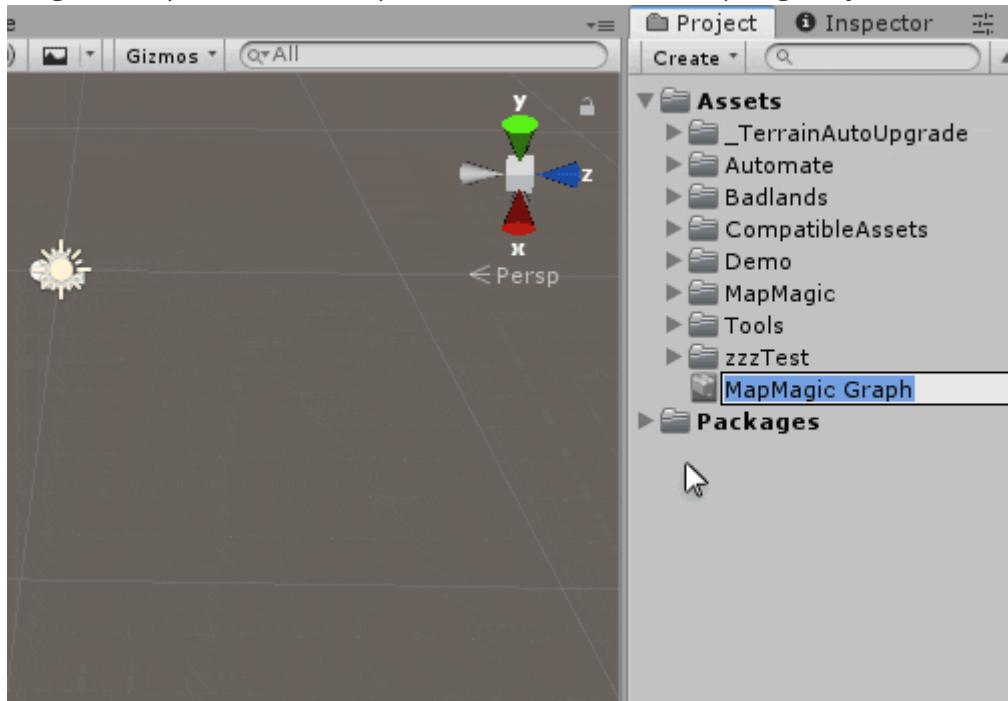
Three quick steps on how to hit the ground running with MapMagic:

1. Create the new MapMagic Graph asset by clicking Create in a Project View, and select MapMagic -> Template Graph (or MapMagic -> Empty Graph if you want to start from

scratch).



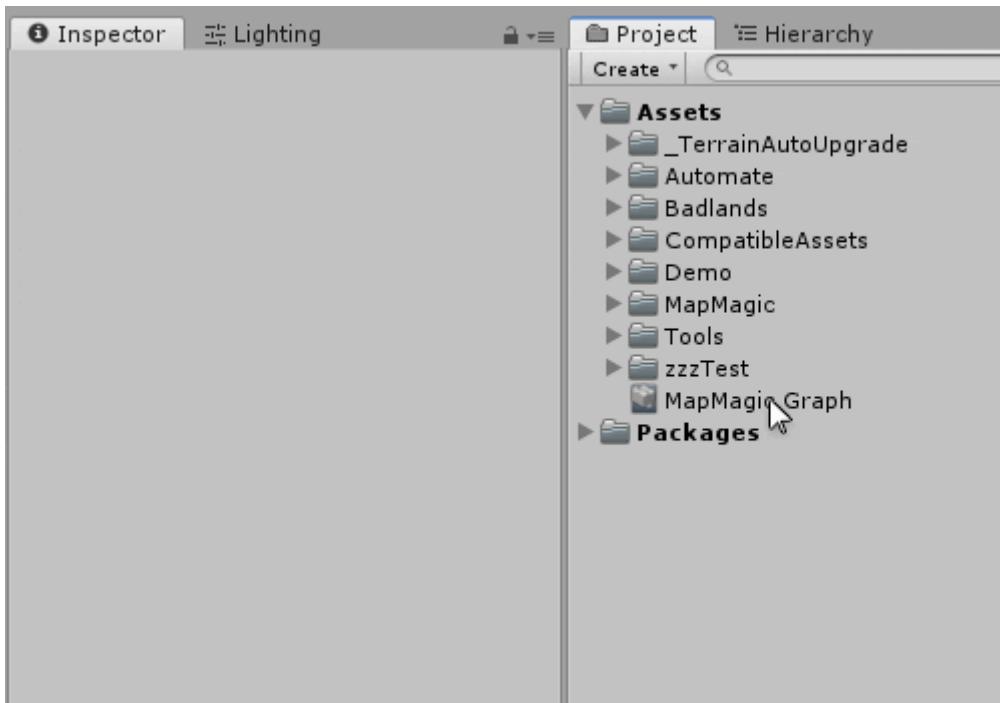
2. Drag and drop the created Graph to scene to create the MapMagic object.



Alternatively: click GameObject menu -> 3D Object -> MapMagic, select the created object and assign graph in inspector.

3. Double-click on the Graph asset in the project view to open up the editor window.

Alternatively: select the Graph asset in the project view, click Open Editor in the inspector.



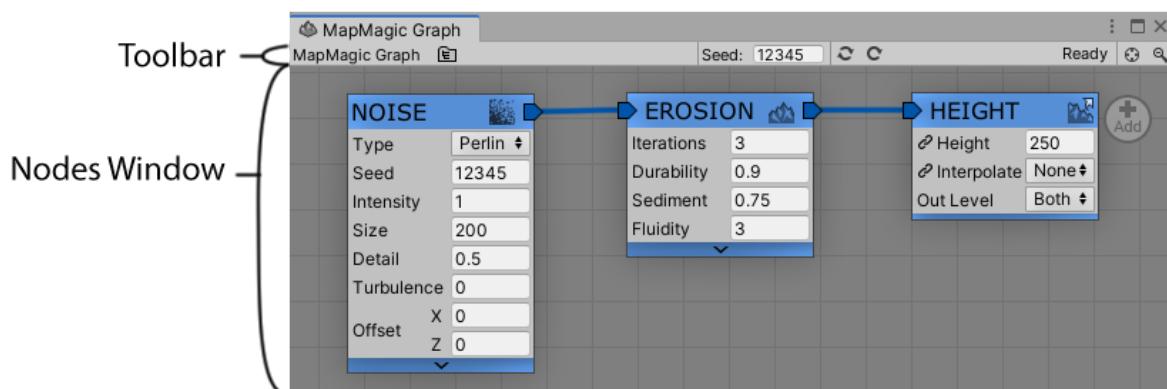
Alternatively: select the MapMagic object, click Open next to the Graph slot.

Graph Window

The Graph Window is the main tool for working with MapMagic, so it is recommended to dock it somewhere if you are going to work closely with MM. Try not to make it overlap the Scene View to let you see the generation results.

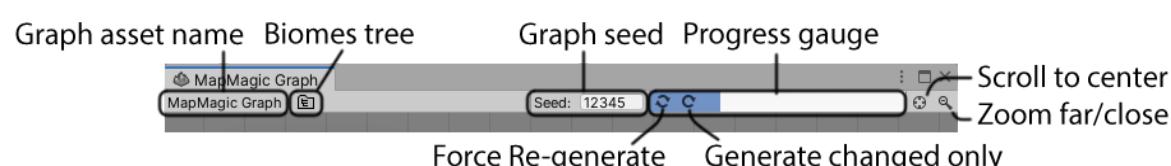
This window could be opened

- by double-clicking the graph asset,
- or by selecting the graph asset in inspector and clicking Open button,
- or by selecting MapMagic object and clicking open folder icon



The graph window consists of a Toolbar (at the top) and the nodes window (all other window space). The nodes window is filled with a grid to help navigating while scrolling or zooming. If you opened a template, a demo, or any other non-empty graph you will see the nodes inside of the nodes window.

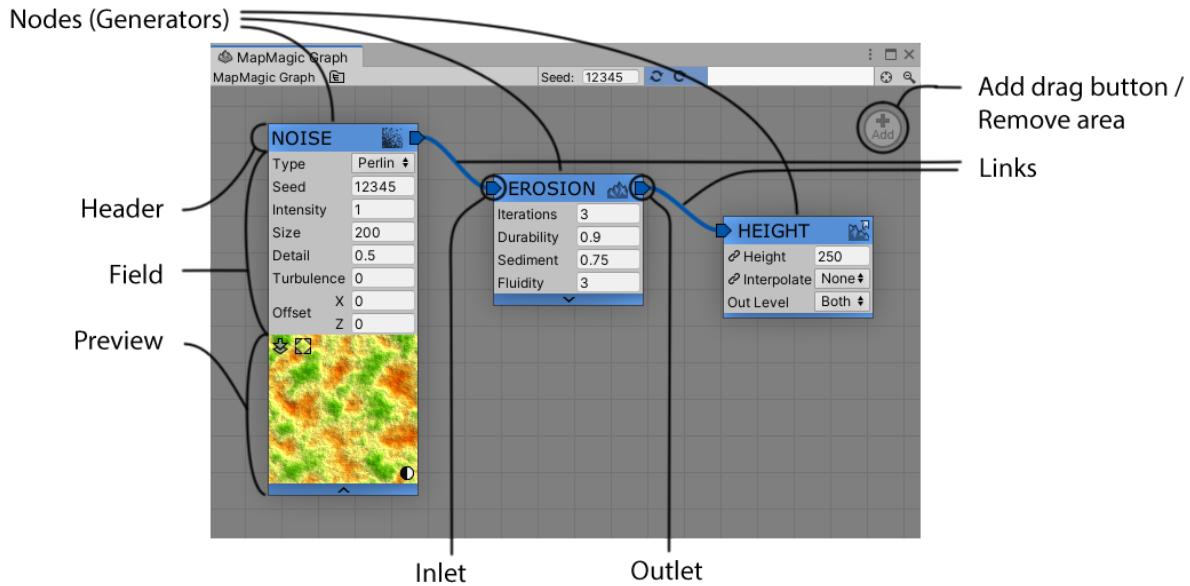
Toolbar



Toolbar controls, from left to right:

- **Graph Asset Name** - the name of the graph currently edited. If current graph is a sub-biome there will be two names displayed - one of the root biome, and one of the current one. See Biomes module for details.
Single click on the Graph Asset Name will highlight the asset file in the Project window.
- **Biomes Tree** button - pressing it will display this graph sub-biomes tree for quick navigation.
- **Graph Seed** - the seed of the current graph, used to generate all pseudo-random values. Changing this value will generate different terrain created by the same principles determined by graph.
- **Progress Gauge** - displays the summary generate progress of all MapMagic object tiles. If all tiles are generated - the label "Ready" is displayed instead of gauge. Gauge is not available if graph is not assigned to MapMagic object.
- **Force Re-Generate** button - clears all the generated results and generates all the tiles from scratch.
- **Generate Changed Only** - will generate nodes that are not generated when Instant Generate is turned off. If Instant Generate enabled the graph will be already generating if it has any node changed.
- **Scroll to Center** - places the graph view so that it is centered at all the nodes rectangle center. Useful when the graph was not made at the origin, or you have scrolled too far and lost somewhere in the wilderness.
- **Zoom far/close** - quickly switches between the minimal (furthest) and maximum (closest) zoom.

Nodes Window

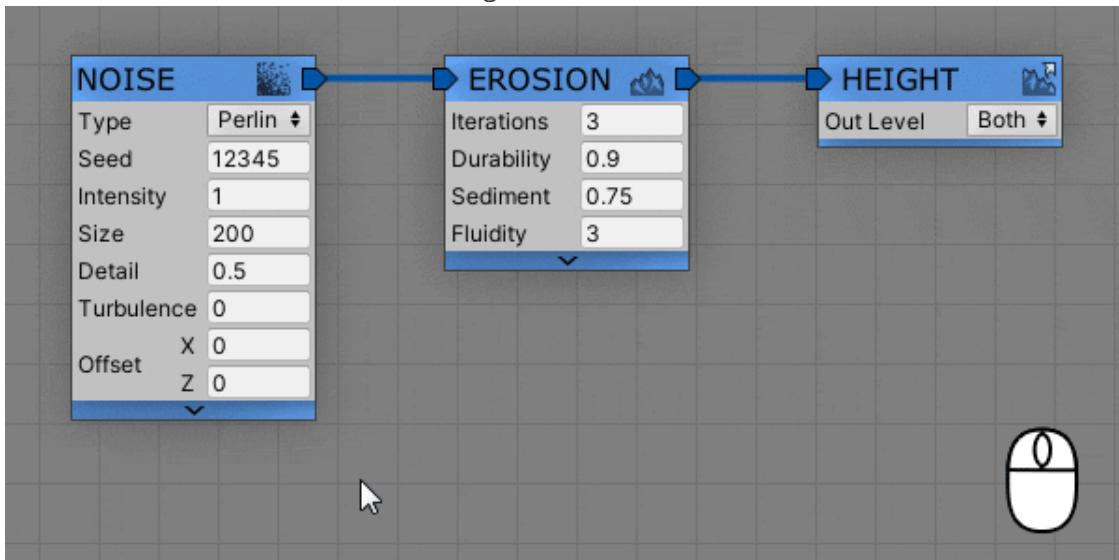


Each node consists of a **Header** with the node name, icon, **Inlet** (or Inlets) on the left, and **Outlet** (or Outlets) at the header right. Note that some nodes - called the Initial nodes - do not require any input data, and thus have no Inlets. The central part of the node contains the node parameter values - it is called the **Field**. Under the node field, at the bottom of the node, you can find an expandable **Preview** field.

In the top right corner of the Nodes Window there an **Add** drag-button, that gives a quick and easy way to create new nodes. Add drag-button turns itself into a "**Remove**" trash bin if node is currently dragged with a mouse.

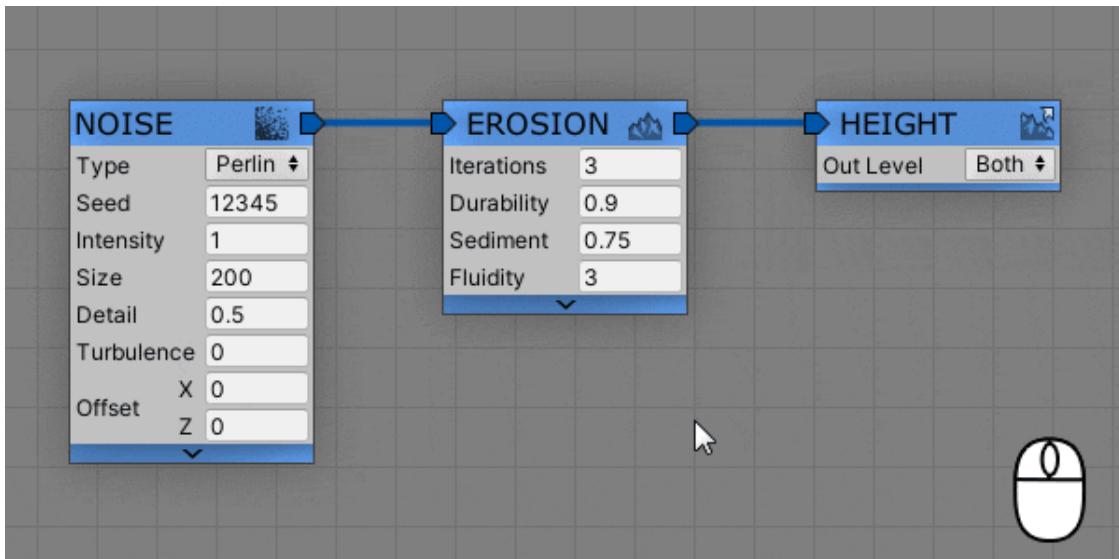
Nodes Window Actions

- The Editor window can be **scrolled** using the middle mouse button:



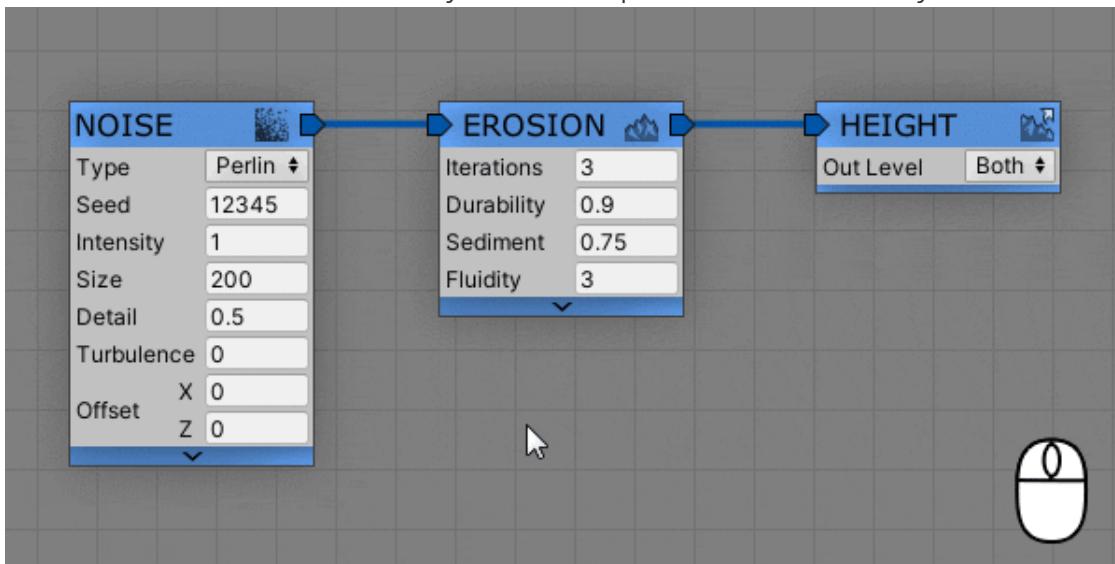
If you are using a laptop with touch pad, you can scroll with the left mouse button with Alt pressed. Pressing the Focus button on the toolbar will scroll to the center of all the graph nodes.

