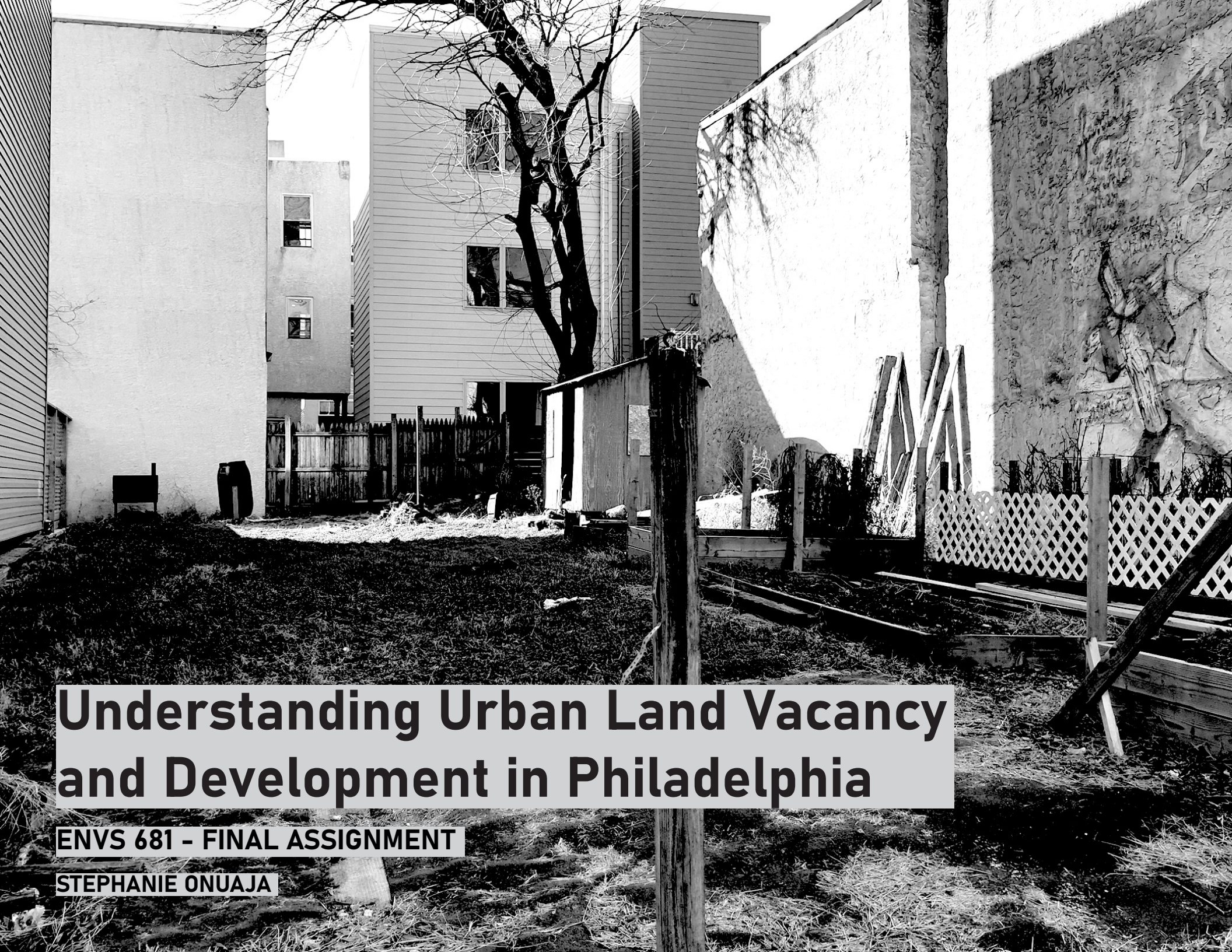


Understanding Urban Land Vacancy and Development in Philadelphia

ENVS 681 - FINAL ASSIGNMENT

STEPHANIE ONUAJA

Introduction

The presence of vacant sites in cities presents issues and opportunities for neighborhoods, urban planners, and developers. Urban vacant land is often associated with disinvestment, crime, lower property values, and high levels of contamination. They can also be seen as an opportunity to reform a neighborhood and respond to the needs of the residents that live there. For instance, they can be used to provide green spaces in areas with mostly impervious surfaces, to mitigate water run-off and the urban heat island effect.

Vacant sites can be locations for new development opportunities, that could shape or change the character of a neighborhood. The city of Philadelphia is no different from other US cities in having its share of urban vacant land. However, it is important to manage vacant sites and their impacts on neighborhoods, as well as the relationship they can have with development. Taking stock of where vacancies are located, and their characteristics would allow the city to decide which parcels to protect or incentivize development for numerous purposes.

Mapping out eight resources that would allow one to live comfortably in a Philadelphia (such as access to affordable housing, food, and transportation), this report would identify areas with the least access to the combined resources. Once these areas are discovered, vacant sites in areas of "high need" of resources would be highlighted.

Research Question

What vacant sites in Philadelphia are most suitable for the development of community resources?

The metrics that would be used to classify "High Need Areas" for community resources in Philadelphia are as follows:

- Proximity to Affordable Housing
- Proximity to Parks
- Proximity to Hospitals
- Proximity to Transportation (SEPTA Rapid Transit Stations & Trolley Stops)
- Availability of High Produce Supply Stores
- Poverty Levels

Data Acquisition

I used the following datasets to satisfy the metrics chosen to exemplify one's ability to live comfortably in Philadelphia.

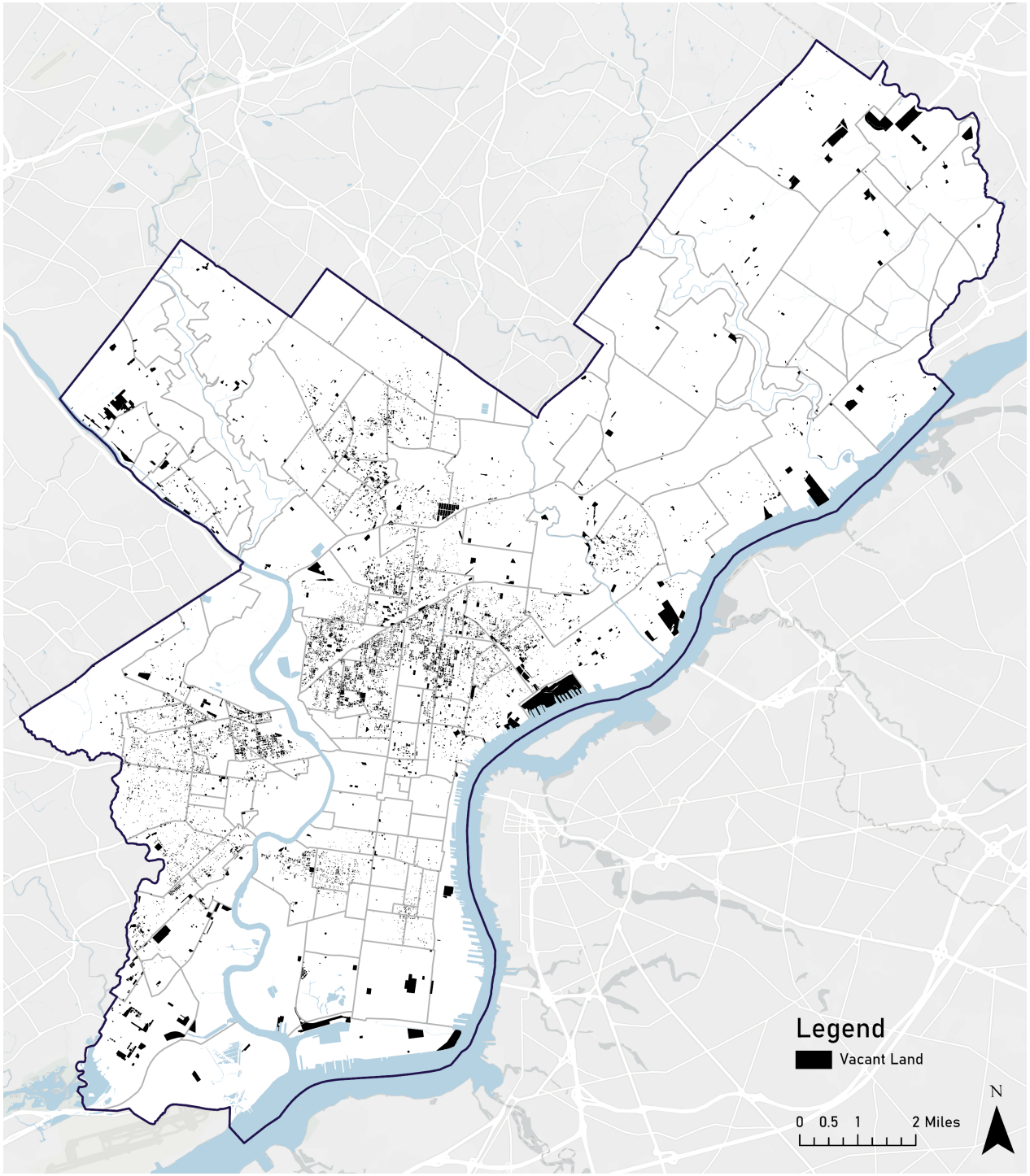
- Affordable Housing Units in Philadelphia – OpenDataPhilly
- Philadelphia Parks and Recreation (PPR) Properties – OpenDataPhilly
- Hospitals in Philadelphia – OpenDataPhilly
- Philadelphia transit (Trolley Lines, Highspeed Lines, and Stations) – Southeastern Pennsylvania Transportation Authority (SEPTA) Open Data
- Neighborhood Food Retail – OpenDataPhilly
- Percentage of Poverty by Block Groups – From the Neighborhood Food Retail dataset (above)

