Exercise 25: Weighted Overlay

This exercise asks you to develop a suitability model using weighed overlay techniques for relocating bears to reduce the chances of bear interactions with visitors at the Shenandoah National Park. This lab is less guided than previous labs. However, you can use the tools and techniques learned from the previous exercises to create the suitability model.


Topics covered in this exercise include:

1. Create slope grid
2. Create Euclidean distance grids
3. Reclassify raster grids
4. Create a suitability model using weighted overlay.

Step 1. Open a Map Project

First, we need to download and open the **Exercise_25.aprx** file.

☐ Download the **Exercise_25** data from https://www.wvview.org/. All lab materials are available on the course webpage and linked to the exercise. You will need to extract the compressed files and save it to the location of your choosing.

☐ Open ArcGIS Pro. This can be done by navigating to All Apps followed by the ArcGIS Folder. Within the ArcGIS Folder, select ArcGIS Pro. Note that you can also use a Task Bar or Desktop shortcut if they are available on your machine.

☐ After ArcGIS Pro launches, select "Open another project."
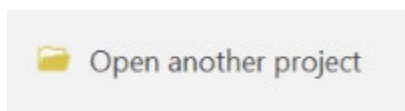
☐ Navigate to the directory that houses the material for this course. The project files are in the **Exercise_25** folder where it was saved on your local machine.

☐ Select **Exercise_25.aprx**. Click OK to open the project.

☐ If necessary, navigate to the WV map.

Note: If you'd prefer, you can also just click on the **Exercise_25.aprx** file within the uncompressed folder directly to launch ArcGIS Pro.

The following layers have been provided in the Data folder:

shen_veg_points: point features of vegetations from National Park Service (NPS) that intersect Shenandoah National Park

Shen_roads: line features of interstates and major roads from National Park Service (NPS) that intersect Shenandoah National Park

Shen_trails: line features of park trails from NPS within Shenandoah National Park

**shen_PkBndryPly:** polygon boundary of Shenandoah National Park from NPS

shen_land_cover: categorical raster grid of land cover from the 2011 National Land Cover Database (NLCD)

dem: 30 m resolution digital elevation model (DEM) in meters from United States Geological Survey (USGS)

Step 2. Adding Data and Setting the Environments Settings

Before starting the analysis, you need to set some environment settings.

- ☐ Navigate to Add Data and the Data folder within the **Exercise_25** folder your downloaded. Add all data into the map.
- ☐ Navigate to Environment. Change the Current Workspace and the Scratch Workspace (if needed) to the **Exercise_25.gdb** geodatabase in the **Exercise_25** folder your downloaded copy of the data. This will cause all of the outputs to automatically be saved to this location. Set the Output Coordinate System to be the same as the Map (this should be NAD 1983 UTM Zone 17N). Set the extent to be the same as the **shen_PkBndryPly** layer. Set the Snap Raster to the **dem_meters** layer. Make sure the Cell Size is the same as the **dem** layer (this should be 30 by 30 meters). Lastly, set the Mask to the **shen_PkBndryPly** layer. Remember to save these changes.
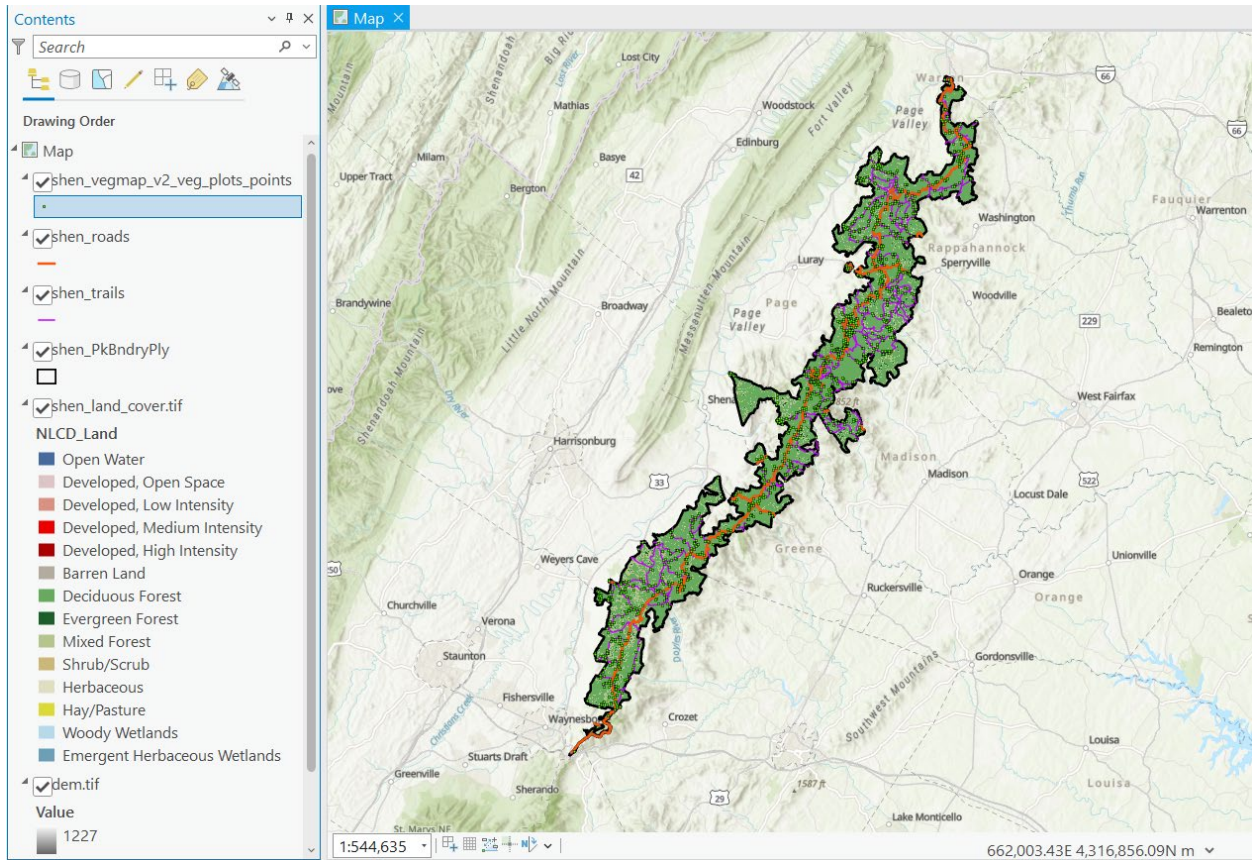
Step 3. Produce the Weighted Overlay Model

