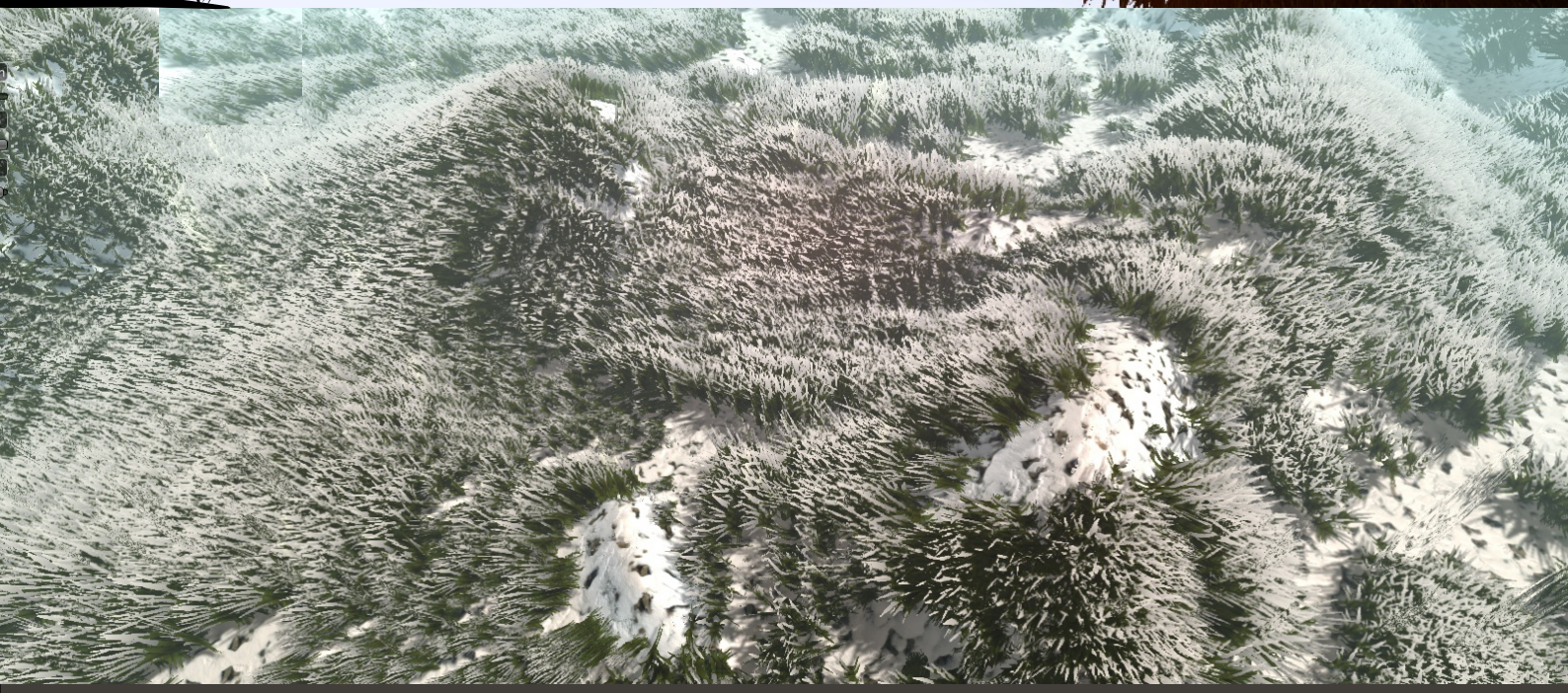
InfiniGRASS Guide



Contents

Features

InfiniGRASS is a robust grass and prefab painting and optimization system, which allows very detailed next gen grass to be placed in mass quantities and is controlled for performance with auto grouping, batching and LOD systems that will minimize CPU usage and reduce draw calls, while giving the option to paint grass in all surfaces with a collider (surfaces created in play mode can also receive grass) and have dynamic options like stepping on grass or making it grow.

- **Create grass of high detail** with any shape and material on any surface, in both Unity editor and while playing the game.
- **Unlimited amount of grass can be placed on a map**, the LOD system will make sure draw calls remain low at all times.
- **Smooth shader fade** option in LOD and cutoff distances
- **Dynamic grass possibilities**. Use any motion or script on grass, only limited by concurrence.
- **Grow grass in play mode and paint it on any surface** with a static collider.
- **Interaction of grass with scene objects**, e.g. throw items to level grass.
- **Static and dynamic batching**, for best performance in each use case.
- **Spectacular shadows**, lighting and grass density
- **Dynamic snow** growth on grass
- **Complete integration with Sky Master ULTIMATE v3.0,** for best lighting, snow coverage control and water combination.
- **Global Wind simulation** with per grass type weighting for total control
- **Translucent lighting** emulation
- **Powerful grass editor**, with complete control over painted grass properties.
- **Fence creation system**, with automatic batching for maximized performance (working in both play mode and Unity editor)
- **Rocks and other prefabs placement** system
- **Extensive collection** of ready to use preset grass brushes.
- **Total control over performance,** with adjustable LOD, grouping and batching systems and compete freedom in grass definition and shading.
- **The system can be used as a general 3D decal system**, the grass is just one of the many possible applications.
- **Rocks can be painted on top of each other** to create various constructs.
- **Special grass placement controls,** for reducing unnecessary detail and adapting grass to the environment.

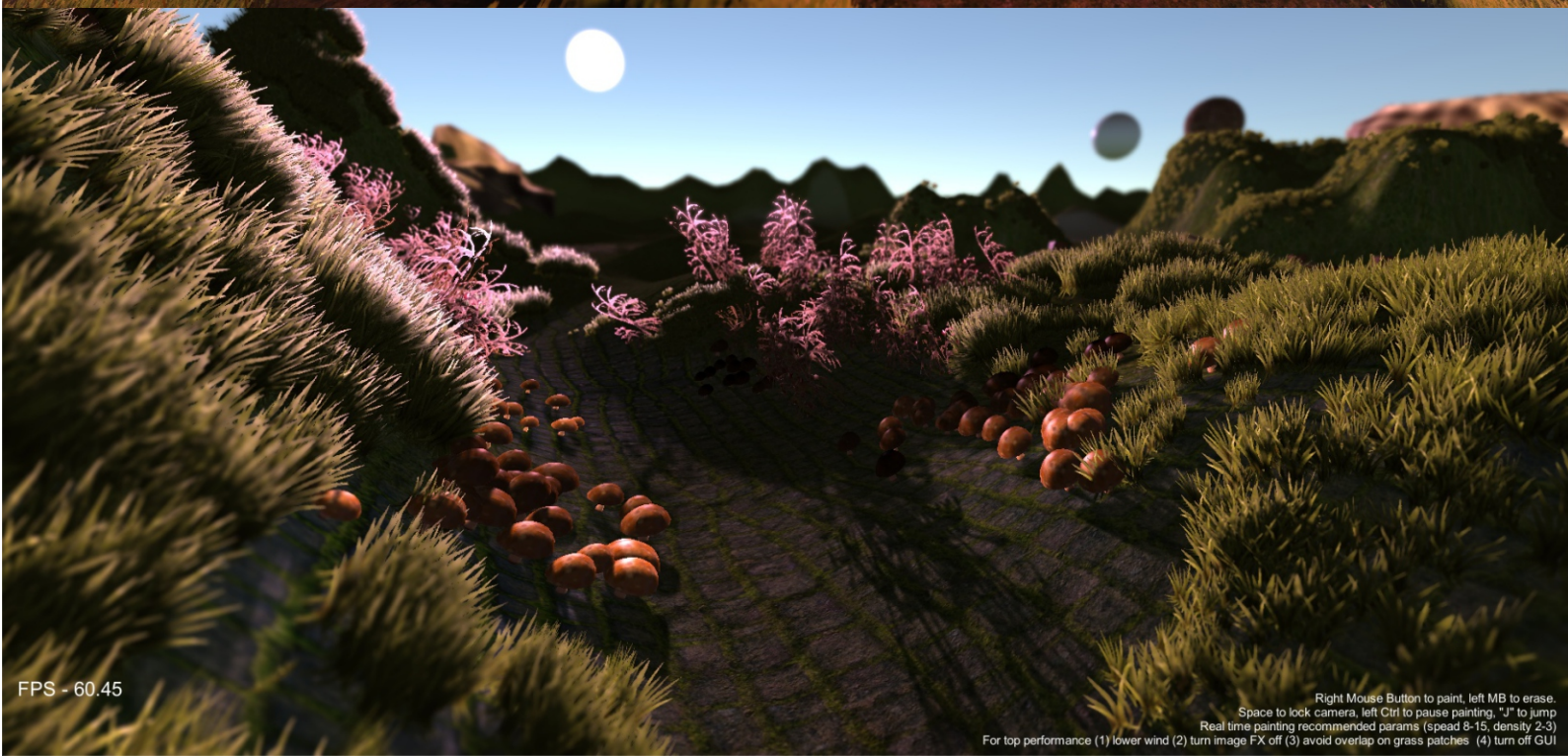
The v1.0 of InfiniGRASS is targeting mid to high end PC, but the core of the system can be used on any multi-CPU platform with the proper grass shapes and shaders. Lower end system can benefit from the multithreading batching and LOD systems. Later updates will bring more shaders for lower end systems and tests on mobile platforms and more platforms will be added to the officially supported depending on the results.

Features v1.1

InfiniGRASS v1.1 brings many new features and a few fixes.

- **Added ability to sort batching by target object,** and allows to control grass with the object transform.
- **Added option to follow the object grass is painted on.** This is more expensive than static grass, but wont show in lower quantities. Two modes are available, parent to object or follow transform. The object must not be scaled (grass follows rotation - translation) in the latter method.
- **Fixed small bug where some blades would in rare case appear in 0,0,0**
- **Fixed bug where absense of Unity terrain would create an error** (in v1.0 Unity terrain should be preset to paint grass)
- **Added two more LOD levels,** now materials must be named LOD0, LOD1 and LOD2 and their mesh filters must be disabled in the source prefab.
- **Added option to avoid hitting the grass own collider** of painted grass
- **Added option to randomize grass rotation,** both uniform and randomized are very usefull and provide different looks. (That is additionally to towards surface normal orientation)
- **Added new 3D "grass" sample brushes, Rocks and Mushrooms** with LOD setup, **Ground Leaves** and **extra vertex varieties (Wild grass)**
- **Added support for texture based grass scaling** depending on Unity terrain splat maps.
- **Addition of castle like wall in demo for vertical painting** and some new ground textures to increase ground quality.

A Unity terrain must be preset in order to use the new texture based grass scaling option.



