Lab Report

Title: Lab 0: Comparing Esri Analysis Methods
Notice: Dr. Bryan Runck
Author: Lucas Rosen
Date: 2/1/2021

Project Repository: https://github.com/LRosen656/GIS5572

Abstract

Esri has three different ways to perform a task: a graphic user interface, Pro Jupyter Notebook, and Arc GIS Online Jupyter Notebook. The goal is to compare three methods to perform a buffer analysis. Scientific and Natural Areas Boundaries shapefile was downloaded form Minnesota Geospatial. A 5-Mile buffer was performed in the GUI, Pro Notebook and AGOL Notebook. Results showed that Pro Notebook could be identical to the GUI and the AGOL Notebook is at least similar.

Problem Statement

The purpose of the lab was to perform and compare identical buffer analyses using 3 different Arc GIS methods: (1) Arc GIS Pro graphic user interface (GUI), (2) Arc GIS Pro Jupyter Notebook (via arcpy), and (3) Arc GIS Online (AGOL) Jupyter Notebook. **Table 1** shows the required data needed. The data I chose was Minnesota Scientific and Natural Area (SNA).

Table 1. Required Data downloaded from MN Geospatial Commons. No preparation was needed.

#	Requirement	Defined As	Spatial Data	Attribute Data	Dataset	Preparation
1	Scientific and Natural Area (SNA) Units	Raw input dataset from MNDNR	SNA Geometry	N/A	Mn GeoSpatial Commons	None

Input Data

The input dataset used in the lab was "Scientific and Natural Area Units" shapefile downloaded from Minnesota Geospatial Commons. The zipped shapefile downloaded includes (1) Scientific and Natural Area Boundaries (a polygon) and (2) Scientific and Natural Area Parking (a point). For the purposes of this assignment, I will just be using the boundaries shapefile to perform the buffer analyses. The data was originally created by the Minnesota Department of Natural Resources. **Table 2** shows the input data, purpose, and link.

Table 2. Input Data.

#	Title	Purpose in Analysis	Link to Source

1	Scientific and Natural Area (SNA) Boundaries	Raw input dataset for buffer analysis from MNDNR	Mn GeoSpatial Commons (https://gisdata.mn.gov/dataset/bdry-scientific-and-nat-areas)

Methods

A five-mile buffer was created around the SNA boundaries using three different methods: Arc Pro GUI, Arc Pro Jupyter Notebook, and ArcGIS Online Jupyter Notebook. **Figure 1** shows a flow-diagram of each method. **Figure 2** shows the initial data.

