# Maps, Mapping, and Geospatial Technologies

**Title**: Geoprocessing

**Due Date**: April 17, 2023 at 11:59 pm

## Required Resources:

- An internet enabled computer
- ArcGIS Pro

## Purpose:

The purpose of this lab is for you to get hands-on experience running spatial analysis operations using geoprocessing tools and scripts within ArcGIS Pro as well as create a map using best cartographic design practices. This lab will continue to build upon your experience using ArcGIS Pro as well as an appreciation for how geospatial data can come in different forms. As you complete the lab exercise today, think about how you could use this in future projects, especially considering the elements of what makes a good map.

You will also notice that there are fewer cues in the exercise – you can always reach out with any questions (jxsigm@rit.edu), but I would like to challenge you to learn more about the software and the methods, tools, and operations to complete your tasks. **This week's lecture includes a lot of helpful tips!**

## Learning Objectives:

- Understand different spatial analysis operations
- Use geoprocessing tools
- Use Model Builder to create a model
- Update a Python Script
- Create a map

## Deliverables:

This week, your deliverable will be a write up of your work, including an export of your map. ***Your write up should not be a copy of this assignment, but a new word document that answers the questions below.*** The data created may be used in future assignments, so it is important you complete this assignment! Upload your write up to the lab assignment on myCourses. All the tasks below should be included in the same word document (or PDF). Name your write-up using this convention before posting:

[your last name]_Week12_lab.docx

## Grading:

This assignment will be graded out of **25** points.

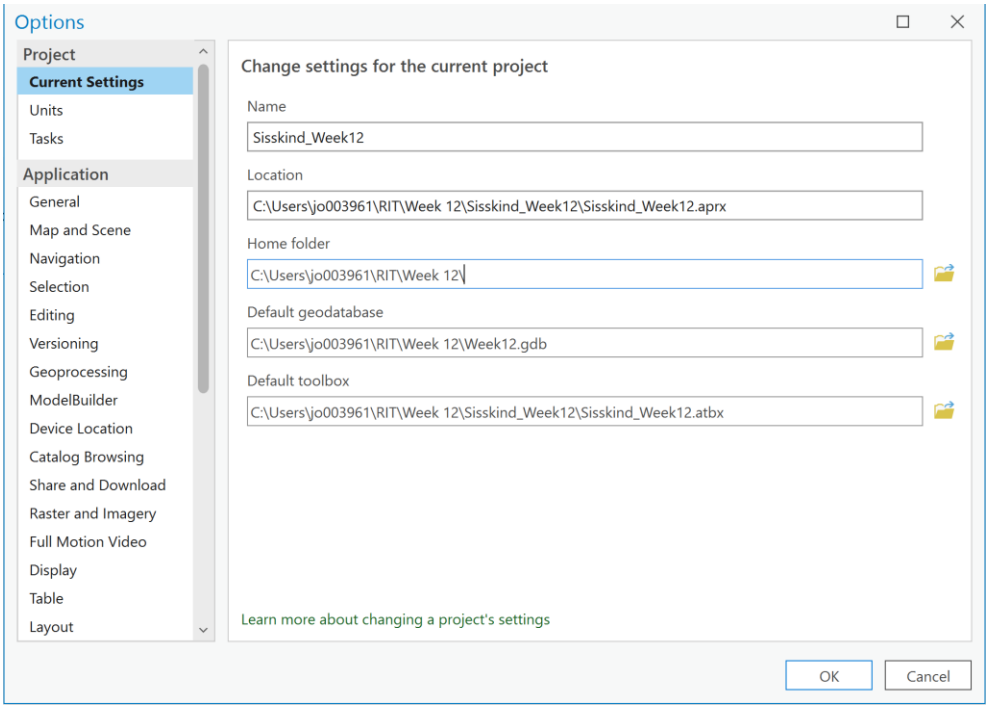
## Task 1: Geoprocessing

For this task, you will run…

1. Open ArcGIS Pro and create a new project by selecting "Map". Name your project **[your last name]_Week12**.

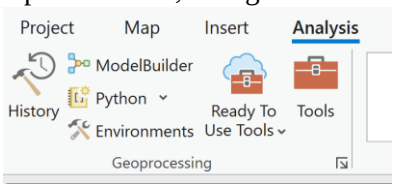
2. Add the folder where **Week12.gdb** was downloaded and unzipped.

