

## Lab Report

Title: Draft 1 – Final Project

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Date: November 9, 2022

Repository: <https://github.com/mgisselbeck/GIS5571>

Time Spent: 5 hours

## Abstract

The idea of nature is commonly associated with the physical features and processes of the environment, like the "natural environment" where there is little to no apparent evidence of human presence or intervention (Hartig, Mitchell, & Frumkin, 2014). This idea of nature is not easily accessible for individuals living in areas of concentrated poverty in Minneapolis. Research has shown that the nature of interest is built in environments like indoor plants and street trees. Community gardens and urban parks comprised of natural features provide communities to engage with and follow natural processes.

Problem Statement, Input Data, Required Data, Methods, Results, Discussion and Conclusion

## Problem Statement

The objective of this project is to identify the most and least wild area in the Twin Cities, identify the vulnerable populations in the Twin Cities, and complete a corridor analysis.

The wildest areas will be calculated by standardizing or rescaling the data layers: Parks and Recreation, Lakes and Rivers, Digital Elevation Model, Trees, and Auto Noise and compiling the layers into Raster Calculator to achieve the Wilderness Continuum of the TCMA. Trees were double-weighted, and areas of high slopes were removed in the Raster Calculation.

The social vulnerability index will be calculated by using Redlined Neighborhoods, Areas of Concentrated Poverty, and Low Property Value Per Acre were clipped to compare with the wild areas. A correlation between high vulnerability and a lack of natural exposure was established.

#	Requirement	Defined As	(Spatial) Data	Attribute Data	Dataset	Preparation
1	Land Cover	Minnesota Land Cover Classification System	.TIFF (Raster)	N/A	<a href="#">Minnesota Geospatial Commons</a>	ETL
2	Urban Tree Canopy	Urban Tree Cover: Minneapolis 2009	.shp (Vector)	N/A	<a href="#">Remote Sensing and Geospatial Analysis Laboratory</a>	ETL
3	Minnesota Digital Elevation Model - 30 Meter Resolution	Elevation (Twin Cities Metro Area)	.TIFF (Raster)	Elevation	<a href="#">Minnesota Geospatial Commons</a>	ETL
4	Parcels, Hennepin County	Parcel Boundaries for Hennepin County	.shp (Vector)	N/A	<a href="#">Minnesota Geospatial Commons</a>	ETL
5	Parcels, Ramsey County	Parcel Boundaries for Ramsey County	.shp (Vector)	N/A	<a href="#">Minnesota Geospatial Commons</a>	ETL
6	Equity Considerations	Equity Considerations for Place-Based Advocacy and Decisions in the Twin Cities Region	.shp (Vector)	N/A	<a href="#">Minnesota Geospatial Commons</a>	ETL
7	Historic Neighborhood Appraisal	Historic Home Owners' Loan Corporation Neighborhood Appraisal Map	.shp (Vector)	Hazardous	<a href="#">Minnesota Geospatial Commons</a>	ETL
8	TCMA Land Cover Classification	TCMA 1-Meter Land Cover Classification	.TIFF (Raster)	N/A	<a href="#">Minnesota Geospatial Commons</a>	ETL

*Table 1. Required Data*

## Input Data

The table below is a collection of data from the Minnesota Geospatial Commons. Data was scraped through an ETL in ArcGIS Pro via a Python notebook. All the data described below will

be used in finding the wildest areas in the Twin Cities Metro Area, most vulnerable area in the Twin Cities Metro Area, and corridor analysis.