You will need to reclassify each layer before creating the model. The following tables describe the suitability criteria for relocating black bears. We use score 1 – 4 to measure favorability, with 1 represents the least favorable land's suitability area for bear habitats, 2 represents less favorable area, 3 satisfactory area and 4 the most favorable.

Slope (Degrees)	
Slope Value	*Score*
≤ 10	4
(10, 20]	3
(20, 30]	2
> 30	1

Distance to Roads

Distance (m)	Score
> 1000	4
(500, 1000]	3
(250, 500]	2
≤ 250	1

Distance to Trails

Distance (m)	Score
> 800	4
(500, 800]	3
(250, 500]	2
≤ 250	1

Distance to Vegetation

Distance (m)	Score
≤ 10	4
(10, 50]	3
(50, 100]	2
> 100	1

Land cover	
Slope Value	*Score*
Open Water	1
Developed, Open Space	2
Developed, Low Intensity	2
Developed, Medium Intensity	1
Developed, High Intensity	1
Barren Land	1
Deciduous Forest	4
Evergreen Forest	4
Mixed Forest	4
Shrub/Scrub	4
Herbaceous	4
Hay/Pasture	4
Woody Wetlands	4
Emergent Herbaceous Wetlands	4

This table provides the weight for each criterion in the Weighted Model.

Criteria	Weights
Slope	2
Distance to Roads	2
Distance from Trails	3
Distance to Vegetation	1
Land cover	2
Total	10

Here are some hints for performing this analysis.

1. Do not conduct this analysis using the **Weighted Overlay Tool**. Instead, use the tools demonstrated in the previous labs.
2. You will need to use the following tools: **Euclidean Distance**, **Reclassify**, and **Slope**. All of these tools are in the Spatial Analyst Toolbox.

3. You will need to produce the final model using the **Raster Calculator Tool**.
4. Make sure to give all of your outputs meaningful names and keep track of the steps you undertake.
5. Remember the map units are in meters.

Here is my output:
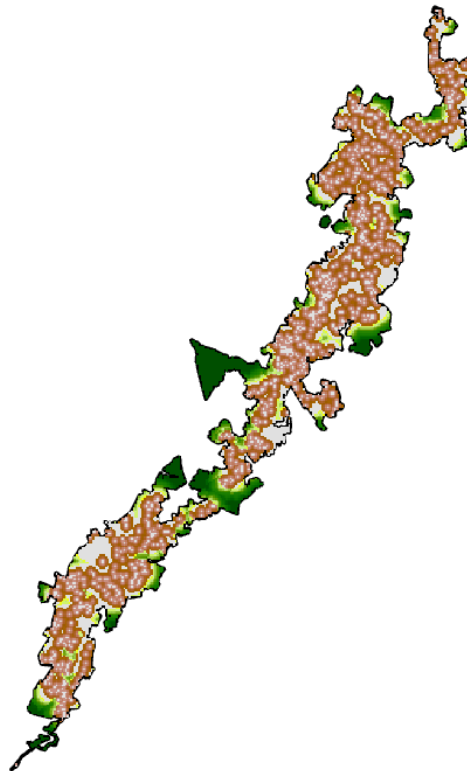
Deliverables 1

Make a map of your suitability model for the county (15 Points). Submit it as a PDF. Include the following:

1. Your name and a title (2 Points)
2. A scale bar and north arrow (2 Points)
3. Your suitability model is displayed and is correct. (5 Points)
4. A legend showing only the suitability values. Your legend should not include the index values. Instead, the legend should be labeled using "High" and "Low" suitability (4 Points)

5. Use a stretch to symbolize the suitability surface (2 Points)

Deliverables 2

Provide a brief description of the methods you used to create the suitability model in paragraph form. (5 Points)

Deliverables 3

Address the following questions:

Question 1. What are some limitations of this modeling method? (5 Points)

Question 2. What are some difficulties associated with assigning appropriate suitability scores and criteria weights? (5 Points)

Question 3. What other factors might be of interest for making this prediction? (5 Points)

Question 4. How might you assess your model? (5 Points)

END OF EXERCISE