



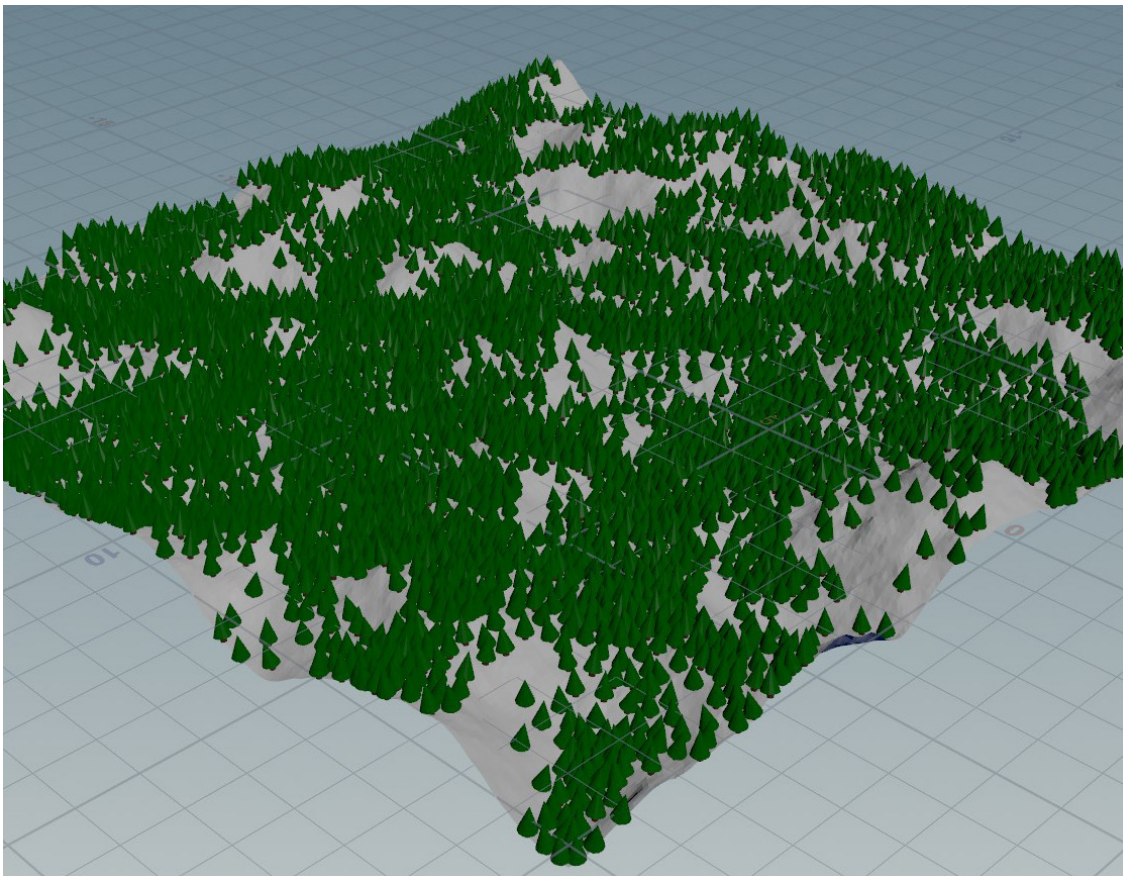
## Curriculum-in-a-Box | Lesson 3 | Guided Work

# LANDSCAPE SCATTER

Students are now asked to follow-along with the teacher as they build something in Houdini. For this lesson, students will learn how to work with attributes, and how to use those attributes to manipulate copies of geometry. This specific example will take a grid, deform it to look like terrain, and then scatter some trees onto the terrain. Copying geometry to points is a fundamental concept for working with geometry in Houdini, and students will have a much deeper understanding of this after completing the following exercise.

### WHAT STUDENTS WILL LEARN

- How to use the Copy to Points SOP to copy geometry
- How to use the Attribute Noise SOP to deform a sphere's *P* attribute
- How to use the Mask by Feature SOP to create an attribute based on the geometric features of the input
- How to create a random *orient* attribute to control the angle of copied geometry



## PART ONE

# Setup Project and Create Terrain

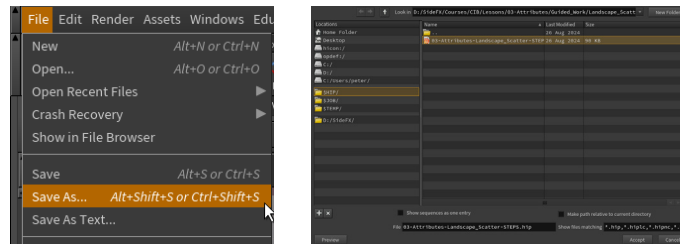
In this first section of the assignment, you will show your students how to set up their project, add a grid to the scene, and then deform it to look like terrain. Later, you will use this terrain as the input geometry on which to place your copied trees.