- To **zoom** in or out, use mouse scroll wheel:

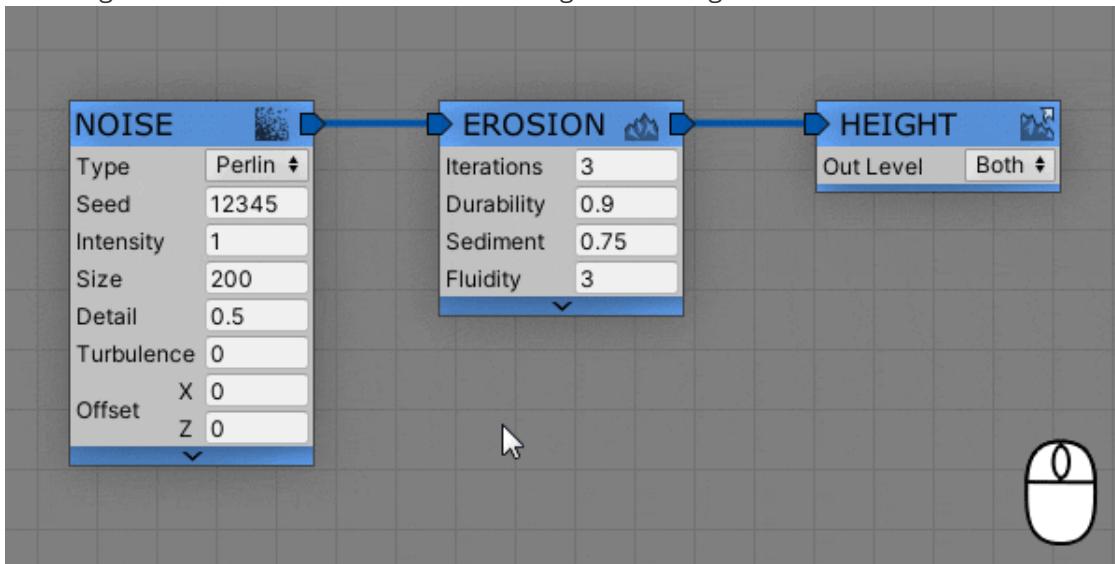


You can press ZoomSmallPlus or ZoomSmallMinus buttons on the toolbar to zoom in/out quickly.

- To move a generator, drag it with the left mouse. To start the dragging you perform the initial click on the node header or any other node space that is free from any control:



- To change the value click on it's name and drag to left or right with the left mouse button:

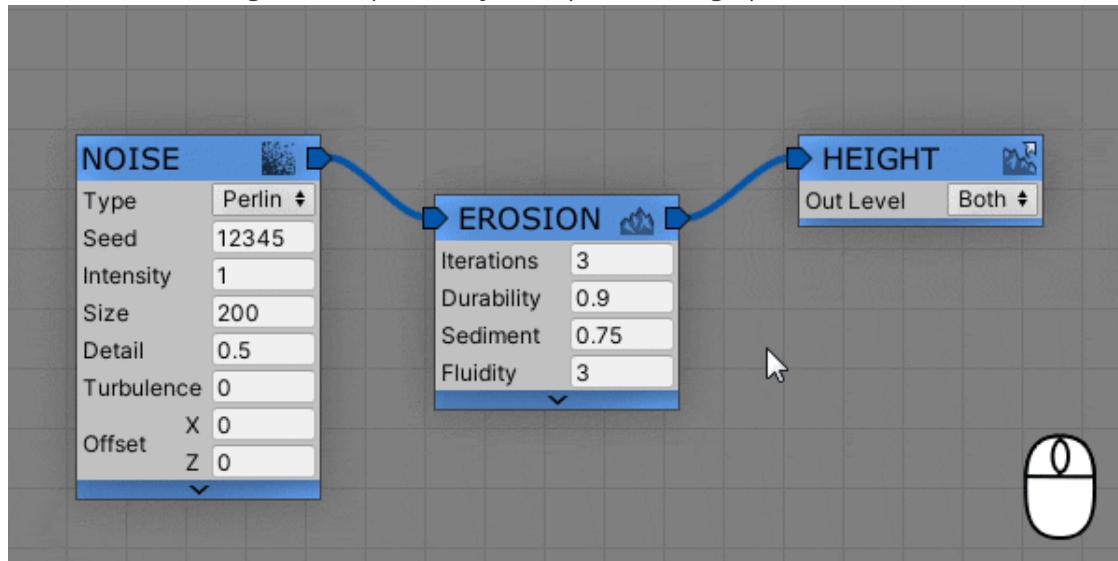


If you want to enter the precise value click on the filed and type the new value from keyboard.

If current graph is assigned to active MapMagic object in scene, then changing any value will make the terrain to re-generate.

- To link the nodes drag node Input to the other node Output with left mouse button. Dragging vice-versa - the Output of one node to the Input of the other will work too.

To unlink nodes drag linked Input to any free space of the graph.

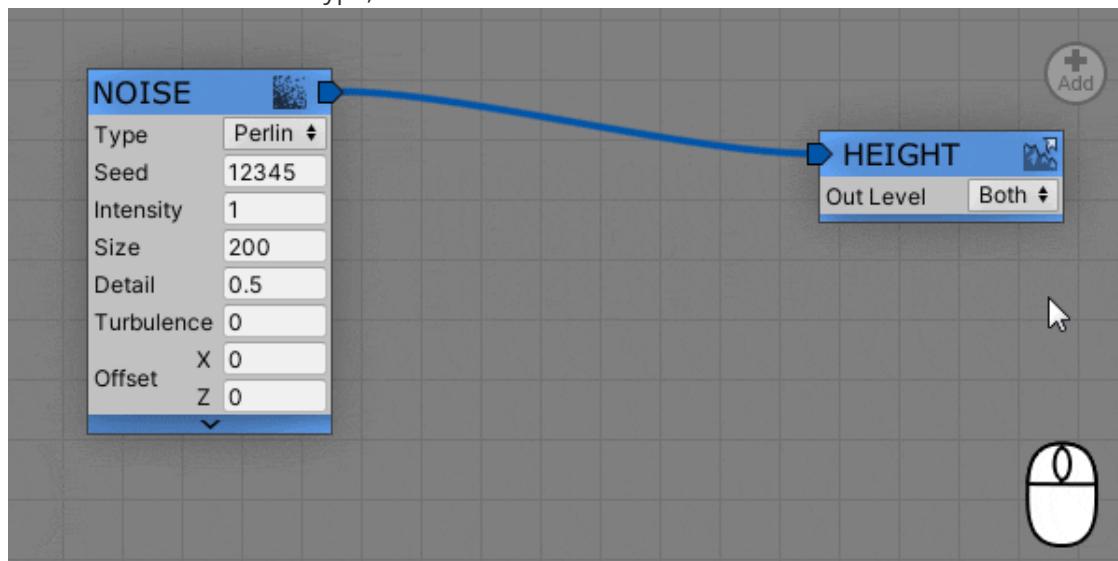


Note that nodes output connectors can have any number of nodes linked, while each inlet can have only one link. So, to re-link node to the other one, simply drag it's Inlet to the other node Outlet.

- To add a new node either right-click on the empty node window space, or use the Add drag-button. Dragging Add to an empty space of the node window (or right-clicking on the empty space, and selecting Create) will simply create a new node:

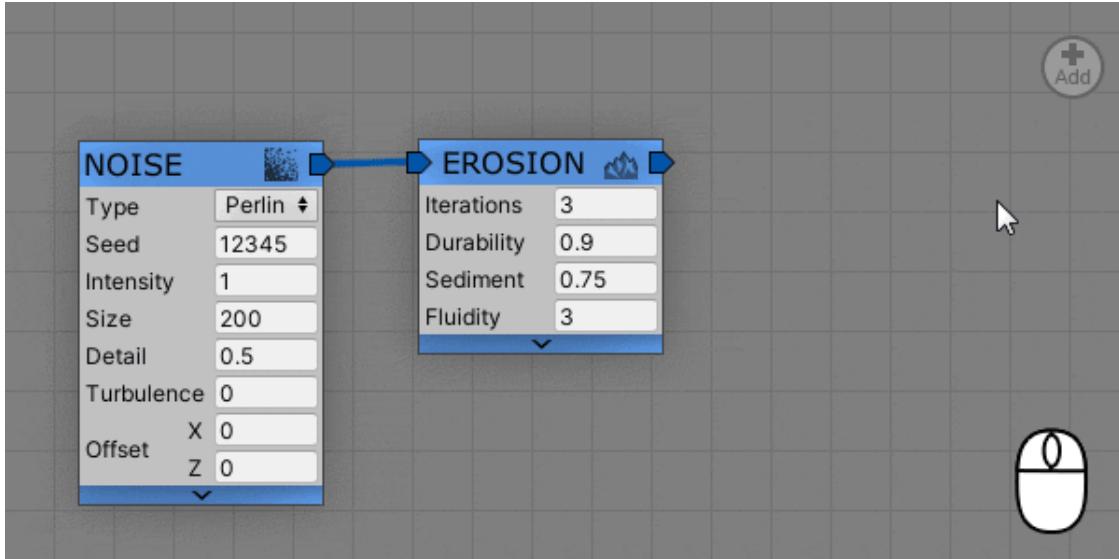


- Dragging Add to the nodes link (or right-clicking and selecting Insert) will create a new modifier node of the link type, and link it with the link's Outlet and Inlet.

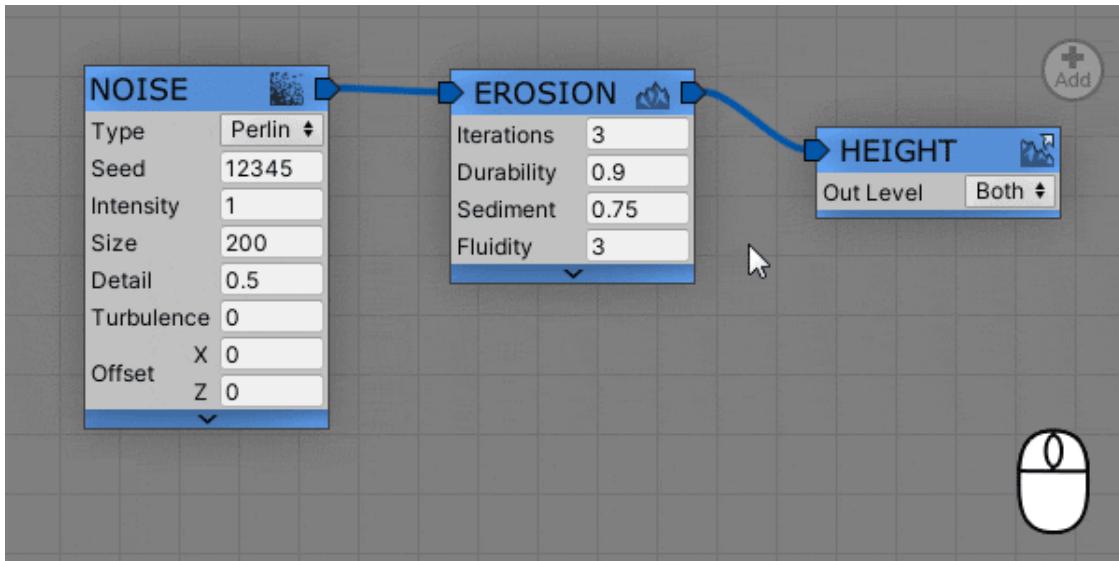


Note there's no Type or Initial/Modifier menu since they are unnecessary - you can insert only the modifier node of the link type. For instance, there could be no Object node insert in a Map link.

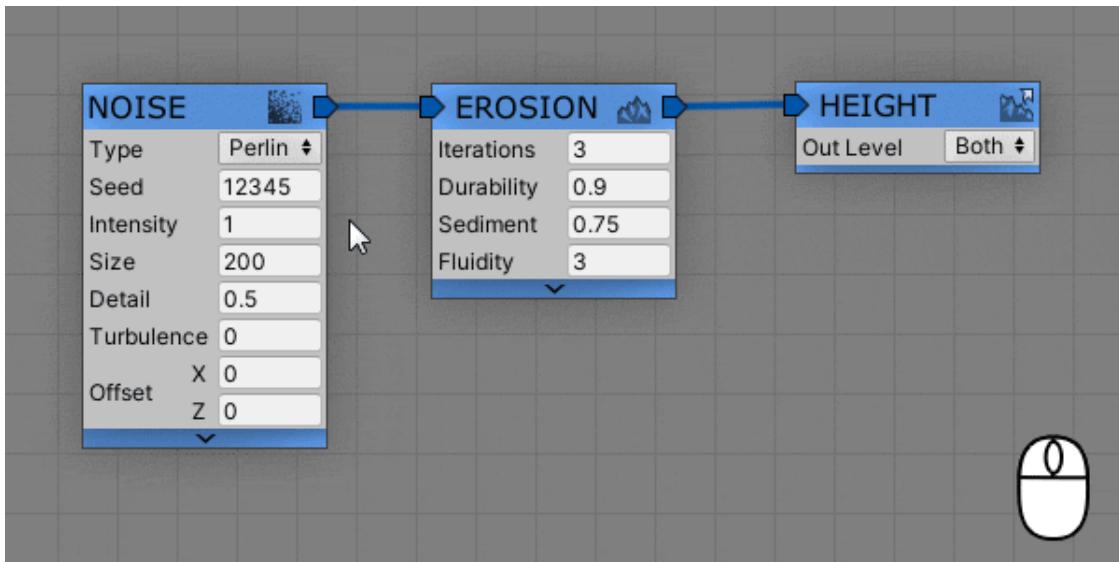
- Dragging Add to the other node (or right-clicking on node and selecting Append) will create the new node of the same type, and link it to the original node.



- To remove the node either drag it to the Remove area (it will be automatically enabled on the place of the Add when node is dragged), or right-click on the node and select Generator -> Remove.



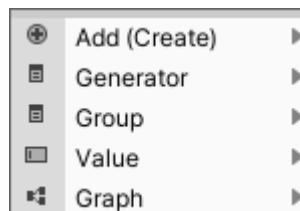
- You can select multiple nodes by pressing the Shift button and drawing the selection frame. Multiple nodes are dragged or removed as if they were one node. Click and drag with the left mouse on any of the nodes to perform a drag. Clicking anywhere on the graph except the selected nodes will cancel the selection.



You can convert selection to a Group by right-clicking on any of the selected nodes, and selecting Group -> Group Selected.

Right Click Menu

Right click menu shows up when on right mouse click anywhere in the node window. Depending on the object clicked there will be some menu options available, while others disabled.

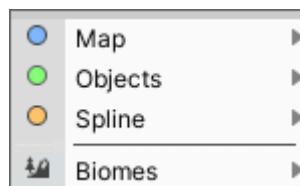


This menu is used to perform all of the advanced node/group/graph operations, in addition to the basic actions accessible with the node interface itself or the Add/Remove button.

