MicroSplat

Core Module Documentation

Overview

MicroSplat is a modular shading system for Unity Terrains. At its core is the fastest texture shader available, supporting up to 32 textures, and is automatically generated based on the settings you choose in order to provide the most optimal shader possible. This unique shader compiling framework allows for MicroSplat to have more options than a traditional shader would provide, and doesn't require you to select from certain combinations of features, only to find that the feature combination you need is not available.

The major focus points of MicroSplat are designed around:

- Performance
- Extremely High Quality rendering
- Ease of Use
- Modularity

Resources

Having an issue? Please use the forums!

Forum Link

Interesting in learning more? Check out my YouTube channel.

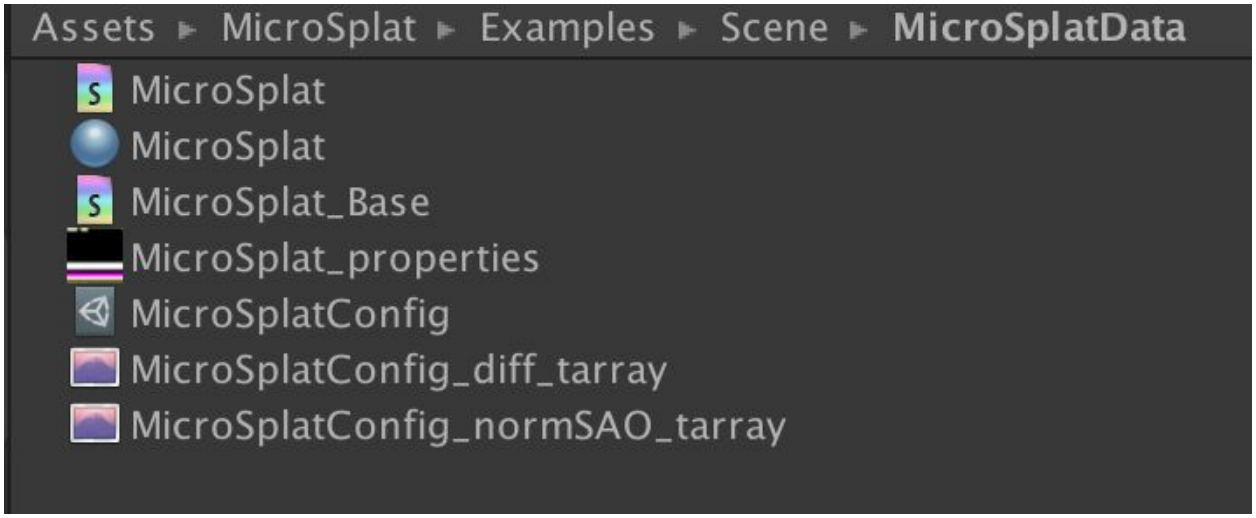
YouTube Channel

Getting Started

If you have an existing Unity terrain, getting started is only a few clicks.

- Select all the terrains you want to treat as a single, continuous terrain.
- Click “Add Component” in the inspector window, and select the “MicroSplatTerrain” component.
- Press the “Convert to MicroSplat” button.

In just a few seconds, this will read the existing textures from your terrain and pack them into custom texture arrays, and create a template material and shaders. A full PBR workflow is generated from the texture maps you have available. For instance, if you only use diffuse maps, the MicroSplat will generate a Normal Map, Height map, Smoothness and Ambient Occlusion map for your textures automatically.