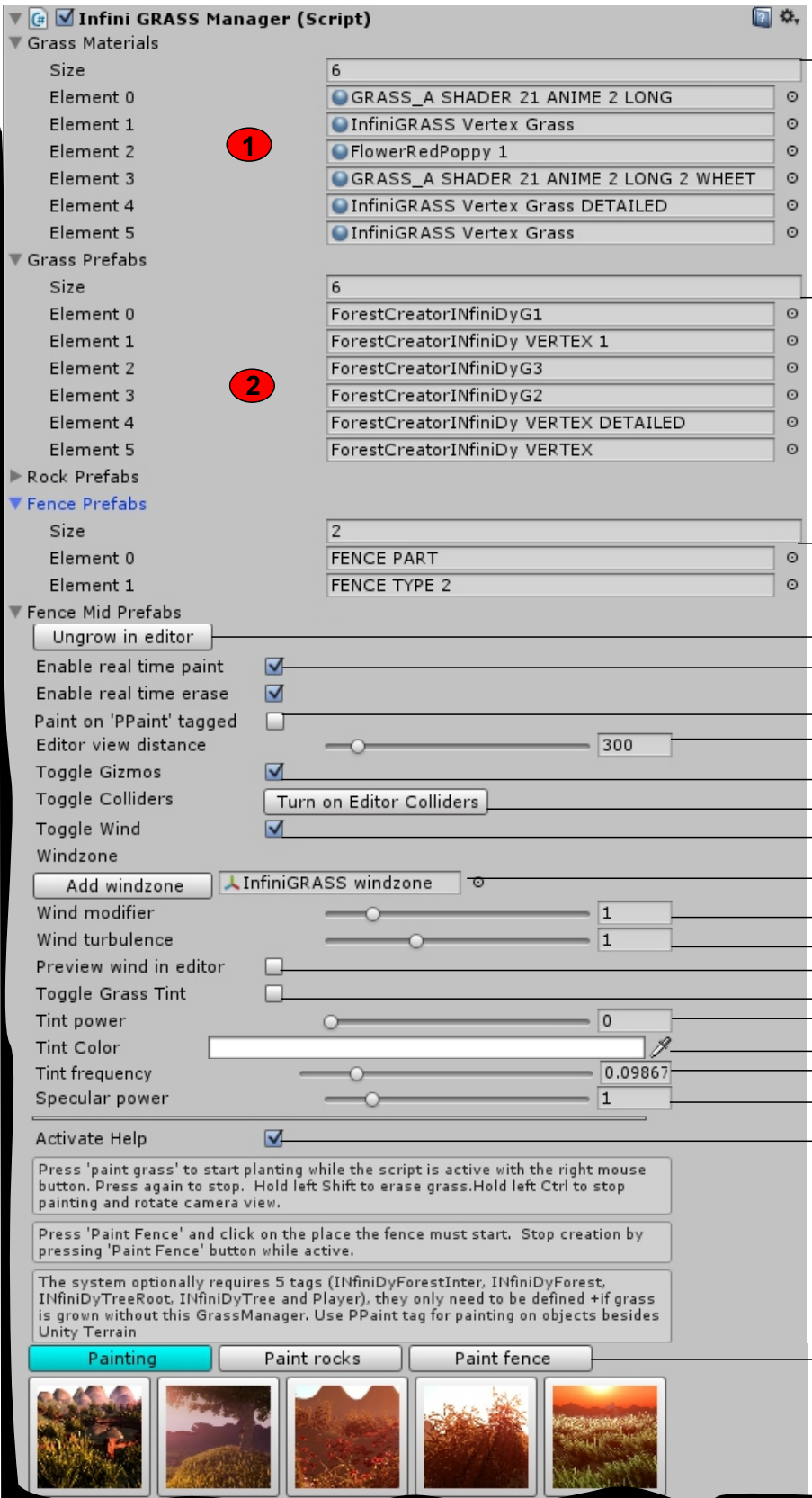
Grass Manager - Editor

InfiniGRASS uses a minimalistic approach with integration of the Grass Manager and Editor in a single interface. The setup requires an empty gameobject where the **'InfiniGRASSManager'** script must be added. It is recommended to name the gameobject as "Grass Manager" for clarity.

After insertion the system will introduce the default prefabs - materials used for the samples in Grass Materials and Grass prefabs lists (1-2). These lists can then hold any number of custom presets per script, with drag and drop from the library. The list count must also be increased accordingly. Icons are provided as a means to select the presets and the extra custom ones can be selected from the horizontal selection slider (Grass type).

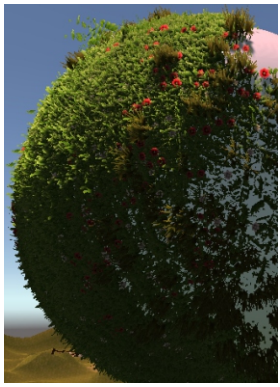
Note: The grasses painted can later be edited for interactivity flag using their type, which corresponds to the Grass Prefabs list Id, so it is recommended not to delete items from these lists and only add to them (after painting with one of the items). The references to the painted grass are kept in a private "Grasses" variable in the script.

IMPORTANT: The system **optionally** uses **four tags to control the grouping of grass, if the grass should be grown without a grass manager.** If these are not automatically added by the scene, they should be manually added. The tags are «INfiniDyForest», «INfiniDyForestInter», «INfiniDyTreeRoot» and «INfiniDyTree». The interactive grass will be batched in the "INfiniDyForestInter" groups. **'Player' tag is used for the player.**



Grass materials (corresponds to the prefabs below, for wind etc shader control)

Grass prefabs for painting are defined here



Use "PPaint" tag to paint on any mesh collider

Fence prefabs are defined here, mid prefabs are used between the fence posts

Remove grown grass from editor, for performance & lower scene file size. Regrow the grass for editing or preview. Grass is auto-regrown in play mode.

Enable real time painting and erasing of grass

Enable painting on objects tagged with "PPaint" (on object collider).

Governs the distance in editor from the camera the grass gets disabled, use to enhance performance while painting - editing grass

Enable gizmos that show the grass placement

Enable grass colliders in editor

Enable wind on the grass

Create a windzone and keep its reference to control grass with accordingly.

Increase or decrease windzone influence to the grass

Add a turbulent effect

Show wind effect in editor

Tint grass with a custom color for extra variation

Tint power & color

Tint frequency (defines the frequency of the color shift pattern)

Sun lighting enhancement on grass for a translucent effect

Activate a summary of the basic use of the system

Select paint type. Grass, rocks & fences can be painted in editor or play mode

Grass Manager - Editor v1.3

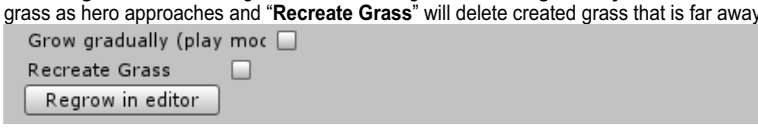
InfiniGRASS v1.3 introduces the following new features:

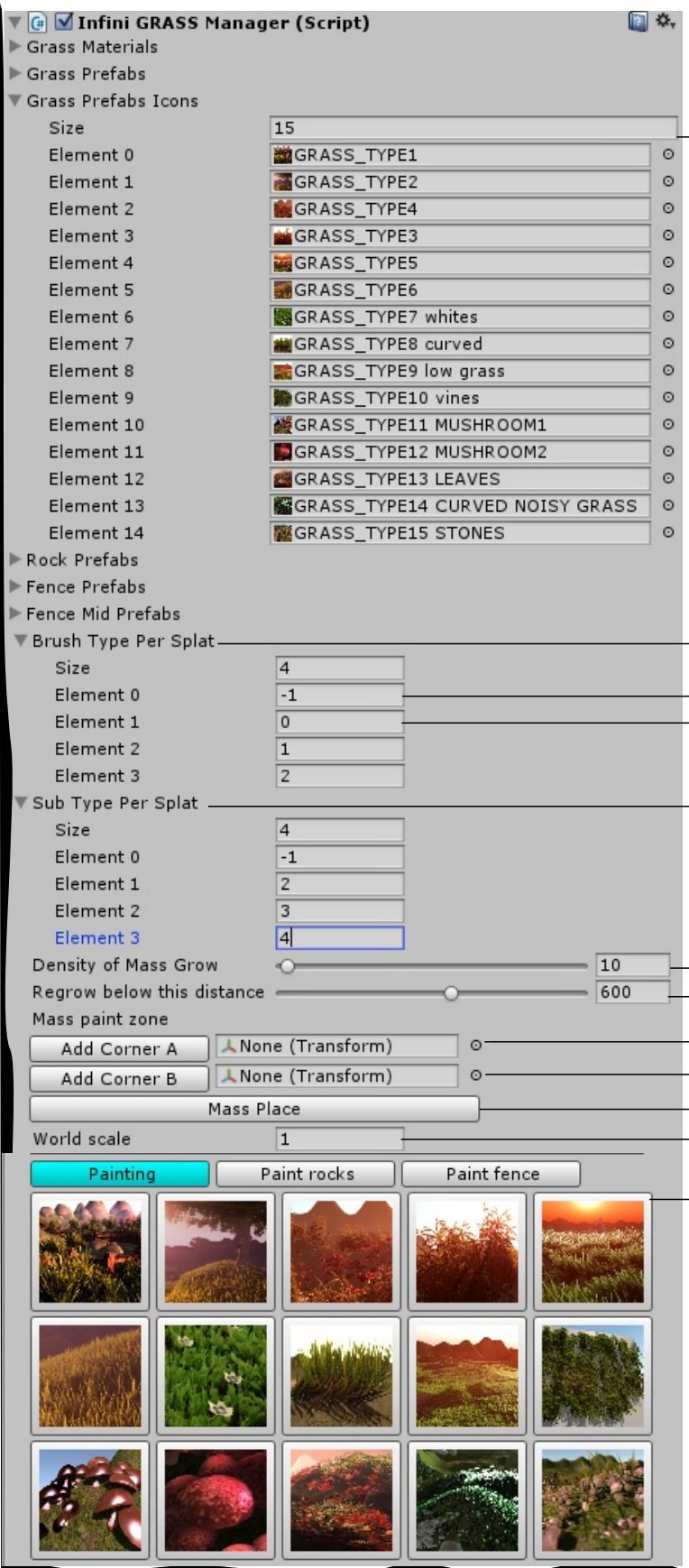
- **Ability to mass place grass,** using two transforms as corners to define a rectangle in the editor
  - The spread can be controlled per splat map, a brush (or no brush wiht -1) can be assigned for each terrain splat.

- **Ability to gradually grow grass** as the hero moves and also optionally erase grass that is far away to lower RAM usage. This feature eliminates the initial delay to grow all grass on the map and also RAM limitation when there is a lot of grass to be grown. This allows for theoretically infinite grass to be placed on vast maps and has the trade off that very dense grass may create a spike as it grows when hero approaches, depending on the target machine power and the player speed. Use the “Regrow below this distance” parameter to define the hero approach distance.

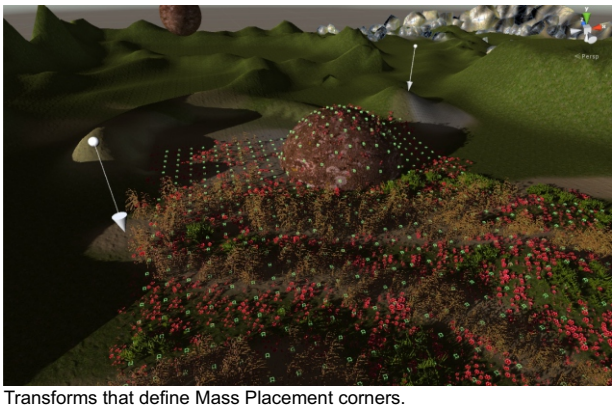
- **Definition of icons** for extra user created custom brushes, in the editor

Gradual growth mode, the grass has to be “Ungrown”. “**Grow gradually**” will create the grass as hero approaches and “**Recreate Grass**” will delete created grass that is far away





Grass brush icons for brushes, these are added in the menu below



Transforms that define Mass Placement corners.
They can be moved while Grass Manager is active.
The 2ond corner (Corner B) must have higher X and Z than corner A.

Assign a brush per splat map for Mass placement

Insert “-1" in order to not spread grass on the specific splat map

Brush ID to be used in splat map

Enable extra grass types for the specific splat map, for variety

Density of grass in Mass Placement, start with lower numbers.

Grass will be grown gradually when below this distance from the player

Transforms that define a rectangle to mass place grass within.
The transforms must be placed above the ground

Mass place grass between the corners and density defined above

Adjust brushes for the desired world scale.

