

# Ethereal URP – Volumetric Lighting, Atmosphere and Fog

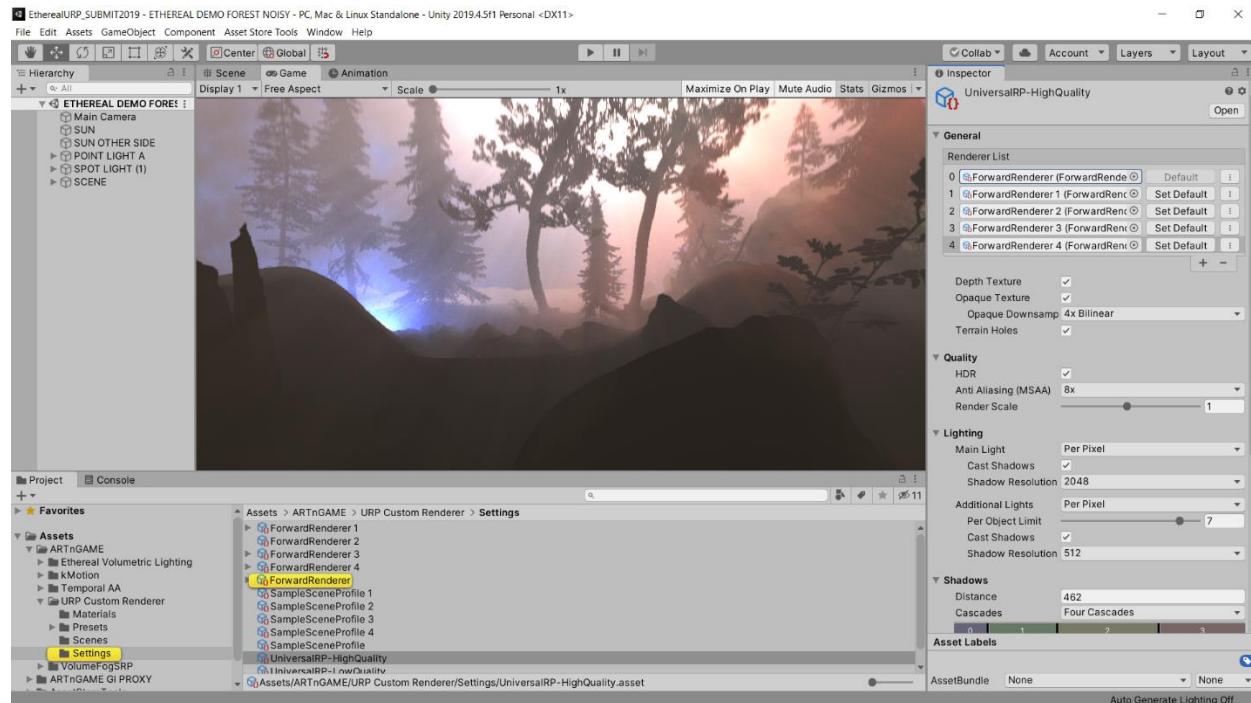
(v1.3.0)

**Ethereal URP is a system to apply volumetric lightning and fog effects in the Universal Pipeline (URP) in Unity. For help with using the system and using it with [Sky Master ULTIMATE](#) Weather suit, please visit [ARTnGAME Discord channel](#), [Tutorial videos](#) and the [Ethereal Forum](#) thread.**  
The system works in URP 7.4.3 and above and supports URP11 and URP12.

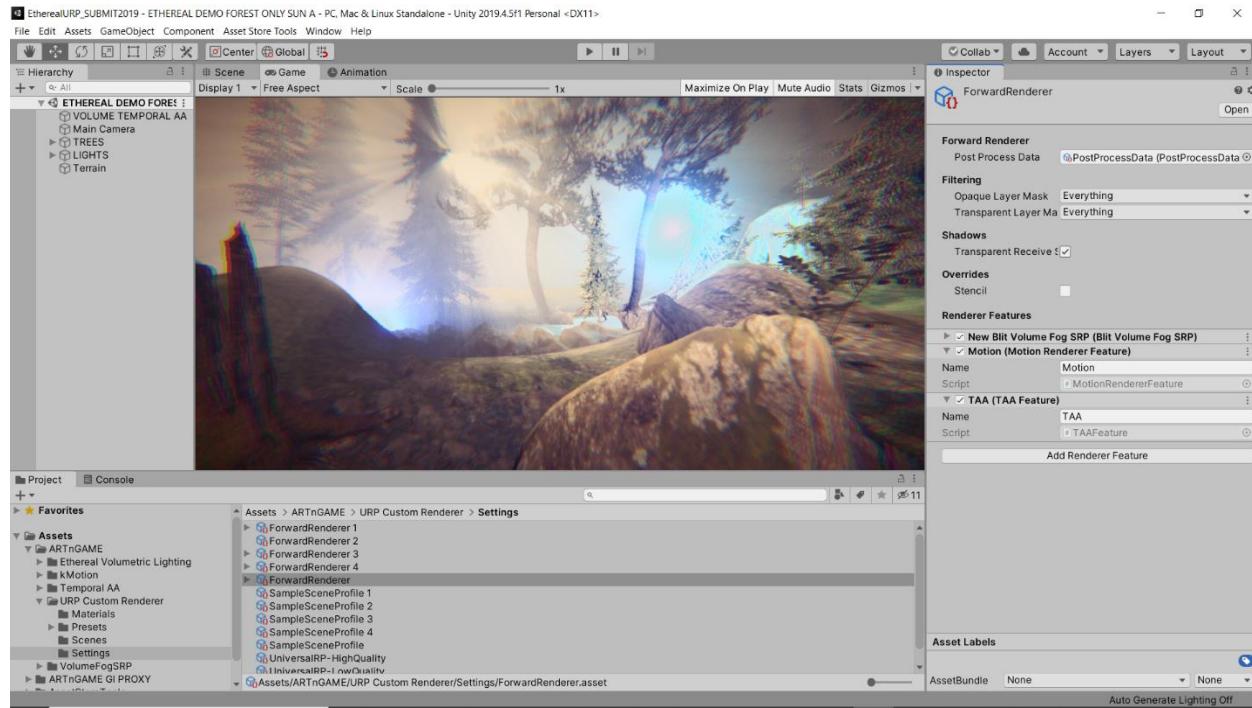
**The system can also be upgraded to [Sky Master ULTIMATE](#) Suit for \$5, which allows access to the full URP weather suit, that includes Ethereal, plus various types of volumetric clouds and integration of Ethereal volumes with the included in the suit water system, water reflections and cloud volumes. The store version of Ethereal can be used for access to the Forest demo scenes and assets and the URP bonus foliage shader that are not included in the Sky Master ULTIMATE URP Suit.**

**In order to setup the system, a URP forward renderer must be setup with the volume fog renderer feature.** A ready-made URP pipeline and Forward Renderer are supplied with the asset for direct use. **Also the Unity fog must be enabled in the Lighting section of Unity, the system uses Unity fog options as base for its fog distribution.**

If there is an existing pipeline and Forward Renderer, then the renderer feature can be manually added as detailed below

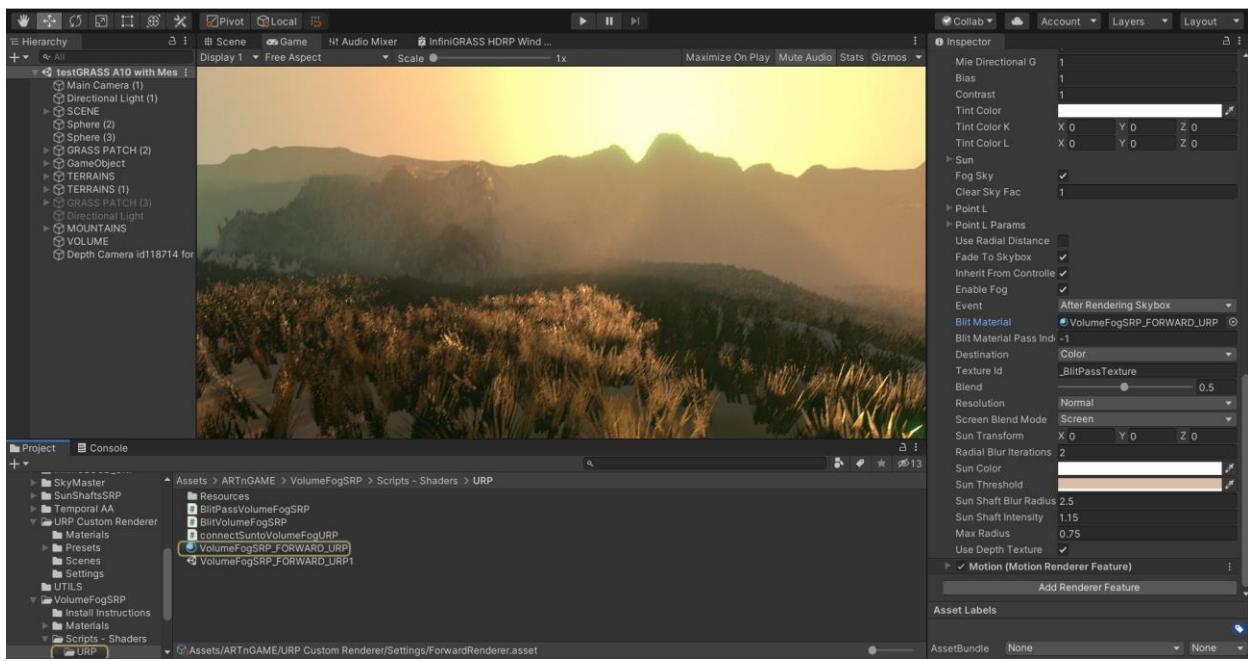


Forward renderer applied to the pipeline

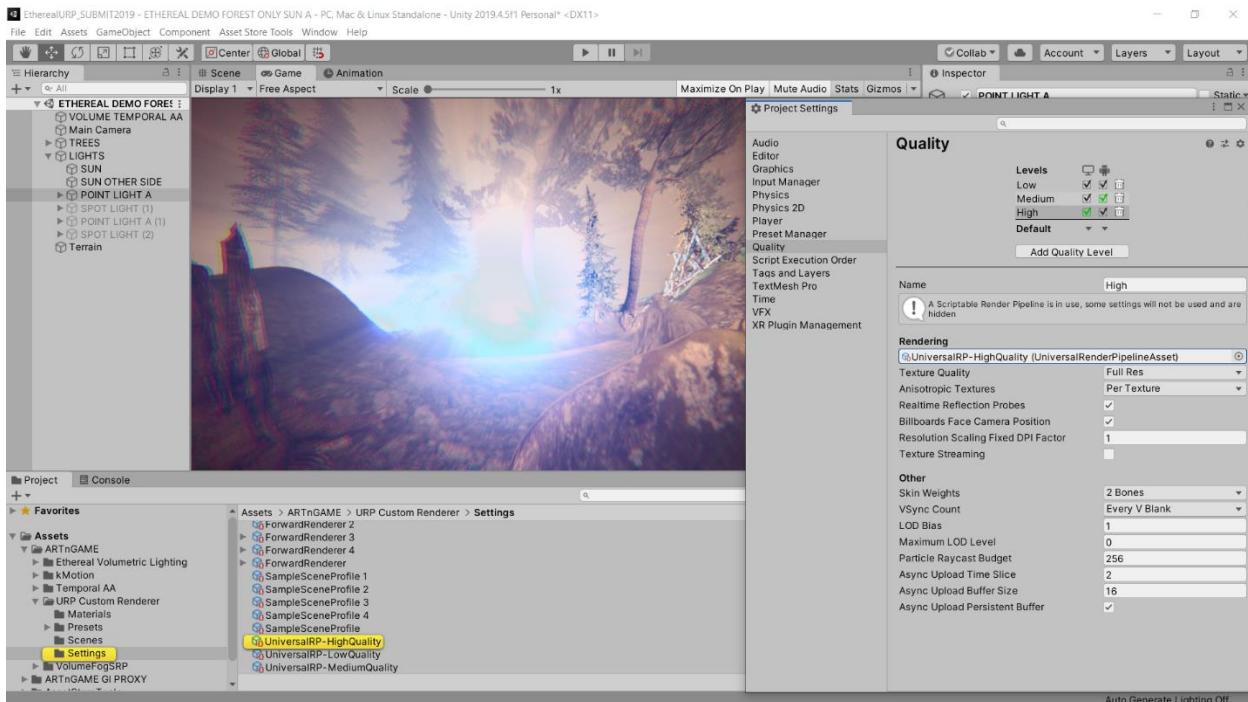


Volumetric Fog renderer feature “New Blit Volume Fog SRP” applied to the Forward Renderer. Here we also apply the Temporal AA and Motion Blur bonus modules.

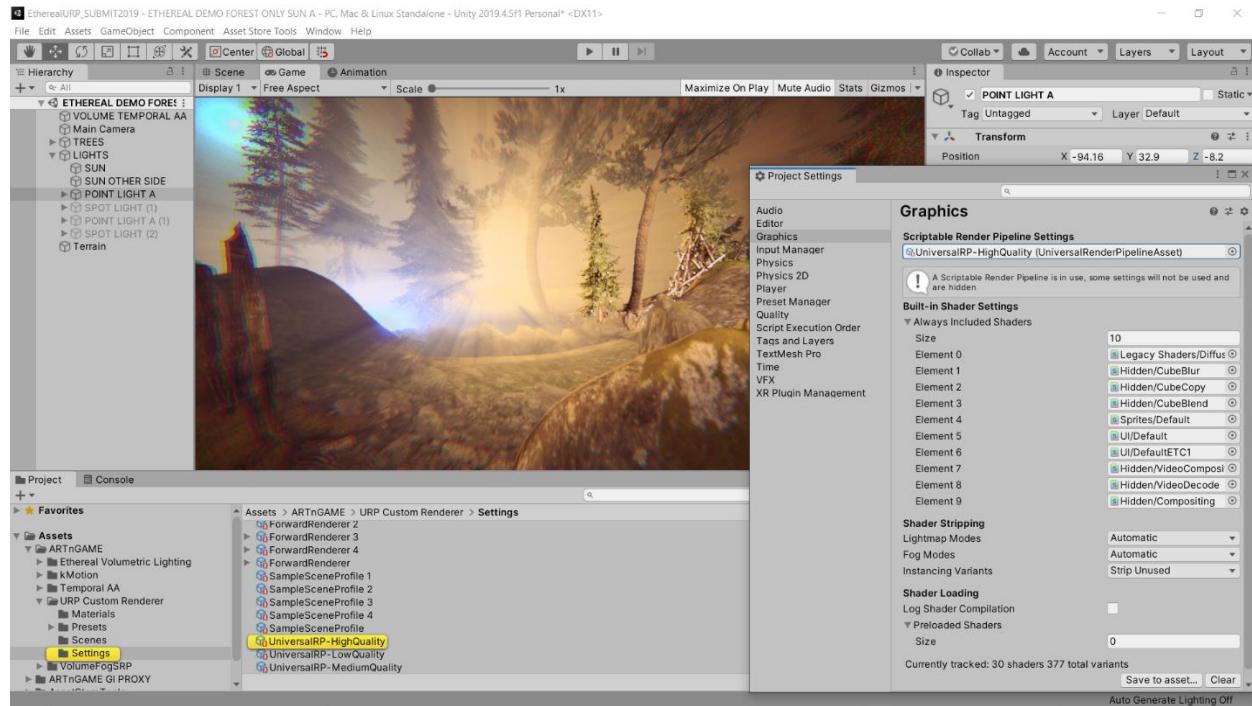




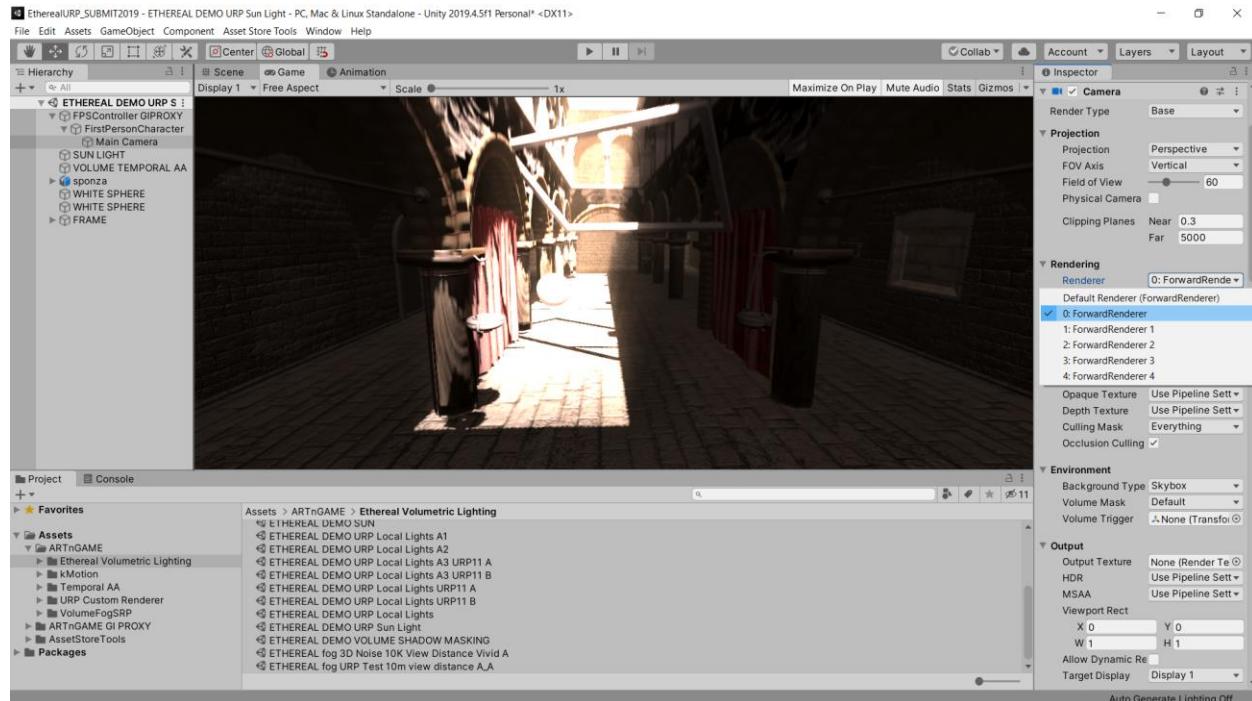
The Renderer Feature “New Blit Volume Fog SRP” must be configured with the material with the volumetric lighting shader as shown above, in the “Blit material” slot, enter the material named “Volume\_Fog\_SRP\_FORWARD\_URP”, in the renderer feature “settings” section.