### 1. Set up your Project Directory

- Download the *CIB\_Lesson03.zip* file and unzip it, then place it in the *documents>HoudiniProjects* directory.
- Open Houdini and from the **File** menu, choose **Set Project**.
- Navigate to the *CIB\_Lesson03* directory and press **Accept**.

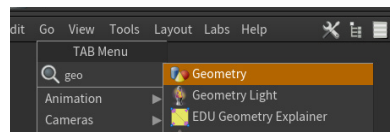
### 2. Save your Scene File

- From the File menu, choose **Save As**.
- Make sure you are in the *CIB\_Lesson03* directory, give the **File** a name and press **Accept**.

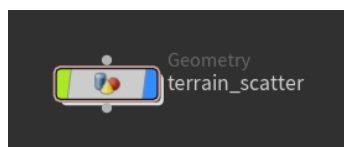


### 3. Set up the Geometry Network

- Press Tab in the Network View, start typing *geo*, then select **Geometry**.



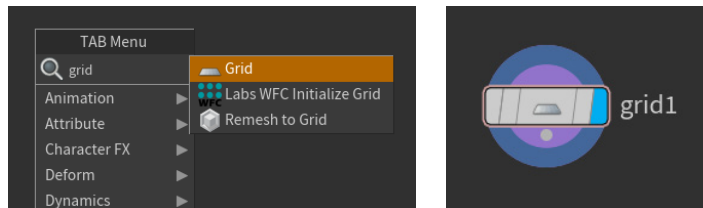
- Click in the Network View to place the node.
- Double-click the *geo1* name and change it to something like *terrain\_scatter*.
  - This will be a container for the geometry that you create.



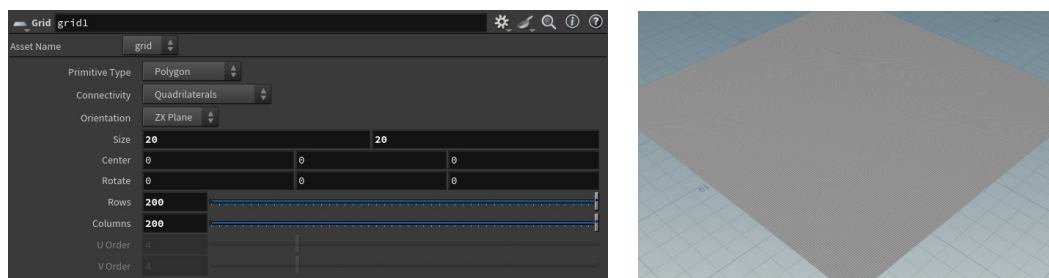
- Double-click the *terrain\_scatter* node to dive inside.

#### 4. Add a grid to the scene

- Press **Tab** in the Network View, type *att float*, and press **Enter**.
- **Left-click** to place the node.

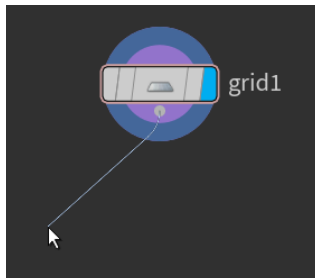


- In the Parameter Pane, change the **Size** to **20** and **20**.
- Also, change both **Rows** and **Columns** to **200**.

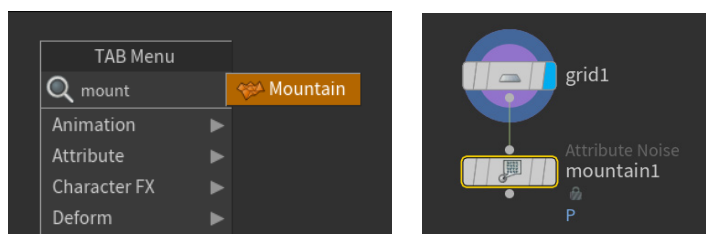


#### 5. Add noise to the grid to approximate terrain

- **Left-click** on the *Grid* node's output dot.
  - You will now have a wire that follows your cursor and is connected to the output dot.

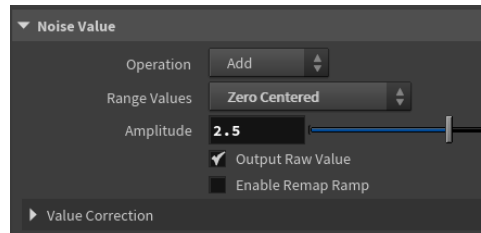


- Press **Tab** in the Network View, type *mount*, and press **Enter**.