Icons can now be enabled for all custom brushes

The “-1" value will not grow grass on the specified splat map (grass in the below sample)

Grass Painting and control

Painting grass on scene requires the Paint grass button to be pressed and in “painting” mode. **The grass is placed with the right mouse button** and can be **deleted with the left shift keyboard button**. The system uses colliders for the painting, so these must be added to items that need to be pointed with grass. Also to paint on items besides the terrain a **special tag must be added to the item (’PPaint’ tag).**

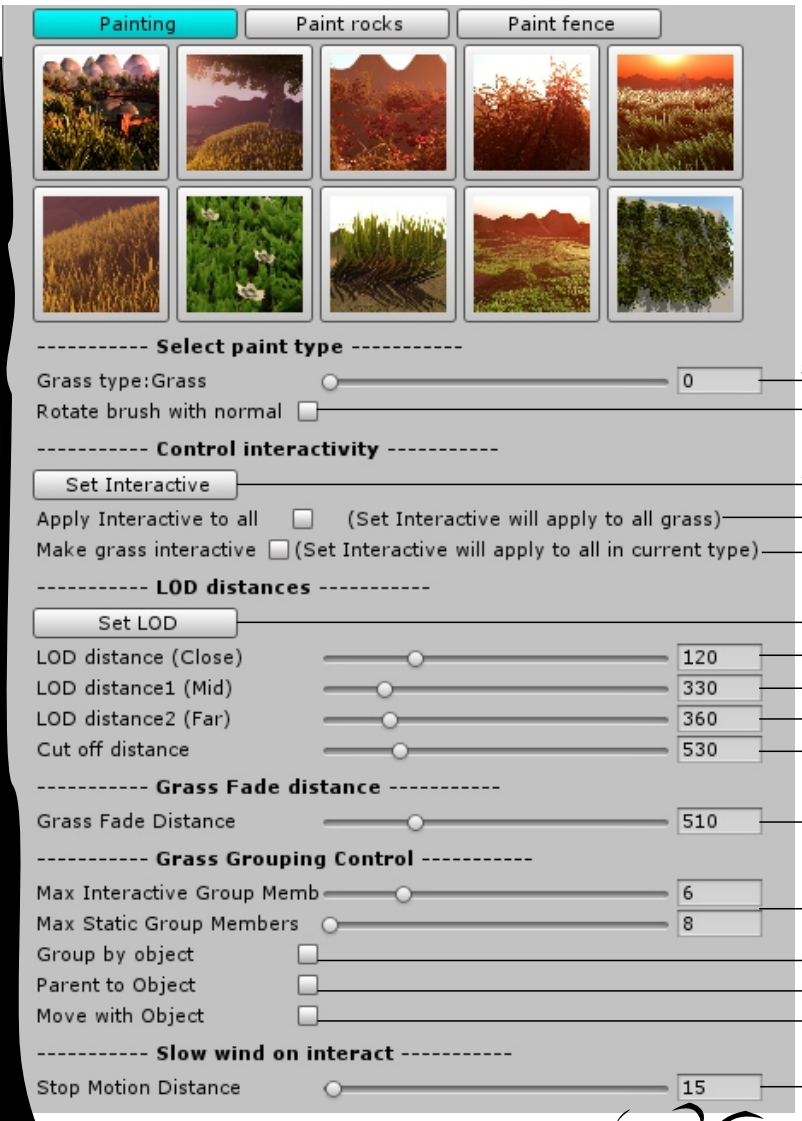
The brush can either be used with a top-down approach (the grass brush grid casts downwards) or using the hit surface normal to rotate the grid and cast towards the normal direction. The normals method is best for painting on objects and the downwards method for painting evenly around a hit point, even when it is angled. The two methods are toggled using the ‘**Rotate brush with normal**’ checkbox.

The grass can be flagged as interactive (’Make grass interactive” option) and this mode allows the grass manipulation in code based on conditions. A step on grass sample is available as reference (’flatten’ option in script), this will scale and rotate grass based on the hero (or other interactor) speed direction and magnitude.

InfiniGRASS has an integrated LOD system, that uses 3 LODs and one cut off distance. Name your materials with ‘LOD0’ to ‘LOD2' word included in the material name and disable their mesh filter in the source prefab, then the system will batch the LODs together and enable them at the specified LOD distances. The cutoff distance will make the grass turn off completely. The grass fade distance governs the fading of the shader based on camera distance, this should be set to fade before the LOD cutoff for a smooth grass vanish effect in the distance.

The system uses a method that automatically groups the items for batching, the number of items to be in each group is controlled by the ‘Max interactive group members’ parameter for the interactive case, which is the most demanding. The static case has a fixed number of 12 items per group, but this may also be changed if required in the prefabs that hold the grass creators. The lower number will allow a faster opening of a group for interaction, but will introduce more draw calls, so there is a trade off between draw calls and interaction performance. The static case requires to only open the group for adding an item if painting grass in real time, which is very fast (depending also whether the grass will be made to grow when painted and the selected growth speed).

Each grass is created by an instantiated script, which also holds a collider that controls the interaction. The created items are then grouped under a batcher and the batcher keeps a reference to the creation script, which is then used to control the batching and interaction.



IMPORTANT: “Group by object” option must be enabled, before using any of the object follow options.

Select grass id of grasses prefabs. Icons cover only the sample prefabs.

Cast grass grid along the hit surface normal (or downwards if disabled)

Set items as interactive in batch. It will apply to the currently selected prefab.

Make all grass items painted interactive, with ‘Set Interactive’

Check to paint interactive grass (static has better performance and can still allow grass addition in play time. Interactive flag is for longer interaction actions.

Set the defined LOD & cutoff distances for all painted grass. Use only in editor.

LOD0 distance for the painted grass

LOD1 distance for the painted grass

LOD2 distance for the painted grass

Cutoff distance for the painted grass

Smooth shader based fade, set distance so that grass will fade before cutoff

The max number of grass patches to be batched together. Use a smaller number than static grass, to have batched groups open faster for interaction.

Group grass for batching by target object, to allow following the object

Parent the batched grass to the object it is painted on, using Group above.

Move grass with the object it is painted on, without parenting (scripted)

Stop wind motion near interactor, so the scripted based control takes over the grass motion completely. Use to avoid sudden motions on interaction.

Grass Painting and control

Painting can be done with various options, enabled from either the editor or the prefab directly for more advanced uses.

The grass patch distance is the minimal distance a new patch will be created at from the last & is used to control constant painting.Raycast distance governs how far the ray will be cast from the hit position to spead the grass patch grass blades.

Grass can have a random scale range. The spread (distance from the hit point) and density defined in the instantiated source prefab can be changed while painting using the Override Grass Spread and Density options. Note that minimum density should be kept lower than maximum for best performance.

Grass placement supports elimination of grass blades that do not hit on the original painted surface and hit on other colliders. This is useful for placing grass near obstacles. The system will check in Near distance for elimination to cut blades or Near distance for scaling to scale blades. If very few blades do register, the 'Clean up low blade count' option can remove the grass patch, if blade count is lower than the minimal for clean up defined with the corresponding slider.

The interaction option refer to the collider that touches the grass and its speed. The Power factor will enchance the force asserted on grass based on collider speed and the Min speed for interact will cut off interaction when the collider speed is lower than the defined threshold.

Select grass id of grasses prefabs. Icons cover the sample prefabs.

Cast grass grid along the hit surface normal (or downwards if disabled)

Activate region based erase.

Radius to erase around the mouse position.

Set range of grass scaling

Scale values min-max (set specific number)

Set range of grass random rotation

Rotation values min-max (set specific number)

Collider scaling (for interaction)

Gizmo scale for preview in editor

Check to define a different density than the set in the grass prefab.

Grass density min-max

Check to define a different spread area than the set in the grass prefab

Grass spread area min-max

Use scaling based on Unity Terrain splat maps (weighted).

Clean up low on blades grass patches

Grass patch deleted if it has lower blade count than the defined

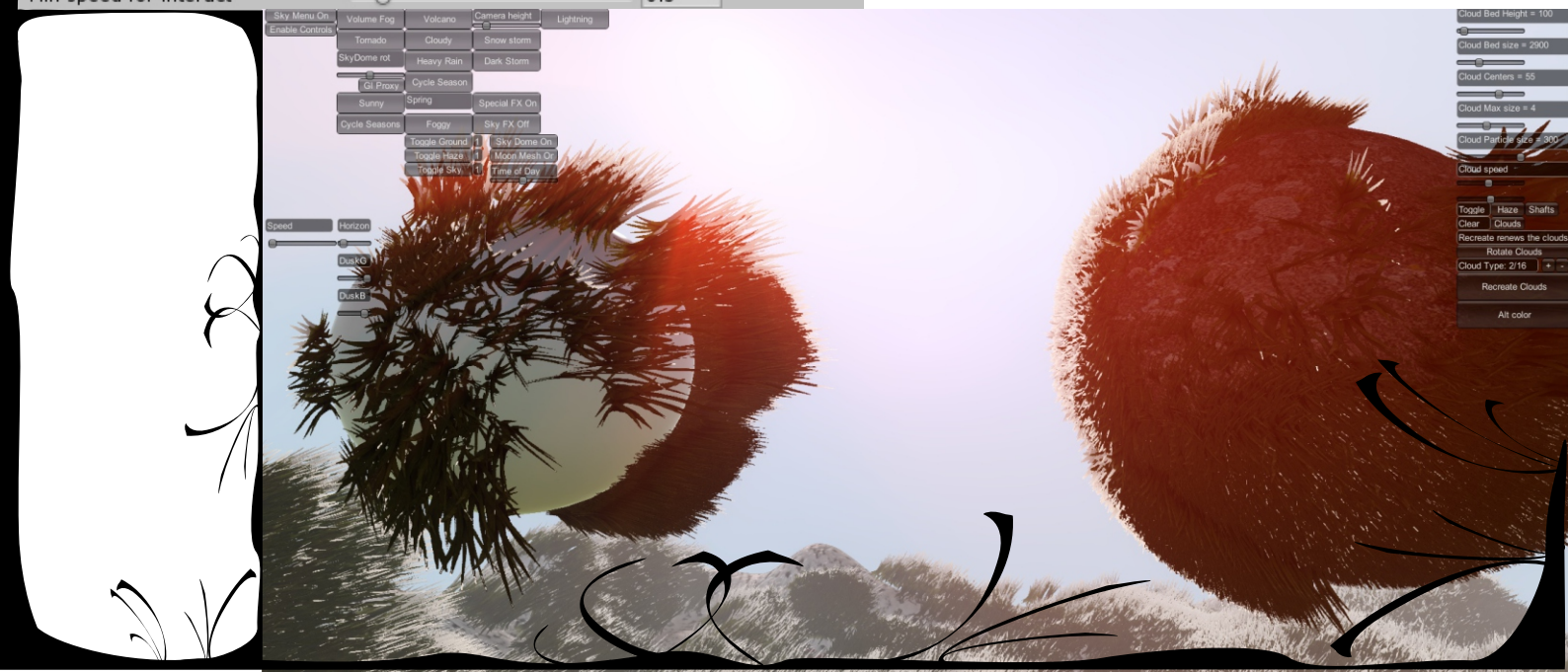
Cut blades that hit different colliders at that range

Scale down blades that hit different colliders at that range

Avoid hitting the automatically created grass collider while painting

Enhance the force asserted on grass based on collider object speed

Cutoff interaction if interactor speed lower than this threahold

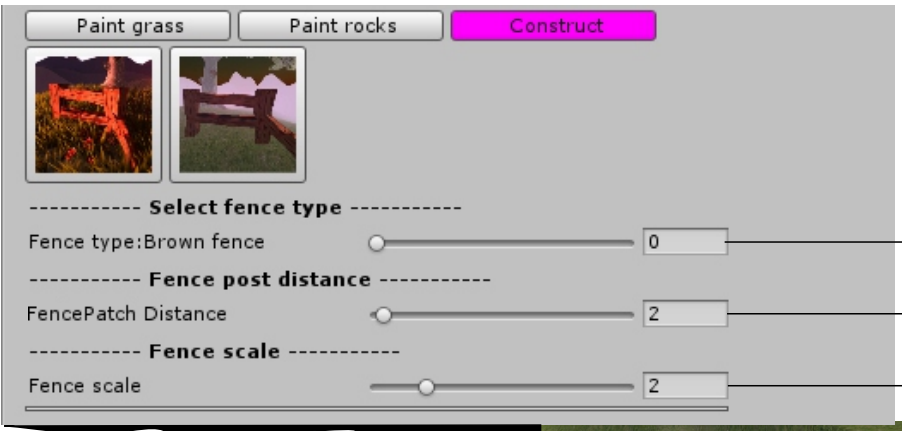


Fence Painting and control

Painting fences starts by selecting Paint fence mode. The first mouse click starts the fence at the clicked point and then dragging the mouse will extend the scale. Click again to place the next post and when the fence is painted, click on ‘Construct’ button to exit fence paint mode and finalize the fence. Press Paint fence to start on the next fence.