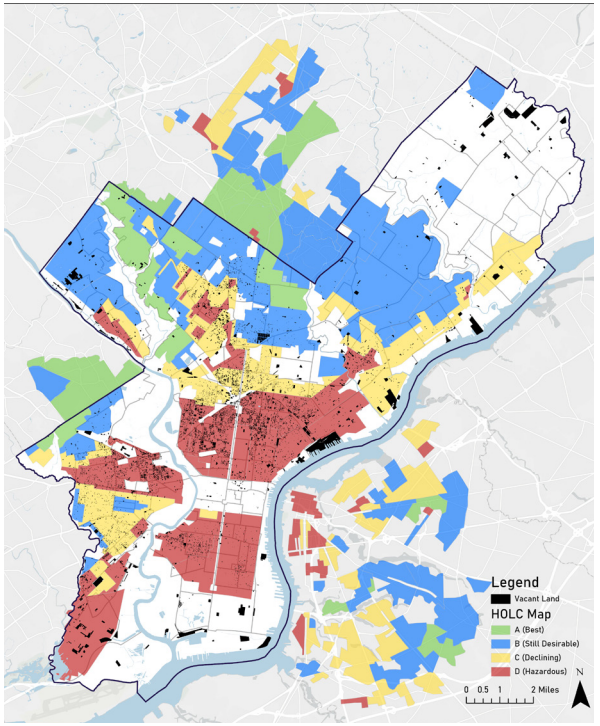
Additionally, I obtained additional datasets containing Philadelphia's neighborhood boundaries and vacant sites.

- Philadelphia Neighborhood Boundaries – OpenDataPhilly
- Vacant Property Indicators "Land" – OpenDataPhilly

Using the Living Atlas in ArcGISPro, I applied HOLC's map for Philadelphia to see if redlined areas are innately linked to vacant sites.

- Home Owners' Loan Corporation (HOLC) Neighborhood Redlining Grade – Living Atlas

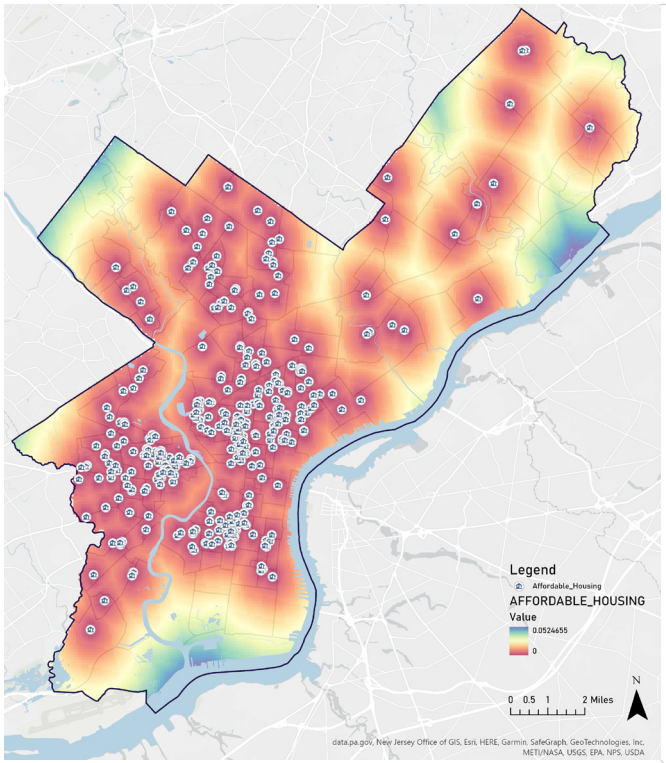




Distribution of Vacant Land in Philadelphia

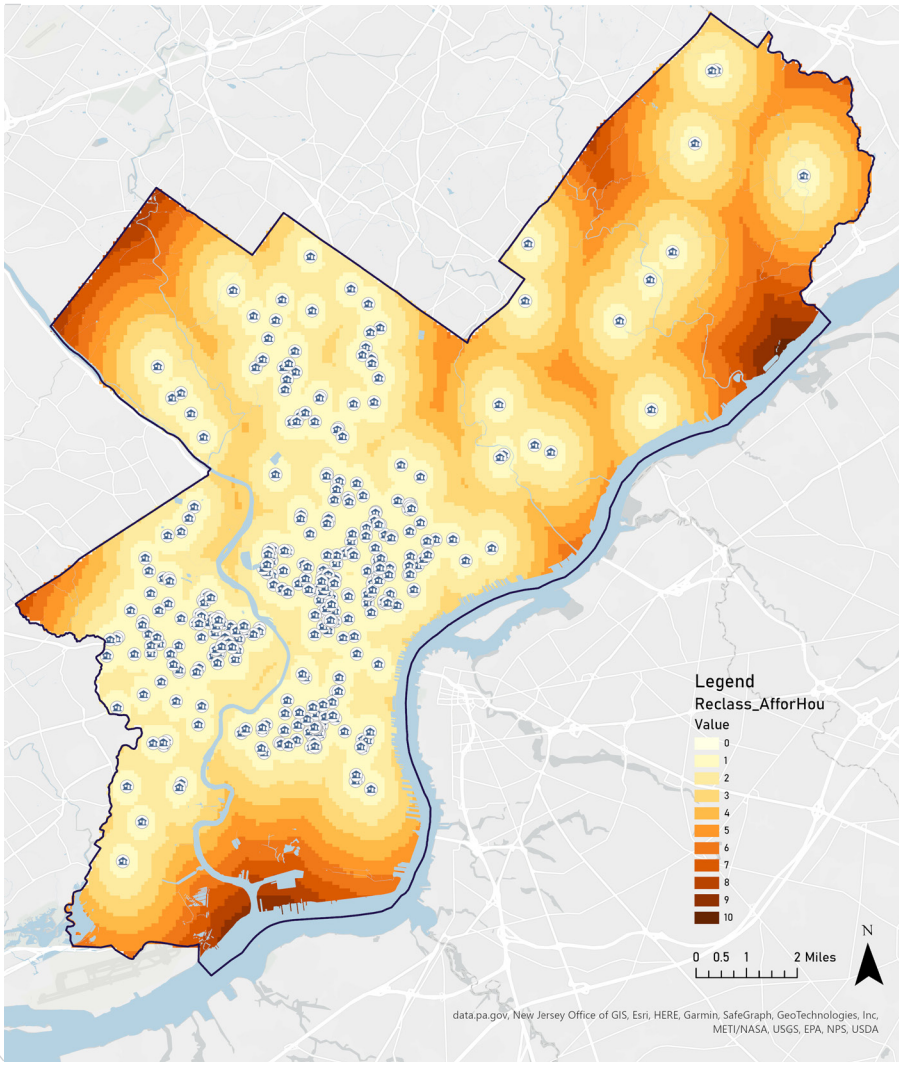
Vacant Sites in Philadelphia are concentrated in West and North Philadelphia. Overlaying Home Owners' Loan Corporation (HOLC) map, one can see that the vacancies are concentrated in areas previously designated as "Hazardous" or Declining". These neighborhood ratings have shaped the investment (or the lack thereof) of cities in the US and discriminatory practices that manifest spatially.

Methodology & Analysis



Euclidean Distance - Affordable Housing

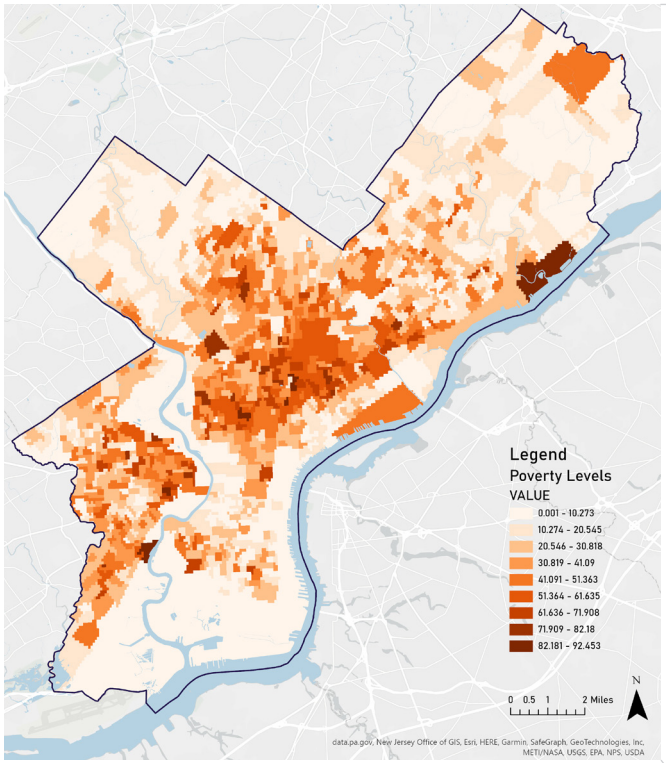
Taking the location of Affordable Housing in Philadelphia, I used the Euclidean Distance tool to determine the closest and furthest distances from the housing units. Using a mask developed from Philadelphia's boundaries, I used Raster Calculator to clip the distance outside of Philadelphia.