3. Let's change the default geodatabase, so that your results get stored in the same location as the lab exercise data. In the **Project Tab**, select **Options** and specify the **Default Geodatabase** as **Week12.gdb**.




4. Use the back arrow to return to the map.

5. We can also set the folder environments for our geoprocessing. Go to the **Analysis** tab and select **Environments**. The current and scratch and workspace should match what was set in the Project Options. If not, change the values.




6. From the geodatabase, add the **basin** and **soils** feature classes to the map.

7. **Save your project**.

8. In the **Analysis** tab, select **Tools**. The Geoprocessing window will appear. Select the **Toolboxes** tab.

9. Find the **Analysis** tools, then **Extract** tools. We will be using the **Clip** tool for this task. Double click on the tool.

10. For this task, we want to clip the soils feature class from the basin. Therefore, we will select the **soils** feature class as the input features and the **basin** feature class as the clip features. The output features will be automatically names "soils_Clip" and stored in the File Geodatabase. You can rename the output if you like, but note that it may be different than what is noted in the lab.

11. Click **Run**. Your output feature class has been added to the map.

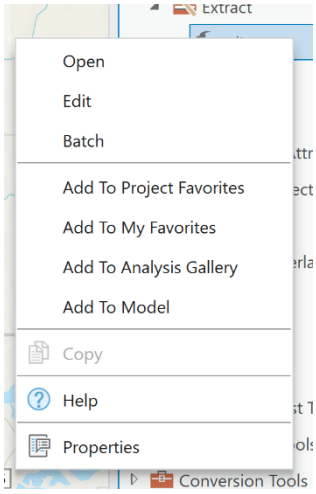
**Question 1: What was the result of running this geoprocessing tool? Include a screenshot of only the "soils_Clip" layer.**

12. On the Analysis tab, select **History.** You should see the operation you just ran ("Clip"). Clicking on it once (or hovering) will provide information about the operation, whereas double-clicking will open the tool with the same parameters.

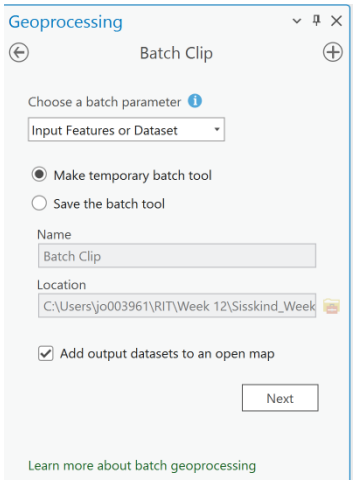
## Task 2: Batch Geoprocessing

For this task, you will use batch processing to clip the other layers.

1. Add the remaining feature classes from the Week12 geodatabase (rivers, flood zones, lakes, and roads).
2. Open the Geoprocessing pane so that you see toolboxes like in Task 1. Right-click on **Clip** and select **Batch**.




3. The Batch Clip Tool will open. Select **Inputs Features** as the batch parameters, as this is the one that will vary from operation to operation. Leave the other parameters as the default.



4. Use the drop-down options to select the newly added feature classes: **roads, rivers, lakes, and floodzones.**

5. Select **basin** for the clip features.

6. Change the output feature class to **%Name%_Clip**. The "%" serves as a wildcard to inform the tool to use the feature class name as the output.