Fence post distance will stop fence posts from being created near the last post. Fence scale should the same for the whole fence (it can be changed during fence creation though and then the result may be manually refined).

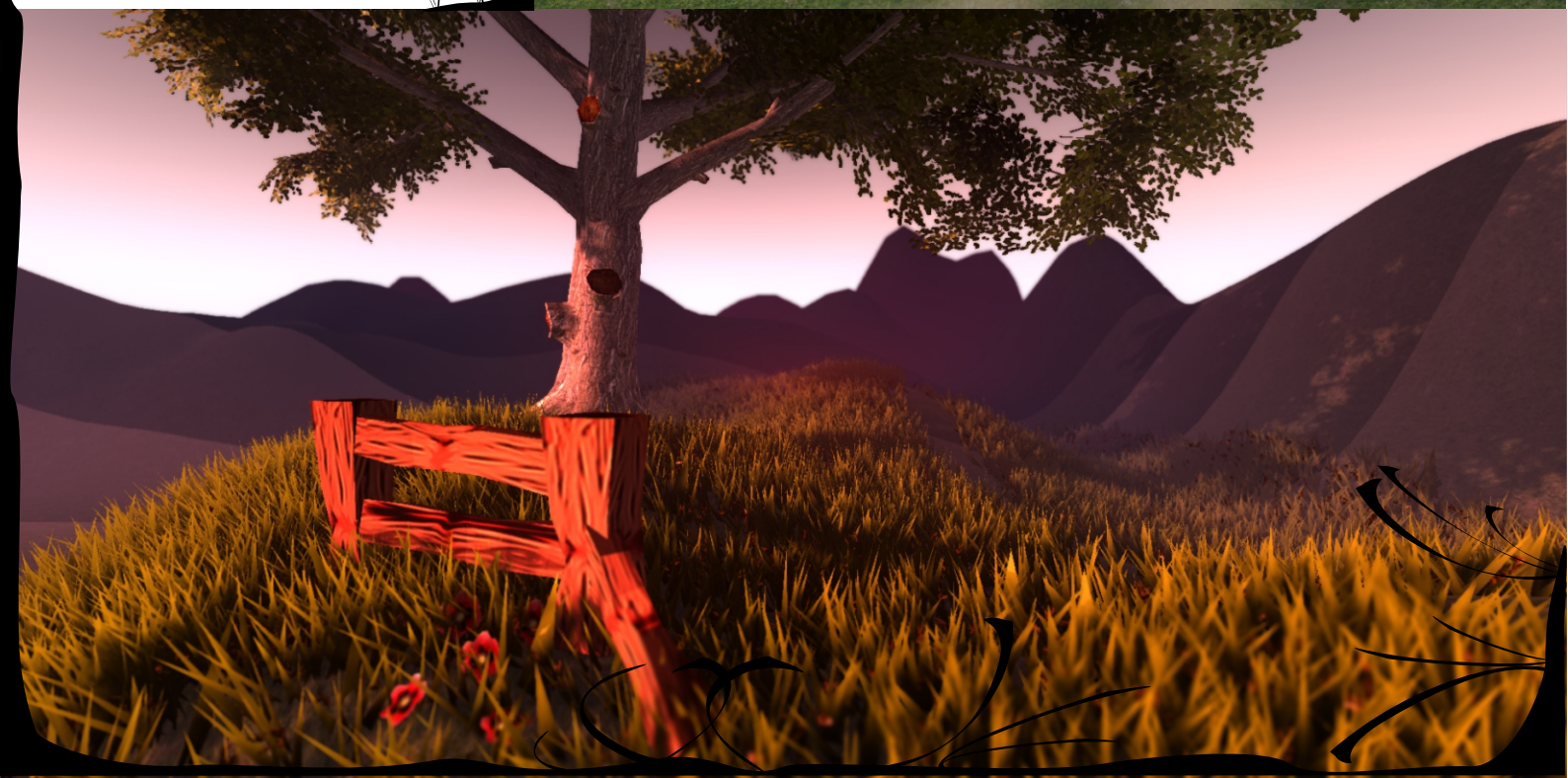
The fence will automatically be grouped in a single gameobject for best organization and will be batched when in play mode for performance. Note that the real time painted fence will be batched per fence, while the editor will be batched whole (all fences together).



Select fence id of fences prefabs. Icons cover the sample prefabs.