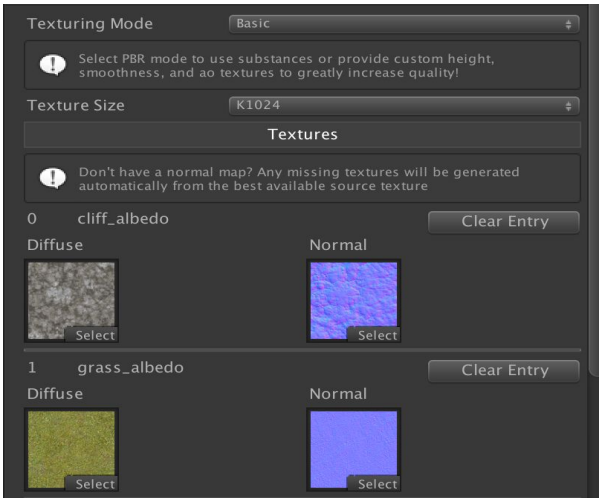
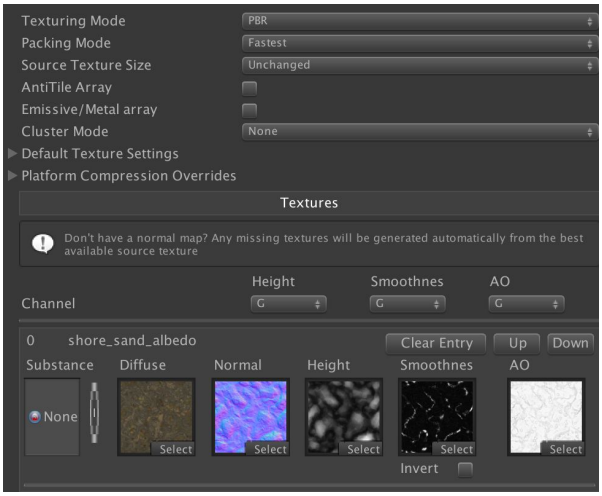


All data created will be organized into a MicroSplatData directory located next to your terrain data. In general, it's best to not rename this data.

The Texture Packer

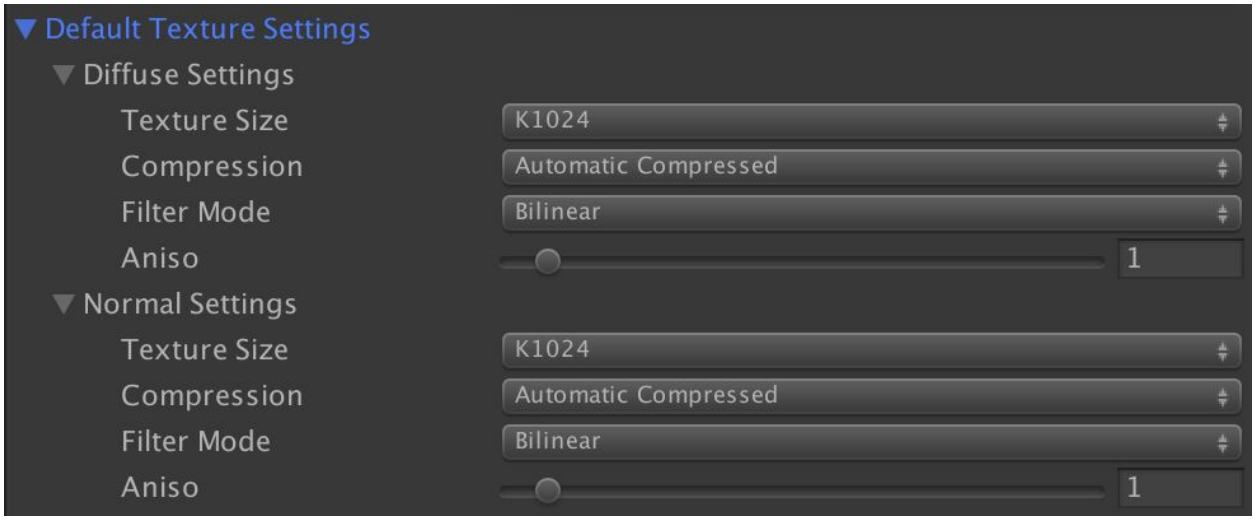
Once the conversion is done, the Texture Array Config will be opened. This is where you will manage textures for your terrain from now on. (You can come back to this screen by re-selecting the TextureArrayConfig object in the MicroSplatData directory.) There are two modes to this interface; a basic version, which only has slots for diffuse and normal maps, and a PBR mode, which allows for substance importing, a full PBR workflow, and more controls over the resulting textures.

