Geospatial Analysis Project

The goal of this geospatial analysis project is to use R, specifically the sf and tmap libraries, to gain insights into the city of Detroit's neighborhood characteristics and their relationship to grocery store accessibility and crime incidents. In particular, we want to explore the relationship between neighborhood access to grocery stores and crime rates. The project will analyze data from four shapefiles provided by the city of Detroit, including neighborhood and zip code boundaries, grocery store locations, and crime incidents.

The project has two tasks:

1. Analyze crime incidents in Detroit's neighborhoods and zip code areas, and create maps to show areas with the highest and lowest crime rates.
2. Analyze robbery incidents around grocery stores and create a map showing the locations of the stores and buffered zones of 1, 2, and 3 miles around them. The number of robberies within each zone will be calculated and exported to an Excel spreadsheet.

The insights gained from this project will help identify areas that require more attention and resources to enhance the safety and security of the city's residents. To accomplish this, the crime incidents data will be filtered to only include incidents that occurred in 2021.

Findings

Task 1: Crime Incidents in Detroit's Neighborhood and zip code areas

The first task of this project involves analyzing crime incidents in Detroit's neighborhoods and zip code areas. The neighborhood and zip code shapefiles will be overlaid with the filtered crime data to create two separate maps.

A map of Detroit neighborhoods was generated for this project, with colors indicating the level of crime incidents in 2021. The green color was assigned to neighborhoods with less than 100 crime incidents, while the red color was assigned to neighborhoods with more than 1200 crime incidents **(Appendix Image 1)**. The results indicate that there are more safe neighborhoods than high-risk neighborhoods, which is reassuring. Nevertheless, it is important to note that most of the neighborhoods fall within the moderate risk category, as seen from the uncolored areas on the

map. This suggests that there is still work to be done in terms of improving safety and reducing crime rates in many of Detroit's neighborhoods.

Next a zip code map where the zip code areas were colored based on the number of crime incidents in 2021. Areas with less than 1000 incidents were colored green, while areas with more than 5000 incidents were colored red **(Appendix Image 2)**. The analysis revealed that there were more green areas than red areas, indicating that the majority of the zip code areas were relatively safe. However, a large portion of the map was left uncolored, suggesting that the majority of the areas have moderate levels of crime incidents. Additionally, the red areas were generally larger zip code areas than the green areas, indicating that certain parts of the city may be more prone to high levels of crime.

Both of the above information is crucial for policymakers and city officials to identify neighborhoods that require more attention and resources to improve safety and reduce crime rates. By focusing on areas with high crime rates, the government of Detroit can develop targeted interventions and programs to improve public safety and enhance the quality of life for residents in those neighborhoods.

Task 2: Robbery Incidents around grocery stores

The second of this project involves analyzing the buffered zones of 1 mile, 2 miles, and 3 miles radius around each grocery store within Detroit neighborhoods and the number of robbery incidents within these radii.

To start off with Task 2, a map of Detroit neighborhoods was created with marked grocery store locations **(Appendix Image 3)**. Observing that not all neighborhoods have a grocery store, 1-, 2-, and 3-mile buffer zones were plotted around each store and color-coded **(Appendix Images 4-6)**. The 1-mile buffer zone did not cover many neighborhoods, and some grocery stores overlapped. The 2-mile buffer zone covered most neighborhoods with at least one grocery store and showed that most stores were within a 2-mile radius of each other. The 3-mile buffer zone covered almost all neighborhoods with a grocery store, except for a few southern ones. A 3-mile radius was

deemed suitable for reaching a store by vehicle or foot, and this information can help with better planning and resource allocation for the city and grocery stores.

Next, the data on robbery incidents within the 1-mile, 2-mile, and 3-mile buffered zones around grocery stores in Detroit was obtained and descriptive statistics were calculated for each buffer zone. The mean number of robberies within a 1-mile radius was 5.568, with a minimum of 0 and a maximum of 24. Within a 2-mile radius, the mean number of robberies was 13.49, with a minimum of 0 and a maximum of 53. Finally, within a 3-mile radius, the mean number of robberies was 27.04, with a minimum of 3 and a maximum of 69. These statistics **(Appendix Image 7)** provide insight into the frequency of robbery incidents in relation to the proximity of grocery stores and can be used to inform future safety measures and crime prevention strategies.

