Raster to Vector Conversion for Overlay Analysis

In some cases, it may be necessary to perform vector-based analyses on a raster data set, or vice versa. The types of analyses that can be performed on raster data vs. vector data vary significantly due to differences in structure. Raster data is comprised of evenly sized and spaced cells that represent a continuous surface, while vector data is comprised of points, lines, or polygons that represent discrete entities and locations on the earth's surface.

There are tools available to facilitate conversion between raster and vector data types. The procedure outlined in this guide describes the steps used to convert a digital elevation model (DEM) raster to vector format so that the result may be overlaid with a vector polygon layer for further analysis.

Step 1   Convert raster to vector

Open ArcMap and create a new, blank map document. Add the raster file to be converted to the map using the *Add Data* tool and ensure that an appropriate coordinate system has been applied to the data frame (right-click the data frame name and select *Properties > Coordinate System*).

Open ArcToolbox and expand the *Conversion Tools > From Raster* toolbox. Double-click the *Raster to Polygon* tool to open its dialog and enter the parameters as follows.

1. Set the *Input raster* to the DEM or other raster file that you wish to convert to vector format.

2. Set the *Field* value to the field that you wish to use to assign values from the raster cells to the resulting polygons. Note that this is an optional input, and should only be used if you have a specific string or integer field set up for the conversion. We have left this option blank for the example shown here.

3. Set the *Output polygon features* to your working directory and give the output a descriptive name.

4. The *Simplify polygons* option will be checked as the default choice. Simplifying the polygons means that polygon shapes will be smoothed into simpler shapes rather than conforming exactly to the edges of the raster cells. If the option is unchecked, then the resulting polygons will conform exactly to the input raster's cell edges.

A portion of the input DEM and the resulting polygon file produced with the *Raster to Polygon* tool are shown below. Note that this example shows the output with the *Simplify Polygons* option turned on.

Have a look at the converted polygon file in ArcMap. Use the *Identify* tool to see the attributes for specific polygons and note that the GRIDCODE field from the original DEM has been maintained in the output file. Thus, each individual polygon in the new file represents a discrete elevation value. This is important for the next step in our example – isolating specific altitude intervals.
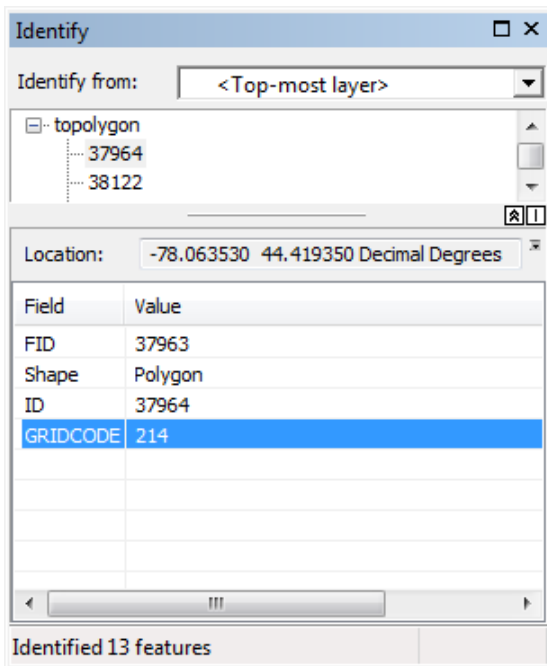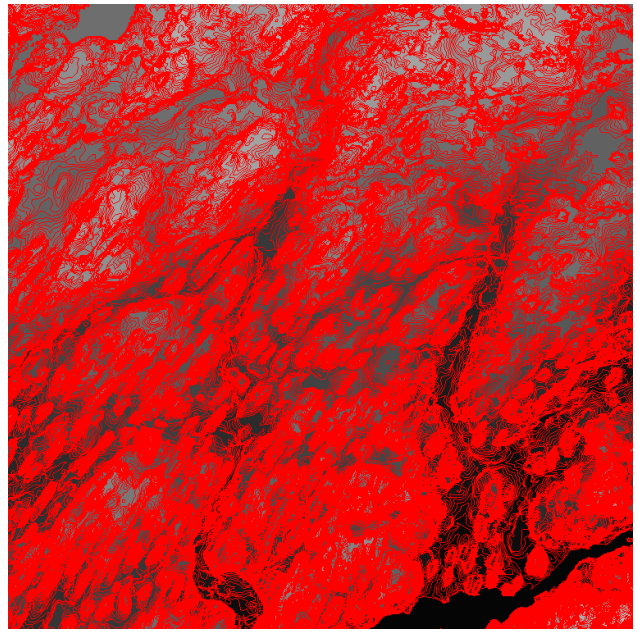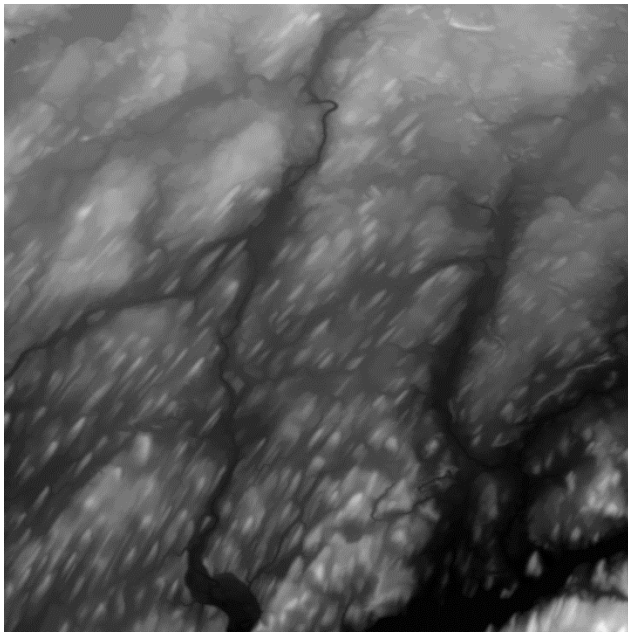
Step 2   Isolate attribute values