#	Title	Purpose in Analysis	Link to Source
1	Minnesota Land Cover Classification System (MLCCS)	To be used in creating variables: (1) trees; (2) parks, recreation areas, and preserves; (3) lakes and rivers. It will be also used to create the wilderness continuum.	<a href="#">Minnesota Geospatial Commons</a>
2	Urban Tree Cover: Minneapolis 2009	Corridor Analysis.	<a href="#">Minnesota Geospatial Commons</a>
3	TCMA 1-Meter Land Cover Classification	Corridor Analysis.	<a href="#">Minnesota Geospatial Commons</a>
4	Minnesota Digital Elevation Model - 30 Meter Resolution	To calculate the slope and hillshade. The output will be included in the cost distance analysis for the corridor analysis.	<a href="#">Minnesota Geospatial Commons</a>
5	Parcels, Hennepin County	To be used for creating the study extent.	<a href="#">Minnesota Geospatial Commons</a>
6	Parcels, Ramsey County	To be used for creating the study extent.	Minnesota Geospatial Commons
7	Equity Considerations for Place-Based Advocacy and Decisions in the Twin Cities Region	Equity Analysis.	Minnesota Geospatial Commons
8	Historic Neighborhood Appraisal	Equity Analysis.	Minnesota Geospatial Commons

*Table 2. Input Data*

## Methods

The layers are standardized in order to be able to exist together under the same scale in the Raster Calculator. Without standardizing, the output layers of each layer would be scattered across several scales which makes it difficult to draw conclusions from. Areas surrounding rivers, lakes, or wetlands tend to be wilder due to the proximity to water, tree density, and an absence of auto noise and urbanization or industrialization.

## Part 1 – Environmental Accessibility

### Part 1.1: Import Packages and Request Data from Minnesota Geospatial Commons

(See Final Project – Part 1.1 Python Notebook)

### Part 1.2: Create a Study Extent

To create the study extent, I used ‘Feature Class to Feature Class’ to apply a SQL expression that selects only Hennepin and Ramsey, and then creates a new feature class.

```
# Create Study Extent (Feature Class to Feature Class)

# Dissolve County Boundaries
```

### Part 1.3: Extracting Variables from TCMA 1-Meter Land Cover Classification

Insert Text Here.

```
# Reclassify Trees (Scale: 1-10) (See Table 3)

# Reclassify Lakes and Rivers (Scale: 1-10) (See Table 4)

# Reclassify Parks, Recreation Areas, and Preserves (Scale: 1-10) (See Table 5)
```

### Part 1.4: Trees

```
# Focal Statistics
```

### Part 1.5: Parks, Recreation Areas, and Preserves

```
# Euclidean Distance

# Rescale by Function
```

### Part 1.6: Lakes and Rivers

```
# Euclidean Distance

# Rescale by Function
```

### **Part 1.7: Wetlands**

```
# Reclassify  
  
# Rescale by Function
```

### **Part 1.8: Raster Calculator**

```
# Reclassify  
  
# Rescale by Function
```

### **Part 1.9: Digital Elevation Model (DEM)**

```
# Calculate Slope  
  
# Calculate Hillshade  
  
# Rescale by Function
```

