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Crime and Food Insecurity in the District of Columbia

Abstract:

This project examines the relationship between crime rates and food insecurity in the District of Columbia at the census block group level. The project utilizes statistical tests such as global and local Moran's I, cluster/ outlier analysis, and hotspot analysis to identify and isolate areas of Washington D.C. with a statistically high crime rate and compares them to a map of low food access areas within the city. Statistical tests determined that crime was concentrated in statistically significant high and low clusters within the city, each with several notable outliers. It was also determined that there were a number of block groups found to be crime hotspots with 95% or greater confidence level. When comparing these results to the low food areas of D.C. I found that 65% crime hotspots overlapped with areas of the city with low access to food. Additionally, 86% of high crime outliers within low crime block group clusters were found to overlap with food insecure areas. Conversely, 42% of low crime outliers within high crime block group clusters had adequate access to food. These results indicate that there is a strong relationship between low food access and criminal activity in Washington D.C.

Introduction:

Street crime has always been an issue in Washington D.C. In a city with such sharp divides between haves and have nots, where the cost of living far exceeds the national average, many individuals may turn to street crime as a method of survival. Behind the glittering white marble of the National Mall, there exists a side of the city where individuals born into poverty and desperation feel they must engage in illicit activity in order to stave off the deepest depths of poverty, at the expense of those around them. There is perhaps no more basic manifestation of

poverty than the lack of access to food, a condition that persists even in the heart of many of our greatest modern cities. The drive to feed oneself is the primary instinct of all life, and an individual will go to almost any lengths to nourish their body and that of their family. The lack of consistent access to food has a measurable effect on behavior, that can be observed in children, and persists throughout their lives. “Children raised in food *insecure* households exhibit significantly lower levels of self-control during early childhood and higher levels of delinquency during late childhood than children raised in food *secure* households... The general theory of crime may need to be expanded to account for the role of early life stressors linked to a tenuous supply of healthy household foods in the development of self-control” (1) In this project I will examine the relationship between impoverished areas of the District of Columbia, low food access areas, and crime incidents in the year 2020. Crime, like all aspects of human behavior is complex, and arises from multiple sources and is shaped by numerous environmental and social factors.

Materials and Methods:

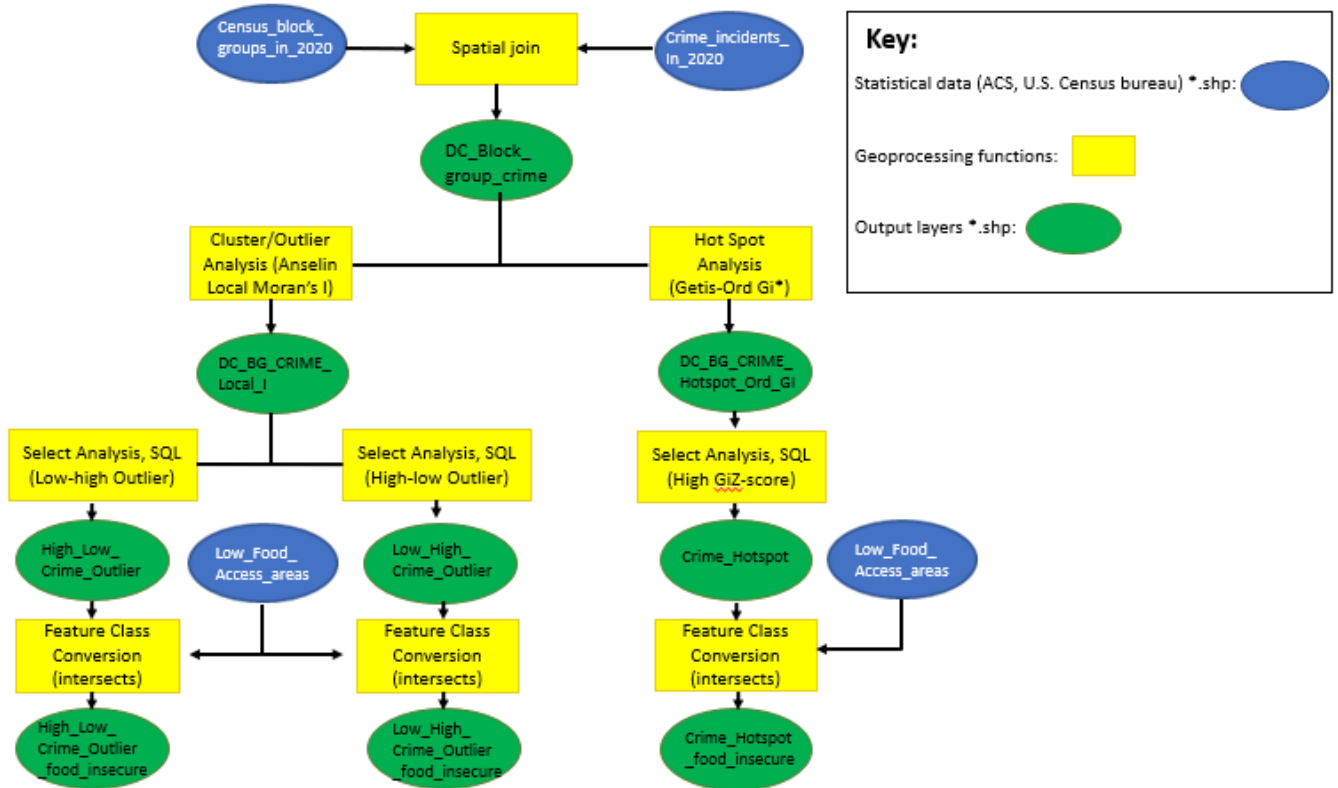
To carry out the analysis of food insecurity and crime in the District, I first had to gather publicly available data on its demographics, census block areas, and a map of Incident report locations compiled by the D.C. Metropolitan Police Department. All of this data was available for public viewing and academic use on the city’s Open Data portal. Furthermore, the site provided a shapefile depicting “” within the city, where fresh groceries are not readily accessible. This layer would serve as the basis for establishing food insecurity at a neighborhood and community level. Although this data cannot pinpoint food insecurity on an individual and family level, which exists in varying levels throughout the city, it can aid in determining which communities are more food insecure overall, and, combined with additional economic data, can