All of the sub-menu items are opened automatically, after mouse pointer is hovering for 0.3 seconds on the parent menu. Clicking on the parent menu will open the sub-menu immediately.

Create Menu

Alternative way to create a node - in some cases (for example, the laptop with no mouse) it's more handy to right-click and select this menu rather than drag the Add button.



Depending on the object clicked Create menu will have a different name and will perform a corresponding action:

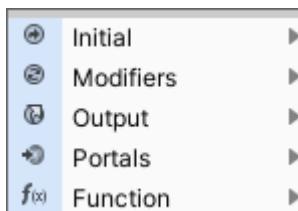
- If clicked on an empty graph space - it will be an Add menu, and will simply add the new node to graph.
- If clicked on the link line - it will be an Insert meny, and will connect the newly created node with the link input and output.
- If clicked on node or outlet - it will be an Append menu that will link the created node to the clicked one.

These actions are similar to the actions performed by dragging Add button on empty space / link / node.

The create menu contains the categories of the nodes to be created. Each category corresponds to the object the node takes as input, output, or internally works with. For example, Map nodes process the Map object (called Matrix in code), while Spline object work with Spline System (SplineSys). Each new MapMagic module brings the new object type, and thus new category. For the MapMagic core version only the Map category is available.

Create menu items

Appears on opening a Create Menu.

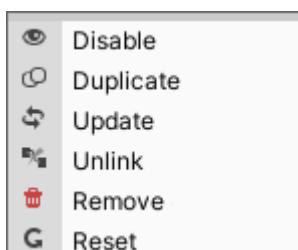


All of the nodes are grouped by their behaviour type:

- Initial nodes:
- Modifiers:

Generator menu

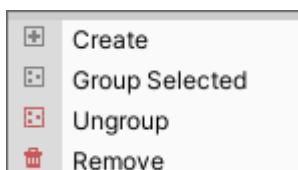
Available if right-clicked anywhere on the node. Contains the list of actions that could be performed with the node (Generator).



- Disable/Enable: disabled generator won't generate any product, but will just read the input and assign it to the output.
- Duplicate: will create the node of the same with the same parameters below the clicked one.
- Update: will convert the outdated legacy generator to the new one if available.
- Unlink: removes all of the node links. If several nodes are selected, removes only their external connections, preserving the links between selected nodes.
- Remove: deletes selected node. Similarly to dragging the node to the Remove area.
- Reset: return all of the generator values to the default ones (the same values that were set on node creation).

Group menu

All the actions related with the groups



- Create: will add a new empty group to the graph.
- Group Selected: will create a new group of the selection size, thus including the selected nodes to the group.
- Ungroup: deletes the group, but leaves the nodes.

- Remove: deletes the group with the nodes.

Graph menu

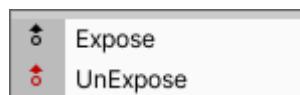
Graph import/export



- Export: saves the selected nodes in a separate graph. Not available if no nodes are selected.
- Import: add the other graph nodes to the current one.
- Update All: converts all of the legacy nodes to the new ones.

Value menu

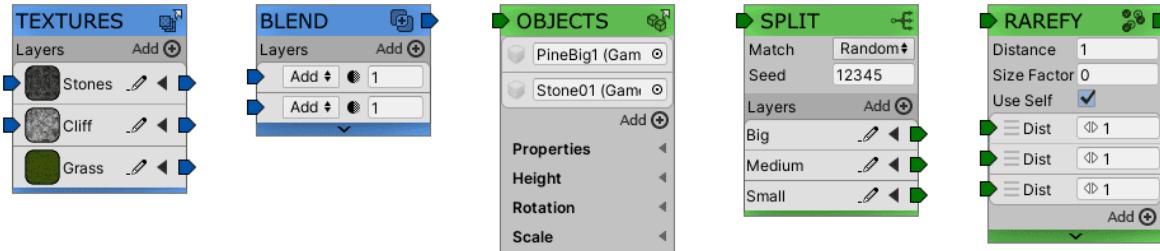
Exposes or removes the value fields for the Functions.



- Expose: makes currently clicked value exposed (available for change from the parent biome)
- UnExpose: removes this value field from exposed.

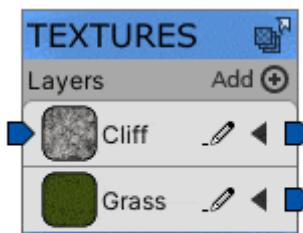
Layers

Some generators like Textures Output, Blend, Split, Combine, Rarefy and others have layers interface. Usually layers store similar parameters.



Add:

To create a new layer press the Add button with plus sign:

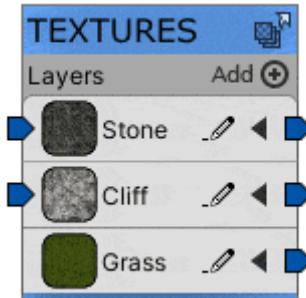


Note that some generators like Textures Output or Rarefy don't have any layers added by default. So keep in mind that if you see the Add button with the plus sign then you can add layers with additional properties here:



Switch:

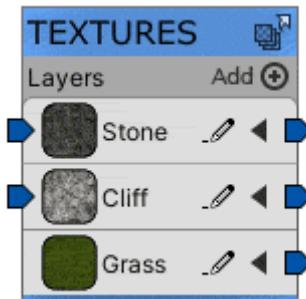
To change the layer order click and drag on it's name or any other non-active area:



Non-active area is any place within the layer except

Remove:

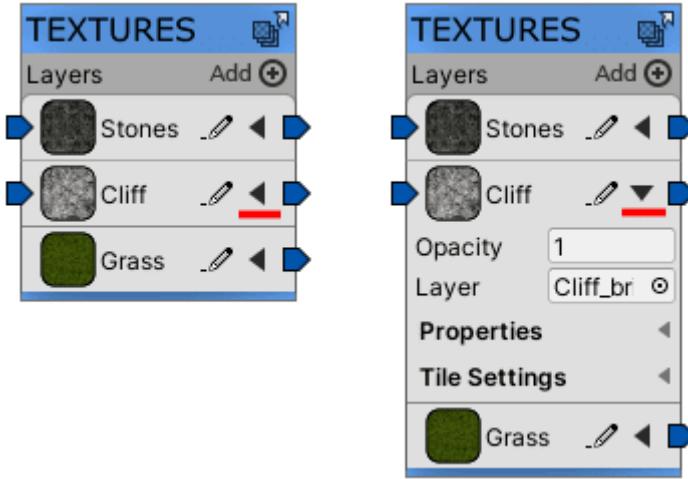
To remove the layer drag it to the Remove field. When the layer is about to be removed the Remove field will be highlighted red:



Note that the Remove field is drawn over the layer itself. It was made intentionally - otherwise Remove won't be visible when dragging the layer atop of it.

Expand:

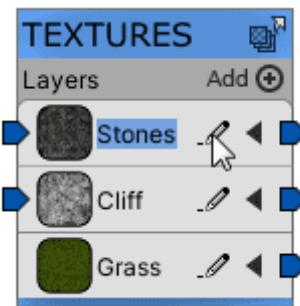
Most of the layers have the additional parameters that could be rolled out by pressing the triangle chevron:



Note that for most of the generators only one layer could be rolled out. It was made to prevent excessive expanding node interface and cluttering of the graph.

Rename:

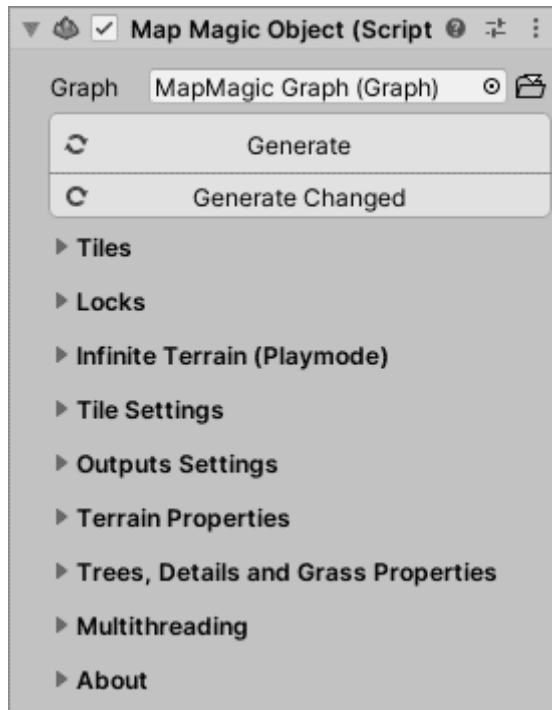
Clicking on a pencil mark will allow to edit the layer name.



I'd like recommend to give reasonable names you your layers since it will help a lot to organize your graph. Since only one layer could be expanded it could be very hard to say what's this layer is about if it is just named "Layer 5".

Settings

Properties of the MapMagic object in scene. Set in Inspector window.



Tiles

Here you can manage the terrains that are generated in editor (i.e. Pinned Tiles). To pin or remove tiles press the checkbutton, and then select the tile in scene. You can use the frame selection to pin/unpin multiple tiles at once.

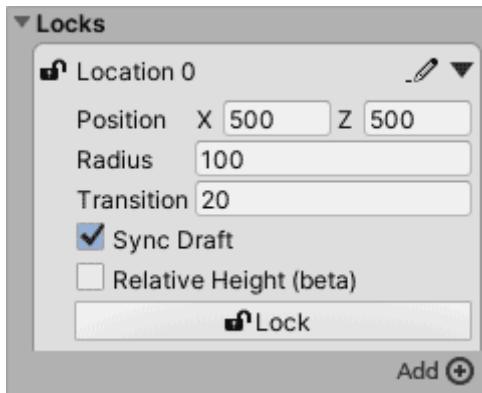


Tiles, as well as all other Unity gizmos, are not displayed and could not be modified when Gizmos are disabled in the scene view.

- **Pin New Tile:** will create a new terrain tile at the selected position.
- **Pin As Draft:** will create a tile with low-resolution (Draft) detail level only. This is useful to when forming the initial terrain shape, since draft are generated way faster and require less memory. When working with large terrains it would be handy to pin the large grid of Draft tiles or observing the whole terrain, and one or two full resolution tiles to work in detail.
- **Pin Existing Terrain:** will convert already existing terrain to MapMagic tile. This will remove all the terrain information on it.
- **Select Preview:** select the pinned tile that will be used to display the nodes preview in graph, in preview window, and to assign a special preview shader to terrain. When preview is not selected, the closest to the camera tile is used. You can select only one preview tile.
- **Unpin:** unpins the tile and removes its terrain.

Locks

Creates an area that is excluded from procedural generate. Could be useful for creating custom locations on pinned tiles. See Locks section for details.



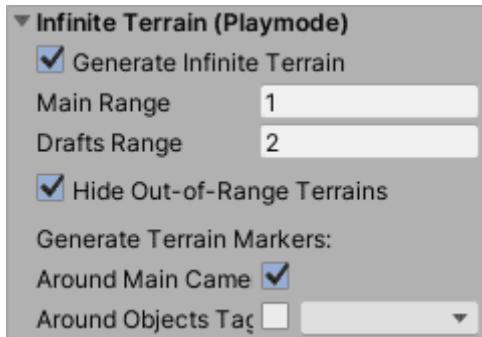
Infinite Terrain

One of the main MapMagic features: when enabled, generates the new terrain tiles when the camera comes closer to them, and removes the tiles that are out of range. Every tile is unique, but based on the same creation principles. This way MapMagic creates an illusion that the terrain is infinite and doesn't repeat itself.

Infinite Terrain will generate low-resolution tiles (Drafts) first. Then it will create the main tiles only in a close range, leaving drafts in a background. This will help to save the memory and the compute time.

As long as the graph (and its seed value) haven't changed will generate exactly the same tile every time player comes to it.

This feature works in playmode only, only the pinned tiles are available in editor.



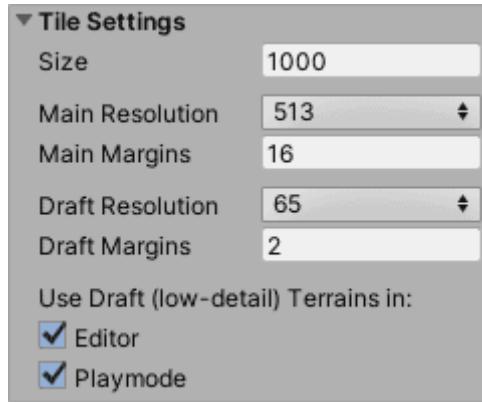
- **Generate Infinite Terrain:** enables/disables Infinite terrain feature.
- **Main Range:** the distance of creating the Main (hi-res) chunks (in terrain tiles). Thus, if tile size is 1000 and Main Range is 2, it will create main tiles in 2000 units.
- **Drafts Range:** the distance of creating Draft (low-res) chunks (in terrain tiles).
- **Hide Out of Range Chunks:** when enabled, will hide pinned chunks when they are out of generate range. When disabled, pinned chunks will be always visible.
- **Generate Terrain Markers:**

By default the main camera is used as a trigger object to generate new chunks. All the generate, remove and enable ranges are counted from the main camera, it is the main generate marker. You can add the other markers enabling **Around objects tagged** and selecting a proper tag from the field. This could be useful if you have several characters that could have a vast distance between them.

Moreover, you can turn off using camera as a generate marker by disabling **Around Main Camera** - for example, if your camera moves between those characters quickly and you don't want to generate terrain while in motion.

Tile Settings

Settings shared between all the tiles of this MapMagic object.



- **Size:** length (X axis) and width (Z axis) of a tile, in world units.
- **Main Resolution:** the size of the output terrain heightmap, in pixels. For terrain layers the size is the same (minus one pixel).
- **Main Margins:**

Many MapMagic nodes, such as Blur, Erosion, Cavity and others require additional pixel information to work with. This way they generate incorrect results on the tile edges. To avoid this, MapMagic generates a map that slightly bigger than the tile itself, and cuts out edges.

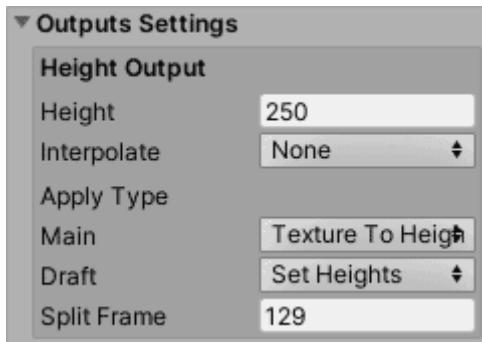
Main Margins value determines the number of additional pixels on each of the map size. For example, for an output resolution 513 and margins of 16 the final map size will be $513 + 16 \times 2 = 545$ (squared).

You can try decreasing this value to speed up the generate process, but check the tile edges for artifacts.

- **Draft Resolution:** the size of the draft heightmap, in pixels.
- **Draft Margins:** extra pixels on the edges for draft tiles (see Main Margins for detail).
- **Use Draft Terrains in:** enables/disables draft terrains for editor or playmode:
 - **Editor:** will disable generating draft tiles while generating main ones. Disable this if you don't like switching to drafts, or work with low resolutions / fast graphs that are applied nearly as fast as drafts.
 - **Playmode:** will disable creating draft terrains first for infinite terrains. All of the tiles will appear in full detail.

Outputs Settings

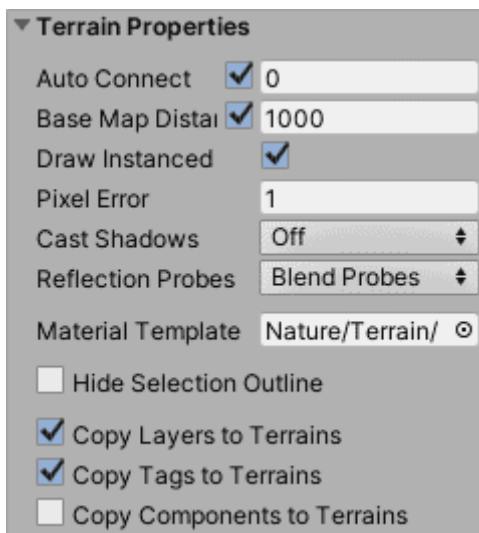
The data that is used by the graph outputs. Usually all of these values could be changed in graph in a corresponding output with the link icon (Linked). However, they could not be the part of the graph: The graph stores the information of how the tile is generated, while this data determines how the generated result is applied.



