Advanced Foliage Shader 4

Model and Texture Guide

Content

1. AFS Grass Shaders

Both AFS Grass shaders – the one replacing the built in terrain engine's grass shader and the shader for manually placed grass models share the same requirements:

Geometry

Grass should be modelled as single sided geometry.
Please make sure that the pivot is at the bottom of your model. Raising the pivot will make the grass sink into the terrain or underlaying geometry which will allow you to even add grass on steep slopes.

Vertex Colors

Vertex color alpha controls bending: Alpha = 0 means no bending and should be applied to the lower vertices whereas Alpha = 1 means full bending which you will probably apply to the upper vertices.
Using vertex colors instead of UV coordinates lets you create even complex shapes like 3 dimensional flowers or small saplings with overlapping UVs.
You may also edit the RGB channels of the vertex colors in order to add e.g. ambient occlusion or some variation in color.
Please note: In case you are not able to edit vertex color alpha (as e.g. you are using Blender) you may take advantage of using the "AfsGrassModel Postprocessor" script which will automatically create those colors on importing the mesh. Have a look at the "AfsGrassModel Postprocessor.rtf" to find out more.

Textures

The grass shaders generally only need a diffuse albedo texture including a transparency mask in the Alpha channel.
However if you enable the "approximated translucency" option in the "Setup Advanced Foliage Shader" script you also have to add a translucency texture.
As all grass textures should be combined into one single texture atlas to speed up rendering the translucency textures have to be as well. And as i am assuming that you will mix manually placed grass with grass placed within the terrain engine the translucency textures are part ot the global "Combined Normal/Translucency/Smoothness map" which is needed by the terrain engine to support e.g. bump mapping on foliage.
Please have a look at the Grass shader documentation for further details.

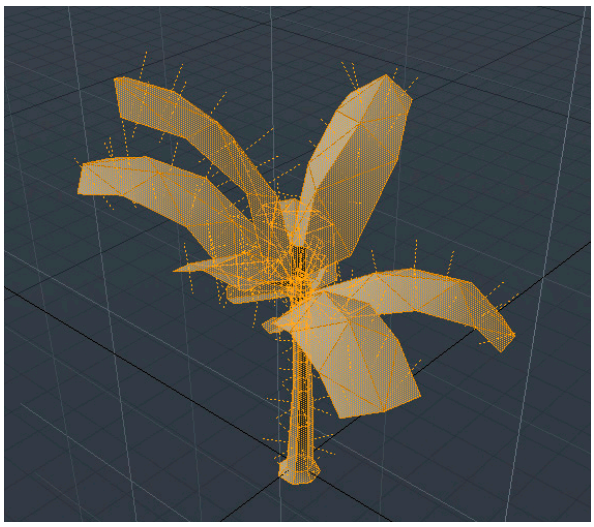
2. AFS Foliage Shaders

2.1. General Requirements

Geometry

In order to support (receiving and casting) correct shadows and lighting we need double sided geometry on anything that usually just would be a single plane like leaves, for single sided geometry could not be lit in a proper way.

Please note: The package ships with 2 dedicated deferred foliage shaders of which one uses single sided geometry (beta).



Creating double sided geometry
Just model your model the way you like and unwrap it. Then select all single, simple planes for leaves or whatever, duplicate them, flip their normals and merge them with the original mesh. In the end we need one single mesh with just one material assigned to it.

Leaves planes must be double sided in case you use the regular foliage shaders.

2.2. Bending

The foliage shaders support complex bending as you might know from the built in tree creator shaders. It is controlled by the vertex colors applied to the model and/or UV4 coordinates and consists of 3 blended animations:

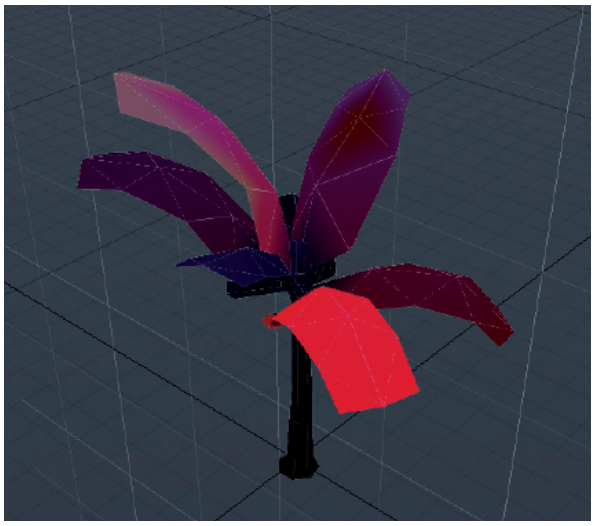
1. Primary or Main bending, which animates the entire model along the wind direction.
2. Secondary or Detail bending, adding a higher frequent animation mostly along the y-axis.
3. Edge fluttering.