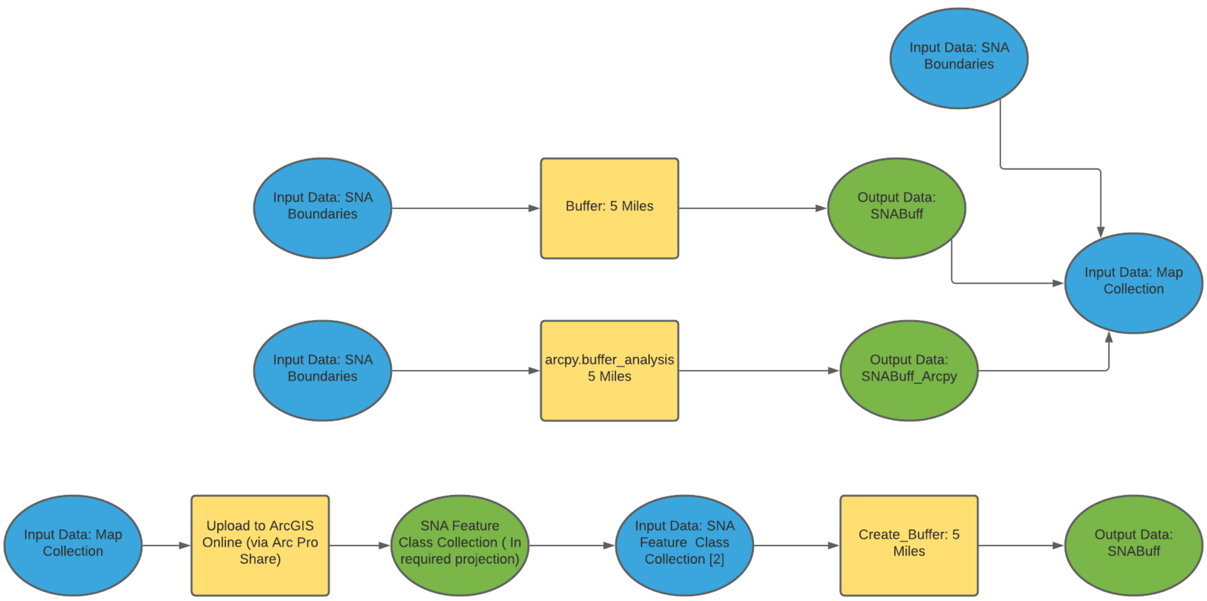

Figure 1. Data flow diagram of Arc Pro GUI (top), Arc Pro Jupyter Notebook (middle), and Arc GIS Online Jupyter Notebook (bottom). Blue indicates input data, yellow is a process, and green is output data.

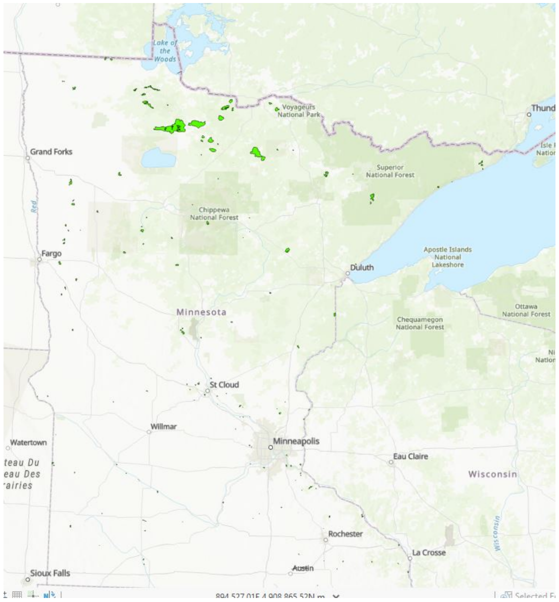

Figure 2: SNA Boundaries

Arc Pro GUI

Once I uploaded the SNA boundaries as the initial data, I clicked on tools and went to "Buffer" in the analysis tools. I then, selected "scientific_and_natural_area_boundaries" for the input data, 5 miles for the distance value and kept everything else to the defaults (**Figure 3**). The output is called "SNABuff". The results show a 5 planar mile radius around each boundary. This is the standard that all the other methods will be compared too.

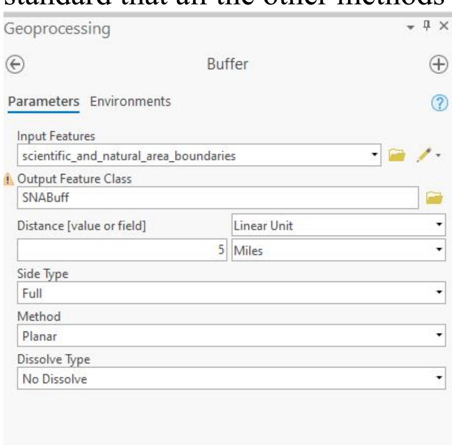

Figure 3: Buffer Parameters

Arc Pro Jupyter Notebook

Arcpy in Jupyter Notebook can perform the exact same operation as the GUI. The only difference is that it is through command code. Once I imported arcpy, I used "arcpy.env.workspace" to link the notebook to my geodatabase. After I checked to see if it worked by viewing the feature classes, I ran the buffer analysis using the exact same parameters as the GUI using the following code:

```
arcpy.Buffer_analysis('scientific_and_natural_area_boundaries.shp', 'SNABuff_arcpy', '5 Miles')
```

The output shows a feature class called "SNABuff_arcpy". The Notebook can be seen in the Lab0 git repository.

ArcGIS Online Jupyter Notebook

Before I could do an analysis on AGOL Jupyter Notebook, I first had to upload the map containing all the feature classes to AGOL. To do this, I click share and went to "web map". After filling out all the necessary information and fixing the projection to match the online projection, I opened a Notebook in AGOL.