The pipeline using the renderer must be inserted in the Rendering slot as shown above

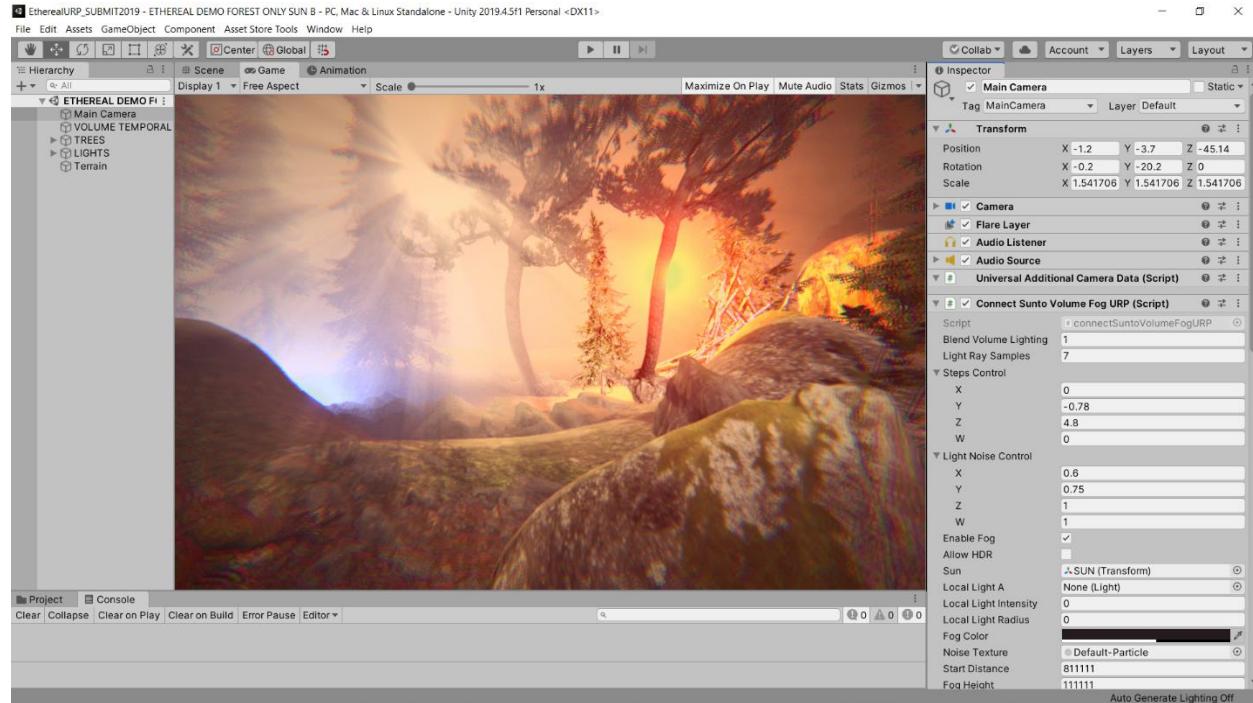


The pipeline using the renderer must also be inserted in the Graphics slot as shown above

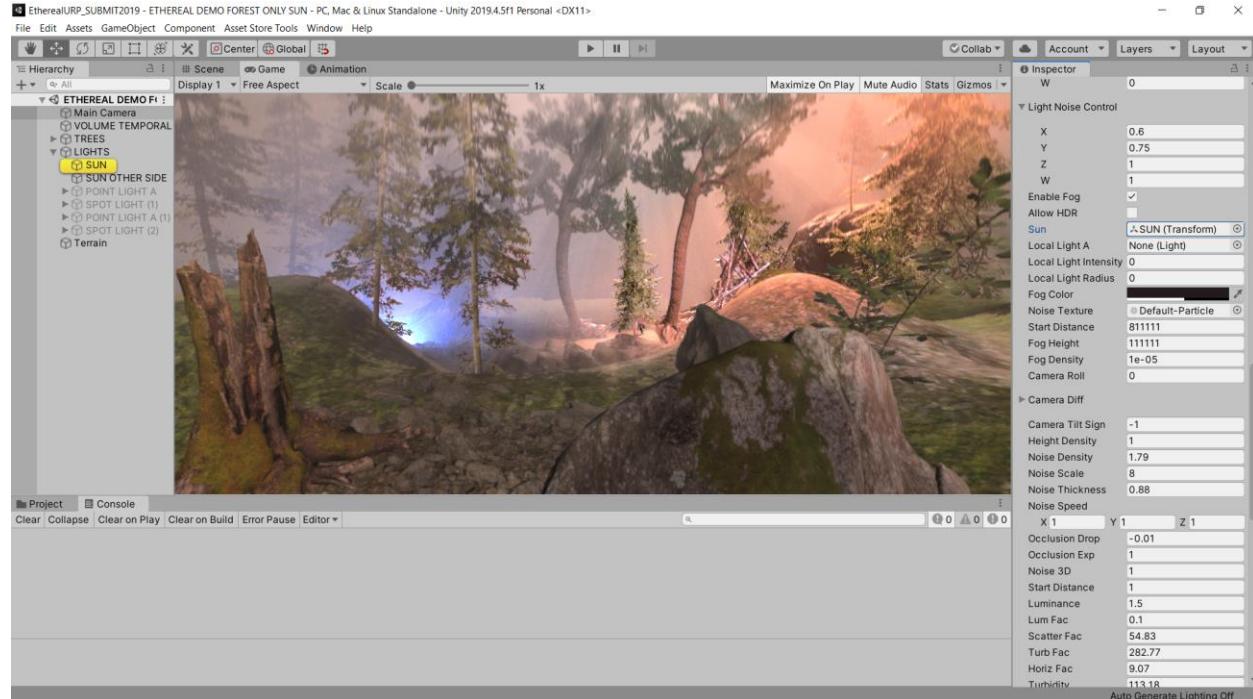


The camera must have the relevant renderer with the Volume Fog render feature selected in the Rendering section as shown above

In order to control and use the fog and volumetric lighting effects, a script must be inserted in the camera, named “`ConnectSunToVolumeFogURP`”.

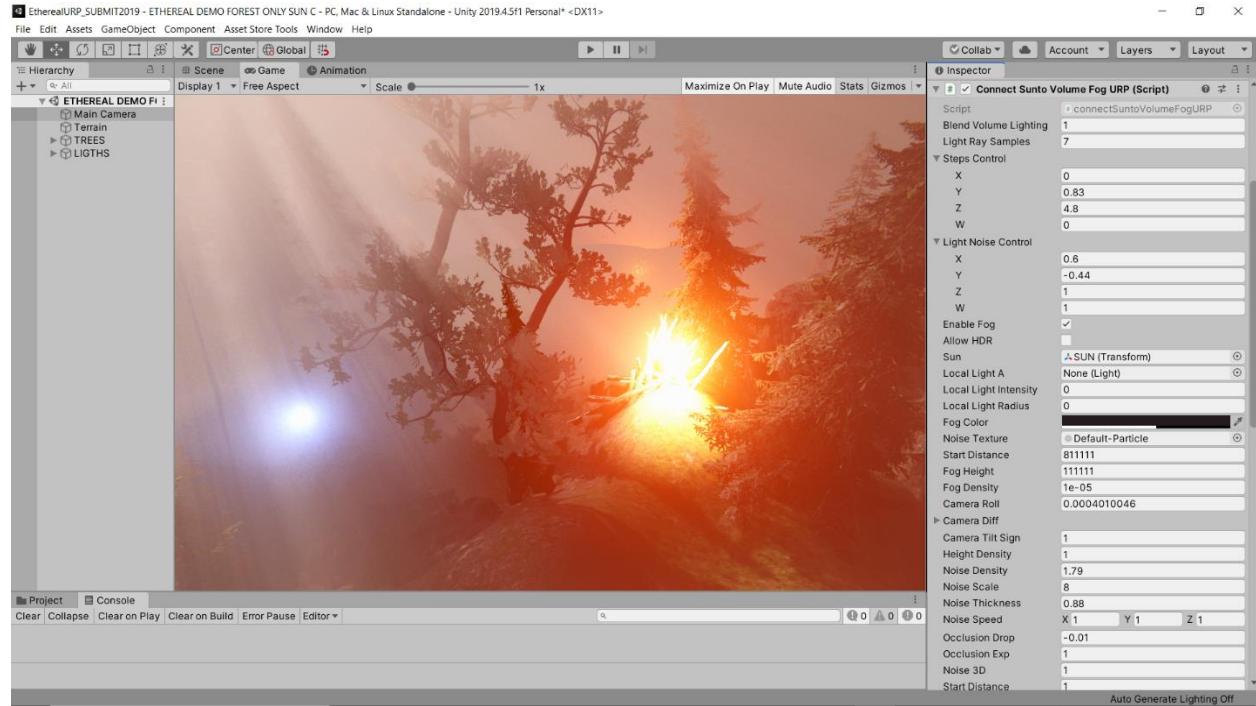


After the script has been inserted in the main camera, the directional light representing the sun in the scene must be dragged from the Hierarchy into the “Sun” slot in the script to finalize the initial setup.



# Parameters

Following are listed all the parameters of the system, for usage reference.



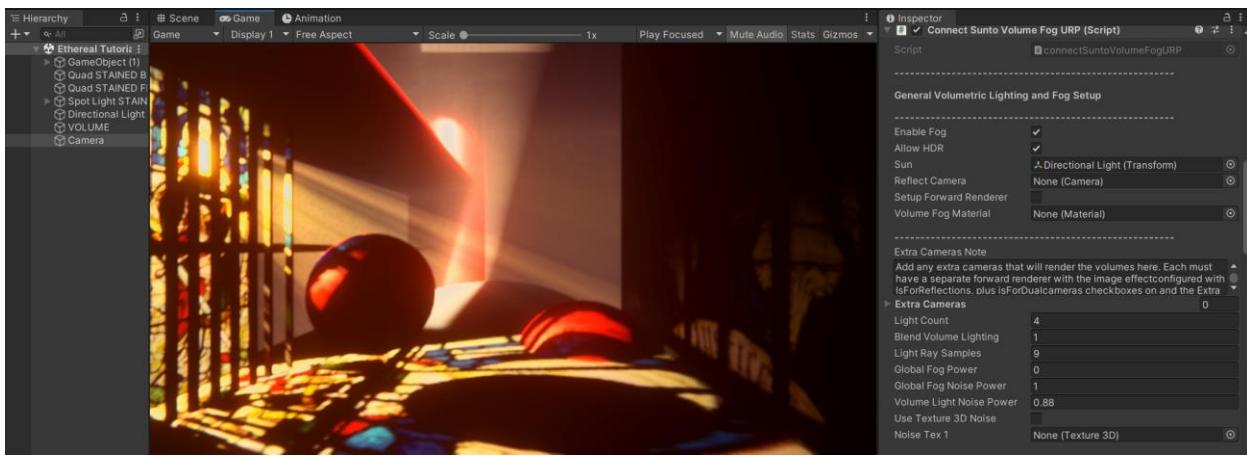
## Volumetric Lighting Settings

**Blend Volume Lighting:** This variable enables the volumetric lighting system for all lights, the volumes intensity are weighted by the number in the variable, so to disable the effect set to zero and to enable the effect set above zero. If set to zero only the volumetric fog effect will be active.

**Light Ray Samples:** The sampling of the volumes, the bigger the number the less noisy the volumes will appear, but the performance will take a bigger hit as the number goes higher. A number between 5 and 9 is recommended.

**Steps and Light Noise control:** Those values are experimental in this first version, the values will affect the steps used in the effect in different ways. Is advised to keep the defaults and play with them to see if can get some more interesting result.

### v1.3.0 - Fog and volumetric lighting separation modes



In the latest v1.3.0 a new mode has been added to control the Fog and the volumetric lighting and their noises separately.

**Global Fog Power** - This variable controls the Fog power in the scene. Use zero to completely remove the fog and leave only the volumetric lighting from sun and local lights.

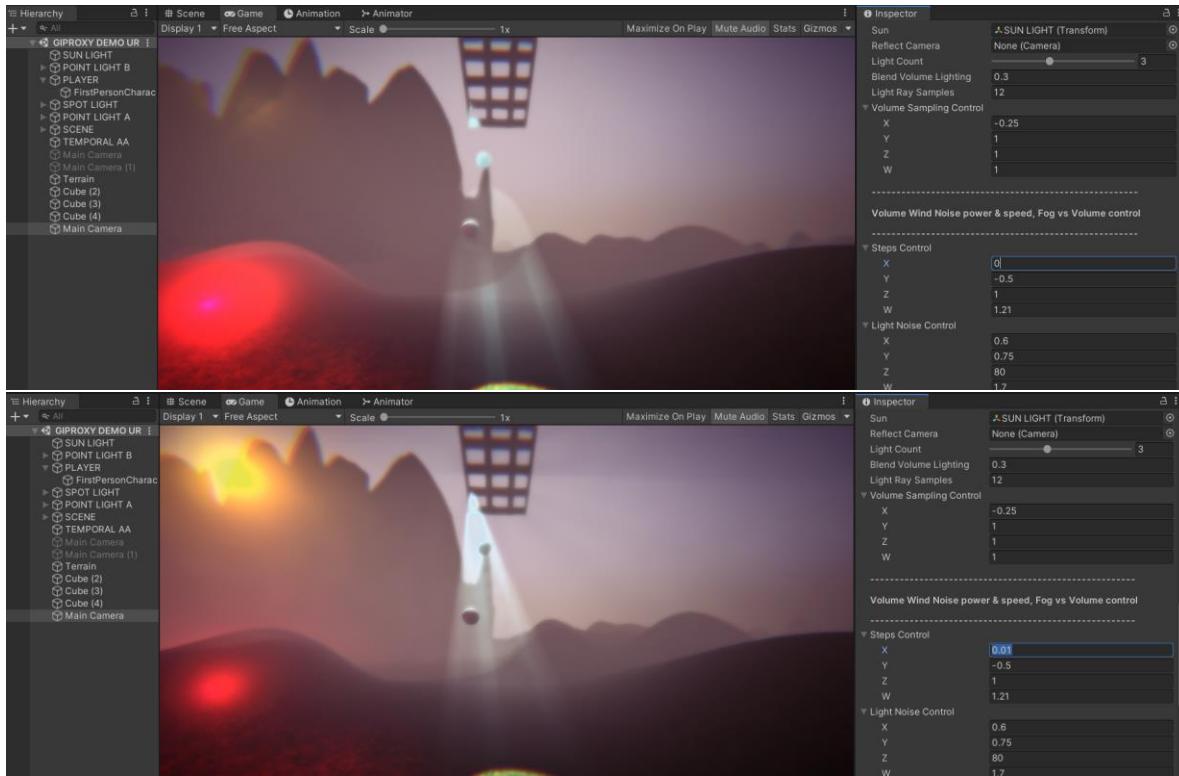
**Global Fog Noise Power** - This variable controls the noise power in the global fog, this noise is also apparent in the volumetric lighting and can be used additionally to get extra noise even when fog power is zero.

**Volume Light Noise Power** - This variable controls the noise in the volumetric lighting alone and wont be applied to the global fog and environment around the volumetric lights.