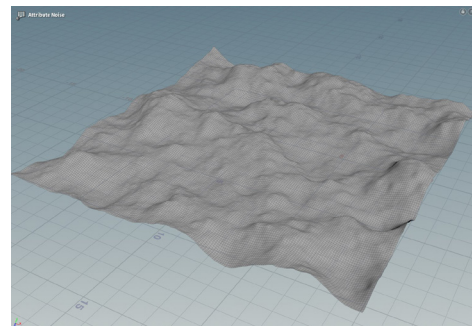
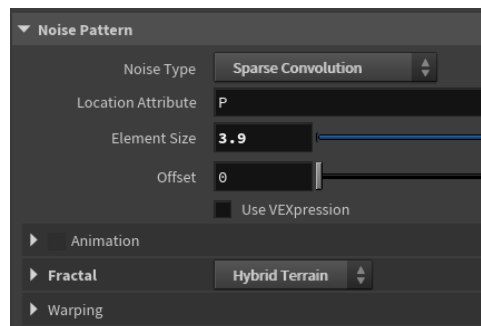


- A new *Mountain* node will be placed in your Network View and will be connected to the *Grid* node.
- You can move the new node in order to keep your network organized. You should see the node snap into alignment with the positions of the other nodes that are already in the network.

- Click the right-most section of the *Mountain* node to move the blue Display Flag.
  - This allows us to visualize what the *Mountain* node is doing. The Display Flag is a cornerstone of using Houdini because it lets you visualize the result of all nodes that were placed before the one with the Display Flag.
  - If your *Mountain* node isn't highlighted in yellow, click on the center of it in the Network View.
- In the Parameter Pane, change the **Amplitude** to 2.5.

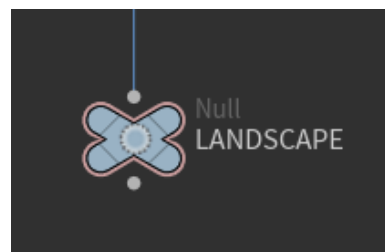
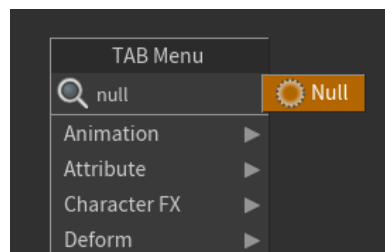


- Scroll down to the **Noise Pattern** section and change the **Noise Type** drop-down to **Sparse Convolution**.
- Also, change the **Element Size** to 3.9.



## 6. Add a Null node to help with network organization

- Click the output dot of the *mountain1* node.
- Press **Tab** in the Network View, type *null*, and press **Enter**.
- Rename the *null1* node to *LANDSCAPE*.



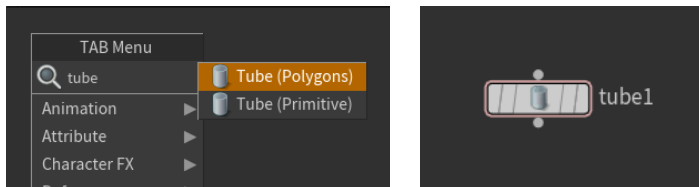
## PART TWO

# Create a Simple Tree

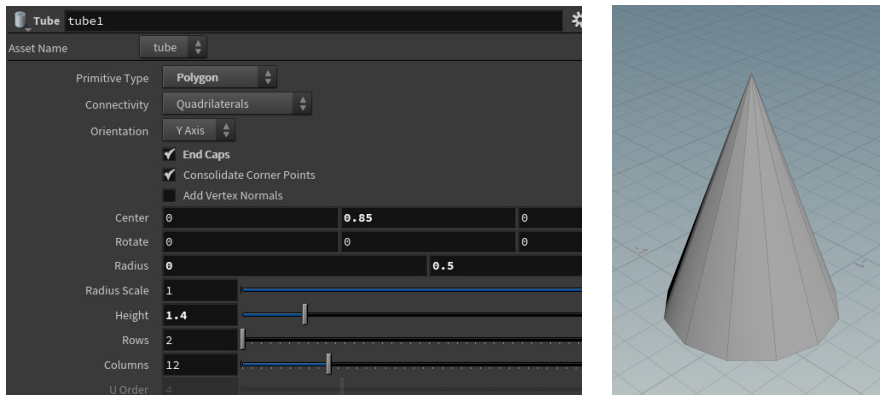
The next step in this exercise will show your students how to use simple geometric shapes to create a tree for your terrain. In order to make the trees stand out from the terrain, you'll add a **Cd** (color) attribute to the parts of the tree. You will also scale the final tree to make sure that the eventual copies don't overlap.

### 1. Make a cone for the top of the tree

- Press **Tab** in the Network View, type *tube*, and press **Enter**.
- **Left-click** to place the node.

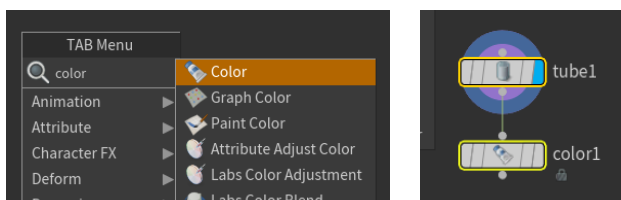


- In the Parameter Pane, change the **Center** values to **0, 0.85, and 0**.
- Change the **Radius** values to **0 and 0.5**, check the box next to **End Caps**, and change the **Height** to **1.4**.