In the Notebook, I first imported the GIS package and validated my credentials. After that, I added the web map by using the panel to create code for me. Once added, I had to check my content to see which feature class the unedited SNF boundary was in. In this case it was the last layer. After using "gis.map" to visualize it, I then turned it into a variable called "MNSNA" to perform a buffer analysis.

AGOL GIS package does not have the exact same buffer tool as Arc Pro. The closest tool was "create_buffer. I looked at the documentation to come up with the closest code that matches Arc Pro:

```
features.use_proximity.create_buffers(MNSNA, distances = [5], units = 'Miles', output_name = "SNABuff_AGOL")
```

The output is called "SNABuff_AGOL" and the Notebook can be seen in the git repository.

Results

The results of each method show a 5-mile radius buffer around each SNA. **Figure 4** shows the GUI buffer, **Figure 5** shows the Pro Jupyter Notebook (overlaying the GUI), and **Figure 6** shows the AGOL buffer (overlaying the GUI buffer).

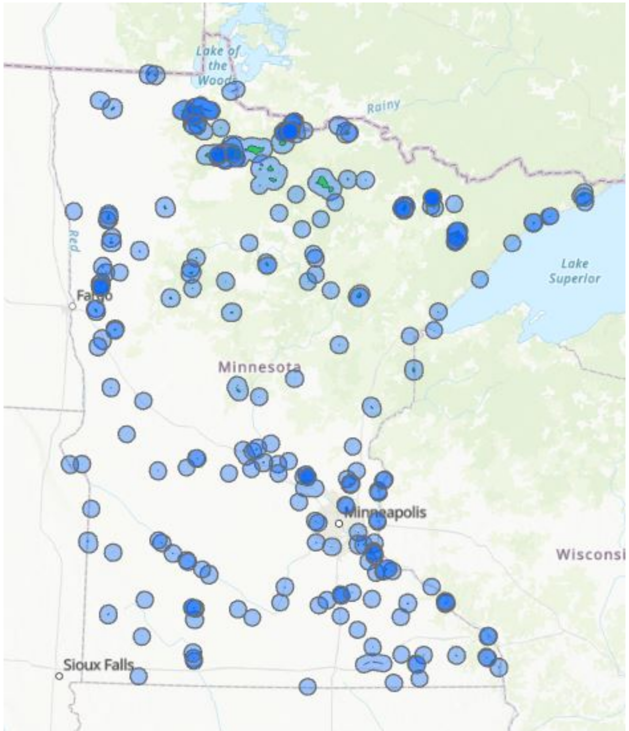

Figure 4: GUI Buffer overlaying SNA Boundaries

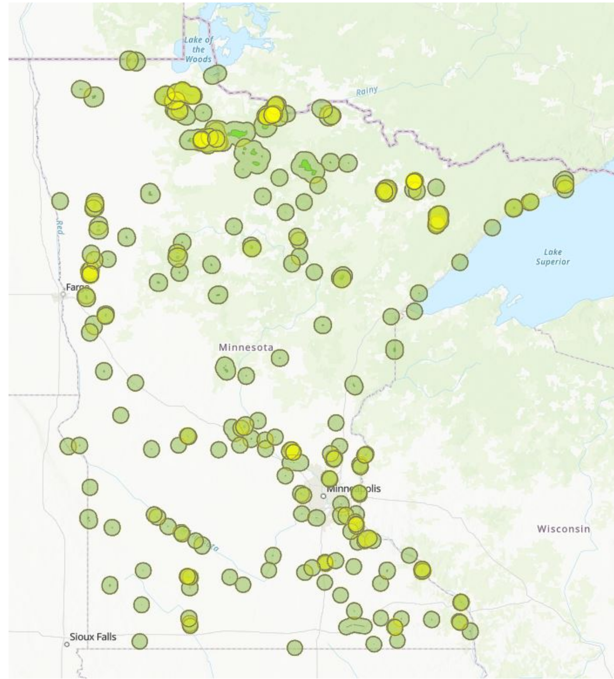

Figure 5: ArcPy Buffer overlaying GUI Buffer

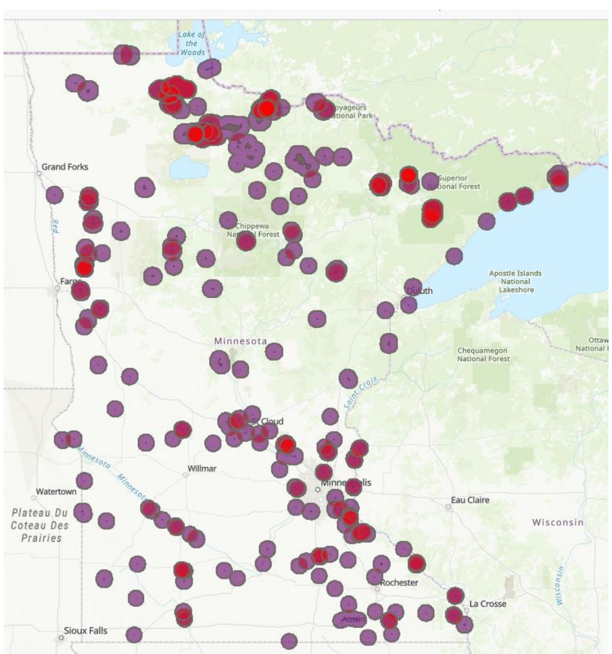

Figure 6: AGOL Buffer overlaying GUI Buffer.

Results Verification

Comparing each coding method to the GUI, I can say with high certainty that Pro Notebook matches the GUI. This is because the processing is the same. I cannot tell if the AGOL is the same. Looking at the overlay on the web map (**see Figure 6**) they appear identical. However, I do not know if the measured distance was planer (the default in pro) or geodesic. The documentation does not specify, so further clarification is needed.

Discussion and Conclusion

GitHub

After doing the tutorial for GitHub, creating a repository, cloning it to a local repository, and pushing it back with the required folders was straight forward. I did misunderstand the instructions and tried to turn each lab folder into a repository locally. This caused issues because I could not push the lab folder repository because there was no GitHub URL for it. Furthermore, I could not push the original repository because the lab repository was conflicting with it. The way I got around it was to pull the lab repository so that it turned back into a folder. This took some trial and error to accomplish.