For this example, we will calculate glacial area at specific altitudes – that is, we wish to calculate the total area of glaciers that exist between 0-100 metres above sea level, 101-200 metres above sea level, and so on. This is just one example of the type of analysis that can be done using raster to vector conversion and overlay analysis.

We will begin by isolating the first elevation interval through attribute selection. Click *Selection > Select by Attributes* from the main menu and use the tools provided in the *Select By Attributes* dialog to enter an expression that will isolate the first set of elevation values for analysis.
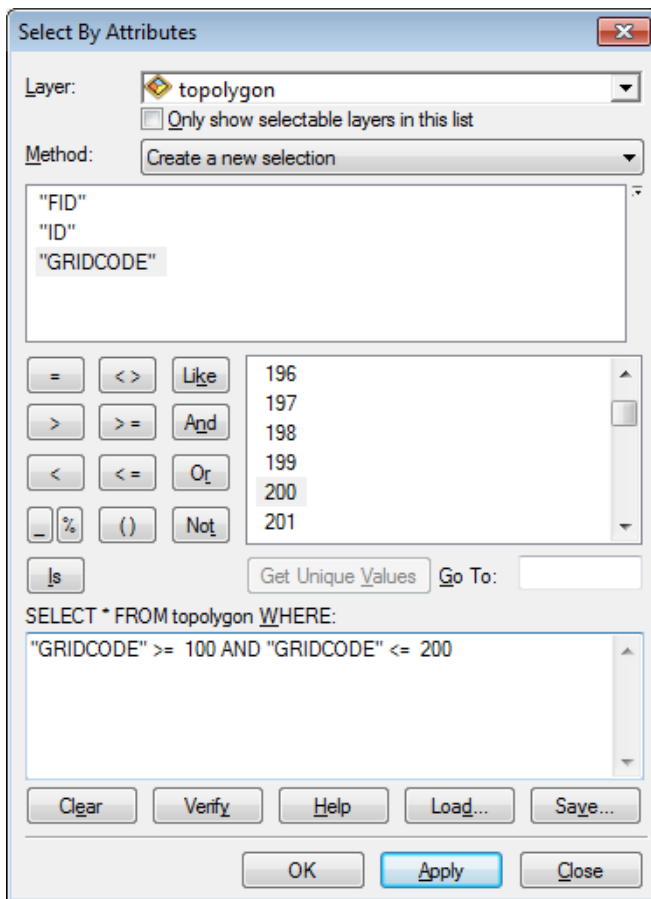
In the example shown here, we have selected all polygons that have an elevation value between 100 and 200 m above sea level.

