

NORWAY VALLEY

#Procedural Terrain Generation

SUMMARY

This is a full-process environmental art production project that includes **procedural terrain generation**, **vegetation generation**, **terrain materials**, **lighting production**, etc.

Since I majored in digital media technology in my undergraduate studies, I have a strong interest in environmental art. Therefore, I want to use the full-process project production to show my **aesthetics**, **procedural production** ideas and **techniques**.

Video Link : <https://www.youtube.com/watch?v=llmuW6yycoo>

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Terrain Designer
Technical Artist
Lighting Artust

RESEARCH

After deciding to make a terrain based on the **Norwegian landscape**, I browsed a lot of local landscape pictures and documentaries to make a complete investigation of the overall landforms and details of the terrain. The terrain of Norway can range from **snow-capped mountains** and **rocks** to **forests and lakes** in a very small area. The altitude changes very quickly, and **cliffs** can be seen everywhere. In addition, according to the data, Norway has extremely **rich vegetation types**.

- 20,000 species of algae

- 2,800 species of vascular plants

- 1,800 species of lichen

- 1,050 species of mosses

- 7,000 species of fungi.



INSPIRATION

Northern Europe, such as Norway, has a rich landscape. Fjords, grasslands, snow-capped mountains, forests, rivers, etc. make the scenery here unique. However, it is difficult to show all the elements in one project. After browsing the videos on Youtube and the photos of my parents' tour, I chose **snow-capped mountains, forests, and rivers** as the main features of this project. The left picture is the Youtube video, and the right picture is the photo taken by my parents at that time.

SKETCH

This project includes three snow-capped mountains. The shadows are **peaks**, and the outer circle is the **mountain body**. There is a **winding river** from west to east. The foot of the mountain and the river bank are covered with **forests, grasslands and vegetation**. In addition, there are many **cliffs** where the peaks and the mountain body meet.

BACKGROUND

This project uses the Nordic landscape as a reference. This is because in 2007, my parents went to the four Nordic countries and brought back many beautiful landscape photos taken with digital cameras. I was **very sorry** that I **could not go** with my parents because I was studying at school. So I hope to restore the landscape of the Nordic landscape with the help of this project to **make up for my childhood**.



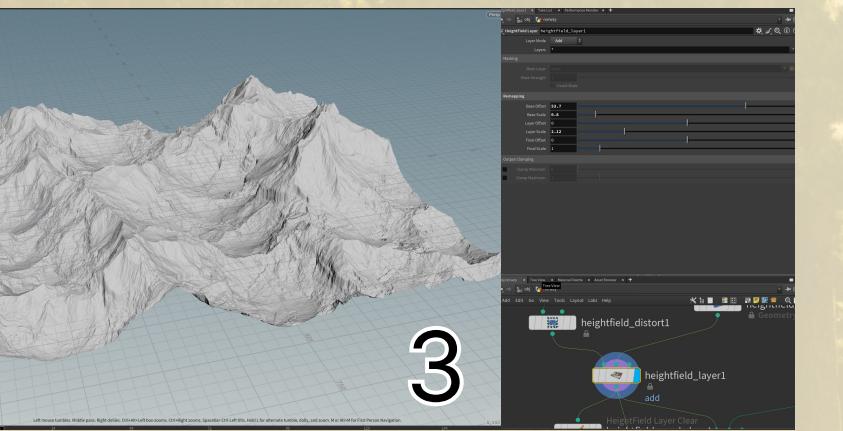
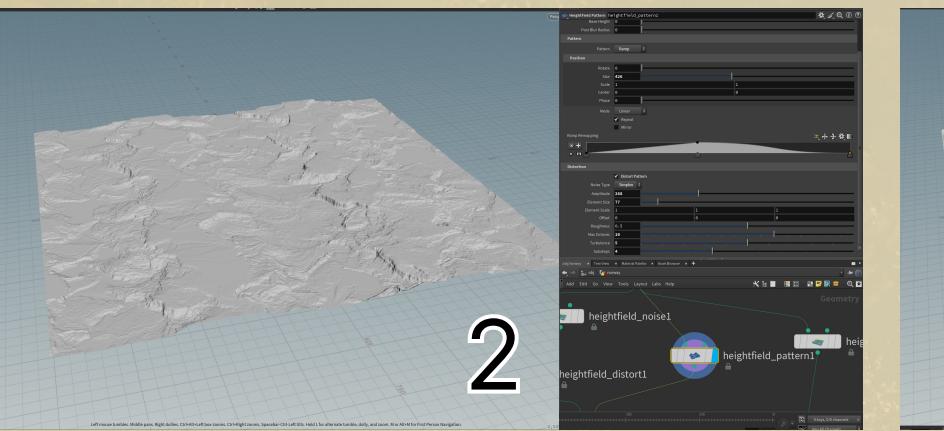
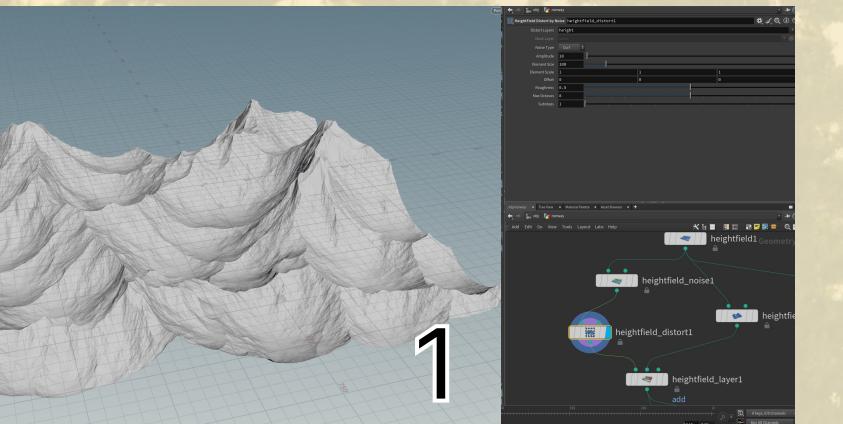
Shot in 2007 by my parents