show us where economic privation, hunger, and its accompanying desperation, occurs most widely within Washington D.C.

I began my analysis by assessing which neighborhoods of D.C. had the highest rates of crime. To accomplish this, I completed a spatial join operation of the Census block group areas of the city with the crime incident map of the year 2020. I chose to use the 2020 dataset, rather than the 2021 dataset, as I felt it was pertinent to conduct my research with a complete year's worth of data. Once the layers had been joined, I carried out a series of tests to determine crime hotspots, cold spots, outliers, and other statistically significant trends regarding the distribution of crime incidents throughout the city. Tests included Spatial Autocorrelation, Moran's I, High/Low Clustering (Getis-Ord General G), Cluster/ Outlier analysis (Anelin Local Moran's I) and Hotspot Analysis (Getis-Ord GI). The null hypothesis for each of these tests was that crime was evenly distributed throughout the city, and the alternate hypothesis was that crime was not equally distributed in statistically significant clusters of high and low activity. The results of these tests were then isolated and compared to the shapefile depicting food insecurity within the District, in order to assess the degree of association between high crime incidents and food insecurity on a neighborhood level. I utilized SQL queries to isolate block groups that had exhibited statistically significant results in my previous tests, during my comparison to the food insecurity layer. Specifically, I compared block groups that had been identified as crime hotspots during Getis-Ord GI hotspot analysis to determine the percentage of these areas which overlapped or intersected with a food insecure region. Additionally, I was interested in the block groups that had been identified as low-high outliers during the local Moran's I test. Many of these regions were economically and demographically similar to the high crime regions surrounding them but exhibited a lower crime rate of statistical significance when compared to

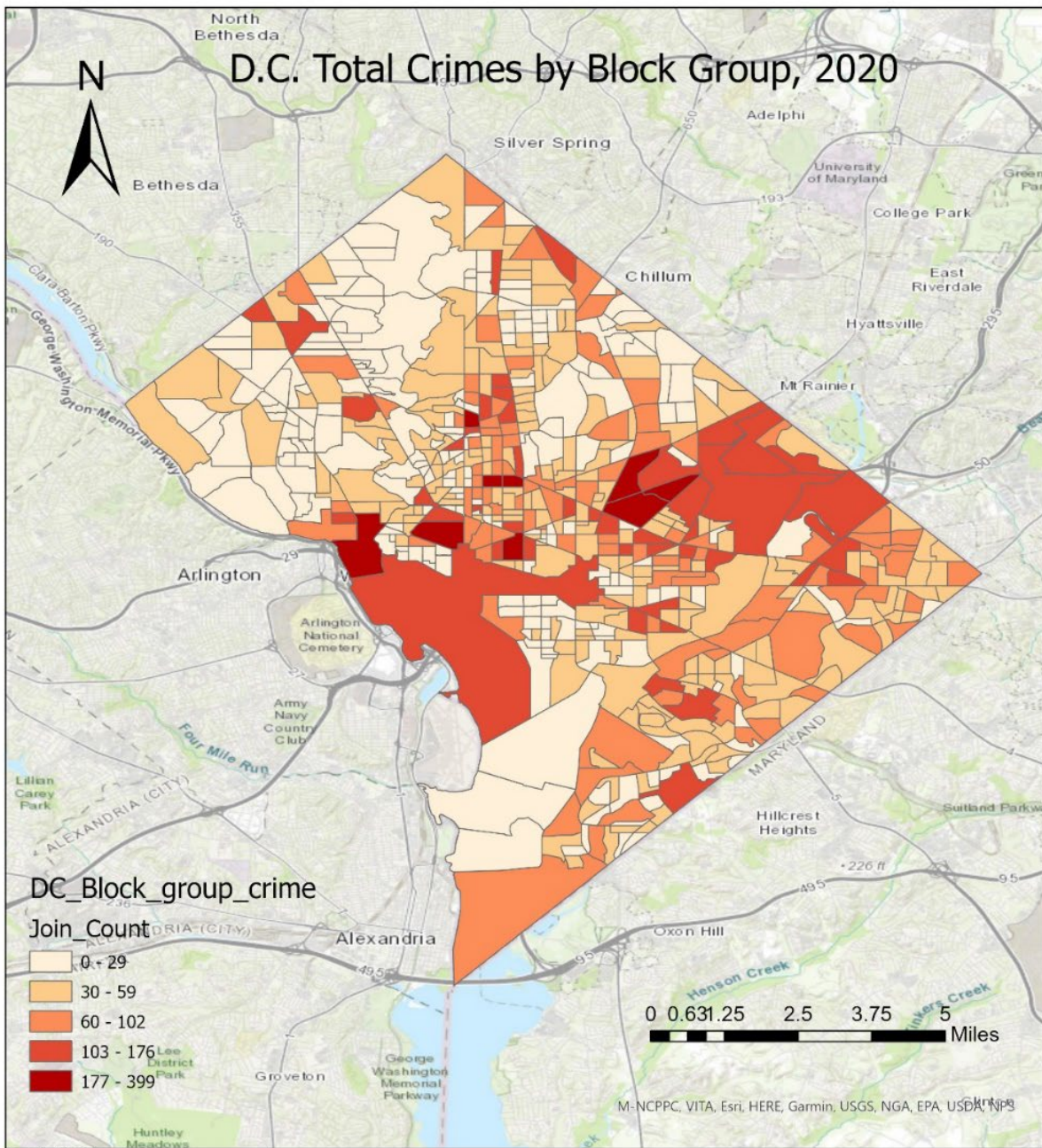
the block groups around them. I was interested in determining whether these areas were more or less likely to overlap or intersect with a food insecure area than the crime hotspots.