Set minimal distance between two fence posts

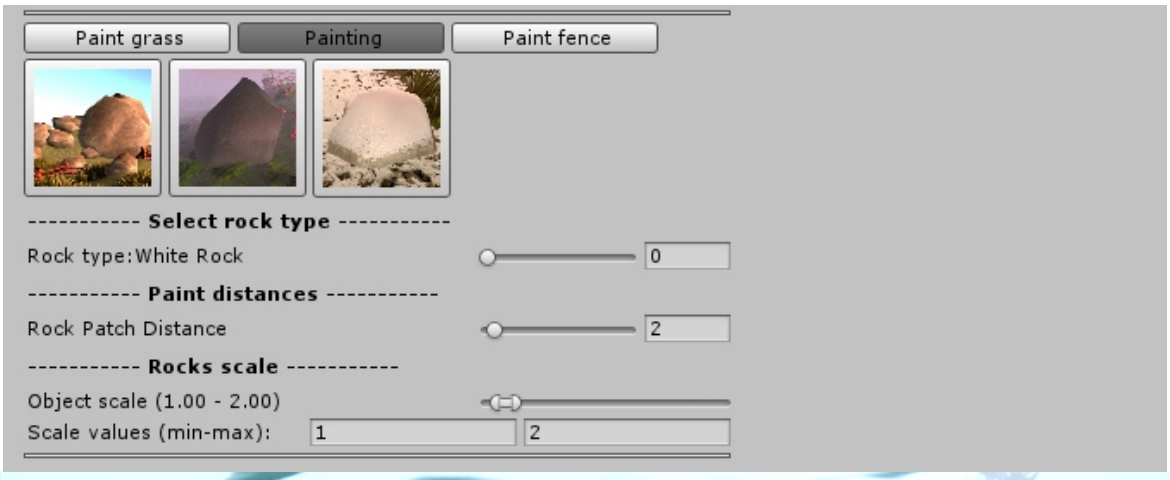
Fence scale

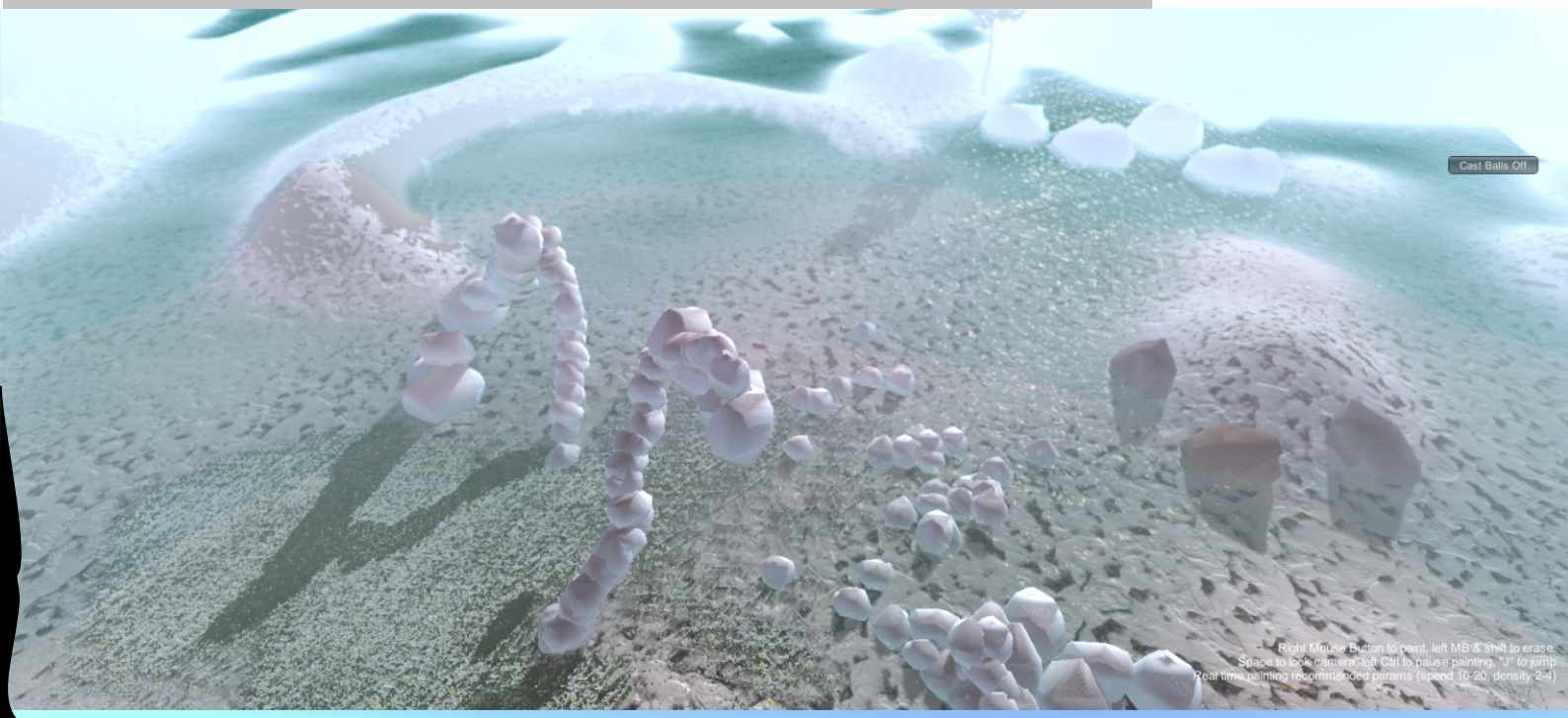


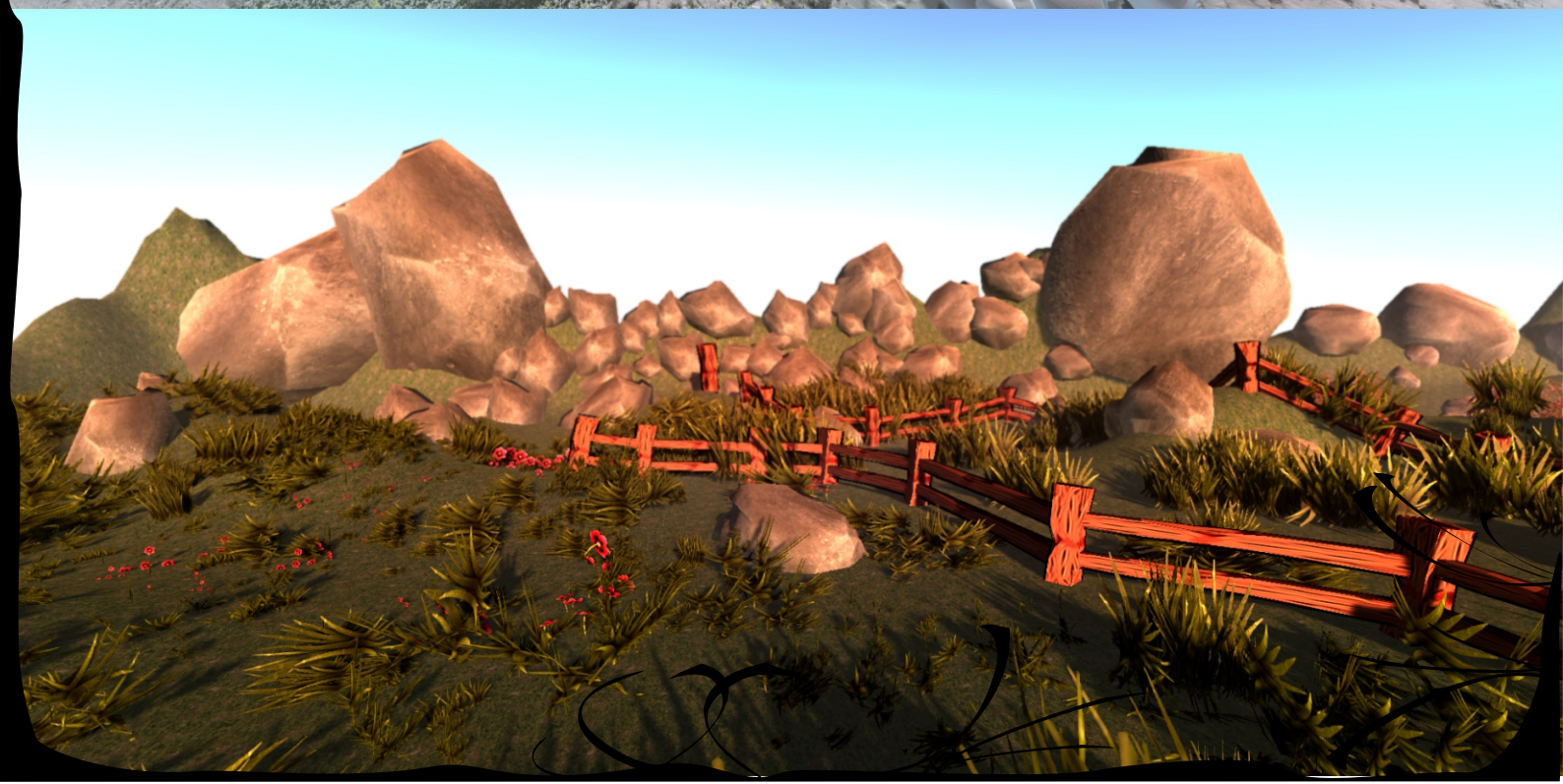
Rock painting

Painting rocks is similar in options to grass (scale and patch distance) and can be done with the left mouse button and same erase scheme (left shift).

Rocks are auto batched for speed. Rocks may be painted on top of each other (when PPaint tag is given).







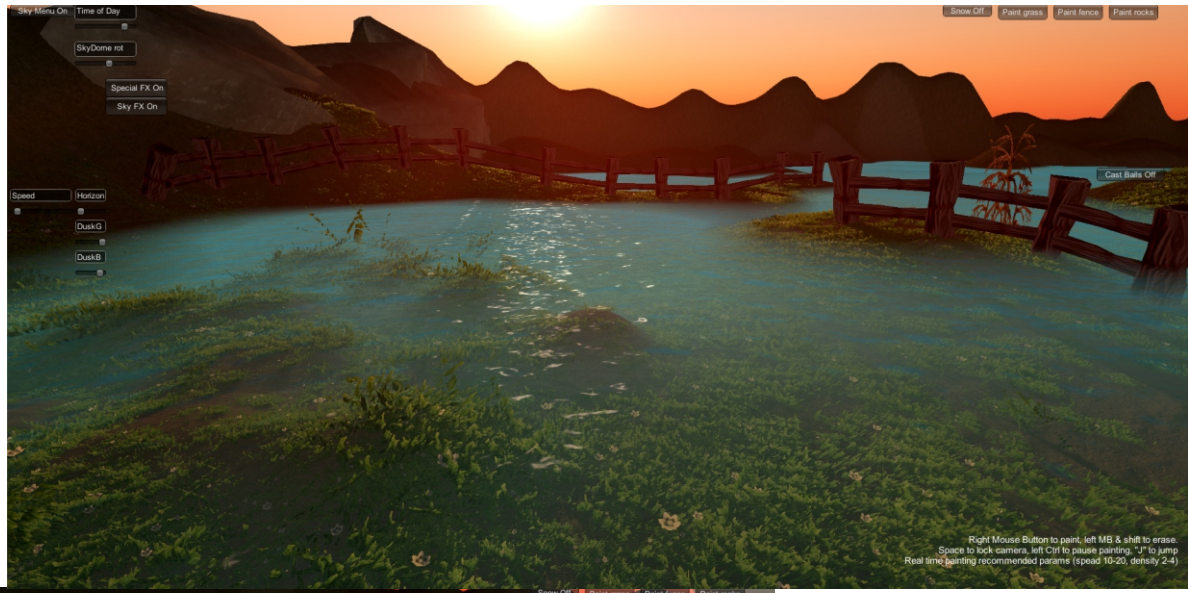
On grass shaping.
- Use low polygon grass for lower end platforms. The vertex variety grass and shaders are a great start for such a setup.
- Create variety by adjusting blades in branch prefabs in various sizes and rotations. Size will also vary based on the level of growth. The grass grows like a tree, where branches are then brought to the ground level.
- The system will align the up vector of the grass blades (branches) with the surface normal, so orient the blades based on the required angle to the up vector (which will determine the angle to the painted surface).

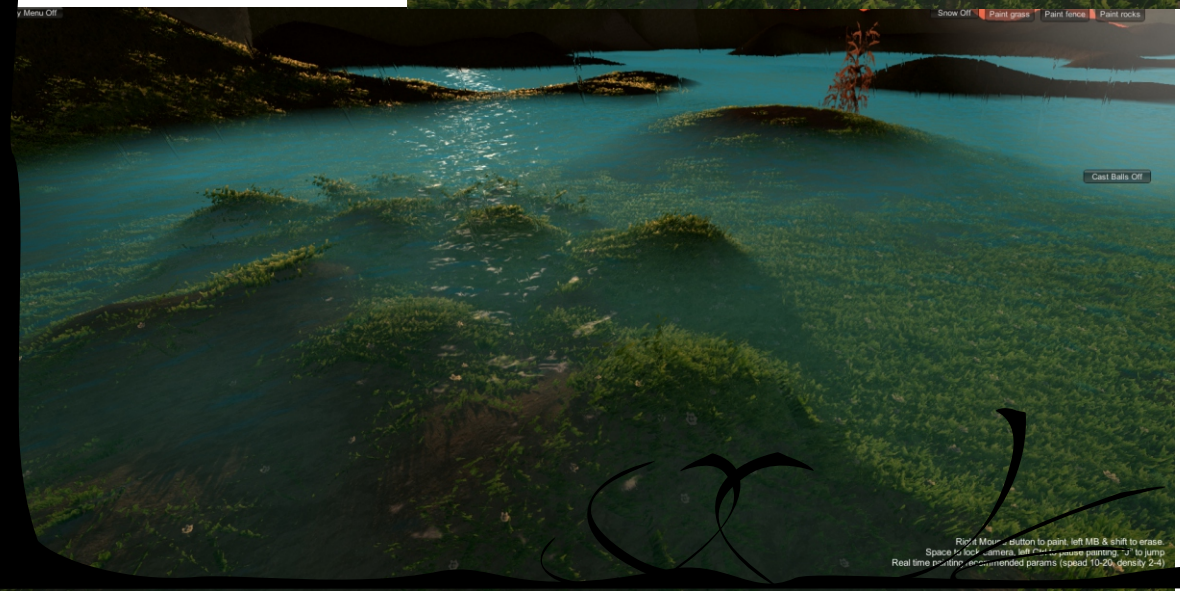
On grass grouping
- Use a lower items count for dynamic grass grouping, as the dynamic phase of grass opens up grass patches locally and this will increase draw calls during the action, so the less items the opened group has, the less the impact on draw calls during interaction. Also it is much faster to open the batched group, which means less or no spike during interaction start - end.

Using lower items per group will create more groups, which in turn will cause a higher draw call count while not interacting, and the LOD system can be used to lower this draw call count.

For static grass a higher count of items may be used, if there is no grass growth in real time it is best to have an as high number as it makes sense for a local LOD group to form.

On grass painting in Unity editor.
- For the more detailed grass, Unity editor introduces a delay while painting/moving the camera, so it is best to use a lower editor view distance number and move closer to the painting area. After painting the grass can be disabled for faster scene editing and reenabled before play mode.
- Use the mass erase mode for easier erase of grass.
- The editor holder object must be selected in order to paint grass and control editor view LOD (so if grass is LODed in editor, to restore it when close up, the Grass Editor gameobject must be active.





On managing grass in scenes

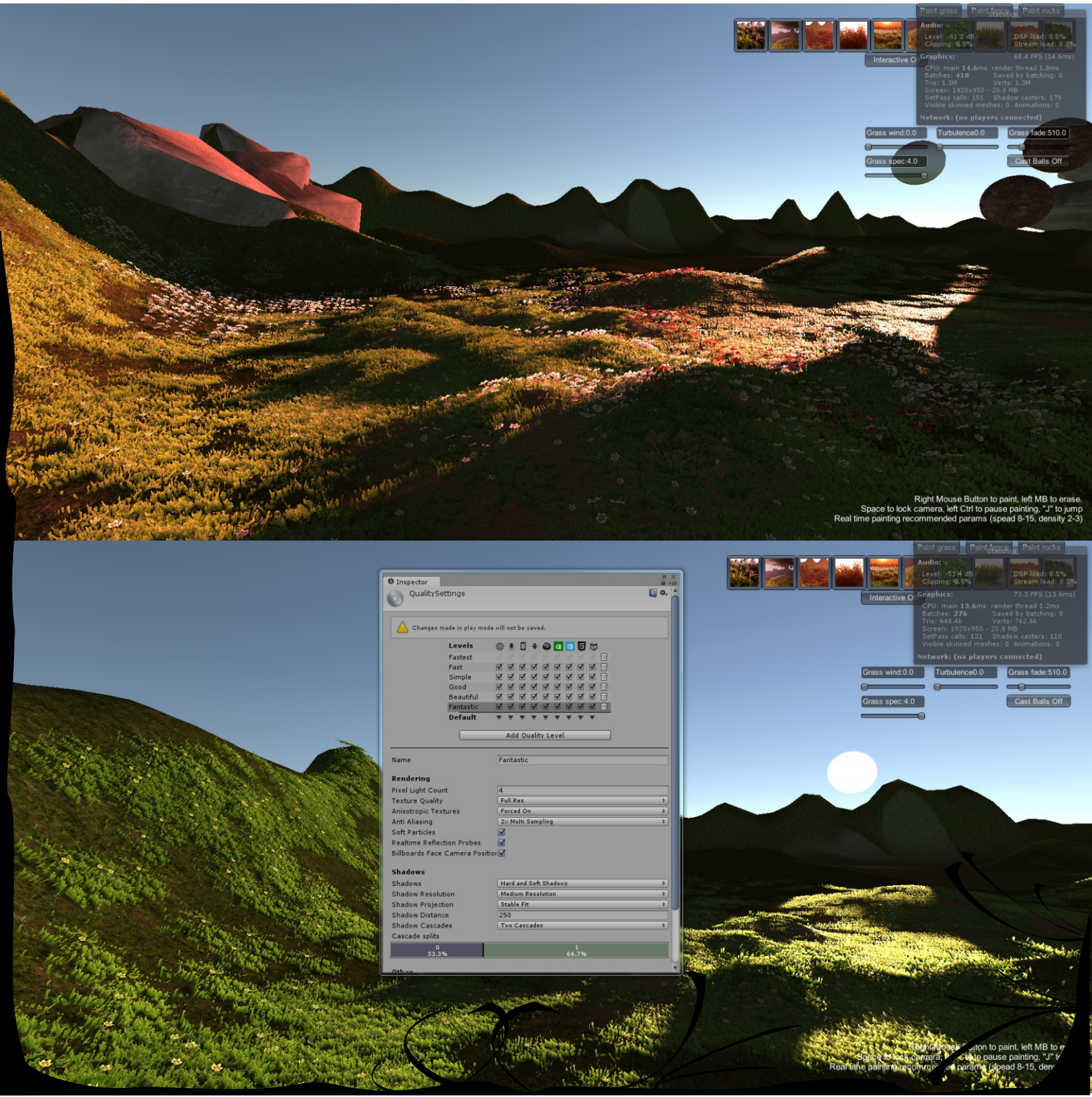
- The system allows the ungrowth of all painted grass in the Unity editor. This allows to reduce the saved scene size, as the grass is only grown at play time. Also it increases the speed of the Unity editor, if the grass quantity is very big.
- The grass can be grown back for further editing at any time.