In order to make the whole blending more believable, there is a fourth factor:

4. per-leaf / per-branch phase variation.

2.2.1. Adjusting primary and secondary—using vertex colors only

When using legacy bending all bending information is stored in vertex colors only. But as we also would like to have ambient occlusion baked to the alpha channel we only have 3 colors left for 4 params and have to combine main and detail bending. This will give us less control over the overall look but a pretty small vertex count.
Please note: Legacy bending is needed on all plants you want to place using the terrain engine.
In case you are looking for some more advanced bending please continue reading at “New bending—using UV4”.



Legacy Bending—**Vertex Colors**

1. Main bending --> Vertex color blue
2. Detail bending --> Vertex color blue
3. Edge fluttering --> Vertex color green
4. Phase variation --> Vertex color red

So when setting up main and detail bending you should keep in mind that wind settings like direction and strength for all different kinds of foliage are equal – but different kinds of plants might react differently to wind according to their overall size, size of leaves, stiffness and so on and so forth. For this reason all plants within your scene need their own main and detail bending which means: All different plants do have to have unique maximum values of vertex blue in order to achieve a variety in bending. So please constantly compare all models and their bending to each other within Unity during the process of adjusting the vertex colors.

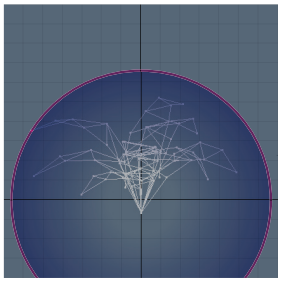
Using the AFS Foliage Tool to adjust main and detail bending

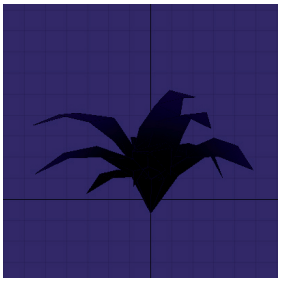
You may just set up edge fluttering and phase variation using your 3d app – and use the AFS Foliage Tool to set up main and detail bending right within unity.

Manually adjust main and detail bending

The way how to apply vertex color blue depends on what kind of plant you are working on.
The package ships with two different models marking the two poles of supported geometry:
Whereas the fern model is the most simple one, the small banana tree is the most complex one, for it consists of a rather stiff trunk and pretty flexible leaves.

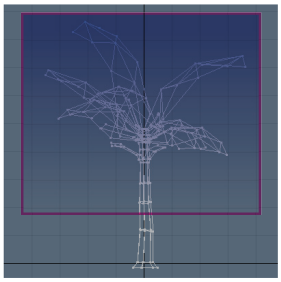
> ***Tip:*** *When starting adding vertex colors for main and detail bending to the first model do not assign the highest possible value (which would be blue = 1.0) but start right in the middle: max blue = 0.5. That leaves you some space for plants with less or more bending.*

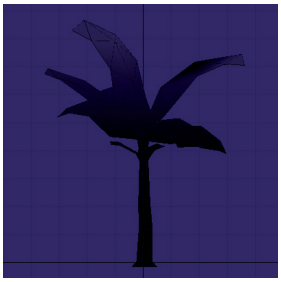




Setting up the fern model

As we do not want to have any bending at its pivot but a lot of it at its outer leaves we simply assign a radial gradient from blue=0 at its pivot to blue = 0.5 at its outer regions.



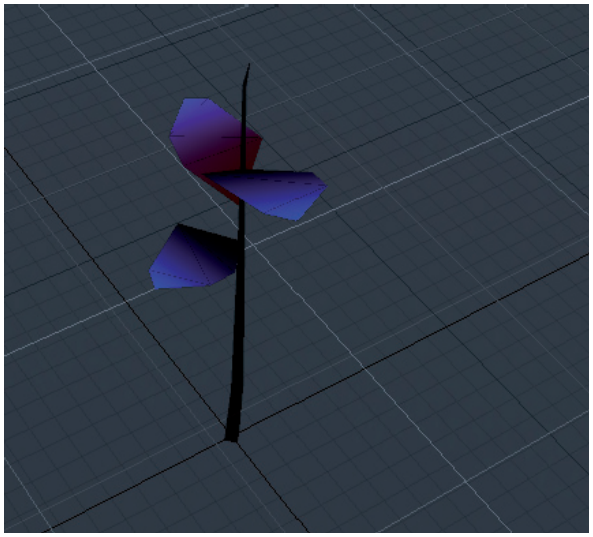


Setting up the banana tree

Simply assign a linear gradient from blue=0 at one third from its pivot to blue = 0.7 at its upper parts.