Code Flowchart



Results:

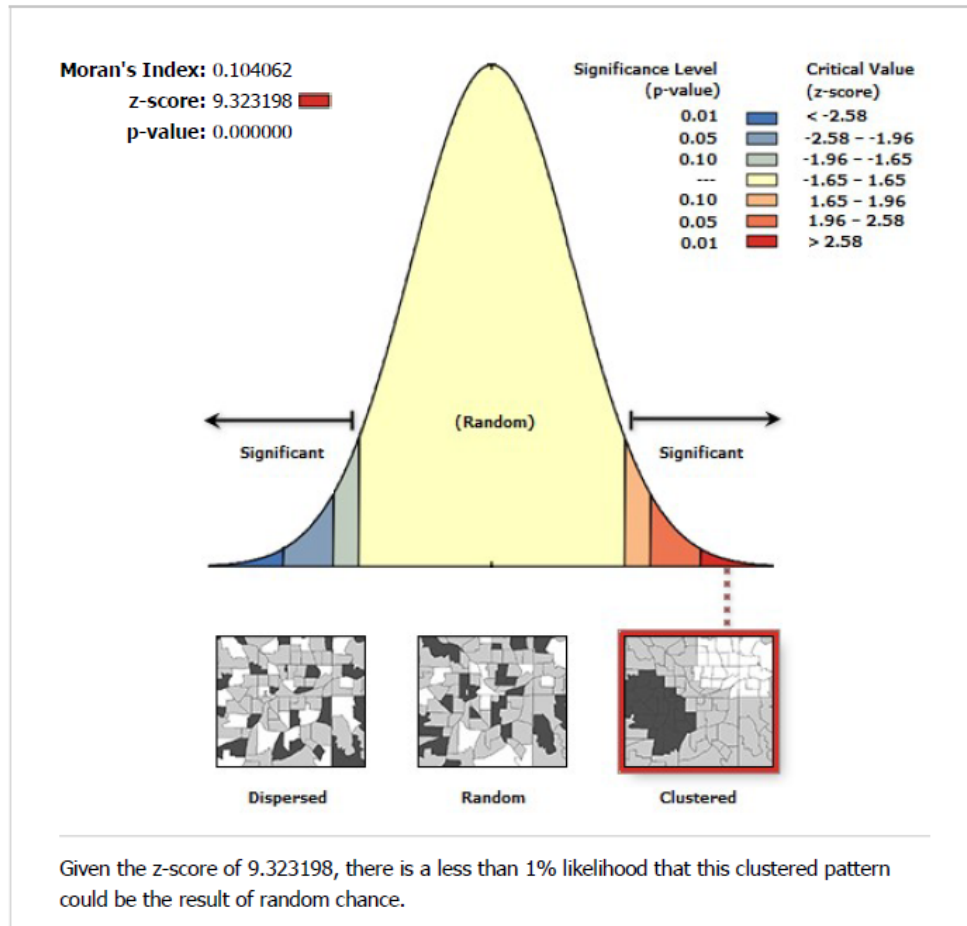
Spatial Join: The map below provides a raw numerical depiction of the number of crimes reported in the year 2020 by census block group. We can see that overall, there appear to be more crimes reported in Northeast D.C., Southeast, D.C. and in areas of downtown surrounding the National Mall and Memorial Parks. The following maps will continue with an analysis to determine which areas have a statistically significant high and low crime rate compared to their surroundings and to the city as a whole.



Spatial Reference
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 Datum: WGS 1984
 Map Units: Degree

Spatial Autocorrelation (Global Moran's I): When assessing the District's crime rate by location using a global Moran's I test, we can determine with a high level of confidence that crime rates are clustered in a statistically significant way rather than being evenly distributed throughout the city. The Z-score for this test was found to be 9.323198, with a p-value of 0.000000 signifying a high degree of confidence.