- **Height Output:** see Height Output for details.
- **Apply Type:** determines the way the generated height map is applied to the terrain:
 - **Set Heights:** the simplest way, via [SetHeights](#). Fast on low resolutions due to reduced overhead, but using it on big heightmaps can create a noticeable lag.
 - **Set Heights Delay LOD:** set heights in several frames via [SetHeightsDelayLOD](#), and then applies LOD modification. Takes a bit more time than Set Heights, but since it's split in several frames the lag is not so noticeable.
 - **Texture To Heightmap:** creates the raw texture data in a separate thread, creates a render texture in coroutine and uses [SyncTexture](#) to apply it. Asynchronous and fast, but does not work in Unity 2018.
- **Split Frame:** number of pixels in stripe that are processed per frame in Set Heights Delay LOD (or send to texture in Texture To Heightmap). If resolution is 513, Split Frame of 129 means that terrain will be applied in 4 frames (four 129*513 stripes). Decreasing this value will make terrain apply smoother, but will increase the total apply time.

Terrain properties

Are equivalent to the settings used for each terrain in the standard terrain's [Settings tab](#). The only difference is that they are applied to all of the MapMagic terrains.



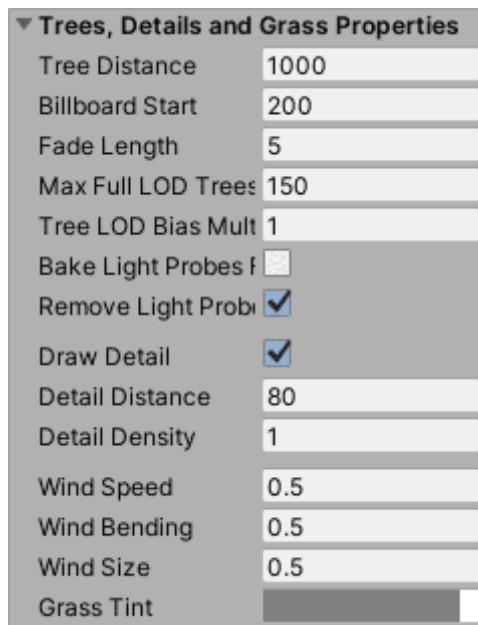
- **Auto Connect:** Connects Terrain LOD Levels so that the tiles are welded seamlessly on detail level switching. The number is the terrains Grouping ID.
- **Base Map Distance:** The maximum distance at which terrain textures will be displayed at full resolution. Beyond this distance, a lower resolution composite image will be used for efficiency. Checkbox enables/disables the base map feature.
- **Draw Instanced:** enables/disables instanced rendering.
- **Pixel Error:** The accuracy of the mapping between the terrain maps (heightmap, textures, etc) and the generated terrain; higher values indicate lower accuracy but lower rendering

overhead. Unlike the standard terrain setting you can set the value to 0 to force the terrain render full-resolution mesh.

- **Reflection Probes:** Use this to set how Unity uses Reflection Probes on Terrain.
- **Material Template:** Material to use for rendering Terrain.

Trees, Details and Grass Properties

Are equivalent to the settings used for each terrain in the standard terrain's [Settings tab](#). The only difference is that they are applied to all of the MapMagic terrains.



- **Tree Distance:** The distance (from camera) beyond which trees will be culled.
- **Billboard Start:** The distance (from camera) at which 3D tree objects will be replaced by billboard images.
- **Fade length** Distance over which trees will transition between 3D objects and billboards.
- **Max Full LOD Trees:** The maximum number of visible trees that will be represented as solid 3D meshes. Beyond this limit, trees will be replaced with billboards.
- **Bake Light Probes For Trees:** If this option is enabled, Unity will create internal Light Probes at the position of each tree and apply them to tree renderers for lighting. Otherwise trees are still affected by light probe groups.
- **Remove Light Probe Ringing:** If you check this box, Unity removes visible overshooting, which often appears as ringing on GameObjects that are affected by intense lighting. This setting reduces contrast, and is dependent on Bake Light Probes for Trees.
- **Draw Detail:** Check this box to draw grass and details.
- **Detail Distance:** The distance (from camera) beyond which details will be culled.
- **Detail Density:** The number of detail/grass objects in a given unit of area. The value can be set lower to reduce rendering overhead.
- **Wind Speed:** The speed of the wind as it blows grass.
- **Wind Size:** The size of the 'ripples' on grassy areas as the wind blows over them.
- **Wind Bending:** The degree to which grass objects are bent over by the wind.
- **Grass Tint** Overall color tint applied to grass objects.

Multithreading

Multithreaded: when **enabled**, Map Magic generate works in a several separate threads. Turning this parameter off forces Map Magic to work in the main thread only using co-routines only (this could be useful for debugging of custom generators or for compatibility reasons).



- **Max Threads:** the number of threads MapMagic uses to generate maps. The recommended value is number of current processor threads -1.
- **Auto Max Threads:** sets the number of threads to processor thread count - 1. This way, on the different hardware the number of threads will be different. Auto mode works both in editor and in build.
- **Apply Time per Frame:** Although generate happens in other threads, applying generated results to the terrain, the final stage, is done using co-routines. This value sets the maximum time spent per frame by co-routine in milliseconds. Increasing this value will shorten the overall apply time, but can create a noticeable lag. Note that in some cases co-routine could not be split in smaller parts, so setting this value to 1 will not help to avoid some profiler spikes.
- **Instant Generate:** when this parameter is enabled there is no need to press the 'Generate' button after changing any of the generator parameters: Map Magic triggers the change and forces generation automatically as you make changes to each node in the graph.

Initial Generators

Constant



Creates a map filled with a given value. This is the most simple generator, used to create transparent masks or flat heightmaps.

Output

The planar map at a certain level.

Properties:

- **Level:** the map will be filled with this value on generate. Value ranges between 0 (no fill, transparent fill or zero ground level depending on the output where it will be used) and 1 (fully opaque fill or maximum terrain height).

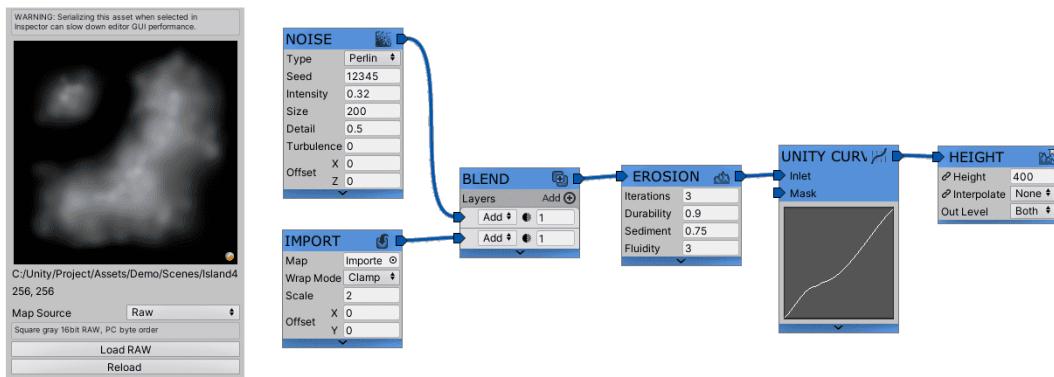
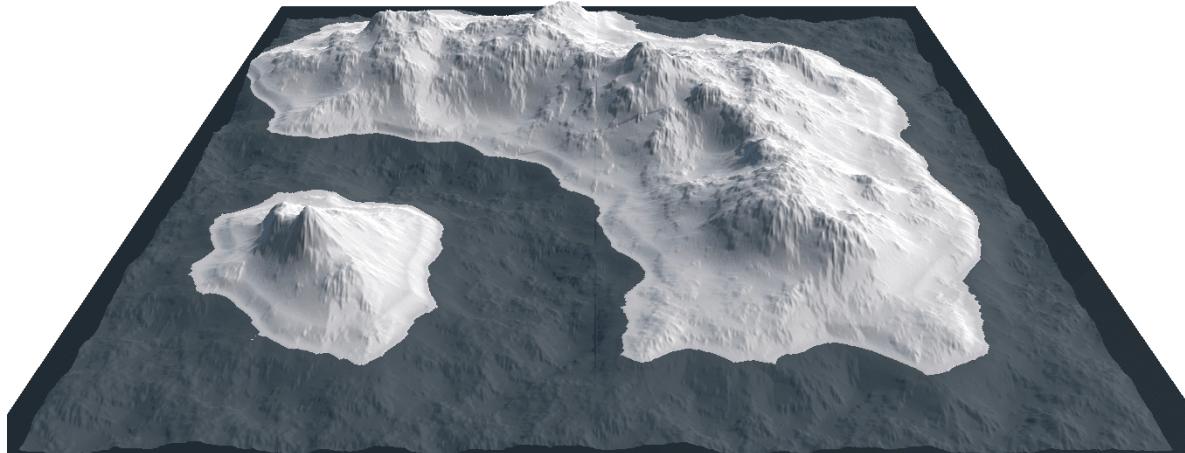


Level: 0, 0.5, 1

Import

Allows to import custom heightmaps from textures or RAW files.

Custom heightmaps could be used to create a base terrain, which then could be detailed with noise, erosion and other nodes:



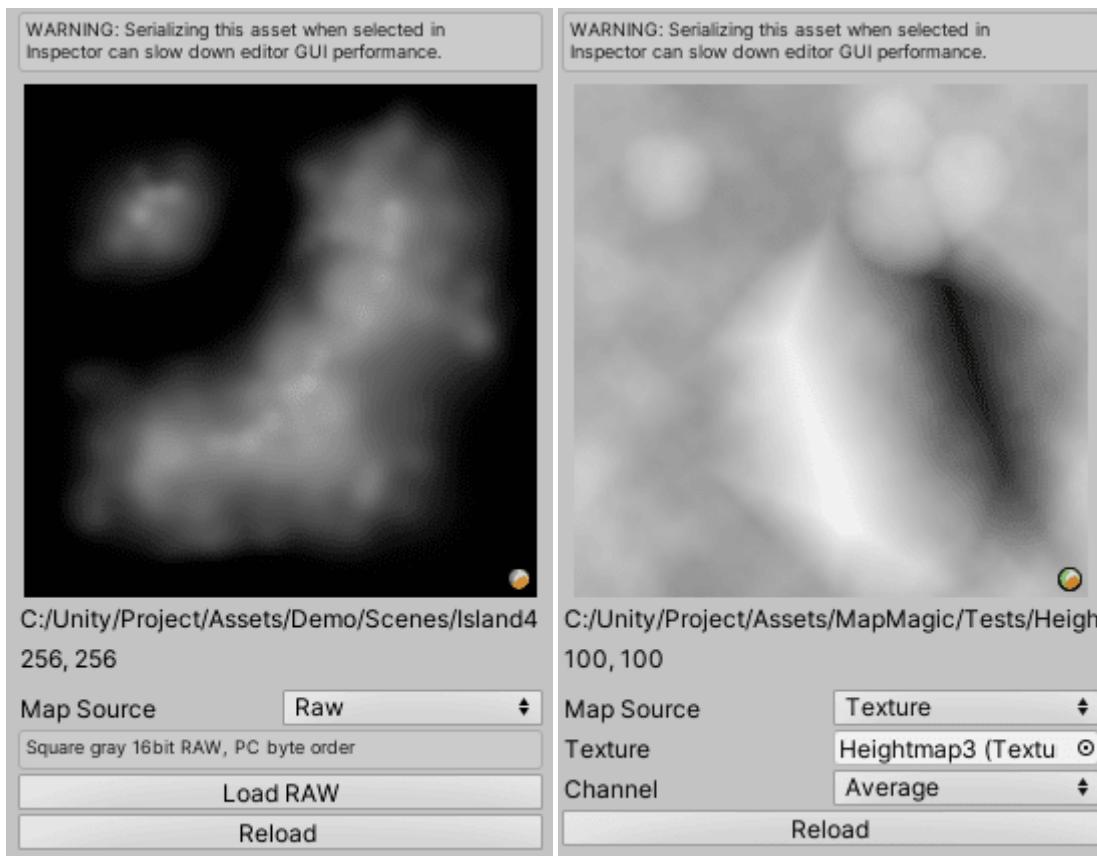
Or it could be used to create custom stamps with the Stamp node.

Imported Map asset

Import node does not load RAW file or texture directly - it's a costly operation that greatly increases the graph size. Instead a special asset is used to load and keep (serialize) RAW or texture data. This asset is called Imported Map. The graph itself (import node) only keeps the reference to this asset.

You can experience some lag when large Imported Map is selected in inspector. This lag is caused by Unity trying to serialize the imported map each frame, and will go out on de-selecting Imported Map.

To create Imported Map use the standard way assets are created: Assets (or right-click in project view) -> Create -> MapMagic -> Imported Map.



Map Source: determines whether the imported map is loaded from RAW file or texture.

Load Raw (for raw mode): opens the dialog to load the .raw file.

In order to use it the .raw file should be properly prepared. It should be:

- square (width should be equal to length)
- grayscale
- 16 bits per channel
- and it should be saved as .raw file with PC byte order

Placing RAW file in the assets folder is not required, it could be loaded from any location.

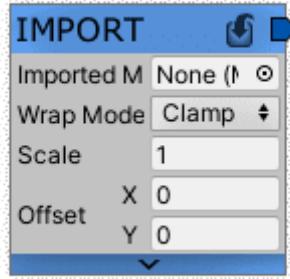
Texture slot (for texture mode): field for the texture asset that is used as the map source. The source texture should be placed inside the Assets folder and should have Read/Write attribute enabled in texture settings.

Channel (for texture mode): Selects the channel to be used as map source:

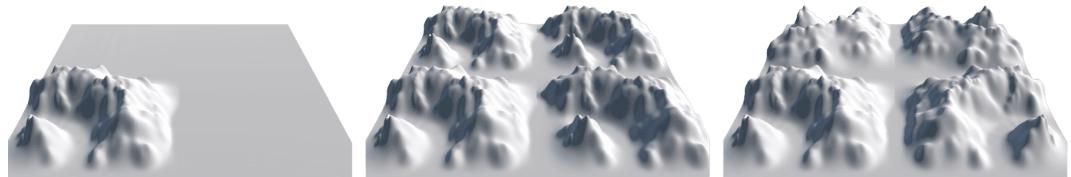
- Average: the average of 3 channels (red, green and blue)
- Grayscale: the map value is calculated using formula: $0.21*R + 0.72*G + 0.07*B$
- Red/Green/Blue: uses only one color channel
- Alpha: using texture alpha

Reload button: reloads map from previously assigned texture or RAW file.

Generator Properties:



- **Map:** imported map asset slot
- **Wrap Mode:** determines how the heightmap should be repeated so that every terrain point will not miss a map:
 - Once: repeat map only once
 - Tile: repeat map endlessly the way the standard texture could be tiled
 - PingPong: will mirror every 2nd map and repeat map endlessly. Use this if you want to fill your land with a figure that is not tilable



Wrap (4 terrain grid): Once, Tile, PingPong

- **Scale:** sets the size of heightmap. By default size is equal to one chunk (terrain).



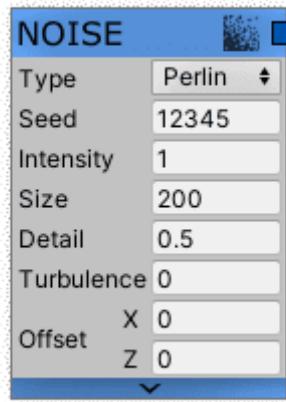
Scale (4 terrain grid): 0.5, 1, 2

- **Offset:** moves figure along X or Z-axis (in world units).