Reclassify - Affordable Housing

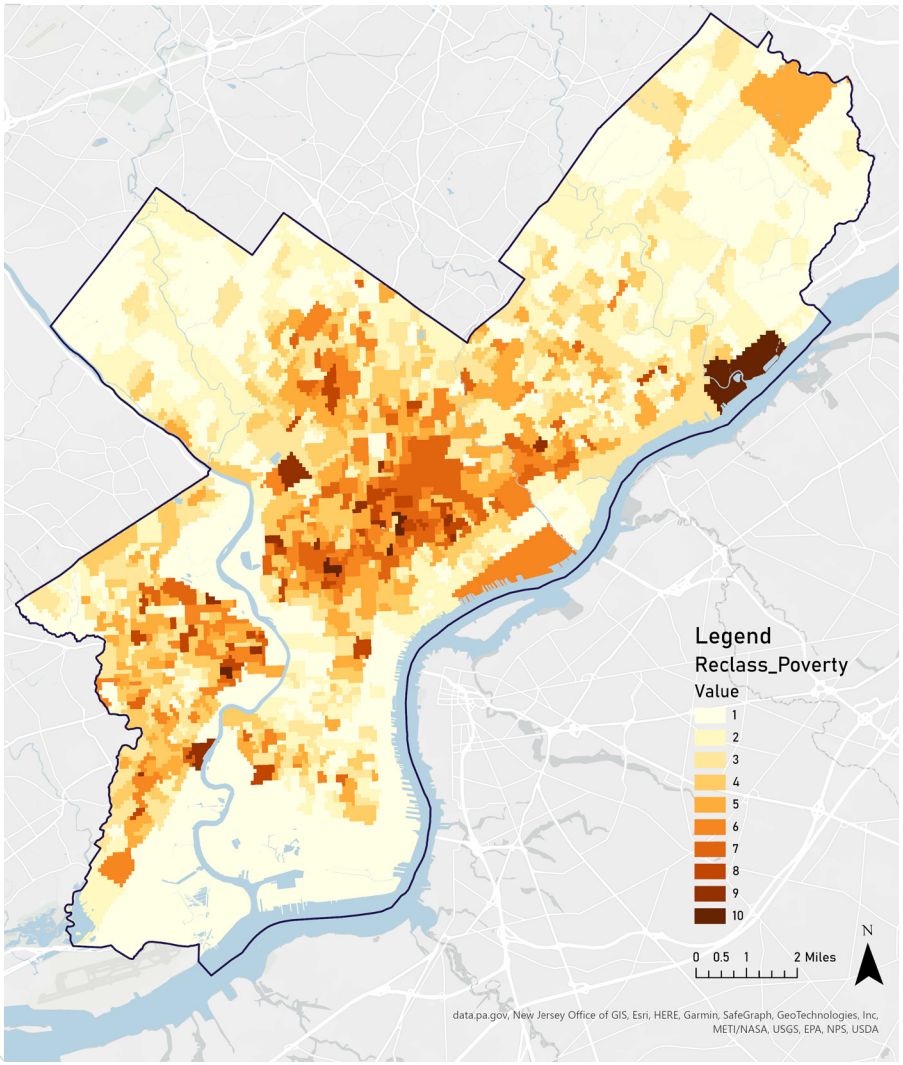
To get the areas farthest away from the affordable housing units, I reclassified the raster into 10 categories. The highest score (10) was given to the areas furthest away from the units, while the lowest score (1) was given to areas closest to them.

Methodology & Analysis



Feature to Raster - Poverty Levels

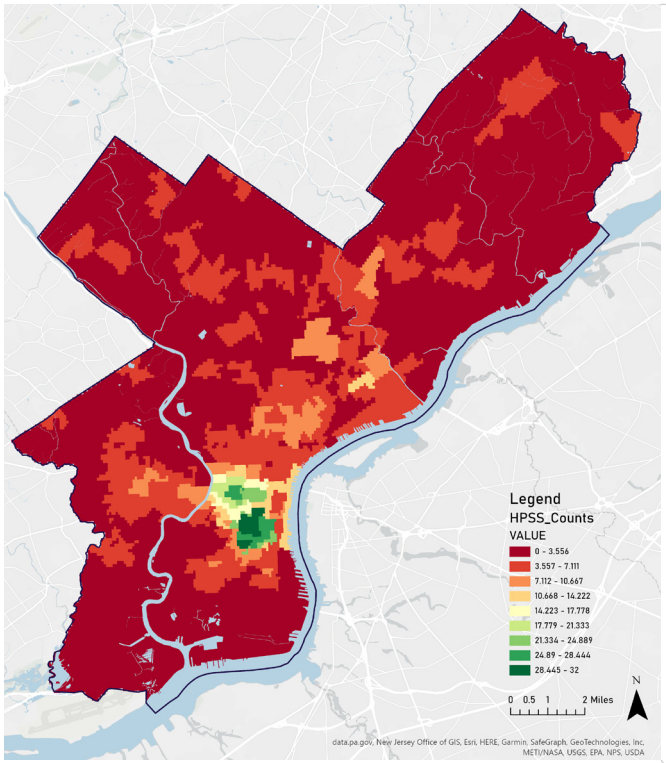
Using Symbology, I visualized the concentration of poverty in Philadelphia by census block groups. I converted this vector into a raster using the Feature to Raster tool.



Reclassify - Poverty Levels

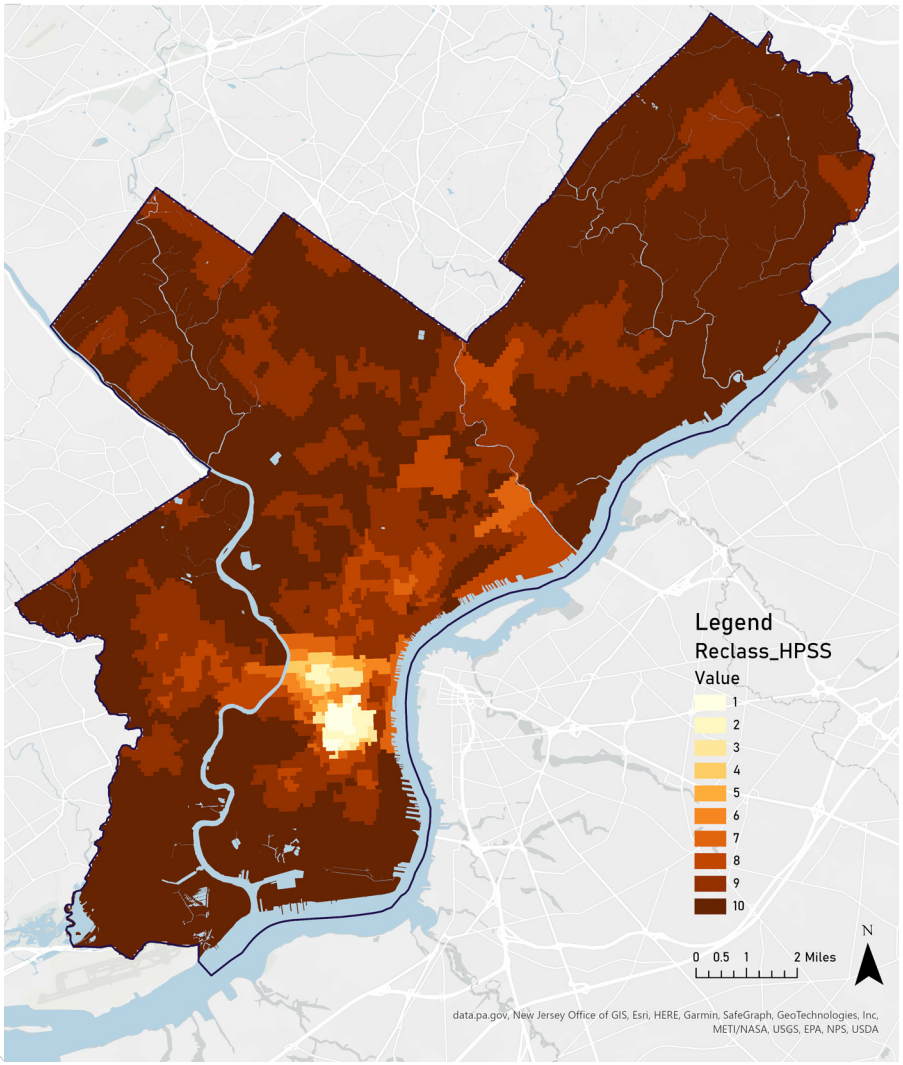
In order to get the areas with the highest poverty levels in Philadelphia, I reclassified the raster into 10 categories. The highest score (10) was given to the areas with the highest concentrations of poverty, while the lowest score (1) was given to areas with the lowest concentrations