Comparing Three Esri Buffer Methods

Using the GUI in Arc Pro is simplest method; all the parameters can be viewed, and the output is seen right away. Usually, a GUI is used to determine what tool should be used as well as the settings. An Arc Pro Jupyter Notebook is used once a task is known and can be made more efficient. For example, if I wanted to perform the same buffer tool on many different shapefiles, I could use a "for" statement to automate the task. AGOL Jupyter Notebook allows for automated tasks and visualization. However, the tools are limited compared to Arc Pro and I had issues with crashing and losing data.

In conclusion, simple tasks such as buffering can be used in all three methods to get similar results.

References

Arcgis.features.use_proximity module. (n.d.). Retrieved January 25, 2021, from https://developers.arcgis.com/python/api-reference/arcgis.features.use_proximity.html

Self-score

Fill out this rubric for yourself and include it in your lab report. The same rubric will be used to generate a grade in proportion to the points assigned in the syllabus to the assignment.

Category	Description	Points Possible	Score
Structural Elements	All elements of a lab report are included **(2 points each)**: Title, Notice: Dr. Bryan Runck, Author, Project Repository, Date, Abstract, Problem Statement, Input Data w/ tables, Methods w/ Data, Flow Diagrams, Results, Results Verification, Discussion and Conclusion, References in common format, Self-score	28	28
Clarity of Content	Each element above is executed at a professional level so that someone can understand the goal, data, methods, results, and their validity and implications in a 5 minute reading at a cursory-level, and in a 30 minute meeting at a deep level **(12 points)**. There is a clear connection from data to results to discussion and conclusion **(12 points)**.	24	23
Reproducibility	Results are completely reproducible by someone with basic GIS training. There is no ambiguity in data flow or rationale for data operations. Every step is documented and justified.	28	26
Verification	Results are correct in that they have been verified in comparison to some standard. The standard is clearly stated **(10 points)**, the method of comparison is clearly stated **(5 points)**, and the result of verification is clearly stated **(5 points)**.	20	20
		100	97