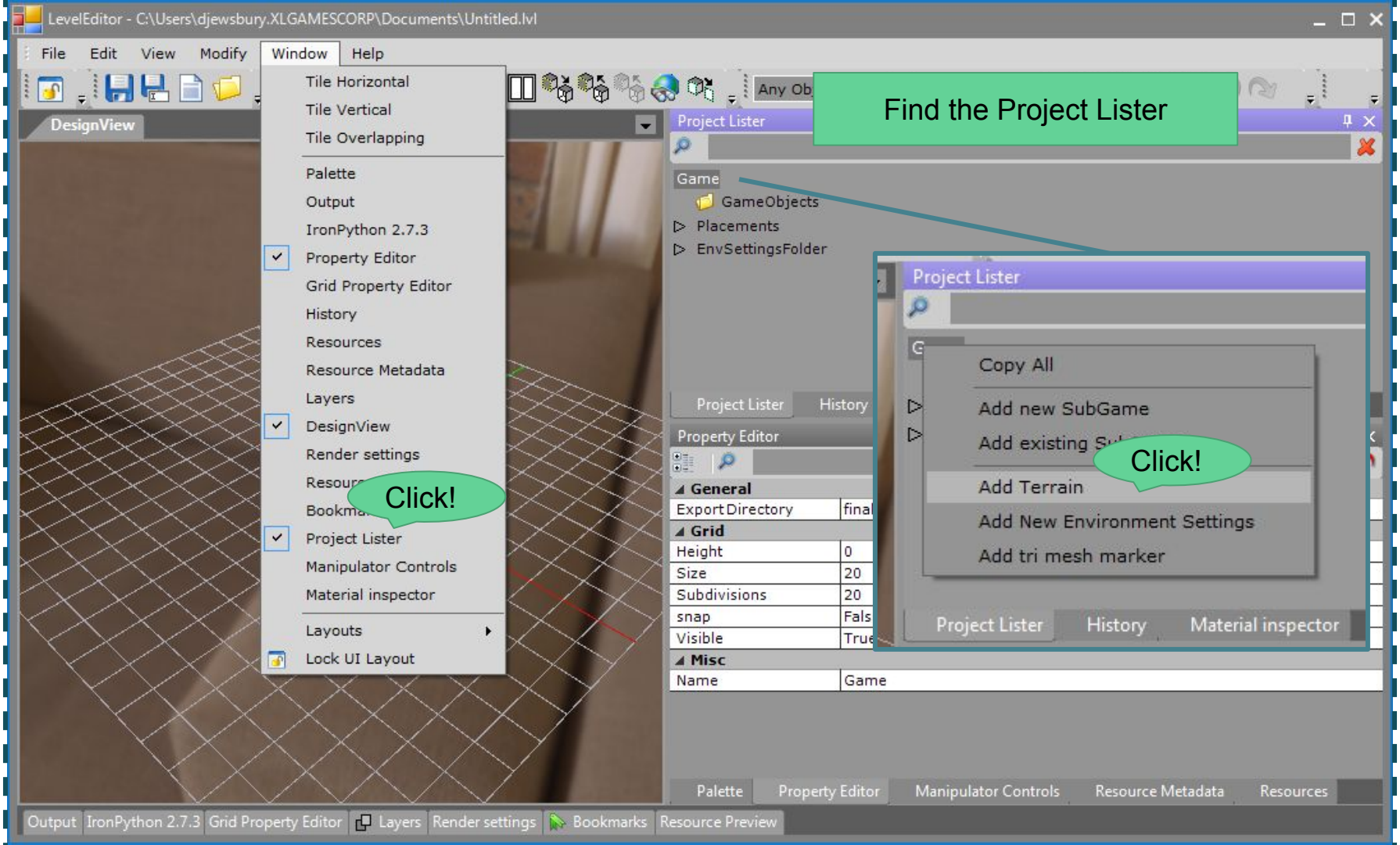
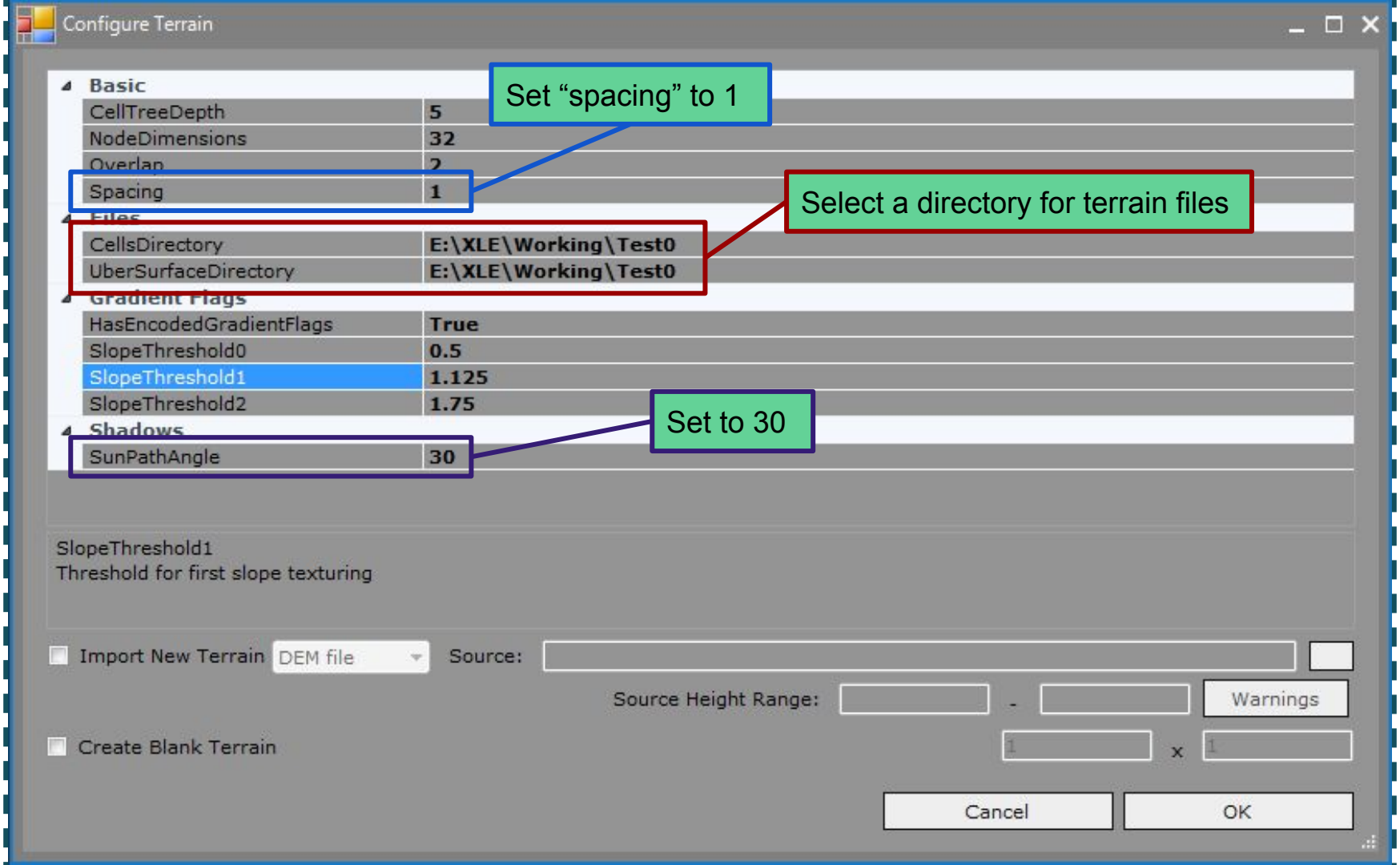
# XLE Getting Started with Terrain

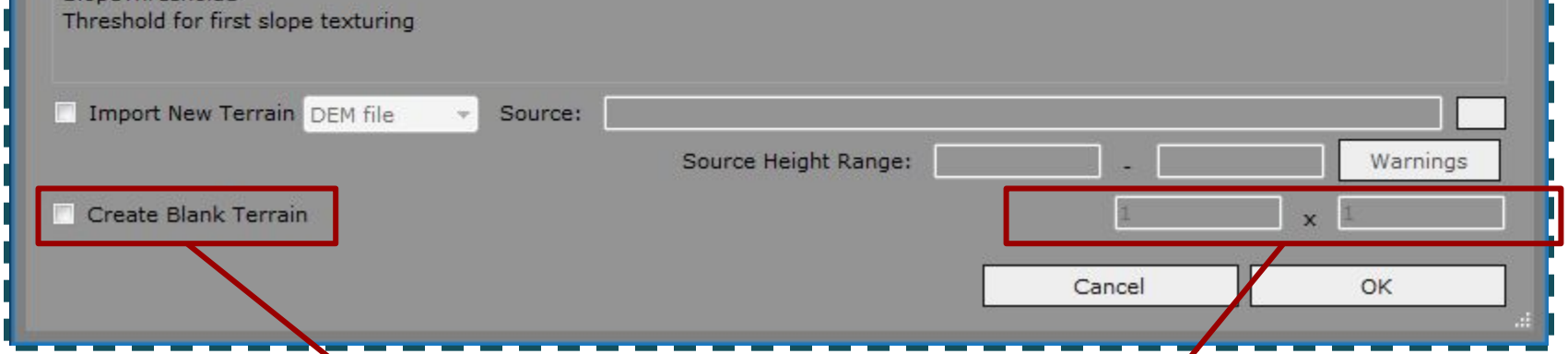
# This file describes the basics for terrains in XLE

1. Creating a new terrain
2. Understanding terrain files
3. Setting up texturing
4. Terrain editing
5. Terrain locks & painting materials
6. Shadowing & ambient occlusion
7. Terrain Decoration
8. Placements & Scatter placer

# Creating a new terrain


LevelEditor - C:\Users\djewsbury.XLGAMESCORP\Documents\Untitled.lvl
File
Edit
View
Modify
Window
Help
Tile Horizontal
Tile Vertical
Tile Overlapping
Palette
Output
IronPython 2.7.3
Property Editor
Grid Property Editor
History
Resources
Resource Metadata
Layers
DesignView
Render settings
Bookmarks
Project Lister
Manipulator Controls
Material inspector
Layouts
Lock UI Layout
Click!
DesignView
Find the Project Lister
Project Lister
Game
GameObjects
Placements
EnvSettingsFolder
Project Lister
History
Property Editor
General
Export Directory
Grid
Height
Size
Subdivisions
snap
Visible
Misc
Name
Game
Copy All
Add new SubGame
Add existing Sub
Add Terrain
Add New Environment Settings
Add tri mesh marker
Click!
Project Lister
History
Material inspector
Palette
Property Editor
Manipulator Controls
Resource Metadata
Resources
Output
IronPython 2.7.3
Grid Property Editor
Layers
Render settings
Bookmarks
Resource Preview


Configure Terrain
Basic
CellTreeDepth 5
NodeDimensions 32
Overlap 2
Spacing 1
Files
CellsDirectory E:\XLE\Working\Test0
UberSurfaceDirectory E:\XLE\Working\Test0
Gradient Flags
HasEncodedGradientFlags True
SlopeThreshold0 0.5
SlopeThreshold1 1.125
SlopeThreshold2 1.75
Shadows
SunPathAngle 30
Set “spacing” to 1
Select a directory for terrain files
Set to 30
SlopeThreshold1
Threshold for first slope texturing
Import New Terrain
DEM file
Source:
Source Height Range:
Warnings
Create Blank Terrain
Cancel
OK




If you want to create a new blank terrain, check this… But this document will describe creating terrain from a starting texture.

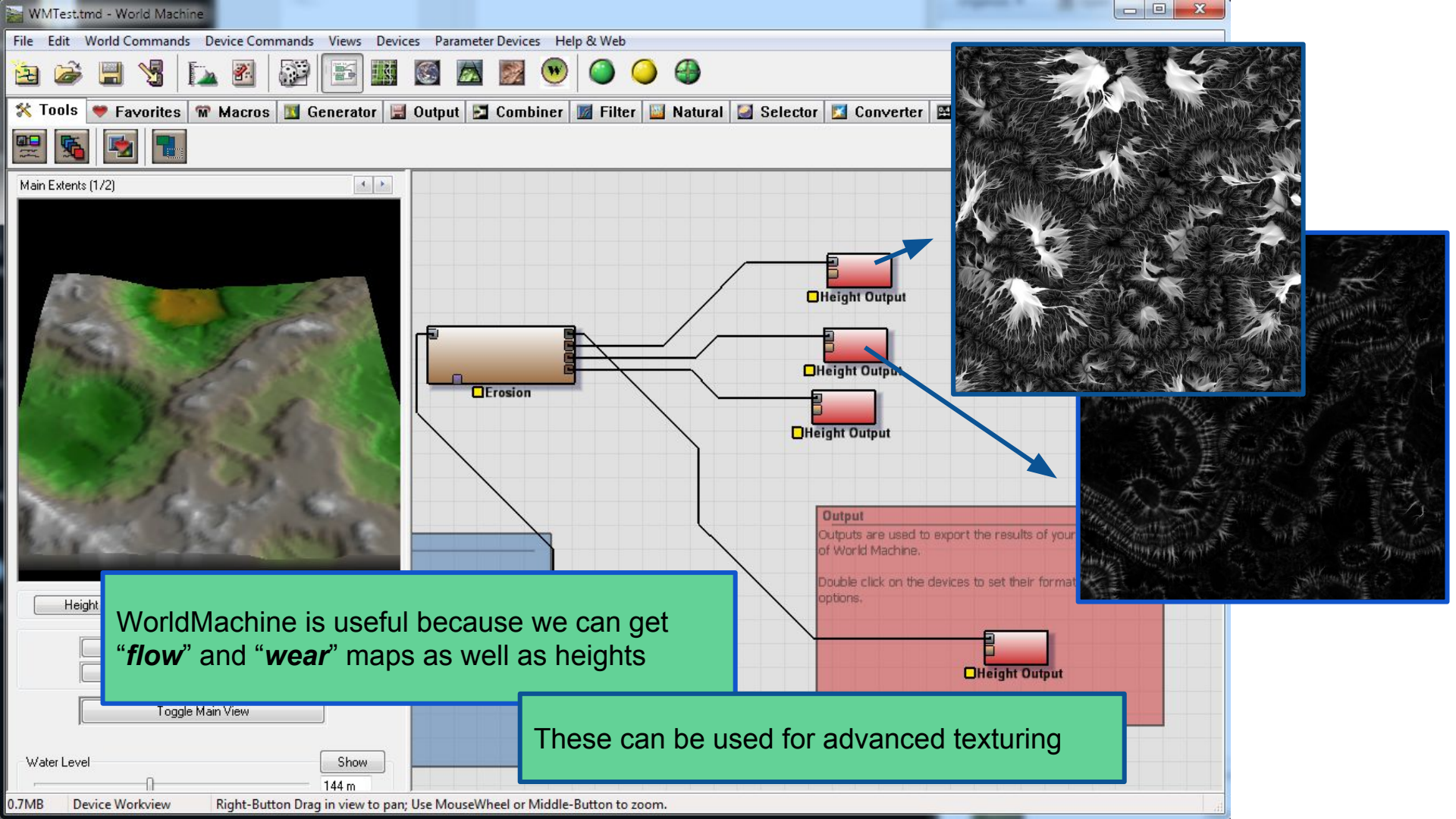
You can specify the terrain size here (in number of cells, typically between 1x1 to 64x64)