## **Part 2 – Social Vulnerability**

### **Part 2.1: Most Vulnerable Areas in the TCMA**

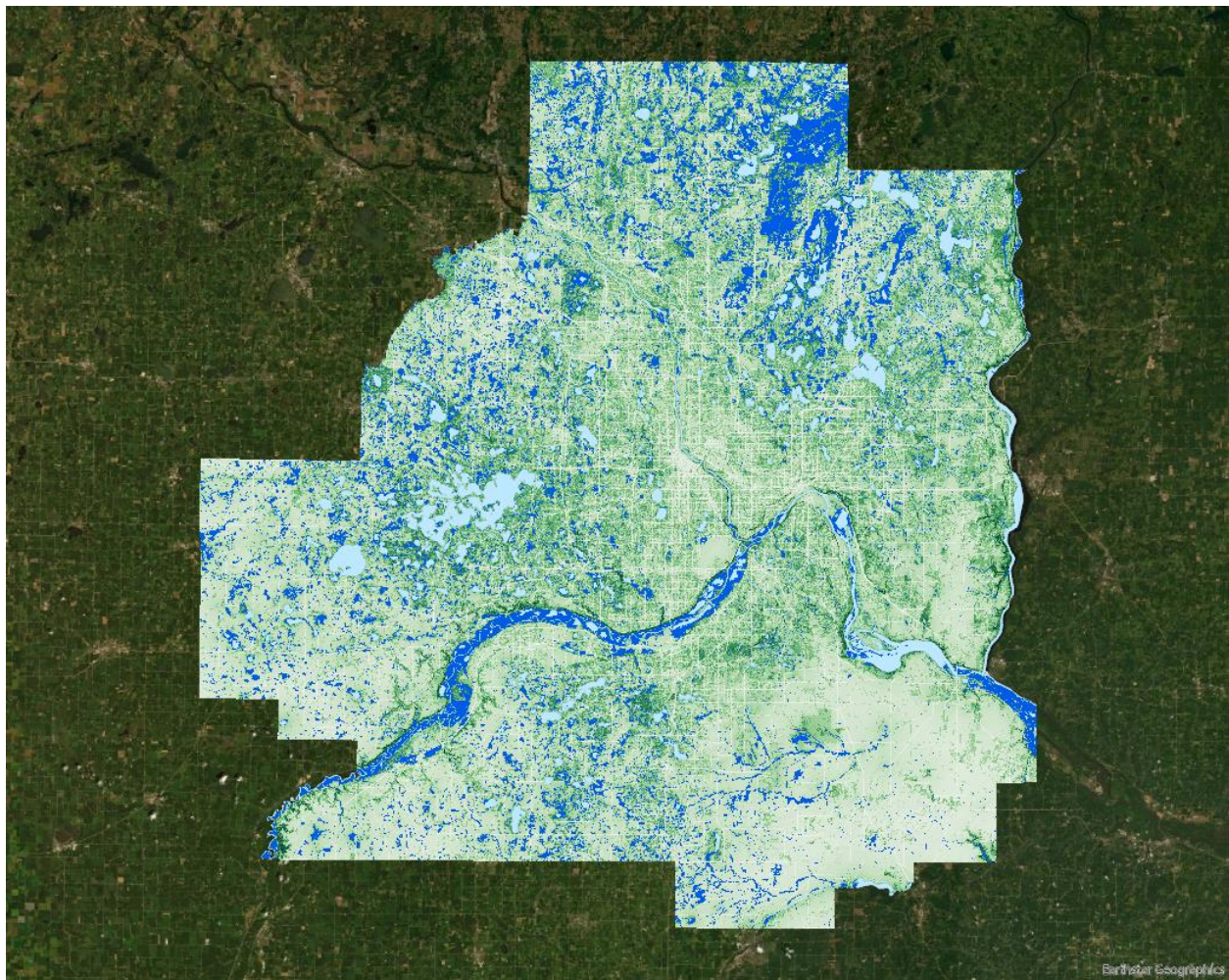
```
# Clip  
  
# Clip Raster  
  
# Raster Calculator
```