A TERRAIN GENERATION

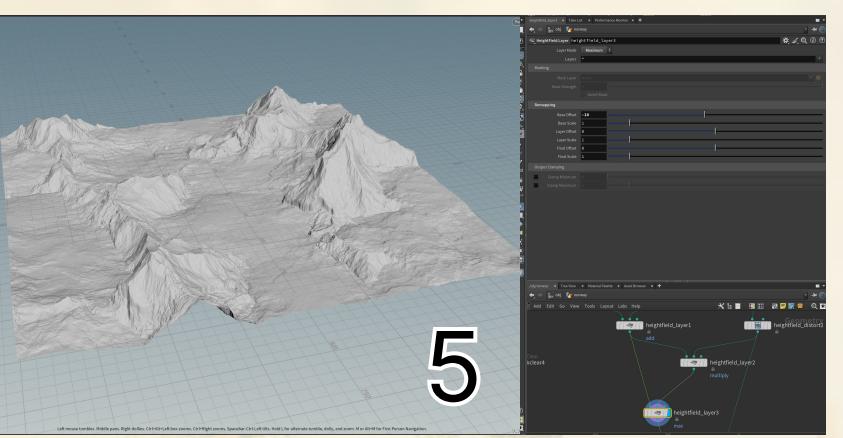
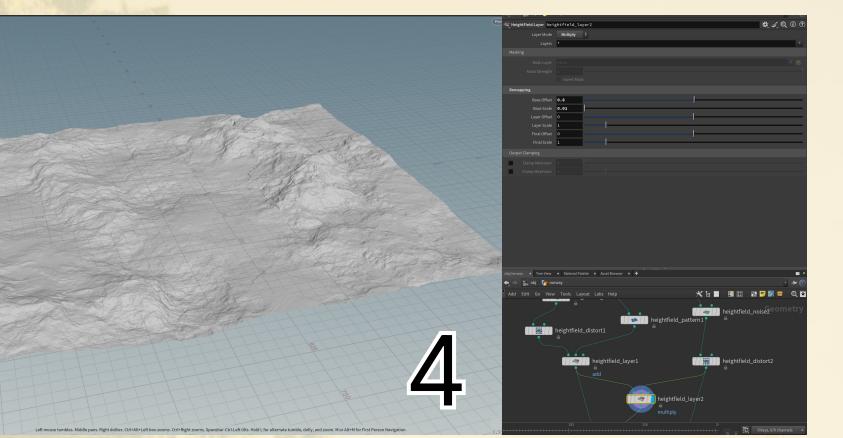
#1 Mountain creation

Merging the hilly mountain in Figure 1 and the plain in Figure 2 with Add Height can form an irregular mountain like Figure 3. Merging can also produce cliffs, gentle slopes and other landforms.