# Importing starting data

Normally, we should start a terrain in a dedicated terrain application:

1. WorldMachine
2. Photoshop (or other painting application)

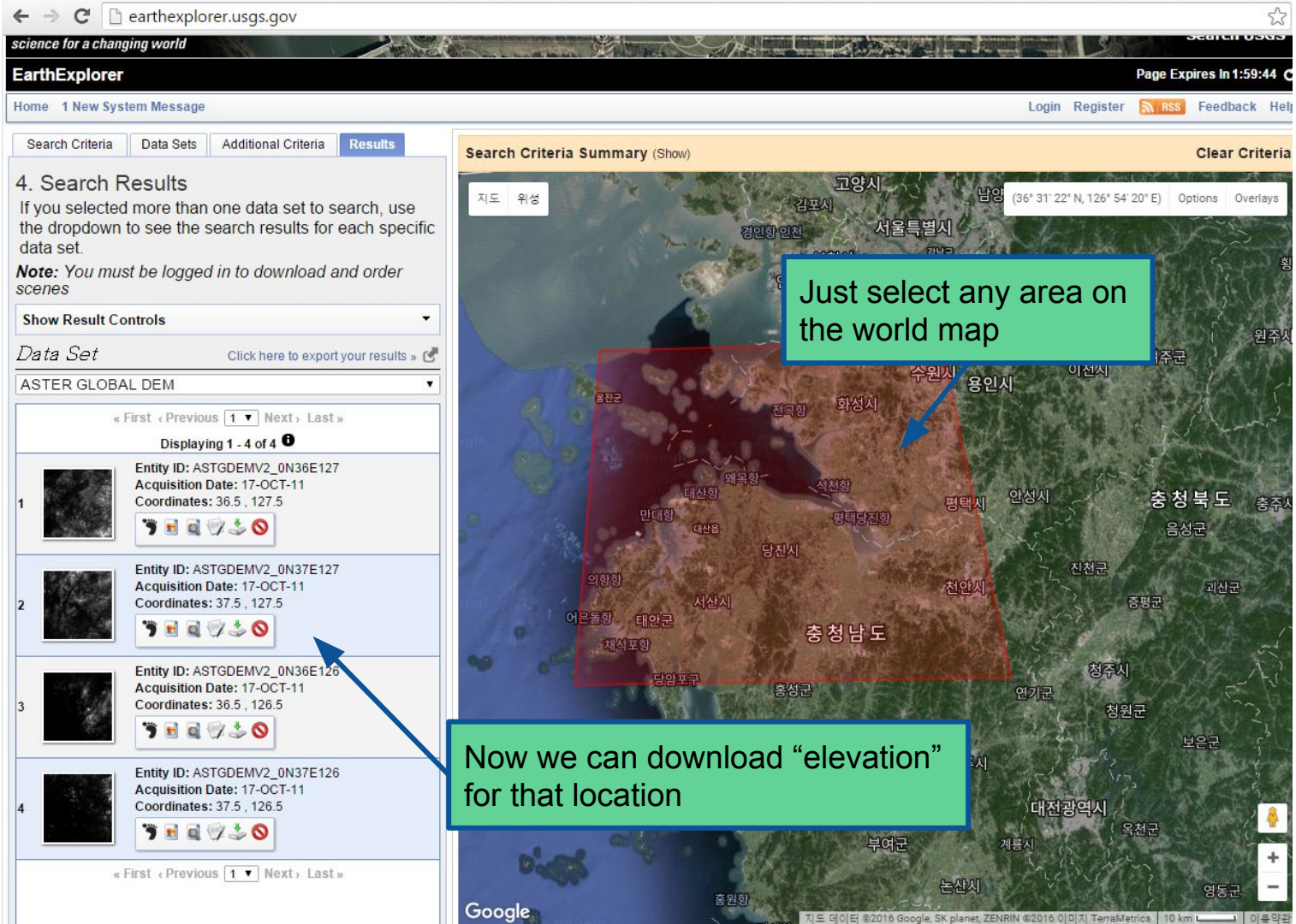
Export a grayscale ***tiff in 8bit or 16bit depth***.

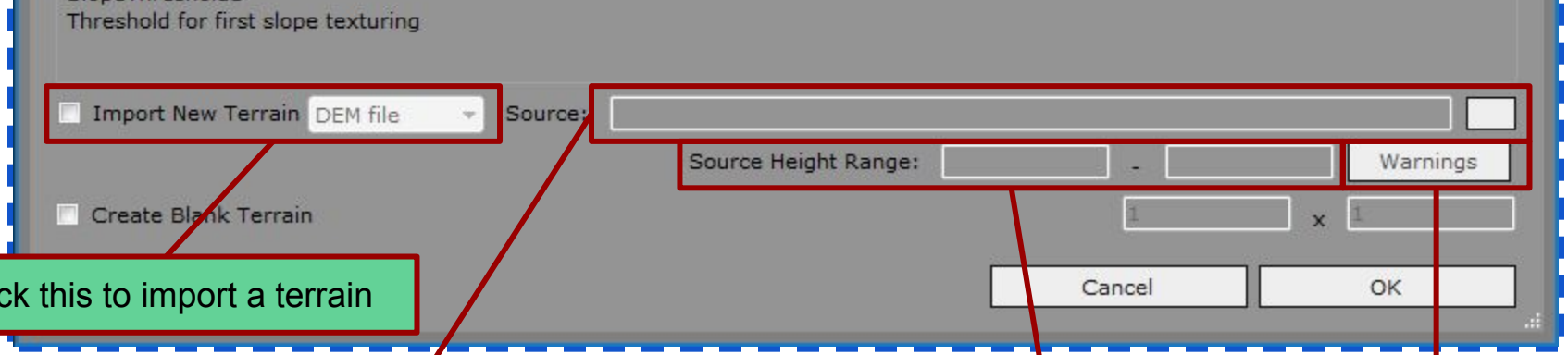

WMTest.tmd - World Machine
File Edit World Commands Device Commands Views Devices Parameter Devices Help & Web
Tools Favorites Macros Generator Output Combiner Filter Natural Selector Converter
Main Extents (1/2)
Height Output
Height Output
Height Output
Erosion
Output
Outputs are used to export the results of your
of World Machine.
Double click on the devices to set their format
options.
Height Output
Height
Toggle Main View
Water Level
Show
144 m
0.7MB
Device Workview
Right-Button Drag in view to pan; Use MouseWheel or Middle-Button to zoom.
WorldMachine is useful because we can get "flow" and "wear" maps as well as heights
These can be used for advanced texturing

# Real world data

We can start with real-world data

1. Obviously, this is the most realistic
2. It’s also the quickest way to get started
3. http://earthexplorer.usgs.gov/


earthexplorer.usgs.gov
science for a changing world
EarthExplorer
Page Expires In 1:59:44
Home
1 New System Message
Login
Register
RSS
Feedback
Search Criteria
Data Sets
Additional Criteria
Results
4. Search Results
If you selected more than one data set to search, use the dropdown to see the search results for each specific data set.
Note: You must be logged in to download and order scenes
Show Result Controls
Data Set
Click here to export your results »
ASTER GLOBAL DEM
« First ‹ Previous 1 Next › Last »
Displaying 1 - 4 of 4
1
Entity ID: ASTGDEMV2_0N36E127
Acquisition Date: 17-OCT-11
Coordinates: 36.5 , 127.5
2
Entity ID: ASTGDEMV2_0N37E127
Acquisition Date: 17-OCT-11
Coordinates: 37.5 , 127.5
3
Entity ID: ASTGDEMV2_0N36E126
Acquisition Date: 17-OCT-11
Coordinates: 36.5 , 126.5
4
Entity ID: ASTGDEMV2_0N37E126
Acquisition Date: 17-OCT-11
Coordinates: 37.5 , 126.5
« First ‹ Previous 1 Next › Last »
Search Criteria Summary (Show)
Clear Criteria
지도
위성
(36° 31' 22" N, 126° 54' 20" E)
Options
Overlays
Just select any area on the world map
Now we can download “elevation” for that location
고양시
김포시
서울특별시
수원시
용인시
화성시
평택시
안성시
충청북도
충청남도
당진시
천안시
서산시
청주시
대전광역시
Google




Check this to import a terrain

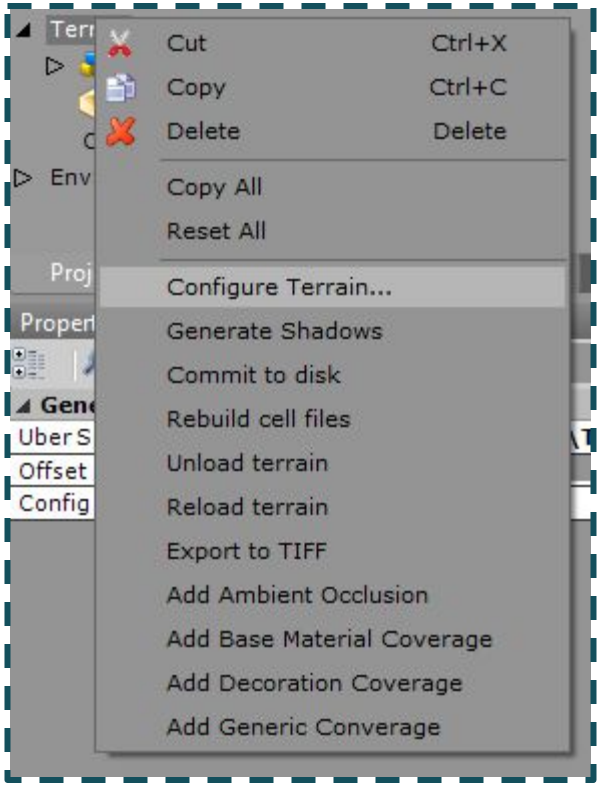
Specify the filename here

Here, we must specify the height range. It's in meters, from the minimum possible height to the highest possible height.
It sometimes takes a few attempts to find good numbers.

If there are errors, you can check for warning messages here.

After the terrain is imported, we can reimport at any time.

In the *Project Lister*, just select ***“Configure Terrain...”*** to go back to the configuration dialog.



# Terrain data files

# Ubersurface

- In your terrain directory, you will see a large ***“height.uber”*** file.
- This is called the ubersurface
- This is the raw uncompressed version of the terrain
- It’s only used in the editor (not the game)
- There is one .uber file for each terrain layer

# Terrain cells

- In the terrain directory, there will be many directories like ***“c03_03”***
- These are terrain “cells”
- This contains the compressed version of the terrain, with levels of detail
- It’s used in the game (and in the editor)

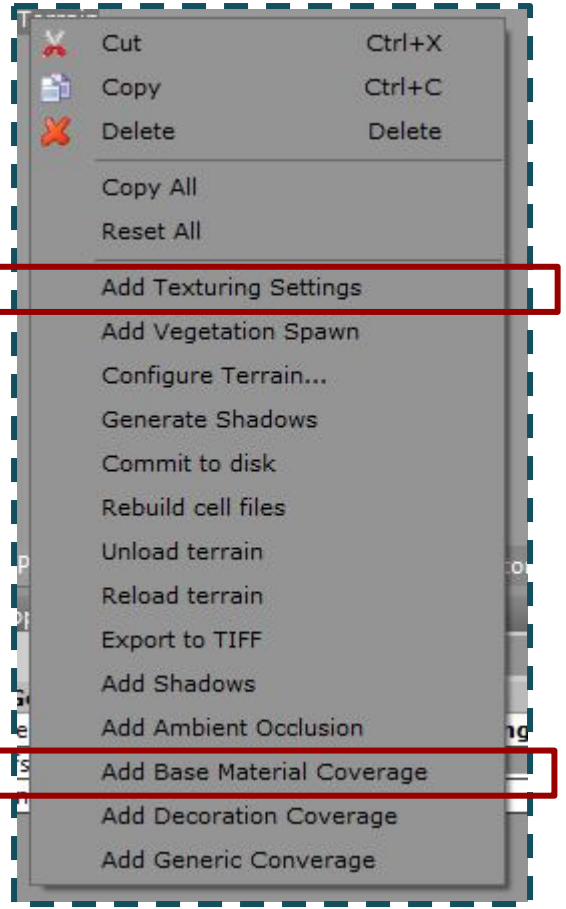
# Rebuilding cells

- Sometimes the editor will ***“Generate Cell Files”***
- This means it’s compressing the data and building levels of detail
- The editor will write changes to both the ubersurface and the cells whenever you save.
- However, you can rebuild the cells files in the Project Lister context menu