You will note that we use the AND operator in this expression, to select values for which both parts of the expression are true; we want to select values that are both greater than or equal to 100 m, AND less than or equal to 200 m. Use of the OR operator would essentially nullify the first part of the expression and the result would include all values that are less than 200 m, but would not filter out values that are less than 100 m above sea level.

The resulting polygons will be selected within your polygon layer. Right-click the layer name in the table of contents and select *Data > Export Data*. In the *Export Data* dialog, choose to export selected features, set the coordinate system using the tools provided, and save the resulting file to your workspace with a descriptive name. Click *Yes* when prompted to add the layer to your map.

Repeat the selection and export steps as needed to isolate the remainder of the intervals for analysis.

Step 3   Overlay

There are a number of different overlay processes available within ArcGIS, and the choice of analysis will depend on what you would like to see as your ultimate output. To view the options available, open ArcToolbox and browse to *Analysis Tools > Overlay*. ArcGIS Help provides a detailed description for each overlay tool.
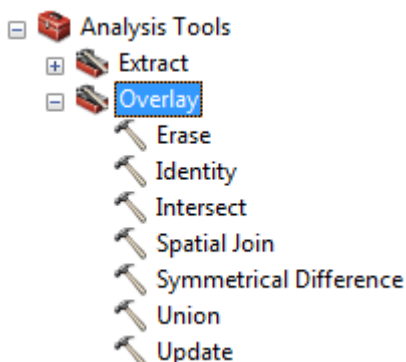
In this case, we wish to overlay glacier polygons with each interval created in Step 2 so that we can calculate the total glacial area that occurs within the given elevation values. This type of analysis can be achieved with the *Intersect* tool, which computes the geometric intersection of multiple features, as shown below.
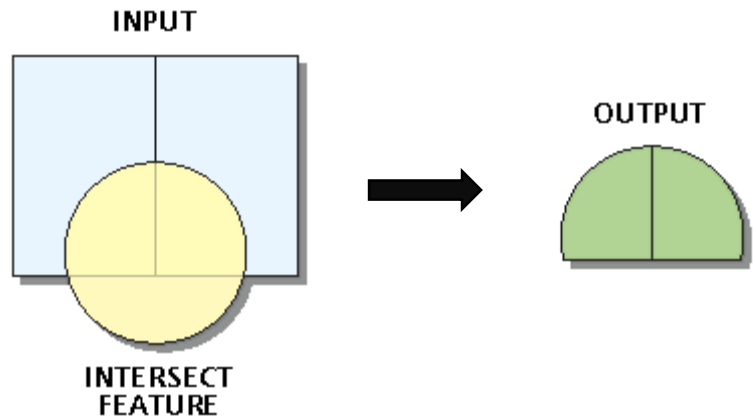
Double-click the *Intersect* tool to open its dialog and enter the parameters as follows.

1. Set the *Input Features* to the first elevation interval file and the glacier file.

2. Set the *Output Feature Class* to your working directory and provide a descriptive name for the output.

3. The remaining parameters – Join Attributes, XY Tolerance, and Output Type – are optional. Read the help for each parameter to determine if you should be leaving the default or making a selection in these cases.

The figure on the left below shows a hypothetical portion of the polygons generated for the altitude interval between 100 and 200 metres, with the altitude polygons shown in grey and glaciers in blue. The result of the *Intersect* tool is shown in the figure on the right.
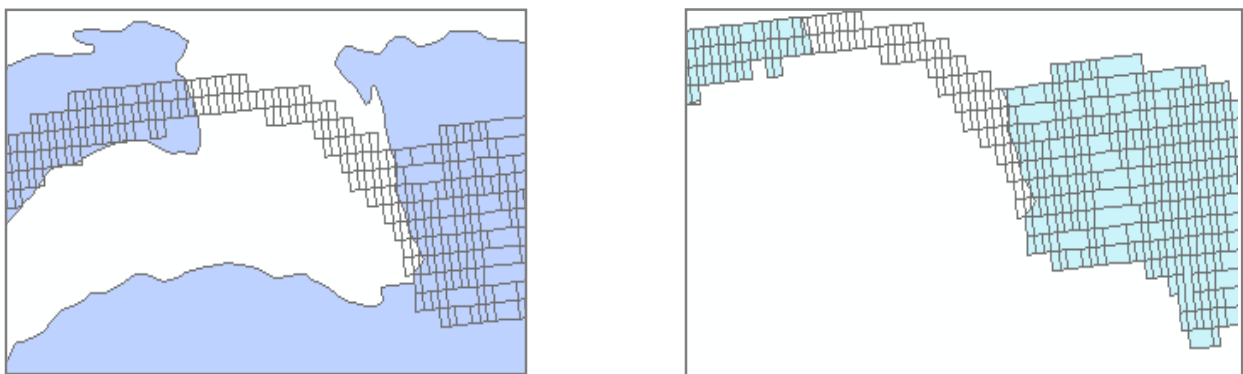