## Part 3 – Corridor Analysis

TBD

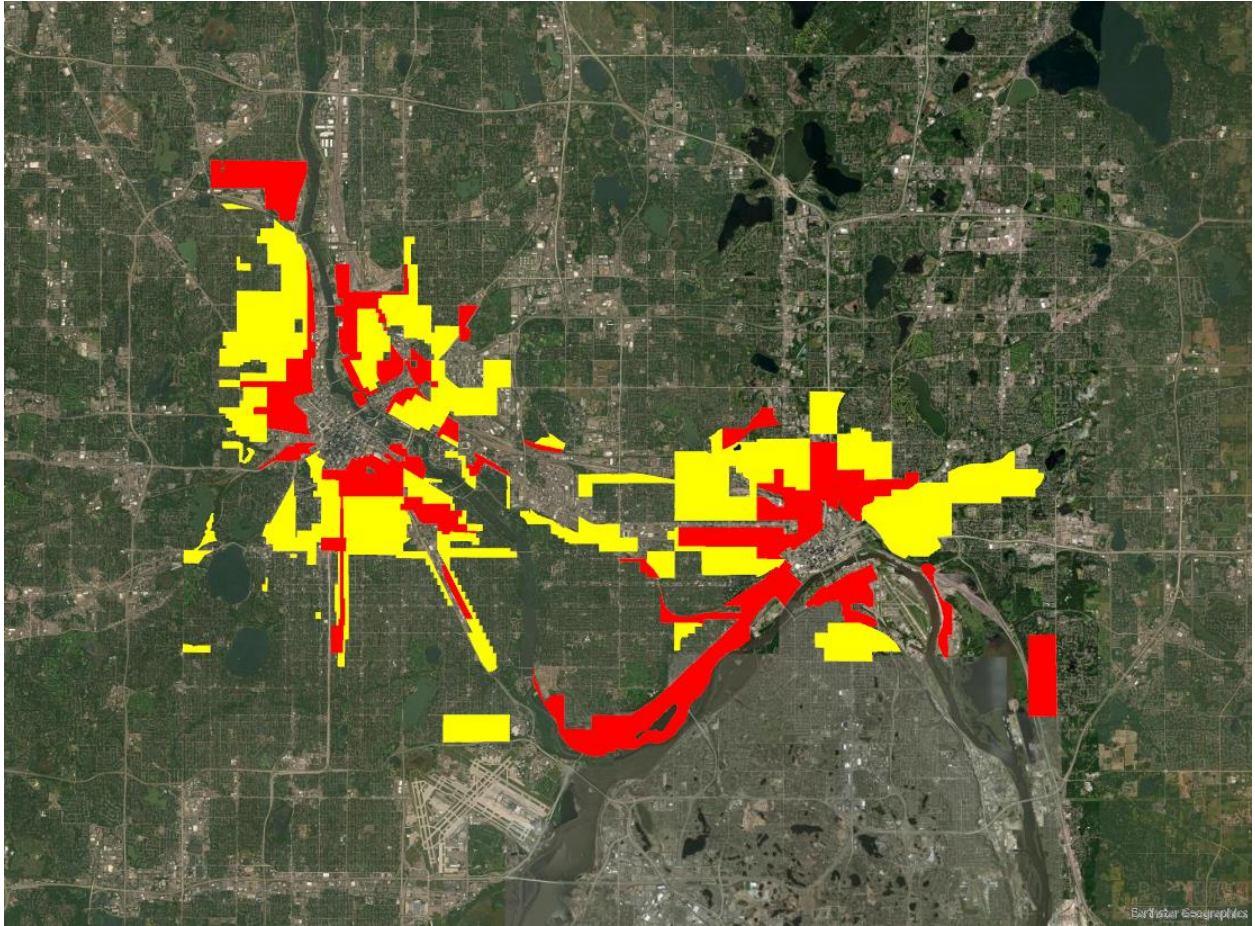
## Results

The results are shown in the figures below (see Figure 2 through Figure 7).