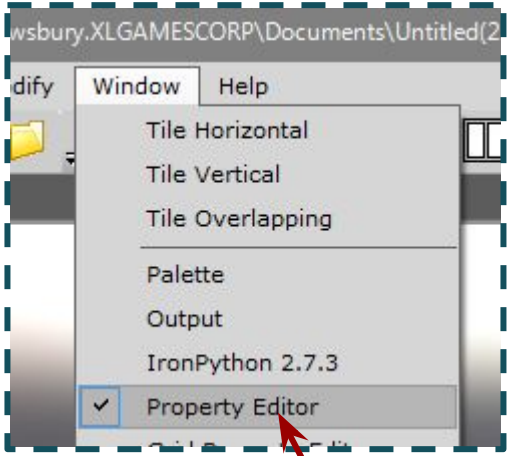
# Setting up texturing

# Add features to the terrain

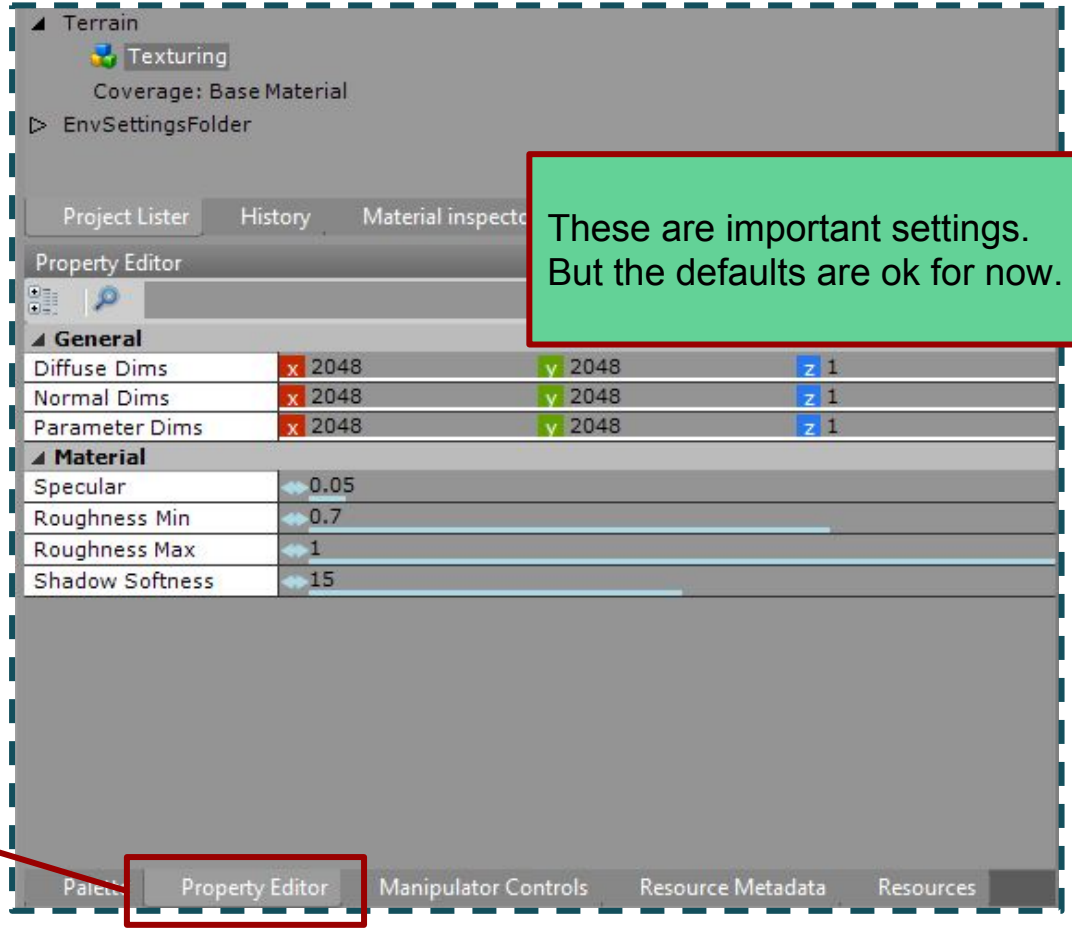
Add texturing & base material coverage



# Texturing settings



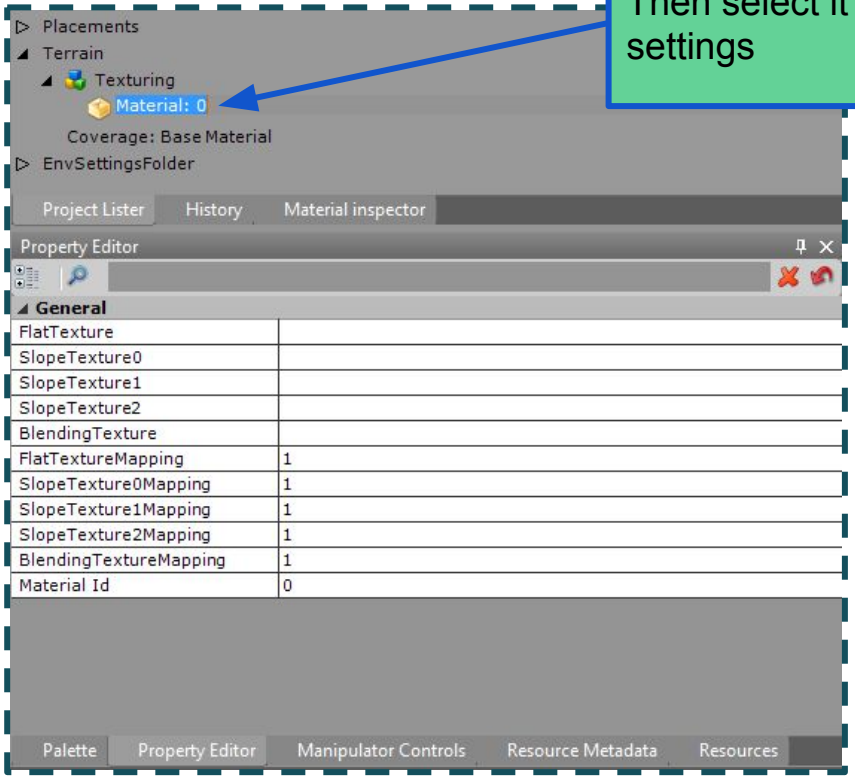

Use the ***Property Editor*** window to view the properties of the selected item.




These are important settings.
But the defaults are ok for now.

# Texturing settings

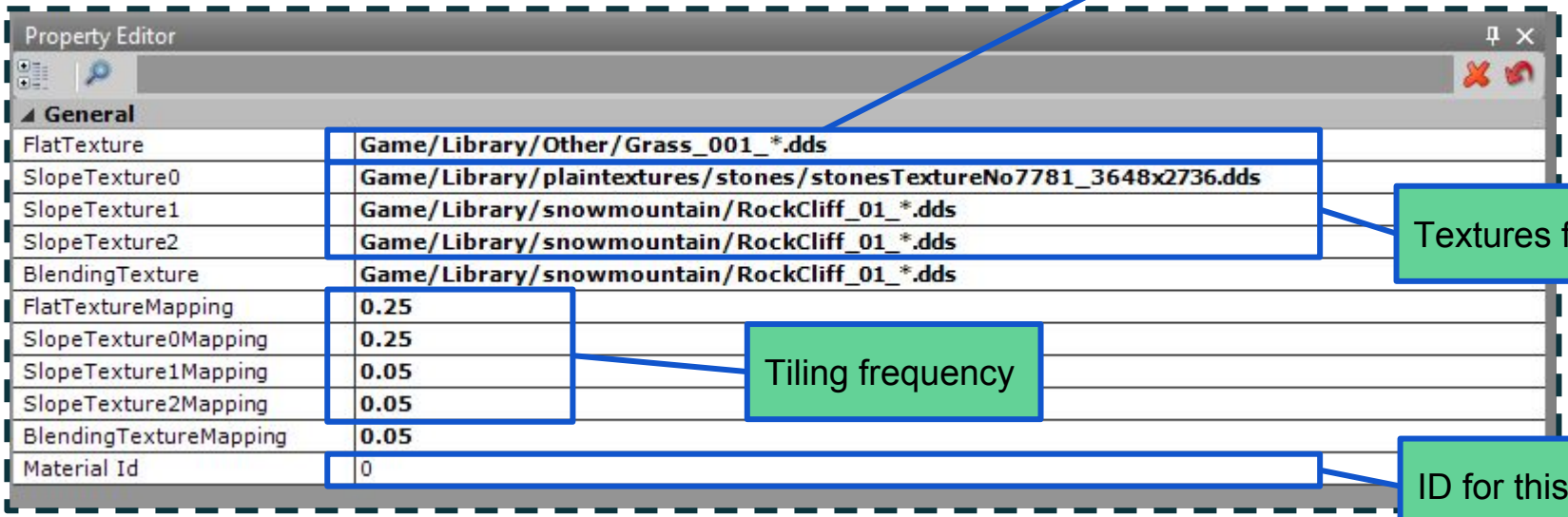

Select “Add Material” in the Texturing context menu




Then select it to see its settings

- XLE supports multiple texturing methods
- The default method is optimised for getting a good result very quickly

# Texturing settings




Texture on flat areas

Textures for slopes

Tiling frequency

ID for this material

Slope angles are specified in the terrain configuration dialog

# Terrain texture names

***<name>_df.<ext>*** (color texture)

***<name>_ddn.<ext>*** (normal map)

***<name>_r.<ext>*** (roughness map) -- 8 bit grayscale

In the editor, it will appear like: <name>_*.<ext>

Roughness can be omitted.

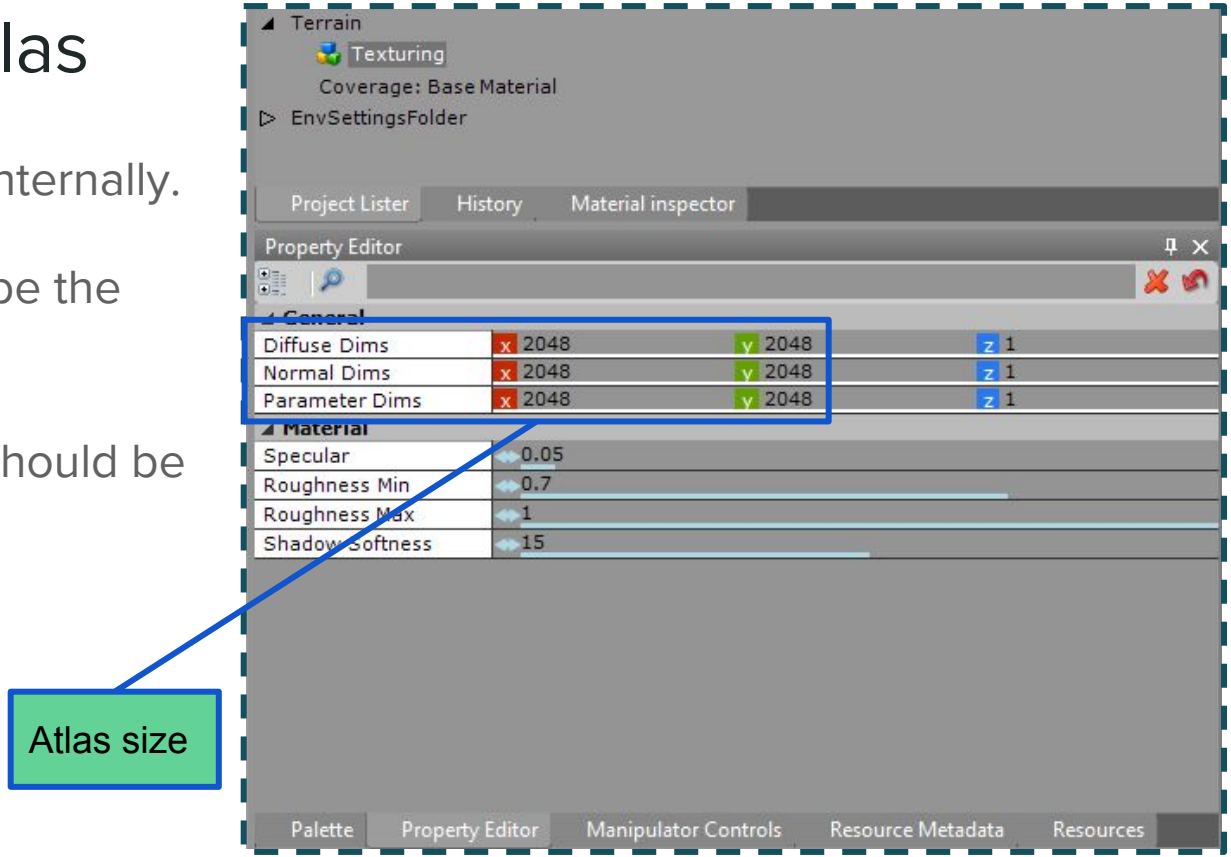
In the future, we could add a ***cavity*** or ***ambient occlusion*** map (and maybe displacement)

# Terrain texture atlas

XLE builds a texture atlas internally.

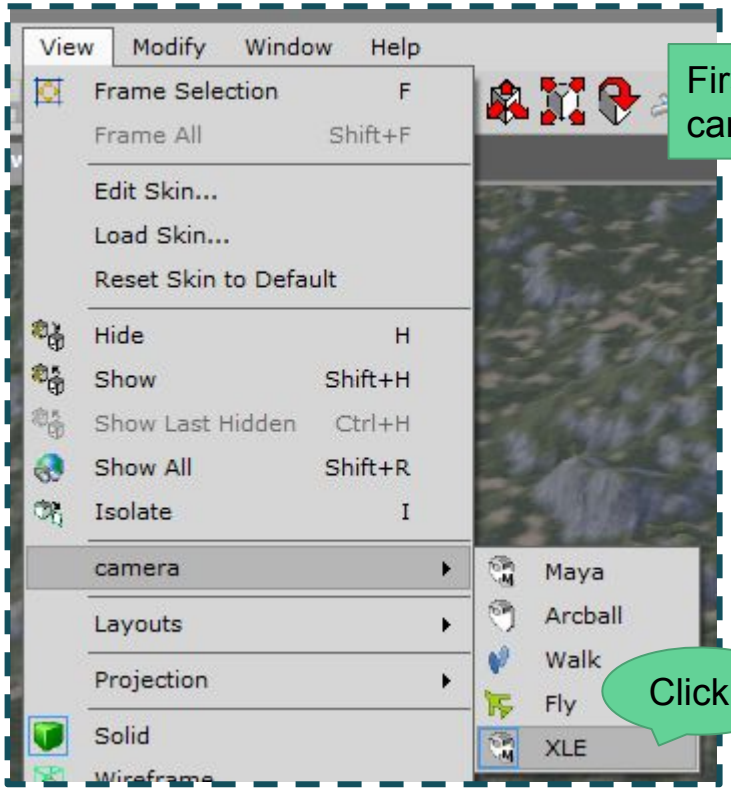
All terrain textures should be the same size as the atlas.

Normally, terrain textures should be very high resolution.




DesignView
Here we have Halla Mountain with some textures applied.
Here, the terrain is covered with a single material. Later, we will paint material values over the terrain

# Terrain editing




***This is important!***

Now, we can use **ctrl + left click** to place the “focus point”

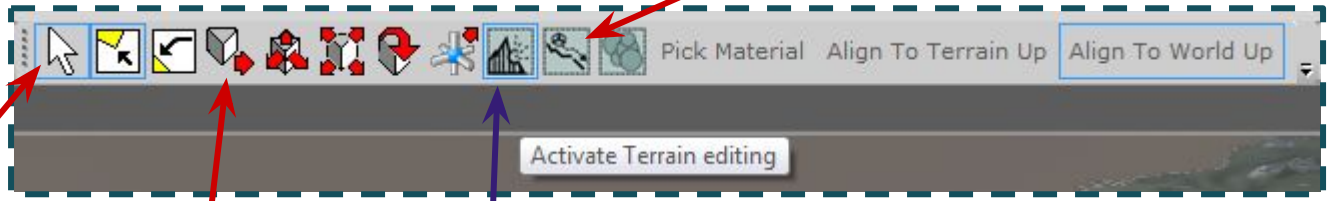
The camera will orbit around this focus point.