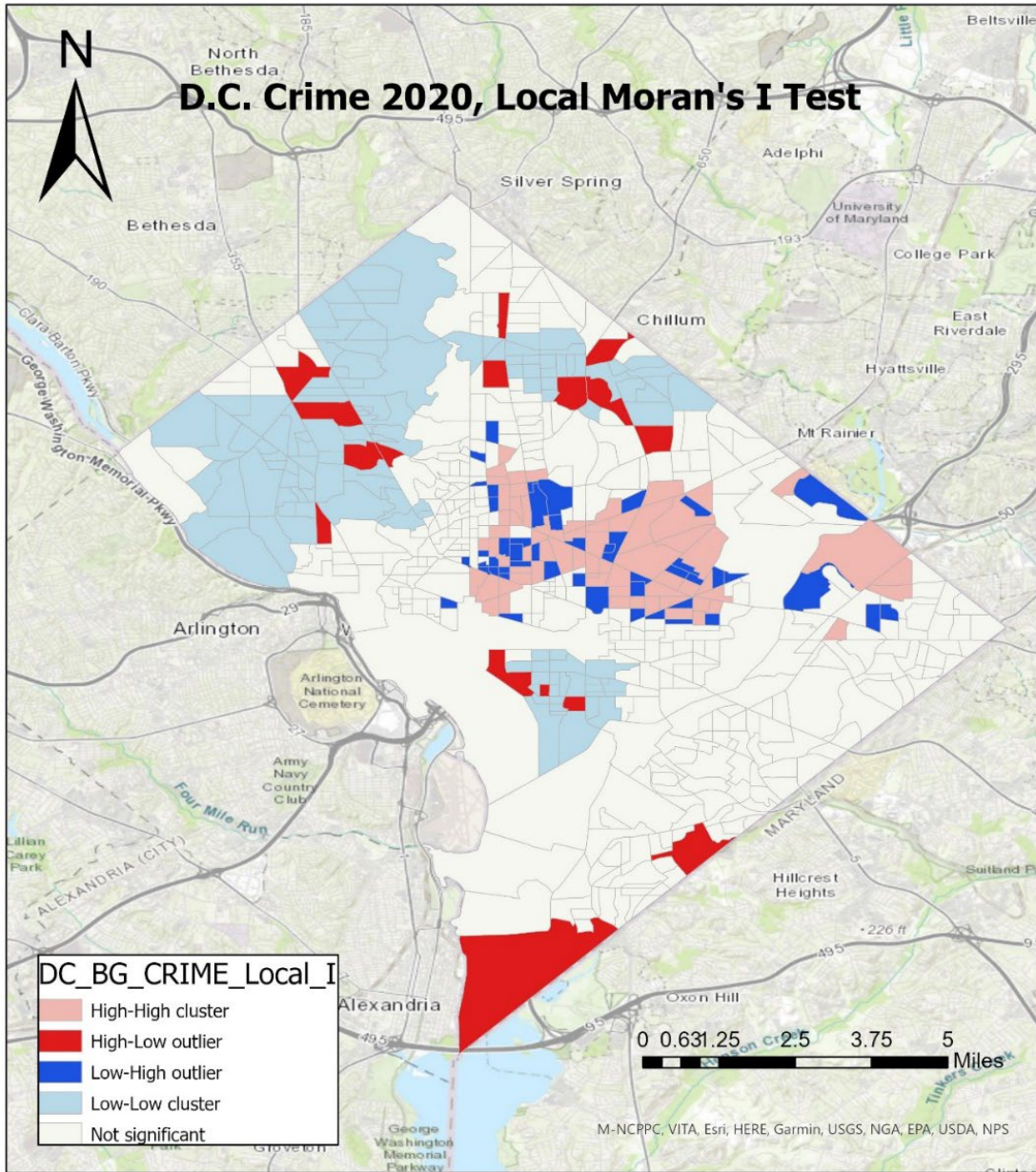
Spatial Autocorrelation Report



Global Moran's I Summary

Moran's Index:	0.104062
Expected Index:	-0.001754
Variance:	0.000129
z-score:	9.323198
p-value:	0.000000