**Use 3D Texture Noise** - This new option can apply noise based on a 3D texture than calculate it in the shader, use it after have applied a 3D texture in the “**Noise Tex 1**” slot.

### v1.1.8e – Steps Control

In the latest v1.1.8e, the **Steps Control X parameter** can be used to set a specific step length for the volume rendering, this means that light volumes will not appear after a certain distance. Use a value of zero to disable this system and render with variable step based on the depth of the scene. Use a value above or below zero to render the effect with similar look independent of the scene depth, this is ideal to make volumes visible when there is outdoors terrain and light volumes may be visible across various large depth differences and the sky, in this case the rendering of the volume from a single light will not be even, thus is good to make use of the new system to make the light volume appear across all scene depths. An example of the effect when rendering **with zero and above zero** is show in the following top and bottom images respectively.



### v1.1.8h – Steps Control revision

In the latest v1.1.8h, **the fixed step system was slightly revised**, so it **may be required to readjust the “StepsControl.x” variable** to get the proper result, also an issue was fixed where local light might appear in front of scene objects in front of the light. The sun light is now also not using the fixed step system.

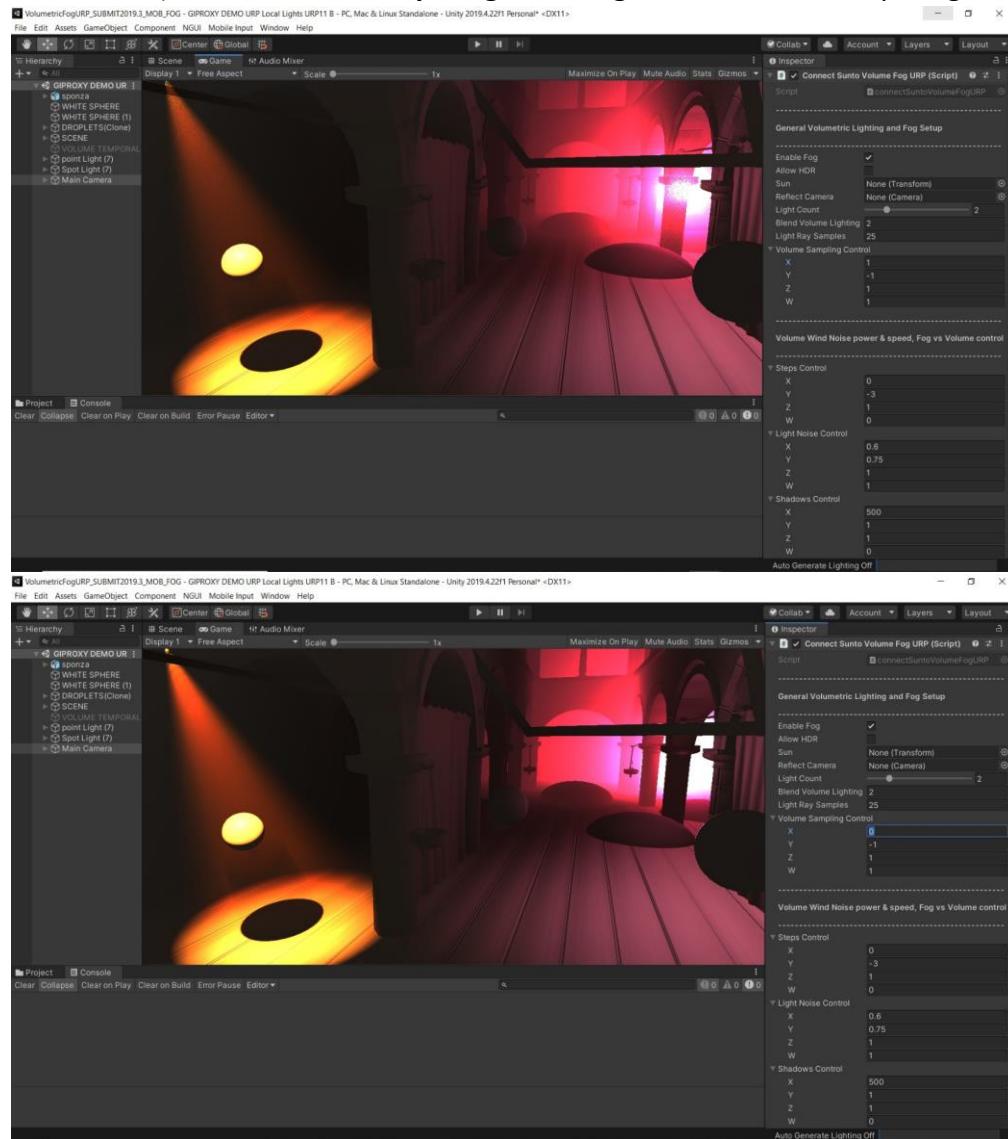
### v1.1.8h – Infinite Local Lights support

In the latest v1.1.8h, the system now can support any number of local lights using a loop inside the shader. The previous shader version has been renamed as “VolumeFogSRP\_FORWARD\_UPR Legacy 1” and is used by default since the system is faster when the light count is fixed and hardcoded. To enable the infinite local lights must change the shader in the “Unlit/VolumeFogSRP\_FORWARD\_UPR” material to the new shader named “VolumeFogSRP\_FORWARD\_UPR” and then can set the “LightCount” to higher than the previously used 6 hardcoded lights to any number. If set below zero, then the system will add volume to all local lights with only limitation the distance dictated by the absolute value of the LightCount variable.

### v1.1.7 - Added option for zero noise point and spot lights.

A new control of volume sampling has been added ("volumeSamplingControl") as shown below

- The **X value** shifts between zero noise sampling (0) to full randomized noise sampling (1).
- The **Y value** is the step length multiplier for the no noise region.
- The **Z & W values** are the step length multiplier for local and directional in the noise region.
- When no noise is used **is best practice to increase the "Light Ray Samples"** (e.g. from around 10 to 20-30) and **increase the spot lights "Range" distance** in the Spot light on Unity side.



When full noise is used with less steps for maximum performance, is best to use image effects like the included Temporal AA, motion blur, or Unity effects like Depth of Field, Boom to cover the noise artifacts (e.g. [Video](#)). When no noise regions is used there is no need to use any extra image effects (e.g. [Video](#)).

### v1.1.2 - Added New system for volumetric wind with parametric noise. ([Example Video](#)).

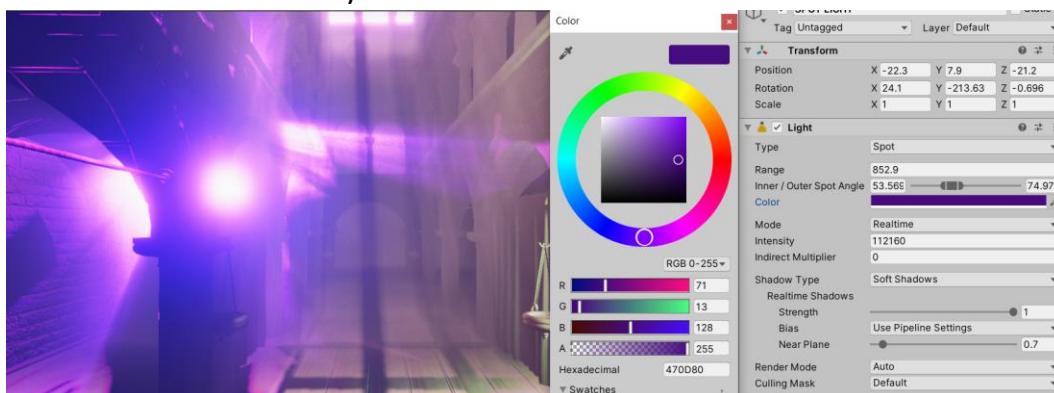
The wind effect is controlled by the **Steps control W parameter (wind strength)** and **Light Noise Z (wind Frequency) and W (wind speed)**.

**v1.1.3 – Added a system to control which lights are activated in various ways**, by intensity and color. This feature is a first experimental version and will be extended further in future versions.

Intensity based control. The lights can be separated between local lights and directional light by using the Light Control A, X and Y variables. X is the directional light power and Y the local lights power. Set for example Y=0 in order to leave only directional light volume in the scene. ([Sample Video](#)). The Light Control A, Z and W parameters and Light Control B, X-Y-Z-W control each individual local light intensity and can be used as an offset to the intensity dictated by the original scene light, in case a different amount of fog intensity is needed for same actual light intensity in the scene. **Note that the individual local light controls work best if all lights remain in view at all times.**

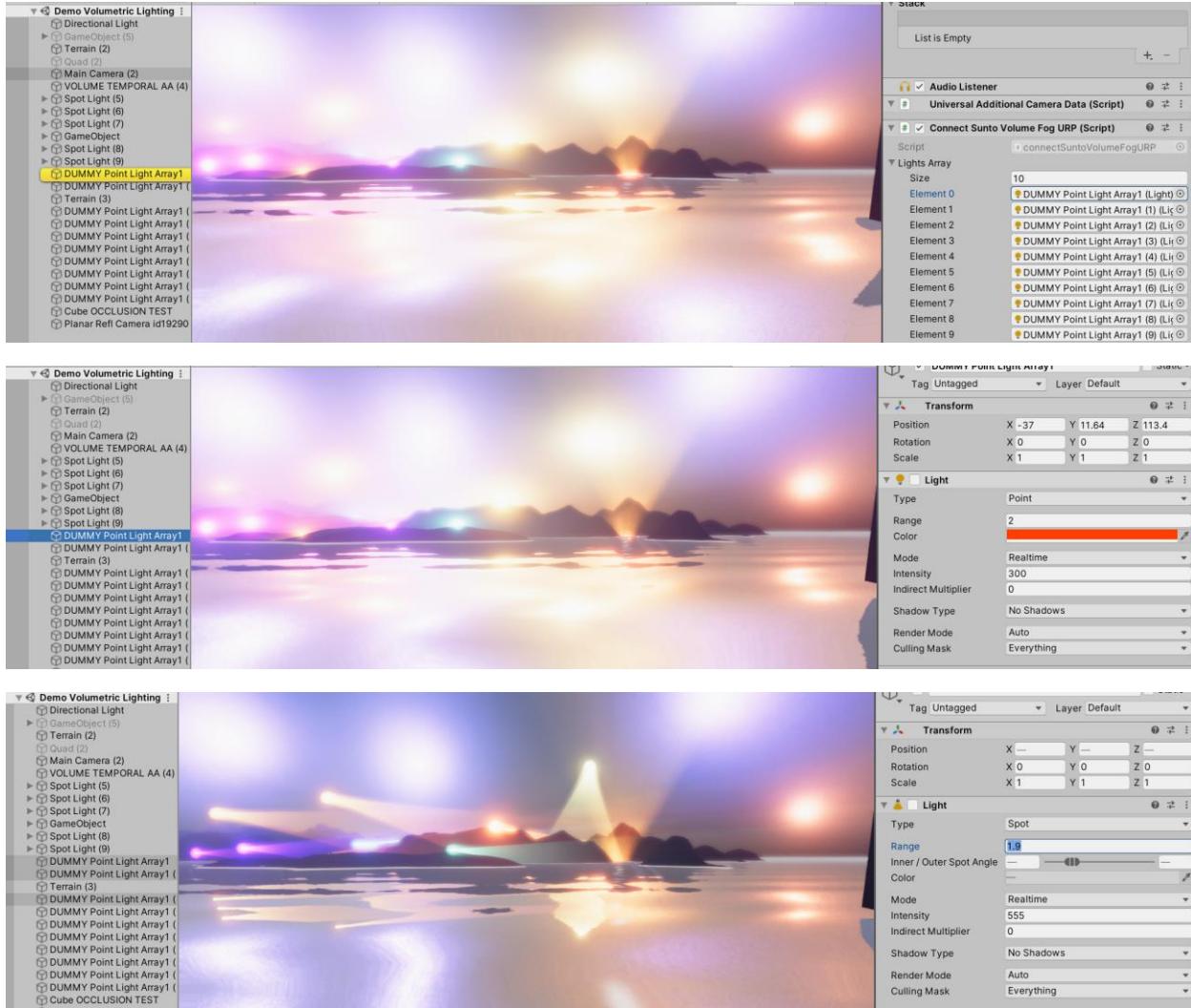


The “Control by color” checkbox enables the system to insert volume for a single chosen light in the scene, the light should be referenced in the LightA slot. **The Light B slot is not yet used**, the system will be expanded later to allow a 2ond light defined for volumetric fog ([Sample video](#)) with this control system. **Note that in order to enable the system for the chosen light, the light must have a specific property in its color, one of its R, G or B color variables must be set to 128**, so the shader can discriminate the light from others in the scene internally. An example is given in the photo below. Any of the R, G or B can be used for that purpose, the rest of the colors can be set arbitrarily.



**v1.1.4 – Added a fake volumes light array system** to enable addition of many volume lights on scene with small impact on performance when lights can be shadowless and faraway of the camera or shadows are not needed. The lights are occluded as normal lights by scene objects.

The “Lights Array” can be filled with up to 32 Point or Spot lights, if set to zero the system is disabled. The lights must also be set to inactive to be used as faked volumes.



The “Range” factor in the light dictates how wide the spot light cone will be where lower makes for a wider cone and how far a point light radius will reach, where smaller range number reaches further distances. The light power is dictated by the “Intensity” factor for both spot and point lights.

**v1.1.4 – Added new Screen Space sun shafts module**, the system casts a volume from sun light, that can be used together with the volume fog and lighting or stand alone for the cheapest sun light volume effect when this is required.



Use the “Enable Sun Shafts” checkbox to enable the module, choose “Screen” or “Add” blend modes for more intensity of the effect. The blur iterations dictate how many steps are used to blur the effect from the sun light towards the screen. The sun light power is chosen in “Sun Shafts Intensity” and the light of the beams is regulated using the “Max radius” and “Sun Shafts Blur radius” variables.

The “Use Depth texture” check box can be used only when a Depth texture is enabled in the Main camera and regulates the effect occlusion based on the depth buffer data.

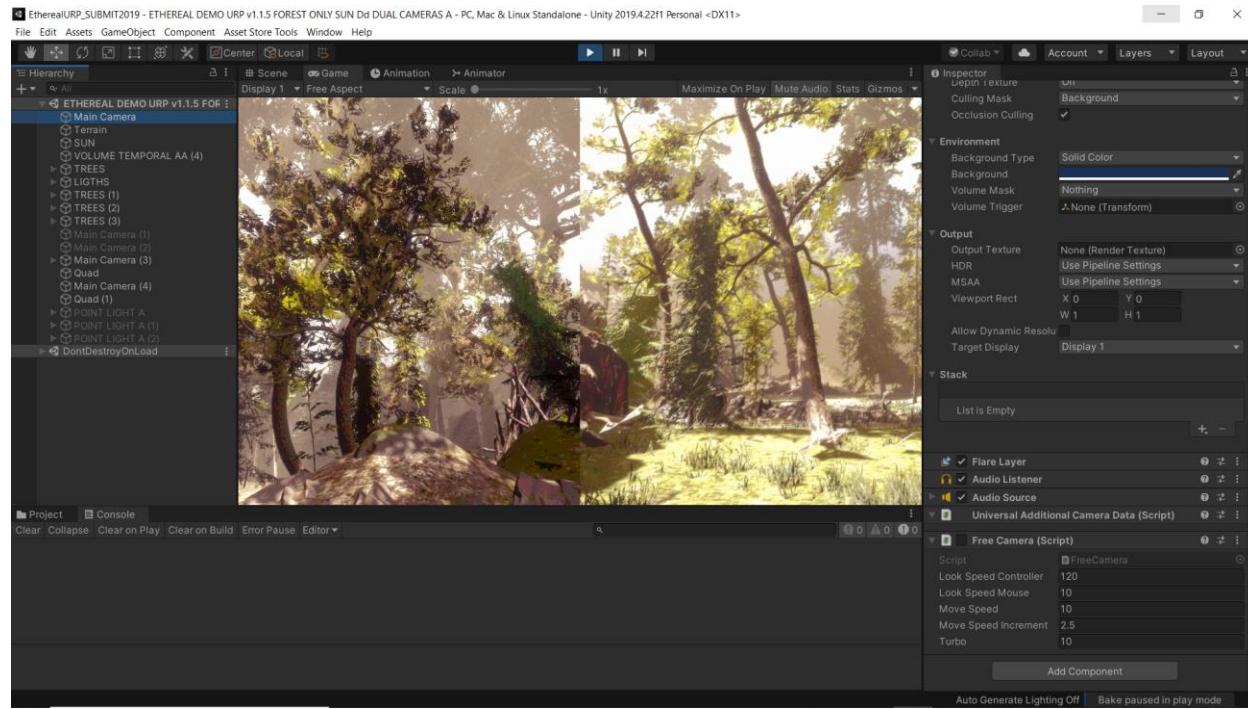
The effect can be used as standalone, to together with the volumetric fog when enabled using the “Enable Fog” checkbox.



