

GEOG2100 Introduction to GIS

Lab 7: Raster processing and analysis

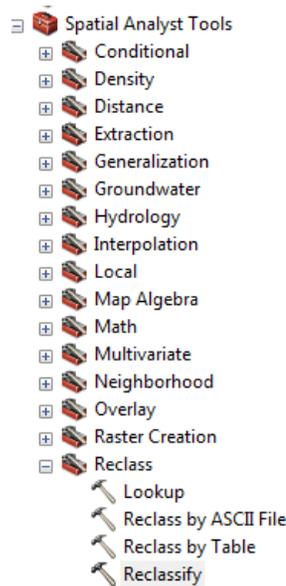
Total points: 20 points

Goals:

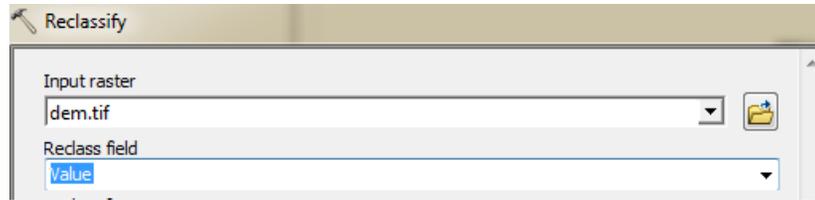
- Get familiar with raster processing tools of ArcGIS;
- Reinforce your understanding of data conversion between raster and vector;
- Perform raster analysis using reclassification and map algebra;

Background: Assuming that **Fossil X** is found in high altitude area (**elevation>2500 m**) and is from **glacier drift**, you will perform spatial analysis to identify potential locations of the fossil.

1. Reclassify. Reclassify the original DEM into three regions of **low**, **medium** or **high** altitude. The pixel value of a point represents the elevation of that point.
 - a. Open ArcMap. Add dem.tif and geology_co.shp to the map.
 - b. **Enable** “Spatial Analyst” extension. Go to Menu, **Customize**→**Extensions**.
 - c. Open ArcToolBox. Select **Spatial Analyst Tools**→**Reclass**→**Reclassify**. *If you skip Step 1.b, you will not be able to perform the Reclassify operation.*



- d. Set up configurations
 - i. Set **Input raster** as **dem.tif**, set **Reclass field** as **Value** and click **Classify**. The value field records elevation information (unit: meters).

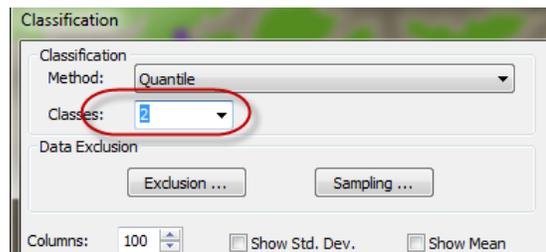


If the attribute information is not loaded by default, you need to **build an attribute table** for the data. You may refer to Lab 3 as well.

- ii. In the reclassify window, click on **Classify** to open the classification window.



Change the classification methods and classes by clicking “**Classify**” button. First set the classes as “**2**” and then set the method as “**Manual**”.



- iii. Then change the values of Reclassification. You should keep **NoData** unchanged. The purpose of this configuration is to set up the New Values (new altitude category) for Old Values (elevation information).

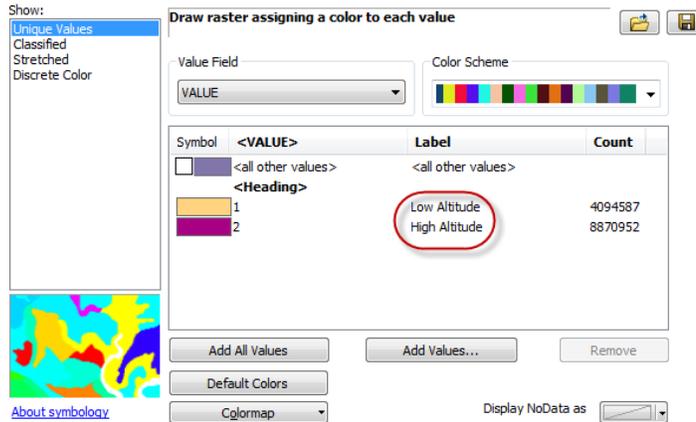
Before

Old values	New values
1557 - 2751	1
2751 - 4342	2
NoData	NoData

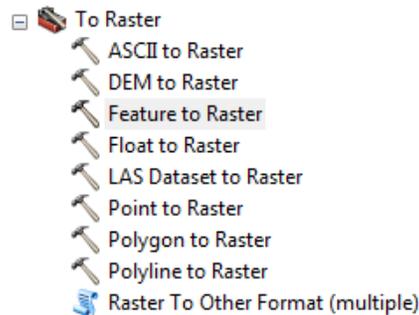
After

Old values	New values
1557 - 2500	1
2501 - 4342	2
NoData	NoData

- e. Open the attribute table of newly created raster layer. Open its attribute table. Explain the reclassified results. **What does “1” from the “Value” field mean (put the range of elevation values here)? (1 point)**
- f. Modify the labelling information of the layer. Open the properties of the reclassified layer and click on **Symbology** tab. Change the labels to “High” for 2 and “Low” for 1.



2. Convert the geology_co to raster.
 - a. Add **geology_co** to the map.
 - b. Find Feature to Raster tool from ArcToolbox: **Conversion Tools → To Raster → Feature to Raster**.

