# ConjureScape Vegetation User Manual

Introduction

ConjureScape's vegetation system is a custom system built for high performance and great visual representation. It consists of a custom LOD system that allows for complex billboarding for vegetation that are far away from the camera and fades between different LOD levels. The system was designed for the best visual switching between LOD levels and makes used of the Unity tree system for terrains.
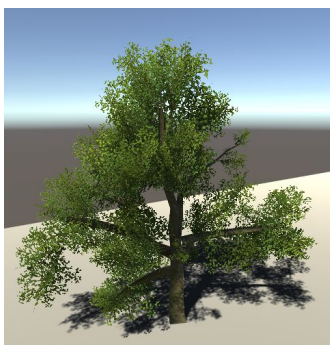
Trees and plants

All ConjureScape trees and plants were created using Unity's tree system. All the trees and plants have 3 LOD's assigned as indicated below:

- LOD 2 = Billboard (using ConjureScape's complex billboarding system)
- LOD 1 = Optimised mesh of the tree or plant
- LOD 0 = High detail mesh of the tree or plant
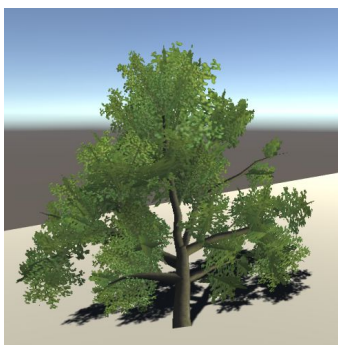
LOD 2 (Billboard)   LOD 1 (Optimised mesh)   LOD 0 (High detail mesh)

Grass

All ConjureScape grass are making use of a texture based solution used in the Detail section of Unity's terrain system. The grass does not have a custom LOD system.
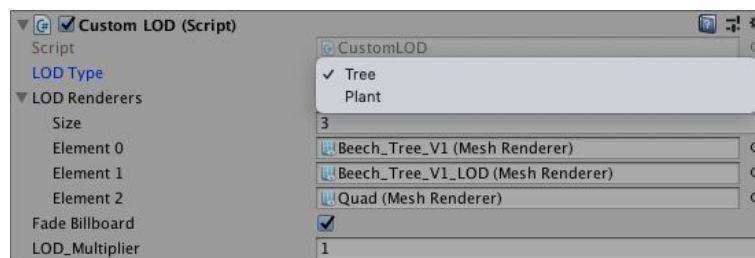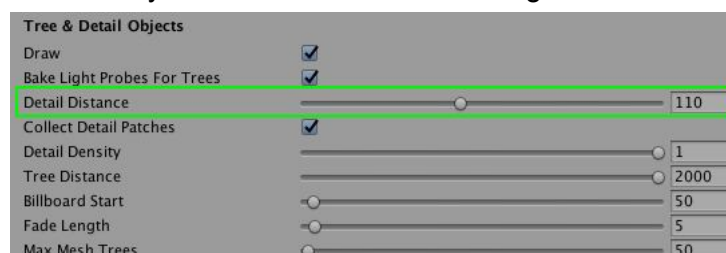

LOD System

ConjureScape is using a custom LOD system. Each tree and plant component has a custom LOD component attached to it. When the scene runs (play mode initiated), the painted trees on the terrain gets removed and replaced with actual tree prefabs in order for the LOD system to work. This functionality does not affect the actual terrain asset. Once play mode has been stopped, the painted trees gets populated on the terrain again and the temporary playmode trees and plants are removed. Now let's look at the LOD system in more detail:

Each tree or plant object has a Custom LOD component attached to it. There are 4 important parameters on the Custom LOD component. Below is a detailed description of each parameter:

LOD Type:

The LOD Type can be set to either "Tree" or "Plant" as indicated on the image above.
When the LOD Type has been set to "Tree", the object's LOD system will behave as a tree.
When the LOD Type has been set to "Plant", the object's LOD system will behave the same as grass and the same detail distance setting used for details in Unity's terrain system will be applied to the object's LOD system as indicated in the image below:
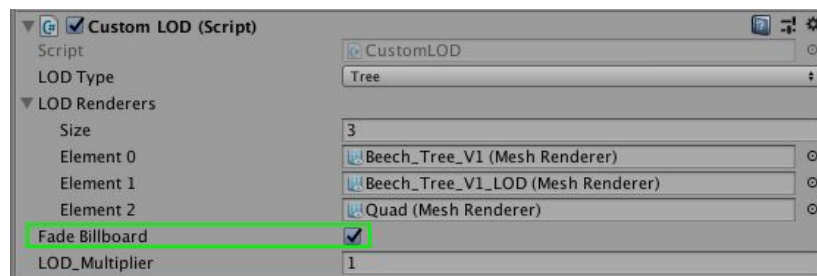
LOD Renderers:

The LOD Renderers array keeps a reference to the LOD meshes. This is used by the LOD system to switch the LOD meshes depended on the distance from the camera. Below is an image indicating how they are assigned:


Fade Billboard:

The "Fade Billboard" parameter indicates whether the LOD System should be using a fade in and out system for switching between the LOD levels. It is recommended to keep this parameter active to experience the seamlessness of ConjureScape's LOD switching.