Methodology & Analysis



Feature to Raster - High Produce Supply Stores

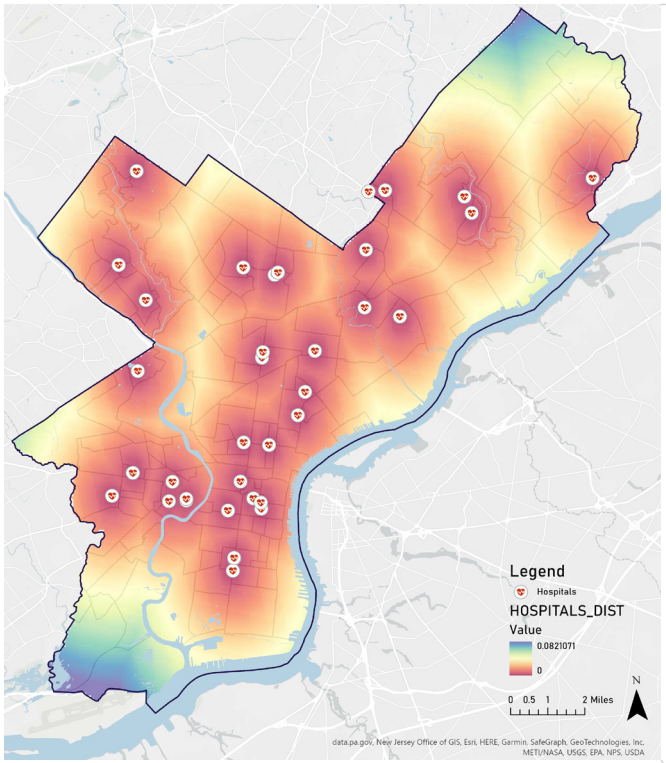
Using Symbology, I visualized the availability of high produce supply stores in Philadelphia by census block groups. I converted this vector into a raster by using the Feature to Raster tool.



Reclassify - High Produce Supply Stores

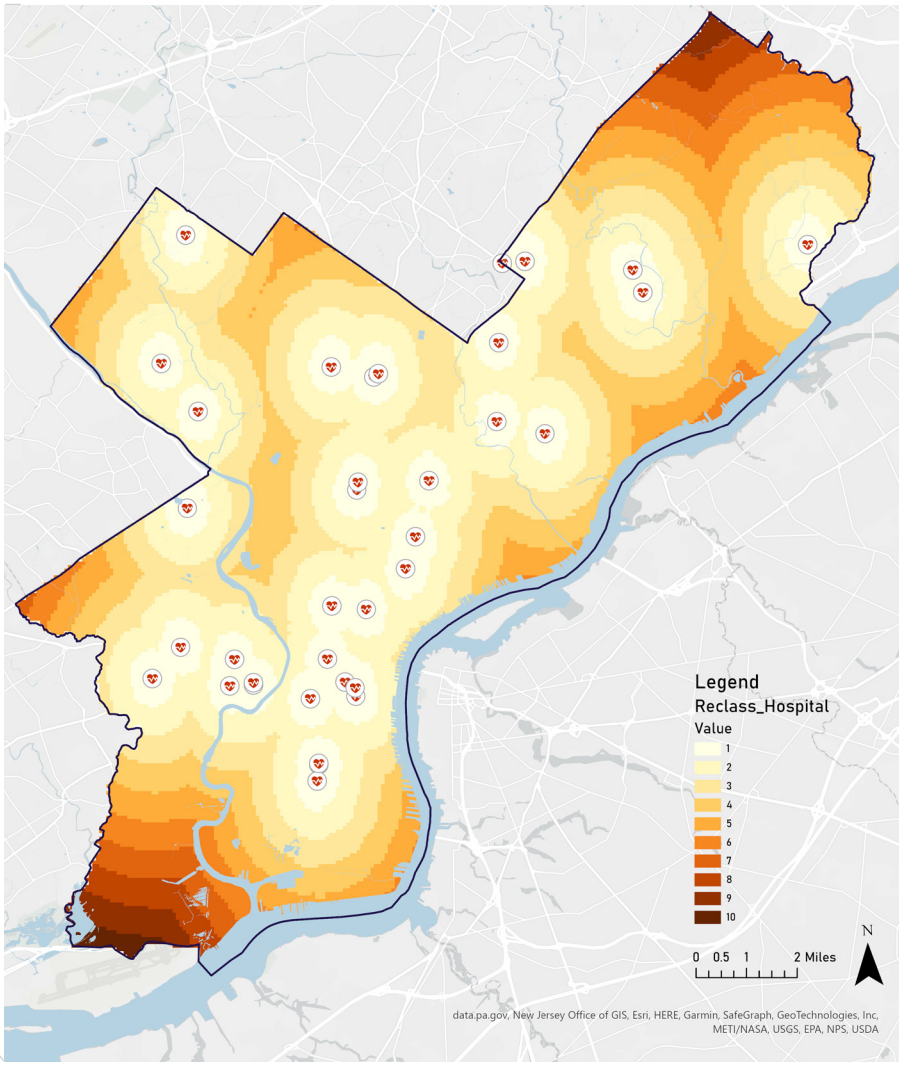
In order to get the areas with the lowest number of high produce supply stores in Philadelphia, I reclassified the raster into 10 categories. The highest score (10) was given to the areas with the lowest numbers of healthy food options.

Methodology & Analysis



Euclidean Distance - Hospitals

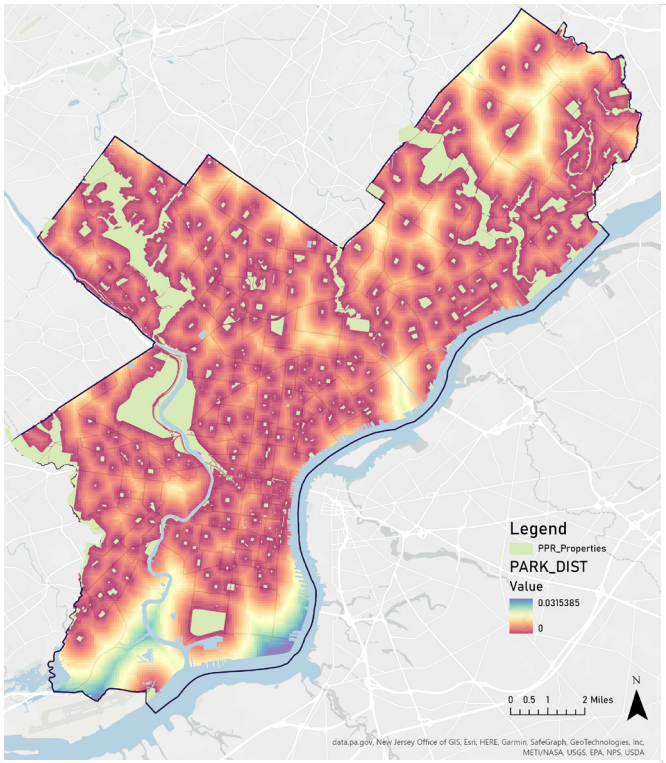
Taking the location of hospitals in Philadelphia, I used Euclidean Distance tool to determine the closest and furthest distances from the hospitals. Using a mask developed from Philadelphia's boundaries, I used Raster Calculator to clip the distances outside of Philadelphia.