2.2.2. Adjusting primary and secondary bending—using UV4

The new bending allows you to store primary and secondary bending separately in UV4.
But as setting up this kind of bending manually is pretty complex i highly recommend to apply it directly within Unity using the “AFS Foliage Tool”.
You might simply prepare your models by adjusting “edge fluttering” and “phase variation” as described below and the “AFS Foliage Tool” will let you adjust primary and secondary bending along the y and xw axes.



However in case you have more complex models or want to have most control at least on secondary bending you can mask it by adding vertex colors to the blue channel:
Only apply vertex color blue to parts of your plants which should be effected by secondary bending like the leaves in the example on the left. You may even paint or bake the strength of the secondary bending by using gradients as shown on the leaves.

Please note: The red vertex colors on one of the leaves defines per-branch phase variation as described below.

Using vertex color blue to mask secondary bending currently is the most advanced technique and allows you to create pretty complex models. Using such geometry in conjunction with the “AFS Foliage Tool” will make it easy to create lively and realistically bending plants at the costs of some higher vertex count.

2.2.3. Comparison Vertex Colors only vs. Vertex Colors and UV4

Vertex colors only

- works for manually placed foliage and foliage placed within the terrain engine
- smaller vertex count
- less control over primary and secondary bending

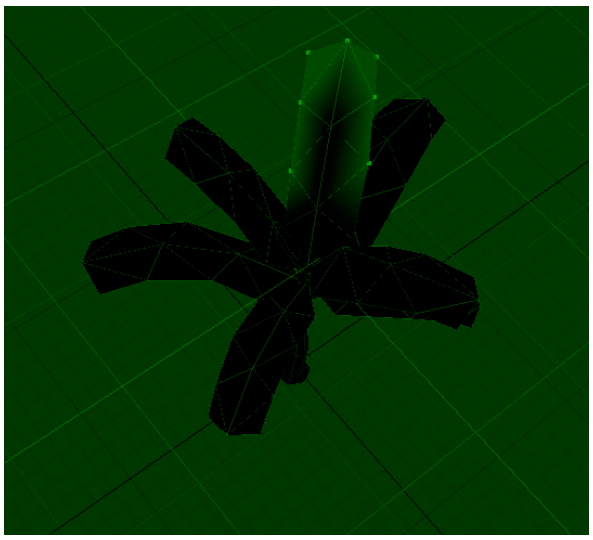
Vertex Colors and UV4

- works for manually placed foliage only
- slighly higher vertex count
- better control over primary and secondary bending
- more variety between adjacent plants (bending in slighly different phases) when using the “Combine children AFS” script

2.2.4. General Bending Parameters

No matter if you have chosen to go with legacy or new bending—you will have to set up “Edge fluttering” and “per-leaf / per-branch phase variation” manually.

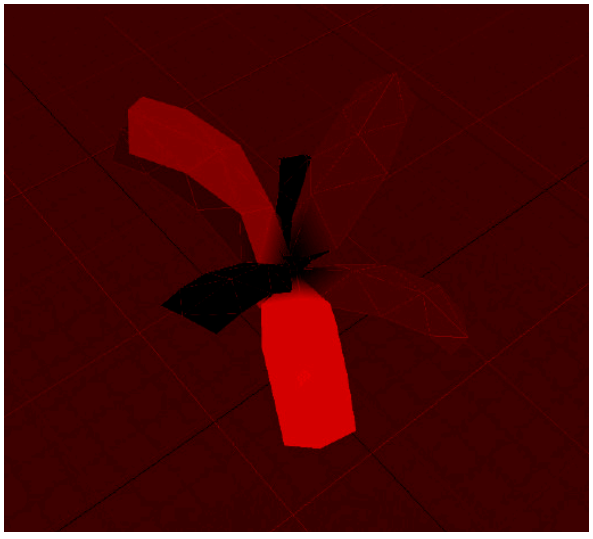
Adjusting edge fluttering



Edge fluttering means just deforming the edges, using the vertex color’s green channel for controlling edge stiffness: green=0 --> no fluttering / green=1 --> full fluttering.
Add edge fluttering to leaves by simply adding some green to the outer vertices of the leaves.

Tip: *Make sure that the connecting point (or pivots) of the leaves have vertex color green=0. Otherwise leaves might loose connection to their parent geometry.*

Adjusting phase variation



In order to avoid that all leaves or branches of your model bend to the exact same pulse, you can add different shades of red to single leaves.

