Lab Report

Title: Buffering Memorial Routes of MN in Three Different Environments
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Project Repository: https://github.com/L-roach/GIS5571/tree/main/Lab0
Google Drive Link: https://drive.google.com/drive/folders/1JVDRkxU110XLeGglOtwAAnUkmUwv9AZ4
Time Spent: 15 hours

Abstract
The buffer analysis process is compared in three different ArcGIS environments, using data downloaded from the MN Geospatial Commons. A 3-mile buffer is created around memorial routes in MN in each environment. The analysis was first run in ArcGIS Pro, next in ArcPro Jupyter Notebooks, and finally in ArcOnline Notebooks. The resultant maps are the same. While the end result does not differ, the processes do. Ultimately, ArcGIS Pro was the simplest tool to use, and Jupyter Pro resulted in the most coding issues.

Problem Statement
This lab compares and contrasts the buffer analysis process in three different ArcGIS environments: ArcGIS Pro, Jupyter Notebooks in ArcPro, and ArcOnline Notebooks. This report examines the methods required for each environment and how they are similar to or different from the other methods.

Table 1. Spatial Inputs Required

#	Requirement	Defined As	(Spatial) Data	Attribute Data	Dataset	Preparation
1	Road network	Road centerlines for all public roads within the state of Minnesota from MDOT	Road geometry (lines)	Designated routes	Mn GeoSpatial Commons	Download
2	Road network buffer	3-mile buffer	Geometry	Distance	Road network	N/A

Input Data
Memorial routes in the state of Minnesota are defined as such by MN state statutes (Sec. 161.14 MN Statutes). The routes travel throughout the state of Minnesota and are concentrated in the southern portion of the state. Memorial routes are more commonly located in the metropolitan areas of the state. These routes are displayed in the data shapefile used in this analysis.

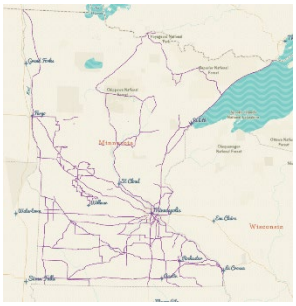
Table 2. Shapefile Information

#	Title	Purpose in Analysis	Link to Source

1	Memorial Routes in MN	Shapefile for buffer analysis from MNDOT	Mn GeoSpatial Commons

Methods

Figure 2. Memorial Routes in MN



The MN Geospatial Commons website was searched for "memorial routes" and the "Memorial Routes in MN" shapefile was downloaded. See Figure 1. Data flow diagram on the next page for a depiction of the processes in ArcGIS Pro, Pro Jupyter Notebooks, and Online Notebooks.

In ArcGIS Pro, once the shapefile was added to a new map (Figure 2. Memorial Routes in MN), the "Pairwise Buffer" tool (Figure 3. Buffer Tool) was selected and run with a distance of 3 miles. The Mid-Century Basemap was selected for the map's layout. The process required a few more steps when coding.

In Jupyter Notebooks Pro, the arcpy system module was imported after the variable for the shapefile was created. The environment settings were assigned before the analysis.Buffer tool could be called from the library (Figure 4. Environment Settings). In the Online Notebooks, features needed to be imported after the variable was assigned to the hosted layer destination (Figure 4. Routes Shapefile Online). Following this, the use proximity library could be used to run the create buffers tool.

Figure 3. Buffer Tool

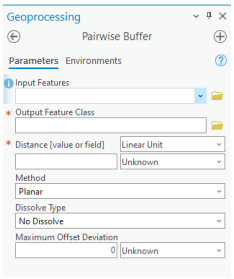


Figure 4. Environment Settings

```
routes= r"C:\Users\roach258\Downloads\shp_trans_memorial_routes\Memorial_Routes_in_Minnesota.shp"

# Import system modules
import arcpy

# Set environment settings
arcpy.env.workspace = r"C:\Users\roach258\Downloads\shp_trans_memorial_routes\memorial_routes.gdb"