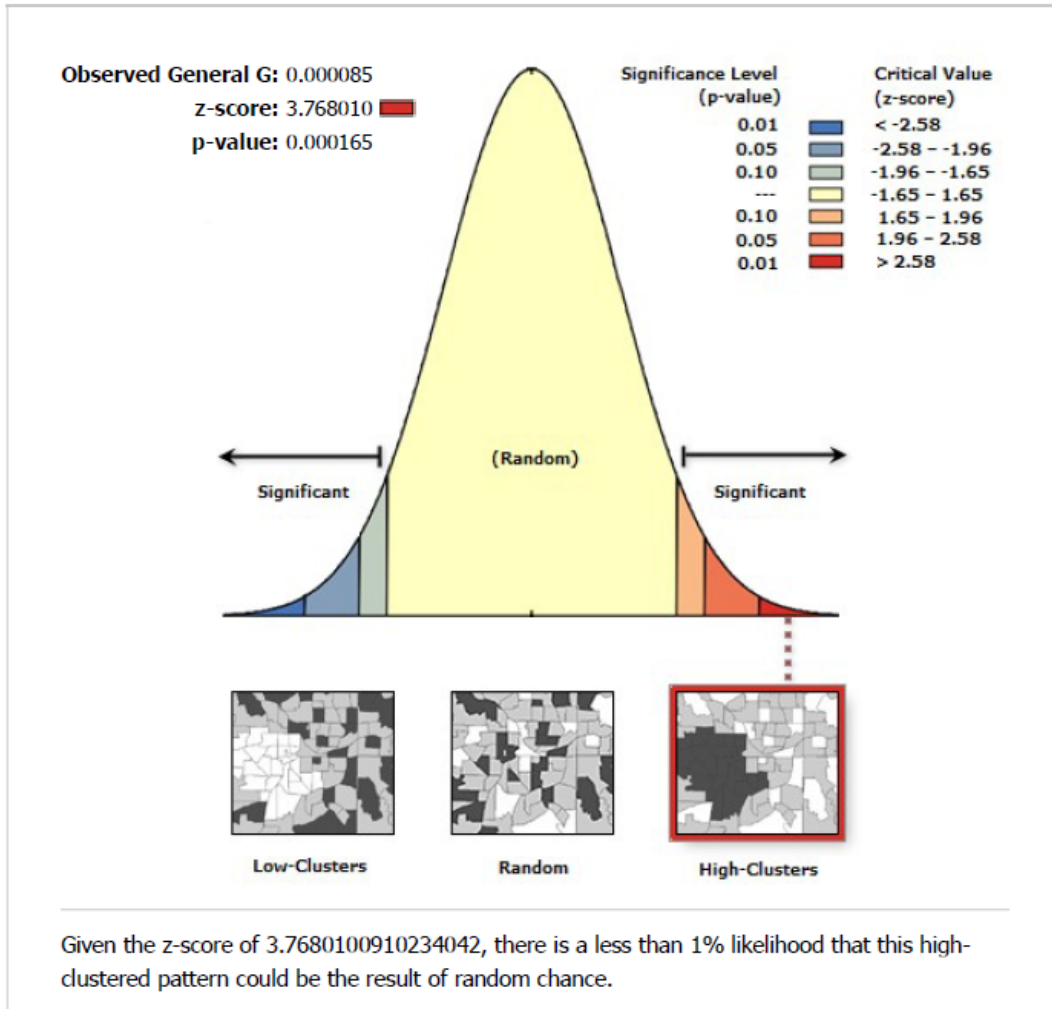
Cluster and Outlier Analysis (Anselin Local Moran's I): After performing a local Moran's I test of crime reports by block group, we can determine statistically significant clusters of high and low crime as well as isolate outliers of high crime surrounded by low crime areas and low crime surrounded by high crime areas. Areas of statistically low crime appear to be concentrated Northwest D.C. and in the Southwest waterfront neighborhood. Areas of statistically high crime appear to be concentrated in a band extending from downtown into Northeast D.C.



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High/Low Clustering (Getis-Ord General G): To gain a better understanding of crime hotspots in the city, I performed a Getis-Ord General G test. High crime clusters were found to be present with a high degree of statistical certainty. The Z-score for this result was found to be 3.768010 with a p value of 0.000165.

