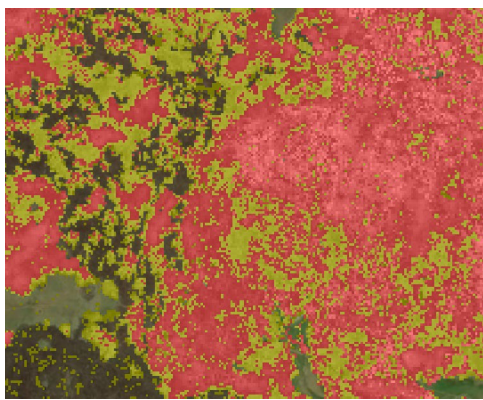


EXERCISE

Habitat Suitability using Raster Functions



Introduction

This exercise will take you through the process of creating a simple habitat suitability map using Raster Functions. This involves creating a function chain that mimics raster calculator equations. Using conditional statements, you will use the lidar derivatives representing canopy height and canopy cover to model the habitat of a fictional “endangered bird species”. In future applications, you can use a variety of lidar derived variables such as the ones derived from the GridMetrics command in Fusion or other surface layers (e.g., aspect and slope), but for this exercise we will simply use the ones that many regions provide for you. We will be working with data on the Dixie National Forest.

Objectives

- Use mathematical functions in a raster function chain to identify suitable habitats

Required Data

- **BrianHead_cover.tif** - Percentage of canopy cover derived from the lidar point cloud
- **BrianHead_height.tif** – Canopy height layer derived from the 95 percentile of returns of the lidar point cloud (p95 is used to reduce the number of error pixels derived from incorrect height lidar values)

Prerequisites

- Have ArcGIS Pro installed on your computer.
- Spatial Analyst or Image Analyst extensions



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Table of Contents

Part 1: Set up ArcPro.....	3
Part 2: Simple Conditional Statements.....	3
Part 3: Complex Conditional Statements	4
Part 4: Analyze the Habitat Suitability Output.....	6

Part 1: Set up ArcPro

Open ArcPro and load the data for this exercise. You can also insert another map if you already have a project going (Insert tab, Project group, New Map).

A. Load the AOI

1. Launch ArcPro from the start menu by clicking **Start, Programs, ArcGIS Pro**
2. Click the **Add Data** button and navigate to where you placed the course material.
3. In the HabitatSuitability_Exercise folder select **BrianHead_Cover.tif** and **BrianHead_Height.tif** then click **Add**.

B. Change Basemap

1. Click **Map** tab, in the **Layer** group, select **Imagery**

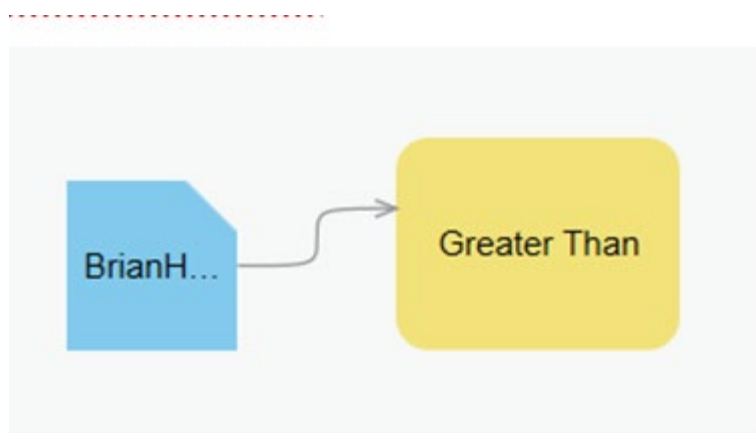
Part 2: Simple Conditional Statements


We will build a raster function chain, very similar to a Model Builder chain from ArcMap. The functionchain will use mathematical functions to build an equation that would otherwise be built using raster calculator. Remember that raster functions generate temporary layers rather than creating new data layers.

A. Classify Canopy Height

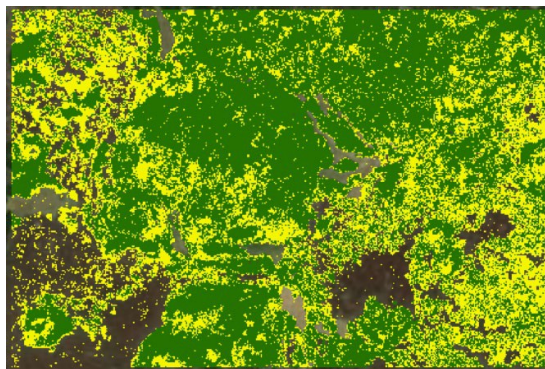
We will be making this equation in the function editor $\text{BrianHead_Height.tif} > 15$, this results in a binaryraster where 1's are locations with a height above 15.

