Lab05 Vector Analysis and Raster Analysis Functions

Exercise 01 – Vector Analysis Functions

> Objectives of this exercise:
> To learn how the vector analysis works in ArcGIS Pro
> - Buffer functions
> - Overlay functions
>
> To complete exercises, you need the following:
> - ArcGIS Pro 3.3.1 (Basic, Standard, or Advanced)
>
> The data needed for this exercise is under the folder Lab 05, named Lab05Data.zip (download and unzip it to your own folder).
>
> Demo video: https://mediaweb.ap.panopto.com/Panopto/Pages/Viewer.aspx?id=b6ac583e-bdc0-4d9f-8577-aef9004c25b1

Task 1. Buffering and Overlaying Layers

You are asked to find a suitable site for a new university aquaculture laboratory. After the initial research, you realized that land use and soil types are two important factors affecting the selection of the site. In addition, the site should be within a certain (Euclidean) distance to the existing sewer system.

The data needed to perform such an analysis are included in Lab05Data.zip. The compressed file includes a task01.gdb Geodatabase file that has three feature classes necessary for the analysis:

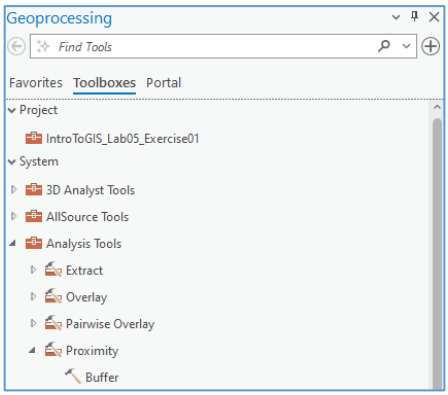
- *landuse*: land use data
  - ✓ An ideal site should be in the land use type of brushland (LUCODE = 300).
- *sewers*: sewer systems
  - ✓ An ideal site must be within 300 meters of sewer lines.
- *soils*: soil types
  - ✓ An ideal site should be in an area with (soil) suitability (SUIT) larger or equal to 2.

1. Start ArcGIS Pro and sign in if necessary. Click **Map**, and create a new project. Name the project **IntroToGIS_Lab05_Exercise01**. Rename the **Map** tab as **Task 1**.
2. In the Catalog pane, right-click Folders and choose Add Folder Connection. Create a folder connection to the Lab05Data folder.
3. Add features *sewers*, *soils*, and *landuse* under *task01.gdb* into ArcGIS Pro.

To identify area within 300 meters of sewer lines, a buffer GIS function on the *sewers* feature class is needed.

4. On the **Analysis** tab, click the  Tools button to open the Toolboxes window.

5. Under **Analysis Tools → Proximity** toolset, double-click the **Buffer tool**. A **Buffer** dialog shows up.



6. In the **Buffer** dialog, select *sewers* for the input features. For the output feature class, the default output location (i.e., the project's Geodatabase) is used, and set the **feature name** as *sewerbuf*. Enter *300* (meters) for the distance (linear unit). Under 'Dissolve type', select *Dissolve all output features into a single feature* for the Dissolve Type, and click **Run**.

7. Open the attribute table of *sewerbuf*, you will find that the table has only one record for the dissolved buffer zone, which represents the area covered by the 300-meter buffer around the sewer lines.

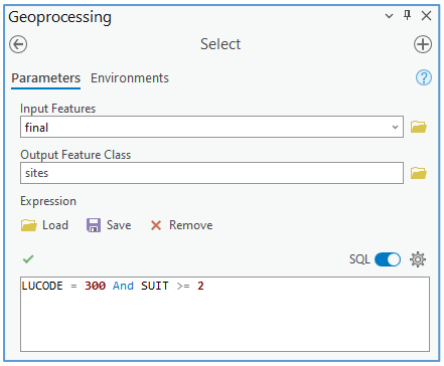
Next, we are going to overlay *landuse*, *soils*, and the *sewerbuf* you just created.

8. Under **Analysis Tool → Overlay** toolset, click the **Intersect** tool. Select *soils*, *landuse*, and *sewerbuf* for the input features, and enter *final* for the output feature class. Click **Run**.

This step, we are going to select from *final* those polygons that meet the **land use criteria** (should be land use type of brushland (LUCODE = 300)) and **soil criteria** (suitability (SUIT) larger or equal to 2).