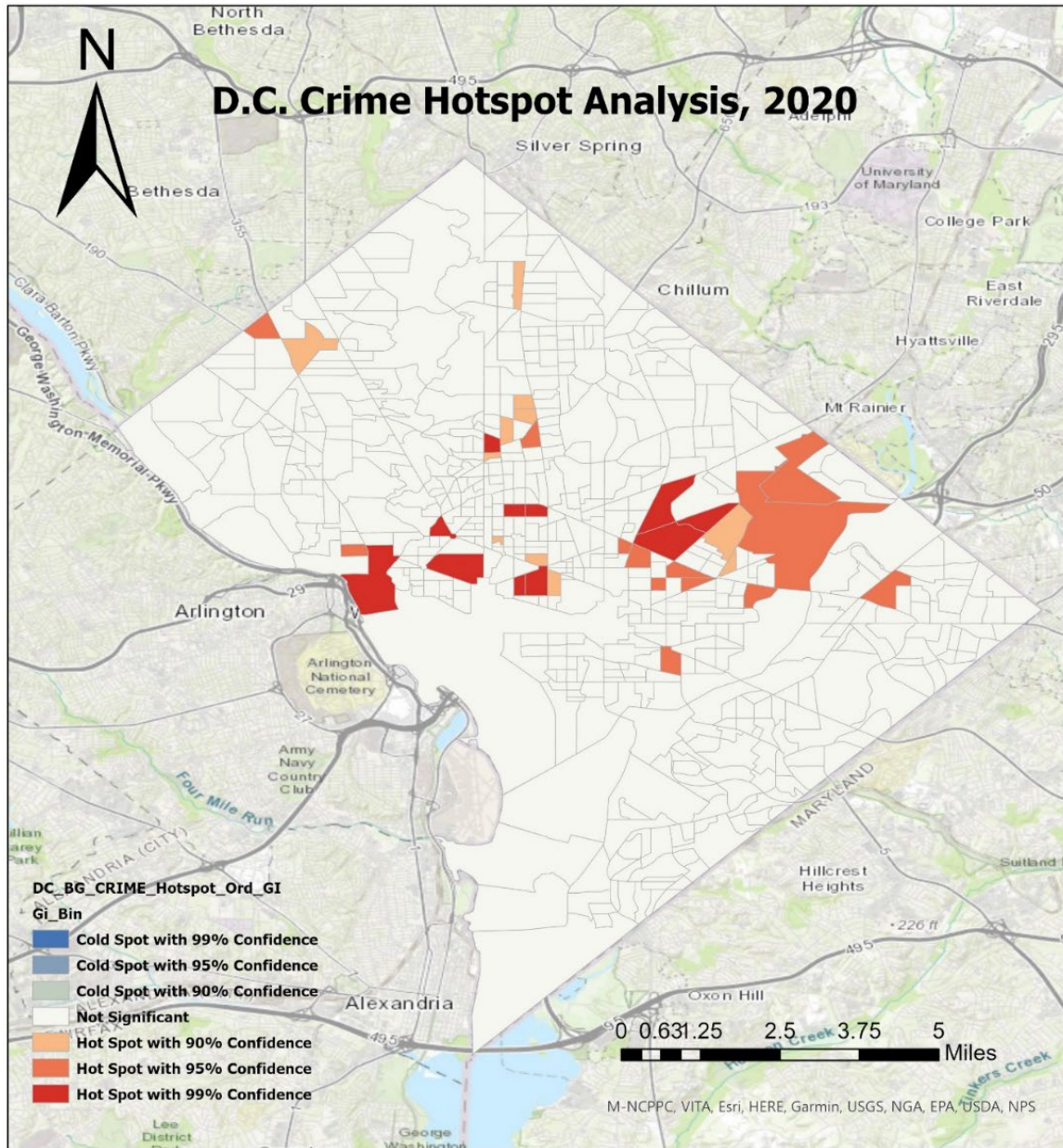
High-Low Clustering Report



General G Summary

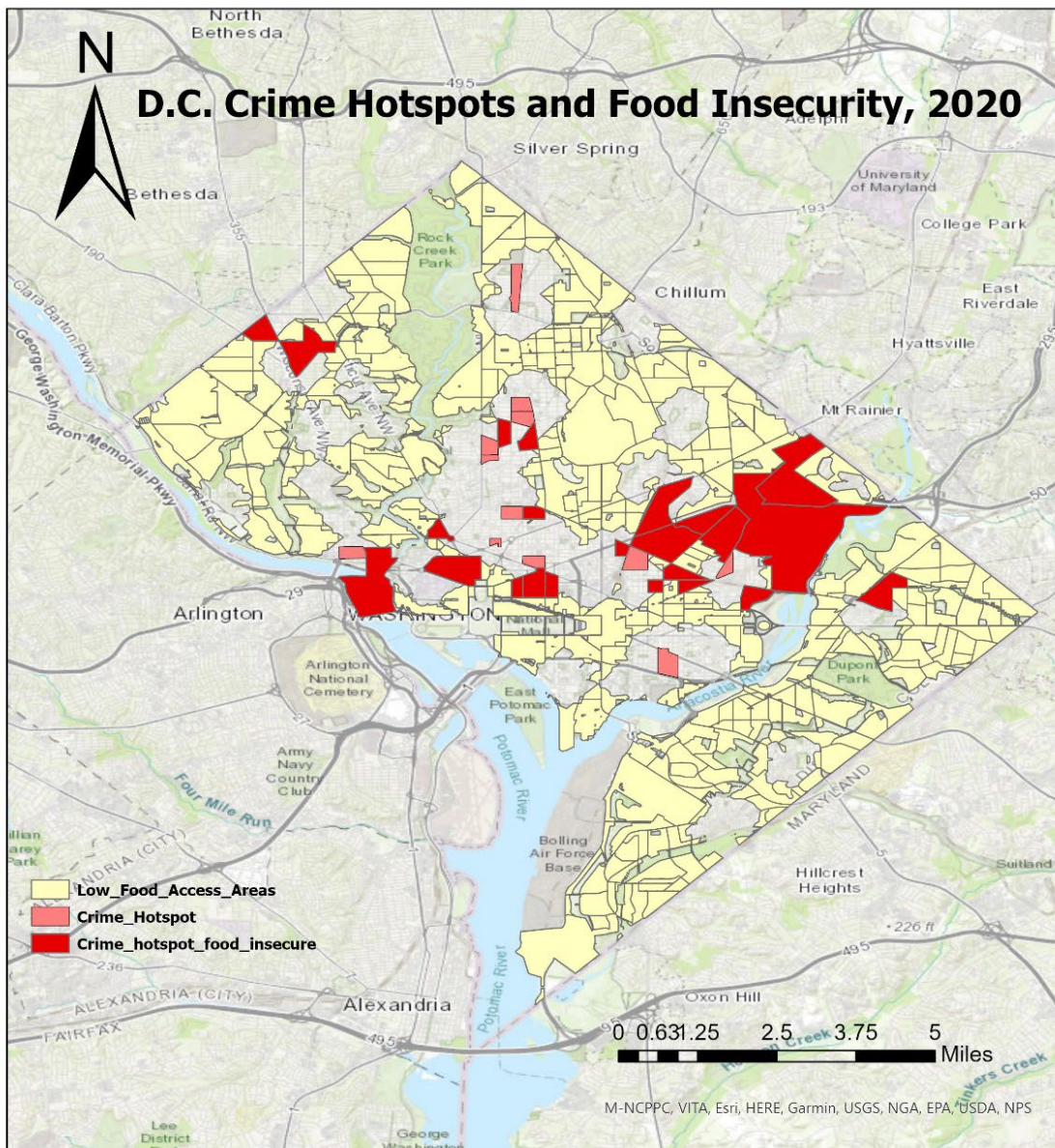
Observed General G:	0.000085
Expected General G:	0.000072
Variance:	0.000000
z-score:	3.768010
p-value:	0.000165

Hot Spot Analysis (Getis-Ord G_i^*) (Spatial Statistics): When we examine statistically significant crime hot spots on the map, we can see several large clusters of block groups within Northeast D.C. And the Downtown area, with smaller clusters located within Northwest D.C. No statistically significant cold spots can be identified anywhere in the city using this test.