Note that no matter which mode you select, any missing textures will be automatically generated from the best available texture as the data is packed into the resulting texture arrays (they don't show up in the interface, or get written to disk). However, the best quality will always be obtained by providing high quality PBR textures, with all texture data defined. High quality normal maps and height maps have the biggest effect on shading quality.

	
Basic Mode: A single resolution for all textures is exposed, and only diffuse and normal maps are available. All other channels are generated automatically.	PBR mode: More control over texture formats, substance importing, and the ability to provide all PBR texture channels. You can even choose which channel to pull the data from, or invert the smoothness map if your texture software provides roughness maps instead of smoothness maps.

If you make any edits, press the Update button at the bottom of the interface to regenerate the texture arrays.

Texture Settings



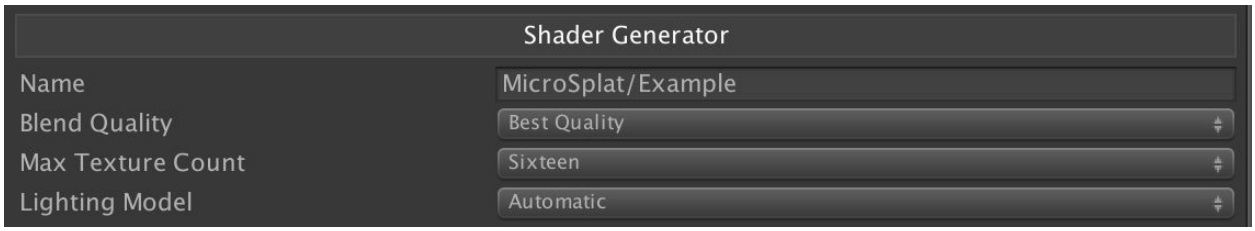
Texture settings are available for each array type, allowing you to control the final output formats. A platform override array is also available, allowing you to specify these settings on a per platform basis.

Unity's tools and API often make use of the source textures assigned to the terrain. MicroSplat leaves these textures alone by default, but a Source Texture Size property is available allowing you to reduce the resolution of these textures automatically. This can save significant memory in builds.

The Shader Generator

To quickly access your the shader settings, select the terrain and double click the 'material template' property on the MicroSplatTerrain component. This will open up the material which will be used by your terrains.

At the top of the shader's UI is a list of currently available modules for MicroSplat. Clicking on one of these modules will bring you to the asset store where the module can be purchased. Once you download and install the module (just like any other Unity Asset Store asset), new features will become available in the Shader Generation section of the shader UI.



Changing any option in the Shader Generator section causes the shader to be recompiled with the new code included. As you add extension modules, the number of options available in this section will grow substantially. But with only the base package installed, there are only a few options available.

- The Shader Name. This is what the shader is called in Unity's shader selection interface. By default, it names your shader after your terrain.

- **Blend Quality**. This controls how many textures are blended for each pixel on the terrain. While many terrain shaders sample every texture that could potentially be used on a pixel, MicroSplat samples between 2 and 4. When set to “Fastest”, only the two most weighted textures are sampled, however blending quality is reduced. On “Balanced”, 3 textures are sampled. And at “Best Quality” the top 4 textures are sampled.
- **Packing Mode**: This allows you to choose between the two texture packing modes. See the section below for more information.
- **Max Textures**. This controls how many textures the shader supports on the terrain. In most cases, you can leave it to the default of 16. However, if you are running on OSX or some older (non DX11) platforms and turn too many module features on, you might run out of texture samplers (OSX is limited to 16 due to driver limitations in Apple’s drivers, the hardware actually supports 32). Each reduction in this setting saves 1 sampler on these platforms. If you are running DX11, sampler’s can be shared, and it is unlikely that you’ll hit any limits. 32 textures is the maximum allowed by a Unity terrain.
- **Lighting Model**. This allows you to override Unity’s default BDRF (specular) function. By default, Unity will usually use a GGX based BDRF which can look too shiny on glancing angles. The “StandardShaderNoSheen” will eliminate this and allow for non-reflectve specular .Additional modes are available for other BDRF functions, such as lambert shading, but note that these settings will force your terrain to be rendered as a forward renderer object when running in deferred rendering.