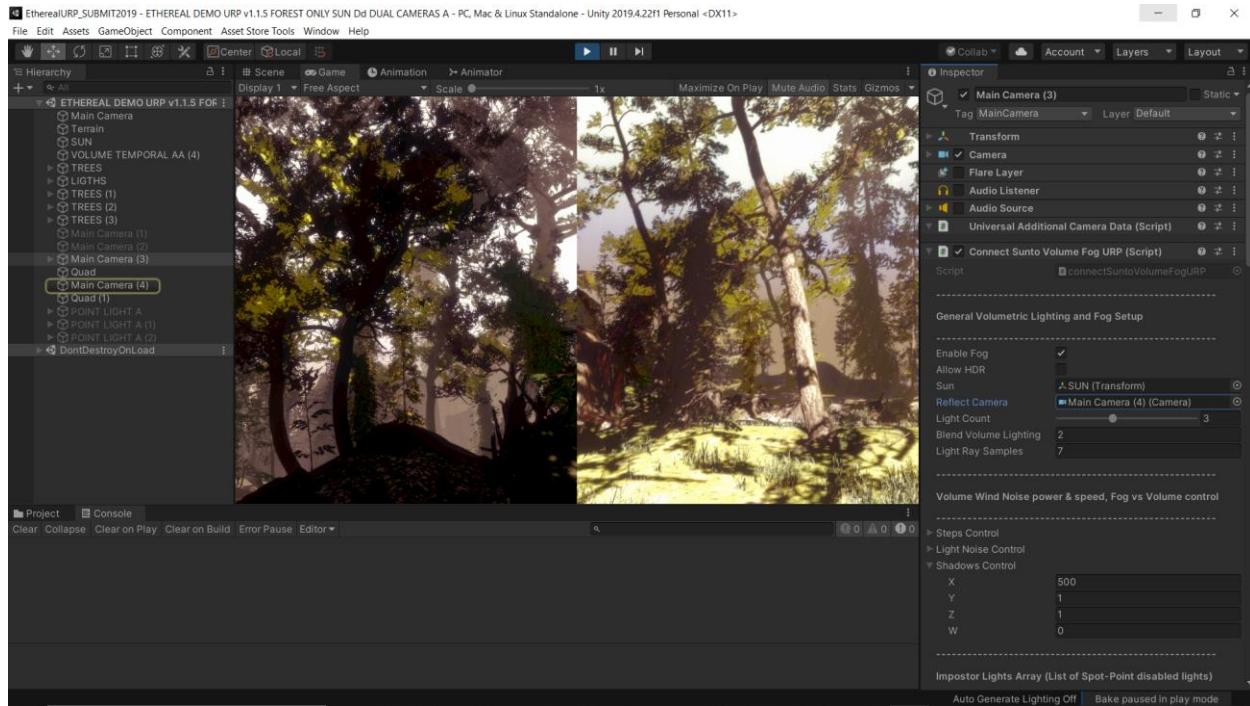
**v1.1.5 – Added new dual camera setup demo**, rendering the same scene from two cameras. One camera must be set as "MainCamera" and hold the "connectVolumeFog" script and the other be "Untagged" and use the Reflections system forward renderer (volume fog renderer feature has the "isForReflections" checkbox enabled). The 2nd camera must be referenced in the connect script in the reflection camera slot. The same system is used in Sky Master UTLIMATE URP version to render a reflections camera of the volume effect for water reflections of the volumetrics.

Both cameras render to a rendertexture and the two textures are applied in two quads in Background layer rendered by a global camera (as shown in the 1<sup>st</sup> photo below) that only renders those, with all image effects disabled for that camera.

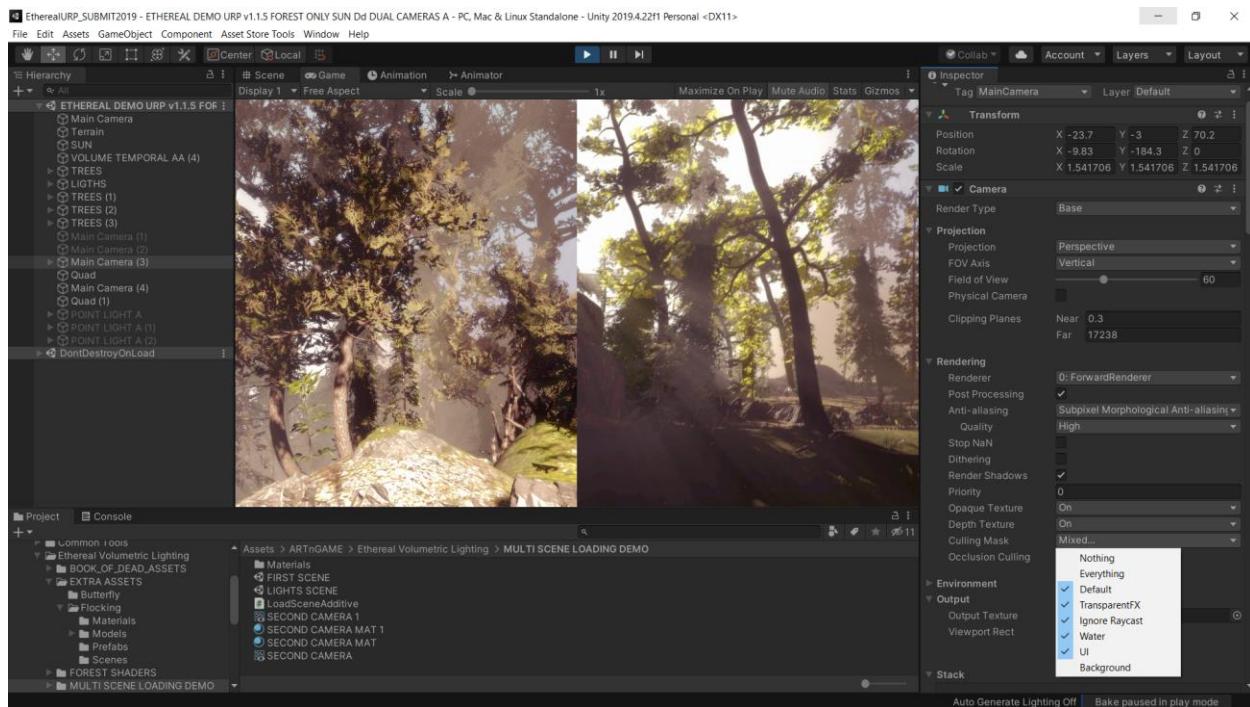
The sample demo scene showcasing the dual cameras setup is named "**ETHEREAL DEMO URP v1.1.5 FOREST ONLY SUN Dd DUAL CAMERAS A**".

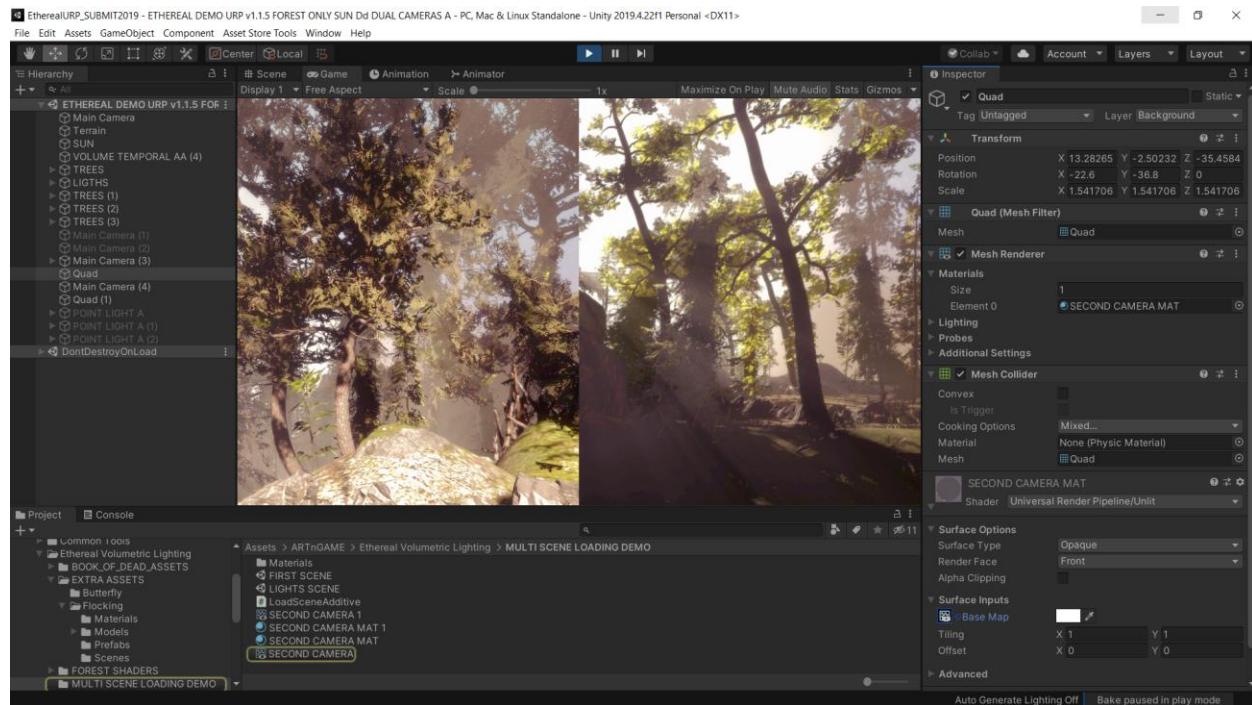
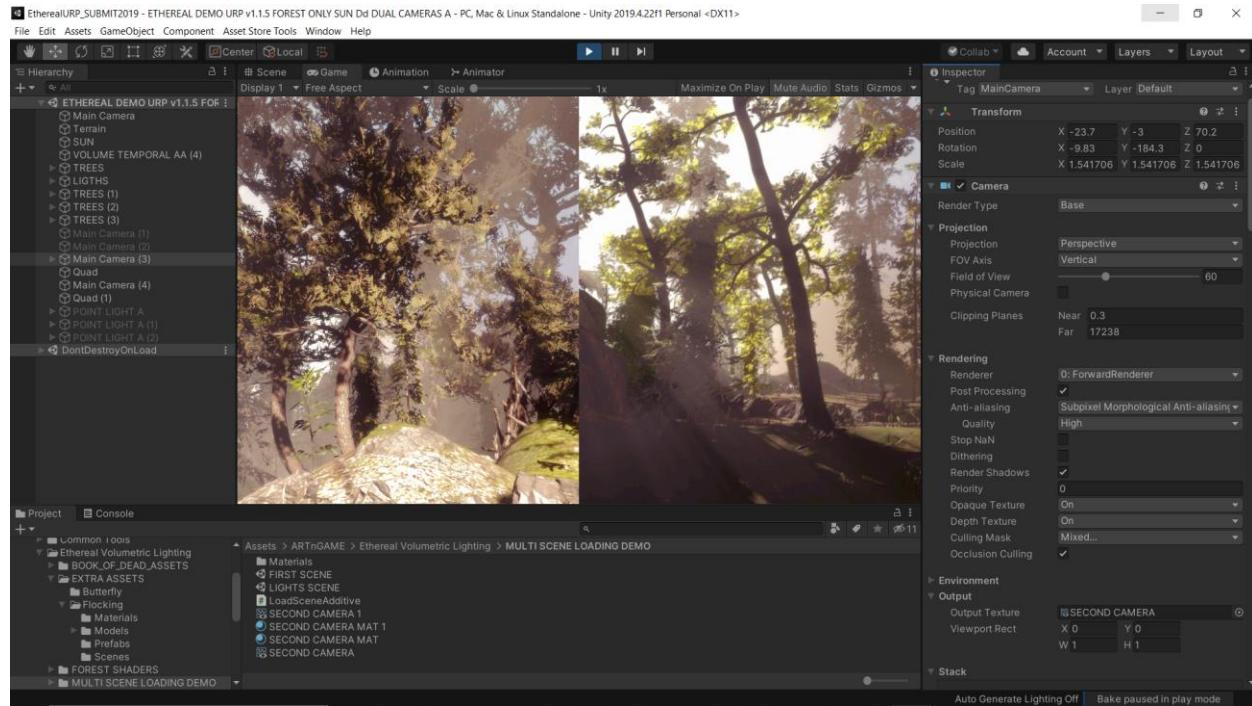


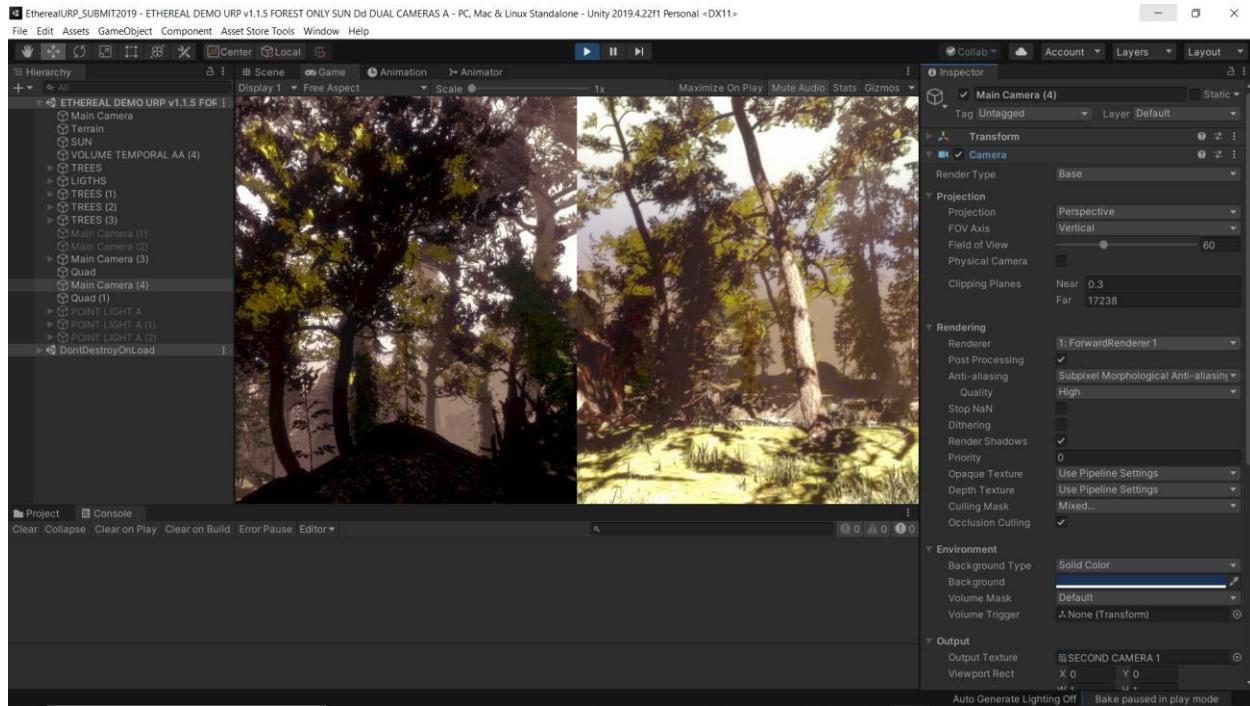
Global camera (Main Camera) rendering the two quads, each quad has a material with texture the render target of the two other cameras that render the left and right images (Main Cameras 3-4).