To go to a distance place quickly, ctrl + left click on it.

The camera will move faster when the focus point is far away.

Use this bar to select the current “manipulator”

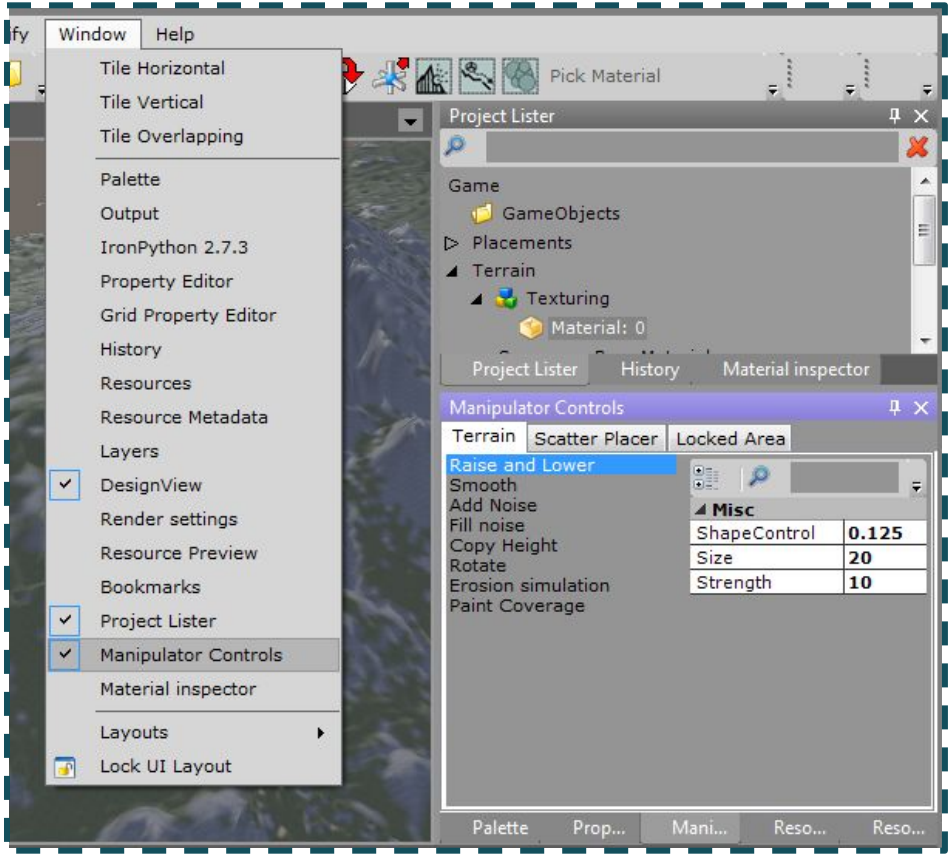
“Move across terrain”




Select

Translate

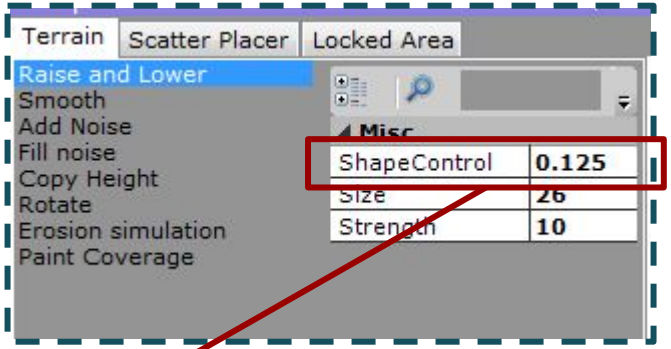
Select this manipulator to enter terrain editing mode

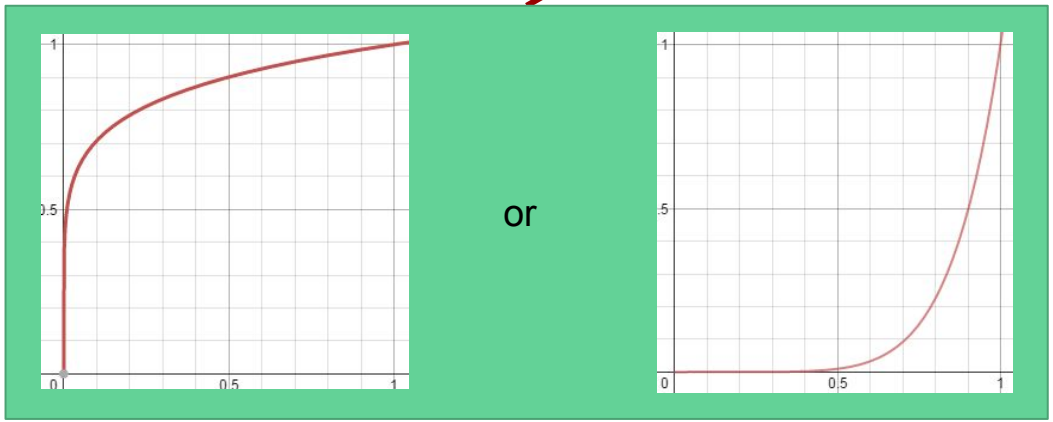



The Manipulator Controls window contains settings terrain manipulators

# “Raise And Lower”

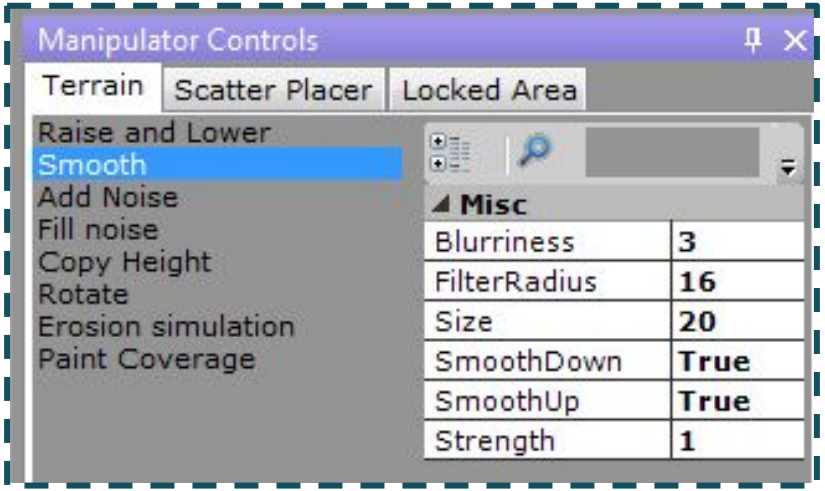
- ***Left click*** to raise. **Shift+left click** to lower
- **Ctrl + mouse wheel** to change size
- **Shift + Ctrl + mouse wheel** to change strength



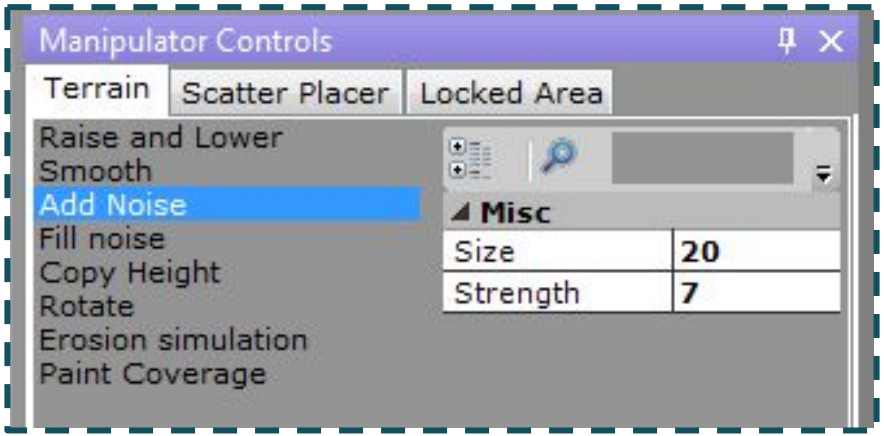
# “Smooth”

Soften areas, or creates flat slopes



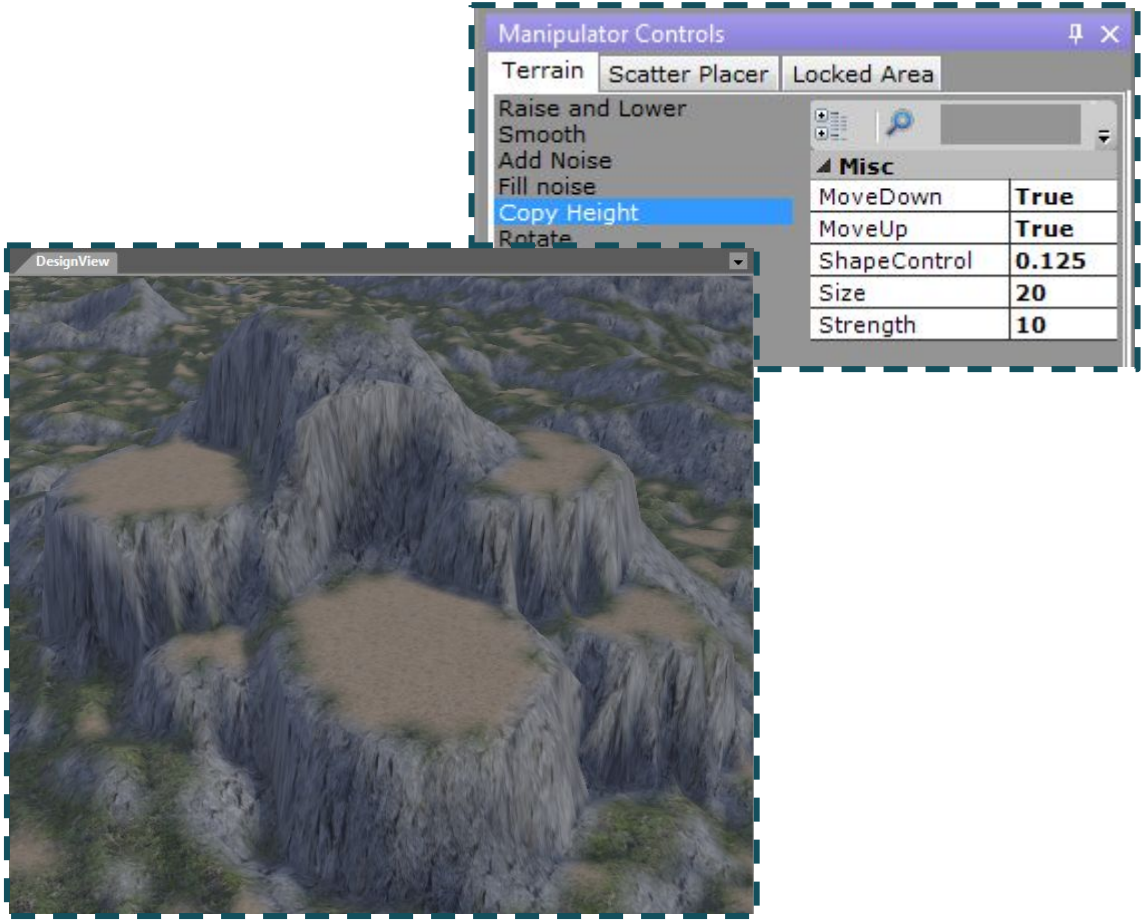
# “Add Noise”

Pushes up and down randomly



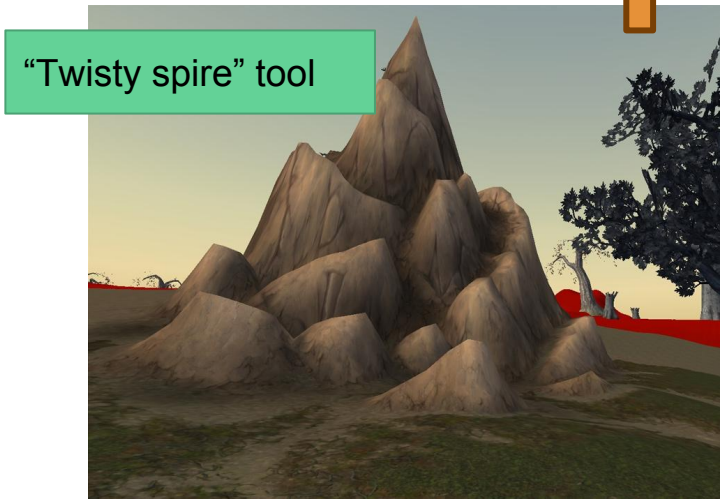
# “Copy height”

Create ledges and terraces by copying the height from one place to another.



# Special case tools

Some terrain appearances are easier special-case manipulators.World of Warcraft does this quite well...