On image quality settings

- The image quality vs performance depends a lot in the quality settings set for the game. The shadowing is the most important factor and it is recommended to use medium resolution shadows and 2 cascades. Resolution is more important in performance impact and has the least impact in image quality, so the best ratio of image quality vs performance is at medium quality shadows and 4 cascades.

On overdraw

- One of the performance factors with the transparent version of the grass, is overdraw. To avoid overdraw it is a good practice to reduce grass density on taller grass, mix low height grass with higher height one and use vertex grass to fill in between areas.
- Use textures with as little transparent space as possible in the edges & keep the blades prefab in an arrangement where blade quads wont overlap a lot (with a large angle between them, which is also good for making grass look full)



Custom grass prefab creation

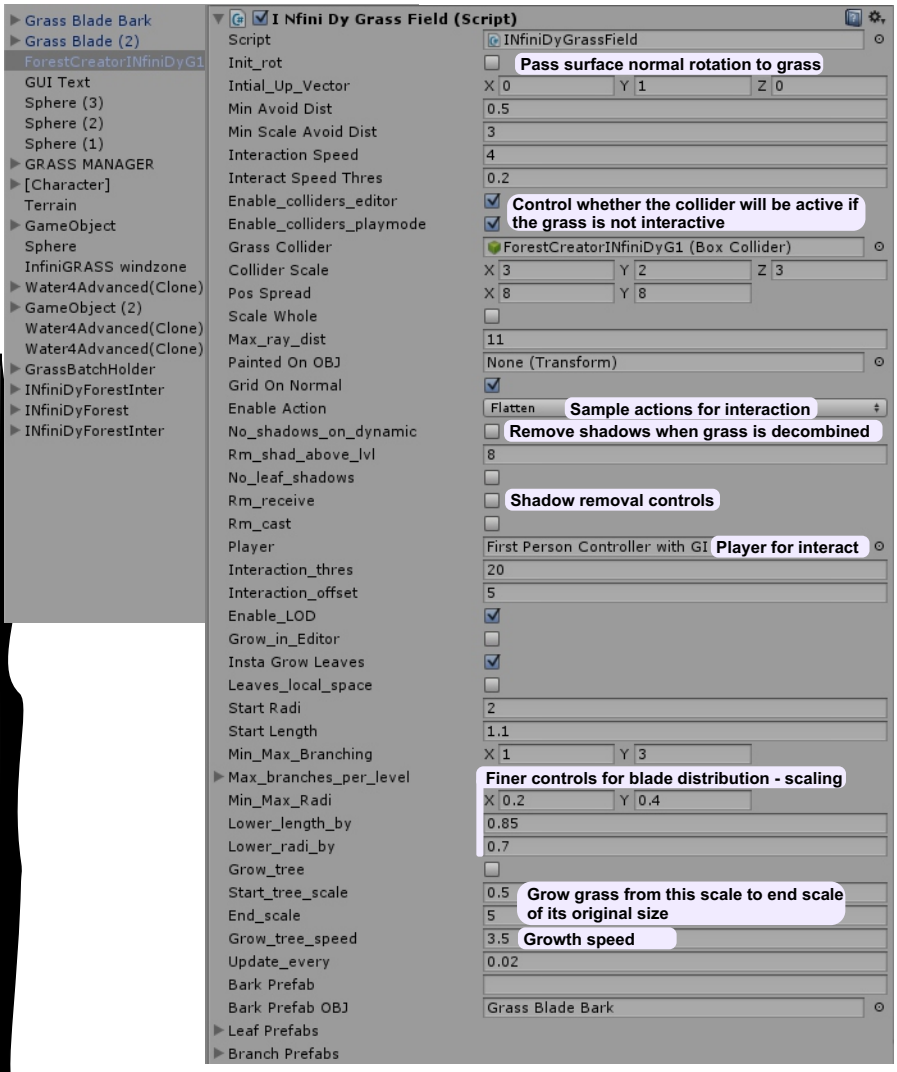
The anatomy of the grass patches prefab will be described in this section. The prefab is a single script, that also holds a collider and a collision handler script. This script instantiates the ‘bark’ (grass base) and ‘branches’ (grass blades) that are defined in its parameters.

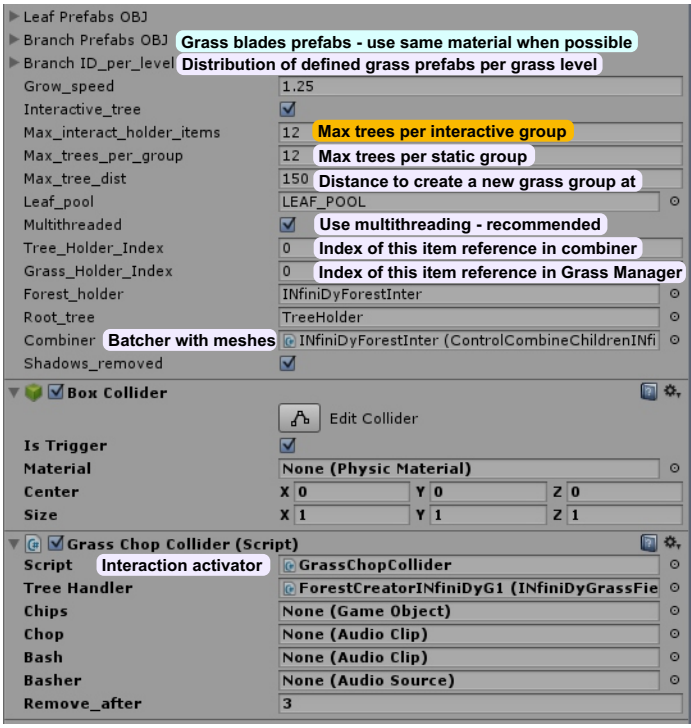
The bark is a single item in the base of the grass (can be used to have a middle flower for example, or for any other use). The LOD may also be a plane in bark itself (if no branch LOD materials are defined, which means no grass blades will be shown at LOD distance), for better performance.

The steps to creating this prefab are:

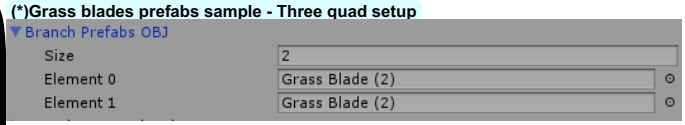
1. Create an empty gameobject.
2. Add the ‘InfiniDyGrassfield’ script to the object
3. Add a collider and the ‘grassChopCollider’ script that handle the collision for the dynamic grass
4. Add the grass middle part and grass blade prefab in the “bark prefab OBJ’ and ‘Branch Prefabs OBJ’ parameters. Leaves may also be defined as an extra decoration for the ground (Leaf prefabs OBJ).
5. Define InfiniGRASS materials for the grass blades and flowers
6. Create a prefab and add it to the grass prefabs in the Grass Manager (and its material)

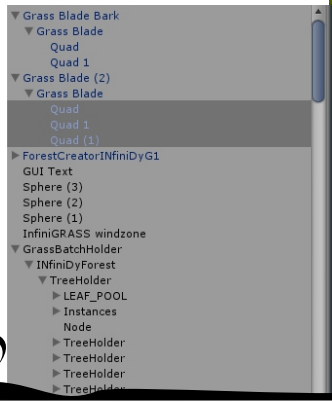
Note that the grass can be any item, so the system can be used to efficiently spread essentially anything around the level, in both editor and real time.





(*)Grass blades prefabs sample - Three quad setup





Exporting grass patches

InfiniGRASS has an export feature that can create an object file from a grass patch. This is useful for organizing static grass and helps in Unity editor performance, as the grass patch is a batched version of the painted grass, like it was batched in play mode for performance.

The system should be used in play mode and when the grass patch is static (so batching applies).

The idea is to copy the batched grass patches as a single model in the disk and place it in the scene to replace (or act with) the already painted grass the batched patch corresponds to.

Steps for grass patch creation:

1. Paint grass in the editor or in real time

2. Choose a big static group members count so all relevant grass will go in the same group

3. After the grass patch is painted, enter play mode and select the batched mesh (or meshes if it was split in 64K vertices)

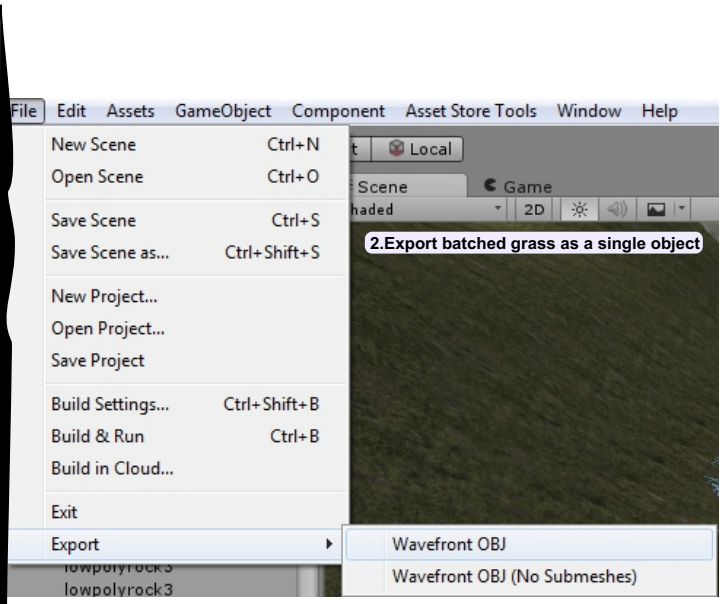
4. Goto File -> Export -> Wavefront object and click to save to a selected directory

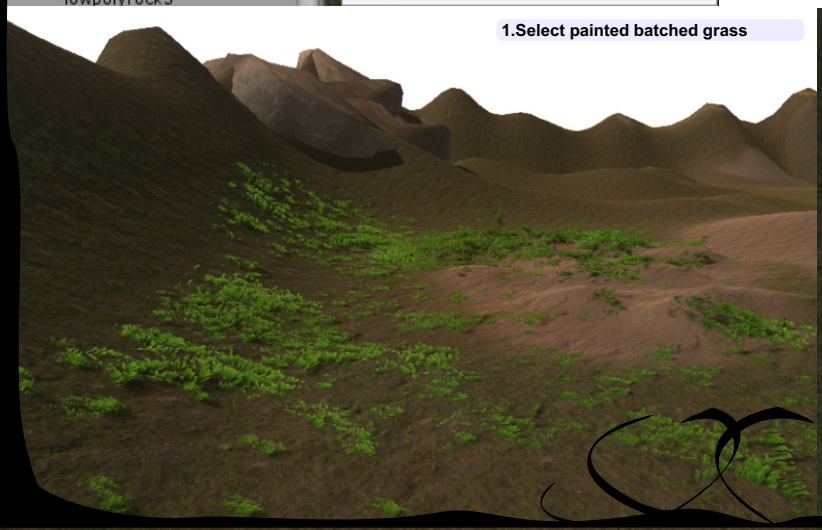
5. Exit play mode and insert object in the scene, rotate the root of the object 180 degress and it will move to the proper location.