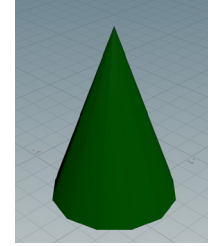
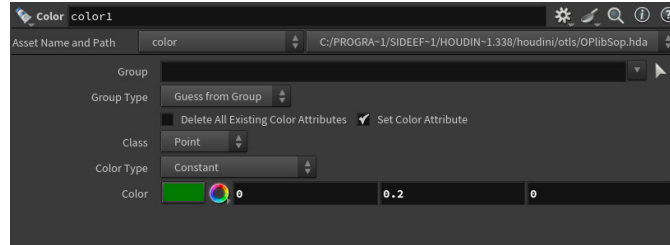


### 2. Color the top of the tree dark green

- **Click** the output dot of the *tube1* node.
- Press **Tab** in the Network View, type *color*, and press **Enter**.

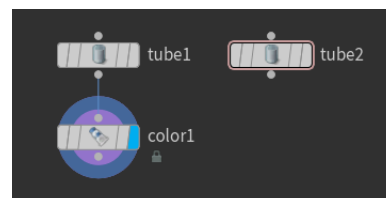
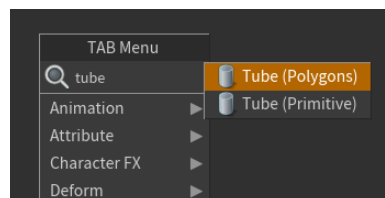


- In the Parameter Pane, change the **Color** values to **0, 0.2, and 0**.

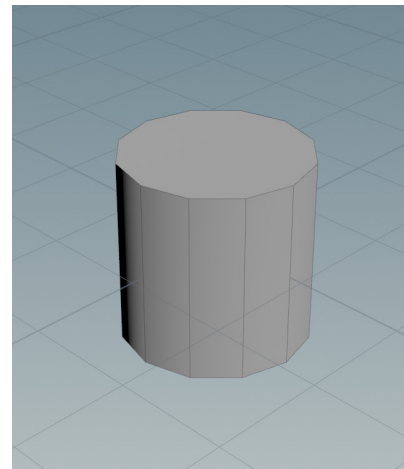
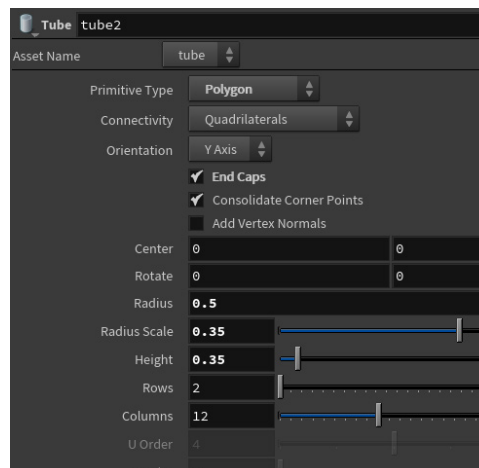


### 3. Make a tube for the tree trunk

- Press **Tab** in the Network View, type *tube*, and press **Enter**.
- Click to place the node.

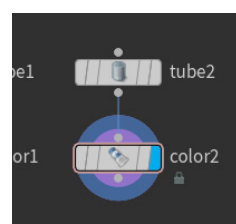
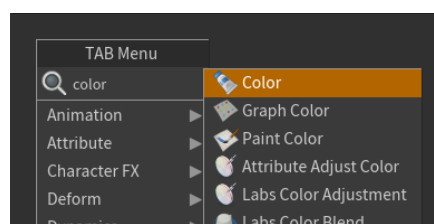


- In the Parameter Pane, check the box next to **End Caps**.
- Set both the **Radius Scale** and **Height** to **0.35**.

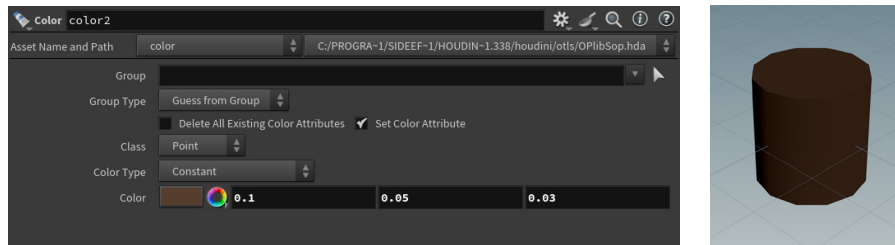


### 4. Color the tree trunk brown

- Click the output dot of the *tube2* node.
- Press **Tab** in the Network View, type *color*, and press **Enter**.