#2 Overall landform

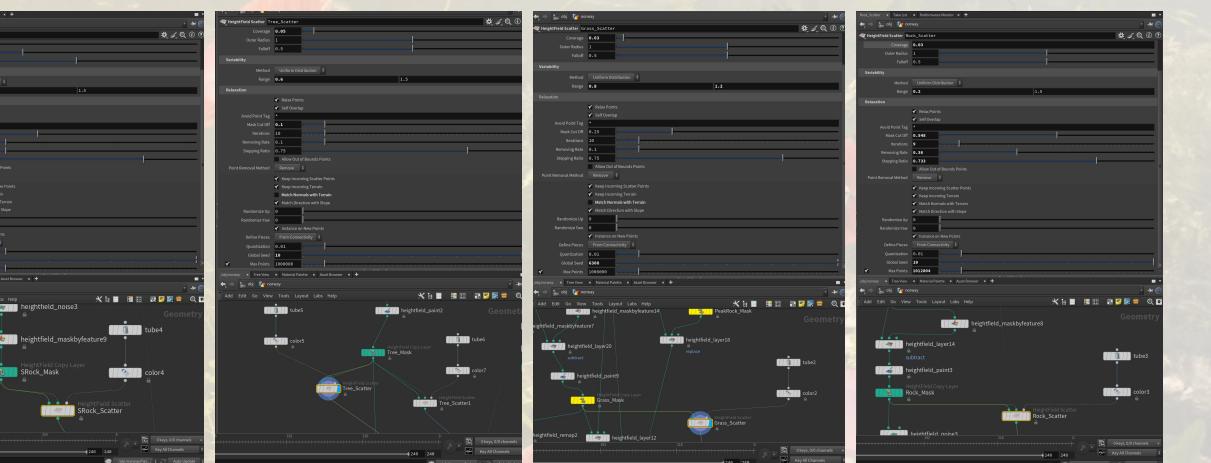
After making the plain part of Figure 4, merge it with the mountain part of Figure 3 in the Max mode to get the highest height of the two height maps. This not only retains the **mountain features** of Figure 3, but also retains the **plain area** of Figure 4, enriching the overall landform, including five landform features such as **peaks, steep slopes, gentle slopes, cliffs, and plains**, as shown in Figure 5.



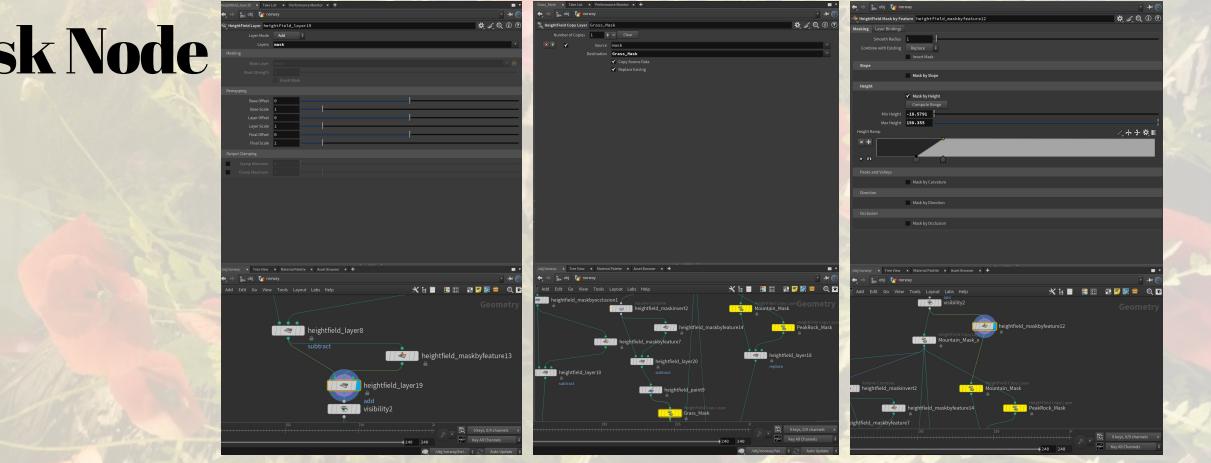
#3 Water erosion

Figure 5 is already quite complete. Based on this, the **Heightfield_erosion** node is used as shown in Figure 7 to calculate water erosion and lock it in frame 8. Compared with Figure 5, Figure 6 has a lot of traces of **water erosion** on the mountain, and the realism is further improved.