Reclassify - Hospitals

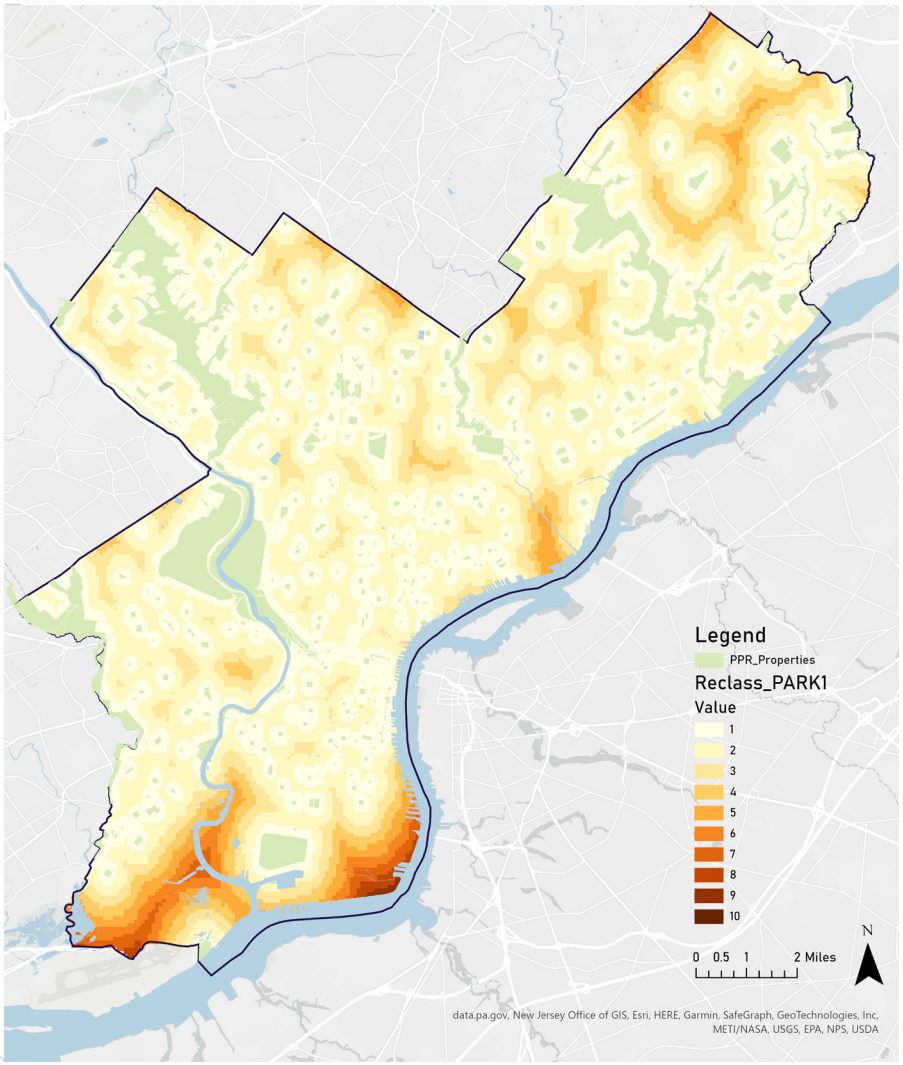
To get the areas farthest away from hospitals, I reclassified the raster into 10 categories. The highest score (10) was given to the areas furthest away from the hospitals, while the lowest score (1) was given to areas closest to them.

Methodology & Analysis



Euclidean Distance - Parks

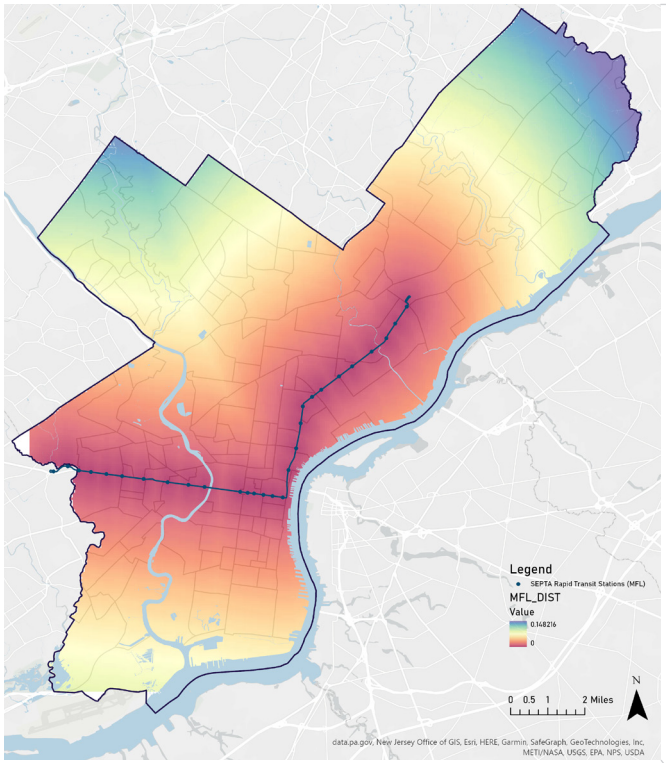
Taking the location of parks in Philadelphia, I used the Euclidean Distance tool to determine the closest and furthest distances from the parks. Using a mask developed from Philadelphia's boundaries, I used Raster Calculator to clip the distances outside of Philadelphia.



Reclassify - Parks

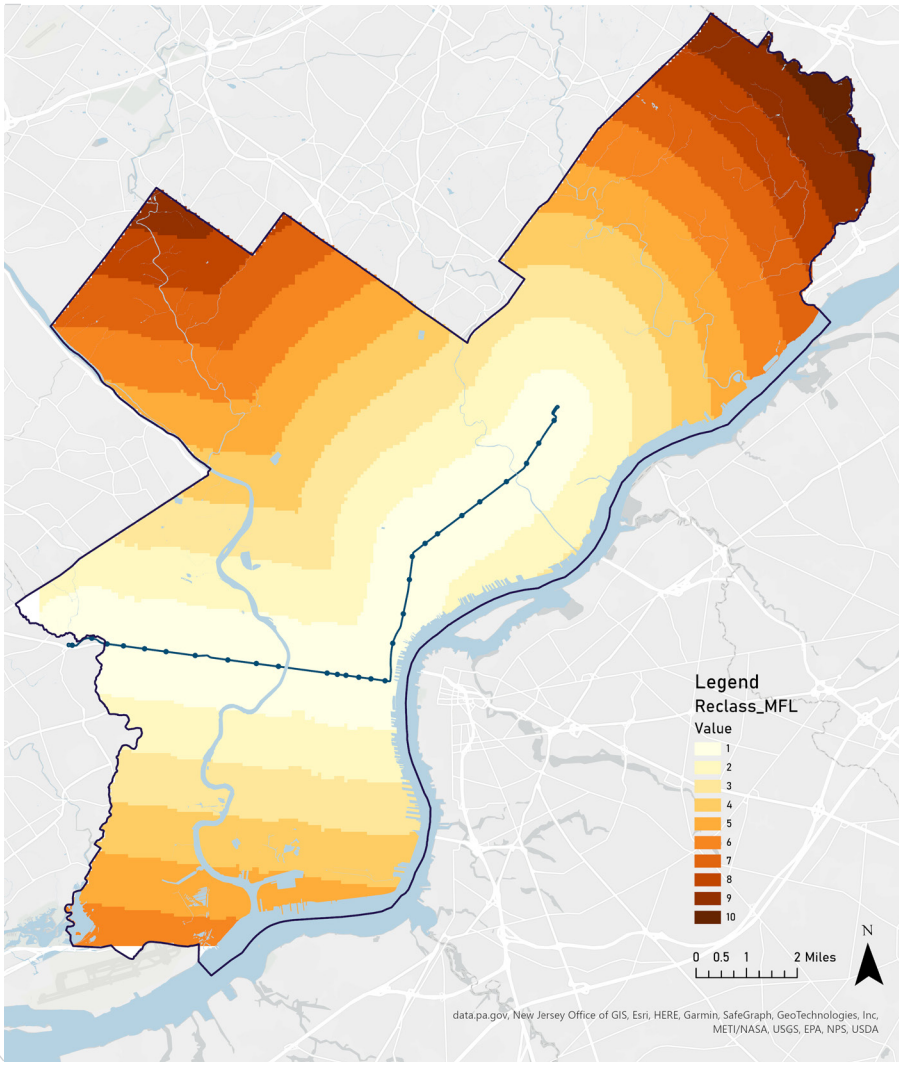
To get the areas farthest away from parks, I reclassified the raster into 10 categories. The highest score (10) was given to the areas furthest away from parks, while the lowest score (1) was given to areas closest to them.

Methodology & Analysis



Euclidean Distance - MFL Stations

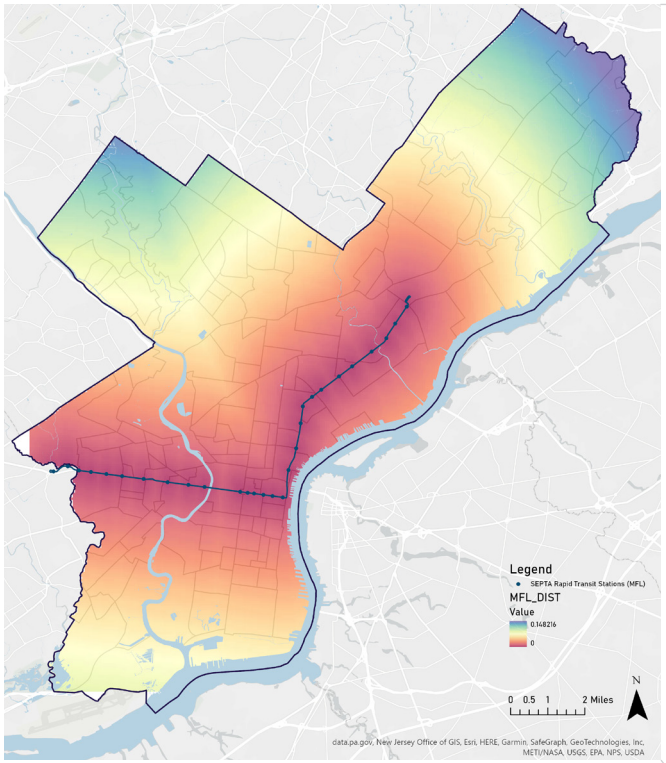
Taking the location of Market–Frankford Line stations in Philadelphia, I used the Euclidean Distance tool to determine the closest and furthest distances from the stations. Using a mask developed from Philadelphia's boundaries, I used Raster Calculator to clip the distances outside of Philadelphia.