If this parameter is set to inactive, then the LOD system acts like Unity's standard LOD system where the meshes simply switch between the LOD levels without any fading effect.

LOD_Multiplier:
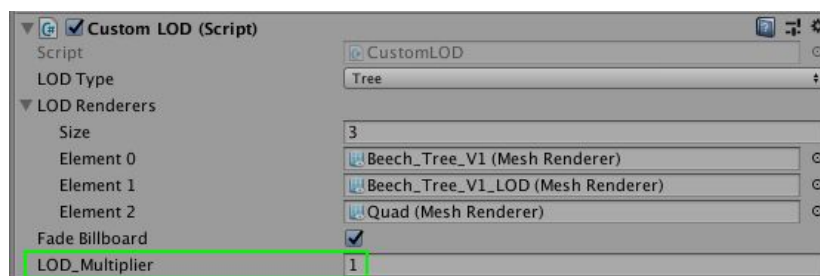
The purpose of the LOD_Multiplier is to allow for custom LOD distances to be set for each object. It uses the values set inside the LOD Distances component that is located on the Default_Include prefab and multiplies the LOD distances with the LOD_Multiplier parameter. This value should only be adjusted if the LOD distances is not sufficient for the specific object. In some cases you might find that the LOD levels are being activated too late or too soon for your liking, this would be the special case where you would want to adjust this LOD Multiplier value to achieve a better distance for the LOD levels to be activated for a specific object. By default this value should be set to 1.

Default_Include Prefab
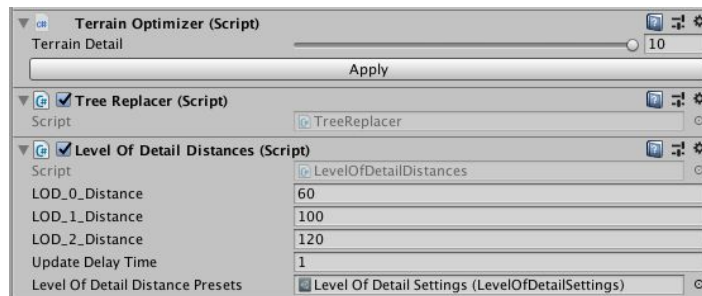
The Default_Include prefab has 3 important components attached to it, "Terrain Optimizer", "Tree Replacer" and "Level Of Detail Distances". These components are essential for the LOD system to work. Let's look into each component in more depth.

Terrain Optimizer:
The terrain optimizer is used to optimize your scene and terrain according to the preset "Terrain Detail" value. Level 1 is lowest quality and level 10 is highest quality.

The Terrain optimizer should be used in edit mode before running a scene. First choose your preferred level of detail by dragging the "Terrain Detail" slider and then hit the "Apply" button in order to set the prefered level of terrain quality. The Terrain Optimizer adjusts the following settings:
- Project quality settings
- Terrain pixel error
- Terrain Detail distance
- Terrain Detail density
- Applies LOD distance values to the "Level Of Detail Distances" component

If you're experiencing low frame rates on lower settings of the optimiser try the following:
- Disable the post render effects
- Unity 2018 (Mac): Untick the "Metal Editor Support" checkbox in the player settings.

Tree Replacer:
The Replacer component is used to replace trees that are painted with Unity's Terrain system with actual prefab objects. This is needed for the LOD system to work and only happens at runtime.

Level Of Detail Distances:
There are 5 important parameters located on the Level Of Detail Distances component. Let's look at each parameter in more detail:
- LOD_0_Distance - this is a value that is adjusted by the Terrain optimizer. This value indicates from what distance in meters from the camera LOD 0 should be activated.
- LOD_1_Distance - this is a value that is adjusted by the Terrain optimizer. This value indicates from what distance in meters from the camera LOD 1 should be activated.
- LOD_2_Distance - this is a value that is adjusted by the Terrain optimizer. This value indicates from what distance in meters from the camera LOD 2 (Billboard) should be activated.

- Update Delay Time - ConjureScape's billboards are 3D billboards, depending on which angle you are looking at the tree or plant, the respective billboard will be activated. The billboard system uses this value to indicate at which intervals (seconds) the billboarding should refresh the angle of view.

Level Of Detail Distance Preset:
This parameter keeps a reference to the preset settings asset of the LOD distances. Feel free to adjust the preset settings asset to your liking. We have set up default values, but this setting asset would be the place to customize LOD distances for each quality level (Level 1 - 10). The Terrain Optimizer uses this settings asset to assign LOD distances to LOD_0_Distance, LOD_1_Distance and LOD_2_Distance parameters.

Scene Requirements

When creating a new scene and you would like to use ConjureScape's trees and plants with our custom LOD system, the following needs to be present in a scene.
- Default_Include Prefab
- Terrain with painted ConjureScape trees and plants
- Camera (Any type of Camera, First person or Third person). The camera must be tagged as "MainCamera".

The Default_Include prefab is located here:
Assets/Egamea/ConjureScape/Utilities/Prefabs/Default_Include.prefab