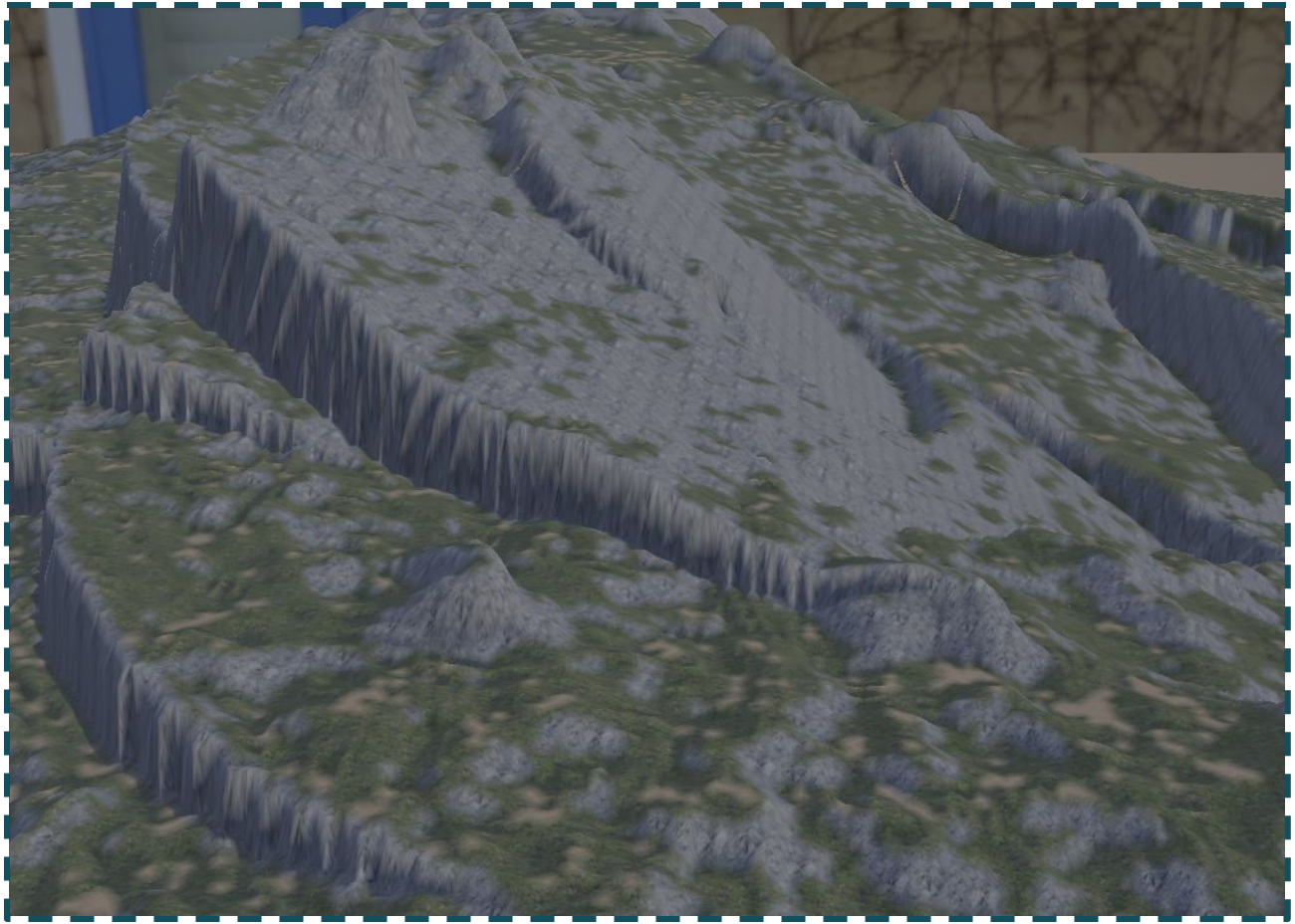




Creative ideas + custom implementation = unique look

# “Rotate”

Example of a simple custom tool



# Terrain manipulators are shaders!

Programmers can change manipulator source code without restarting the World Builder. This is great for rapid development and customization...

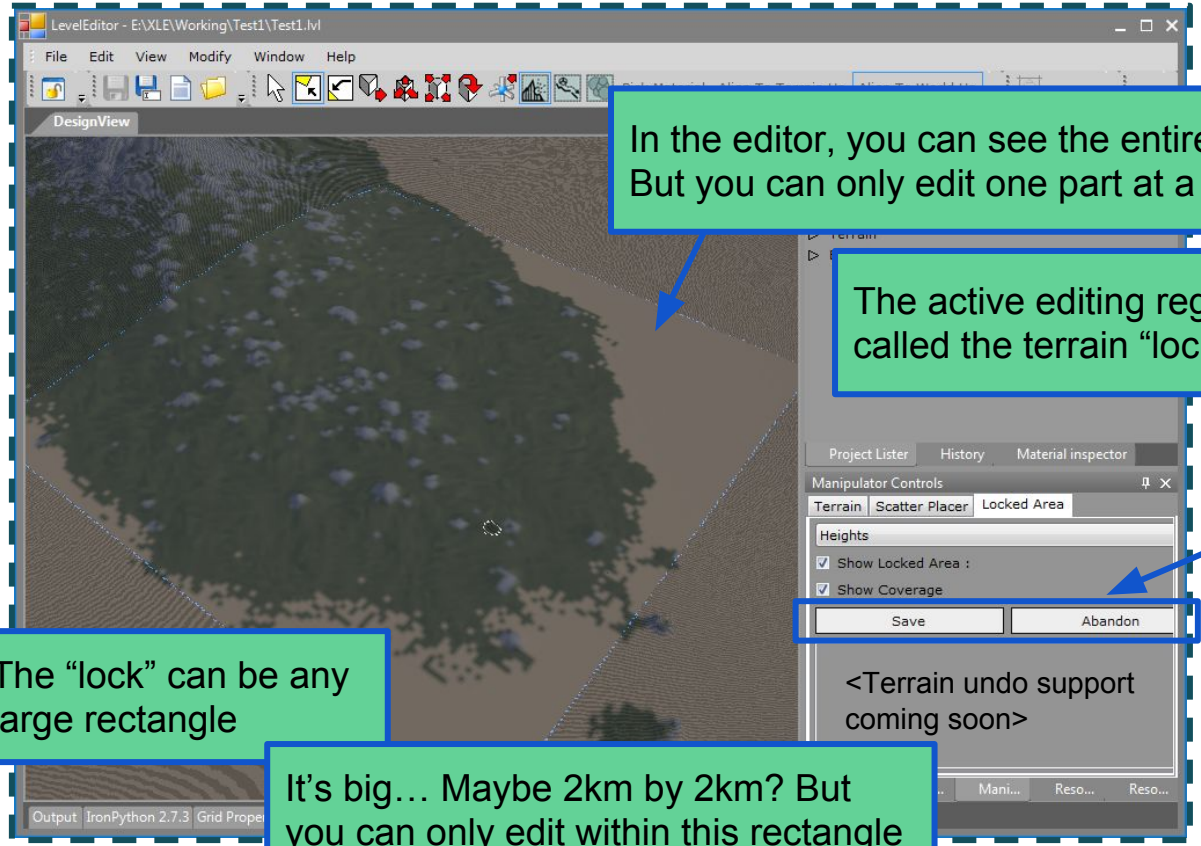
```
[numthreads(16, 16, 1)]
    void RaiseLower(uint3 dispatchThreadId : SV_DispatchThreadID)
{
    uint2 surfaceSpaceCoord = DispatchOffset + dispatchThreadId.xy;
    float rsq = LengthSquared(float2(surfaceSpaceCoord) - Center);
    if (surfaceSpaceCoord.x <= SurfaceMaxs.x && surfaceSpaceCoord.y <= SurfaceMaxs.y && rsq < (Radius*Radius)) {
        float r = sqrt(rsq);
        float A = (1.0f - r/Radius);

            // different strength values can have a really interesting result
            //    values between 1/8 -> 8 are the most interesting
        A = pow(A, PowerValue);

        OutputSurface[surfaceSpaceCoord - SurfaceMins] += Adjustment * A;
    }
}
```

# Terrain locks & painting materials

# Terrain “lock”




In the editor, you can see the entire world. But you can only edit one part at a time

The active editing region is called the terrain “lock”

You can save or abandon changes here

The “lock” can be any large rectangle

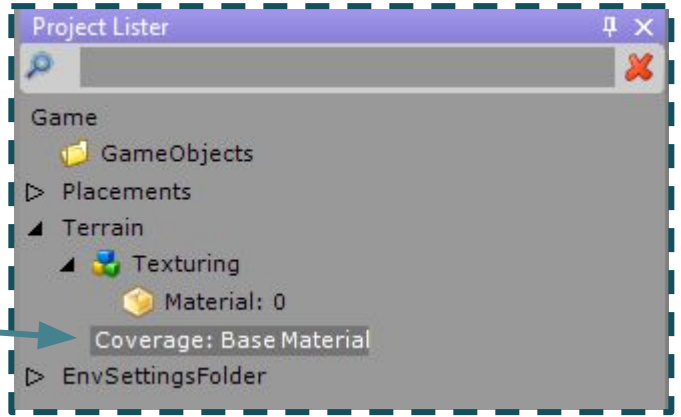
It’s big… Maybe 2km by 2km? But you can only edit within this rectangle

After saving, you can lock a new area

# Terrain layer

- The terrain is really many large bitmaps
- One bitmap is the terrain heights
- But there are other bitmaps for ***coverage layers***

We added material coverage earlier

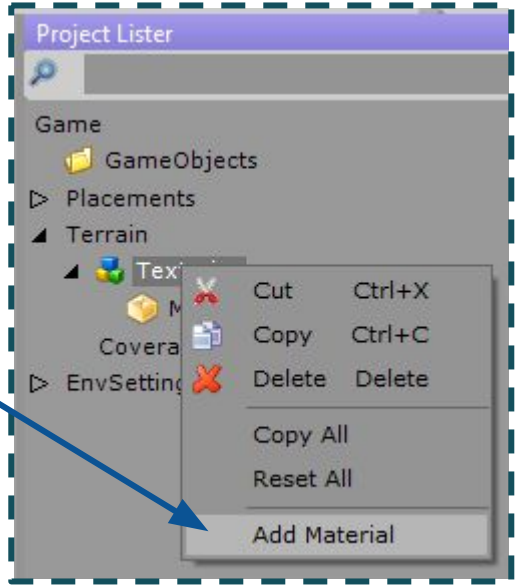


# Material layer

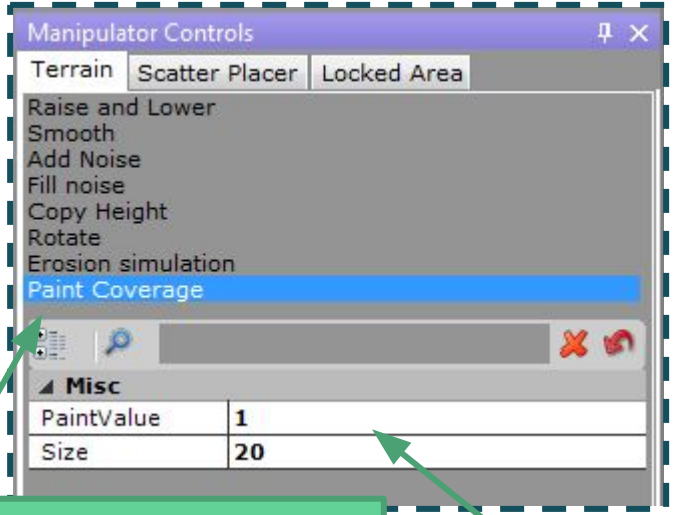
First, add another material

Each material as a number “id”
There can be 256 materials

We will paint the material id over the terrain.