9. Under **Analysis Tool → Extract** toolset, click the **Select** tool.

10. Select *final* for input features, name the output feature class *sites*, and click + **Add Clause** to specify your query expression (LUCODE = **300** And SUIT >= **2**). You can convert your expression to SQL expression. Click **Run**.



Task 2. Dissolving and Clipping Layers

Datasets are seldom in exactly the condition you need for a project. If you lack the data to support your analysis, there is not much you can do except start looking or developing data. Sometimes, however, the problem is that there is too much data. You may have thousands of features on the map with unnecessary details, or data that cover a greater area than you are interested in.

In task 2 you will try dissolving and clipping functions. The Geodatabase *task2.gdb* contains three feature classes: *Stands*, *Streams* and *GoshawkNests*. The *Stands* feature class is a polygon layer of forest stands; the *Streams* feature class is a polyline layer showing the locations of streams; the *GoshawkNests* feature class is a point layer of goshawk nests (this point data layer will not be used in this lab). Supposedly you would like to know the total value for lease area F and to show the locations

of streams in this particular leasing area to avoid logging near streams. One way this task can be done is through using dissolve and clip functions.

1. In the same project, insert a new map and rename it as **Task 2**.
2. In the **Catalog**, add *Stands* and *Streams* under *task02.gdb* into ArcGIS Pro. Open the attribute table of the *Stands* layer. Two fields that are relevant to this task are the *StandValue* and the *LeaseID*. The *StandValue* contains the dollar value of each stand in millions of dollars. It was obtained by multiplying *ValuePerMeter* (price of the stand per square meter) by *Shape_Area* (in square meter) and then dividing by 1,000,000. The *LeaseID* attribute indicates the leasing area of a particular stand.
3. Under the **Toolboxes → Data Management Tools → Generalization**, click **Dissolve**. Key in the following details:

    - Input Features: S*tands*
    - Output Feature Class: *Leases*
    - Dissolve Field(s): *LeaseID*
    - Statistical Field(s): *StandValue*
    - Statistical Type: *Sum*
    - Create multipart features: *check*

    Click **Run**.

    When the stands are dissolved, the newly created class Leases will be added to ArcGIS Pro. The *Leases* layer should have only five polygons.

Now you would like to clip the *Streams* layer so that only streams in leasing area F are kept. In order to do so, leasing area F has to be selected first.

4. Open the attribute table of *Leases*. Select the record of area F. Its outline should be highlighted in cyan color.
5. In the table of contents of ArcGIS Pro, right-click on the *Leases* layer, point to Selection, and choose *Make Layer From Selected Features*. You will see a layer called “Leases selection” appear in the table of contents. This layer exists only in the map document, and it is not stored on the disk.
6. Under the **Toolboxes → Analysis Tools → Extract**, click **Clip**. Key in the following parameters:

    - Input Features: *Streams*
    - Clip Features: *Leases selection*
    - Output Feature class: *Streams_F*

    Click **Run**.

Lab05 Vector Analysis and Raster Analysis Functions

Exercise 02 – Raster Analysis Functions

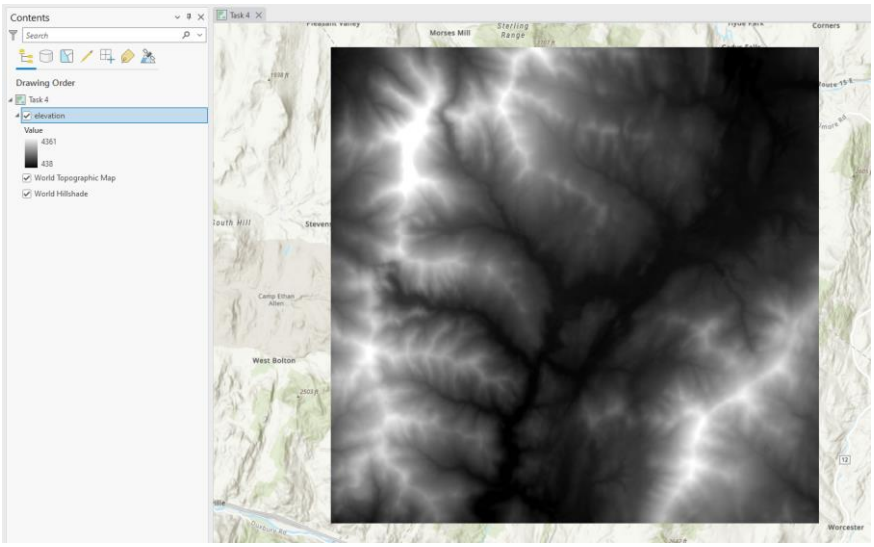
> Objectives of this exercise:
> To learn how the raster analysis work in ArcGIS Pro
> - Slope analysis
> - Reclassification
> - Raster calculation
>
> To complete exercises, you need the following:
> - ArcGIS Pro 3.3.1 (Basic, Standard, or Advanced)
>
> The data needed for this exercise are under the folder Lab 05.
>
> Demo video: https://mediaweb.ap.panopto.com/Panopto/Pages/Viewer.aspx?id=2b94e191-8fc7-4792-b7a4-af02001a5026