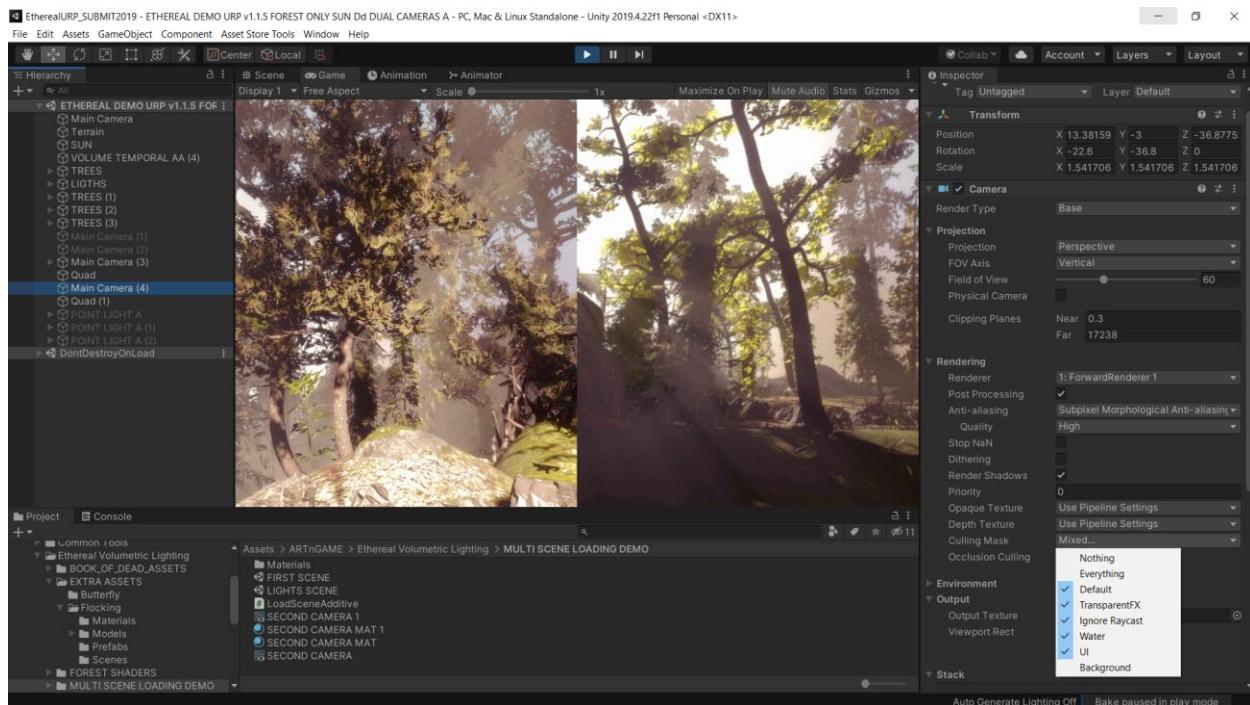
Camera rendering the left image, using the volumetric lighting script and referencing the Camera rendering the right image in the “Reflect Camera” slot. This camera must render all layers besides the Background one where the quads are and render in the “SECOND CAMERA” rendertexture that is applied as a texture to one of the quads material (3 Photos below)

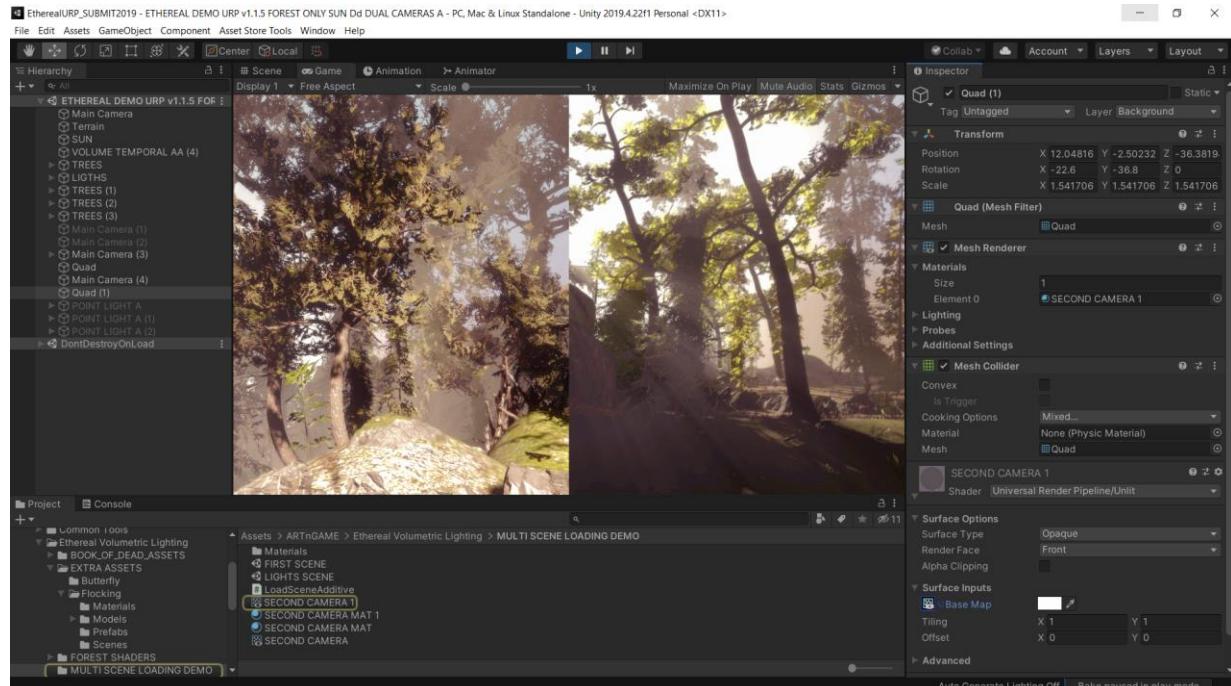
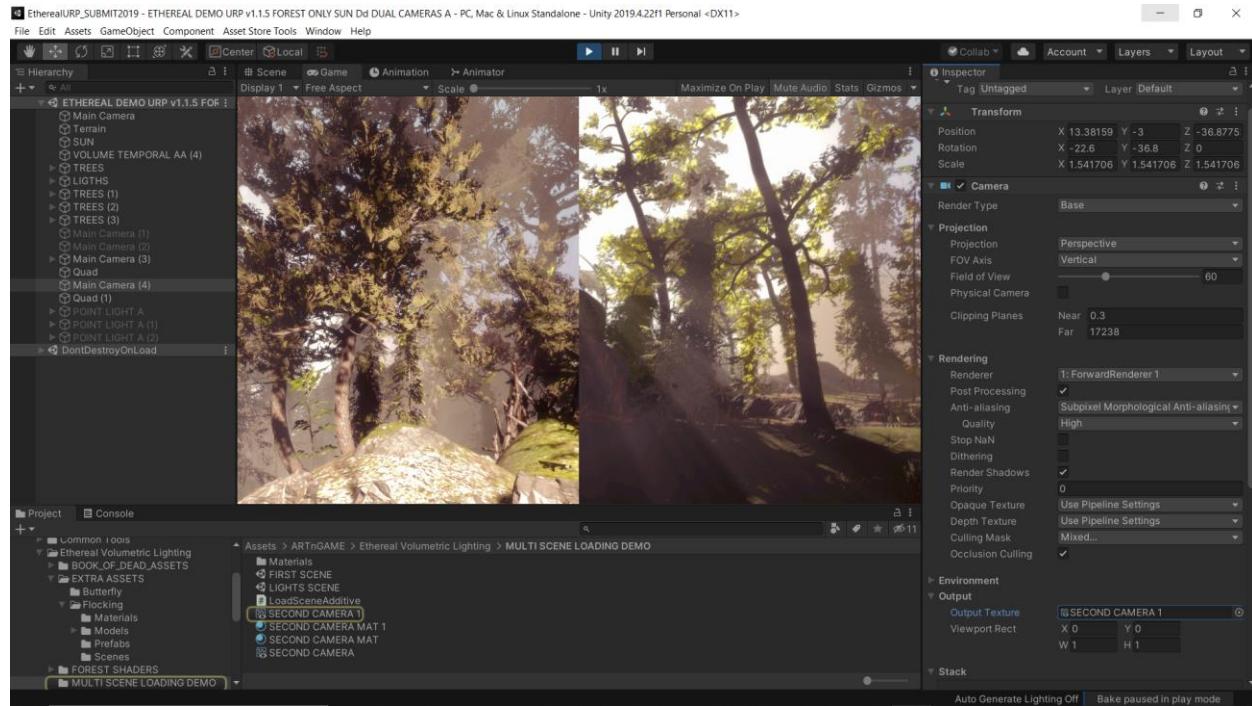






**Camera 4 rendering the right image**, the camera is auto setup to render the volumes using the script on the Camera 3, where is also referenced for that purpose. This camera must render all layers besides the Background one where the quads are and render in the “SECOND CAMERA 1” rendertexture that is applied as a texture to one of the quads material (3 Photos below)

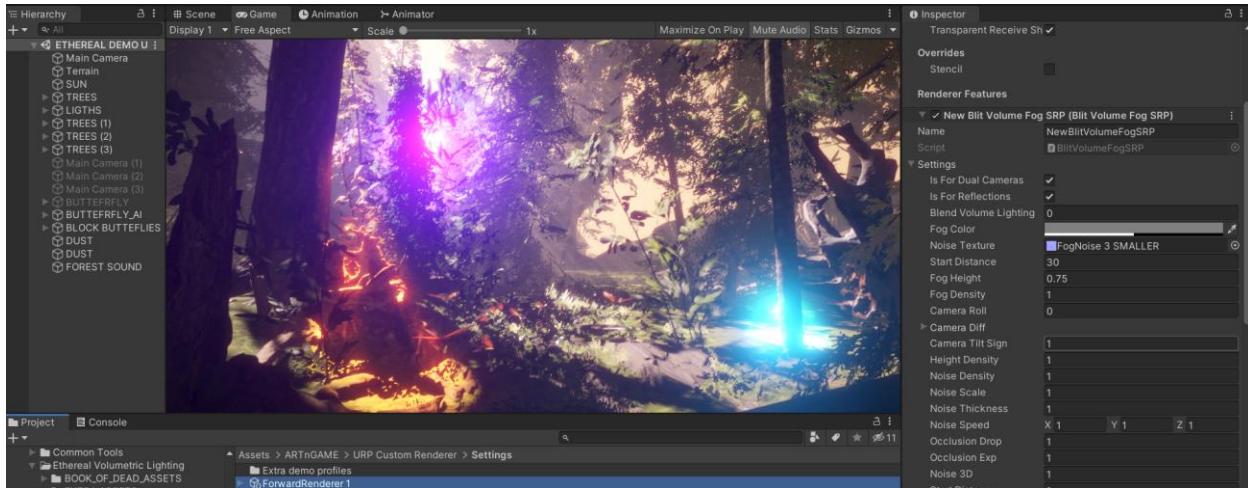




This way the result of the two cameras 3-4 both have the volumetrics rendered and apply their result in the two quads rendered by the global camera that does not apply any volumetrics. This setup could potentially be used for VR purposes as well, though has not been tested in such and VR has not been tested in the asset in general.

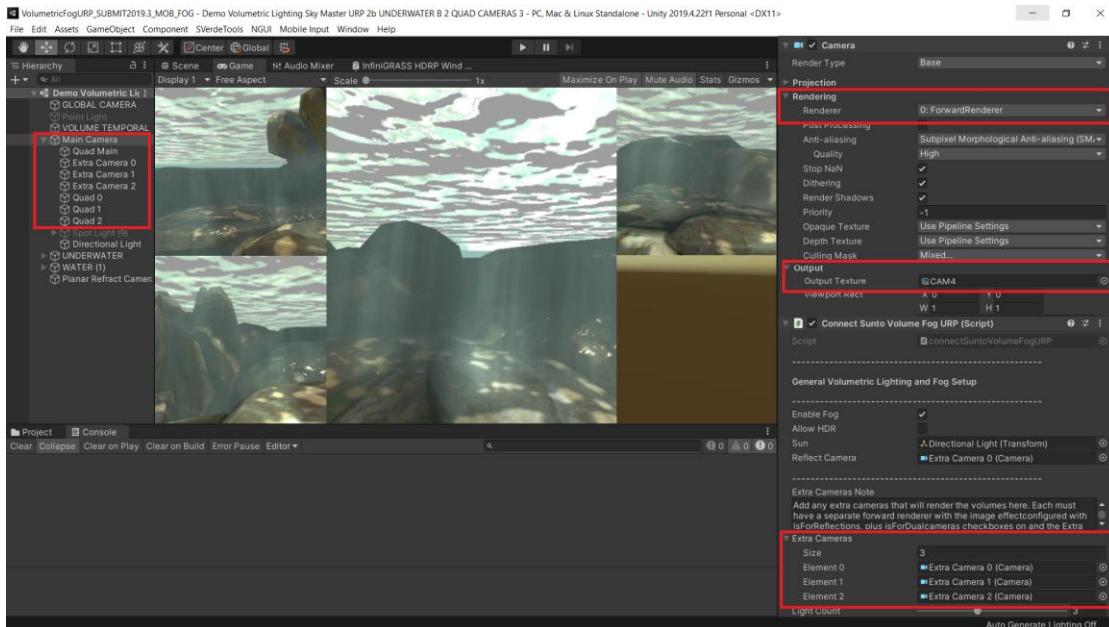
## V1.1.8e – New Dual camera setup demo and control variable

In the latest v1.1.8e, a new variable has been added to differentiate the rendering of 2nd camera in the case dual normal cameras are used, versus use in a reflection camera for water. For Dual cameras both “isForReflections” and “isForDualCameras” checkboxes must be activated. The new demo showcasing the use of two cameras, with one main camera and another rendering to a render texture can be found in "ARTnGAME\VolumeFogSRP\MULTI SCENE LOADING - DUAL CAMERAS DEMOS\ETHEREAL DEMO DUAL CAMERAS B.unity" folder.

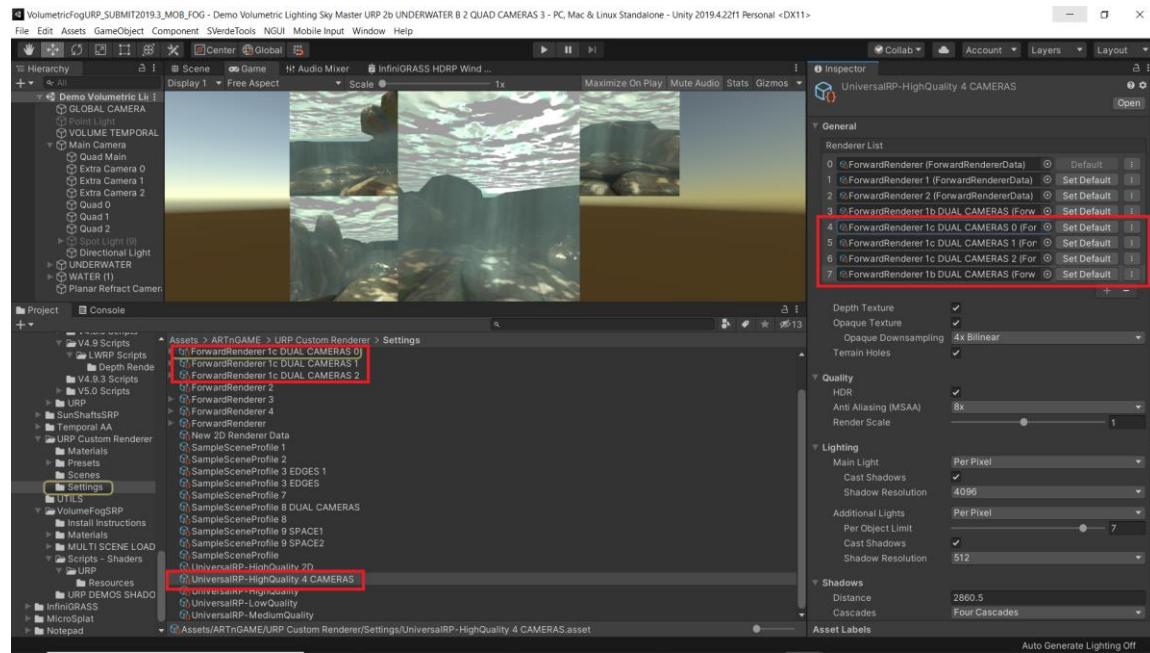


## V1.1.8f – New Multiple cameras setup demo and control variables

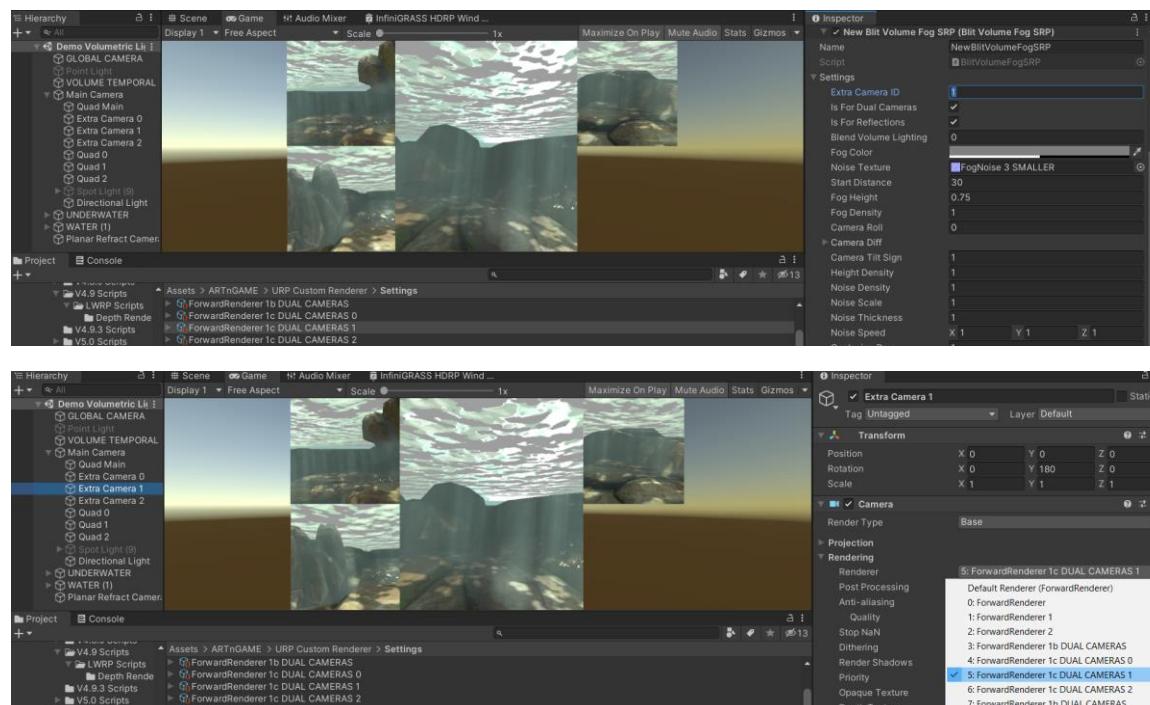
In the latest v1.1.8f, a method has been added to render up to eight cameras with the volumetric effect and a demo showcasing the system with 4 cameras. First a main camera must be setup for the volumetric effect, this must be tagged as MainCamera and have the connectVolumeFog script as with the dual camera setup.