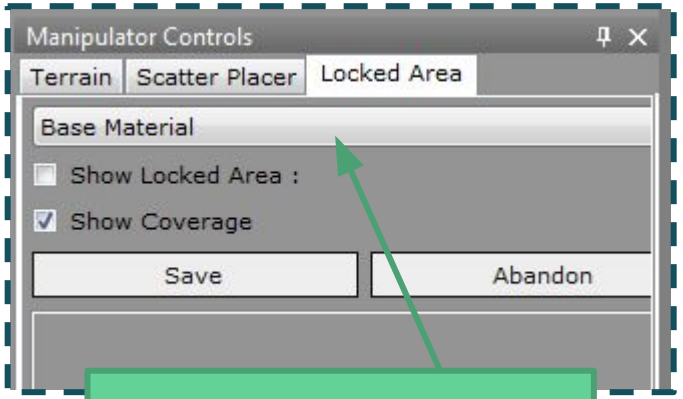


# Paint Coverage Manipulator



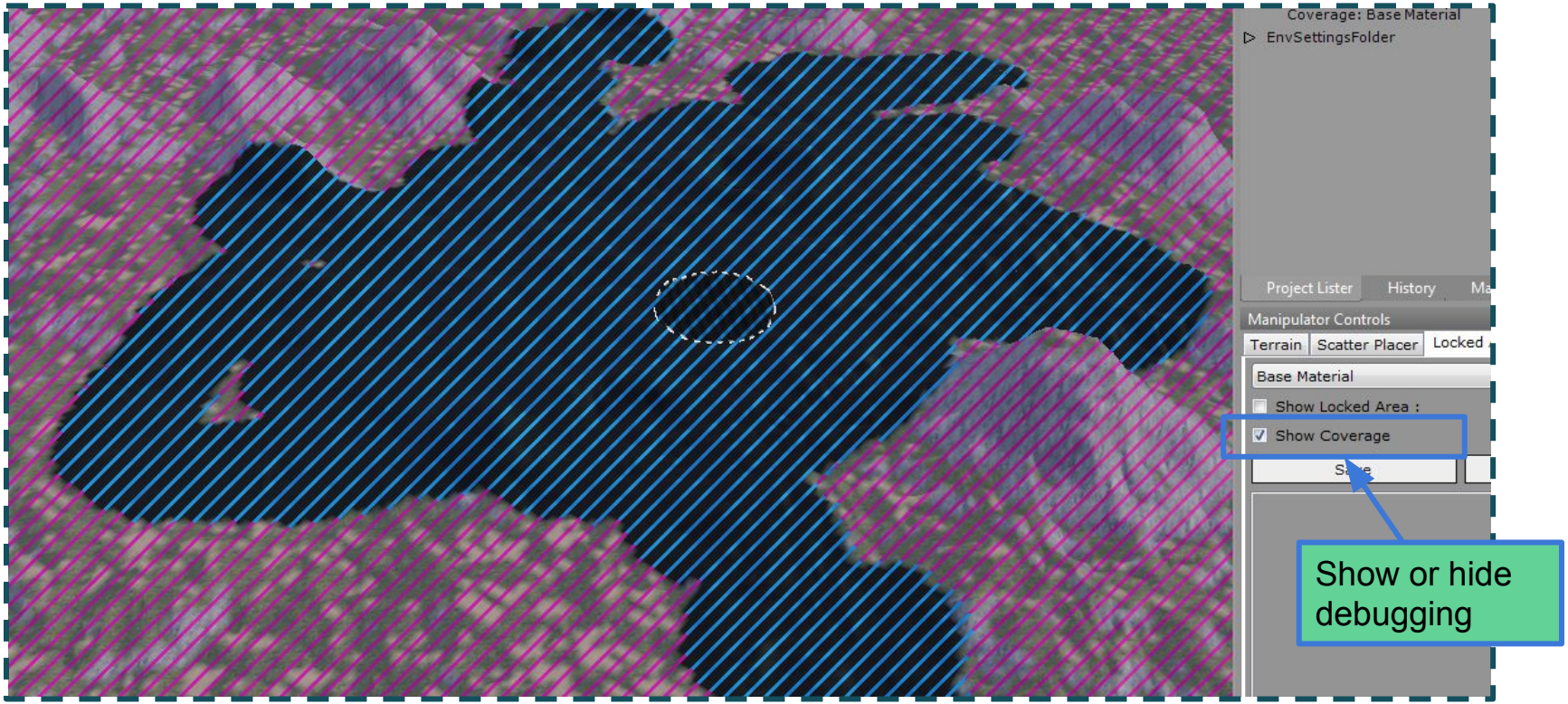

Select the “Paint Coverage” manipulator

This is the material id we will paint

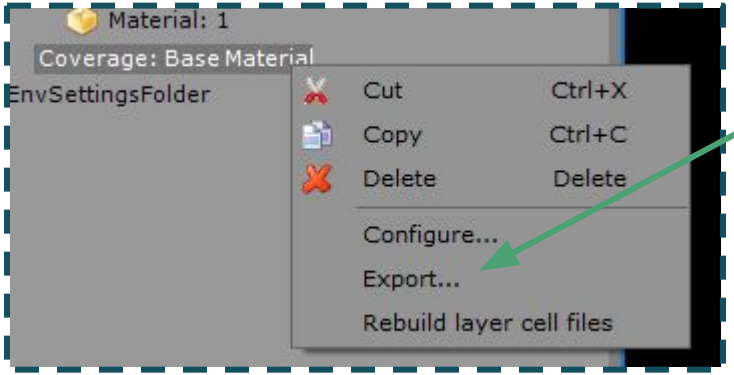



Select the “Base Material” layer

# Paint Coverage Manipulator



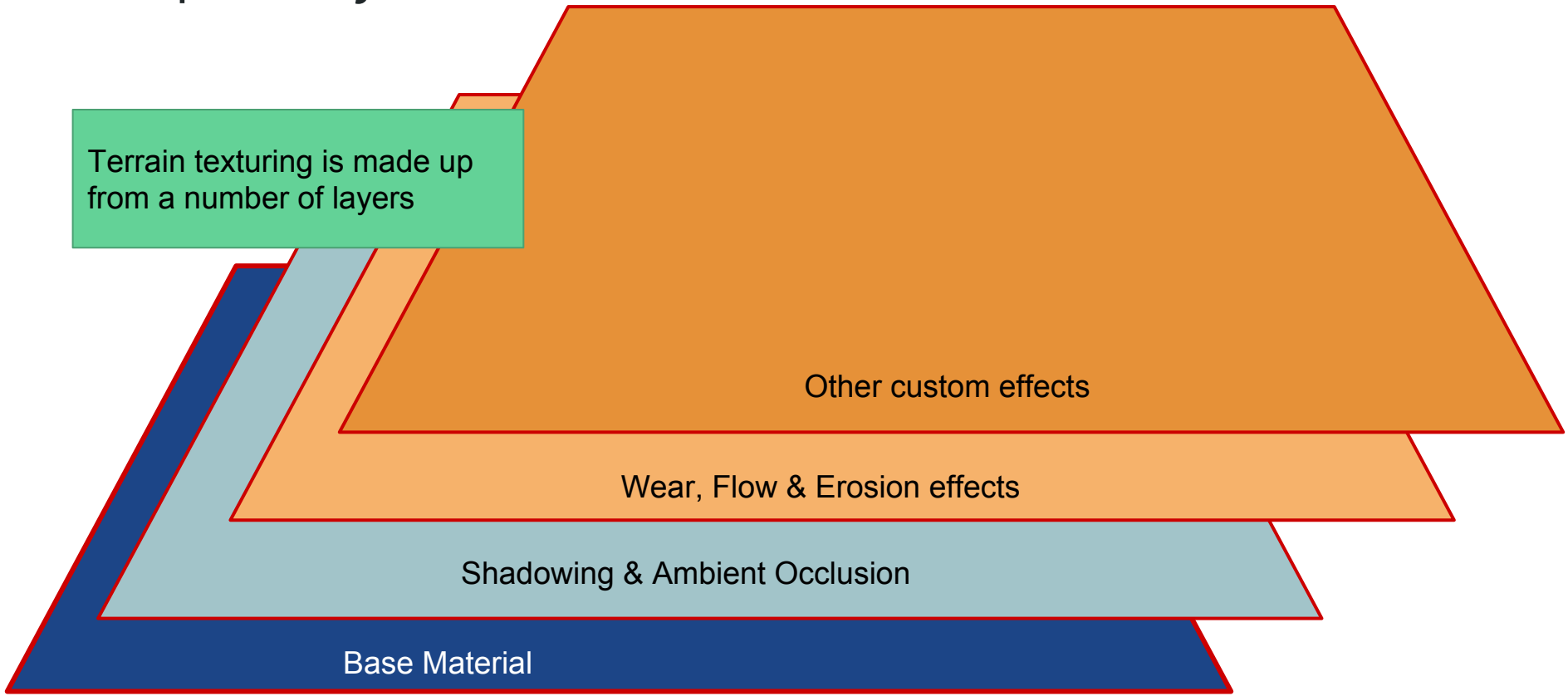
# Import / export tiff



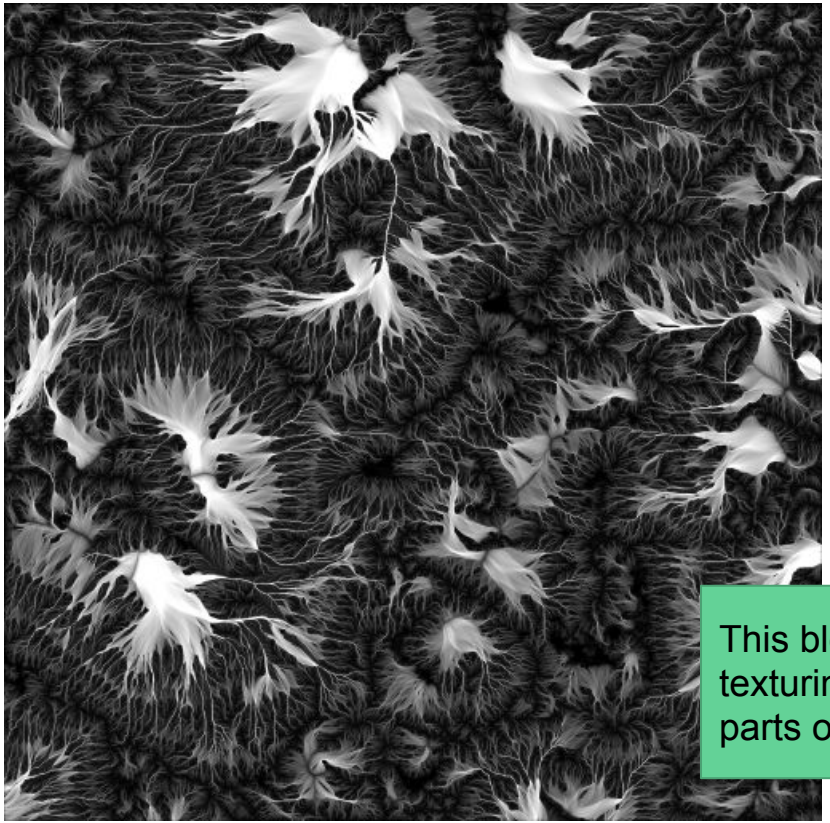

We can import or export tiff files for coverage layers, also

So we can do some painting in Photoshop

# Complex layered terrain



# Complex layered terrain



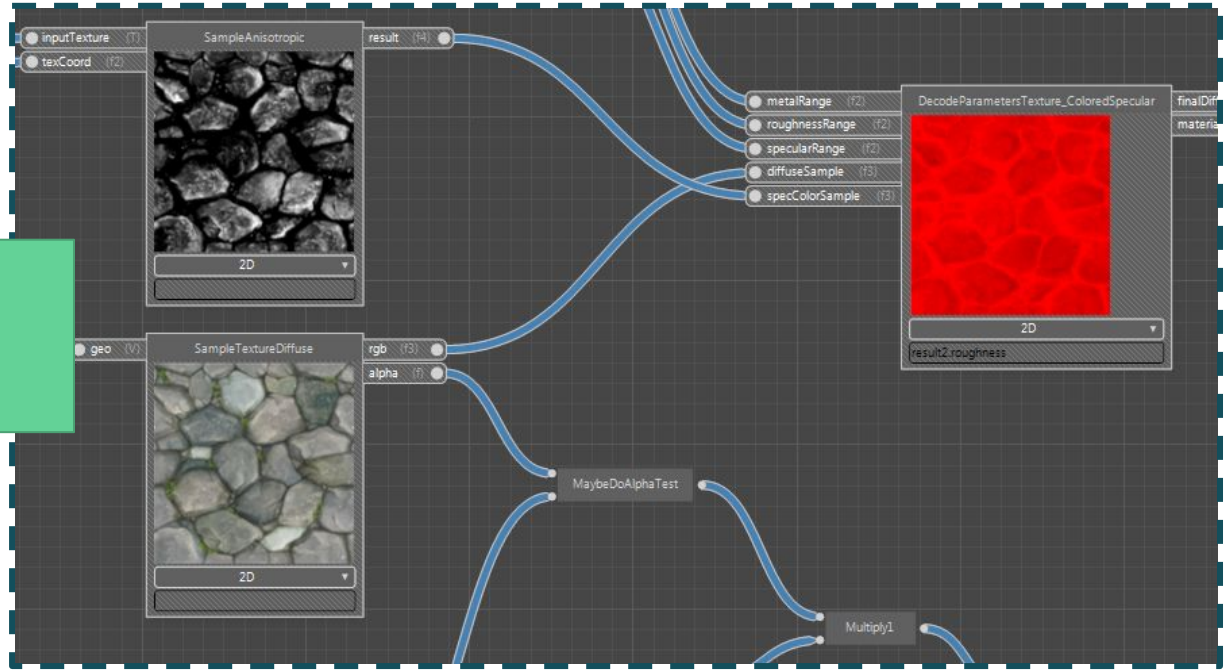
Remember the “flow” texture we got from WorldMachine?

This shows the speed at which snow & rain water moves across the surface

This blended with the base texturing to give detail to distant parts of the terrain

# Complex layered terrain

We will blend layers using custom shaders built in the MaterialTool node editor.



# WorldMachine macros

The WorldMachine website contains a lot of “macros” for automatic texturing

These are a great reference for what’s possible with custom terrain shaders

# Shadow & ambient occlusion

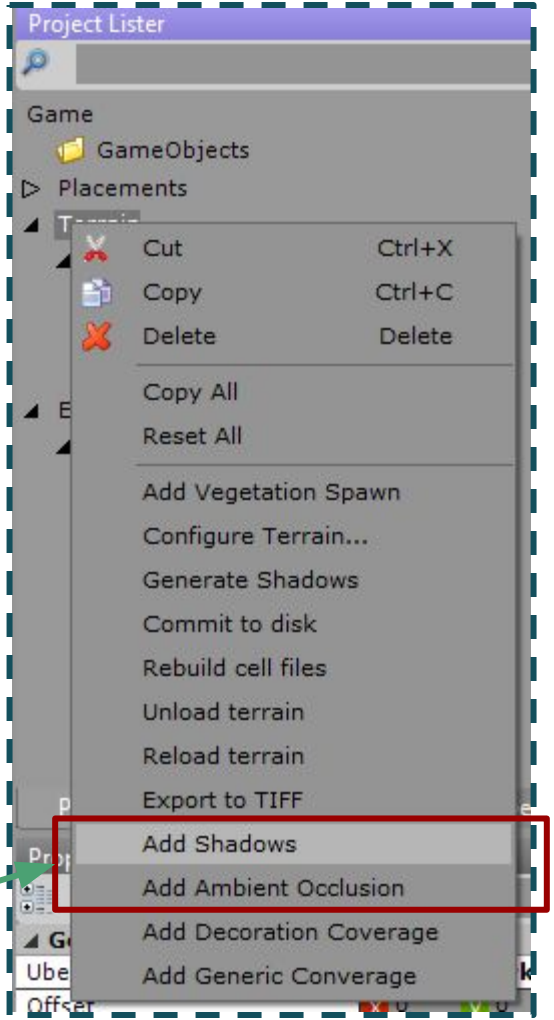
# Shadows & ambient occlusion

The terrain uses unique precalculated shadows and ambient occlusion.

These terrain shadows are much more efficient than other methods.

They also have a very soft natural look in the distance

Just add from the context menu



# Terrain shadows

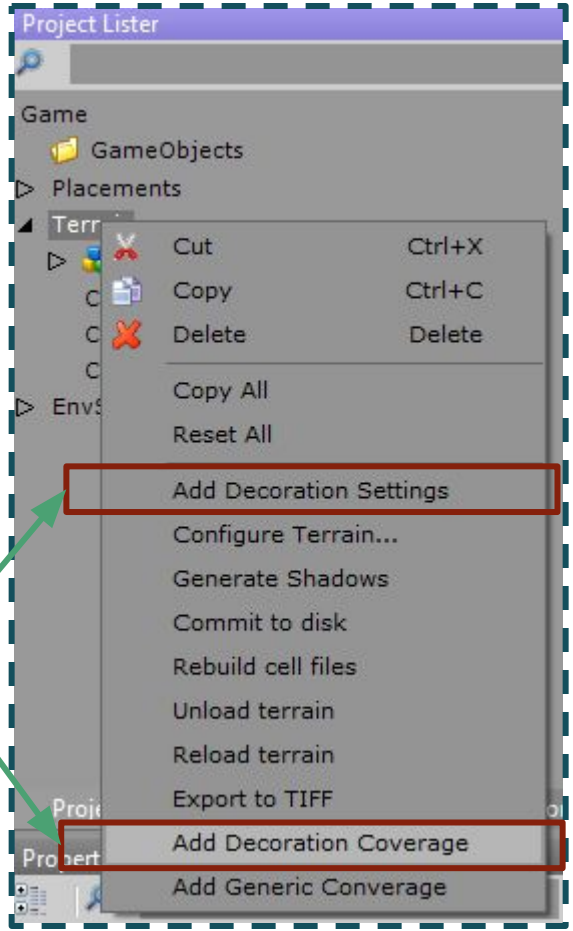
Terrain shadows are driven by the first directional light in the scene.

Right click on ***“Settings: environment”*** in the Project Lister and select ***“Add Sun”***. You can use the “EnvUtility” object to move the Sun through 180 degrees.

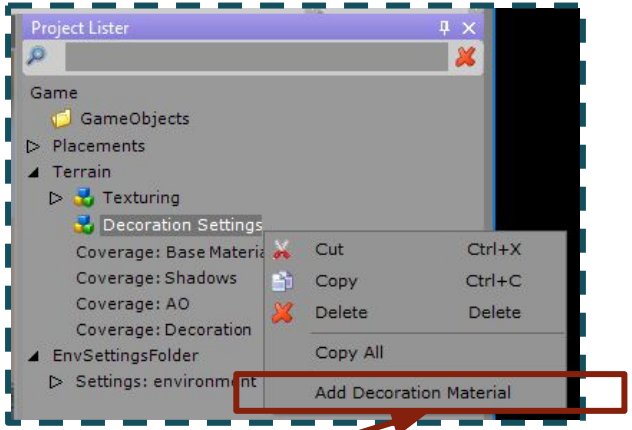
# Terrain Decoration

# Decoration

We can cover the terrain with grass, rocks, flowers and small decoration using a Decoration layer.