Reclassify - MFL Stations

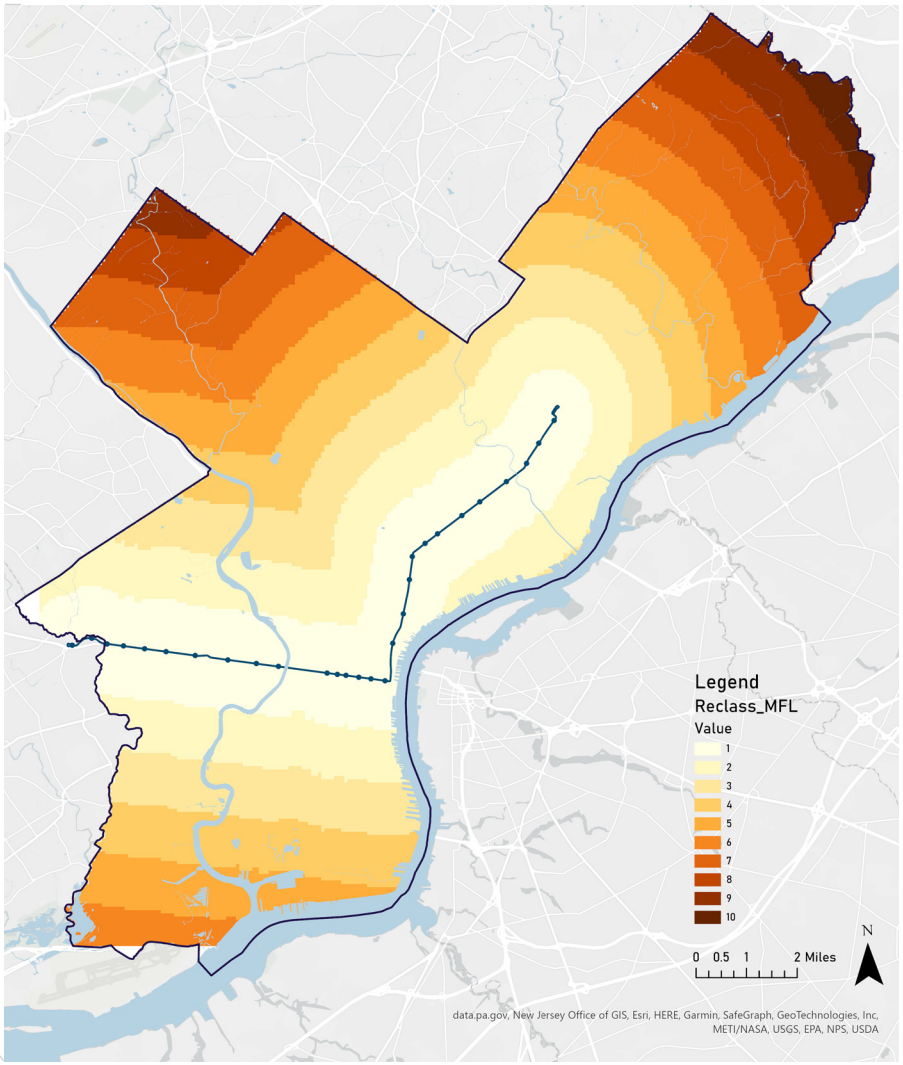
To get the areas farthest away from the MFL stations, I reclassified the raster into 10 categories. The highest score (10) was given to the areas furthest away from the stations, while the lowest score (1) was given to areas closest to them.

Methodology & Analysis



Euclidean Distance - BSL Stations

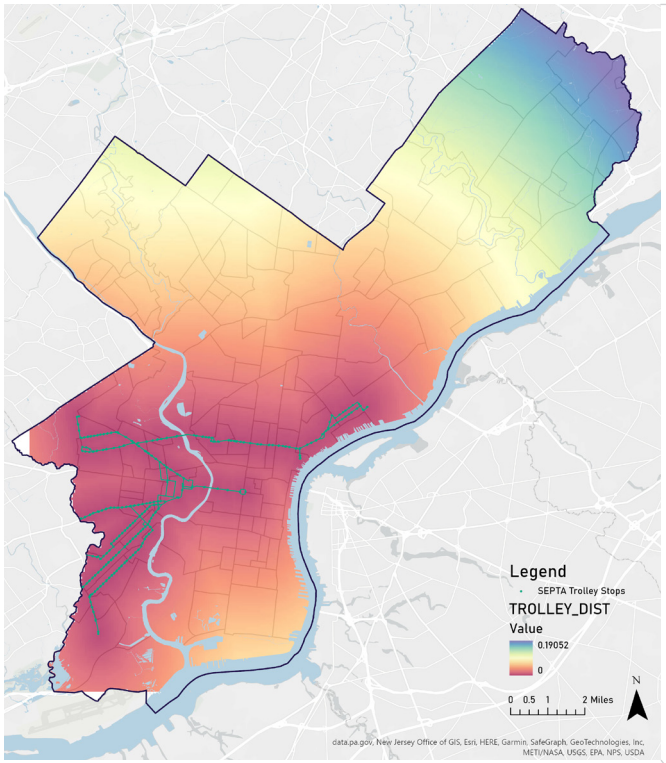
Taking the location of Broad Street Line stations in Philadelphia, I used I used the Euclidean Distance to determine the closest and furthest distances from the stations. Using a mask developed from Philadelphia's boundaries, I used Raster Calculator to clip the distances outside of Philadelphia.



Reclassify - BSL Stations

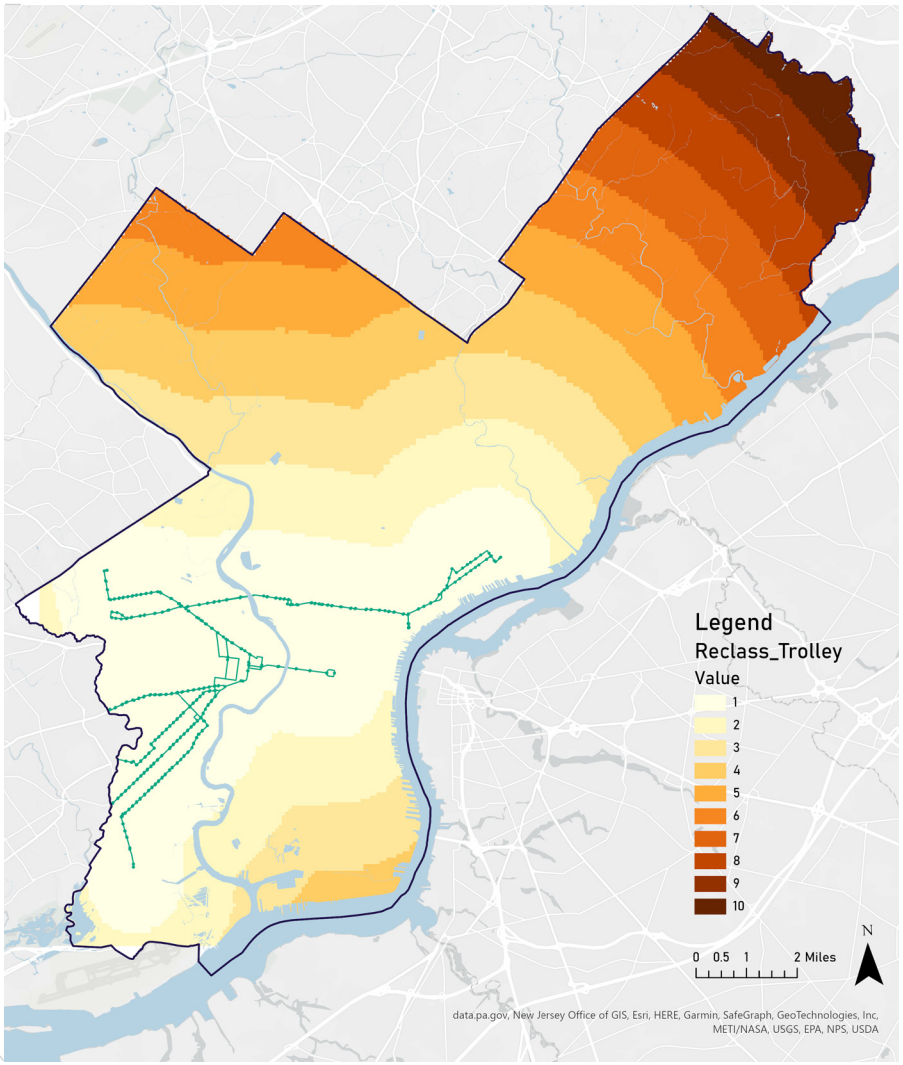
To get the areas farthest away from the BSL stations, I reclassified the raster into 10 categories. The highest score (10) was given to the areas furthest away from the stations, while the lowest score (1) was given to areas closest to them.