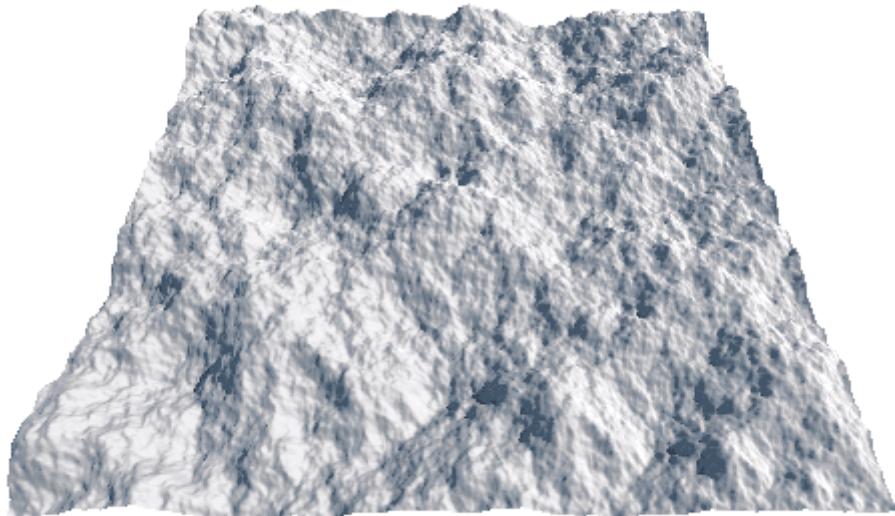


Offset (4 terrain grid): 0, 500, 1000

Noise

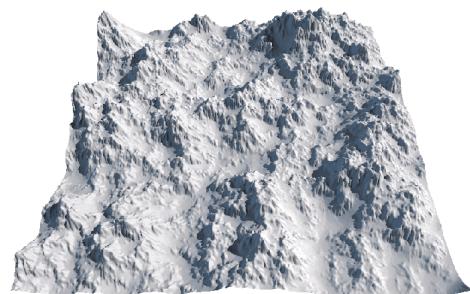
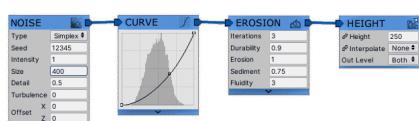


The Noise Generator is one of the most basic generators in MapMagic. It generates a fractal noise map that is widely used as a base for various map creation algorithms.

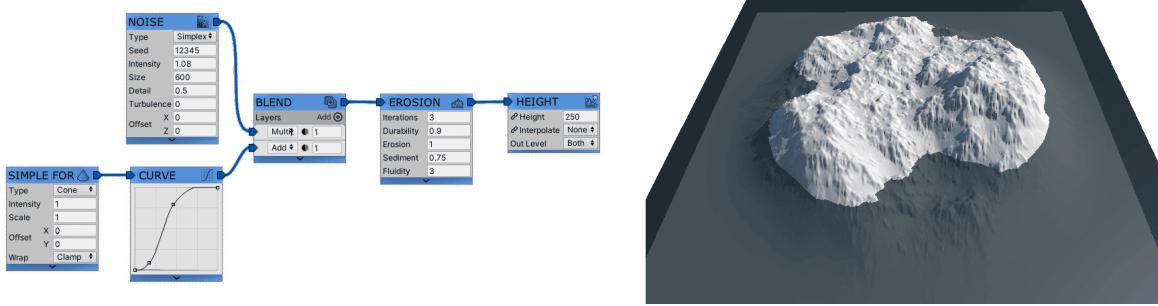


Use Cases:

Might be used to create the initial terrain height:



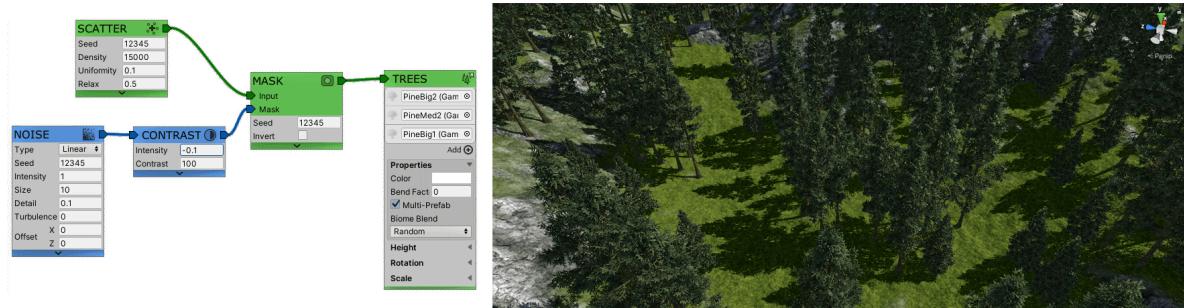
Or to add some detail on low-resolution heightmap that comes from Import or Simple Form generators:



As well as be used as a mask to define various areas, including biomes. In this case Noise node usually goes with Contrast and Blend nodes:



Or to mask objects, trees, biomes:



Inputs:

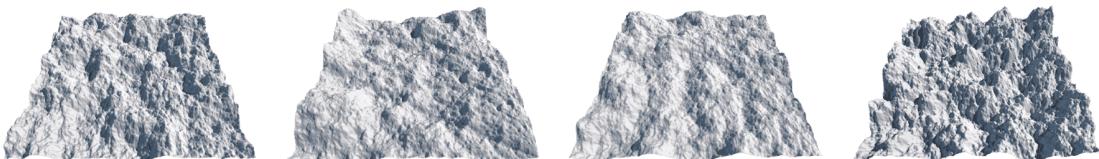
Initial generator (has no inputs).

Output:

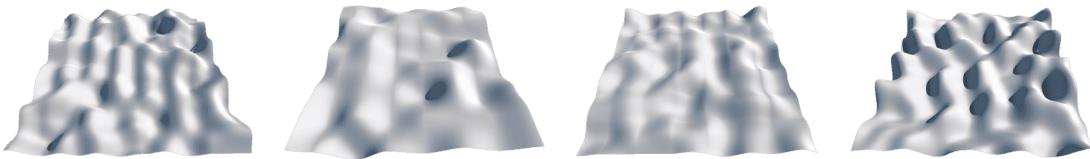
Single output - a noise map, ranged from 0 to 1.

Properties:

- **Type:**
 - Unity: the noise created with the standard Unity Mathf.PerlinNoise function. Mostly for the debug purpose.
 - Linear: for the fractals larger 1 linearly interpolates values between random values. If you turn off detail fractals you can notice the "flat" look, seems that this noise is made of planes. The fastest algorithm and is recommended to use in various masks.
 - Perlin, or bilinear: more advanced large fractal interpolation, that takes into account further random values.
 - Simplex: perlin filtration, but uses triangular (hexagon) noise points grid instead of the square ones. Since triangular grid is more dense than the square one, visual pattern of this noise type is a bit smaller and requires "Size" parameter adjustment. The slowest noise type, but suits best for the heightmap creation.



Type: Unity, Linear, Perlin, Simplex



Type with no detail (detail=0): Unity, Linear, Perlin, Simplex

- **Seed:** a number used to initialize pseudo-random noise generator. If two generators use equal seed numbers the resulting pattern will be the same.



- **Intensity:** sets the highest noise value.



Intensity: 0.3, 0.6, 1, 1.5, 2

- **Size:** this parameter determines the size of the biggest fractal. Noise above this value ceases to be fractal being a standard perlin noise. Lower size values result in a very homogeneous and predictable noise, while high values can create diverse noise and scenic heightmaps.



Size: 50, 100, 200, 300, 400



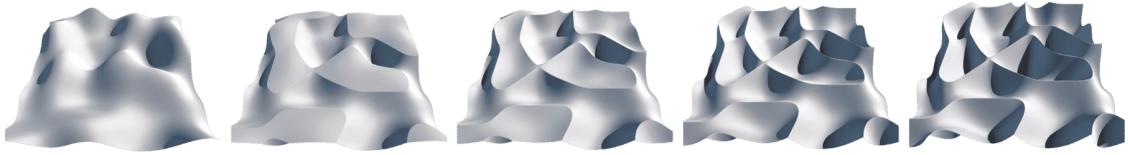
Here the same noise sizes generated with no detail to make the pattern visible

- **Detail:** this parameter determines the big and small fractals' bias. When the parameter is higher than 0.5 then small fractals have greater impact, which results in a more 'noisy' map. When parameter is below 0.5 small fractals are less significant than the big ones, which results in a smoother noise.



Detail: 0, 0.25, 0.5, 0.75

- **Turbulence:** creates "bubbles" (positive) or "ridges" (negative).



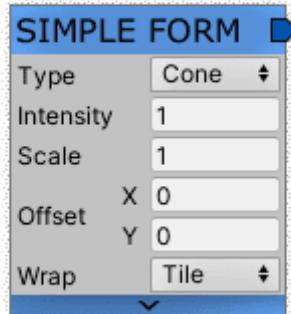
Turbulence: 0, 0.25, 0.5, 0.75, 1

- **Offset:** this parameter defines the noise pattern position, shifting it along the x and z axes. These values can be positive or negative. Offset applies to all of the terrains and sums with the terrain position, so the noise maps continue seamlessly on all the terrains.



Offset Z: 0, 100, 200, 300, 400

Simple Form



Creates simple mathematical pattern: gradient, pyramid or cone.

Use cases:

Used mainly to create gradients, for example, to blend biomes from North to South:



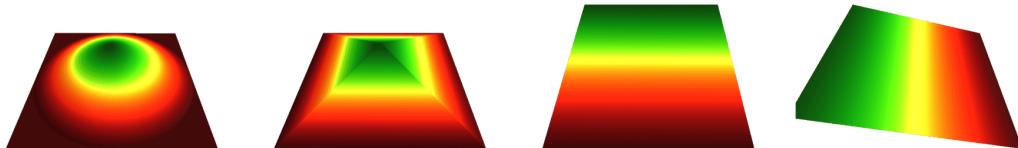
However, cone and pyramid modes could be handy too. The way to create a crater from Simple Form:

A Simple Form is used as a basic terrain for the island:

Cone could be transformed into a blob with a curve:

Properties:

- **Type:**
 - Gradient X: fills a map with an x-axis aligned gradient.
 - Gradient Z: fills a map with an z-axis aligned gradient.
- **Pyramid:** creates a pyramidal form.
 - Cone: creates a cone.



Type: Cone, Pyramid, Gradient X, Gradient Z

- **Intensity:** the height of the simple form figure.



Intensity: 0, 0.5, 1, 2

- **Scale:** sets the size of heightmap. By default size is equal to one chunk (terrain).



Scale: 0.1, 0.5, 1, 2

- **Offset:** moves figure along X or Z-axis (in world units).



- **Wrap Mode:** determines how the heightmap should be repeated so that every terrain point will not miss a map:

- Once: repeat map only once
- Tile: repeat map endlessly the way the standard texture could be tiled
- PingPong: will mirror every 2nd map and repeat map endlessly. Use this if you want to fill your land with a figure that is not tilable.



Wrap Mode: Once, Tile, PingPong

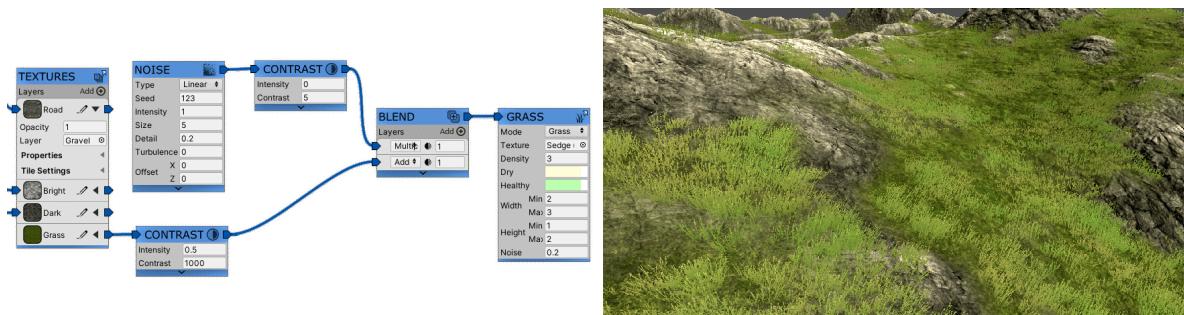
Modifiers

Blend



Blends two or more maps together using the specified blend algorithm. This generator acts quite similar to the layer blending mode in Photoshop or other graphics editor. Think of the most bottom 'Base' map input as a background layer, and the layers above are the blending layers.

Use cases:



Green grass mask texture multiplied with the random noise mask

Properties:

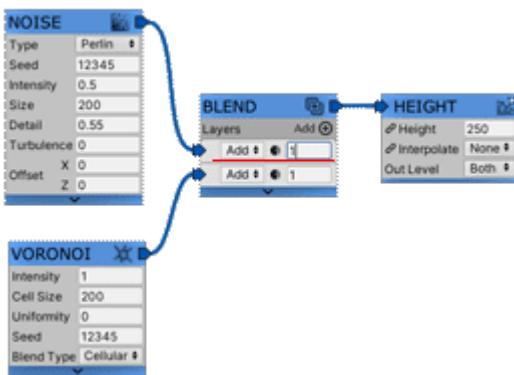
Each layer (except the Base one) has the algorithm and opacity properties.

- Algorithm - determines how exactly the layers are blended
- Opacity the blending layer opaqueness factor. If the value is 0 the blending result is not visible.

Here are the algorithms the blend generator offers:

- Mix: simply blends two maps using the opacity value Algorithm's formula is { return b; };
- Add: adds the Blend layer to the Base layer, i.e. the sum of the layers { a+b; }
- Subtract: subtracts the Blend layer from Base layer { a-b; }
- Multiply: multiplies the two layers. Note that since input values in most cases are less than 1, the multiplied value would be lesser than any of the input ones. { a*b; }
- Divide: the opposite of Multiply. The result can often exceed 1, so use it with care. { a/b; }
- Difference: the delta value between two layers { Mathf.Abs(a-b); }
- Min: the minimum value between both layers. { Mathf.Min(a,b); }
- Max: the maximum value between both layers. Try experimenting with Min and Max blend algorithms as they can bring clean and useful results { Mathf.Max(a,b); }
- Overlay: this effect is often used to process images but the feasibility of using it for blending height or splat maps is questionable.
if (a > 0.5f) return 1 - 2(1-a)(1-b);
else return 2ab;

Algorithm examples for the graph scheme:



Algorithm: Mix, Add, Subtract, Multiply, Difference, Min, Max

In current case base layer (voronoi) opacity is always 1, and the algorithm is always additive. Blend mode is changed for Noise only. In Mix mode opacity is set to 0.5

Most common blend algorithms for masks are Add and Multiply.

Add will blend two masks in "OR" mode, combining their **allowed zones**

While applying map with Multiply will blend it in "AND" mode, combining their **restricted zones**

Blur

Smooths the input map.

Inputs:

- Input - the default map to be processed by the generator.
- Mask - multiplies the generator intensity by the mask map's value. For the mask pixels that have a value of 0 the generator effect is invisible, for the pixels that have a value of 1 the intensity is unchanged.

| Source heightmap | Mask map | Masking result |

Outputs:

- Output - stores the generator's processing result.

Properties:

- Intensity: amount of blur applied per iteration.
- Iterations: number of blur iterations applied. Note that increasing the iterations count will reduce blur performance. The maximum reasonable amount of iterations is about 10, if you want more map smoothness use the Loss parameter.

Iterations: 0, 1, 10

- Loss: forces the generator to skip some of the input pixels. This will result in a bit more 'pixelated' look, but will give the map extra smoothness. A value of 1 means that no pixels will be skipped. The Loss parameter has virtually no effect on performance so it could be used to create extremely smooth maps. Use it together with high Intensity and Iterations counts to avoid noticeable pixelization.

Loss (with Iterations = 10): 1, 20, 60

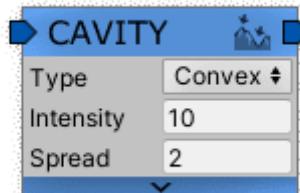
Do not try to make your map extra-blurry by increasing Iterations value only. This will result in poor Blur performance. Use Loss value instead.

- Safe Borders: masks terrain borders so that the generator effect on the borders is zero, and increases with distance from the border. This parameter sets the amount (in pixels) until the effect's full strength. When set to 0 border masking is off. This parameter is essential for better terrain welding, so always enable it if this generator outputs to height.

Safe Borders: 0 (off), 20, 100

Note that turning Safe Borders off (setting it to 0) will result in seams between chunks.