Based on the findings, it can be helpful for grocery store owners to understand the crime rates in the neighborhoods surrounding their stores, which can inform their decisions regarding security measures and resource allocation. It can also help them identify areas with higher crime rates and work with local law enforcement and community groups to improve safety in those areas. Additionally, this information can be useful for residents to make informed decisions about where to live and shop, as well as for researchers to further investigate the relationship between crime rates and access to grocery stores.

Conclusions

This geospatial analysis project used R and various libraries to analyze crime incidents, grocery store accessibility, and their relationship in the city of Detroit. The project provided insights into the levels of crime incidents in different neighborhoods and zip code areas, identified areas that require more attention and resources to improve safety, and analyzed robbery incidents around grocery stores. The findings can be used by policymakers, city officials, grocery store owners, residents, and researchers to inform their decisions and actions to enhance the safety and security of Detroit's residents. Overall, this project highlights the importance of geospatial analysis in understanding and addressing complex social issues.

Appendix

Image 1 - Map Of Neighborhoods Showing Different Crime Levels

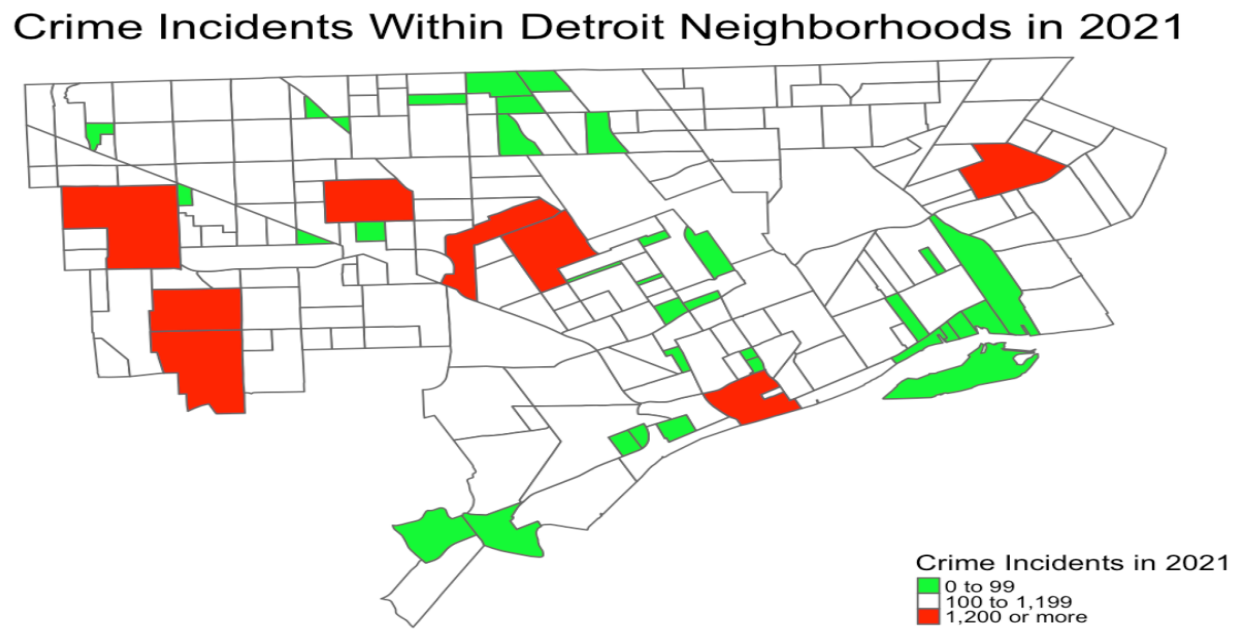

Image 2- Map Of Zip Code Showing Different Crime Levels

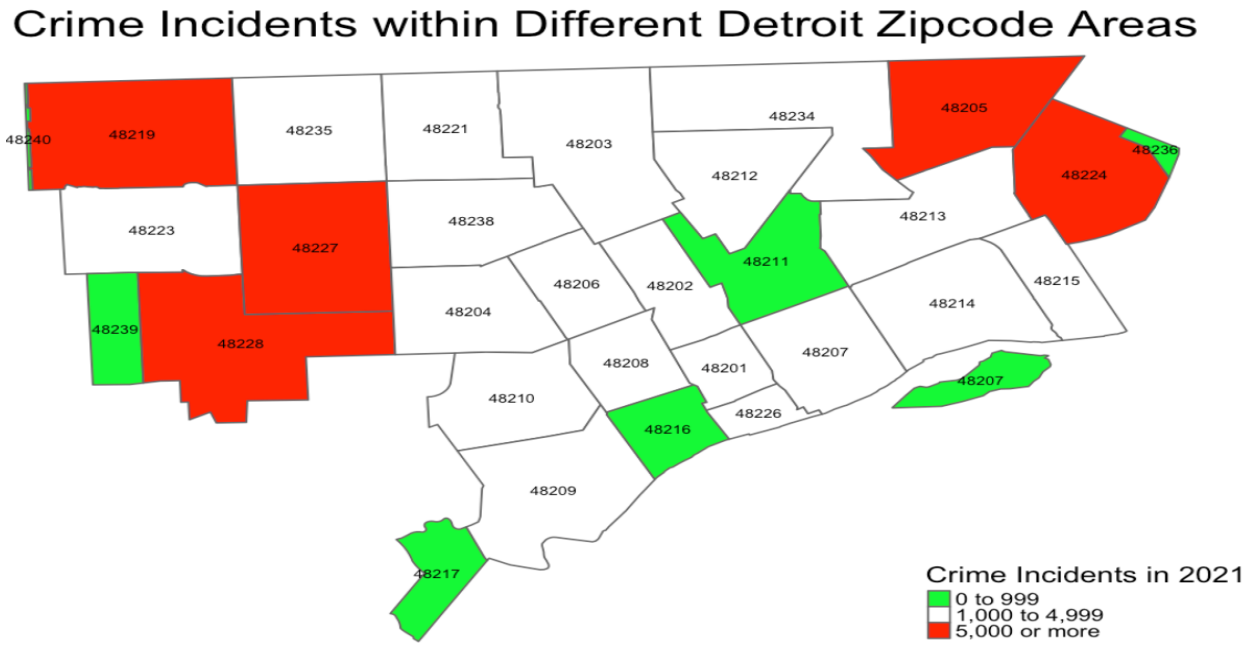

Image 3 - Map of Neighborhoods with Grocery Stores Plotted

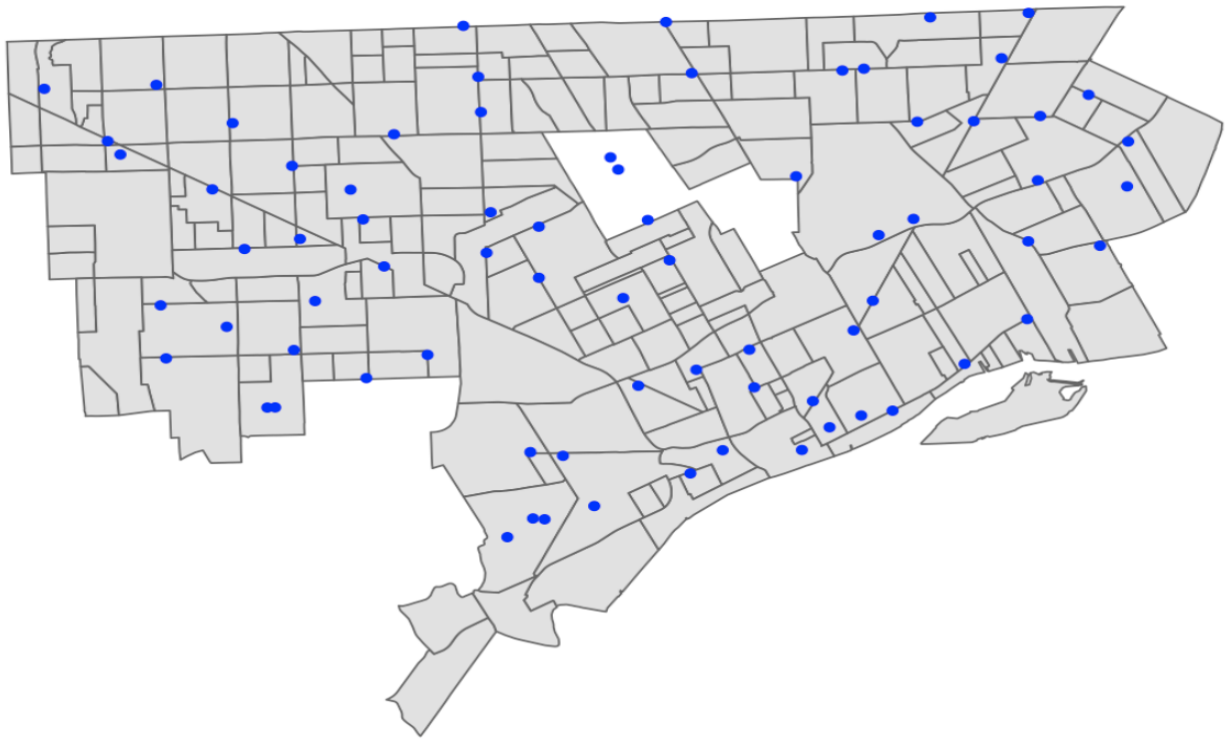

Image 4 - Map of Neighborhoods with Grocery Stores Plotted and 1 Mile Buffer

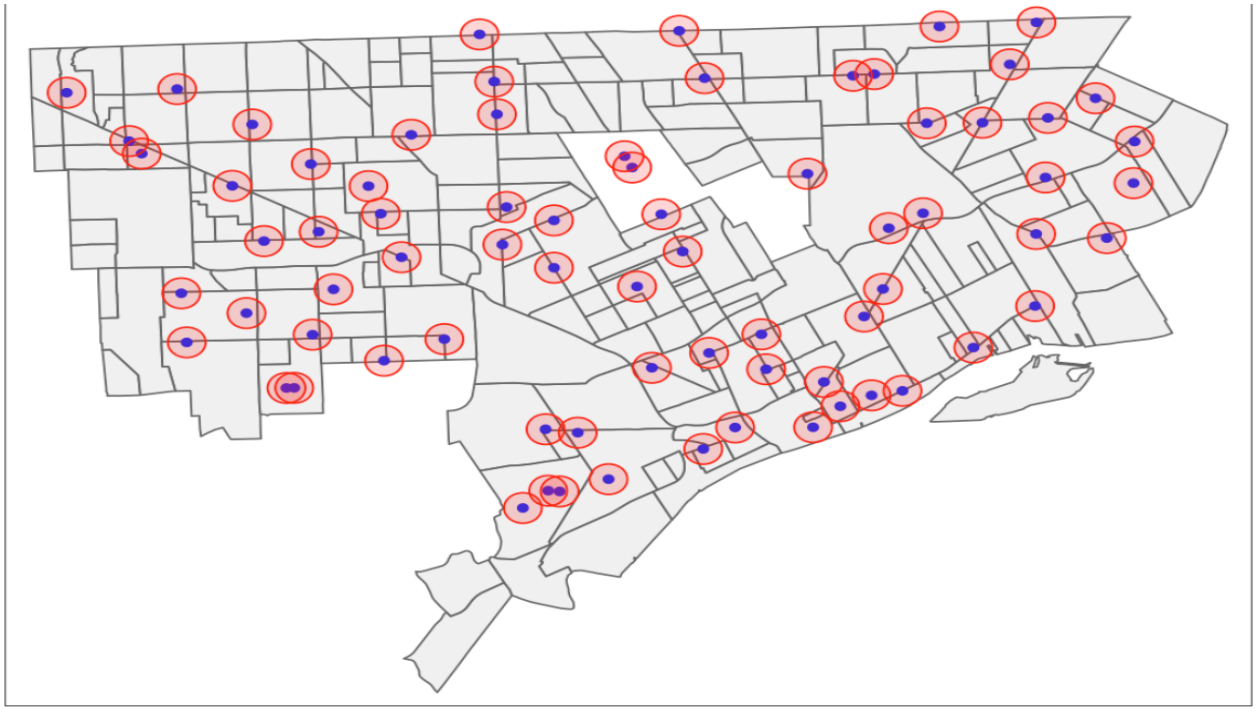

Image 5 - Map of Neighborhoods with Grocery Stores Plotted and 2 Mile Buffer