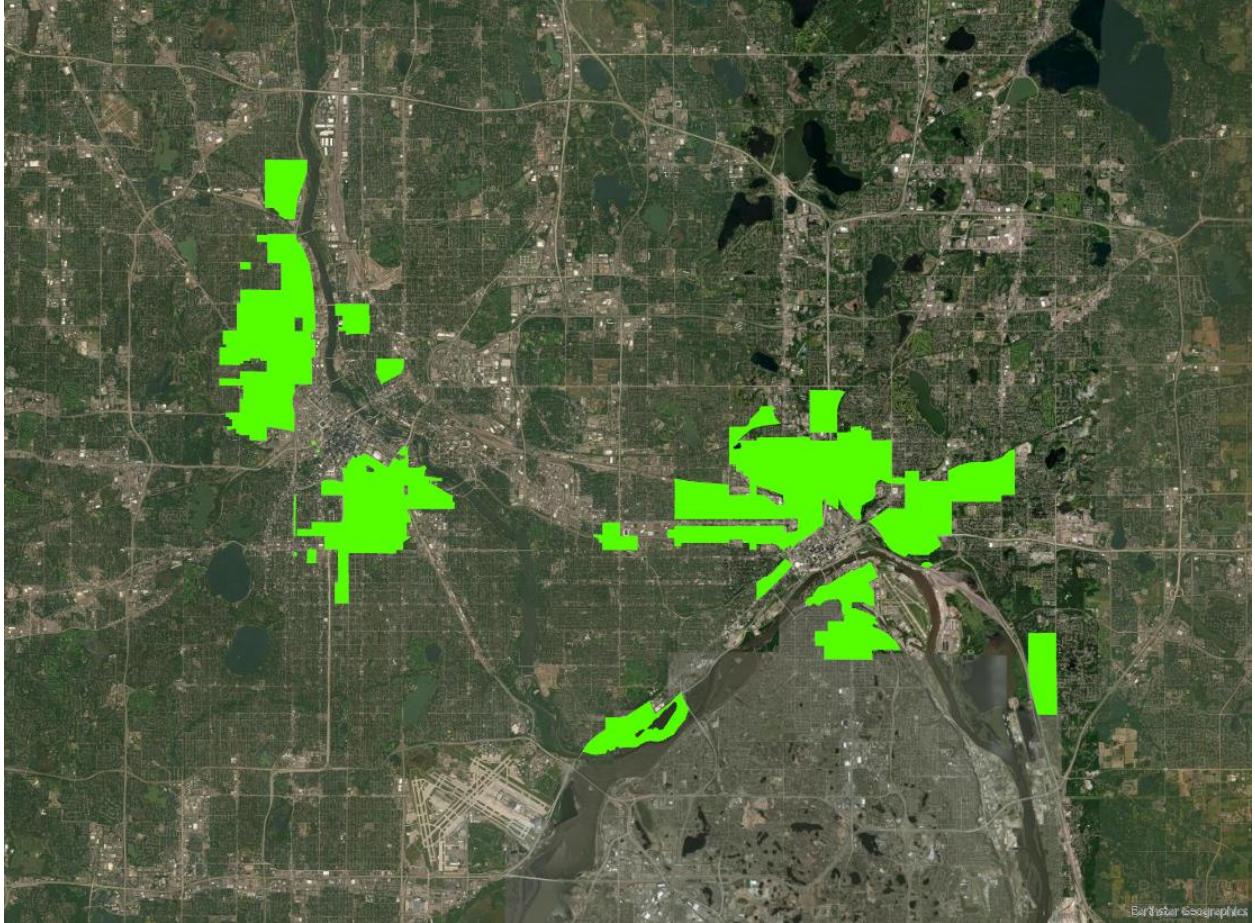


*Figure 2. Wilderness Continuum.*



