GGR321
Assignment 1 – Parts 2 & 3 (out of 3)

Part 2: Learn the essential tool – ArcGIS Pro ModelBuilder

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Objectives

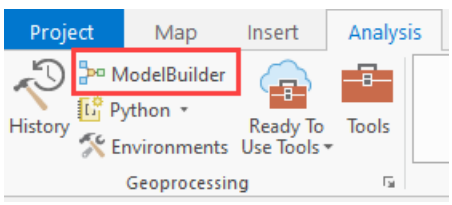
In this part of assignment, you will:

1. Convert geospatial data between different types.
2. Create and execute simple scripts using ModelBuilder.
3. Perform basic math and buffering operations.

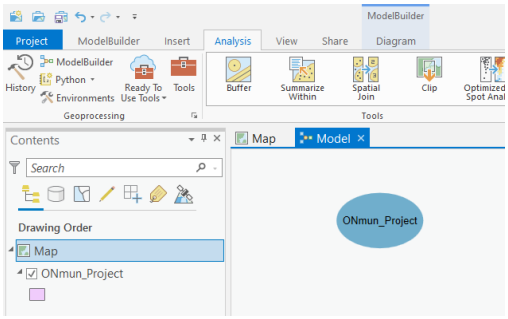
Part 2-1: ModelBuilder

ModelBuilder is a set of tools specific to ArcGIS that allows for automating GIS tasks. Instead of writing code, you work with a Graphical User Interface (GUI) and connect tools together.

STEP 1: Open Model Builder

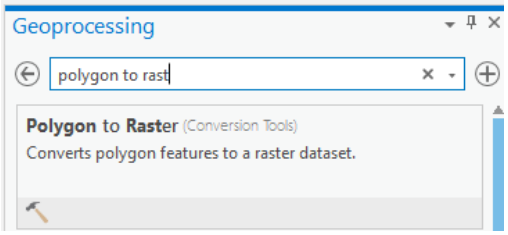


STEP 2: Add your data



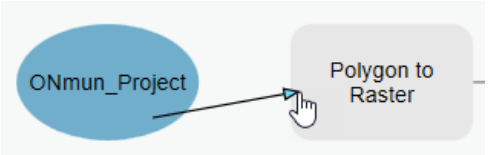
- Add the **projected** ONMun layer to the model, either:
  - Drag-and-drop the shapefile into the Model pane

STEP 3: Convert your shapefile to raster



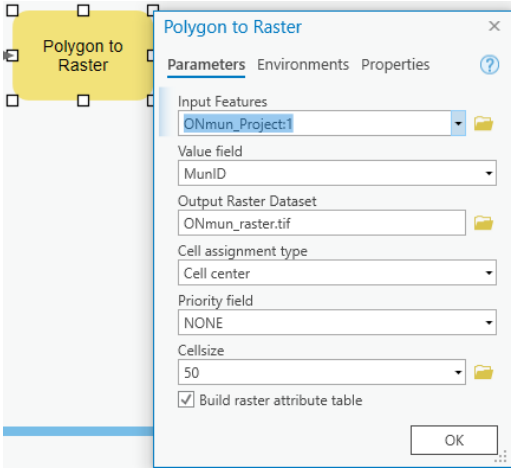
- Open Tools and navigate to the Conversion Tool toolbox.
  - Analysis tab > Tools
- In the Geoprocessing pane, navigate to Polygon to Raster and add the tool to the Model pane
  - Toolboxes > Conversion Tools > To Raster > Polygon to Raster
  - Drag-and-drop the tool into the Model pane
  - Tip: you can also search for tools and still use the drag-and-drop method (see picture)

STEP 4: Make a connection



- Click on the **projected** ONMun layer and drag an arrow to the "Polygon to Raster" tool
- Select "Input Features" when prompted

STEP 5: Set the correct parameters



- Double-click the "Polygon to Raster" tool and set the following parameters:
  - Value field: **MunID**
  - Cell size: **50**.
  - Output Raster Dataset: **ONmun_raster.tif**
    - Save the data to your drive with an appropriate name.
  - If you do not specify a file extension the raster will be saved in the ArcGIS GRID format. Valid file extensions are *.tif (compressionless) (preferred), *.jpg (can be compressed) (may lose information), *.img (ENVI image) (may not be compatable), etc.
- Run your model with one of the following
  - Model builder tab > Run
  - Right-click the blank space and click "Run"

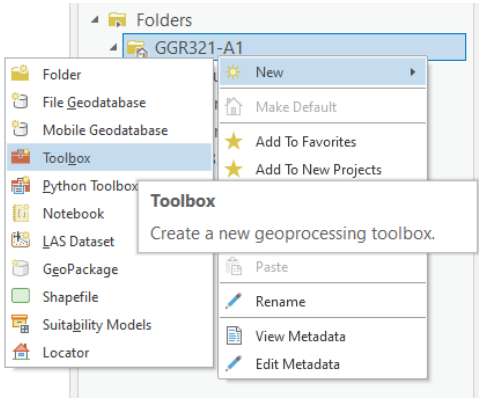
Question 4 [3 marks]. Visualize the new raster layer with proper color scheme in ArcGIS Pro and provide a screenshot. What is the spatial resolution of your new raster layer?