Tip: *When using legacy bending make sure that the connecting points (or pivots) of the leaves have vertex color red fitting the vertex color red of the point they are connected to. Otherwise leaves might loose connection to their parent geometry.*

Please note: *In case you use* ***Touch Bending*** *vertex color red is added on top of primary and secondary bending in order to give you more variety in touch bending. Branches which are pretty much exposed and should be strongly effected by touch bending should have high red values. In case you use* ***Leaf Turbulence*** *(see: “Foliage Shaders.rtf”) vertex color red is multiplied with the given Leaf Turbulence value.*

For these reasons i recommend to limit the range of used red shades to e.g. 0.5 – 1.0.

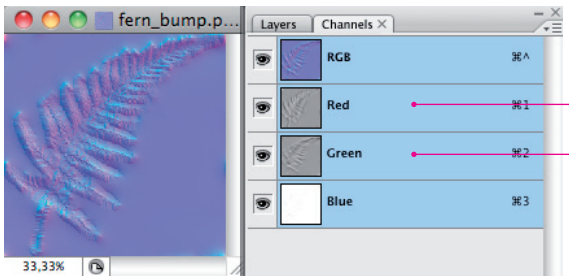
Adding ambient occlusion

Ambient occlusion can be baked to vertex color alpha. How you will do this is up to you and depends on your 3d App.In order to bake ao within unity you can use a small script, which can be found it here: http://adrianswall.com/shared/unity_vertex_ao.rar

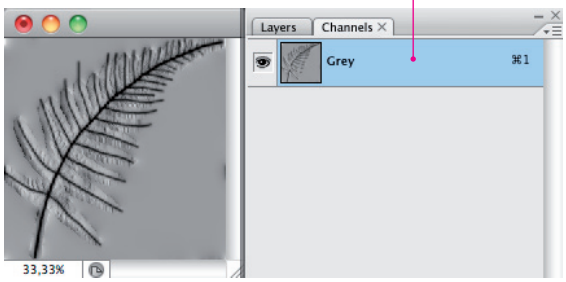
Textures

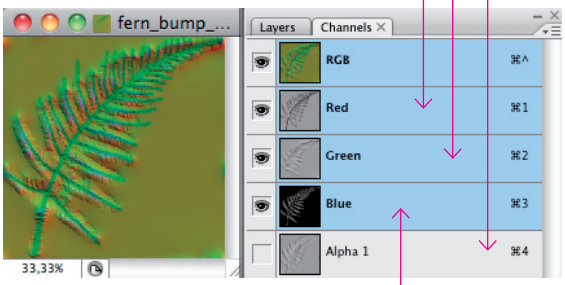
The foliage shaders support diffuse, alpha, normal, smoothness and translucency maps but in order to keep the texture load and bandwidth footprint as small as possible those are combined into 2 textures: Diffuse/Alpha and Normal/Translucency/Smoothness.
You will have to generate the combined Normal/Translucency/Smoothness texture manually like shown in the figure below.

Normal Map (RGB)

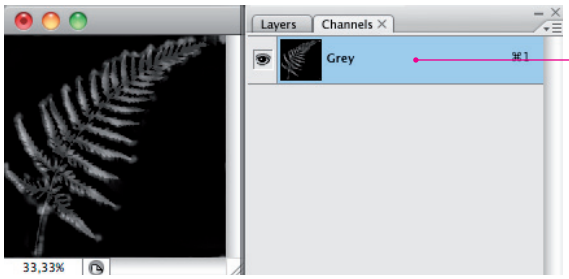


Translucency Map (Grey)





Smoothness Map (Grey)



Texture Atlasing

In order to let the “Combine Children AFS” script combine different plants into one mesh those plants have to share the same material and textures. So you will have to create a texture atlas for those plants and map all models to that atlas.
Dynamic and static batching also rely on this texture atlas.

3. AFS Grass and Foliage shaders and the terrain engine

Usually you would just add single textures or models to the terrain and let the terrain engine create a texture atlas for all given details automatically. Unfortunately this will not work in case you want to use the AFS grass and foliage shaders within the terrain engine as at least the foliage shaders need a second texture containing the combined Normal/Translucency/Smoothness maps.
For this reason you will have to create the texture atlas manually and map all objects—no matter if they use the grass shader or the foliage shader—to that atlas.

Please note: *Using a manually generated atlas won't let you use any grass rendered as billboard or simple texture, because adding this kind of grass would add a second texture to the internal texture atlas of the terrain engine and corrupt the texture lookup within the manually setup atlas.*

Please note: *Placing meshes within the terrain engine implies all disadvantages placing meshes within the terrain engine usually does: They do not cast shadows and they do not have any collider.*