1. **Open** the **Function Editor** via the Imagery tab, in the Analysis Group
2. **Open** the **Raster Functions** pane in the same group
3. In the Raster Function pane search for the **Greater Than** function and **drag and drop** it into the function editor
4. Drag in and connect the **BrianHead_height** to the top left (**Raster**) of the **Greater Than** box



5. Add a **conditional circle**  from the function editor ribbon, double click it so you can edit the number and **put in 15**. Connect this to the bottom left (**Raster2**) of the **Greater Than** box


6. Click **Save As** to save your function chain. Name it Height15 and add a description.
7. In the Raster Function pane clear your last search and select the **Custom tab** double click on your saved function chain and click **Create New Layer**



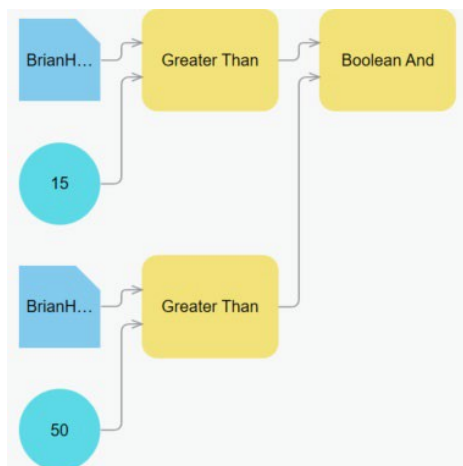
Part 3: Complex Conditional Statements

You have just executed a simple Boolean statement. In the next section we will explore more complex and powerful expressions, such as running multiple statements in one expression chain. The added complexity will pay off with an increase in efficiency for our geospatial workflow.

A. Write A More Complex Statement

1. In the same function chain as before **drag and drop** the **BrianHead_Cover.tiff** and add another **Greater Than** function and a **conditional circle** with the number **50**.
2. Search for and add the **Boolean And** function
3. Connect the **BrianHead_Cover** box to the upper left (**Raster**) of the **Greater Than** box
4. Connect the **50 conditional circle** to the lower left (**Raster 2**) of the **Greater Than** box
5. Finally connect this **Greater Than (Out)** box to the lower left (**Raster2**) of the **Boolean And**
6. function.
7. Connect the first **Greater Than (Out)** associated with the height raster to the top right
8. (**Raster**) of the **Boolean And**
9. Click AutoLayout 

10. **Save As** the edited function chain and label it something intuitive like Height15_Cover50



11. In the Raster Functions pane clear your last search and double click the function you just created.

12. Click **Create New Layer**

13. Let's analyze the above chain to see what is going on. This process will create a raster where cells that have a Height > 15 and a Cover > 50 will have a value of 1, and everything else will have a value of 0. In other words, every pixel where the specific conditions are met will get classified as 1's.

B. Write an Even More Complex Statement

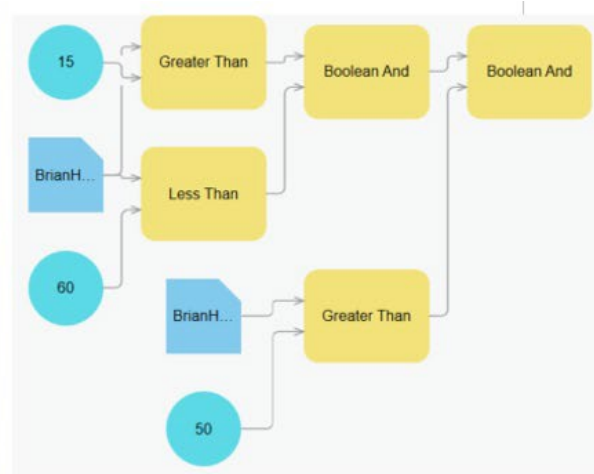
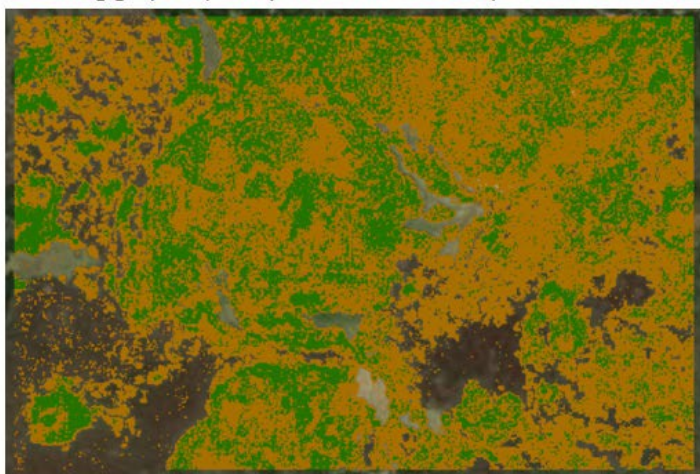
Imagine that we have determined that our fictional "endangered bird species'" ideal nesting sites occur in trees between 15 and 60 meters and in areas where the canopy cover is greater than 50.