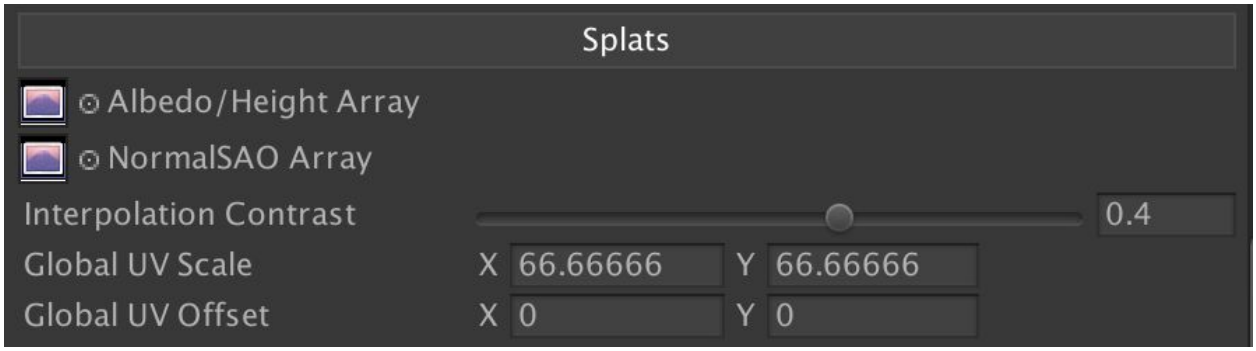
  If set to Lambert, the shader will be compiled using the legacy Lambert lighting system from Unity4. Note that this is NOT a physically based rendering (PBR) shader. In this mode, data in the roughness texture will map to the gloss value, and the ambient occlusion will be used for specular power.
- **UV Mode**. By default, the splat maps will use the UVs from the terrain, but when you set this to WorldSpace, it will use a world space projection for the splat map UVs, which can be useful if you want multiple terrains to seem perfectly with oddly scaled UVs.

- **Shader Model**. By default, MicroSplat will choose the minimum shader model possible for your shader. Shader Model 3.5, or 4.6 if Tessellation is enabled. However, you can override the shader model to 4.6 or 5.0 using this control.
- **Emissive/Metal Array**. Allows you to use an extra texture array with a per-pixel emissive and metallic map packed together. You can enable the creation of this array in the TextureArrayConfig and assign the resulting array after enabling this option.
- **Per Pixel Normal.** In Unity 2018.3, unity added per-pixel normal support for terrain. This uses a normal map to store the normal for the terrain and sampling it per pixel instead of computing it on the GPU per vertex. The main advantage to this is better looking normals which are not affected by the changing vertex count. However, Unity only supports this option when drawing with instancing on, which currently is incompatible with tessellation, and per pixel normals were not available for older versions of Unity. Per Pixel normal is automatic in 2018.3 when instancing is enabled, but in previous versions of Unity or when instancing is not used, you can turn on this option to enable it. Once enabled, an option to bake the normal map is available in the MicroSplatTerrain component, and must be updated whenever the terrain topology changes.
- **Disable Height Blending**. This will disable height based blending and use a linear blend, like Unity's included shader. If trying to get the most performance possible, this can reduce calculations slightly as well.
- **Disable Normal Maps**. This will disable the sampling of normal maps, which can be useful for non-PBR looks which don't need normals. Note that Smoothness and AO will also be disabled if you are in the fastest packing mode.
- **Sampler Mode**. This allows you to force the textures to be sampled using the LOD or Gradient sampler modes. When Per Texture UV scaling is enabled, the sampler mode if forced to LOD or Gradient. Not that the LOD sampling mode is the fastest, but breaks trilinear and anisotropic filtering.
- **Use Custom Splatmaps**. When this option is enabled, splat maps can be supplied on the MicroSplatTerrain component instead of using the splat maps provided by the Unity Terrain system. This is most useful if you want to procedurally generate or modify

texturing choices and want to avoid the hitch from basemap generation with standard Unity Terrain updates. Note that the splat maps have to have a normalized weight (totalling 1) across all splat maps.