Methodology & Analysis



Euclidean Distance - Trolley Line Stations

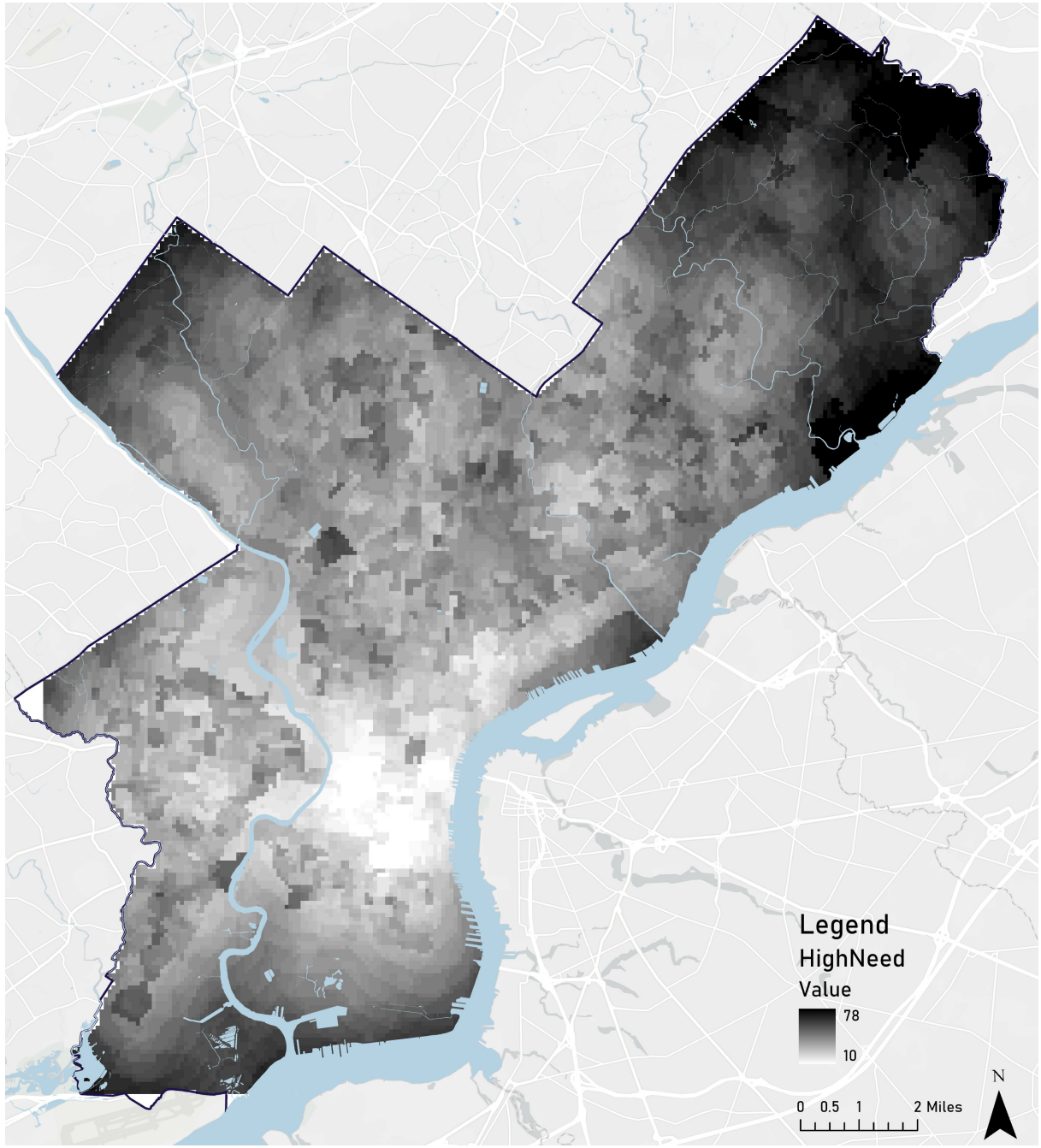
Taking the location of the trolley line stations in Philadelphia, I used the Euclidean Distance tool to determine the closest and furthest distances from the stations. Using a mask developed from Philadelphia's boundaries, I used Raster Calculator to clip the distances outside of Philadelphia.



Reclassify - Trolley Line Stations

To get the areas farthest away from the trolley line stations, I reclassified the raster into 10 categories. The highest score (10) was given to the areas furthest away from the stations, while the lowest score (1) was given to areas closest to them.

Methodology & Analysis



Areas in high need for community resources in Philadelphia

After reclassifying the eight metrics, I developed a formula to calculate the areas in Philadelphia with the lowest availability of resources and a concentration of poverty.

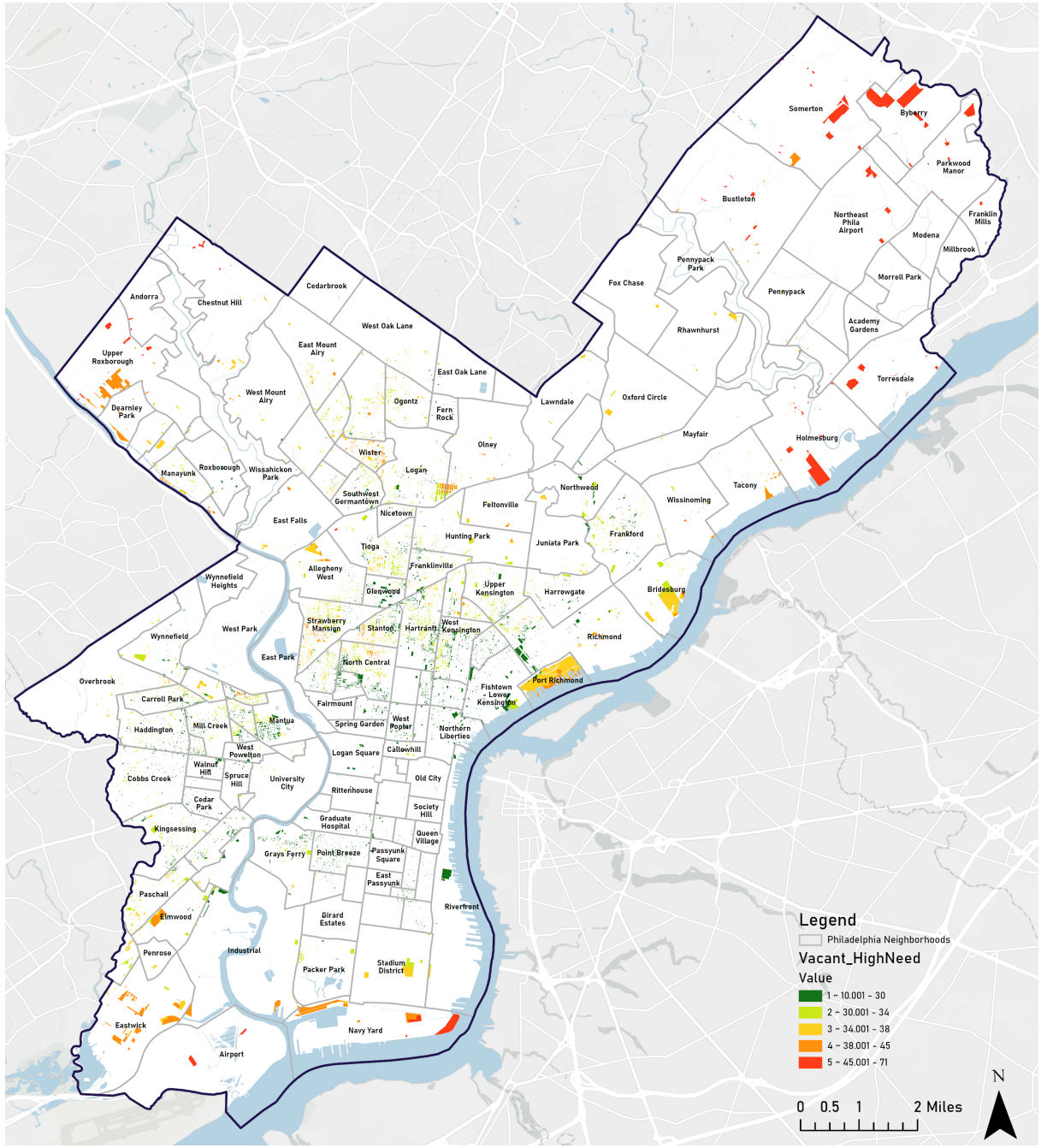
Philadelphia has good transit accessibility, especially in the areas closest to the city core. As a result, I was concerned certain areas in Philadelphia in need of community resources would not be accounted for due to having good access to transportation options. I found it important to consider areas with concentrated poverty which would better explain the lived experience of the residents there. Additionally, I recognized how fundamental housing is to one's stability, safety, and economic mobility.

Since there are 3 transportation-related variables, I decided to place a higher weight on poverty and affordable housing to balance the formula.