#8 Scatter Node



Mask Node

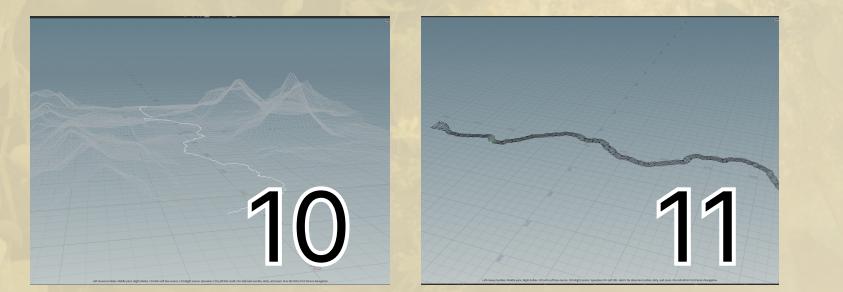


B RIVER GENERATION



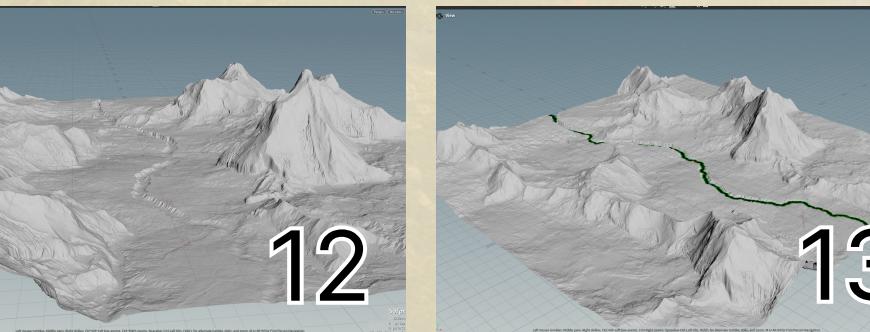
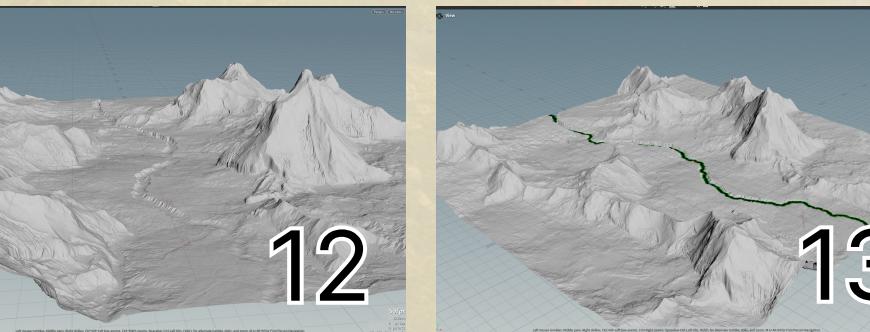
#4 River curve

Draw a curve across two mountains on the terrain in Figure 6, as shown in Figure 8. Then use the custom node **FitTerrain** to make the river curve more **tortuous** and **adapt the height**, as shown in Figure 9. FitTerrain will identify the height data of the terrain near the curve. In this way, the height of the curve can **fit the nearby terrain** and erode downward.