Shader Properties

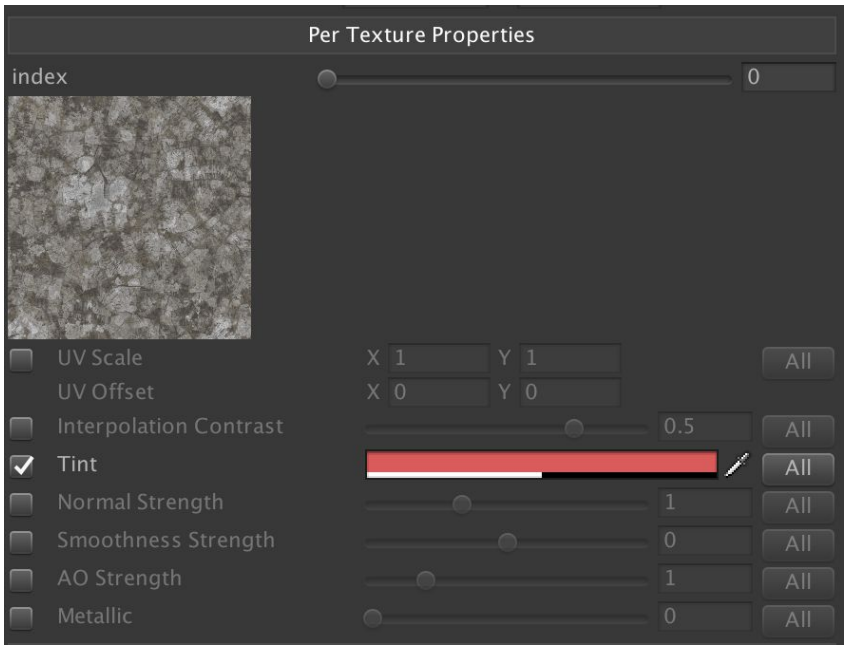
Below the compiler are various shader property sections.



This is the main splat mapping parameters. The Texture Array Config output our full PBR texture set into just 2 texture arrays, which you can see assigned here. If the Emissive/Metal array option is enabled, a third Texture Array is shown for the emissive/metal array.

- Interpolation Contrast
    - This controls the blend between textures when painted on the terrain. At 0, it closely mimics a Unity terrain. At 1, the blend is extremely sharp between two textures, and based on the height maps.
- Global UV Scale/Offset
    - These allow you to control the amount of tiling the textures use over the terrain, and offset the textures as well.

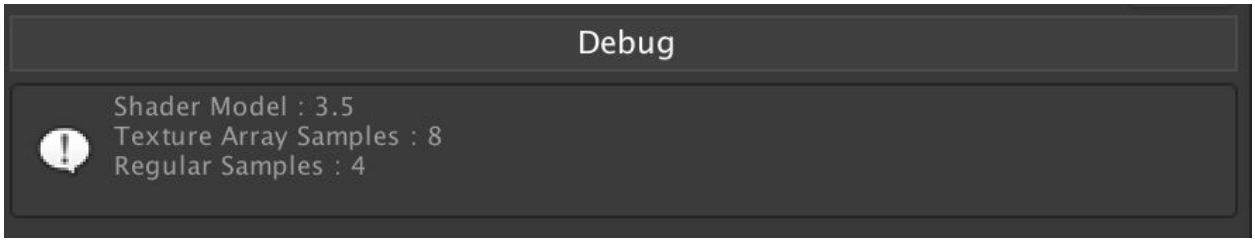
Per Texture Properties



The Per Texture Properties section of the shader UI lets you control various parameters of each texture in the shader. This allows you to give each texture it's own UV scale and offset, tint colors, or adjust PBR parameters like how smooth or metallic the surface is. Additional modules will add additional Per Texture Properties for their various features, and all properties have tooltips if you hover over them to explain what they do.

