Timothy Schragel
491 - GIS and Python

Habitat Sutablilty Script

For my final project I created a habitat analysis model within arcpy. The script currently only uses raster datasets, though I plan on adding additional filetype coverage in the future. I based my script loosely on this cougar habitat analysis from ESRI. It gave me a rough idea of how to run a habitat suitability analysis, but it used vector data for cougars and I used raster for trees. I started by gathering suitable data files, using Oregon State Universities PRISM Climate Group for all climate data (Rainfall, January Temperatures, and July Temperature). I also utilized the GIS-Data (M:) drive for a digital elevation model of Oregon (M:\04_Oregon\DEMrasters\Oregon_DEM\ordemfeet). I put all four of these datasets into a data folder and used them for my analysis. I then created a script that took all four layers, clipped them to either to Wilamette National Forest or the state of Oregon, and produced a raster of the areas in which a Douglas-Fir would most likely grow. I wanted the user to be able to input their own values to create their own outputs, so I also created a custom input section to the script. This Custom Input section reads through the Data folder and asks the user which layers they plan on using, as well as the minimum and maximum values for each layer. Each layer is then combined using raster algebra, specifically a boolean and, and the output is saved. The user also has the option to save each layer used in the analysis. After the script is run it will print 'Done.'. Once the done is printed, the project file names 'PythonFinalV2.aprx' can be opened. This project file has three layouts, the first for the Sutable habitat, the second for each individual layer used in the douglas-fir analysis, and a final one for the custom habitat analysis. Please note that in order for the code to run properly the project must be closed. There were three difficulties I encountered while creating this code. The first was the clip function, I was unsure of the area units and had to test the function out multiple times in order to find the right format and values. The second was the raster algebra. At first I created one large function that handled everything and produced an output but quickly learned how confusing it was to debug. I then broke the big function into a bunch of helper functions which helped streamline the debugging and allowed me to save individual layers which then helped debug the output results. The final difficulty was allowing for user input. I wanted to create a script that could handle additional raster layers so the user

could use their own data. This proved to be a bit more difficult than I expected. Looping through datasets in a folder, gathering inputs, filtering those datasets, then combining them all at the end was hard to wrap my head around at first. I ended up breaking everything into helper functions again. This proved to be very helpful in debugging and creating the necessary functions. As for my results, they do not represent the actual coverage of the Douglas-Firs' habitat. I seem to be having an issue with the climate dataset which voids the Wilamette Valley, so if I can get around that I should have more accurate results. And finally, future plans. I want to try a few different things. First would be the allowance of feature classes in the analysis. Once I get those added I want to be able to pull data from ESRI's catalog or possibly my own online catalog. And potentially add in more from the dem, like aspect and slope.
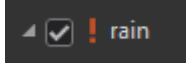
Instructions

1. Unzip PythonFinalv2.zip / Get PythonFinalv2 from timmys' student drive
   a. R:\GEOG491_591_12249_FALL2022\Student_Data\timmys\PythonFinal v2
2. Open PythonFinalv2 folder
3. Right click 'HabitatSutability.py' and click Edit with IDLE(ArcGIS PRO)
   a. Edits
      i. Change 'ws' to the filepath for PythonFinalv2's 'Data' folder
      ii. Change 'outws' to the filepath for PythonFinalv2's 'Output' folder

```
 9 ws = r"C:\Users\Timothy Schragel\Desktop\PythonFinalv2\Data"      ##!! CHANGE FILEPATH !!##
10 outws = r"C:\Users\Timothy Schragel\Desktop\PythonFinalv2\Output"   ##!! CHANGE FILEPATH !!##
```

4. Run program
   a. In IDLE press 'F5' or click 'Run' in the toolbar then 'Run Module'
5. Program Inputs
   a. Study Area
      i. Enter '1' for the Wilamette National Forest or '2' for the state of Oregon

      `Enter [1] for the Wilamette National Forest or [2] for Oregon:`

   b. Analysis
      i. Enter '1' for built in analysis or '2' for custom values

      `Enter [1] for Douglas-Fir Habitat Analysis or [2] for custom values:`

   c. (Custom Values Only)
      202201tMean & 202107tMean are degrees fahrenheit
      RainfallIN is annual mean in inches
      Elevation is in feet
      i. Input 'Y' or 'y' to use referenced data layer

      `Are you using 202101tMean.tif? [Y/N]`

      ii. Input minimum value for shown range (press enter to skip)

      `Input minimum value for 202101tMean.tif, range of -12.17259979248 to 21.343999862671:`

      iii. Input maximum value for shown range (press enter to skip)

      `Input maximum value for 202101tMean.tif, range of -12.17259979248 to 21.343999862671::`

   d. Save Outputs
      i. Sutable Habitat Output (Automatically Saved)
      ii. Additional Layer
         1. Enter 'y' or 'Y' to save all files

         `Save all files [Y/N]:`

            a. NOTE! If custom analysis is used, layers are saved in the order that they were asked.