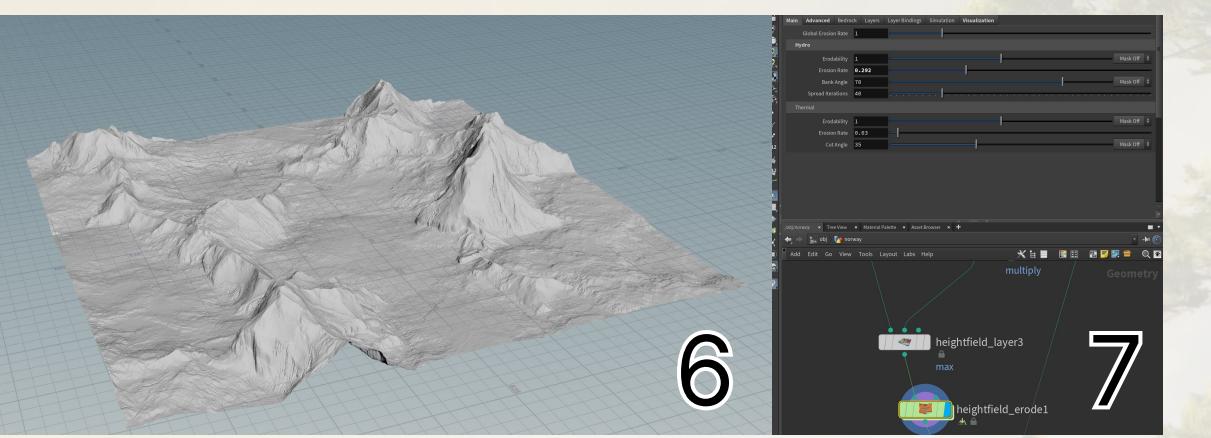
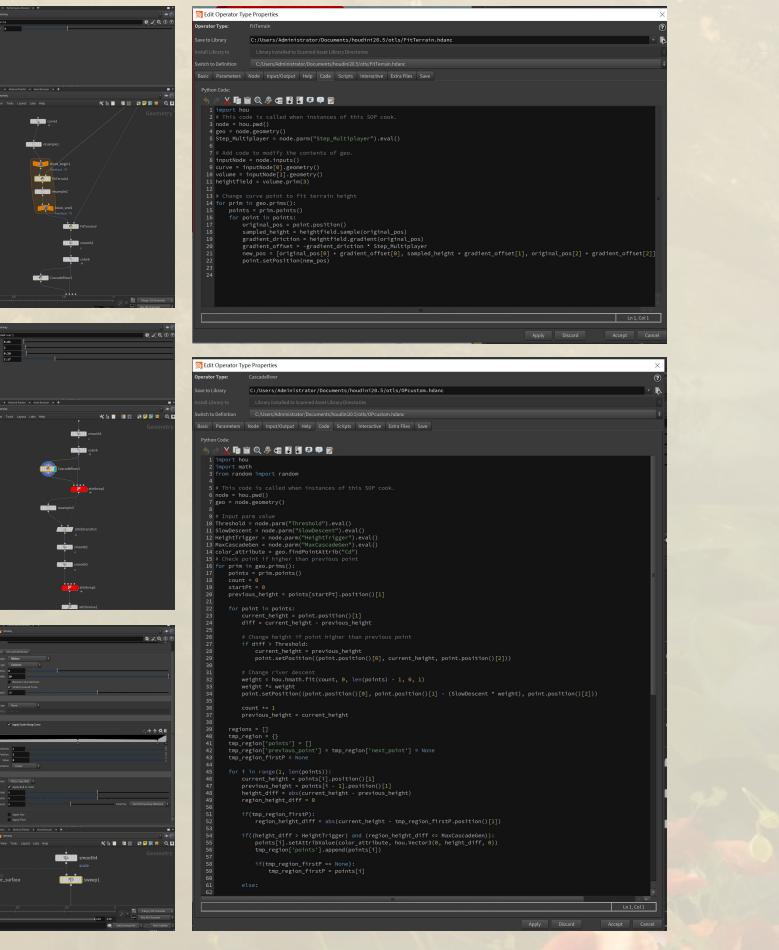
#5 Rivers & terrain

As shown in Figure 10, the river curve fits the terrain very well. Figure 11 uses the **Sweep** node, with Surface Shape set to **Ribbon** and Surface Type set to **Columns**. This node can widen the previously drawn curve and use it as the **river surface**. The Width node can set the width of the river surface.



#6 Erosion effect

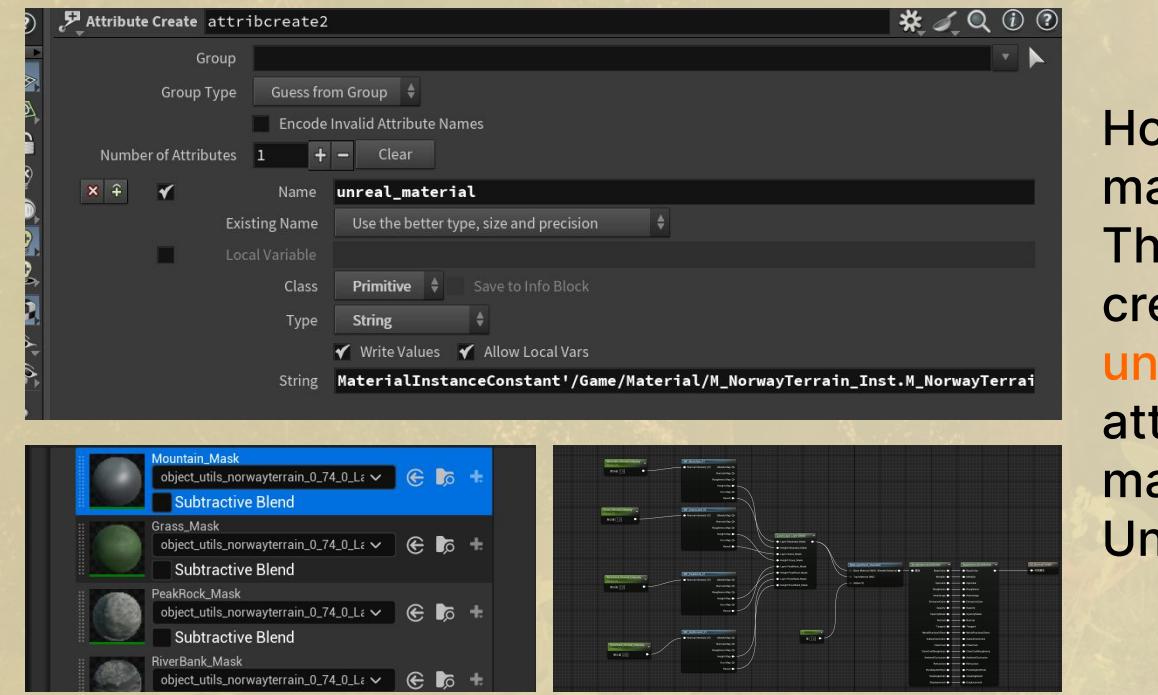
Use the **Heightfield_project** node to **combine** the terrain in Figure 6 with the previous river surface to generate the riverbed landform on the original terrain. The effect is shown in Figure 12. The final terrain after merging the river and terrain is shown in Figure 13.