Next to each section of properties is a checkbox. This allows you to toggle the effect on and off. Doing so will recompile the shader with that code removed, ensuring the most optimal shader possible. Once enabled, you can use the "index" slider to choose a texture and adjust the properties. If at any time you wish to set all the textures to the same value, you can press the "All" button and your current settings will be applied to all of the terrain textures.

Debug

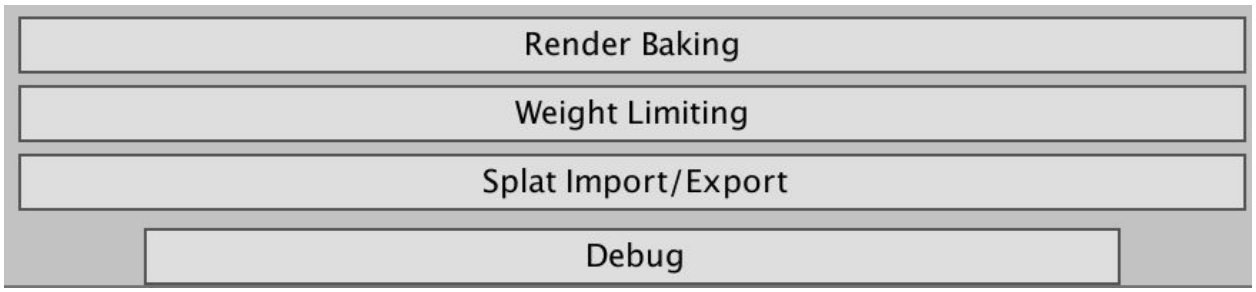


The debug section of the shader UI shows you information about the cost of your shader. While these numbers are somewhat subjective, they can be used to learn about the relative cost of each feature you enable.

MegaSplatTerrain Component

The component placed on each Terrain has a reference to the template material. You can quickly get to the material settings by double clicking on this material. When multiple terrains are setup together, a single template material is used for all of the terrains, and MicroSplat manages syncing changes from the template materials to the actual materials the terrain uses internally. If you change settings on the template material via script, you can call MicroSplatTerrain.SyncAll() to perform the same sync. Sync buttons are exposed, but you really shouldn't have to use them unless you change the template material used by terrain.

Additional modules may install additional controls into this section.



Several rollouts are available for various utilities:

Render Baking

The render baking section can be used to bake out maps from the terrain, such as the overall albedo, normal, or other PBR values.

Weight Limiting

A primary optimization of MicroSplat is controlling how many texture sets are sampled for each pixel from the terrain textures. This can be set from from 2 (fastest) to 4 (Best) with the Blend Quality setting. In most workflows, it's rare for more than a few textures to be used on a single pixel, but some external tools will output splat maps which use more textures than this. The weight limiting tool will adjust your splat maps so only the most dominant maps are used on any given pixel, preventing these types of issues. It can also be used in conjunction with the faster blend quality options to reduce errors caused by this type of optimization.

Splat Import/Export

These tools can be used to import or export splat maps from the Unity terrain. When importing splat maps, the textures will be resized to the size of the terrain data. Also, it will only import splat data for channels with textures assigned.

Debug

In normal operation you should never have to look into this section, but occasionally a user will manage to unhook various data which MicroSplat generates and manages, so these references are exposed here. These include the PropData object, where MicroSplat stores information about per-texture property values, and the keywords object, where MicroSplat stores data about the features you want compiled into your shader.

Packing Modes

On the Texture Array Config and shader editor there are choices for Packing Mode. This allows you to choose between two packing formats for texture data, with the tradeoff being between speed and quality. In the default (fastest) mode, the texture data is packed into two Texture Arrays; one for Diffuse and height data, and another for Normal, Smoothness, and AO data. When using the “quality” setting, the normal maps are put into their own array, and the smoothness/ao data are put into another array.