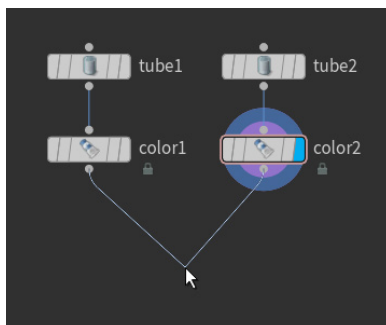


- In the Parameter Pane, change the **Color** values to **0.1**, **0.05**, and **0.03**.

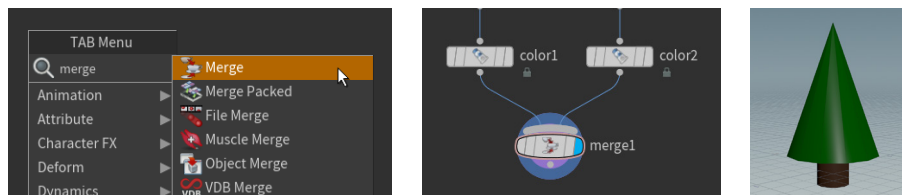


## 5. Combine the two pieces together

- While holding **Shift**, click the output dot of the *color1* node and then click the output dot of the *color2* node.
  - You will now have wires connecting the outputs of both nodes to your cursor.

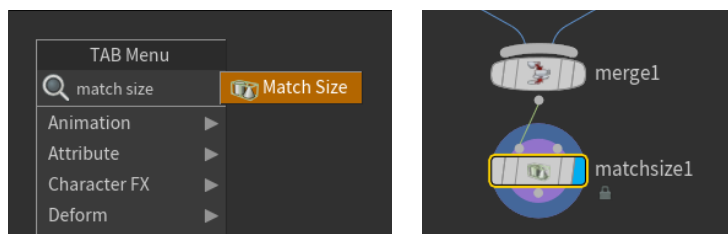


- Press **Tab** in the Network View, type *merge*, and press **Enter**.



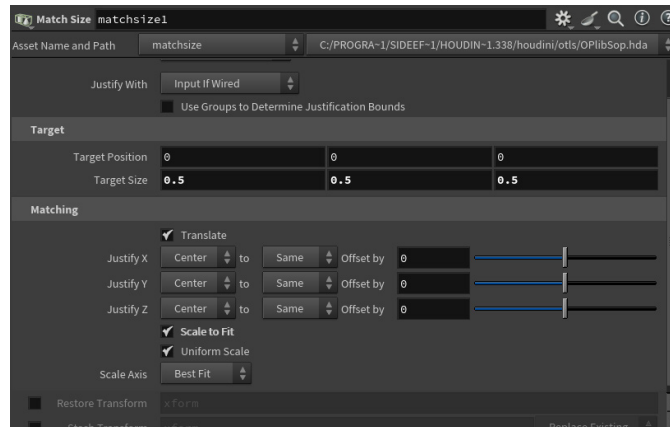
## 6. Move the tree to the XZ plane and scale it

- Click the output dot of the *merge1* node.
- Press **Tab** in the Network View, type *match size*, and press **Enter**.

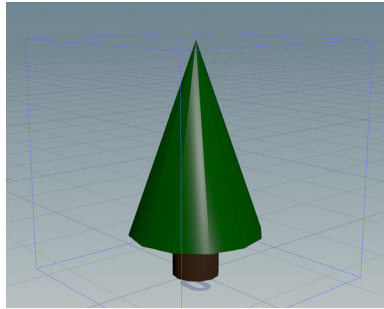




- In the Parameter Pane, change the **Target Size** to **0.5, 0.5, and 0.5**.
- Change the **Justify Y** drop-down to **Min**, and check the box next to **Scale to Fit**.

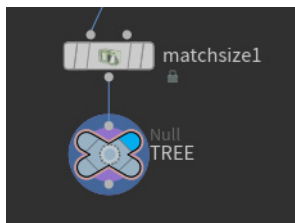
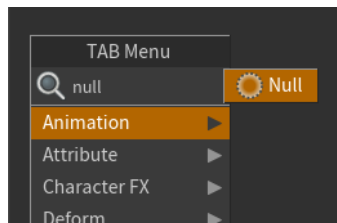


- Your tree should now be scaled to the bounding box and moved to the XZ plane.



## 7. Add a Null node to help with network organization

- Click the output dot of the *matchsize1* node.
- Press **Tab** in the Network View, type *null*, and press **Enter**.
- Rename the *null1* node to *TREE*.