PROCESS

C TO UE5 PROCESS

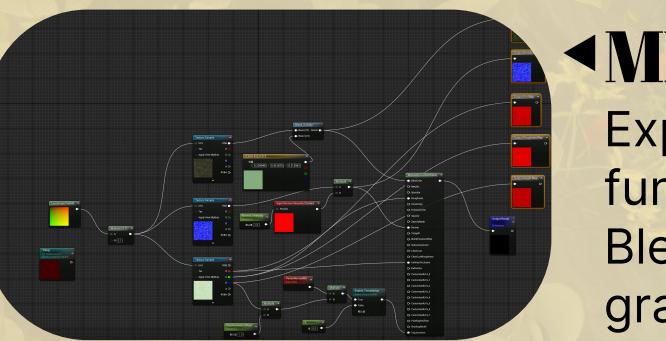
Houdini specifies terrain material attributes



Houdini specifies terrain material attributes. The **attributecreate** node creates a parameter with Name **unreal_material** and a String attribute that specifies the material instance path in the Unreal engine.

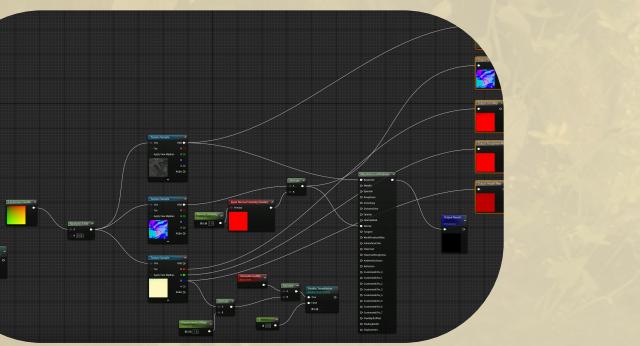
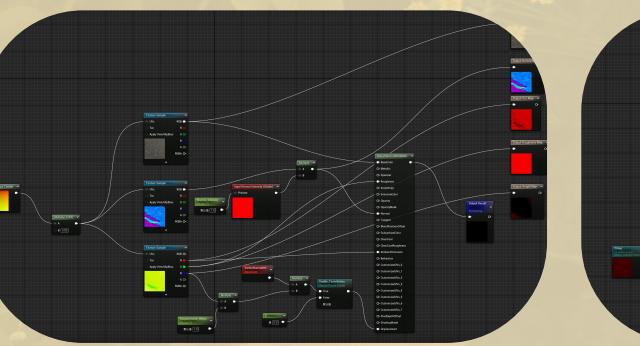
MF PeakRock ▼

Output the mountain material function to the landscape material.



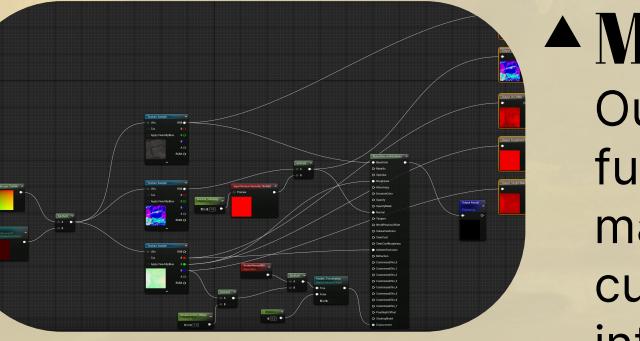
► MF Grass

Exports grass material function to terrain material. Blend_Overlay customizes grass color.