Raster Calculator

Formula : ("Reclass_AfforHou" * 2) + ("Reclass_Poverty" * 2) + "Reclass_HPSS" + "Reclass_Hospital" + "Reclass_PARK1" + "Reclass_MFL" + "Reclass_BSL" + "Reclass_Trolley"

Methodology & Analysis



Vacant sites most viable for the development of community resources in Philadelphia

After determining the areas in high need of community resources in Philadelphia, it was necessary to identify sites of opportunity to create those resources.

I developed a vacant land mask from a vector of vacant sites in Philadelphia using the Feature to Raster tool and then Reclassified it to produce a binary output. Finally, using the mask of Philadelphia's boundaries, I used Raster Calculator to clip the areas outside of Philadelphia.

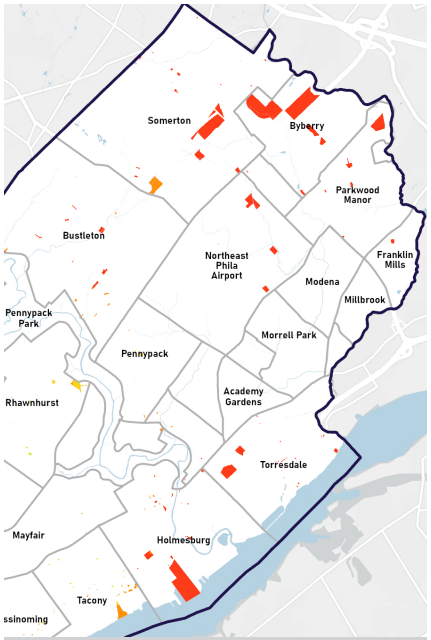
With the vacant sites mask, I used Raster Calculator to apply the final step in the formula, which would capture the vacant sites in Philadelphia most suitable for the development of community resources.

Raster Calculator

Formula : "VACANT MASK" * "HighNeed"

Conclusion

The final output classified vacant sites with a score from 1 to 5. The highest scores represent the areas with the most need, which are shown in red. The lowest scores show the areas with the lowest need, which are shown in green. Some development opportunities in high-need areas include affordable housing units, grocery stores, parks, community farms, community centers, hospitals, and health clinics. The results show different patterns around Philadelphia.

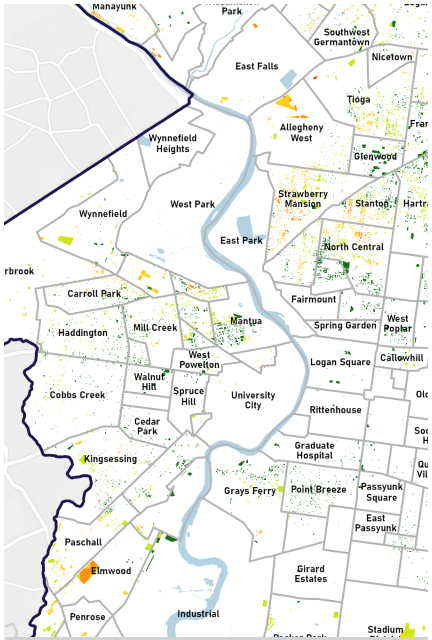


Northeastern Philadelphia

The Northeastern Philadelphia area has a high need for community resources. This is compounded by the area's lack of affordable housing options, sparse access to medical care and healthy food options, pockets of high poverty levels, and limited public transit accessibility.

North Philadelphia

The North Philadelphia area has a mixed result with areas of high need and low need for community resources. Although the area has a lack of healthy food options, a high level of poverty, and limited access to healthcare in some areas, it has great access to public transit and affordable housing options.



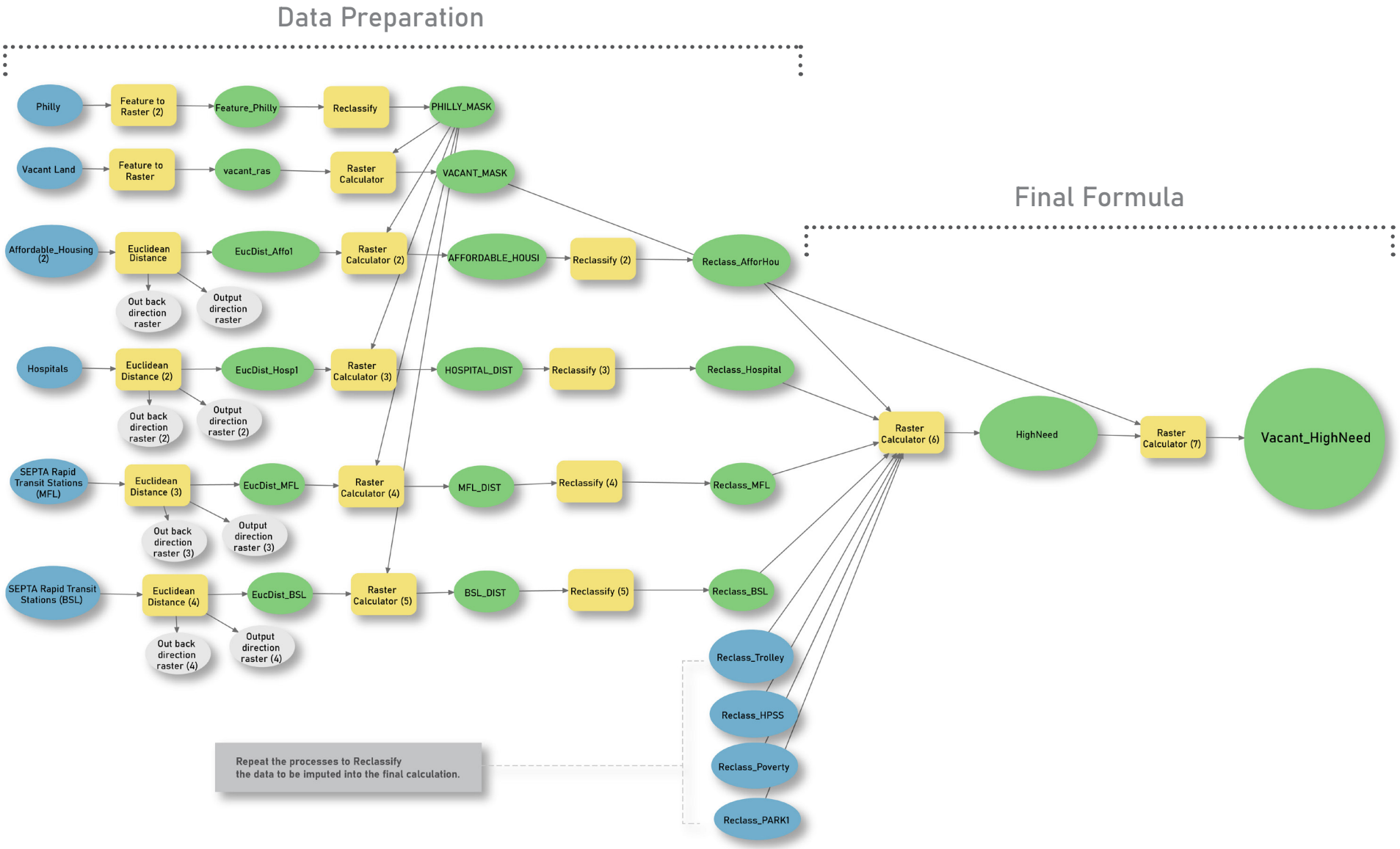
West Philadelphia

The West Philadelphia area also has a mixed result with areas of high need and low need for community resources. Although the area has a lack of healthy food options, a high level of poverty, and a limited access to parks in some areas, it has great access to public transit, healthcare, and affordable housing options.

Southwestern Philadelphia

The Southwestern Philadelphia area has a high need for community resources. This is compounded by the area's lack of affordable housing options, low access to medical care and healthy food options, and high poverty levels.

Model Builder



Sources

- Philadelphia Neighborhood Boundaries,
https://www.opendataphilly.org/dataset/philadelphia-neighborhoods

- Vacant Property Indicators “Land”,
https://www.opendataphilly.org/dataset/vacant-property-indicators

- Affordable Housing Units in Philadelphia,
https://www.opendataphilly.org/dataset/housing-production

- Philadelphia Parks and Recreation (PPR) Properties,
https://www.opendataphilly.org/dataset/ppr-properties/resource/9ca1d7e7-e19b-48ae-a96c-2c7f92c24050

- Hospitals in Philadelphia,
https://www.opendataphilly.org/dataset/philadelphia-hospitals

- Philadelphia Transit (Trolley Lines, Highspeed Lines, and Stations) – Southeastern Pennsylvania Transportation Authority (SEPTA) Open Data:
https://septaopendata-septa.opendata.arcgis.com/

- Neighborhood Food Retail:
https://www.opendataphilly.org/dataset/neighborhood-food-retail

- Poverty Levels, from “Neighborhood Food Retail dataset”,
https://www.opendataphilly.org/dataset/neighborhood-food-retail

- Home Owners’ Loan Corporation (HOLC) Neighborhood Redlining Grade,
ESRI Living Atlas