**Lab Report**

Title: Exploration of the Esri Ecosystem

Notice: Dr. Bryan Runck

Author: Taryn Reitsma

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**Project Repository:** <https://github.com/taryn-reitsma/GIS5571>

**Google Drive Link:** N/A

**Time Spent:** 8.5

**Abstract**

Esri has an abundance of resources for its users that can be used for many types of projects and data management. It is important to explore their relative advantages and disadvantages when deciding how to move forward with an Esri product. I experimented with three Esri products: ArcGIS Pro, Jupyter Notebooks in ArcGIS Pro, and Jupyter Notebooks in ArcGIS Online, and I performed a buffer on the same dataset for each method. I used a line dataset from Minnesota Geospatial Commons that included a road network for Rice County, Minnesota for each method (Minnesota Geospatial Commons, 2024). ArcGIS Pro has pre-packaged geoprocessing tools that prompt you to input preferences for the tool, but for Jupyter Notebooks in ArcGIS Pro and ArcGIS Online, I followed documentation provided by the ArcGIS Online website documentation and Esri documentation to perform the buffer. All three methods successfully produced the expected output, but I found that the process for ArcGIS Pro was more efficient than the others.

**Problem Statement**

Explore the varying functionalities within the Esri ecosystem by performing a buffer on a dataset provided by the Minnesota Geospatial Commons using three different environments: ArcGIS Pro, Jupyter Notebooks in ArcGIS Pro, and Jupyter Notebooks in ArcGIS Online.

Table 1.Target Data for Analysis

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **#** | **Requirement** | **Defined As** | **(Spatial) Data** | **Attribute Data** | **Dataset** | **Preparation** |
| 1 | Buffered road network in Rice County | Raw input dataset from MnDOT for Rice County and 911 Center | Road geometry | Road location and address range information | [Minnesota GeoSpatial Commons](https://gisdata.mn.gov/dataset/us-mn-co-rice-trans-roads) | Project into NAD83 UTM Zone 15N |

**Input Data**

The input dataset for my Analysis is titled “Roads, Rice County, Minnesota,” and was collected from the Minnesota GeoSpatial Commons. This dataset is compiled of polylines that mark the location of major roads in Rice County, Minnesota. The original purpose for this data was to provide road locations and address range data to be used by Rice County and the 911 Center (Minnesota Geospatial Commons, 2024).

Table 2. Dataset Used in Analysis

|  |  |  |  |
| --- | --- | --- | --- |
| **#** | **Title** | **Purpose in Analysis** | **Link to Source** |
| 1 | Roads, Rice County, Minnesota | Raw input data from MnDOT for road network analysis | [Minnesota GeoSpatial Commons](https://gisdata.mn.gov/dataset/us-mn-co-rice-trans-roads) |

**Methods**

Figure 1. Data flow diagram.

*A screenshot of a computer flowchart

Description automatically generated*

*Link to Lucid Chart Flow diagram:* [*https://lucid.app/lucidchart/504392c4-1221-47bb-88a8-24487d2b57b7/view*](https://lucid.app/lucidchart/504392c4-1221-47bb-88a8-24487d2b57b7/view)

**Results**

All three methods tested returned the expected result of a 50m buffer around the Rice County Road network. Table 3 includes the cumulative number of steps and whether a result was returned. Although all 3 methods returned the expected feature class, using the pre-packaged tools in ArcGIS Pro to perform a buffer proved to be more efficient using only three steps while the Jupyter Notebooks used in ArcGIS Pro and ArcGIS online both required four to complete. However, these results do show that all methods can be used to perform the same task accurately.

Table 3. Summary of Esri Methods and Output

|  |  |  |
| --- | --- | --- |
| **Method** | **Number of Steps to Complete** | **Returned Expected Output (Y/N)** |
| ArcGIS Pro | 3 | Y |
| Jupyter Notebook in ArcGIS Online | 4 | Y |
| Jupyter Notebook in ArcGIS Pro | 4 | Y |

**Results Verification**

The final output resulted in three layers that are 50 meter buffers of the road network in Rice County. Figures 2-4 depict an ArcGIS Online map created for each method with the layer being the corresponding output. The features display the expected result of a buffer of a polyline layer.

Figure 2. 50m buffer created using Jupyter Notebooks on ArcGIS online

*A screenshot of a map

Description automatically generated*

Figure 3. 50m buffer created using Jupyter Notebooks in ArcGIS Pro

A screenshot of a map

Description automatically generated

Figure 4. 50m buffer created using ArcGIS Pro

*A screenshot of a map

Description automatically generated*

**Discussion and Conclusion**

**GitHub**

I was able to move quickly through the GitHub tutorials, since I use it at my job frequently. It took me a little bit to figure out how to create the folders in the desktop app, but overall, I did not struggle too much. I think it will take some practice for me to use GitHub on my own device. There are strict regulations with using GitHub through my company, so I am not used to having as much freedom.

**Esri Training**

The Esri training courses were both a helpful refresher and good indicator of my comfort level with basic GIS concepts. It took me longer than I expected, partially because of the length of the some of the videos, but overall, I still found the courses worthwhile. The section about projection took me the longest, which was surprising to me because I thought I knew this topic well, but taking a step back and re-learning it was helpful for gaining a more thorough understanding. I completed the training in Python the quickest, which also came as a surprise. This has helped my confidence for the upcoming course content.

**Esri Ecosystem Practice**

I have not had any experience using code windows within ArcGIS before, so this was a very helpful introduction to the capabilities within Esri for combining GIS software with Python. However, I have a lot of practice reading documentation, and the Esri developer documentation made it very easy for me to perform the task quickly. This section of the lab likely took me the least amount of time. As for the different ecosystem approaches, I found that for using basic ArcGIS tools, I preferred using standard ArcGIS Pro because it was much more efficient to quickly reach the desired result. However, using Jupyter Notebooks within both ArcGIS Pro and ArcGIS Online was helpful exposure to the capabilities of these tools, and how with more complex types of data or analyses, using notebooks may be more optimal than using the packaged tools in ArcGIS Pro.

**References**

ArcGIS. (2024). *Get started with notebooks—ArcGIS Online Help | Documentation*. Arcgis.com. https://doc.arcgis.com/en/arcgis-online/get-started/components-of-the-notebook-editor.htm

Esri. (2014). *arcgis.features.analysis module | ArcGIS API for Python*. Arcgis.com. https://developers.arcgis.com/python/api-reference/arcgis.features.analysis.html?rsource=https%3A%2F%2Flinks.esri.com%2Fagol-help%2Fpython-api%2Farcgis-features-analysis%2Fcreate-buffers#create-buffers

Minnesota GeoSpatial Commons. (2024). *Roads, Rice County, Minnesota*. Mn.gov. https://gisdata.mn.gov/dataset/us-mn-co-rice-trans-roads

**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 | **24** |
| **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 | **28** |
| **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 | **100** |