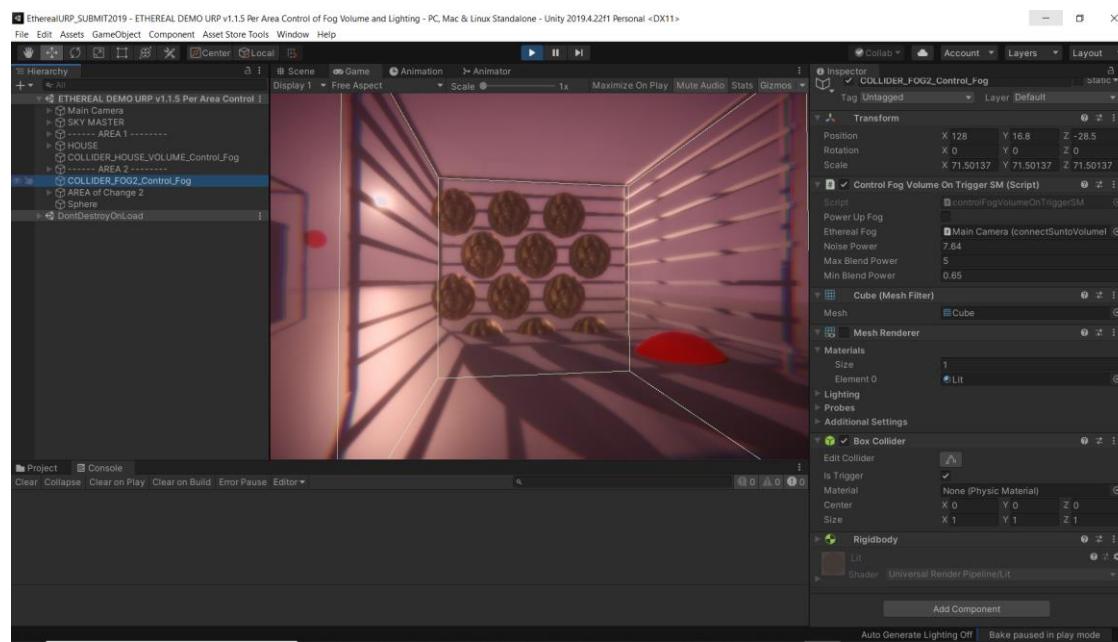
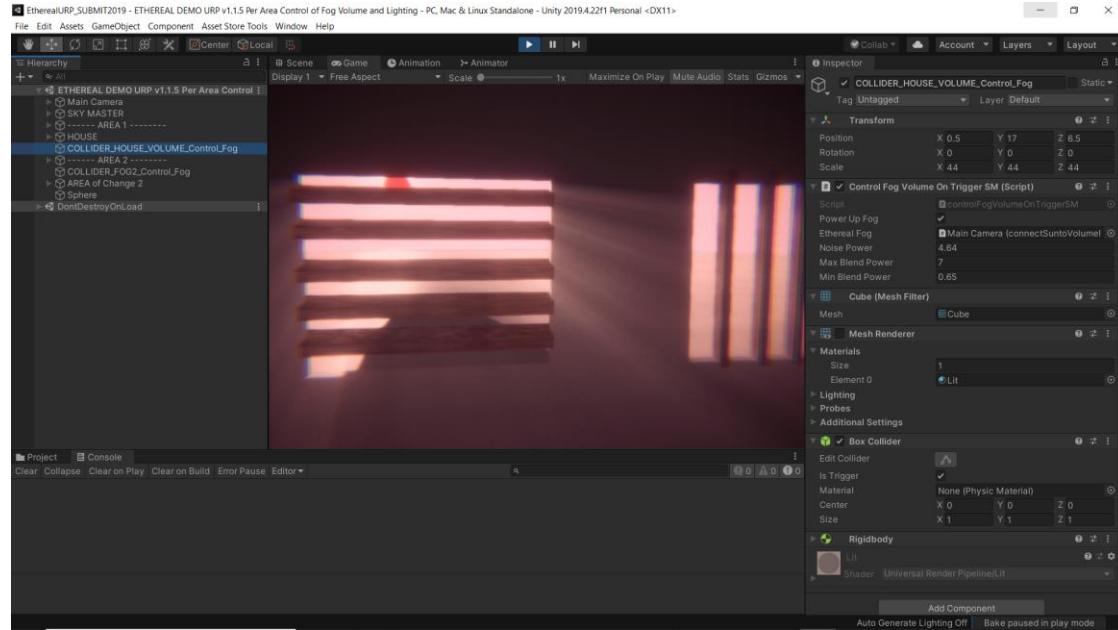
The system works by declaring the extra cameras to the **Extra Cameras** list, so the system can pass the proper camera based on the Renderer Feature variable **ExtraCameraID**, which must be setup for each renderer feature that each of the extra cameras will use.

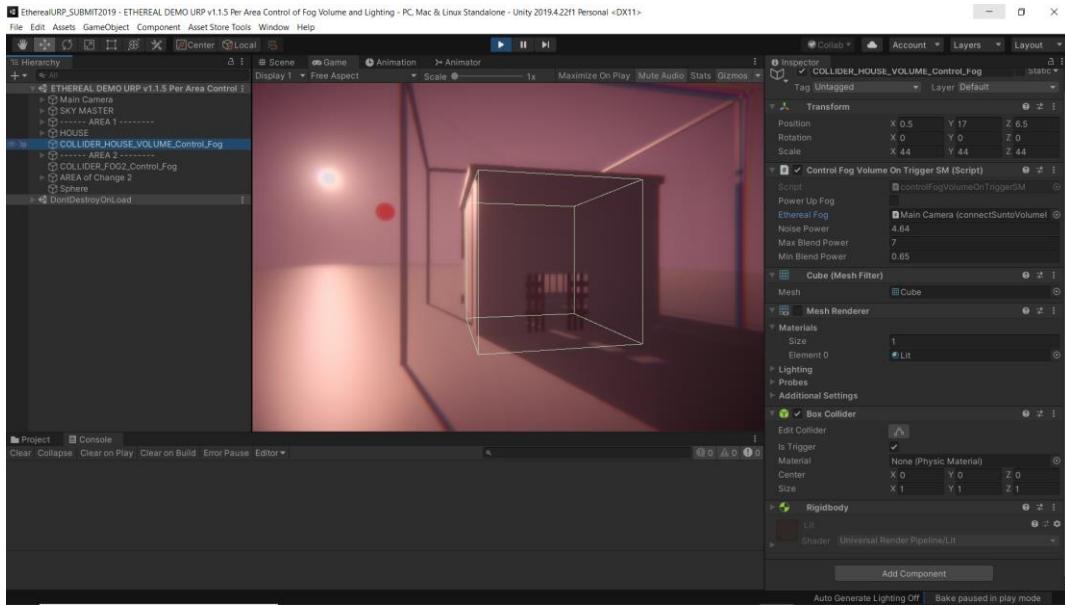


After enabling the “IsForDualCameras” and “IsForReflections” for the extra cameras renderers, the **ExtraCameraID** must be set to the number same as the camera position in the **ExtraCameras** list for the camera that will be using this renderer, as shown for camera 1 in the below images. Then the cameras will render the volume effect properly.



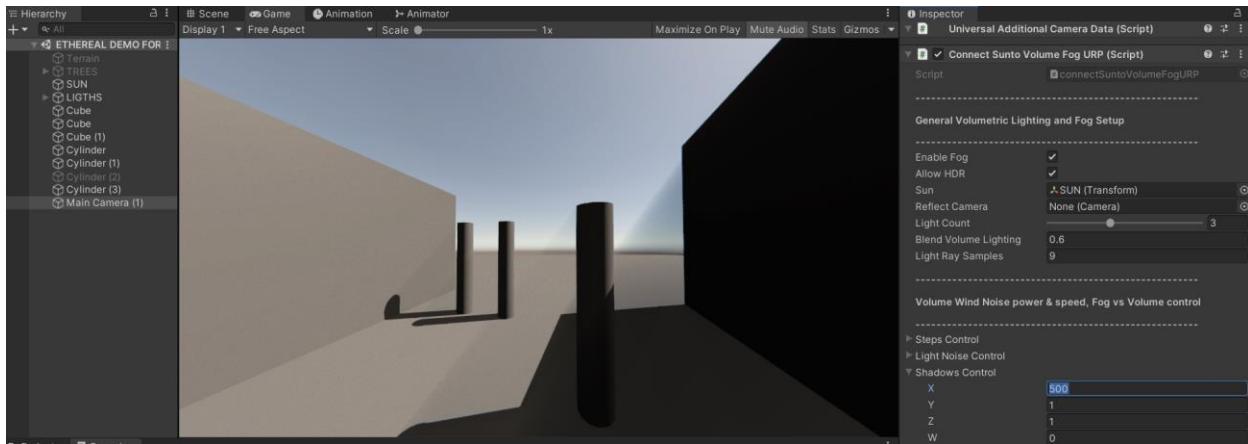
**v1.1.5 – Added new system to change volumetric lighting parameters on entering specific volumes**, like enter a house from outdoors. The system uses colliders with a script that senses when enter the collider and change the volume fog parameters as needed. In the demo scene there is no fog outside the house and fog appears only when enter the house collider. The setup of the script on the collider is shown below. The min Blend power is the power of volumetrics outside the collider, the max the power inside the collider.





The demo scene has two regions that alter the fog, to showcase multiple use of such regions. Each regions must have a collider and the “ControlFogVolumeOnTriggerSM” script attached.

### v1.1.6 - Added volume shadows cutoff option based on camera distance and volume shadows strength control.

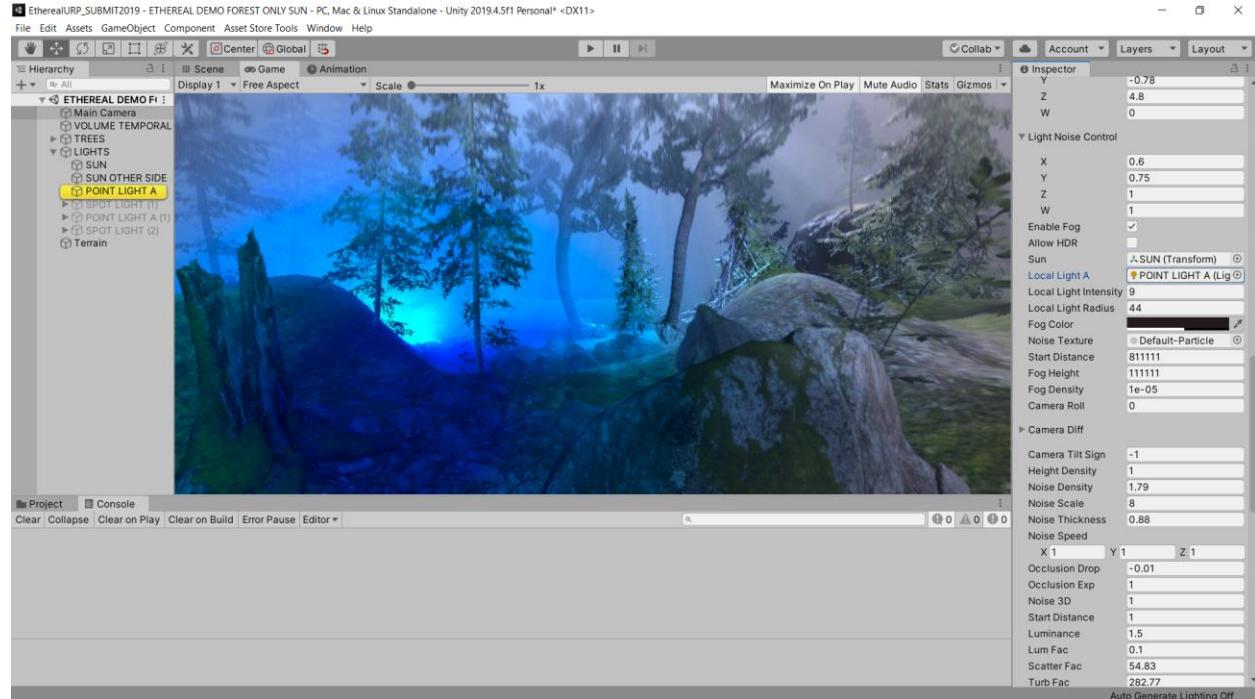


This new option adds a “Shadows control” vector, the X controls the volumetric shadows far distance and should be at or below the Unity shadows far distance. The Y and Z control the exponential of the shadow darkness and shadow strength respectively, for adding more darkness to shadows if needed for special effects. The W is not yet used, it is planned to add one more shadows control in next versions.

## Volumetric Fog Settings

**Enable Fog:** This checkbox enables the overall fog and volume lighting effects, disable it for a removal of all fog and light volumes from the scene.

**Local Light A:** The system allows for a single light to colorize the surrounding area of its central point using its color and the Local light intensity and Radius variables, an example is shown below.



**Fog Color:** The fog color gives a general tint to the overall volumetric effect.

**Noise texture:** Noise Texture used for the 2D noise functionality.

**Start distance:** Dictates where the fog starts in relation to the camera, increase this number to push the fog further back and make the near camera space clearer.

**For Height:** Dictates the height of the fog, use a high height and low density to get a light fog effect.

**Fog Density:** Dictates the density of the fog, use a very small number at first and increase as desired.

## Fog Noise Parameters

**Height Density:** Dictates the height of the noise effect on fog.

**Noise density:** Dictates the density of the fog effect.

**Noise scale:** Dictates the scaling of the fog effect.

**Noise thickness:** Dictates the thickness of the fog effect.

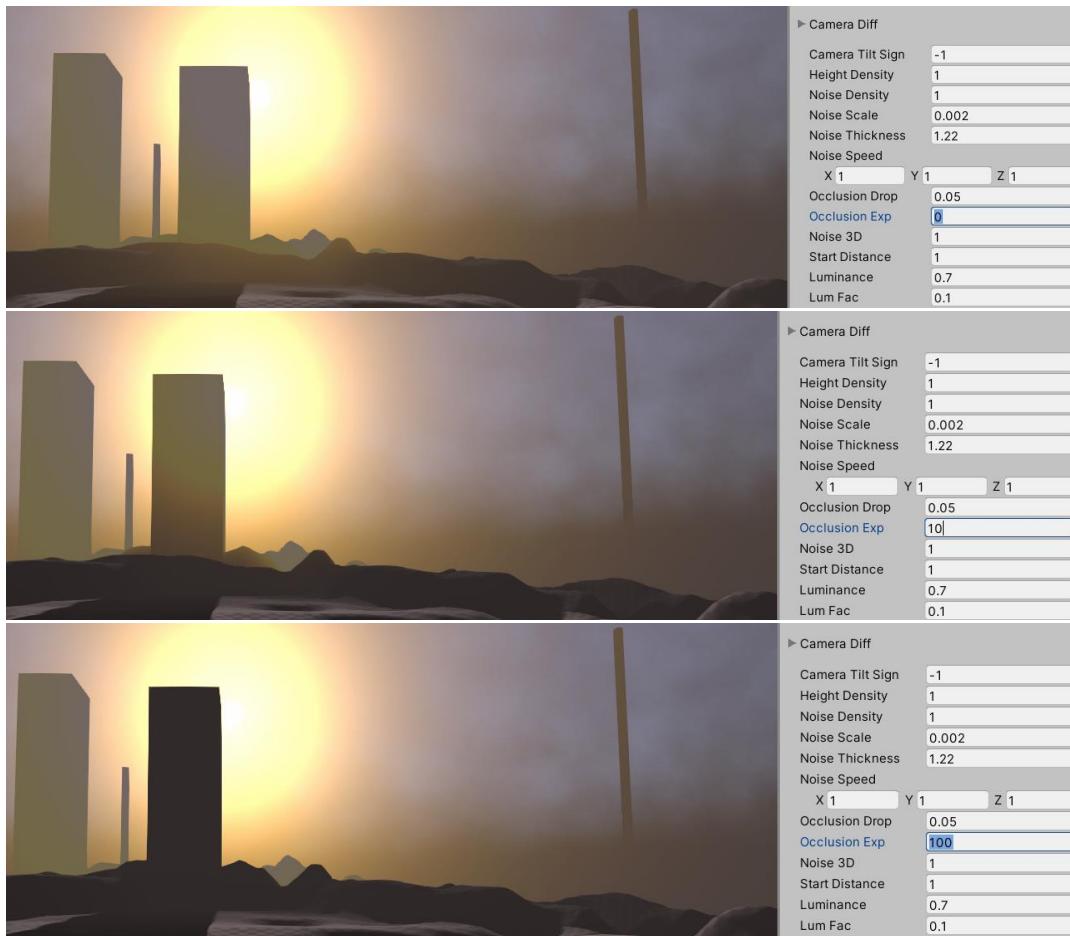
**Noise Speed:** The velocity of the noise motion, use to emulate wind pushing the dust particles to a direction defined by the x,y,z vector.