Add Decoration Settings and Decoration Coverage

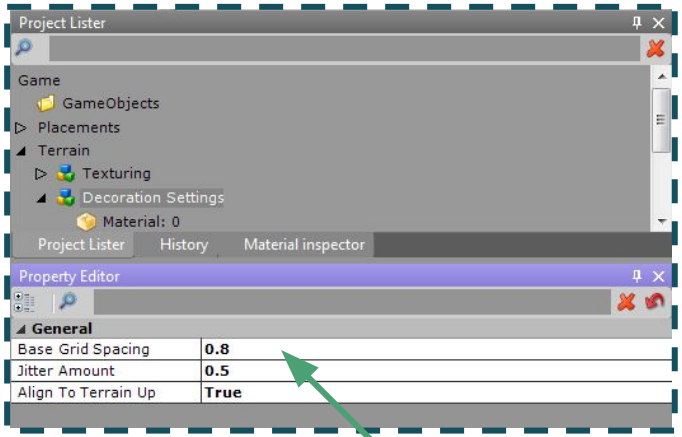



Add some materials

Materials work just like the base texture materials

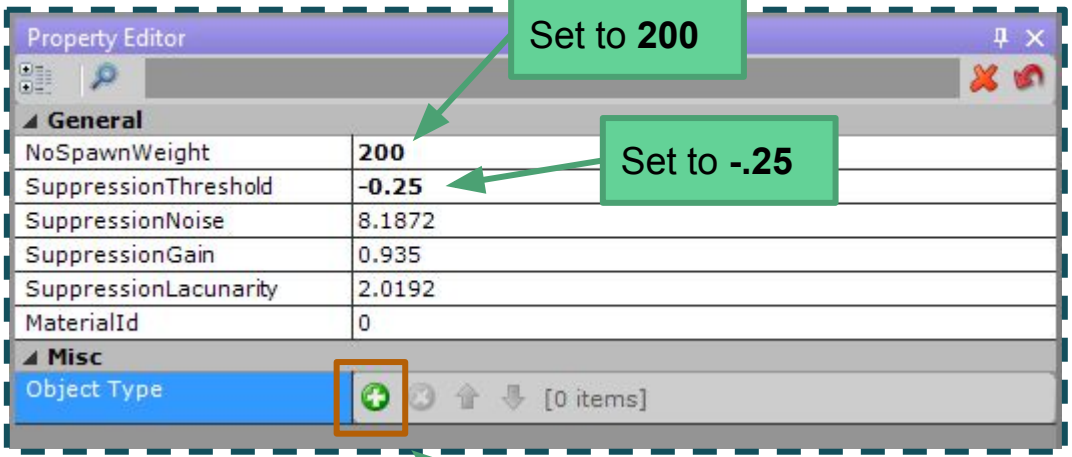
# Decoration Settings

Set these settings “Decoration Settings”




Small numbers for “Base Grid Spacing” are extremely expensive

Set these settings for material 0




Set to **200**

Set to **-.25**

Click to add object

# Decoration Settings

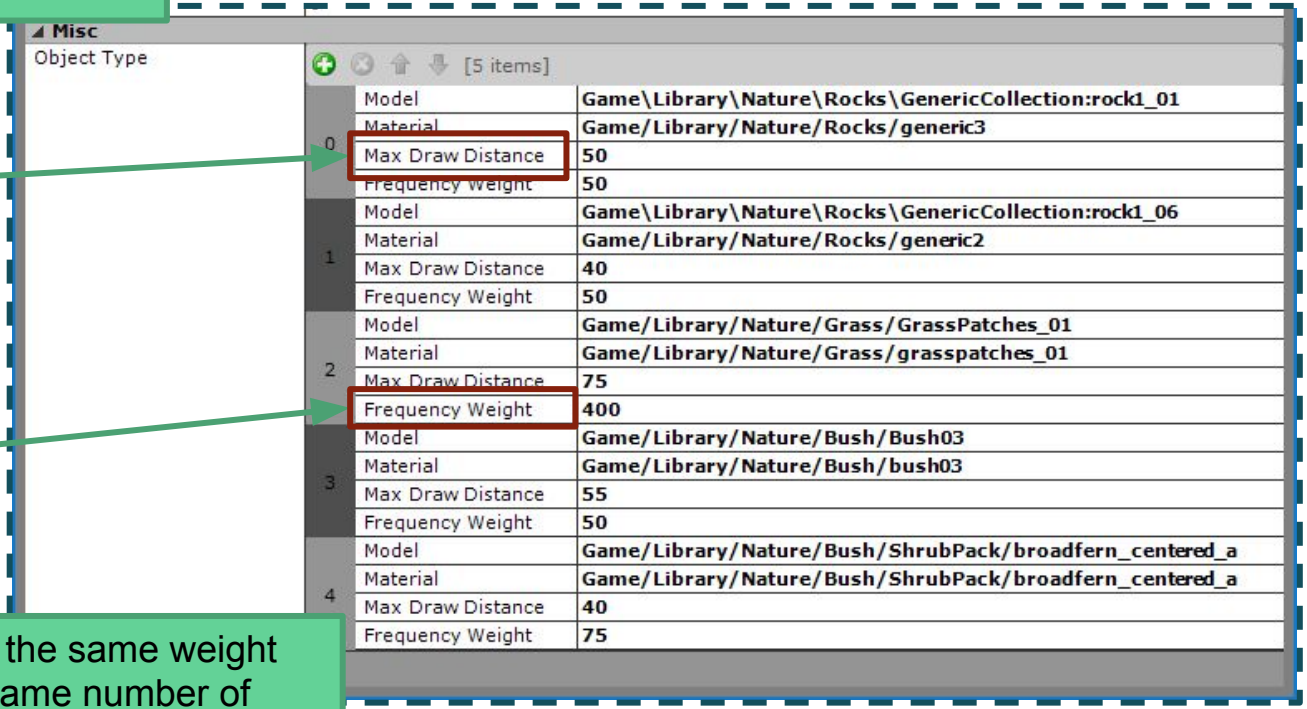
Add these objects...

Each object has a different draw distance

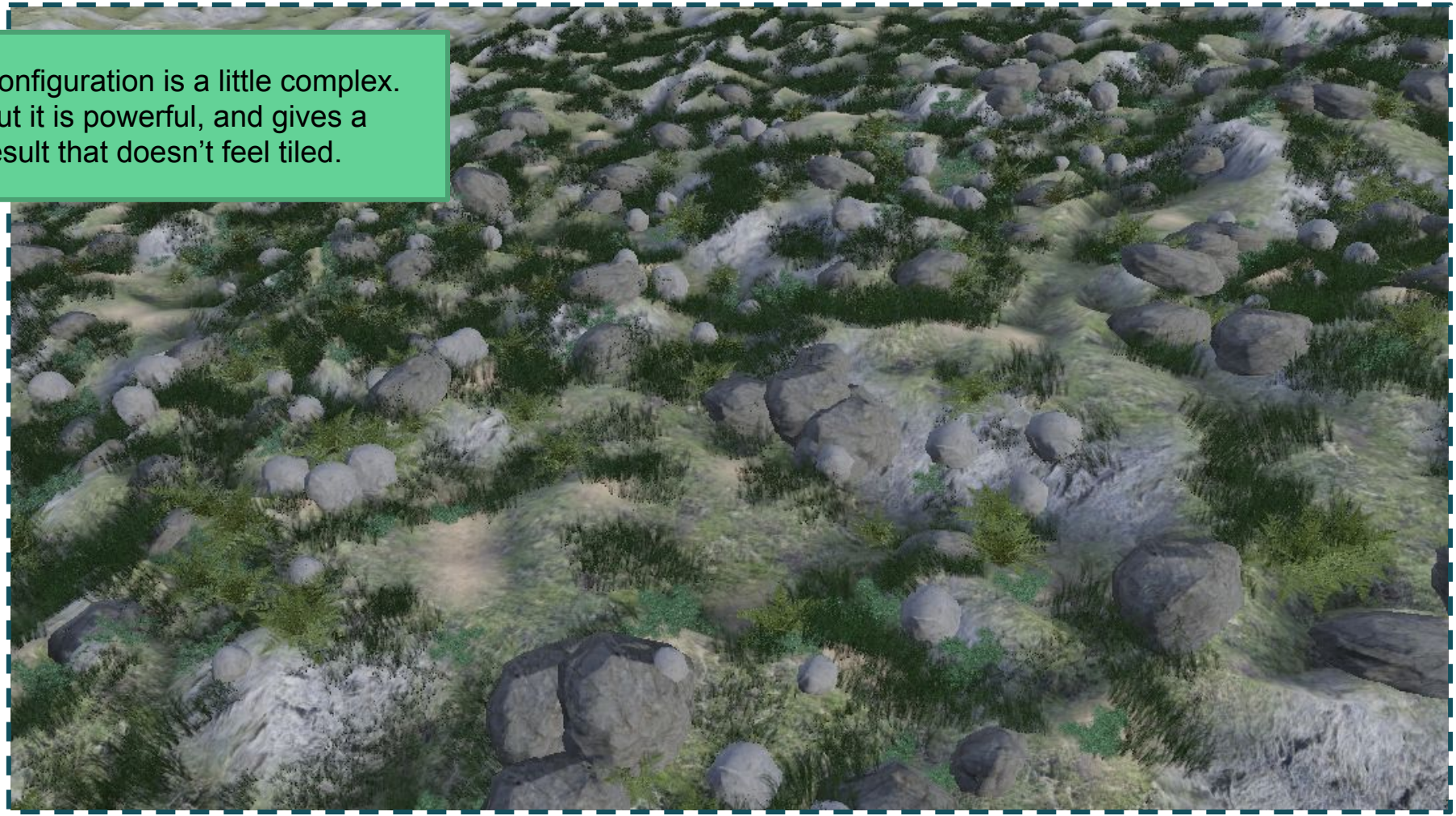
This determines how frequently objects appear.

Grass has the highest weight, so it appears most frequently.

Objects with the same weight appear the same number of times

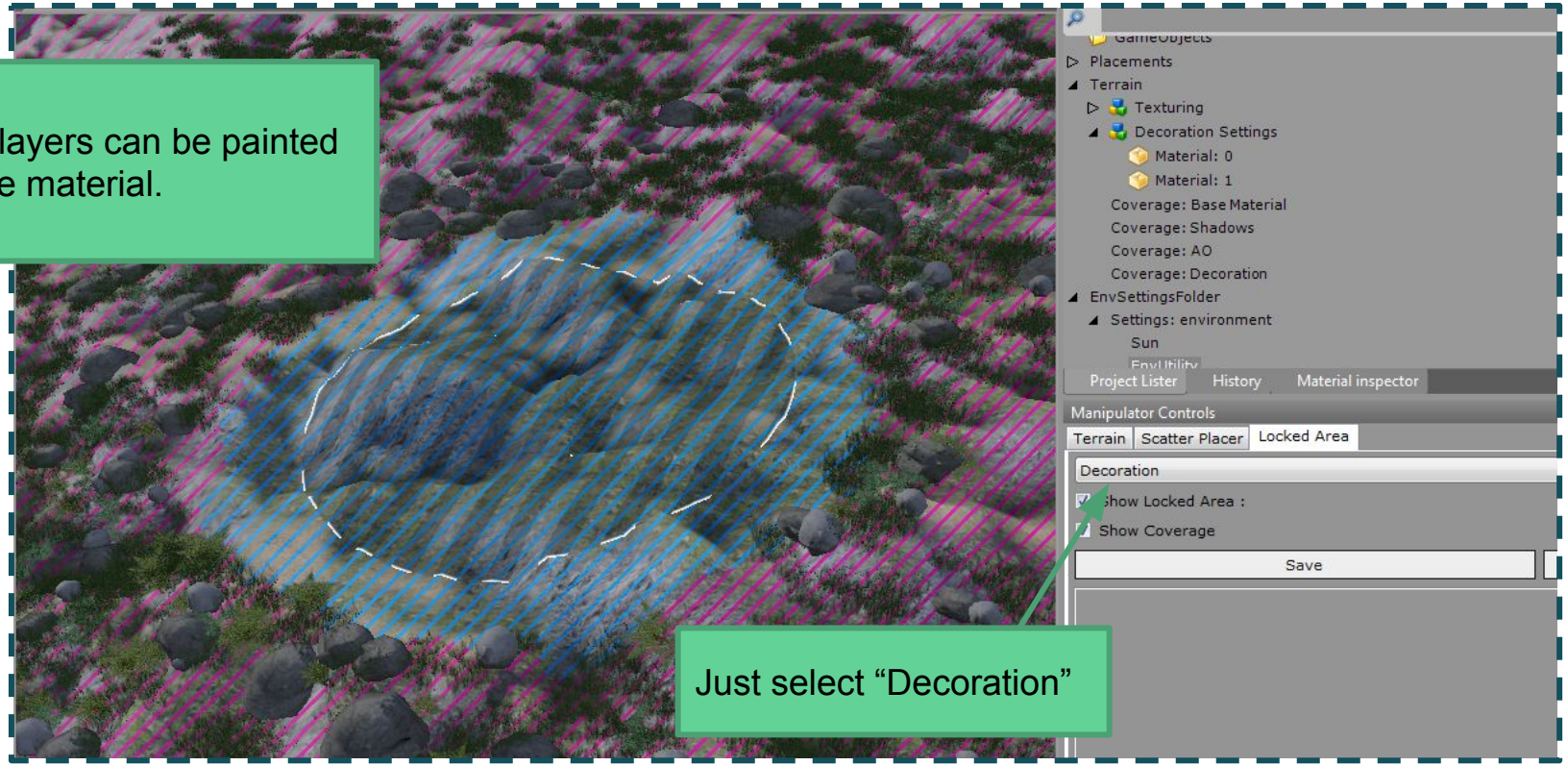


Configuration is a little complex. But it is powerful, and gives a result that doesn’t feel tiled.



# Painting decoration layers

Decoration layers can be painted like the base material.