7. Click **Run**.

8. You should now have 4 more "clip" feature classes added to your map.

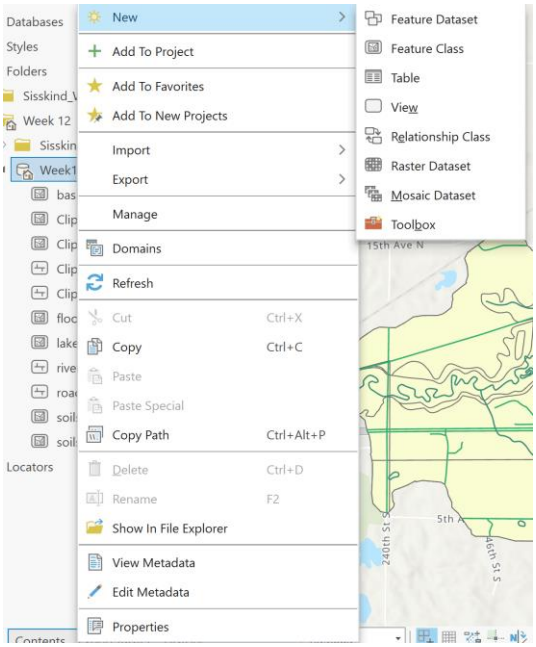
**Question 2: Only have the "Clip" layers visible and zoom to one of the layers. Take a screenshot and include in your write up. What are the benefits of the Batch Processing operation?**

## Task 3: Model Builder

For this task, you will create a model using Model Builder to conduct a flood analysis.

1. First, we will add a toolbox to our File Geodatabase. As a reminder, File Geodatabases can store vector, raster, tables, and tools.

2. In the Catalog Pane, right click on your File Geodatabase and select **New >> Toolbox.**




3. Name your toolbox **Week12**.

4. You can create a model in two ways – either by going through the Analysis tab or right clicking on the toolbox and choosing New >> Model. Select one way to create your model.

5. In the ModelBuilder tab, select **Properties**.

6. Name your model **flooding** and give it a label of **Flooding Analysis**. Just like names and aliases for feature classes, the label allows for spaces and special characters, while the name is what is stored in the database.

7. Before closing the window, make sure that "Store tool with relative path" is checked.

8. Select **Save**. If you created the model in the toolbox, you should see the name update in the catalog pane.

9. Let's create a model! Drag the **basin** and **floodzones** feature layers from the Catalog pane into the model.

10. From the Geoprocessing pane (you may need to reopen if you closed it), add the Clip tool.

11. At this point, the feature layers should be blue (since they are actual files), and the tool should be gray.

12. Click on **floodzones** within the model and drag your cursor towards the **Clip** box. An arrow should appear. Connect the arrow to the Clip box and select **Input Features or Dataset**. Repeat with **basin**, this time selecting **Clip Features**.

**Question 3: What color did the Clip and Output Features/Dataset objects change to? Why do you think they changed from gray to a color?**

13. Double click on the Clip box. The Output Features or Dataset may be automatically named as floodzones_Clip. You can change that output name if desired. Select "Ok".

14. In the ModelBuilder ribbon, select **Auto Layout** and **Fit to Window** to organize your model elements.

15. **Save your model!**

**Question 4: Not a question – but take a screenshot of your model and include in your deliverable.**

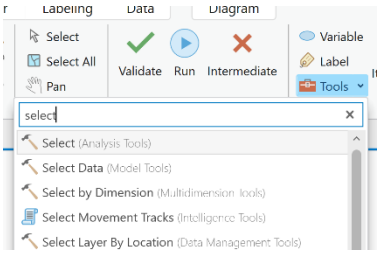
16. Select **Run** in the ModelBuilder ribbon. Close the progress box when complete.

17. Right click on the **Output Features or Dataset** in your model and choose **Add to Display**.

18. Go back to your map view – you should now see the result added to the Table of Contents.

19. Close your current model – then navigate to the model in the Catalog Pane, right-click the model and choose **Edit.**

20. You can search for tools direct from the ModelBuilder ribbon. Search for **Select** and add it by dragging and dropping.

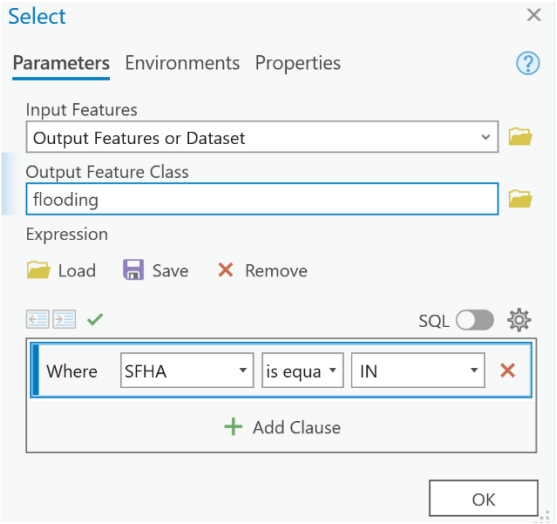



21. Double-click on **Select** and choose the **floodzones_clip (or Output Features or Dataset)** from the previous model.