**Noise 3D:** This chooses between the 3D noise (1) or 2D noise (0), it is advised to use the 3D.

## Fog Occlusion Parameters

**Occlusion Drop:** Dictates the power of occlusion when fog meets a scene object.

**Occlusion Exponent:** Dictates the falloff of occlusion when fog meets a scene object.



## Atmospheric Scattering Parameters

**Luminance and Lum Factor:** Dictates the luminance power and falloff of the fog effect.

**Scatter factor:** Adjust light scattering in atmosphere

**Turbidity factor:** Adjust light power in atmosphere

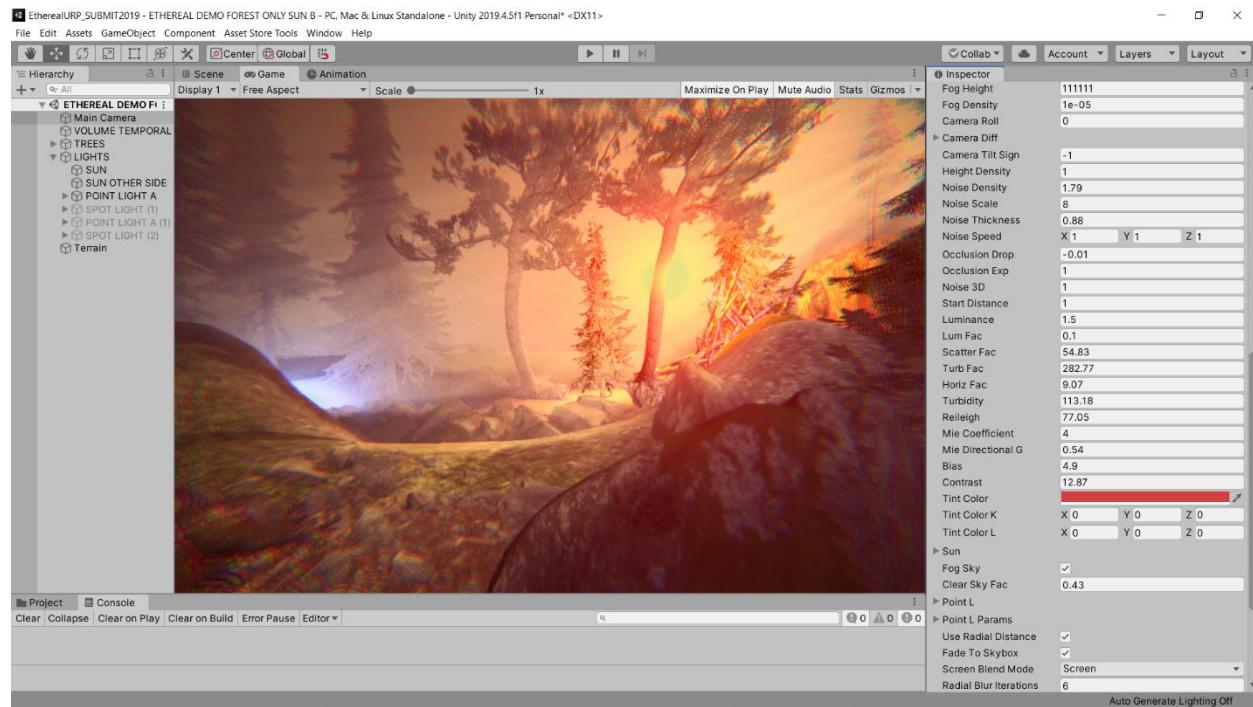
**Horizontal factor:** Adjust horizon spread of light in atmosphere

**Rayleigh & Mie coefficient:** Adjust light scattering physical variables

**Mie directional G:** Adjust concentration of light around sun, increase towards one to decrease light spread.

**Bias and contrast:** Adjust brightness and contrast of the effect

**Tint Colors:** Tint the effect using coloration factors



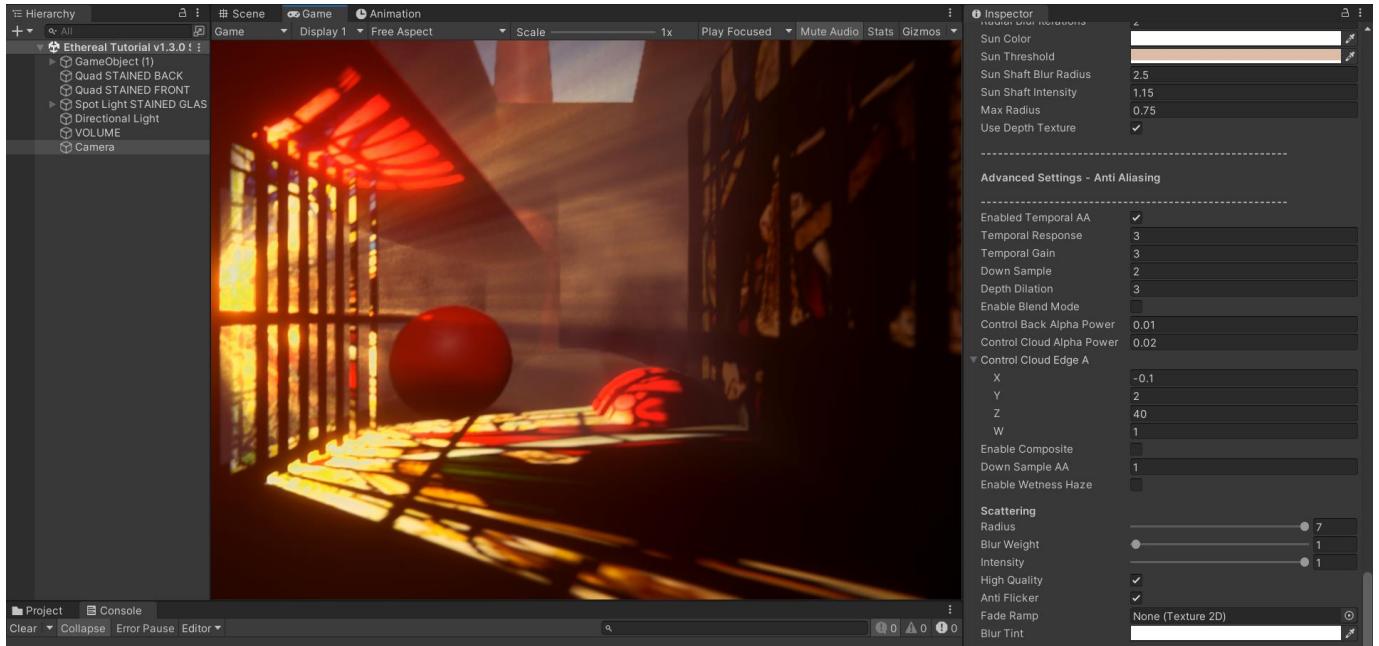
## Sky blending Parameters

**Fog Sky:** Dictates whether the sky will receive fog

**Clear Sky Factor:** Regulates the percentage the sky receives fog

## Advanced Parameters

The system in v1.2.0 includes a number of advanced parameters to fine tune the system for performance using downscaling and temporal AA and for scene blending.



**Enable Temporal AA** - This option enabled an integrated to the effect temporal AA filter that can reduce the noise of the effect. The effect can be tweaked by the “**Temporal Response**” and “**Temporal Gain**” parameters.

**Downsample** - This option can be used to render the effect in lower resolutions, by dividing the screen resolution by the factor defined in the variable.

**Depth Dilatation** - Use this option to push the effect in the missing gaps left by downsampling effect, using the scene depth information.

**Enable Blend Mode:** Enables advanced blending control of the volumetric effect with the environment.

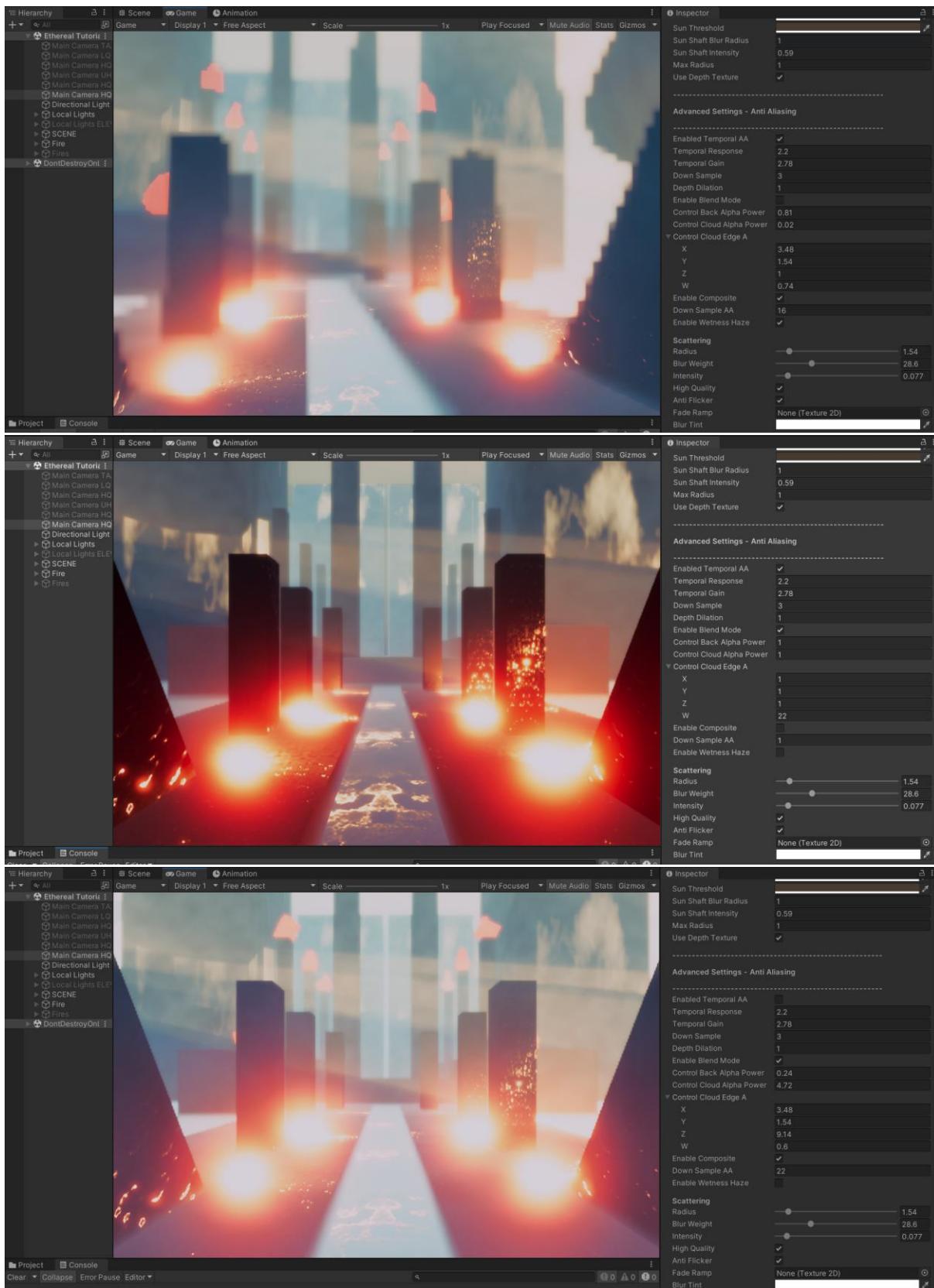
**Control Back Alpha Power:** Controls the background blending in the overall effect.

**Control Cloud Alpha Power:** Controls the power of the volumetric effect over the background.

**Control Cloud Edge A:** Controls the blending of the objects interfacing with the effect based on scene depth. X and Y control the power of the scene, Z the power of the volumetric lighting and fog and W the power of the overall effect.

**Enable composite:** This mode enables the composition of the temporal AA solution with added controls, enabling to downsample the temporal AA effect using the “**Downsample AA**” variable.

Some of the combinations of the various modes can be seen below.



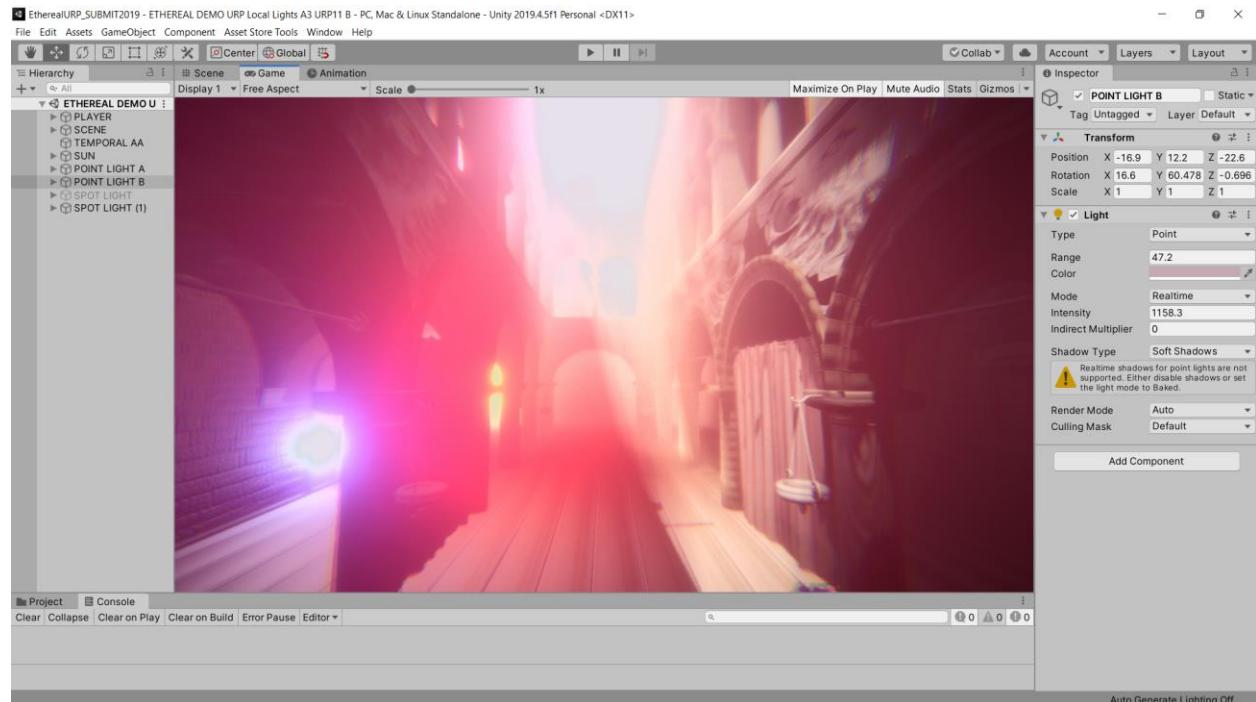
# Universal Pipeline versions

The system includes a few scenes specific to URP11 that supports Point Light shadows.

Note that the scenes may appear too bright in URP versions below 11.