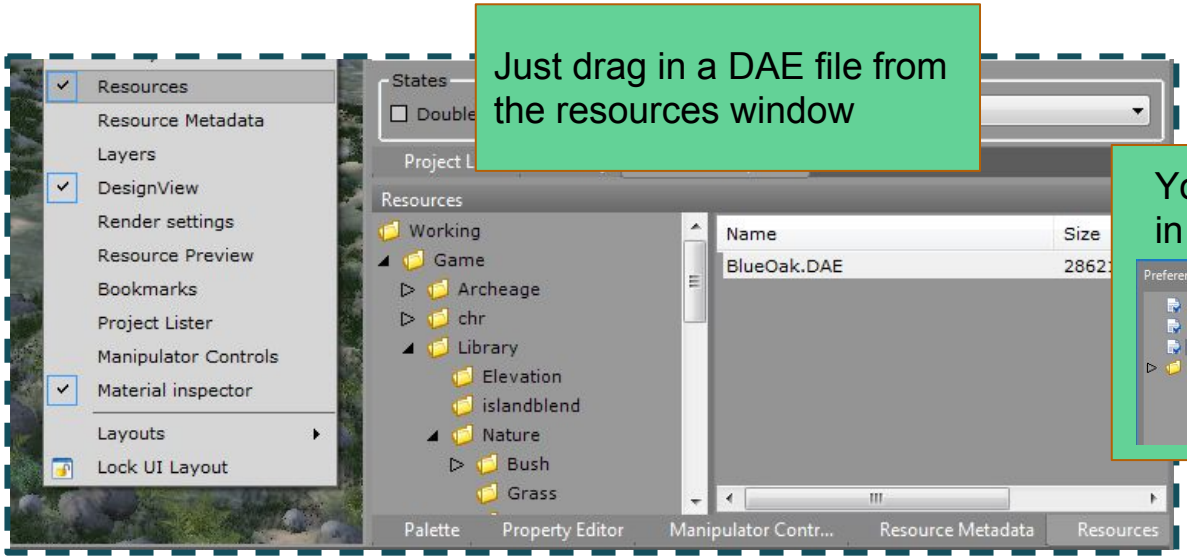


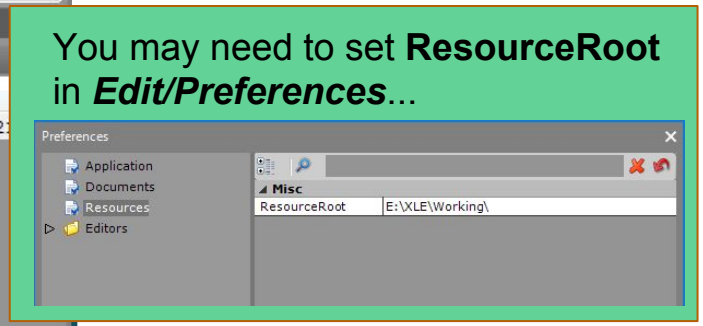
# Placements & Scatter Placer

# Placements

The decoration objects are procedurally generated small objects.

But we can also manually place objects on the terrain.

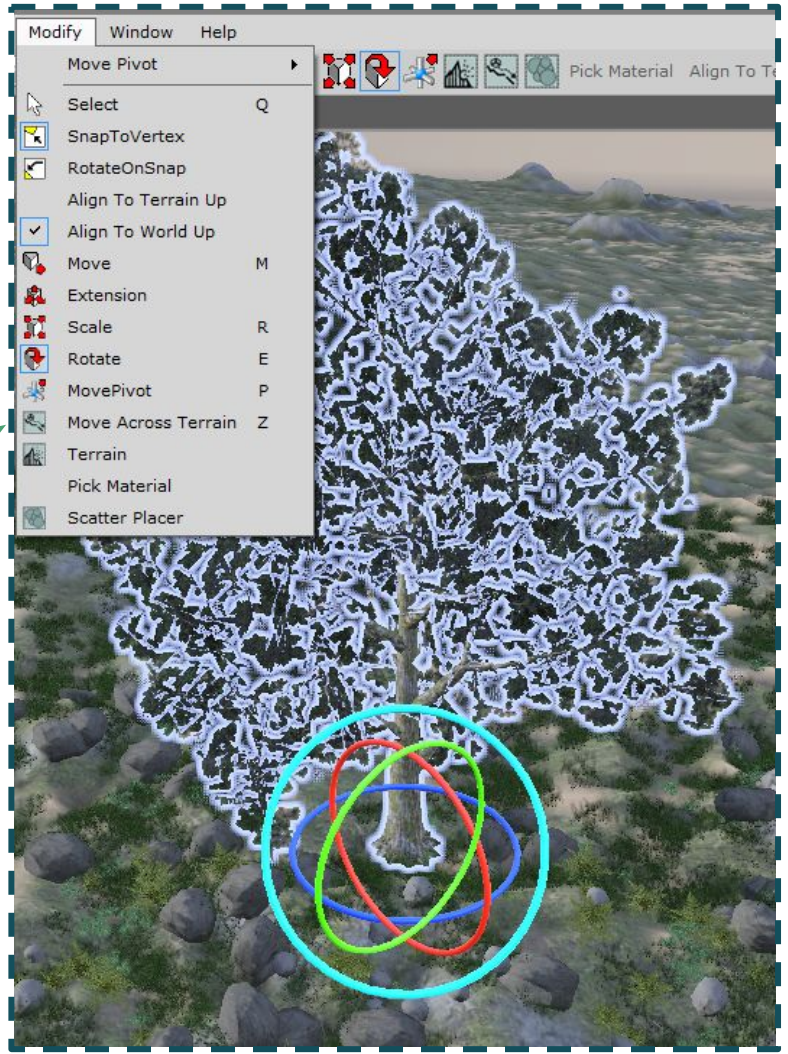


# Placement tools

Use the manipulators in the Modify menu to adjust placements.

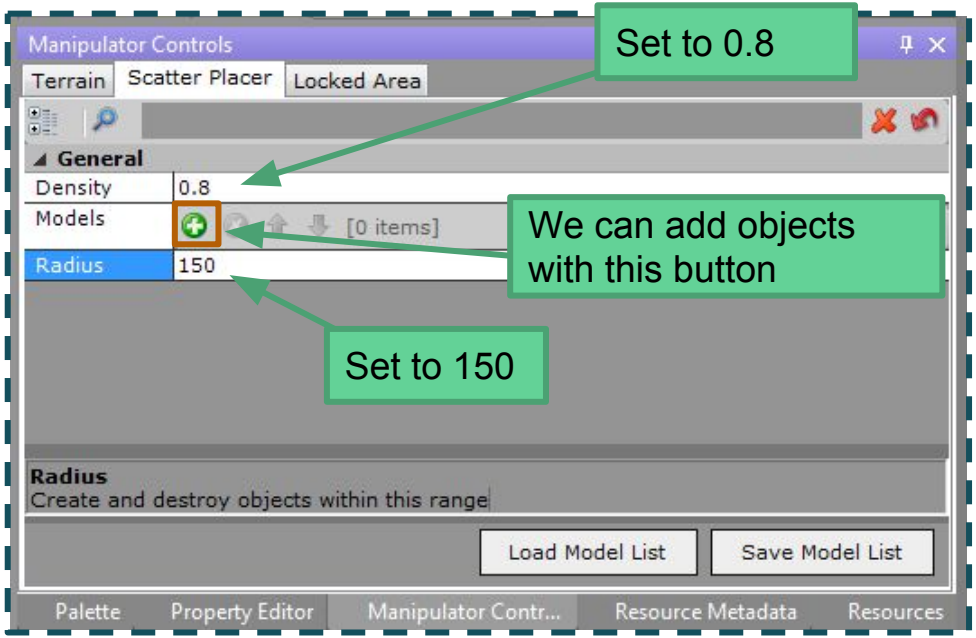
With the Move Across Terrain modifier, hold shift to reset height.



# Scatter Placer


With the Move Across Terrain modifier, hold shift to reset height.

Settings are in the Manipulator Controls window

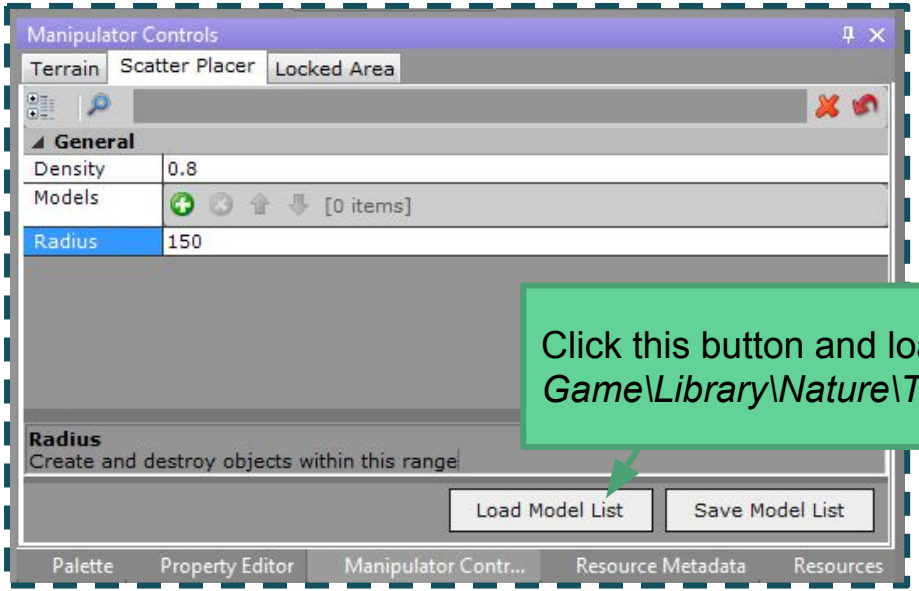



Set to 0.8

We can add objects with this button

Set to 150

# Scatter Placer




Click this button and load:
*Game\Library\Nature\Trees\Maple\ScatterPlaceExample.xml*

This will load a set of 60 example objects.

# Scatter Placer

Click on the terrain to randomly place objects with a circle.

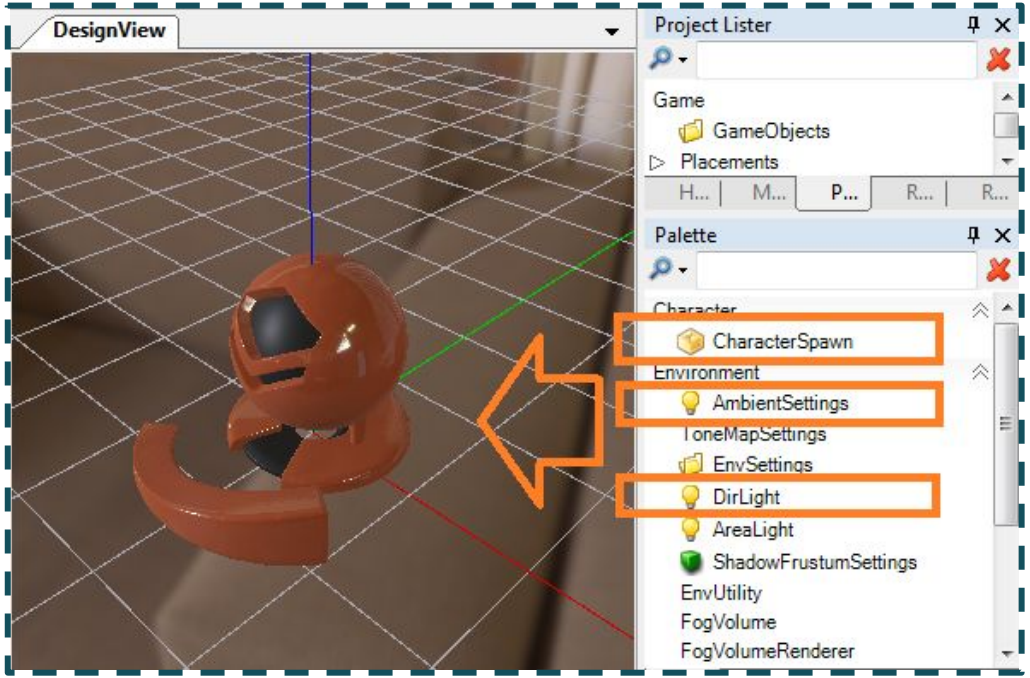
It uses an algorithm called “blue noise”. It’s very random, but tries to keep things evenly spaced.

It works even if there are already objects there.

Afterwards, use the ***Move Across Terrain*** manipulator to adjust the result

# Export to game

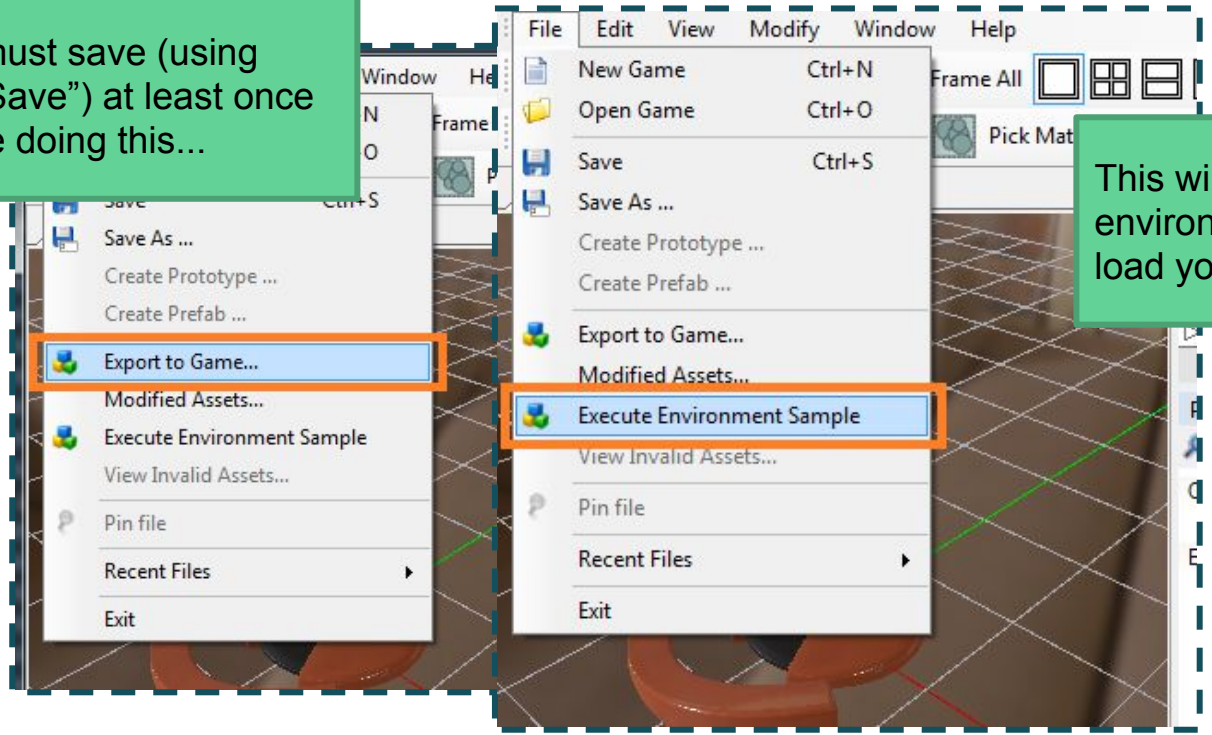
# Drag in environment settings




Drag the following objects into the main viewport

# Run in the environment sample

You must save (using “File/Save”) at least once before doing this...




This will launch the environment sample and load your world

# Now... experiment!

- With XLE we have a lot of tools for creating terrains very quickly
- But we also have a lot of power for creating unique next-gen appearances