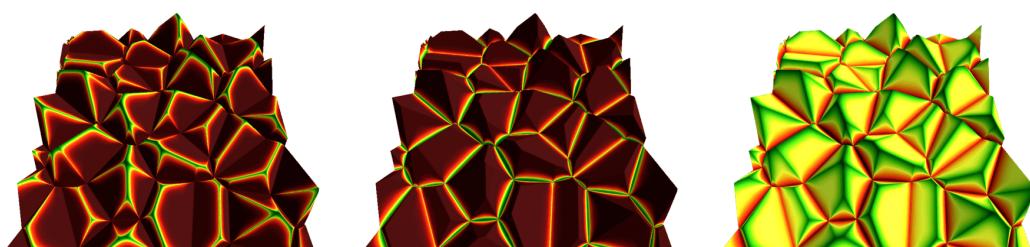
Cavity



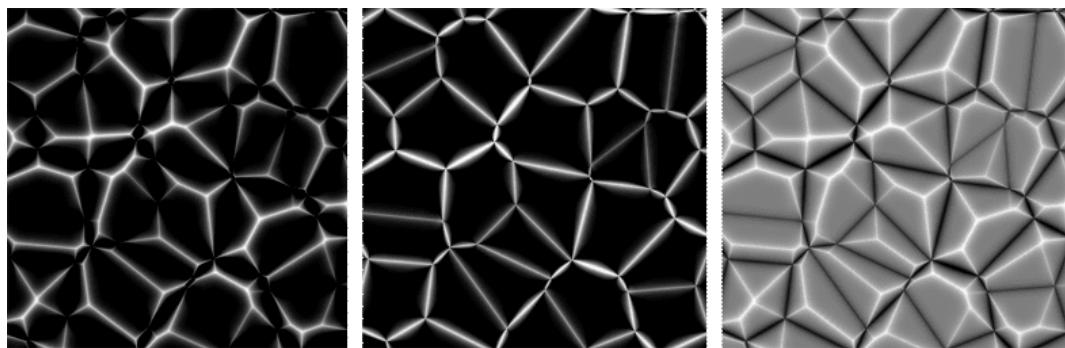
Generates the maps of concavity and convexity. All of the bulges and cambers are regarded as convex and the hollows are regarded as concave. Note that output maps do not intersect: one pixel can not be convex and concave at the same time.

Properties:

- Type:
 - Convex highlights the bulgy areas
 - Concave highlights hollows
 - Both generates the mid-value (gray) map, darkens concave areas and brightens convex ones

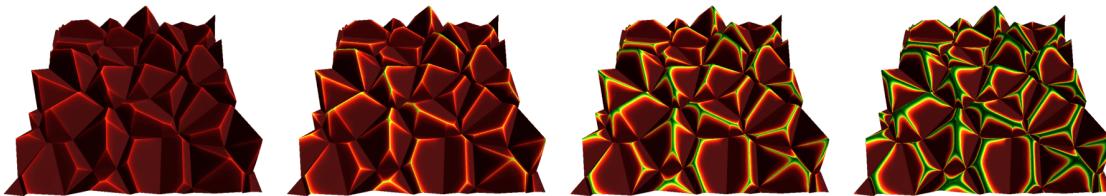


Type: Convex, Concave, Both



Type, shown on the map: Convex, Concave, Both

- Intensity - the amount of influence of the generator on the input map. When the value is set to 0 the generator effect is not visible. In other words, it is the generator's effective opacity.



Intensity: 1, 5, 10, 20

- Spread - since really curving terrain areas are rather rare, the Cavity Generator can expand resulting information on more level areas.

Contrast



Changes the intensity (brightness) and the contrast of the input map. Could be useful for the simple modifications of various masks.

Increasing contrast to large values (100-1000) will return single-bit masks, with only 0 or 1 values and no gradients (or almost no gradients).



Increasing contrast of the Noise and grass texture masks

Properties:

- **Intensity:** changes the height (or brightness, if considering map is an image) of the map. Ranges from -1 (any input map would be black) to 1 (any map would be white).

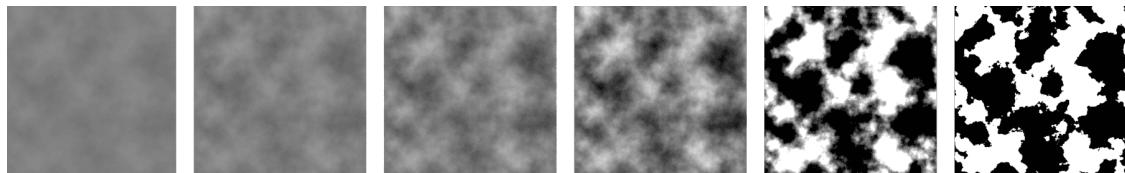


Intensity: -0.5, -0.25, 0, 0.25, 0.5

- **Contrast:** changes the map contrast. Ranges from 0 (planar map at Intensity level) up to infinity.

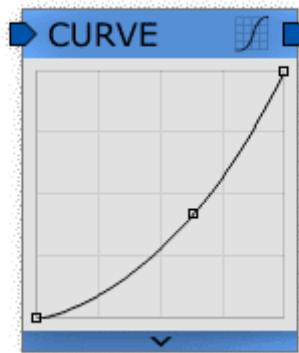


Contrast: 0.25, 0.5, 1, 2, 10, 1000



Contrast on map: 0.25, 0.5, 1, 2, 10, 1000

Curve



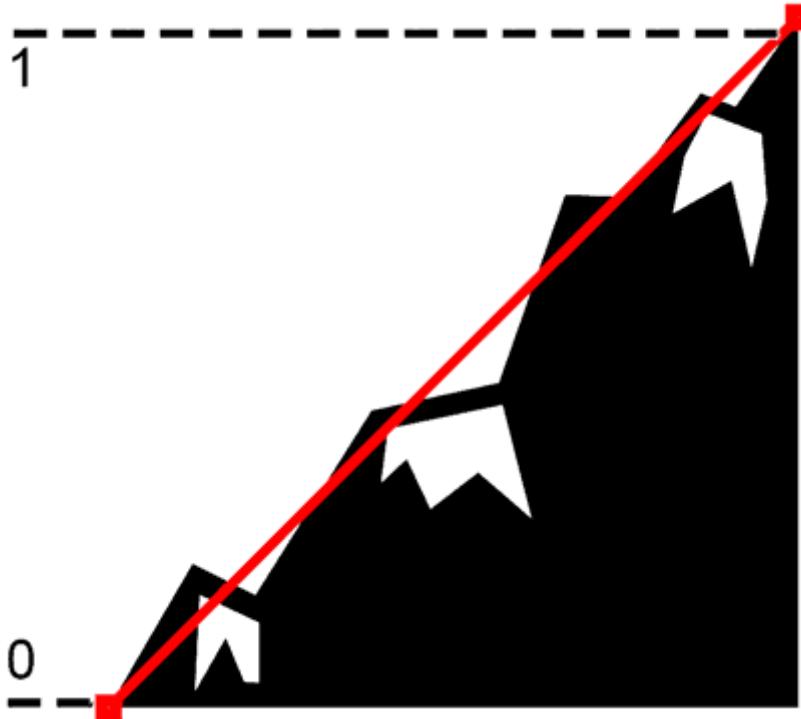
Adjusts map values using a user-defined curve. It works similar to the curves adjustment in graphics editors like Photoshop. The horizontal axis of the curve chart is the input value, vertical axis is the output value.

This generator provides plenty of opportunities for map editing: it can be used to invert maps, adjust minimum or maximum values, clamp map values or even make ladder slopes (although a terrace generator could be more handy for this).

For example, to give the map more contrast just move left and right keys horizontally closer to the central line. To invert the map move the left key to the top and the right key to the bottom so that the diagonal line is inverted (note that key tangents should be set to auto to achieve a straight line).

Understanding curve:

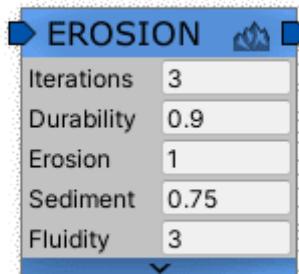
Imagine you have a mountain with more or less straight slope going from the zero level up to its top at the level one - this slope will be the default linear curve. When we add a point and drag it down we change the shape of this imaginary slope, and all of the other slopes as well.



Properties:

- Curve field: displays a curve preview. To create a point click anywhere at the curve. To move the point - drag it with the mouse. You can create a point and start dragging, just keep the mouse button pressed. To delete the point drag away anywhere from the curve field. The first and the last points are draggable too.
- If any of the terrain tiles assigned as preview - the curve field background shows preview tile [histogram](#). Note that the histogram does not represent a terrain tile relief, slice or part of it, it's completely different thing.

Erosion

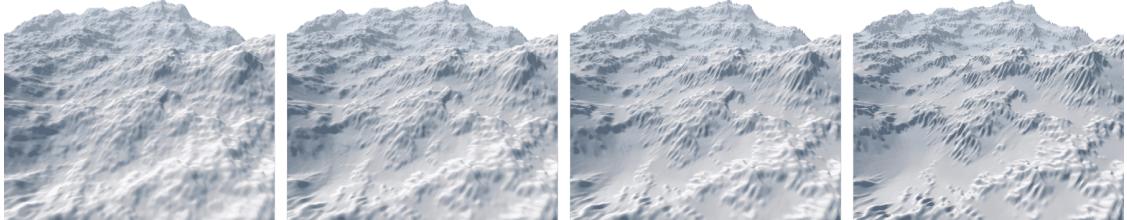


Reproduces water's flowing action on the terrain's surface. Flows erode cliff formation, transport eroded stratum to another location and settle it as a sediment. Note that all of the flows, erosion and sediment calculations are iterative and very resource intensive, this makes the Erosion Generator the slowest generator of all the MapMagic generators. It usually takes a second to generate erosion with the default parameters on a modern computer - compared to any other generator which are nearly realtime. But the result is usually worth it.



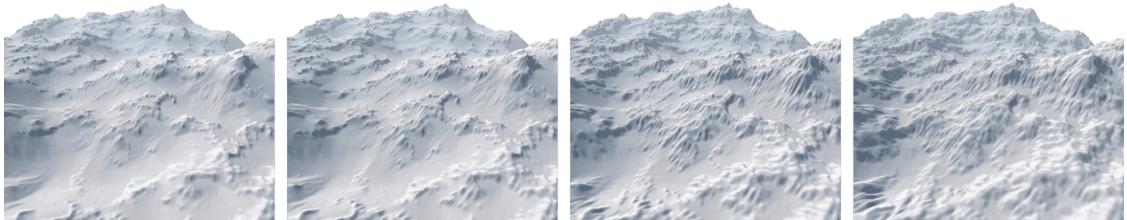
Properties:

- **Iterations:** number of passes the generator should perform. This parameter determines the performance directly. In most cases there is no need to set it more than 5-7 as further erosion becomes less noticeable.



Iterations: 1, 3, 5, 10

- **Durability** factor: determines how durable the input terrain is - i.e. how much it is affected by the flow erosion. Lower values will erode the land more with each iteration but the overall result will be less accurate and predictable, so it is recommended to set this value to 0.8 or higher. If value is set to 1 then the land will not be eroded at all.



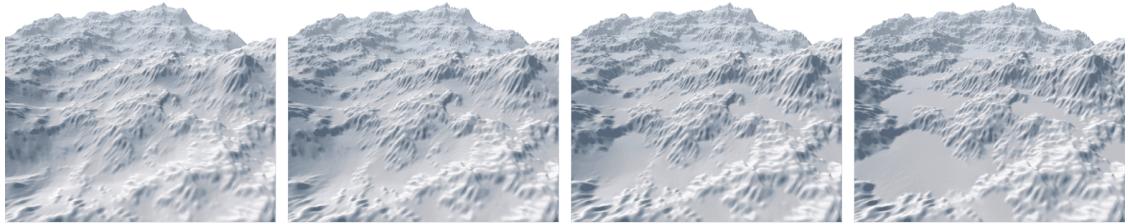
Durability: 0, 0.5, 0.9, 0.99

- **Sediment** factor: this factor multiplies the amount of stratum that will be settled out of the flow. A value 0 means that all of the eroded land will be disintegrated or carried away somewhere so that no sediment will be left at all, just eroded land will remain. A value 2 means that the stratum amount will be magically doubled before it settles. A realistic value should be slightly below 1, but fine results can be achieved within all of the 0-2 value range.



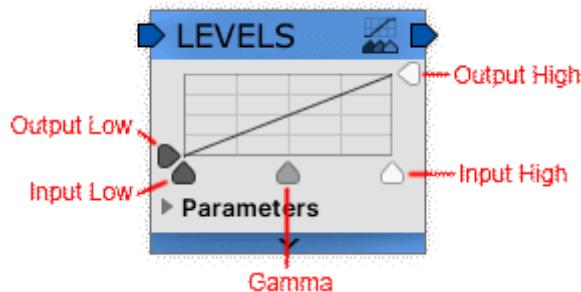
Sediment: 0, 0.5, 0.75, 1, 2

- **Fluidity** iterations: the amount of passes used to calculate flow runs. A higher value means the farther sediment will travel from where the stratum was originally eroded. Together with the Iterations parameter it affects performance greatly.



Fluidity: 1, 3, 10, 30

Levels



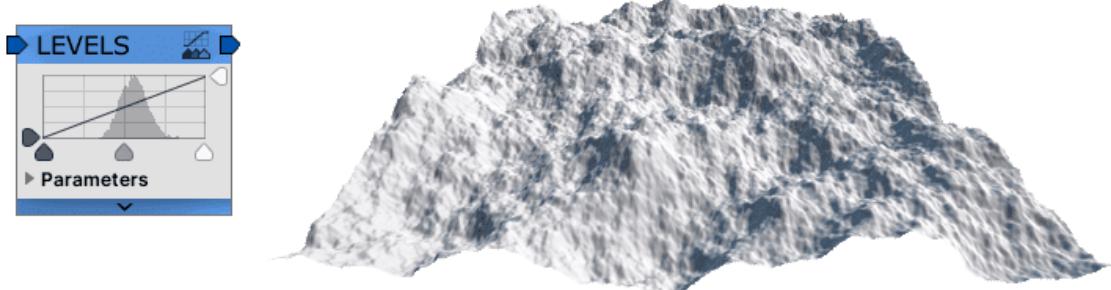
This tool is used to make a map higher or lower, to change contrast or to correct map gamma.

All of the levels sliders are draggable. Output high and low levels sliders are dragged vertically, while Input low and high and Gamma are dragged horizontally. To reset the slider to its original position drag out of the node and release it. Resetting Gamma this way will always place it between Input low and high (value 0.5).

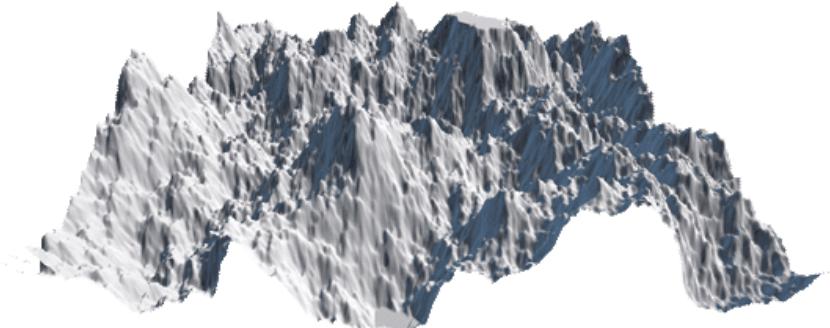
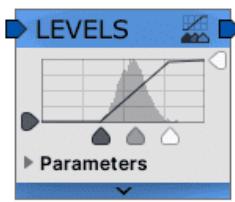
In most cases Levels generator can replace the [Curve](#) node. While curves are more flexible and give more control, levels node is a bit faster, and has more compact interface. But the main advantage of Levels node over curves is that its properties could be exposed for function. Curve node key values could not be exposed, so could not be adjusted from the parent graph.

To expose the slider properties, or to enter their values manually unroll the Parameters rollout. Here the values could be edited the way it's done in other generators.