An example of the scene in URP 7.4.3 and in URP11

## URP 7.4.3



## URP 11.0

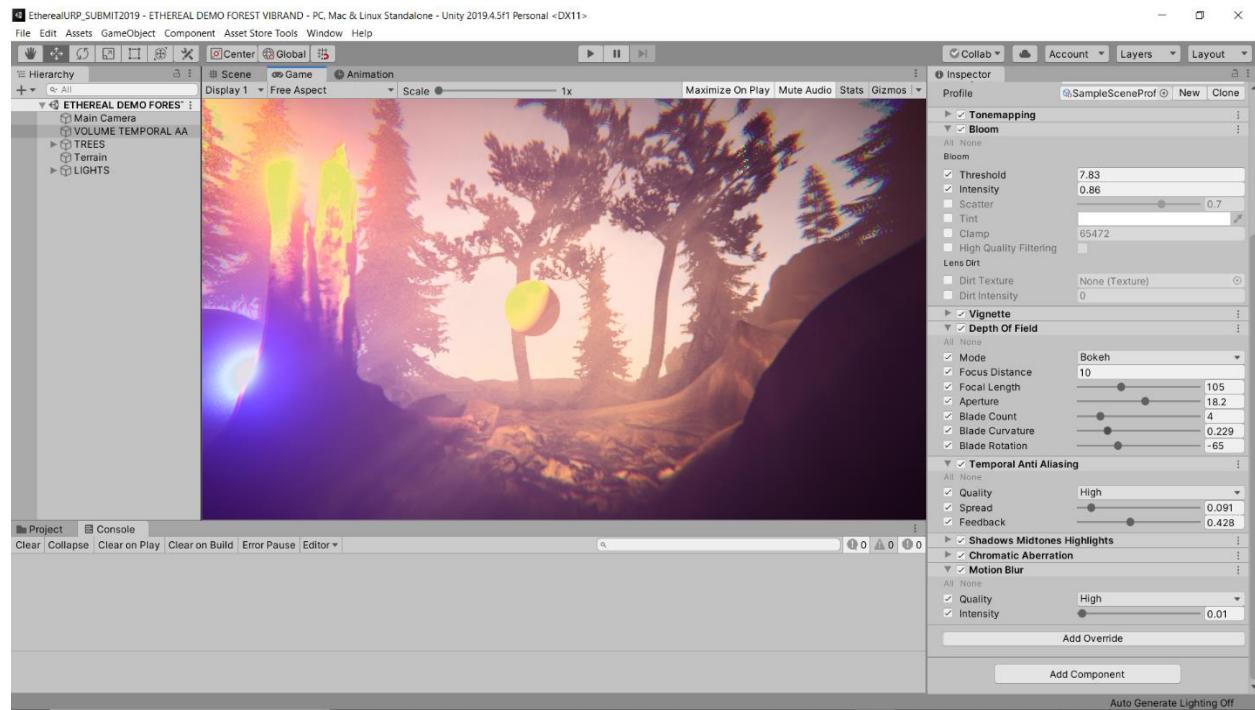


# Setup of Volume Effects

The system includes two bonus modules, a Temporal AA module and a Motion Blur module, those are both experimental modules that can help reduce the noise artifacts if sampling is set lower.

In the following photo the setup of the two modules is shown, both are used as a feature to be added in the volume system of URP, in a volume in the scene.

The Temporal AA is a work in progress system, which may produce few artifacts in some configurations, thus make sure to use the low quality mode as this reduces any artifacts in this first version.

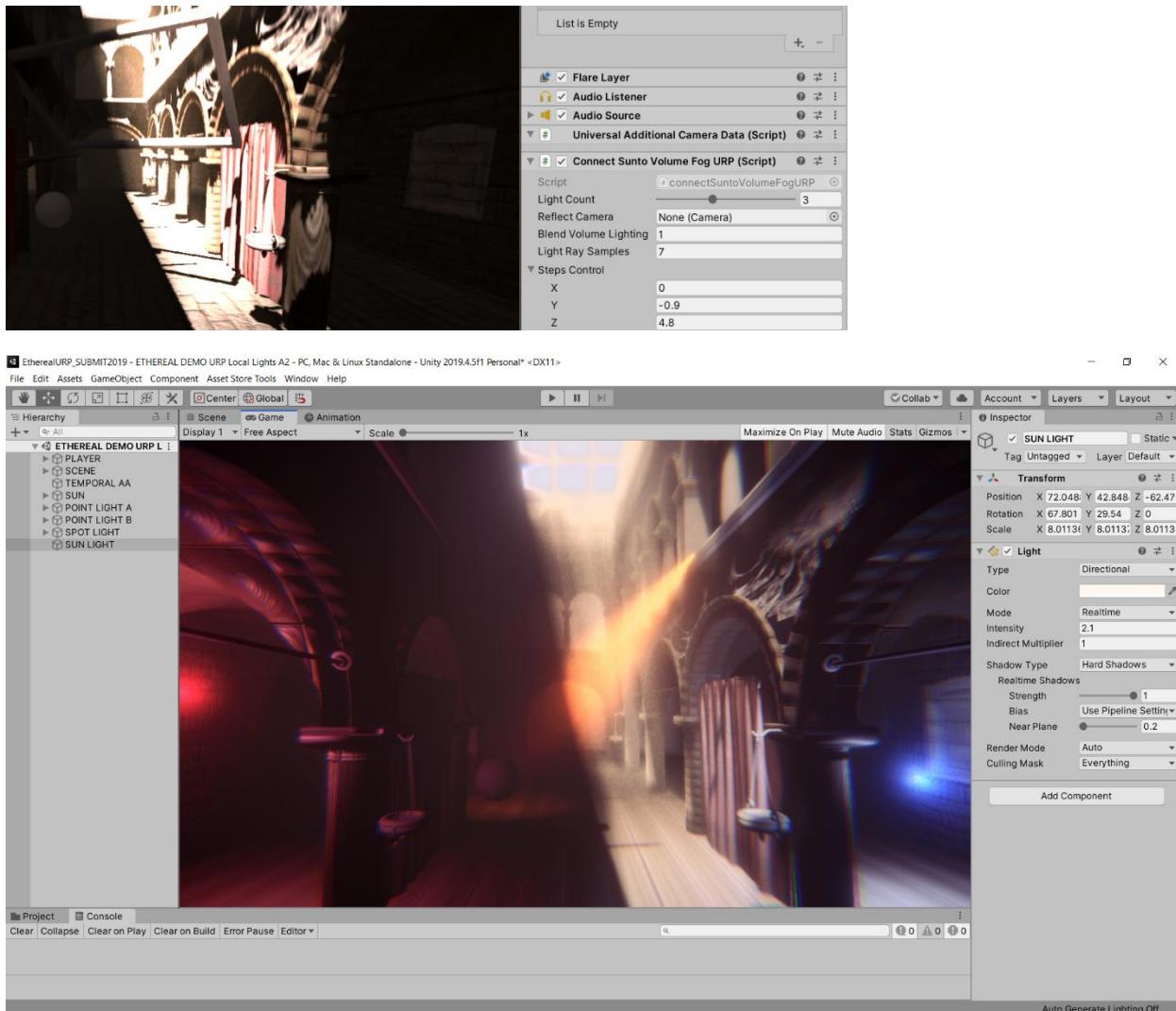


# About Supported Volumetric Lights

The system supports volumetric lighting from all Unity lights, directional, spot and point lights. For volume shadows on Point lights, URP11 and above is required.

The asset can support one Directional light and 3 local lights of any type (spot or point). The lights must be pre-defined and activated in the scene on game start and cannot be disabled, as this would affect the look of the remaining lights. Can be removed from the scene by placing them very far away from the player. The 3 lights limitation is to be expanded in next versions, though for performance reasons is advised to not use more than 4 total volume lights in the scene.

**Version 1.1.1:** The system as of v1.1.1 supports 6 local lights and has new performance optimizations to support the increased lights number. The light count can now be set in the script using the relevant slider.



## **Demos and folder structure:**

The main demos are included in the “ARTnGAME -> Ethereal Volumetric Lighting” root. The GI Proxy folder contains the assets for the Atrium demo and the “BOOK\_OF\_DEAD\_ASSETS” folder inside “ARTnGAME -> Ethereal Volumetric Lighting”, contains the Forest demo assets. The “FOREST SHADERS” folder contains the bonus foliage shader for URP, with Sub Surface Scattering and Wind.

The system is based on the Volumetric Fog SRP asset, thus the scripts are included in the “VolumeFogSRP” folder and demos for the fog without the volumetric lighting are included in the same folder.

The “URP Custom Renderer” folder contains the sample URP pipeline and forward renderer setup for direct use or reference if another URP pipeline asset is to be used.

## **How to enable URP10 and URP11 for the Volumetric Lighting and Fog.**

The URP pipeline changes constantly, thus to use in URP10 or URP11, please make the following fix in the shader file "VolumeFogSRP\_FORWARD\_URP.shader".

**ISSUE:** Volumetric lighting is not casting shadows from Spot Light in URP 10 and no shadows in URP11.

**FIX:** In shader "VolumeFogSRP\_FORWARD\_URP.shader", uncomment the following line

Line 57 - Uncomment to make compatible with URP10

```
//#define URP10 ////////// ENABLE IF USING URP 10
```

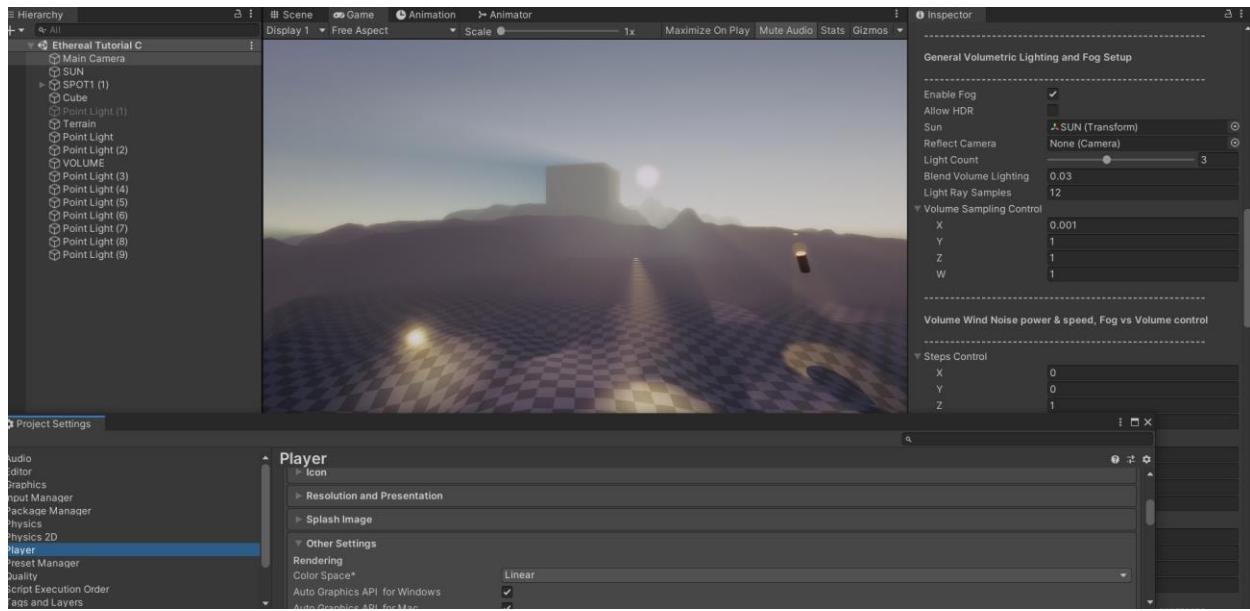
The line should become

```
#define URP10
```

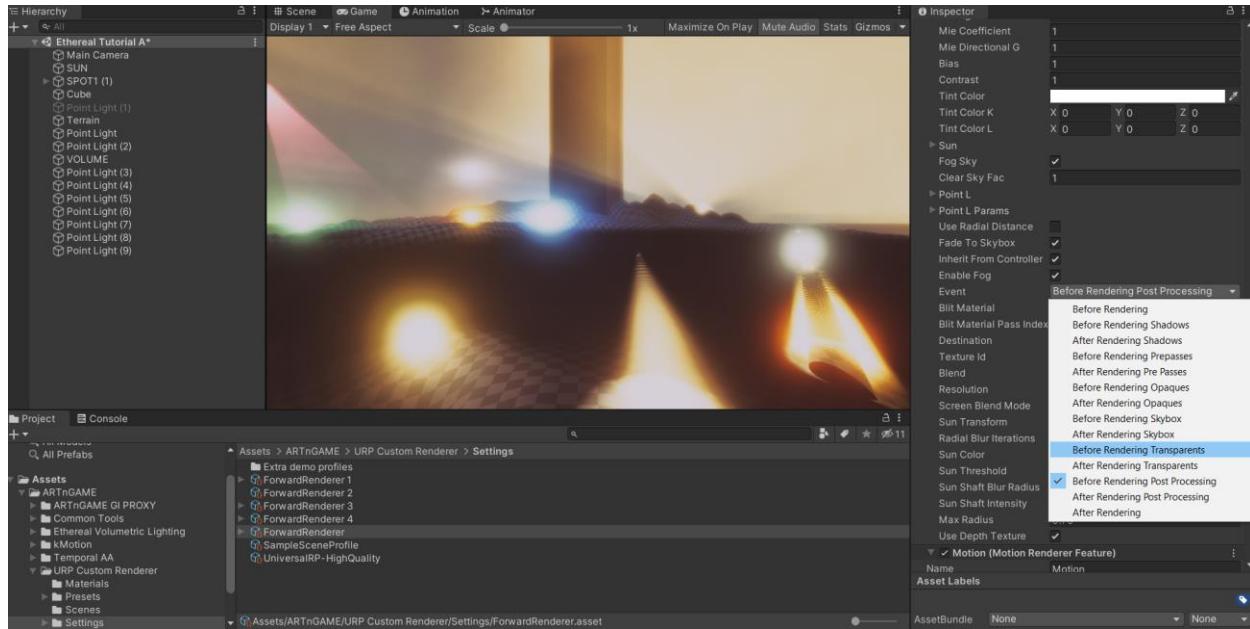
**For URP11, uncomment the relevant #define URP11 and comment out the #define URP10.**

## IMPORTANT NOTES:

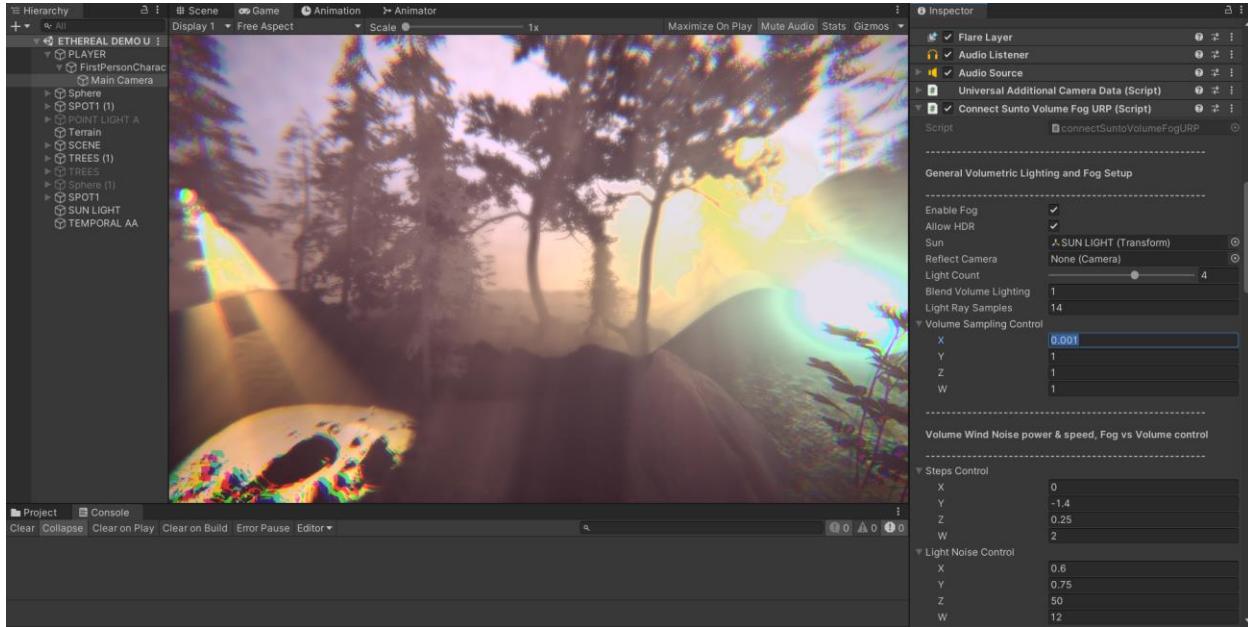
- The system is made with Linear color space in mind, use Lineal color space to get the best results.**



- The system can be made to render in front or below transparent materials, use the drop down menu in the forward renderer fog feature to choose to render before transparency for making particle effects for example appear in front of the fog, default mode is after transparency as shown in the image below.**



**3. In the latest v1.1.8d** the default for local lights has been changed to the one without noise, this means that already installed demo scenes before this variable was created or scenes created with a rather older version will have spot lights that may look with a gradient, in this case either increase the steps (Light Ray Samples) to more than 14 and decrease brightness of the effect (Blend Volume Lighting) or install the v1.1.8d demos on top of previous as have been corrected for this new default mode. Also can enable the noise mode by putting one instead of near zero in the Volume Sampling Control (X) variable, then can decrease the steps and increase brightness. Also adjust Steps control Y-Z values to get the final look as desired.



**4. In some cases the Unity lighting settings “Intensity Multiplier” slider may affect the scene lighting in strange ways**, this is not related to the asset itself, but may create strange looking brightness at some sun angles, so is recommended to use zero for this value if the lighting is affected like shown in the first image below, in the second image the lighting is the correct one when set this variable to zero.