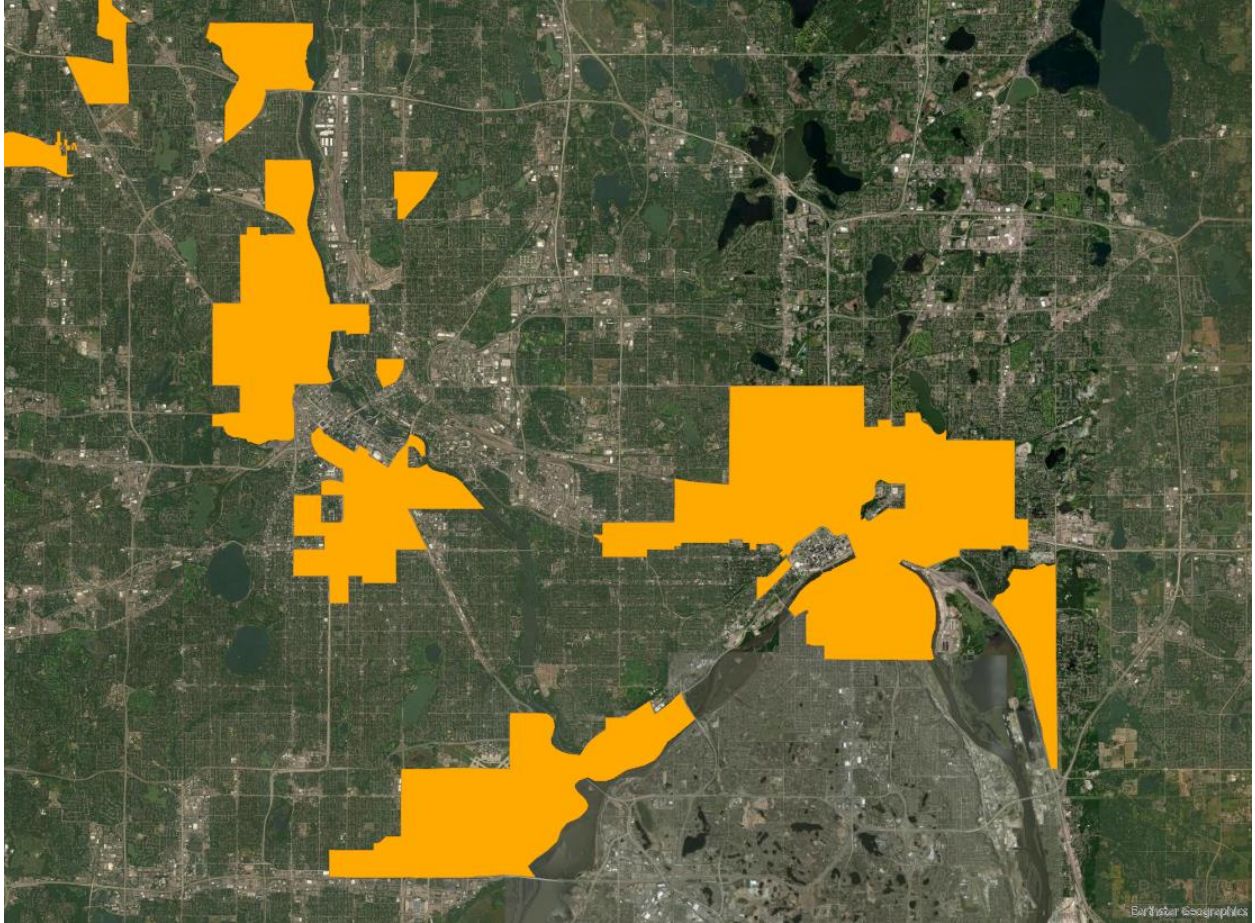
*Figure 3. Redlined Neighborhoods in Hennepin and Ramsey County.*