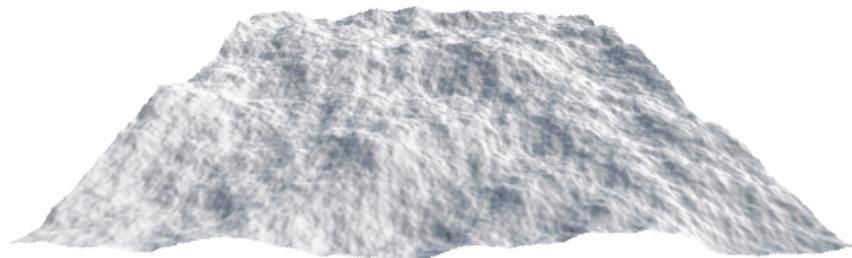
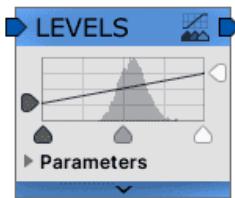
Use Cases:



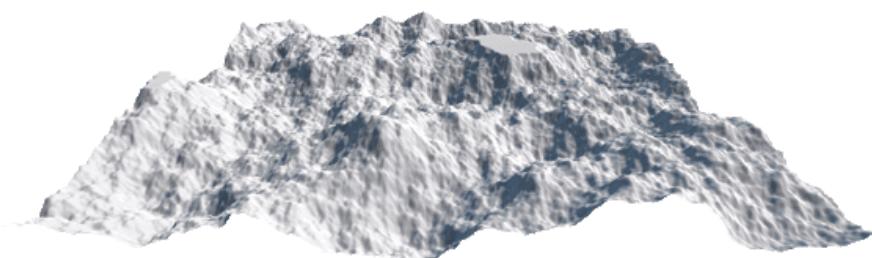
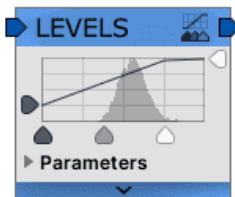
Original non-modified terrain



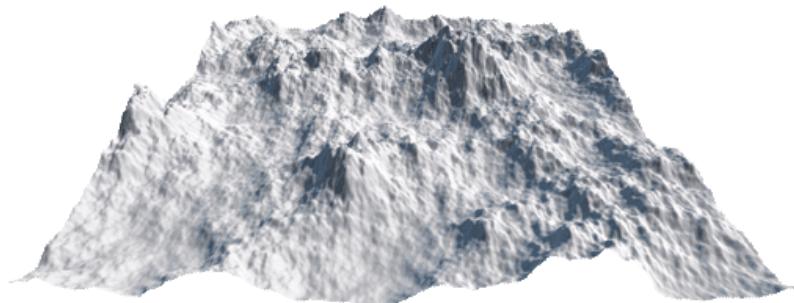
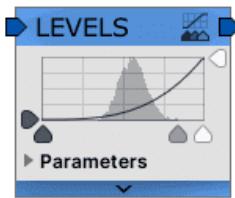
Increasing contrast by lowering Input levels range



Decreasing contrast by lowering Output levels range



Offset height by adjusting Input and Output levels



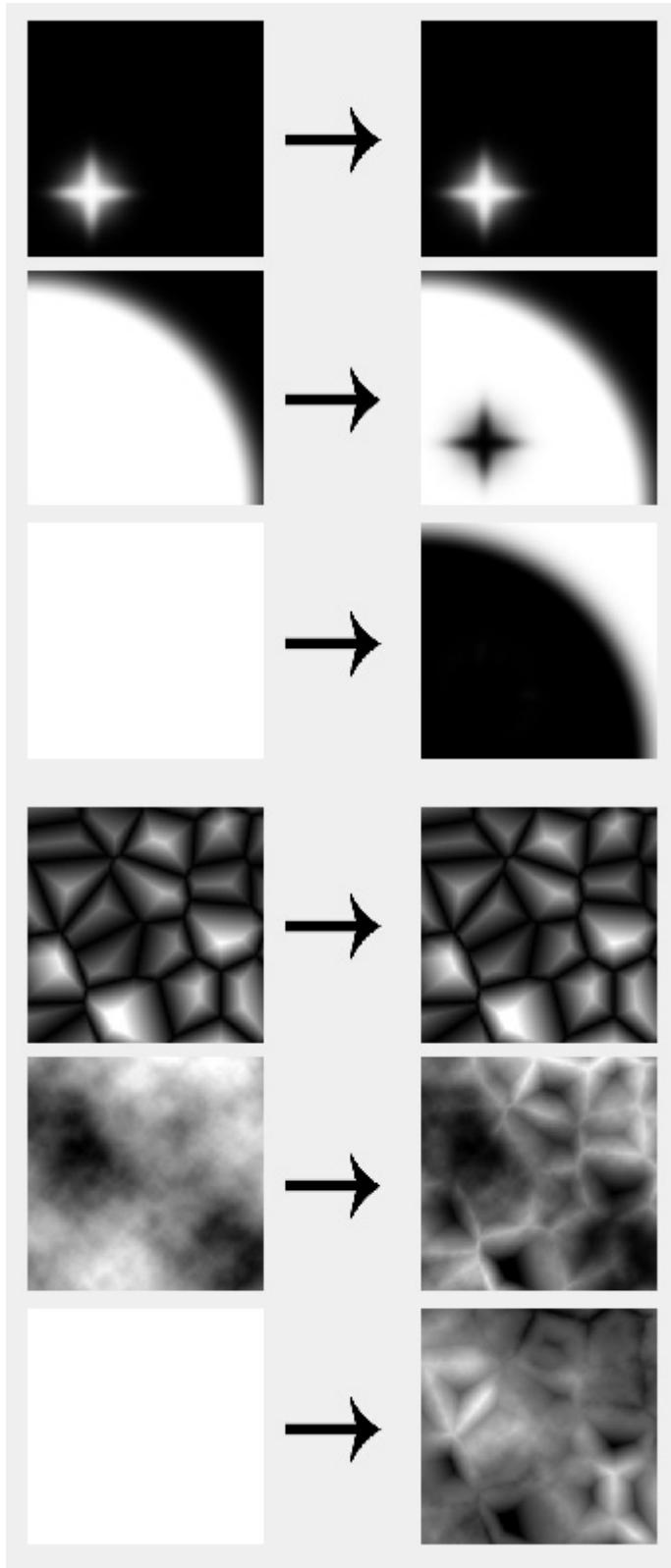
Changing gamma

Normalize

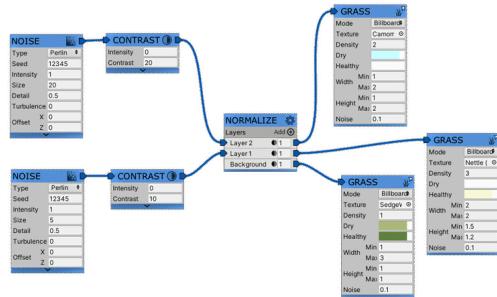


This generator is used to combine several maps so that their sum is always 1.

Normalize Generator final result depends on the layer order. Layers are blended together similarly to the layer system in Photoshop and other graphics editors: Each of the upper layers overlaps the lower ones. A mathematical algorithm for each layer generator multiplies all underlying layer values with the inverse value (1-value) of the current layer. The sum of the output maps values is always equal to 1.



Some generators like Biomes Set or Textures Output have a normalizer built-in, but in some cases it would be handy to pre-normalize them manually. In other cases it would be necessary to normalize masks for Mask node, Grass Output or other nodes.



Normalizing grass masks

Inputs:

Input in all of the layers - source non-normalized maps.

The Background layer does not require an input since it is regarded as completely filled (a constant of 1). This layer could not be removed or sent up or down.

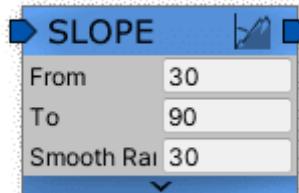
Outputs:

Map outputs in all of the layers - input maps processed so that any pixel sum of the map values is equal to 1.

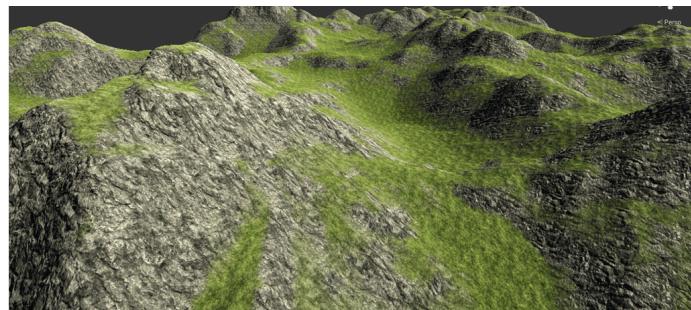
Properties:

- Each layer has an Opacity value that multiplies layer's map before applying it.

Slope



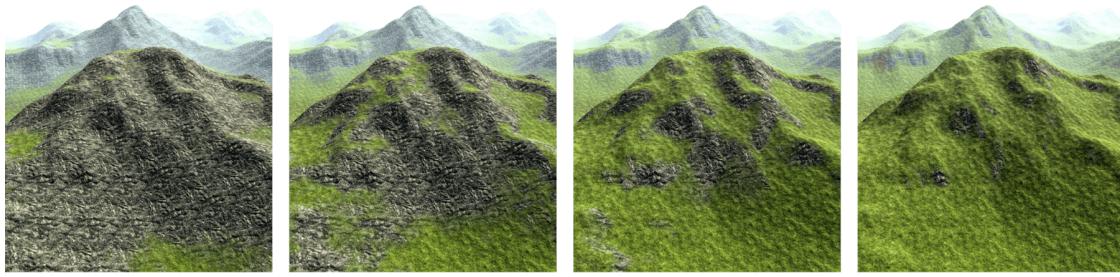
Generates the height difference map. For each map pixel it calculates the average height delta to four nearby pixels. Could be useful for separating horizontal and vertical surfaces (to fill them with grass and cliff respectively).



Masking only inclined areas with Slope

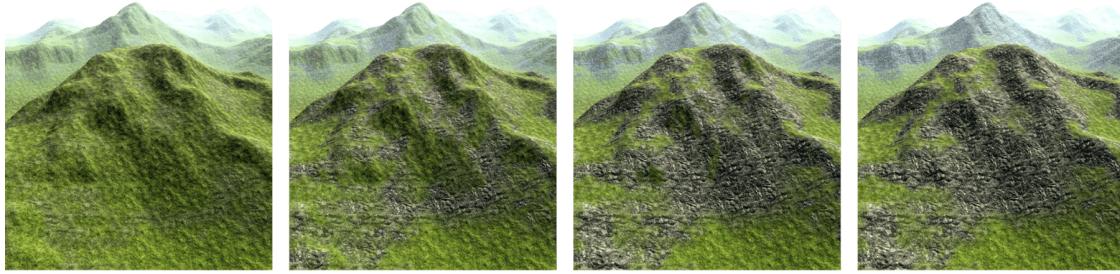
Properties:

- **From:** the starting angle (in degrees) of the masking effect.



From: 10, 20, 30, 50

- **To:** the ending angle (in degrees) of the masking effect. Usually it's 90 (vertical), but if you want to create an inversed effect (from 0 to X) or mask only the slope of some particular degrees (from X to Y) it might be needed to set this value.



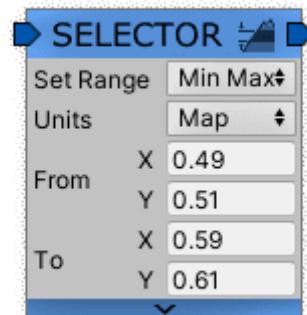
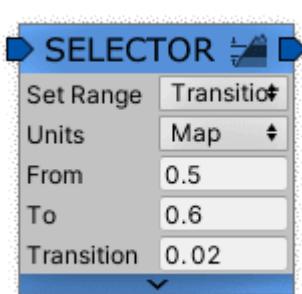
To (while From is 20): 20, 30, 40, 90

- **Smooth Range:** the range (in degrees) of the transition between masked and unmasked effect.

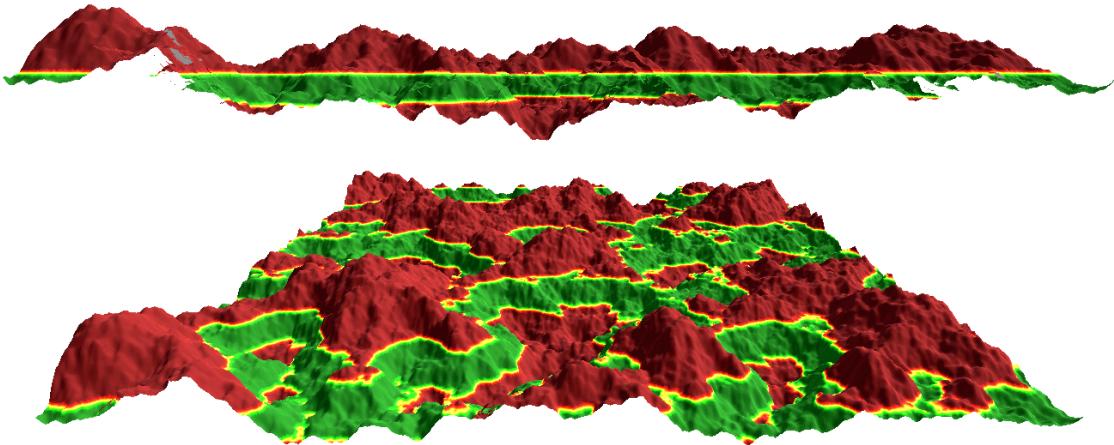


Smooth Range: 0, 10, 20, 50

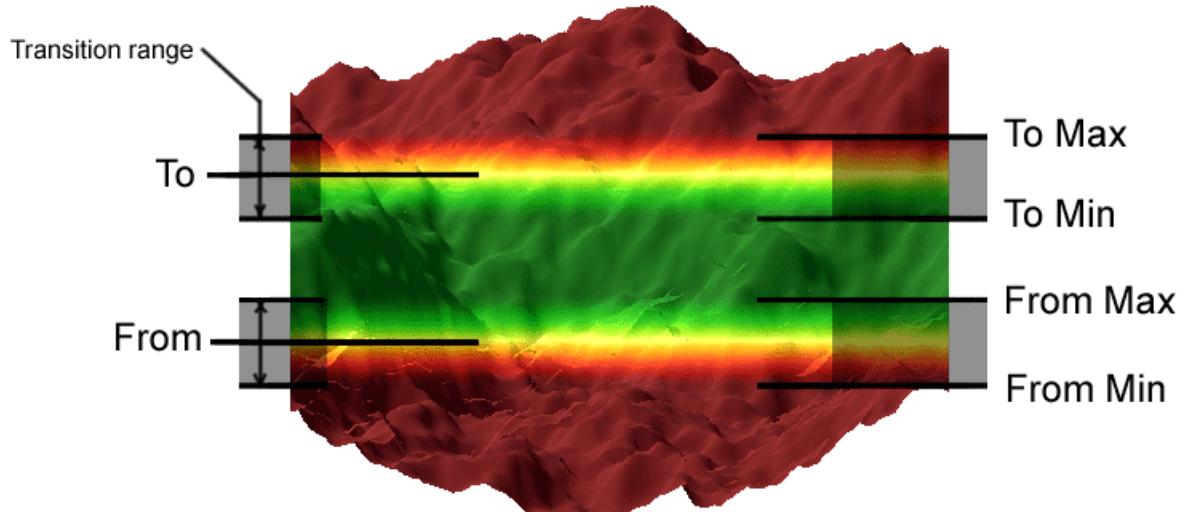
Selector



Selects (masks) the values interval at a specified level. In simple terms if the value is within From-To range it becomes 1, otherwise it becomes 0 (if not taking transition into account).



Transition effect allows gradual masking - it creates smooth gradients both at From and To ends.

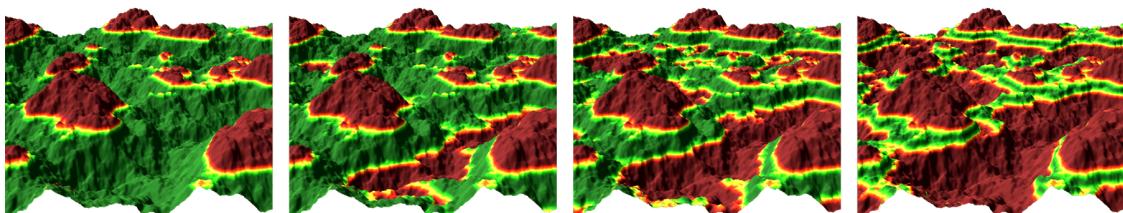


Properties:

- **Set Range:** switches the node interface between transition and min/max values. It's the matter of personal preference which UI type to choose (however in Min/Max you can set different transitions for from or to ends).