6. View outputs
    a. Open PythonFinalV2.aprx

        i. If data is not shown, press the red '!' ![rain toolbar button]
        ii. Navigate to PythonFinalV2's Output folder
        iii. Select same layer name
            1. All data should populate, if not manual selection should be used for each map frame
    b. Switch between layouts to see results
        i. 'SutableHabitat' - Areas which are suitable for Douglas-Firs

Habitat
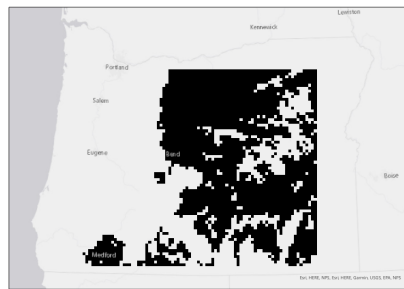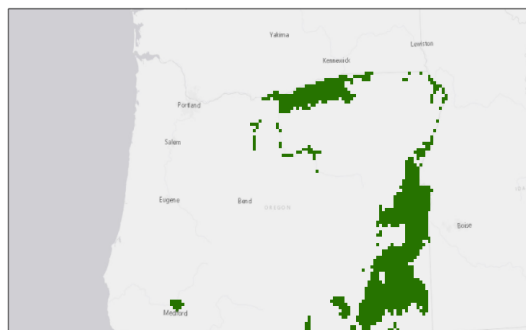
        ii. 'BinaryRasterValues' - Shows each layer used in analysis
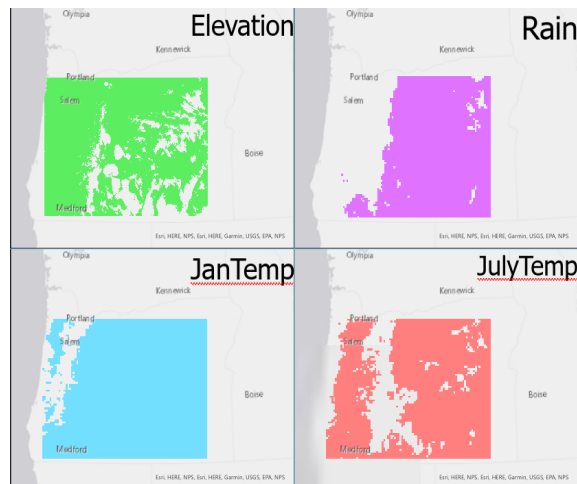
        iii. 'Custom Analysis' - Shows result from custom analysis

Custom Analysis

Folder Image - File Path
(R:\GEOG491_591_12249_FALL2022\Student_Data\timmys\PythonFinalv2)

	Data	12/5/2022 12:21 PM	File folder	
	Output	12/5/2022 12:24 PM	File folder	
	PythonFinal	12/5/2022 12:13 PM	File folder	
	HabitatSutability.py	12/5/2022 12:28 PM	Python File	7 KB
	PythonFinalV2.aprx	12/5/2022 12:17 PM	ArcGIS Project File	88 KB

Data Folder

	ordemfeet	11/30/2022 12:47 PM	File folder	
	202101tMean.ovr	11/27/2022 1:41 PM	OVR File	349 KB
	202101tMean.tfw	11/27/2022 1:41 PM	TFW File	1 KB
	202101tMean.tif	11/27/2022 1:45 PM	TIF File	9,867 KB
	202101tMean.tif.aux.xml	11/27/2022 1:45 PM	XML Document	3 KB
	202101tMean.tif.ovr	11/27/2022 1:45 PM	OVR File	349 KB
	202101tMean.xml	11/27/2022 1:41 PM	XML Document	3 KB
	202107tMean.ovr	11/27/2022 1:39 PM	OVR File	321 KB
	202107tMean.tfw	11/27/2022 1:39 PM	TFW File	1 KB
	202107tMean.tif	11/27/2022 1:45 PM	TIF File	9,867 KB
	202107tMean.tif.aux.xml	11/27/2022 1:45 PM	XML Document	3 KB
	202107tMean.tif.ovr	11/27/2022 1:45 PM	OVR File	321 KB
	202107tMean.xml	11/27/2022 1:39 PM	XML Document	3 KB
	RainfallIN.tfw	11/27/2022 3:28 PM	TFW File	1 KB
	RainfallIN.tif	11/27/2022 3:28 PM	TIF File	9,160 KB
	RainfallIN.tif.aux.xml	11/27/2022 3:28 PM	XML Document	2 KB
	RainfallIN.tif.ovr	11/27/2022 3:28 PM	OVR File	336 KB

Rainfall, January Temeprature, and July Temeprature - https://prism.oregonstate.edu/
Elevation data - M:\04_Oregon\DEMrasters\Oregon_DEM\ordemfeet
Habitat Data -
https://www.srs.fs.usda.gov/pubs/misc/ag_654/volume_1/pseudotsuga/menziesii.htm

Douglas Fir analysis:

```
- - -
= RESTART: C:\Users\Timothy Schragel\Desktop\PythonFinalv2\HabitatSutability.py
Enter [1] for the Wilamette National Forest or [2] for Oregon: 1
Enter [1] for Douglas-Fir Habitat Analysis or [2] for custom values: 1
Save all files [Y/N]: y
Done.
```

Custom Analysis:

```
= RESTART: C:\Users\Timothy Schragel\Desktop\PythonFinalv2\HabitatSutability.py
Enter [1] for the Wilamette National Forest or [2] for Oregon: 2
Enter [1] for Douglas-Fir Habitat Analysis or [2] for custom values: 2
Are you using 202101tMean.tif? [Y/N]y
Input minimum value for 202101tMean.tif, range of -12.17259979248 to 21.343999862671:
Input maximum value for 202101tMean.tif, range of -12.17259979248 to 21.343999862671: 15
Are you using 202107tMean.tif? [Y/N]y
Input minimum value for 202107tMean.tif, range of 8.3178997039795 to 41.383598327637: 25
Input maximum value for 202107tMean.tif, range of 8.3178997039795 to 41.383598327637:
Are you using ordemfeet? [Y/N]y
Input minimum value for ordemfeet, range of NA to NA: 0
Input maximum value for ordemfeet, range of NA to NA: 6000
Are you using RainfallIN.tif? [Y/N]n
Raster Skipped
Do you want to keep all data layers? [Y/N]: y
Done.
>>>
```