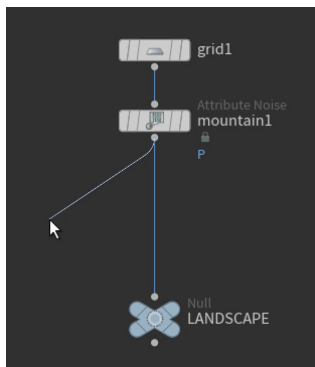
## PART THREE

# Scatter Points onto Landscape and Copy Trees to Points

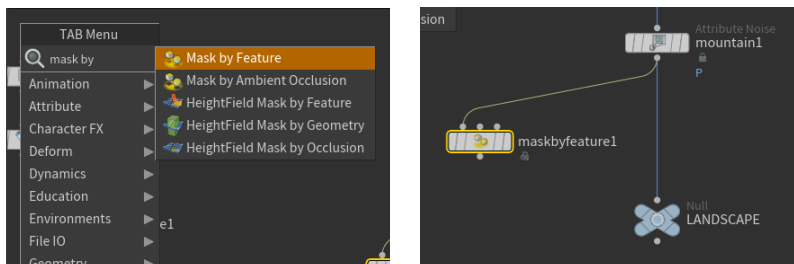
In this final part of this exercise, you will guide your students through scattering points onto the landscape, and copying the simple trees to these points. In order to not scatter points evenly across the terrain (which would look less-natural), you'll use a Mask by Feature SOP to focus on certain areas of the terrain. You'll also learn how to add a random *orient* attribute to your points in order to add a bit of visual interest to the scene.

### 1. Select features of the landscape onto which you'll scatter points

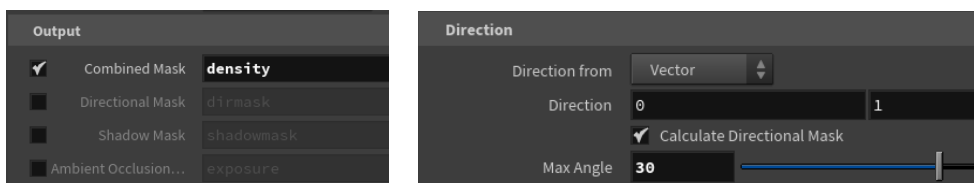
- Click the output dot of the *mountain1* node.
  - You will now have a branching wire that follows your cursor and is connected to the output dot.



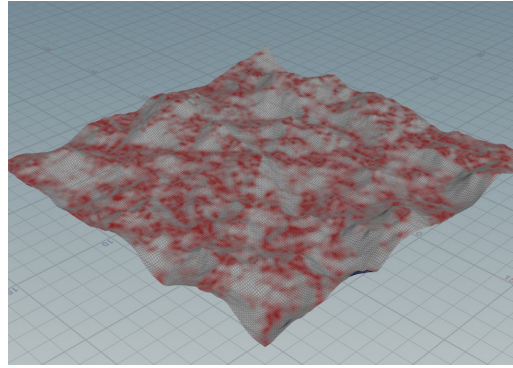
- Press **Tab** in the Network View, type *mask by*, and press **Enter**.



- In the Parameter Pane, change the **Combined Mask** from *mask* to *density*.
- Also, change the **Max Angle** to 30.

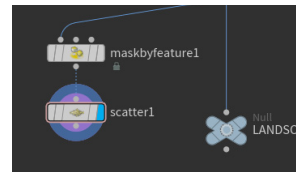
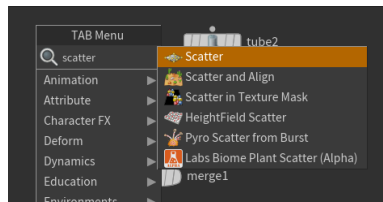


- To visualize the *density* attribute, press this button next to the text parameter.

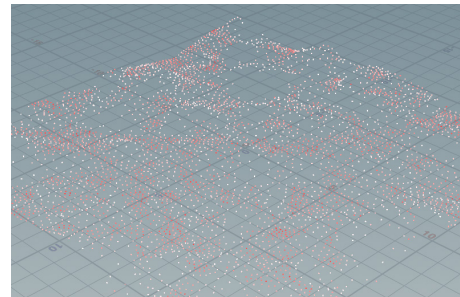
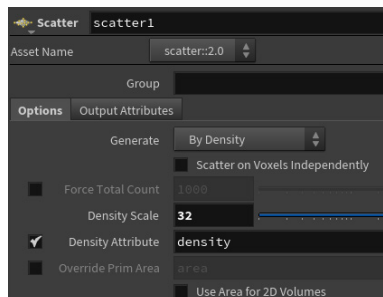


## 2. Scatter points in the area with *density* present.

- Click the output dot of the *maskbyfeature1* node.
- Press **Tab** in the Network View, type *scatter*, and press **Enter**.

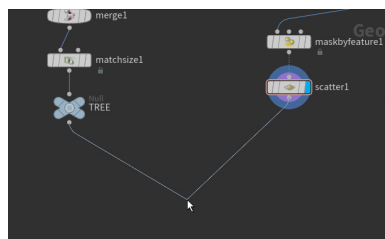


- In the Parameter Pane, **uncheck** the box next to **Force Total Count**.
- Change the **Density Scale** to **32**, and **check** the box next to **Density Attribute**.