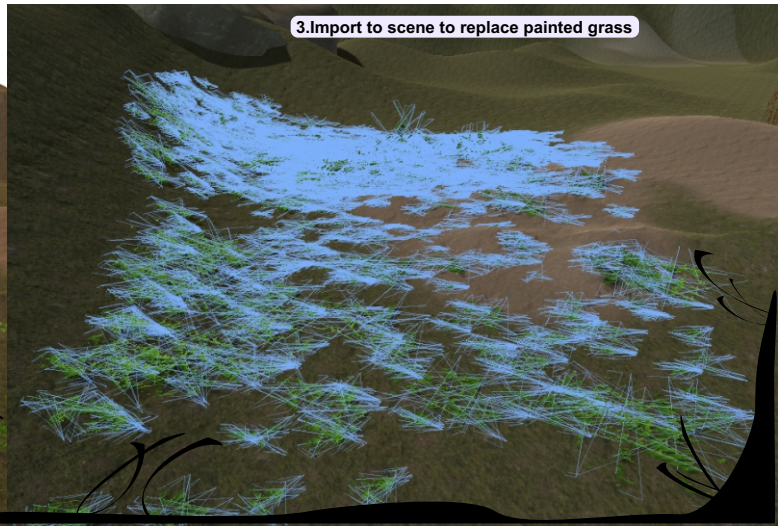
6. Apply the material of the originally painted grass on the created grass patch and it can now be used independetly of the InfiniGRASS system as a separate entity. A prefab can also be created after this step, so it keeps the material and location when inserted in the scene.

NOTE: The grass area should be kept low, so a LOD system can be applied to the patches (a simple cutoff based on camera distance for example)

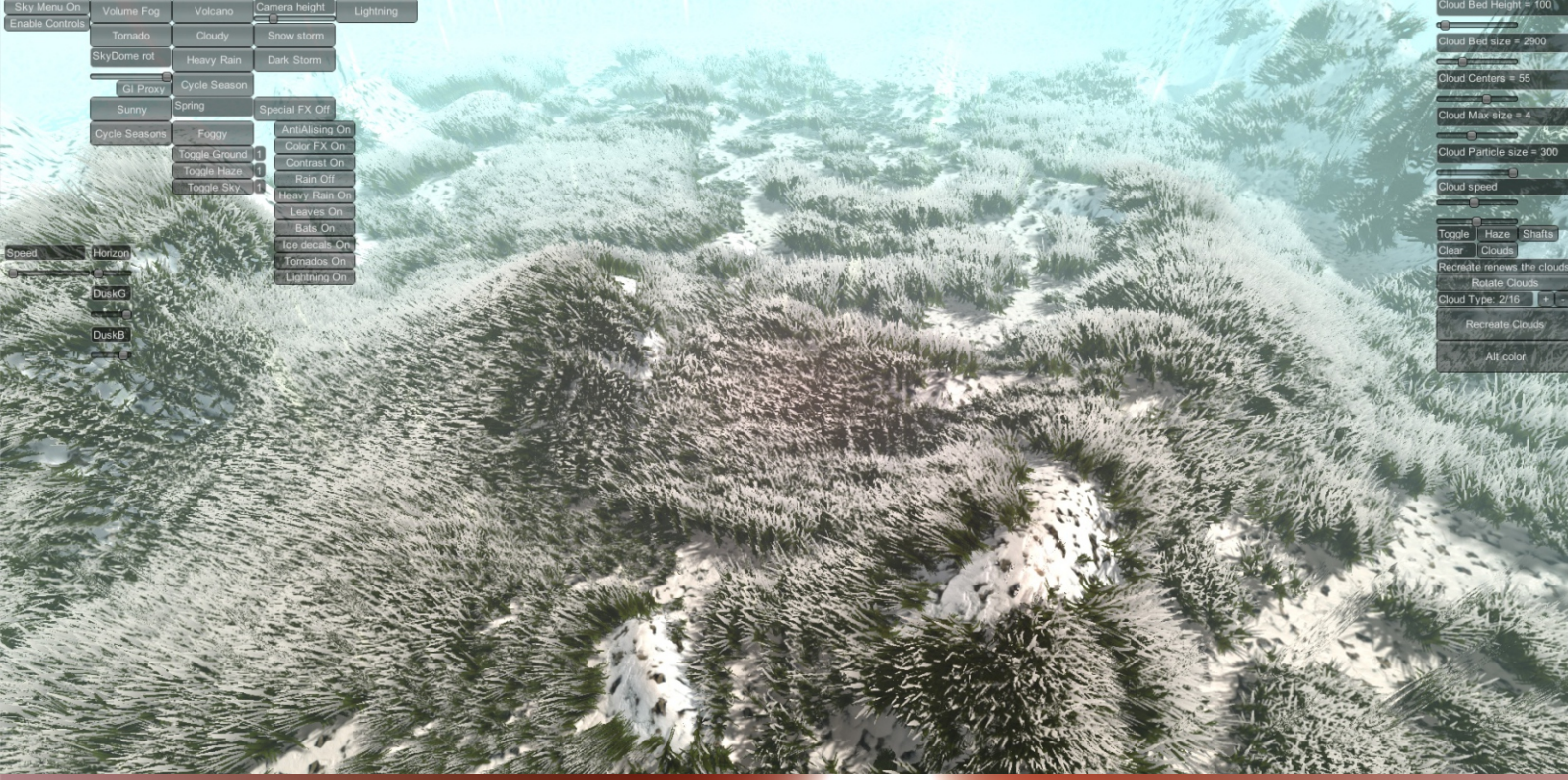
NOTE 2: The fading based on camera will still work, so the LOD cutoff may fade for a smooth grass vanishing.