22. Name the output feature class **flooding**.

23. Let's add an expression to this model. You may remember this from prior assignments, including the field collection lab. We are going to create a rule to find where coded areas are "in" a "special flood hazard area".

24. Create the following expression: **Where SFHA is equal to IN** (or create a SQL expression of **SHFA = 'IN'**).




25. Select **OK**.

26. Right-click the **floodzones_clip (or Output Features or Dataset)** and turn off **Add to Display**. This will still create the feature class but will not add it to the map.

27. **Run your model!**

28. Right-click the final output and add to your map.

**Question 5: Not a question – but take a screenshot of your model and include in your deliverable.**

29. **Save and close your model**.

30. You can remove the **floodzones_Clip** layer from your map. You may need the rest later.

## Task 4: Scripting for Geoprocessing

In this task, you will use Python to create a script to complete a geoprocessing operation. **Don't worry if you do not know Python!**

1. On the **Analysis** tab, click the **Python** button and select **Python Window**.

2. We will enter our code in the bottom of the window at the "prompt".

3. If you were using an external editor, you would first need to type **`import arcpy.`** There is no harm in doing this if you want to try it out.

4. While typing, you will see words begin to auto-complete. This is common in integrated development environments (IDE) and you may have seen this before. Feel free to keep typing throughout or selecting the right prompt.

5. We are going to buffer the created flooding areas by 500 feet to identify dangerous locations under heavy rain. Use the following line of code to run this analysis in the Python window (as a reminder, your layer names may differ). Press enter when complete to run:

```
arcpy.analysis.Buffer('floodzones_Clip_Sel','flooding_500ft',500)
```

**Question 6: What was the result of running your script? Do you think it worked? Take a screenshot and include in your write up.**

**Question 7: What was your experience using the integrated window? In your response (50-75 words), note if you have previously worked with Python.**

## Task 5: Create a Map

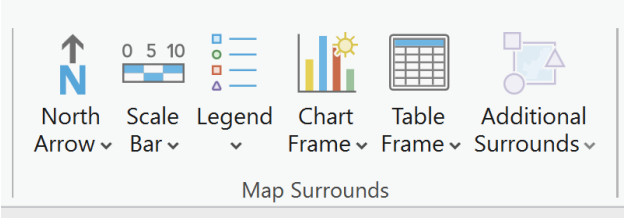
For your final task, you will create a map using your results. The map should show flood zones in Special Flood Hazard Areas as well as areas within 500 feet of those zones, so that those driving can be aware when in the basin (that should be enough of a hint as to what data should be included…right?). Your data should be symbolized to reflect the features they are representing.

To create a map…

1. Zoom to the extent of the basin layer before getting started.

2. Select Insert >> New Layout >> 8.5x11 Landscape.

3. Insert a new **Map Frame** and select the current map view.




4. From the Insert tab, add a North Arrow to your map. You will select your style, then click and drag where you want it on the layout. You can resize it later if needed.

5. From the Insert tab, add a Scale Bar. Use the same click and drag approach you used for the north arrow.

6. Select the map frame to make the **Map Frame** tab visible. Select it.

7. In the ribbon, find **Insert Graphics and Text**. Add text to give the map a title.

8. From the Insert tab, add a Legend using the same click and drag approach previously used. You should rename your layers in the Table of Contents to make it easier to read in the legend.

**Question 8: Using a short answer format (~100 words), describe the process you used to make your map. What design techniques did you employ (feature/ground, graphical representation) when building your final output? What basemap did you choose (if at all!) and why? Why did you choose that north arrow, that scale bar, and give it that name?**

**Question 9: From the Layout tab, select Share >> Export Layout and Flattened PDF. Using the defaults, export your map and submit in addition to your write up.**