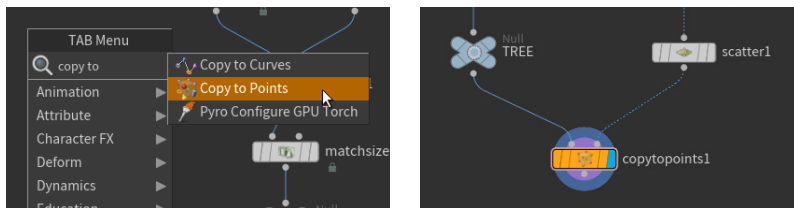


## 3. Copy the trees to the points

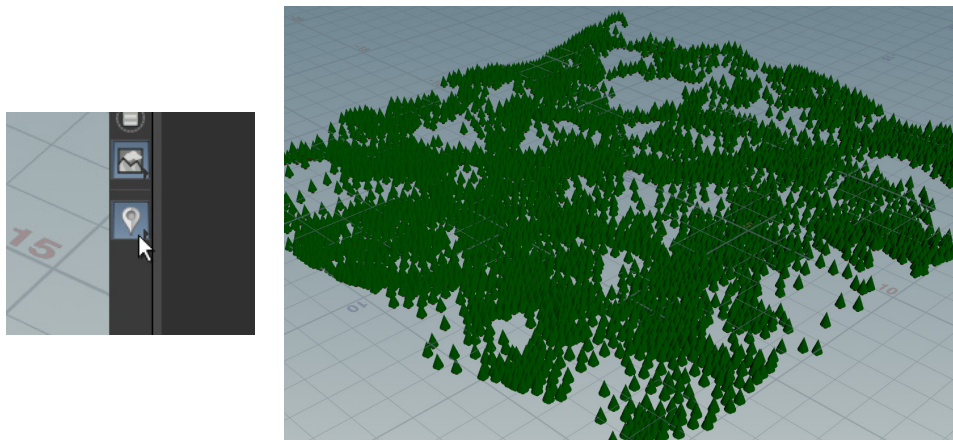
- While holding **Shift**, click the output dot of the *TREE* null, and then click the output dot of the *scatter1* node.



- Press **Tab** in the Network View, type *copy to*, and select **Copy to Points**.
  - Make sure to move your blue Display Flag to the *Copy to Points* node.

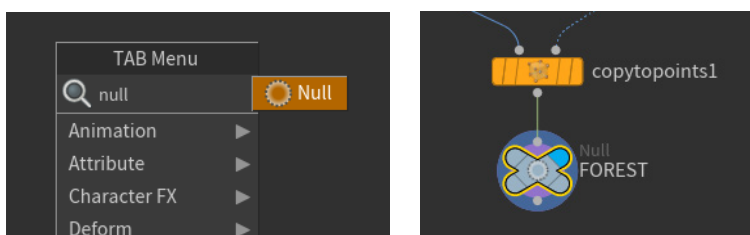


- Turn off your visualization with this pin icon button next to the Scene View.



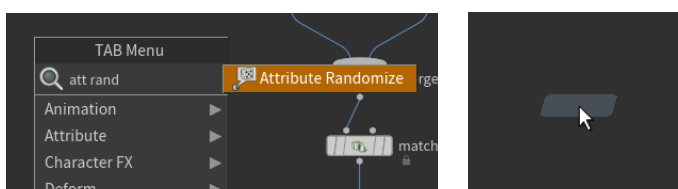
#### 4. Add a Null node to help with network organization

- Click the output dot of the *copytopoints1* node.
- Press **Tab** in the Network View, type *null*, and press **Enter**.
- Rename the *Null* node to *FOREST*.