```

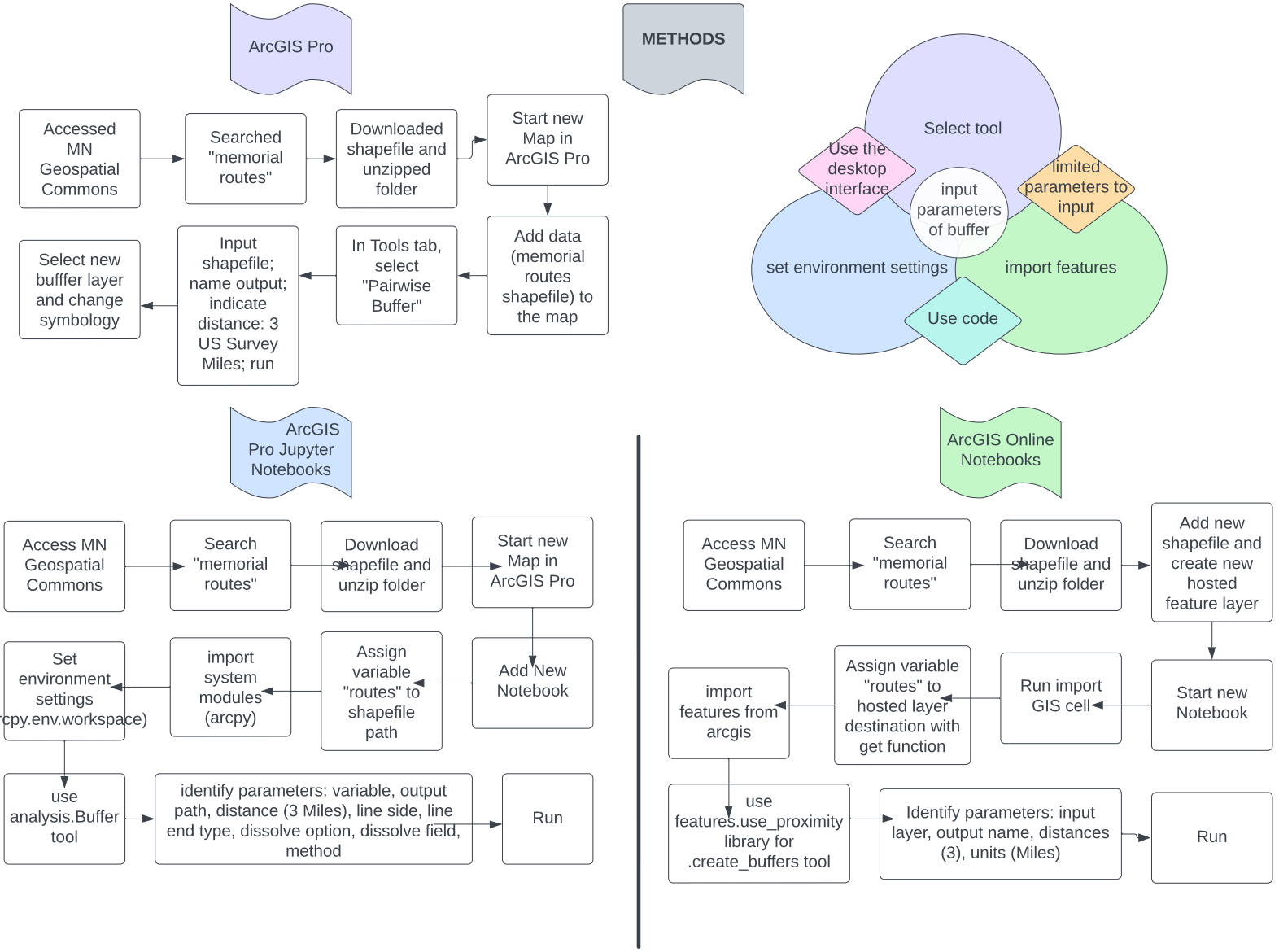
Figure 5. Routes Shapefile Online

```
routes = gis.content.get('fa6a24419b5647b9bed6ce78cdf2856f')
```

```
routes
```

shp_trans_memorial_routes
Feature Layer Collection by roach258_UMN
Last Modified: September 22, 2022
0 comments, 2 views

Figure 1. Data Flow Diagram



Results

Each method of running a buffer analysis produced the same result. The resultant maps feature a 3-mile buffer around the memorial routes in the state of Minnesota (Figure 6. Memorial Routes Buffers), depicted in red. Even though the methods are slightly different, they create the same result. These results demonstrate that each method would suffice to create a buffer analysis, however, some methods were easier to manage than others. Specifically, there initially were issues with the Jupyter Pro code but once the syntax of the parameters was corrected, the code ran and the analysis was complete.

Results Verification

The results are correct due to a visual inspection of the maps. Since the same shapefile was used in each GIS analysis environment, no further inspection is required of the data. The analysis produced the same result, per visual inspection, and could be further verified by adding all resultant buffer layers to the same map and analyzing the overlap, if there were concerns about the results and additional verification requested.

Discussion and Conclusion

Though all three environments are capable of running the same analysis, the coding needed for operations in Jupyter Pro encountered the most issues. Initially I had trouble figuring out the code for setting the environment in Jupyter Pro and importing features in Online Notebooks. Once that was troubleshooted, defining the parameters took a couple rounds before the code ran without errors. While ArcPro and Jupyter Notebooks in Pro use the same application, both Pro Notebooks and Online Notebooks use code. The ArcPro buffer tool and the Online Notebooks required minimum inputs for the parameters in the buffer analysis, compared to the analysis in Notebooks in Pro. All three methods required adding data and inputting parameters to the buffer analysis. Even though Jupyter Notebooks gave me the most issues, the troubleshooting required made me learn the most about this tool.

GitHub

Creating an account in GitHub was seamless. Creating folders (even after the tutorials) created some issues for me. Initially, I could only create new files and was not able to figure out how to create a folder for each upcoming lab. Also, I was not able to access GitHub locally, i.e. the desktop version on my personal computer. I ran into administrator permission errors when I attempted to download or access the desktop version through Citrix. The tutorials were informative, and I like the concept of pushing and pulling changes as well as creating new forks in repositories. Ultimately, I was able to create folders in the online access portal, set up my repositories for the semester, and am excited to continue wrapping my head around the idea of working with GitHub.

References

Office of the revisor of statutes. Sec. 161.14 MN Statutes. (n.d.). Retrieved September 21, 2022, from https://www.revisor.mn.gov/statutes/cite/161.14

Self-score

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	**20**
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	**24**
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	**18**
		100	**90**

Figure 6. Memorial Route Buffers