Repeat the overlay steps as needed to achieve your results.

Step 4 Calculate Area

The output intersections created in Step 3 can now be used to calculate the total area of glaciers for each specified elevation interval.

1. Open the attribute table of the intersection output created in Step 3 and select *Table Options* ▤ ▾ > *Add Field.* Create a field called AREA with a data type of *Double* and click OK.

2. If necessary, open the *Editor* toolbar (*Customize > Toolbars*) and start an editing session (*Editor > Start Editing*).

3. Right-click the AREA field in the attribute table and select *Calculate Geometry*. In the resulting dialog, select *Area* as the Property and set the remaining options according to your preferences. Click OK. The area will be calculated and entered to the file's attribute table. Click *Editor > Stop Editing* and save your edits.

   Note*: If your data is not projected, you will not have the ability to calculate area; your files must be projected to a linear coordinate system in order to calculate geometric properties.*
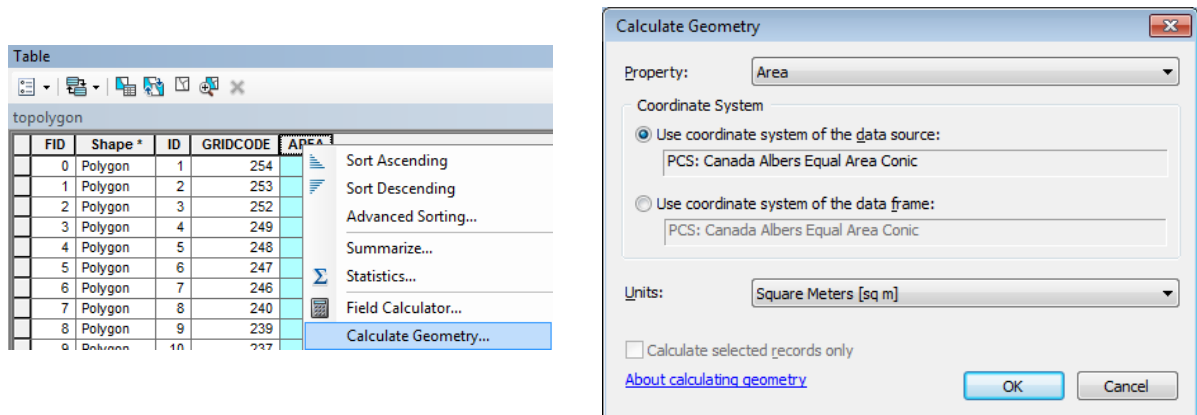
4. If you wish to calculate the total area of all polygons in the layer, simply right-click the field heading and select *Statistics.* The resulting dialog will provide summary statistics for the field.
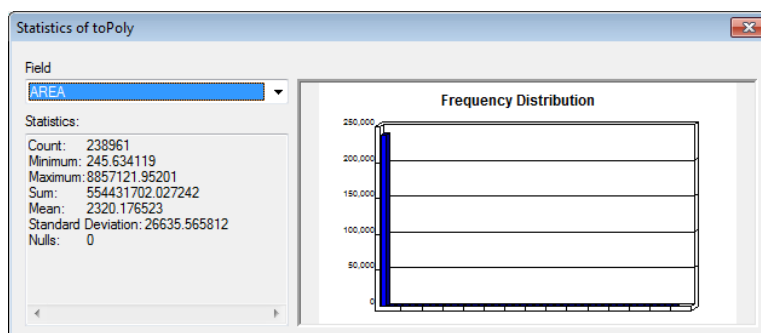
For further assistance with this guide or other topics related to geospatial and/or statistical data and software, please contact us at madgichelp@trentu.ca.