Assignment 5: Geospatial Analysis with WhiteboxTools

(60 Points Total)

Data available under Resources>Assignment Data.

Develop a model to predict areas that meet the site characteristics required for an invasive species to thrive. You will generate a binary or conservative model with a 30 m spatial resolution covering a seven-county area in the Allegheny Highlands of West Virginia. You have been provided the following data sets:

1. **wbt>counties.shp:** vector polygon county boundaries
2. **wbt>lc.tif:** 30 m spatial resolution land cover from the National Land Cover Database (NLCD 2011). Here is a link to the legend for these data: https://www.mrlc.gov/data/legends/national-land-cover-database-2019-nlcd2019-legend.
3. **wbt>elev.tif:** 30 m spatial resolution digital elevation model (DEM) derived from the National Elevation Dataset (NED) with elevation in meters.

Here are the criteria required for the invasive species:

1. Elevations above 1,000 meters
2. In Evergreen (42) or mixed forest (43) types
3. At slopes less than 15°
4. At aspects between 22.5° and 157.5°

Your Tasks

T1: Use **GeoPandas** to read in the county boundaries then display the county boundaries. **(3 Points)**

T2: Read in the elevation data and display the raster data using **matplotlib**. **(3 Points)**

T3: Use **WhiteboxTools** to calculate **topographic slope** and **topographic aspect** from the digital elevation model. **(3 Points)**

T4: Generate binary grids for each of the four criteria described above using **WhiteboxTools**. There are multiple means to accomplish this. I recommend using the **raster_calculator()** function. You may need to review the WhiteboxTools documentation: (https://www.whiteboxgeo.com/manual/wbt_book/preface.html) **(12 Points)**

T5: Create a single figure with four subplots showing the four scored grids. Each plot should have a title indicating the variable it represents. All raster grids should be visualized as categorical data to differentiate suitable and not suitable cells for each criterion. **(12 Points)**

T6: Use the **resample()** function from **WhiteboxTools** to resample the land cover binary grid to have the same extent as the other grids. You will need to set the **base** argument to one of the other binary grids. **(3 Points)**

T7: Create a final raster where cells that meet all criteria are coded to 1 and all other cells are coded to 0. There are multiple ways to achieve this. I recommend the **raster_calculator()** function. **(6 Points)**

T8: Use **matplotlib** to display your final model. The raster should be visualized as categorical data to differentiate suitable and not suitable cells. **(6 Points)**

T9: Create an HTML file that summarizes the number of cells of suitable and not suitable habitat for each county. This can be accomplished using the **vector_polygons_to_raster()** and **cross_tabulation()** tools. **(6 Points)**

T10: Using the results presented in the HTML table, write a short paragraph that indicates what counties are at the highest risk of being impacted by this invasive species based on both land area and percent land area. **(6 Points)**

Deliverables

- Jupyter Notebook. Answer T10 within a Markdown cell.