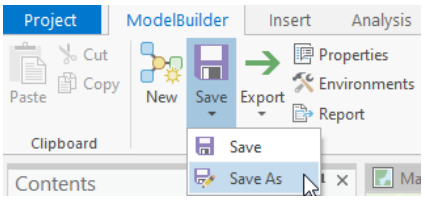
Important: By default, Model Builder uses the coordinate system of the input data layers. However, it may use the coordinate system of the active data frame. We will get into changing the Environment Settings later. You should be aware that the outputs from Model Builder depend on the Environment Settings which can, and often should, be user defined. For the moment, we can use the default settings.

Now, you have successfully created a simple ArcGIS tool that converts shapefile to raster with specific settings. The tool can be saved and re-used in future for similar scenarios.

STEP 6: Save your new tool

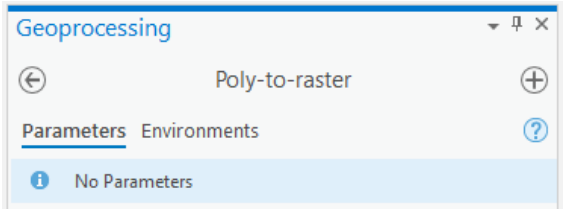
- You have just created a Model or script that runs a simple program.
- Model Builder can be used to connect tools into an automated workflow.
- Automated workflows are great for reducing the time to complete repetative tasks.
- Once you create a model, you can save it inside a toolbox.
- In Catalog, to create a toolbox, right-click the folder you want to save the toolbox in and select **New > Toolbox**.
- To save the model into your new toolbox, navigate to ModelBuilder tab > drop-down button on Save > Save as > Save to your new toolbox





STEP 7: A note about your new model

- If you want to make changes to the model you will need to right-click on the model and select Edit.
  - If you attempt to open the model (by double-clicking or selecting Open) the model will not open in the editor.
  - It will attempt to "open" or run the model.
- We have not created a model that accepts parameters, so it will run if you click OK.
- It is easier to open the model in the Model Builder editor and run from there.

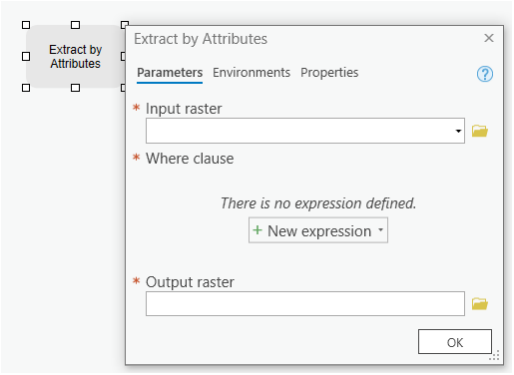


Question 5 [2 marks]. Which data model is the better for representing municipal boundaries, raster or vector, and why?

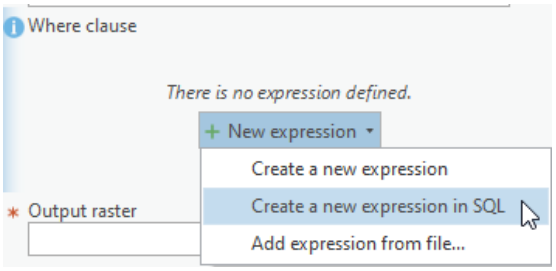
Part 2-2: Raster to Vector

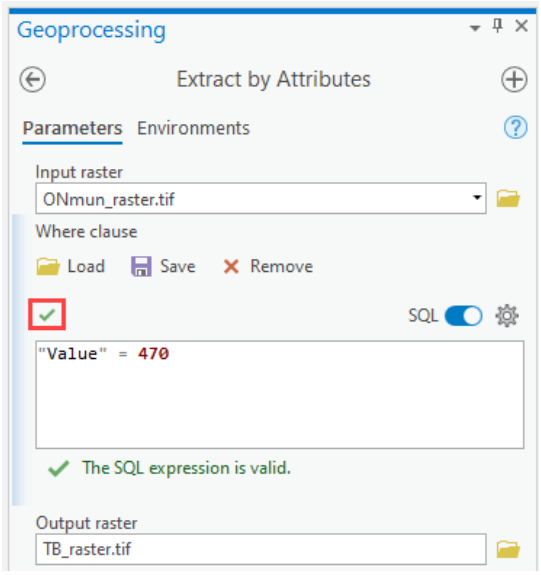
Now let's convert a raster to a vector. But instead of converting the entire raster, we will convert a particular city – Thunder Bay.

STEP 8: Select only the raster cells that represent the City of Thunder Bay.