The figure above depicts historical redlined neighborhoods: red indicates neighborhoods that were directly redlined and labeled "Hazardous" and yellow indicates neighborhoods that were declining in 1934 labeled as 'Definitely Declining'.

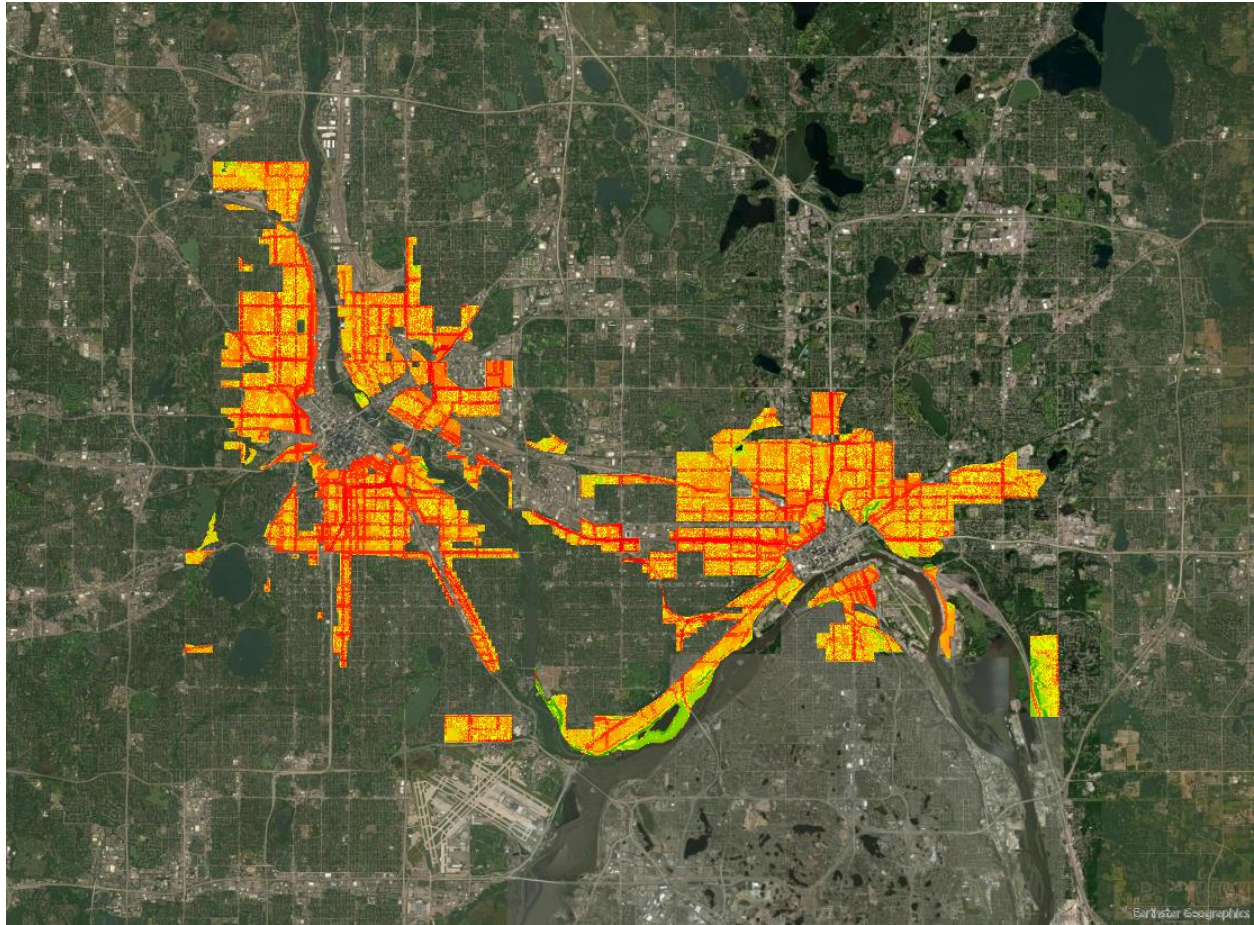


*Figure 4. Areas of Concentrated Poverty.*





*Figure 5. Redlined Areas of Concentrated Poverty.*



*Figure 6. Areas of Concentrated Poverty and Environmental Quality.*

The figure above depicts the environmental quality of the areas of concentrated poverty in the Twin Cities. The Wilderness Scale shows the yellow-colored areas as "Not Wild".

## Results Verification

The results will be verified qualitatively with a linear regression model.

## Discussion and Conclusion

The project helped to identify the desperate need for accessible nature for areas of concentrated poverty in the Twin Cities. In the TCMA, North Minneapolis and Downtown Minneapolis are at high risk. Nature is a vital component of public health and mental well-being. Studies show that regular direct access to nature can: increase self-esteem and resilience against stress and adversity. improve concentration, learning, creativity, cognitive development, cooperation, flexibility, and self-awareness (Hartig et al., 2014). Furthermore, it is crucial to provide accessible nature to vulnerable populations who are surrounded by industrialized environments. Creating feasible park projects allows for a greater opportunity for success while supporting communities most at risk in hopes it will create a bigger ripple effect.

## References

Hartig, T., Mitchell, R., & Frumkin, H. 2014. "Nature and Health." *Annual Review of Public Health*, 35 (1): 207-228. doi:10.1146/annurev-publhealth-032013-182443.

## Self-score

Category	Description	Points Possible	Score
<b>Structural Elements</b>	All elements of a lab report are included ( <b>2 points each</b> ): 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	<b>27</b>
<b>Clarity of Content</b>	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 ( <b>12 points</b> ). There is a clear connection from data to results to discussion and conclusion ( <b>12 points</b> ).	24	<b>22</b>
<b>Reproducibility</b>	Results are completely reproducible by someone with basic GIS training. There is no ambiguity in data flow or rationale for data	28	<b>26</b>

	operations. Every step is documented and justified.		
<b>Verification</b>	Results are correct in that they have been verified in comparison to some standard. The standard is clearly stated ( <b>10 points</b> ), the method of comparison is clearly stated ( <b>5 points</b> ), and the result of verification is clearly stated ( <b>5 points</b> ).	20	<b>18</b>
		100	<b>93</b>