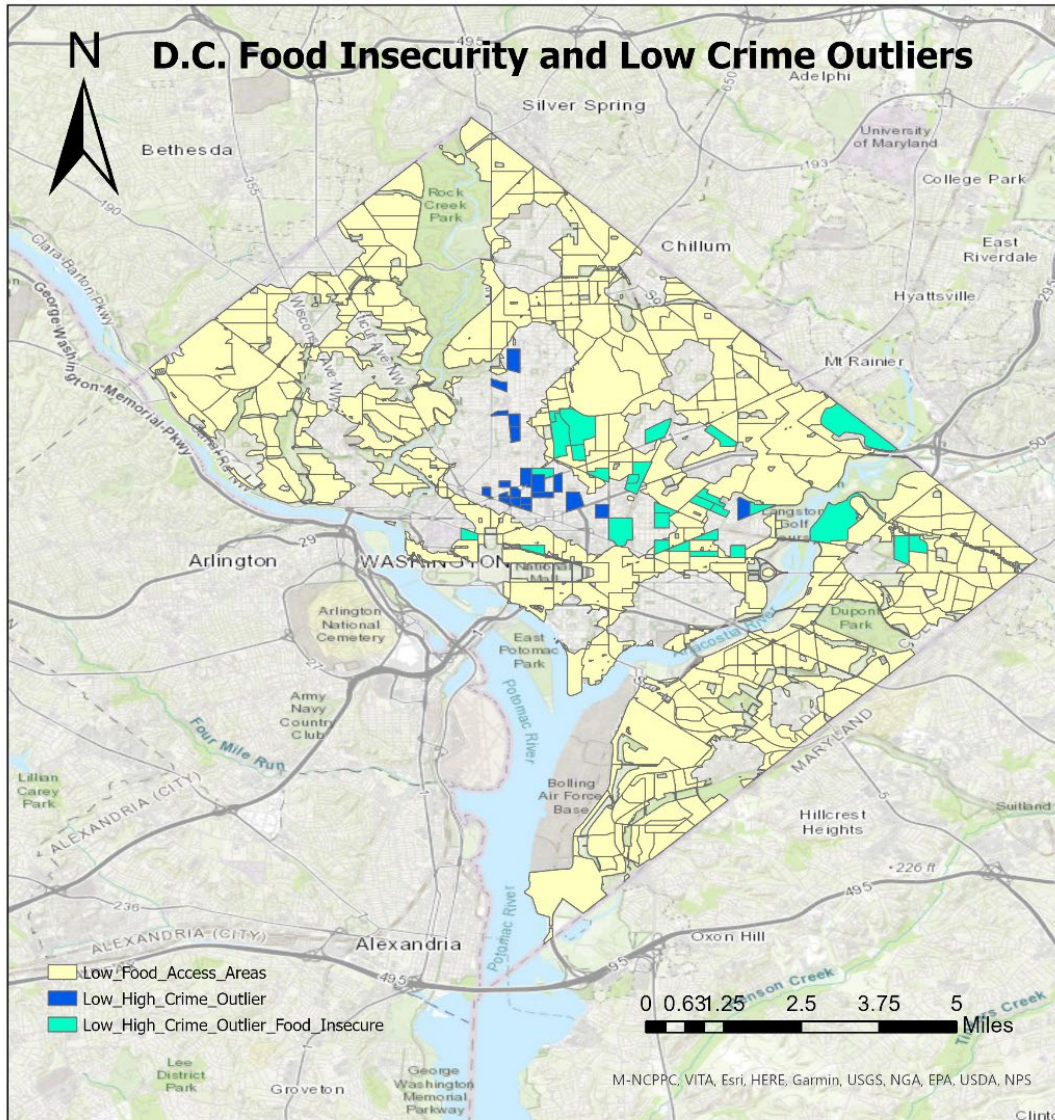
Spatial Reference
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 Map Units: Degree

22 of the 34 block groups found to be crime hotspots in the Getis-Ord Gi test were located in areas that overlapped or intersected with a food insecure area. This accounts for **65%** of block groups that were found to be crime hotspots. This shows that the majority of crime hotspots are partially or fully within areas of the city found to be food insecure.