1. Using the Greater Than, Less Than and Boolean And functions try to **write a function chain** that captures this habitat scenario: height > 15 and < 60 and canopy cover of > 50. If you get stuck look at the image below.

2. Save your chain and name it **HabitatSuitability**

3. Click **Create New Layer**.

i. It should look similar to the following graphic (it may be different colors)



Part 4: Analyze the Habitat Suitability Output

A. Make the Habitat Suitability Layer Transparent

1. Highlight the **HabitatSuitability** layer you produced earlier
2. Click on the Appearance tab and find the transparency slider above the Swipe tool in the Effects group
3. In the transparency box, set the **Transparency** value to 50%

B. View the Habitat Suitability Layer On Top Of Canopy Height Layer

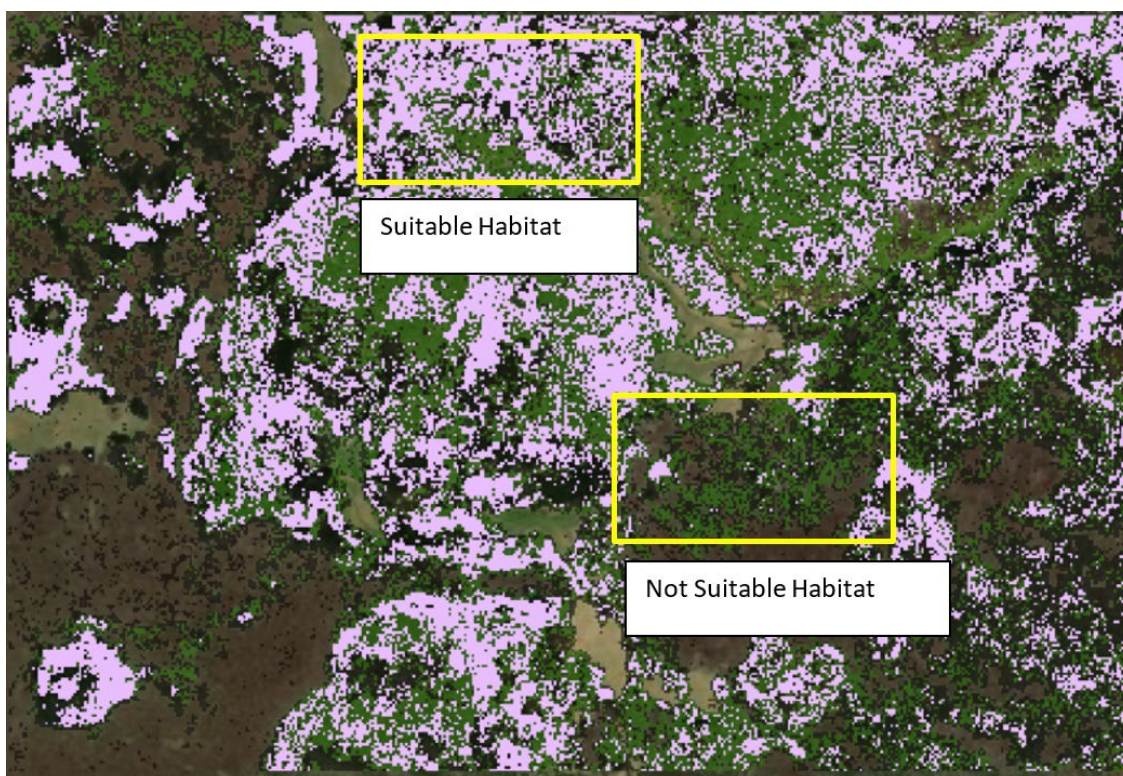
1. Make sure that your **Habitat Suitability** layer is above your **Canopy Height** layer. Reorder them in the Contents pane by dragging and dropping.
2. Change the primary symbology to **Classify** and the color of the **0** pixels so that they have no color and change the **1** pixels to a color that is noticeable (Purple).
3. Do this by double clicking the color ramp under the Habitat Suitability layer in the

C. Contents pane.

1. Select Classify as the primary symbology.
 - i. Click the box next to 0 and select **No Color**
 - ii. Click the box next to 1 and select a **purple**

Note: More complex raster calculator math can be performed and there are other tools (such as the weighted sum tool) that make it possible to do more complex suitability analysis. For the purpose of this exercise we wanted to provide you with a fundamental understanding of how to perform some basic calculations using raster functions. You can expand on these in the future.

2. Zoom in and explore the areas where there is suitable habitat.
 - i. The spatial resolution of the layers used for the analysis create a salt and pepper effect, but general patterns can be observed regarding where bird habitat exists.





3. What things can you now do with this layer? You can find stands that may need more management to make sure there is enough habitat for this species or identify areas that aren't currently occupied by the species but that could be used as habitat by them.

Congratulations! You have successfully completed this exercise. You now know how to integrate multiple derivatives into a habitat suitability analysis. You can use the skills you learned in this exercise to extract a variety of different forest and surface characteristics from rasters.