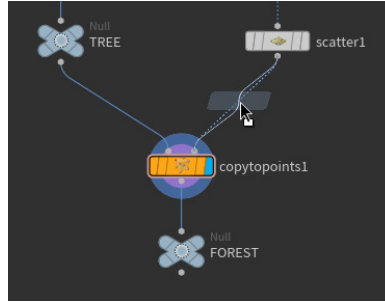


#### 5. Randomize the orientation of the trees

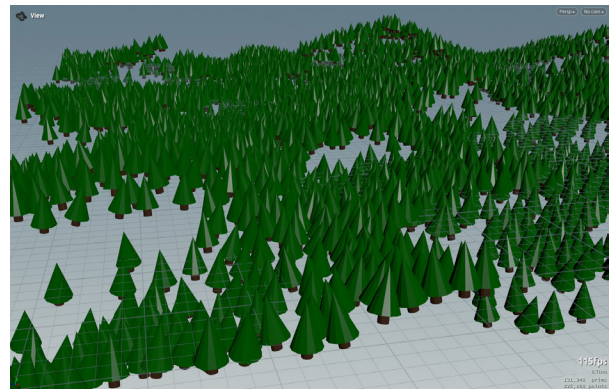
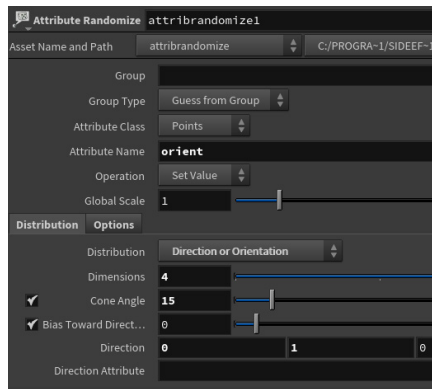
- Press **Tab** in the Network View, type *att rand*, and press **Enter**.
  - You will now have a ghost node attached to your cursor.



- Left-click to place the node between the *scatter1* node and the *copytopoints1* node.

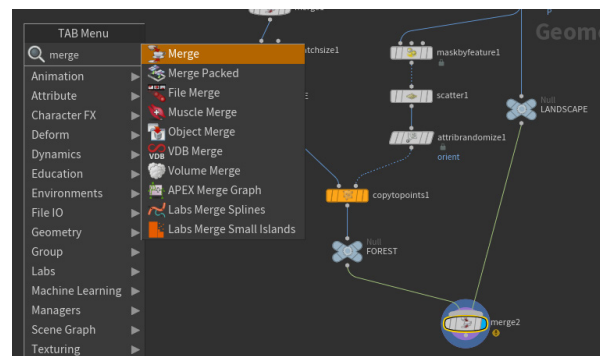
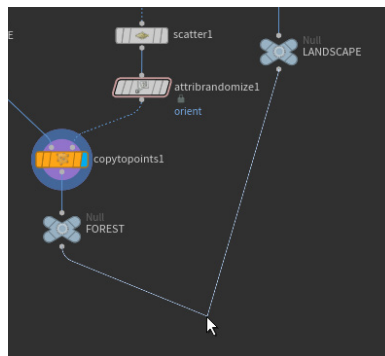


- In the Parameter Pane, change the **Attribute Name** to *orient*.
- Change the **Distribution** drop-down to **Direction or Orientation**, and change the **Dimensions** to **4**.
- Check the box next to **Cone Angle**, and change the value to **15**.
- Check the box next to **Bias Toward Direction**, and change the **Direction** values to **0, 1, 0, and 0**.

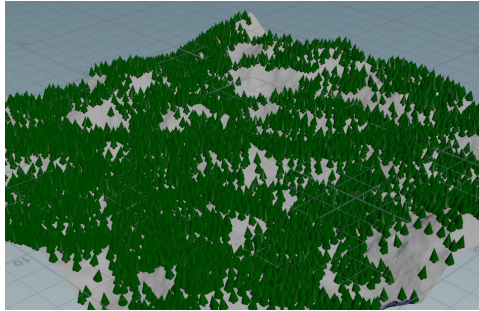


## 6. Combine the forest and landscape

- While holding **Shift**, click the output dot of the *FOREST* null, and then click the output dot of the *LANDSCAPE* null.
- Press **Tab** in the Network View, type *merge*, and press **Enter**.

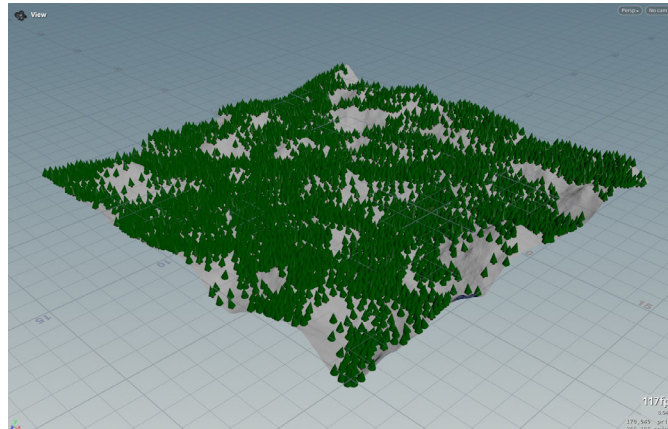
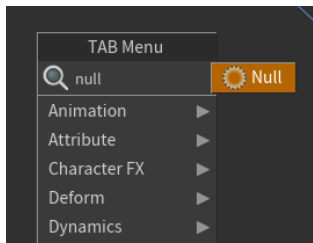


- You should now see both geometries (forest and landscape) combined in your Scene View.



## 7. Add a *Null* node to help with network readability

- Click the output dot of the *merge2* node.
- Press **Tab** in the Network View, type *null*, and press **Enter**.
- Rename the Null node to *OUT*.



## CONGRATULATIONS

You have now completed your landscape scattering exercise. This has taken you through a project that began with a grid, you then deformed the grid to resemble a landscape, created simple tree geometry, scattered points onto the terrain, and then copied the trees onto those points.