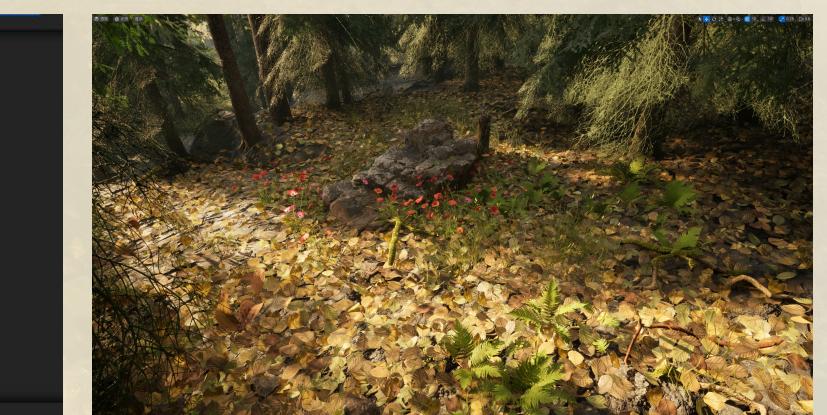
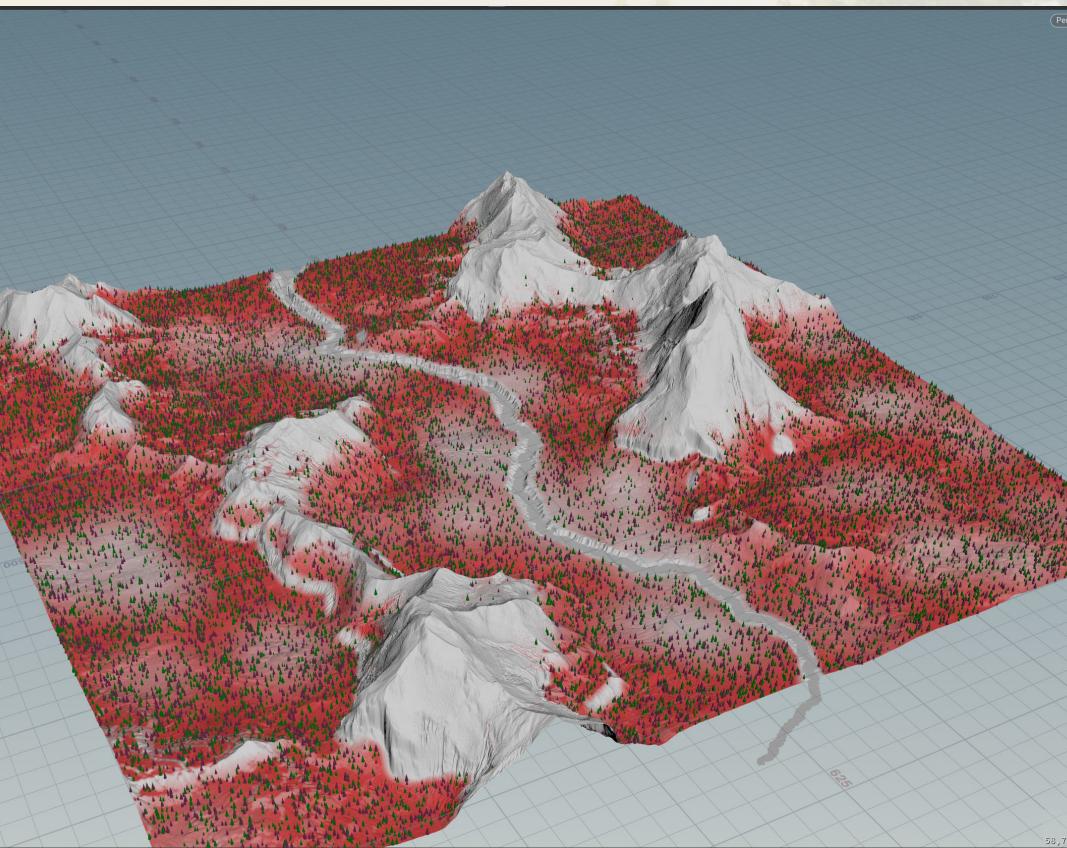
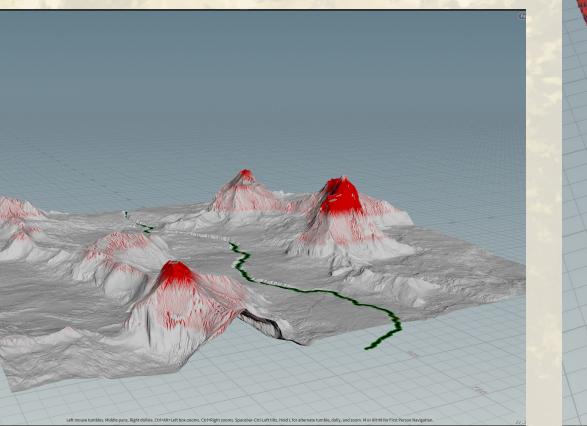
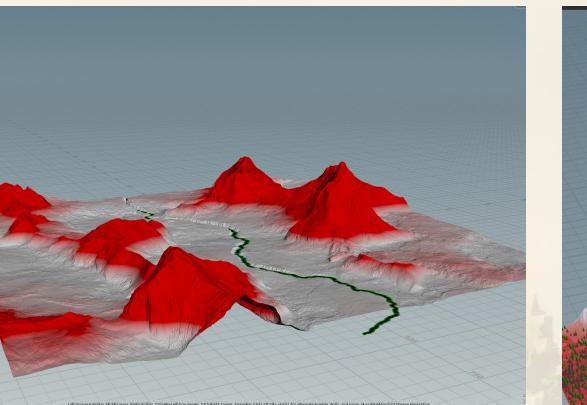
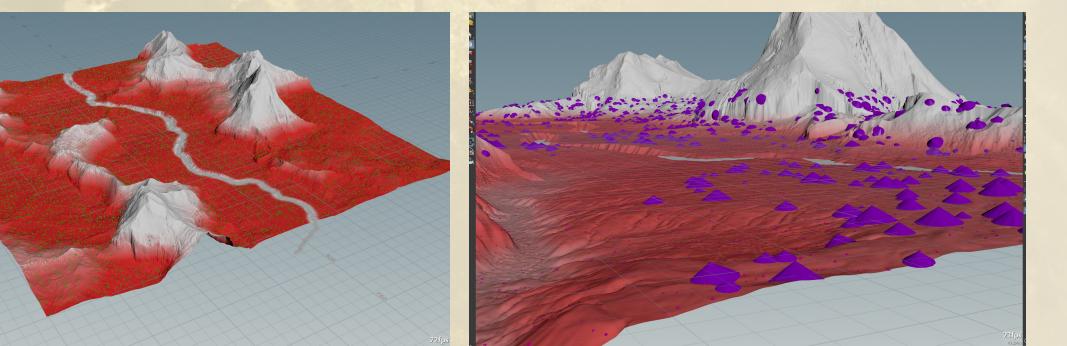
▲ MF Mountain