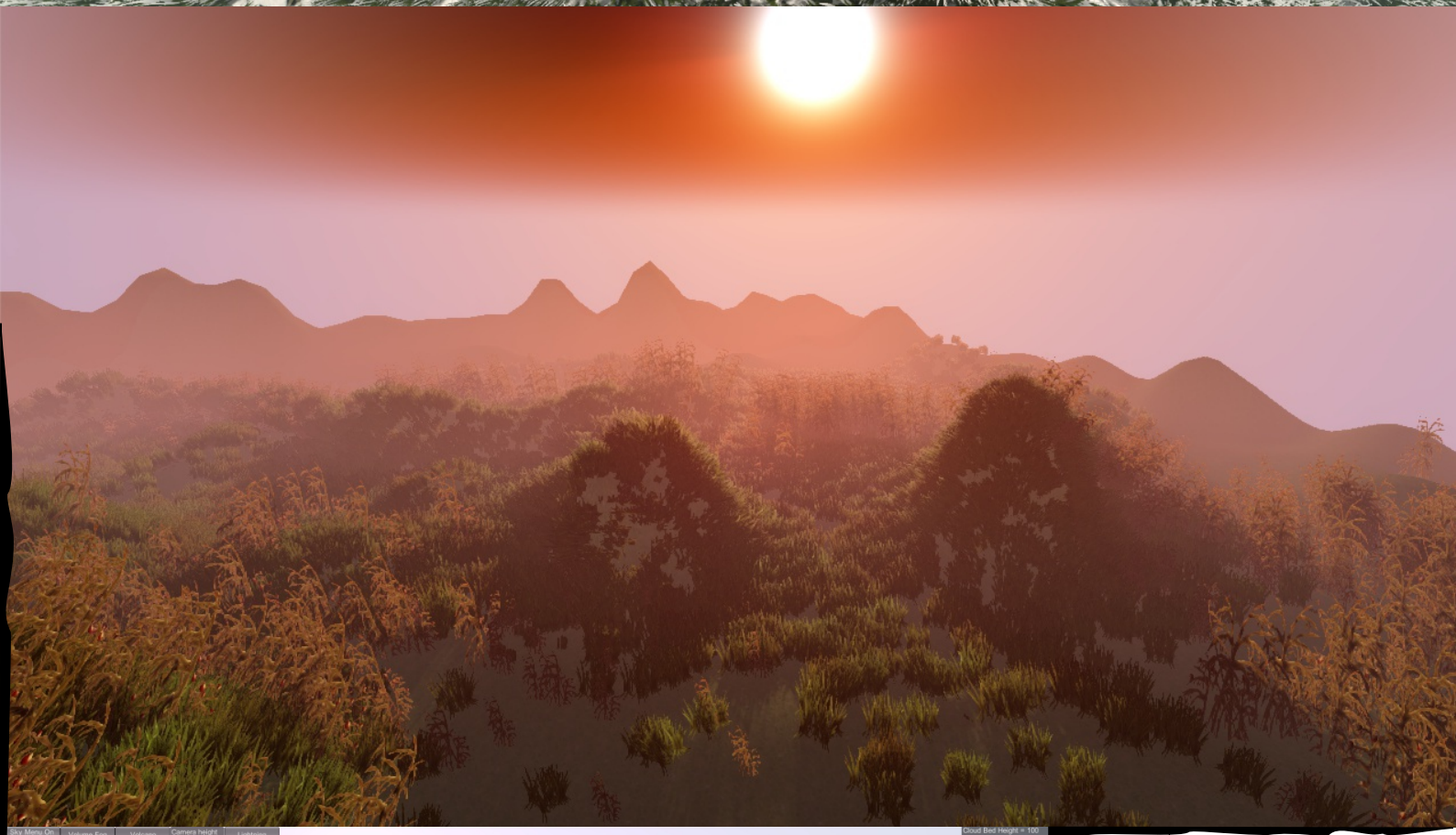




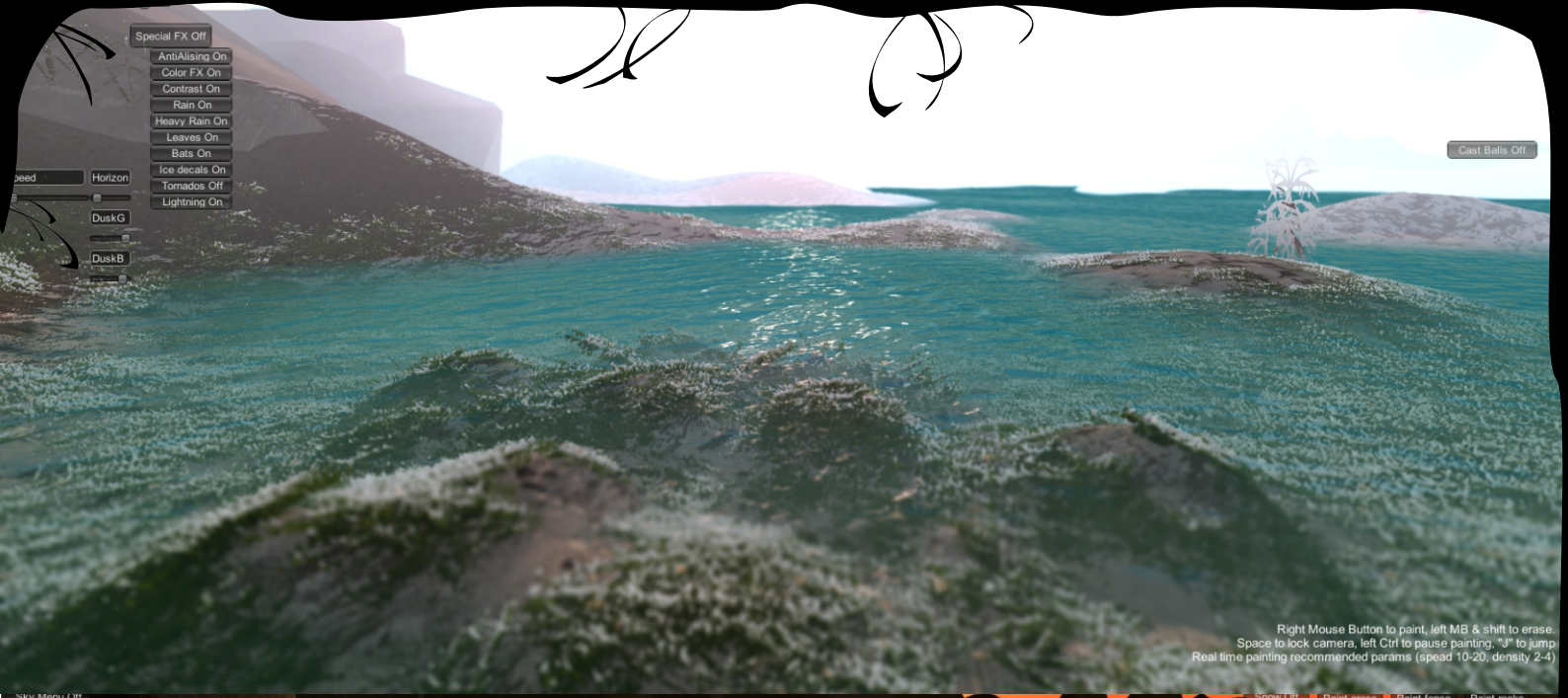


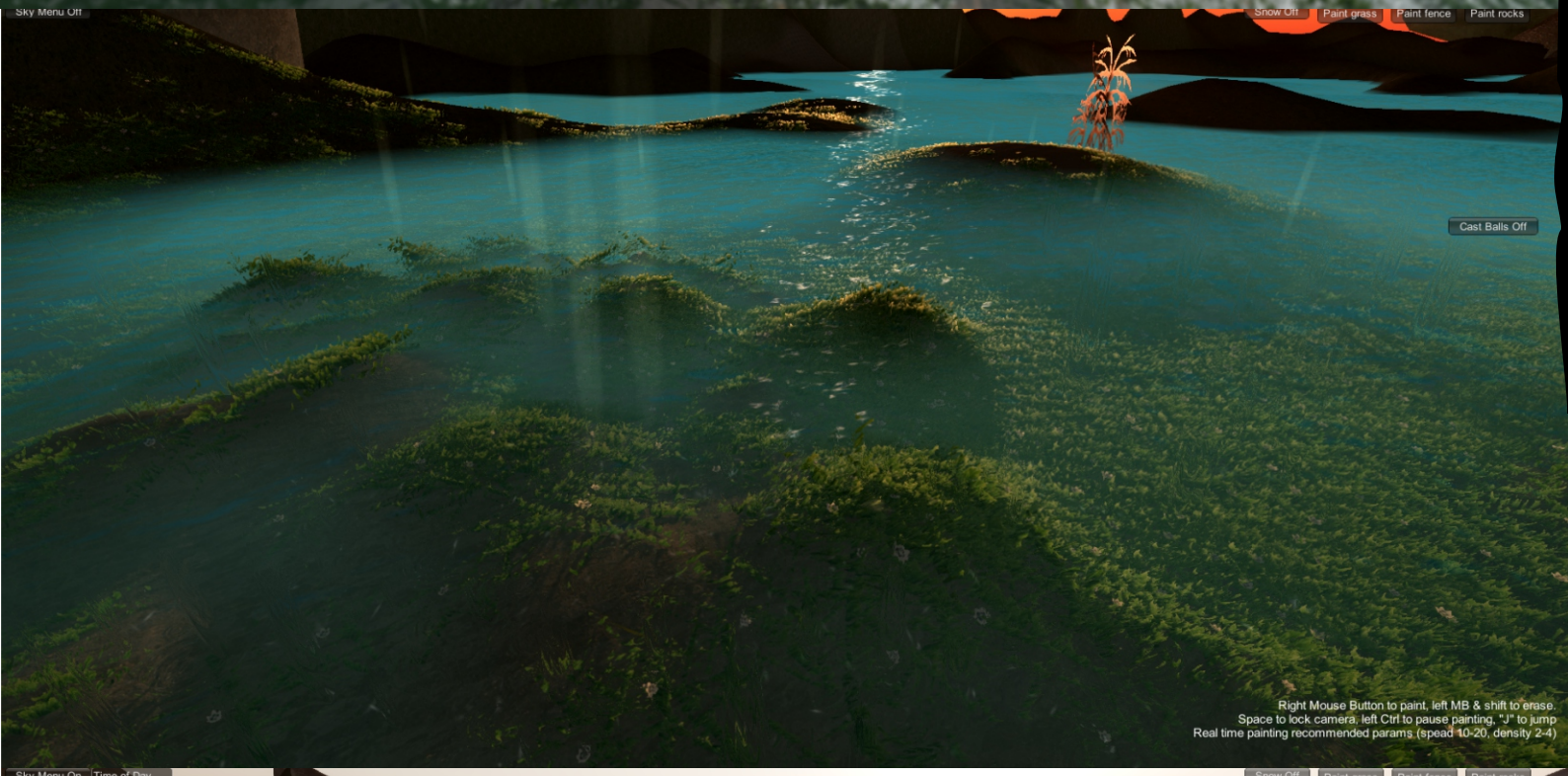

Sky Menu Off
Snow Off
Paint grass
Paint fence
Paint rocks
Cast Off
Right Mouse button to paint, left to erase.
Space to lock camera, "J" to jump


Sky Menu On
Enable Controls
Volume Fog
Volcano
Camera height
Lightning
Tornado
Cloudy
Snow storm
SkyDome rot
Heavy Rain
Dark Storm
GI Proxy
Cycle Season
Sunny
Spring
Special FX Off
Cycle Seasons
Foggy
AntiAlising On
Color FX On
Toggle Ground
Contrast On
Toggle Haze
Rain Off
Toggle Sky
Heavy Rain On
Leaves On
Bats On
Speed
Horizon
Ice decals On
DuskG
Tornados On
Lightning On
DuskB
Cloud Bed Height = 100
Cloud Bed size = 2900
Cloud Centers = 55
Cloud Max size = 4
Cloud Particle size = 300
Cloud speed
Toggle
Haze
Shafts
Clear
Clouds
Recreate renews the clouds
Rotate Clouds
Cloud Type: 2/16
Recreate Clouds
Alt color




Sky Menu On
Enable Controls
Volume Fog
Volcano
Camera height
Lightning
Tornado
Cloudy
Snow storm
SkyDome rot
Heavy Rain
Dark Storm
GI Proxy
Cycle Season
Sunny
Spring
Special FX On
Cycle Seasons
Foggy
Sky FX Off
Toggle Ground
Sky Dome On
Toggle Haze
Mood Mesh On
Toggle Sky
Time of Day
Horizon
DuskG
DuskB
Cloud Bed Height = 100
Cloud Bed size = 2900
Cloud Centers = 55
Cloud Max size = 4
Cloud Particle size = 300
Cloud speed
Toggle
Haze
Shafts
Clear
Clouds
Recreate renews the clouds
Rotate Clouds
Cloud Type: 2/16
Recreate Clouds
Alt color


Special FX Off
AntiAliasing On
Color FX On
Contrast On
Rain On
Heavy Rain On
Leaves On
Bats On
Ice decals On
Tornados Off
Lightning On
Horizon
DuskG
DuskB
Cast Balls Off
Right Mouse Button to paint, left MB & shift to erase.
Space to lock camera, left Ctrl to pause painting, "J" to jump
Real time painting recommended params (spead 10-20, density 2-4)


Sky Menu Off
Snow Off
Paint grass
Paint fence
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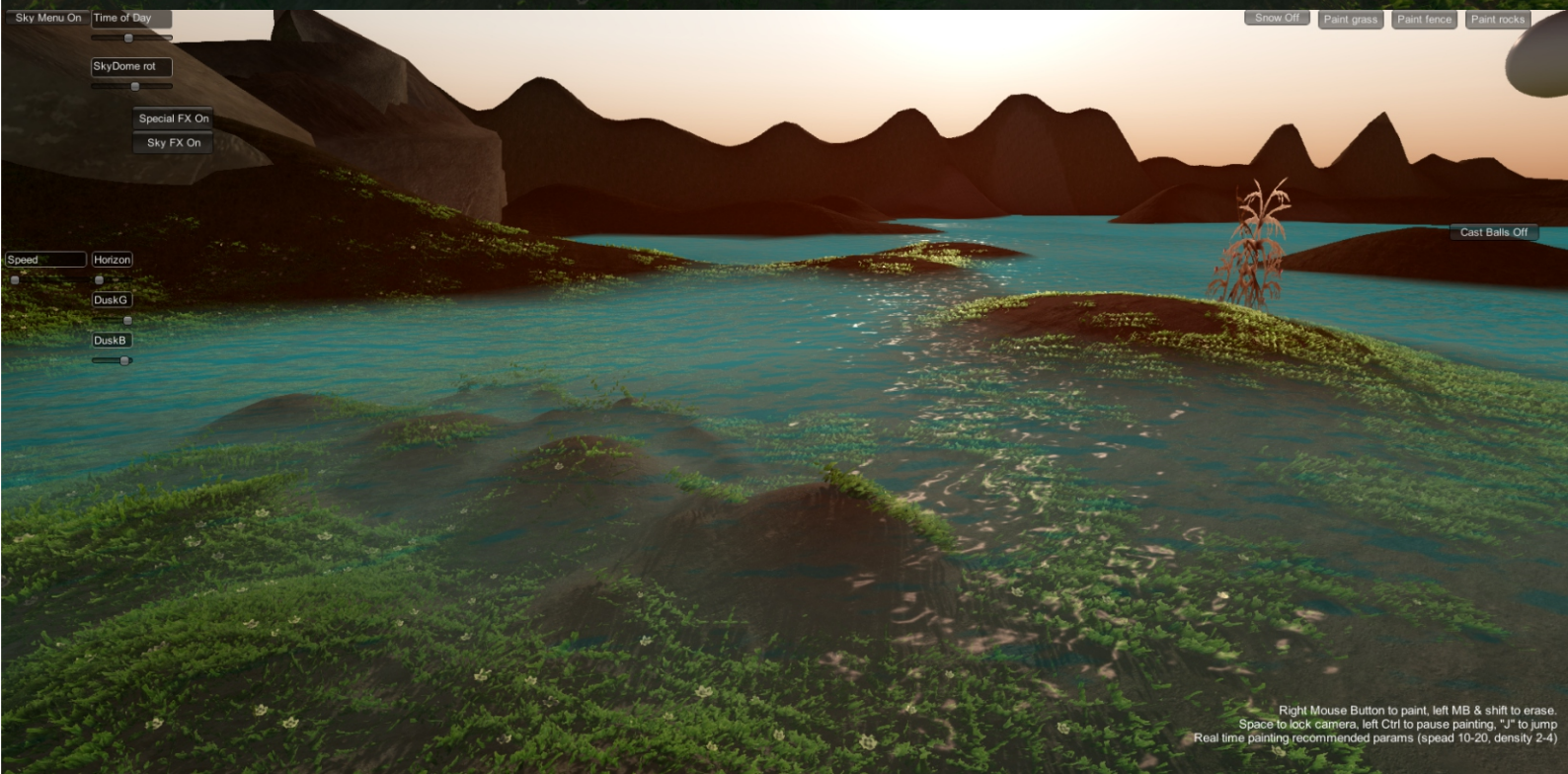
Sky Menu On
Time of Day
SkyDome rot
Special FX On
Sky FX On
Snow Off
Paint grass
Paint fence
Paint rocks
Speed
Horizon
DuskG
DuskB
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