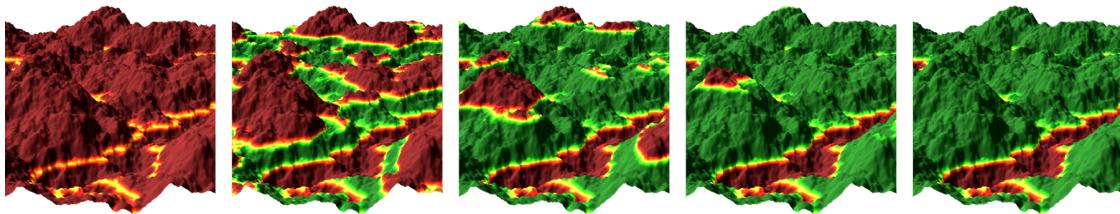
In Min/Max mode from and to minimal value is converted using $X\text{-Transition}/2$, and maximal: $Y+Transition/2$

- **Units:** determines whether the map units (ranging from 0 to 1) or world units (ranging from 0 to 250 or whatever set in output/MM object settings. See [Height Output](#) for details).
- **From:** determines the lower selection range. All values higher this value (or min-max range) will be selected, up to To value.



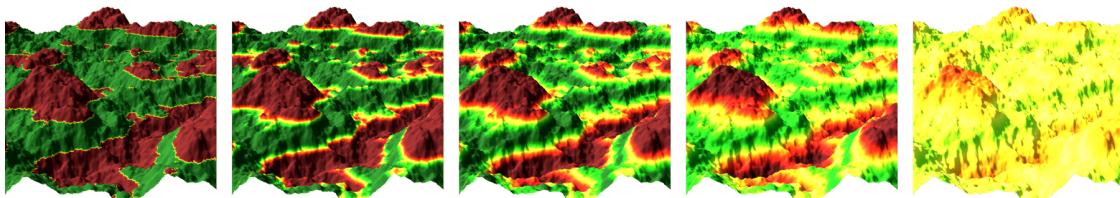
From (while To 0.66): 0, 0.5, 0.55, 0.6

- **To:** determines the upper selection range. All values below this value starting with From will be selected.



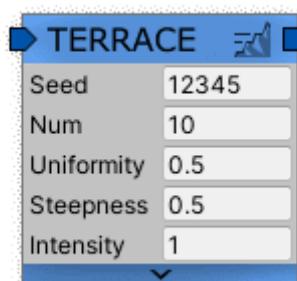
To (while From 0.5): 0.5, 0.6, 0.7, 0.8, 0.9

- **Transition:** sets the gradient on Front and To ends for smooth masking:

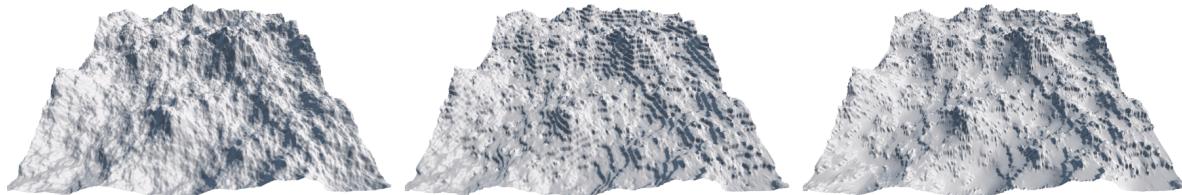


Transition: 0, 0.05, 0.1, 0.2, 1

Terrace



Produces step-like land forms on the slopes of hills. Used together with a Noise (as terrace's input) and Erosion (originates from terrace's output) Generator, it can produce fine landscapes. Don't underestimate the Terrace Generator - even if it seems that pure terrace output is not good enough looking, together with erosion it can make a terrain much more realistic and diverse.

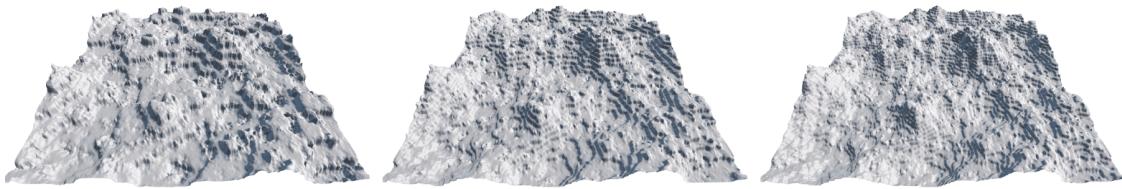


Initial terrain | Terrace generator | Terrace+Erosion

Properties:

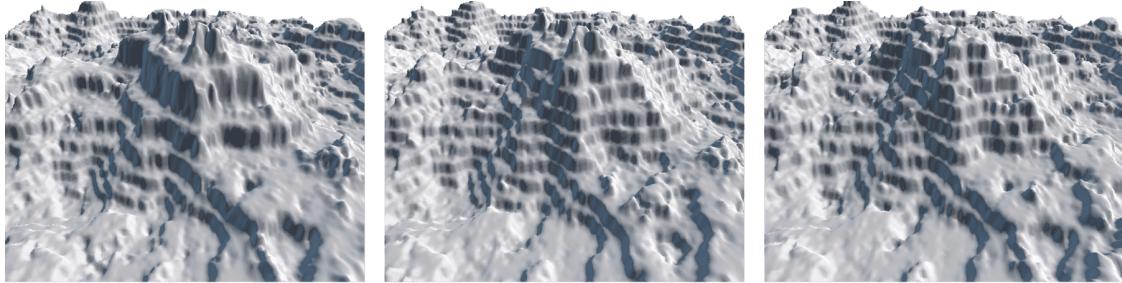
- **Num:** sets the number of treads - from 2 (at the top and bottom of terrain) to any reasonable number (note that making a terrace height lesser than a unit often does not make sense). This parameter affects the generator performance but since Terrace Generator is relatively fast every value below 100 will not have an appreciable influence on total the

generation time.



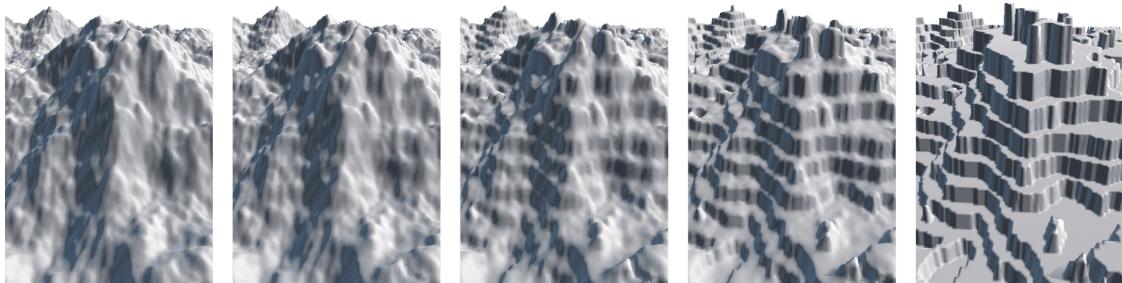
Num: 10, 20, 30

- Uniformity: the terrace's step's height difference. When set to 1 all of the steps have the same height and when set to 0 the height may vary from zero to twice the uniform height.



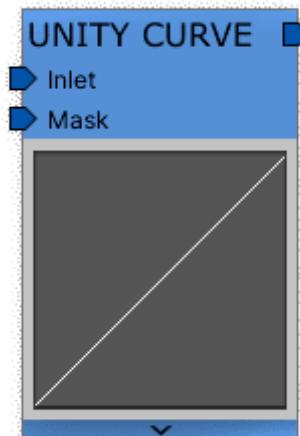
Uniformity: 0, 0.5, 1

- Steepness: determines how inclined the step's vertical plane(riser) is and how acute the bend between the tread and riser would be. A value of 1 will generate absolutely vertical risers with maximum tread length, while a value of 0 will set the tread's length to zero (but that does not mean that terracing would be turned off - to make the terrace effect even less noticeable use the Intensity parameter).



Steepness: 0, 0.5, 1

Unity Curve



Similar to the [Curve](#) node, but uses Unity animation curve interface instead. This gives more flexibility and control at the price of increased generate time.

Inputs:

Inlet (mandatory) - a source map.

Mask - the node effect opacity mask. The higher the value of the mask - the more visible curve effect is.

Properties:

Curve field: displays a curve preview. Clicking on it will open up a Curve Editor window - the standard Unity curve editing tool (see Unity manual: <https://docs.unity3d.com/Manual/EditingCurves.html> for more information).

Outputs

Height



Applies the Input map as a terrain height.

Output Generator

Output Generators bring all the map and object inputs to life: convert maps to terrain heightmap, splatmap or detailmap and place real objects on terrain. All of the generator chains should end up in one (or more) Output Generators - otherwise they will not be generated at all.

Inputs:

Input: a map that will be applied to terrain.

Properties:

Note that all of the properties marked with the link icon () are stored not in the graph, but in MapMagic object (Outputs Settings). Assigning this graph on a different MM object will virtually set this values to the MM object ones. Changing these values will change the MM object's values, as well as all the biomes and sub-graphs.

- **Height:** the maximum terrain height. Changing this value will set the terrain's Terrain Height parameter for each of the tiles. Does not affect the graph maps (it will just stretch the terrain upwards). To raise the maximum terrain height lower the intensity of all the generators.



Height: 100, 200, 300, 400

- **Interpolation:** smoothen the terrain on height apply:

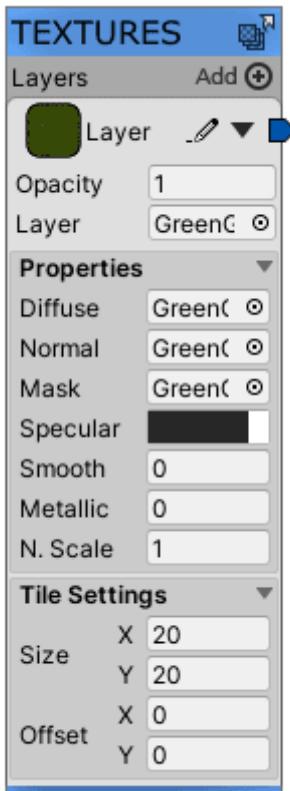
- None: applies the heightmap as is (generated map pixel -> to terrain heightmap pixel). The fastest apply speed.
- Smooth: interpolates between two pixels, smoothing applied heightmap a bit. Still fast apply speed, but some small detail may be lost.
- Scale 2X: upscales the applied heightmap twice each dimension, making terrain more detailed. This way terrain polygon density is four times bigger than other other maps (like splatmap). For instance, when using resolution of 513 in MapMagic, the terrain tile heightmap size will be 1025.
- Scale 4X: further terrain density upscale. Mainly used to create smooth terrains with low MapMagic resolution. Slowest apply time.

Note that the maximum terrain resolution Unity supports is 2049. This way the maximum MapMagic resolution for Scale 2X would be 1025, and for Scale 4X - 513.

- **Out level:** selects whether this output should be applied to main or draft detail level.

- Draft: applied only for [draft \(preview\)](#) terrains. Useful if you have the other output with more complex graph thread that is applied to main terrain level.
- Main: applied for main high-resolution chunks only. Some outputs like Grass do not need their effect to be applied for draft tiles, so it's recommended to use them in Main output level.
- Both: the output is applied both for draft and main tiles.

Textures



Applies the terrain texturing information, i.e. colors the terrain with textures.

Note that Textures Output has a [normalizer](#) built-in. It blends layers and normalizes them so that their sum is always 1. This way the layers order matters - each upper layer will overlap the bottom ones. Consider layer masks as Photoshop layers masks.

The Background layer does not require an input since it is regarded as completely filled (a constant of 1).

To use the Textures Output you've got to create the [Terrain Layer](#) asset files: **Assets > Create > Terrain Layer**. Then these assets should be assigned in Textures Output in Layer slot.

Main Properties:

- Opacity: the visibility factor of this layer
- Layer: Terrain Layer asset

Properties:

Clicking on the properties tab will open up the layer settings so that layer parameters could be modified without opening up the layers asset.

Note that changing these values will change terrain layer asset

- Diffuse: base color Texture of the Terrain Layer
- Normal: normal information for your Terrain Layer
- Mask: The TerrainLit Shader, which is part of the High Definition Render Pipeline (HDRP) and Universal Render Pipeline (URP), uses this Mask Map Texture data. Custom Terrain shaders might also use this Texture for user-defined purposes, such as ambient occlusion or height-based blending.
- Specular: The specular highlight color of the Terrain Layer.
- Metallic: The overall metallic value of the Terrain Layer.

- N. Scale: Normal Scale of the Terrain Layer. This value acts as a scaling factor for the normal values present in the Normal Map.

See [Terrain Layer](#) documentation for more detail.

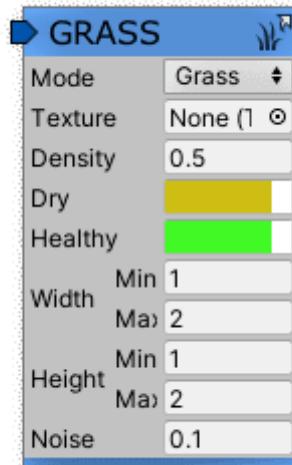
Tile Settings:

- Size: the size of the texture tile, in world units. The bigger the value - the bigger the pixels of the terrain tile are.

Note that due to better terrain welding splat prototypes the size parameter should be a multiple of the size of the terrain: if the terrain size is 1000 the proper terrain sizes are 10, 20, or 100. But with the tile size of 15 you'll get **texture seams** between tiles.

- Offset: the offset of the terrain tile, in world units.

Grass



Output generator, paints grass on terrain using layer's maps as a mask. This generator can place detail meshes as well.



Properties:

The grass layer parameters are similar to the standard [terrain grass and detail properties](#)

- **Mode:** determines whether it will be a standard grass, a billboard grass or a detail mesh
 - Grass is the default method to display grass using the static planes.
 - Billboard grass images will rotate so that they always face the camera.
 - Mesh Vertex Lit mode is used to place a detail meshes (does not support opacity).
 - Mesh Unlit mode is used to place custom unlit grass bushes with opacity.



Mode: Grass, Billboard, Mesh Vertex Lit, Mesh Unlit

- **Texture** field (for the grass modes): a grass albedo (diffuse) texture
- **Object** field (for the mesh unlit/vertex lit mode): a detail mesh prefab
- **Density:** number of objects for current grass type



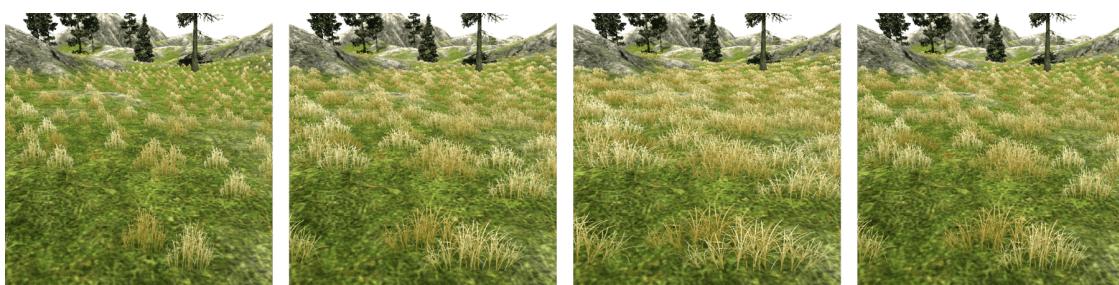
Density: 0.1, 0.3, 1, 2

- **Dry/Healthy** colors: The alternating patches of grass are considered more 'healthy' at the centers than at the edges and the Healthy/Dry Color settings show the health of grass clumps by their color. (Tech note: the noise is actually generated using Perlin noise; the noise spread refers to the scaling applied between the x, y position on the terrain and the noise image.)



White dry yellow healthy, red dry yellow healthy, red dry green healthy

- **Width** and **Height** values specify the upper and lower limits of the size of the clumps of grass that are generated.



Height: 1-1, Width: 1-1, 2-2, 3-3, 1-3

- The **Noise** spread value controls the approximate size of the alternating patches, with higher values indicating more variation within a given area. (Tech note: the noise is actually generated using Perlin noise; the noise spread refers to the scaling applied between the x,y position on the terrain and the noise image.)



Dry/Health colors spread with different noise values: 0.02, 0.1, 0.2, 1

Out level: selects whether this output should be applied to main or draft detail level.

- Draft: applied only for [draft \(preview\)](#) terrains. Useful if you have the other output with more complex graph thread that is applied to main terrain level.
- Main: applied for main high-resolution chunks only. Some outputs like Grass do not need their effect to be applied for draft tiles, so it's recommended to use them in Main output level.
- Both: the output is applied both for draft and main tiles.