MF Soil ►
Export the base dirt material function to the terrain material.



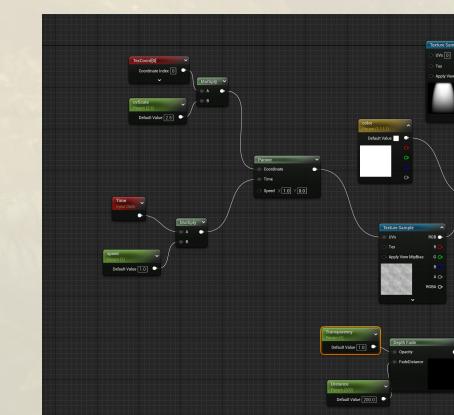
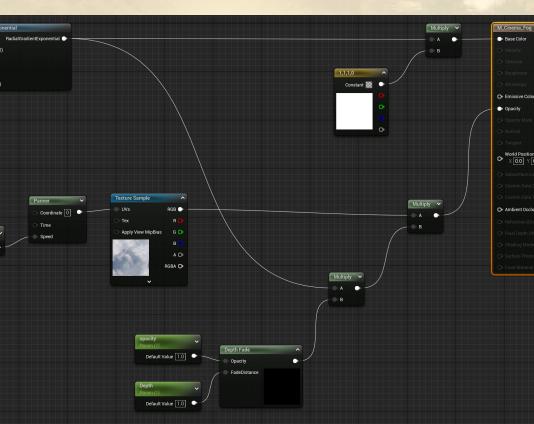
Terrain Production

The trees are mainly distributed at the foot of the mountain, on the plains and by the river. The height condition is set through the **HeightfieldbyFeature** node, and the cliffs and riverbeds are manually removed using HeightPaint. Finally, two Scatters are created and different densities are set to **enrich the diversity** of the trees.



Planting

Warm-colored flowers and large-leaf ferns complement each other, making the deciduous woodland rich and colorful. Mossy stones and wood piles also highlight the realism.



Scene fog

A patch is used as the fog body, and the fog material is assigned to this patch. The blending mode is set to **semi-transparent**, and the **RadialGradientExponential** and **Depth Fade** nodes are used to control the transparency. The following figure is the fog effect.

Tyndall effect

Six patches are **interlaced** to form a mesh, and the material is assigned to it. The material blending mode is set to **Additive**, and the Time node can make the light produce a **slight shaking** effect over time.

FINAL

DEPTH RENDERING