- Create a new model with ModelBuilder
- Add the **Extract by Attributes** tool by dragging it into your new model.
- We will now use the **Extract by Attributes** tool to create a new raster for the ***city*** of Thunder Bay.
- To select just the city of Thunder bay, we will extract only pixels that have the MunID of 470 (City of Thunder Bay).
- Double-click the **Extract by Attributes** tool in your model to open the settings window.
- In the settings, select **ONmun_raster.tif** raster you created in previous steps as the Input_raster.
- Click the drop-down button next to "New Expression" > **Create a new expression in SQL**.
- We will define a statement in Structured Query Language (SQL) that will select a subset of the total pixels.
- Even if a raster does not have an attribute table, you can always select the pixel values using "Value".
- In this case, enter into the query builder, **"Value" = 470** and click on **Verify** to make sure the expression is valid.
- Pay attention to the spaces and quotation marks, as the expression must have the correct syntax.
- Name the Output raster as **TB_raster.tif**





STEP 9: Add **Raster to Polygon** tool twice to the model.

- You will convert the output from the Extract By Attributes tool, twice, to two different shapefiles.
- In the first instance, leave **Simplify polygons** checked.
- In the second instance, convert the Thunder Bay raster with Simplify polygons unchecked.
- Validate and run your model.

Question 6 [3 marks]. Create a figure showing the differences between the simplified polygon of Thunder Bay and the un-simplified polygon of Thunder Bay.

- Configure the symbology settings to proper visualize both layers.
- The figure should be zoomed in sufficiently so that the differences in the boundary are visible.
    - You do not need to present the entire geographic region in the figure.
- Include a figure caption describing which polygon color represents each file.
- Include a legend.

Question 7 [2 marks]. Include a screenshot of your ModelBuilder (successfully validated/run) that shows the selection of Thunder Bay and the creation of the two vector files.

Part 3: Spatial analysis as an expert - Site selection

Objectives

In this part of assignment, you will:

1. Recall basic GIS/spatial analysis methods.
2. Perform GIS problem solving with ModelBuilder.

You have experimented with ArcGIS Pro ModelBuilder. Now it's time to apply your GIS knowledge from GGR278, the prerequisite for this course. There will be no detailed steps provided for this part. You will need to think like an expert, using ModelBuilder to solve the problem and create a reusable tool.

STEP 10: Create a site suitability model in Model Builder to determine the areas where agriculture can be practiced according to two constraints: slope and proximity to a road.

Data to be used in this part: **DEM.tif and Roads.shp**

Criteria that need to be satisfied:

- An agricultural policy in a region requires that there is no agriculture on slopes greater than 5%.
- Vehicular resources in this area are very restricted, farmers would need to bring their crops to the road by cart or horse. Thus, only areas within 500 meters of a road are suitable.
- Using the DEM and road layers, find areas where the slope is less than or equal to 5% and are within 500 meters of a road.

Other considerations:

- The .prj file is not provided with your data, which means both data files have not properly projected yet. You will need to define the projections and then unify them into one Projected Coordinate System to work with. (Tip: recall what you learned from GGR278 on how to define the projection system and be clear with the differences between the Define Projection tool, Project tool, and Project Raster tool)
- What we know about the coordinate system of these spatial data:
  - The DEM.tif file was created in the Geographic Coordinate System: WGS 1984.
  - The Road.shp file was created in the Geographic Coordinate System: NAD 1983.

Question 8 [15 marks]. Create a map showing the suitable and unsuitable agricultural land (binary 1 = Yes; 0 = No). Include a screenshot of your ModelBuilder and also submit your toolbox file, which contains the model you created in this part (we will check the original model and test whether it is runnable).

! This section requires problem solving and some independent learning to identify the procedure necessary to achieve the final result.
! All Analysis should be conducted on files that are projected to: NAD 1983 UTM Zone 16N.
! Your figure should cover the entire area of the DEM (Hint: Set Processing Extent in ModelBuilder).

Useful tools:

- Con Tool (Conditional Tool Box) in Spatial Analyst Tools.
  - Performs a conditional if/else evaluation on each of the input cells of an input raster.
  - You will need to create a binary raster with the Con tool, so that where Values of 1 = True (i.e., it is within 500 m of a road), 0 = False
- Euclidean Distance in Spatial Analyst Tools
  - Calculates, for each cell, the Euclidean distance to the source features.

Assignment 1 Submission Requirements [Important]:

1. Please submit your Assignment 1 in **two files**:

   a. **One PDF file** that includes your answers to the questions and required screenshots for all three (3) parts of Assignment 1.

   b. **One Zip file** that includes the required toolbox containing the models you created.

2. Use **Times New Roman 12-point font** with **1.5** line spacing.

3. Don't forget to include the **title of the assignment**, **your official name**, and **your student ID number** at the top of the first page.

4. Submit **the PDF and Zip files** through Quercus by the due date.