Task 4. Raster Analysis

The raster analysis methods included in this task are slope analysis, reclassification and raster calculation. Slope represents the rate of change of elevation for each digital elevation model (DEM) cell.

By default, the slope appears as a grayscale image. You can add the Colormap function to specify a particular color scheme, or allow the person viewing the mosaic to modify the symbology with their own color scheme.

1. Open the **IntroToGIS_Lab05_Exercise01** project, save it as **IntroToGIS_Lab05_Exercise02.** In the **IntroToGIS_Lab05_Exercise02** project, insert a new map in **Catalog** and rename it as **Task 4**. Close Task 1 and Task 2 maps if you still see them. Add **elevation** from the task03 folder to the mapping area. Click **Yes** if prompted to calculate statistics for elevation.

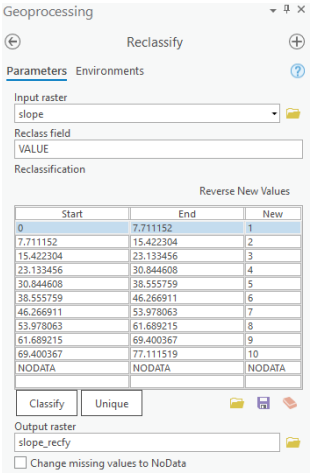


Next, we are going to create a layer of the cost of traveling over the landscape, based on the fact that: (1) it is more costly to climb on steeper slopes; and (2) it is more costly to construct a road on certain land use types.

2. On **Analysis** tab, click **Tools → Spatial Analyst Tools → Surface → Slope** *(make sure the Spatial Analyst in the Extension is activated)*. Use the following settings and click **Run**.

    - **Input raster**: *elevation*
    - **Output raster**: *slope*
    - **Other settings**: No Change (use the default)

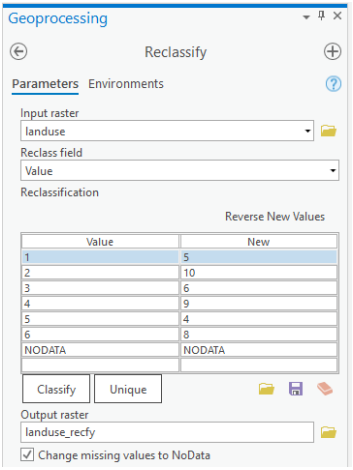
3. Reclassify the **slope** layer. Click **Tools → Spatial Analyst Tools → Reclass → Reclassify**. In the Reclassify pane, choose *slope* as the **Input raster**. Click **Classify**, select **Equal Interval** as the **Method** and set the **Number of classes** as **10**. Set *slope_recfy* as the **output raster.** Click **Run**.



4. Add **landuse** from the task03 folder to the mapping area. Click **Yes** if prompted to calculate statistics for landuse. Reclassify the **landuse** layer. In the Reclassify pane, choose *landuse* as the **Input raster**. Click Unique, and reclassify the values as:

5 (Agriculture) → 4	4 (Built up) → 9
3 (Barren land) → 6	6 (Forest) → 8
1 (Brush/Transitional) →5	2 (Water) →10

Use the Delete button on your keyboard to delete 7 (Wetlands) and check *Change missing values to NoData*. Higher values indicate higher road-construction cost. Set *landuse_recfy* as the **Output raster**. Click **Run**.



5. Explore the ***Raster Calculator*** to combine these two factors (slope and land use) using different weights (e.g., 0.6 and 0.4, or others, the sum of the weights should be 1). Click **Tools → Spatial Analyst Tools → Map Algebra → Raster Calculator**. Type in the map algebra expression, for example, 0.6 * "slope_recfy" + 0.4 * "landuse_recfy". Please try this out by yourself.