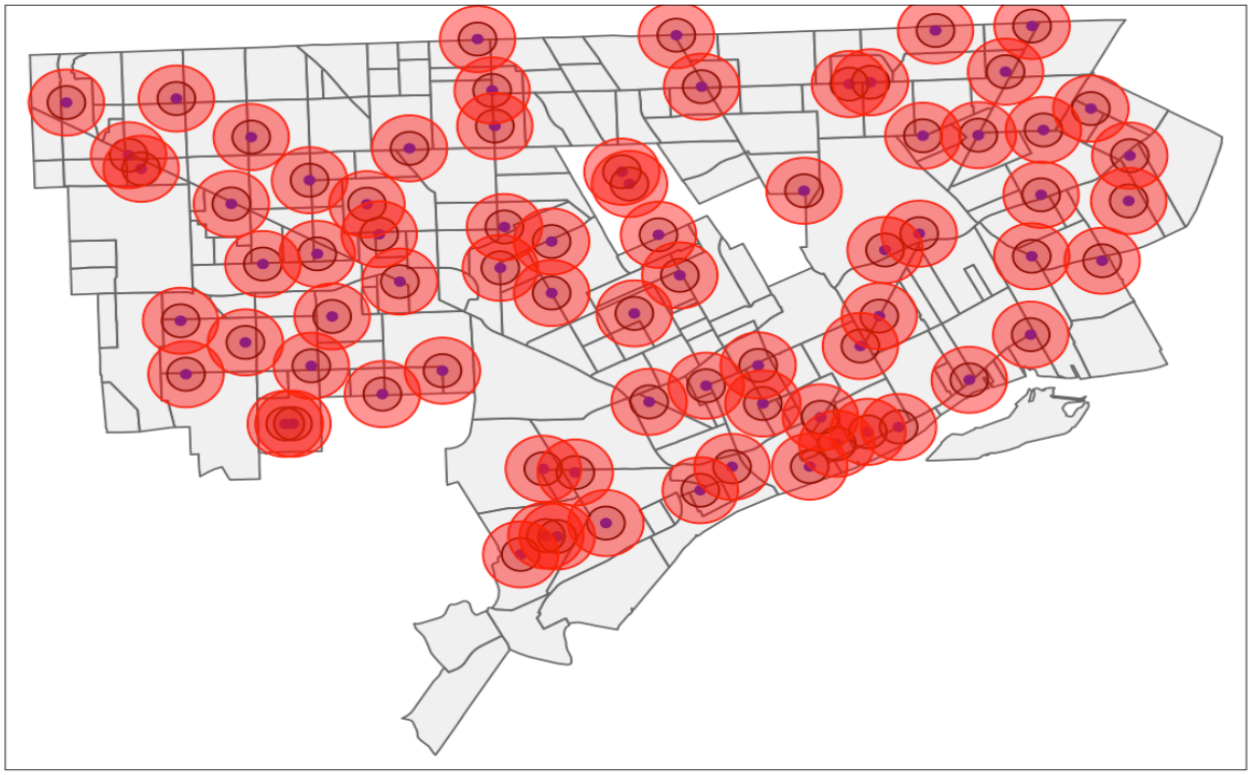

Image 6 - Map of Neighborhoods with Grocery Stores Plotted and 3 Mile Buffer

Image 7 - Descriptive Statistics of the Number of Robberies within 1,2 and 3 miles of Grocery Stores

```
RobberiesWithin1MileSummary
 Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
0.000   3.000   4.000   5.568   8.000  24.000
RobberiesWithin2MilesSummary
 Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
 0.00    9.00   11.50   13.49   17.00   53.00
RobberiesWithin3MilesSummary
 Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
 3.00   18.00   25.00   27.04   34.00   69.00
```