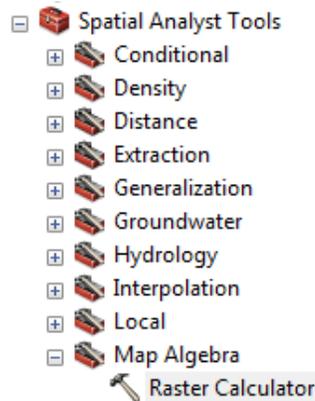


- c. Convert the vector layer to a raster layer. Set up the configurations. You should identify an appropriate **raster field** for conversion to make sure the **cell values represent rock types**. Specify the output cell size of the converted raster as the same of the DEM layer. You can drag the DEM layer to the Output cell size window. **Which field do you select? Why? (2 points)**.
 - d. Open the attribute table of the raster layer (**georaster_co**). Check the number of rows. Each row represents one rock type. **How many rock types are there? What does the “COUNT” field record? (2 points)**
3. Perform **Reclassify** for the raster layer of **georaster_co** to identify the target geological type which is “glacial drift”.

- a. Find **Reclassify** Tool. The reclassification should differentiate glacier drift and other rock types.
- b. Modify the labels of the reclassified layer.

Symbol	<VALUE>	Label	Count
	<all other values>	<all other values>	
<Heading>			
Rock Type			
	biotite gneiss/sandstone/shale	Other	22767800
	glacial drift	Glacial Drift	639938

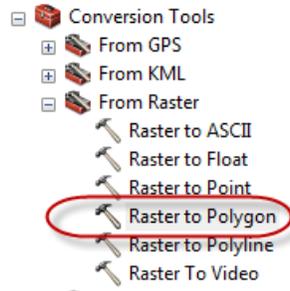
4. Perform the analysis with map algebra.
 - a. Open Raster Calculator: *Spatial analyst* → *Map Algebra* → *Raster Calculator*



- b. Use the following expression to identify targeted cells: (“glacier”==1) & (“elevation” == 2). Glacier and reclassified elevation layers are required. Your layer names may be different.
- c. Perform the map algebra calculation. View the results from previous step. You should include a screenshot here to explain the results. **What is the cell value of target cells (i.e., the cells showing Fossil X locations)? How many cells are in that category? (2 points)**
- d. Open attribute table of the final raster layer. **Select the target cells only.** *If you skip this step, your conversion will include all types of cells.*

Rowid	VALUE	COUNT
0	0	1243384
1	1	417467

- e. Find the conversion tool, *ArcToolbox* → *Conversion Tools* → *From Raster* → *Raster to Polygon*. Choose the raster layer as the Input raster and specify the output location. This converts the raster to vector as the final layer showing the spatial extent for Fossil X. **When you convert the data, which field do you select? Why? (2 points)**



5. Create a map (**4 points**):
 - a. The map should include *two data frames*:
 - i. One for the entire region (two layers: the reclassified elevation layer and the reclassified geology layer)
 - ii. One for the region showing locations of Fossil X (two layers: the fossil vector layer and a base map of your choice).
 - b. The map should include essential map elements. Modify legends to show the reclassified attribute information (e.g., High and Low altitude)
 - c. Add a short description to explain the reclassified layers.
6. For Step 4, develop *another algebra* to identify targeted cells. **Write down the expression, and explain how the expression can be used to identify targeted cells (3 points)**
7. Open a new map and load all layers from *Lab7_Step6.gdb*. Complete the following operations and answer questions. You may refer to ArcGIS help to find information about the tools for the analysis.
 - a. Neighborhood analysis: Calculate slope and aspect of the DEM layer
 - i. Turn on spatial analyst extension
 - ii. Find the tool *Spatial Analyst Tools* → *Surface* → *Slope*. Setup the tools properly. Based on the map and the symbology, **what is the maximum slope? What is the minimum slope? (1 point)**
 - iii. Find the tool *Spatial Analyst Tools* → *Surface* → *Aspect*. Setup the tools properly. Perform a *reclassify* operation for the aspect layer to generate an attribute table. **Which direction (e.g., North, South) has the largest number of cells? (1 point)**
 - b. Calculate the average elevation of each rock type zone
 - i. Find the tool *Spatial Analyst Tools* → *Zonal* → *Zonal Statistics*
 - ii. Choose *geology* as the *Zone* layer, *RockType1* as the *Field*, *dem* layer as the *Value* layer
 - iii. Include two screenshots: one for the zonal statistics layer (with symbols showing unique elevation values) and one for the geology layer (with symbols based on *RockType1*). **Do you observe any correspondence between two layers? (1 point)**
 - c. Calculate the distance to the nearest river
 - i. Find the tool *Spatial Analyst Tools* → *Distance* → *Euclidean Distance*

- ii. Use *river* as the source layer. **Based on the map, which region has the farthest distance to a river? (1 point)**
8. (Optional, **2 points**) Identify an operation that can be performed for both raster and vector, read the help document to understand the purpose of the operation, perform the analysis with datasets and explain the differences. If you cannot find the tool, use *Windows* → *Search*, type the name of the tool. You can use datasets from previous labs or perform raster/vector data conversion. You should include screenshots when explaining the difference. Possible tools:
 - a. Multiple-ring buffer (vector) vs. Euclidean Distance (raster)
 - b. Expand (raster) vs. Buffer (vector).
 - c. Clip (vector) vs. Extract by Mask (raster). A clip vector layer is needed.

Items to turn in:

- A complete map.
- A document describing your answers to questions.
 - Make sure you include all required screenshots.