When using texture compression, this can increase the quality of the normal, smoothness, and AO maps over the more compact packing mode. How much this matters will really depend on the type of textures you are using, but in most cases I find that the quality difference is relatively minor, and running in the fastest mode is best.

Note that the packing mode on the shader and Texture Array Config must match.

Additional Modules

Additional modules can be downloaded to expand the feature set of MicroSplat. Once downloaded and installed from the asset store, new options will appear in the Shader Generator

section. Documentation for all modules is included with this package in case you have any questions about the workflow. This unique model allows you to pay for only the features your game needs, instead of paying for one large expensive package.

Global Properties

Often you might want to control aspects of MicroSplat from an external control system, like a weather manager such as Enviro. When a “G” button is located next to a property, you can toggle it to be driven by a global shader property. When these are enabled, the G will turn yellow and the property will no longer be editable.

You can then set these values globally via code, using the Shader.SetGlobal function, something like:

Shader.SetGlobalVector(“_Global_WetnessParams”, new Vector2(minWetness, maxWetness));

A list of all potentially global values:

_Global_WetnessParams	Vector2	Minimum and maximum wetness in the scene. Zero to one values expected.
_Global_PuddleParams	float	Maximum puddles in the scene. Zero to one values expected.
_Global_StreamMax	float	Maximum height of streams. Zero to one values expected.
_Global_RainIntensity	float	Rain drop intensity. Zero to one values expected.
_Global_SnowLevel	float	Overall amount of snow. Zero to one values

		expected.
_Global_SnowMinMaxHeight	Vector2	Begin and end height of snow in scene in meters.
_Global_WindParticulateRotation	float	Direction of wind particulate flow in radians. Should not be animated at runtime.
_Global_WindParticulateStrength	float	Strength of wind particulate effect. Zero to one values expected.
_Global_SnowParticulateStrength	float	Strength of snow particulate effect. Zero to one values expected.

Vegetation Studio Integration

When Vegetation Studio is installed, a few extra options are exposed. “Vegetation Studio Grass Mask” can be used to add foliage into the terrain texturing at distances beyond which it is feasible to draw actual foliage.

“Vegetation Studio Shadow Map” can be enabled to add raycast shadows for distant trees. This allows tree’s and other objects well past Unity’s shadow bounds to still cast shadows onto the terrain that correctly move and elongate with the sun position and angle.

Finally, MicroSplat can render out a tint map, which allows the bottom of the grass to be tinted towards the terrain texture using an appropriate shader on your vegetation.

Please consult the Vegetation Studio Documentation for more information on these features.

Additional Information

Are you interested in creating assets for sale that use this shader system? Do you make an asset which could use a better shader in your demo scene? If so, please contact me and I can help you do this with a special version for inclusion into your asset.

Are you a shader developer who wants to extend this system with new features, even selling an extension module on the store yourself? If so, please contact me and I can help you do this.

Working with Multiple Terrains

First, make sure all your terrains have a unique name. MicroSplat uses the terrain name as a prefix to generate various resources it needs for each terrain, so if multiple terrains have the same name, they will overwrite each other.

When working with multiple terrains, you can setup all the terrains as one “system” by selecting them all and doing the conversion. This will create one MicroSplatData directory for all of their data, with a single shared material, shader and per-texture property object used by all of the terrains. Modules which need to generate additional textures or data will create these based on the terrain name and place them in this same directory.

If you wish to have multiple terrains that do not share settings, it is suggested to put each of the TerrainData assets Unity creates into it’s own folder and set them up one at a time. This will give them each their own MicroSplatData directory, with their own shader, material, and per-texture property data object.

Note that you should avoid renaming things in the MicroSplatData directory, as this can cause various issues when objects need to find each other, often causing MicroSplat to regenerate the data it needs from scratch, or potentially finding the wrong data. Also note that textures, like global maps, can be overridden on the MicroSplatTerrain object for each terrain- so

you could have one MicroSplat system which is used across multiple terrains, but each terrain can have it’s global maps.