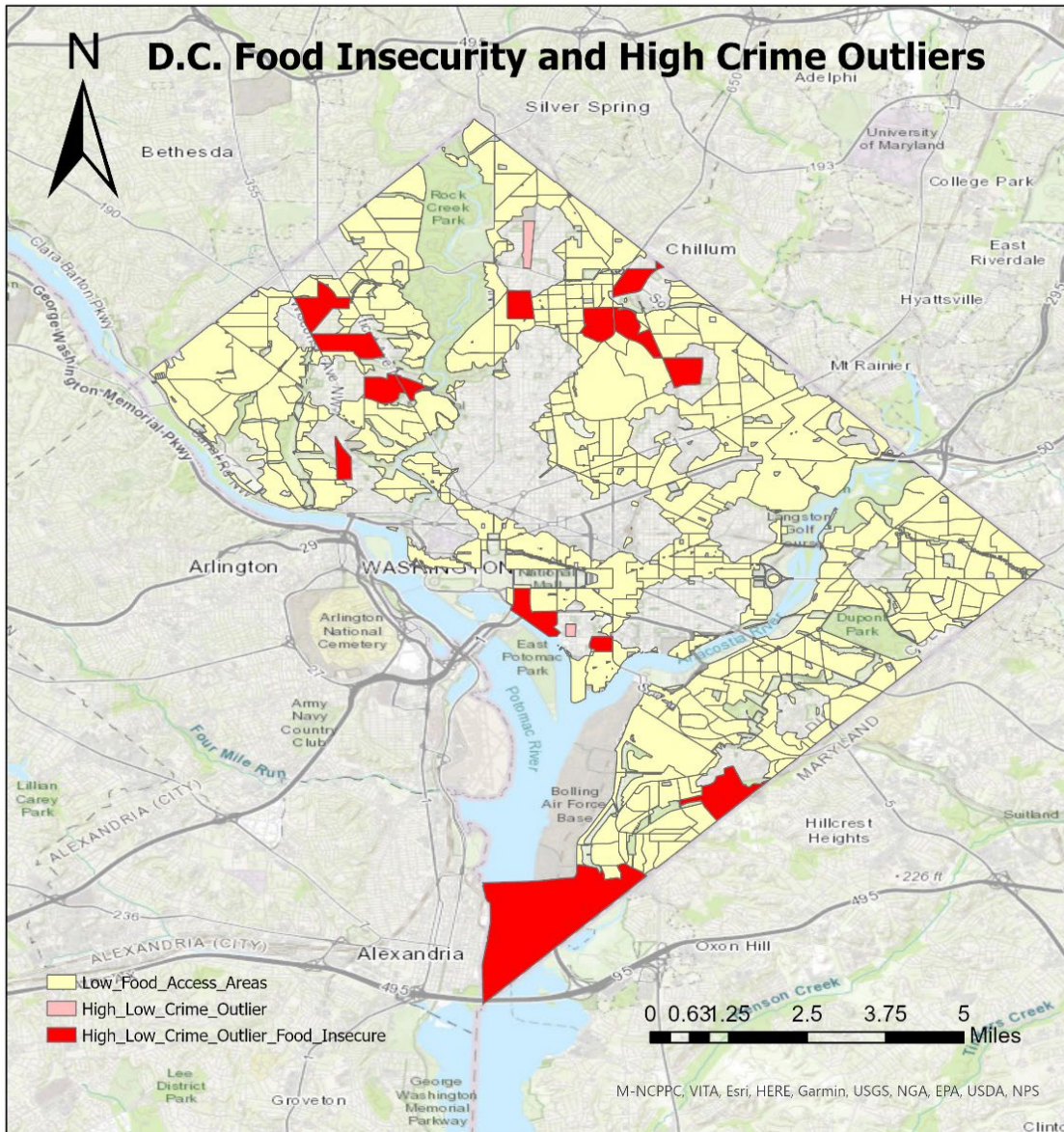
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 GCS: GCS WGS 1984
 Datum: WGS 1984
 Map Units: Degree

28 of the 47 total block groups found to be low crime outliers in the local Moran's I test were located in parts of the city that overlap or intersect with food insecure areas. This accounts for **58%** of low-high outliers. The remaining 42% of low-high outliers were found to be fully within areas that had easy access to food. When compared to the previous map results, we can see that block groups identified as low-high outliers were less likely (**58%**) to be in low-food access regions of the city than block groups identified as crime hotspots (**65%**).



Spatial Reference
 Name: GCS WGS 1984
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 Datum: WGS 1984
 Map Units: Degree

13/15 of the block groups found to be high crime outliers in the local Moran's I test were located in parts of the city found to be food insecure. This accounts for **86%** of high-low outliers. Only two high crime outliers fell fully within areas of the city found to be food secure.



Spatial Reference
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Discussion and Conclusions:

The role of food insecurity as an inflammatory factor in human behavior has long been studied by sociologists, historians, and other academics concerned with examining human societies and the motivations for various human behaviors. Much of this research, however, has primarily been in the context of examining civil conflict and unrest in the developing world within the context of famines and mass societal and environmental events. The idea of studying how these same factors affect the citizens of developed countries within their own borders is a relatively novel concept, but one that has gained an increasing amount of traction among academics. In a 2016 study conducted by Clemson University on violent crime and food insecurity on the county level “The results show that a one percent increase in food insecurity leads to an increase in the violent crime rate of approximately 12 percent holding other predictors of violent crime constant. The impact that food insecurity has on crime rates also changes based on the income level and population of the county.” (2) These findings at the county level appear to hold true at the neighborhood and block group level as well. In my research I was able to discern that 65% of block groups identified as crime hotspots coincided with areas had a low access to food. Conversely, neighborhoods that were demographically similar to crime hotspots were more likely to have a significantly lower crime rate than surrounding block groups if they were located in food secure parts of the city. 42% of block groups with a markedly lower crime rate than adjacent high crime neighborhoods coincided with areas of the city that had adequate access to food. This idea is supported by a concept in existing literature referred to as the sociology of food. “In 1983, Murcott theorized that people associate food with how they live. If people live in a food secure environment, they tend to feel better about themselves and their surroundings” (2) The opposite effect can be seen when examining

high crime block groups occurring within otherwise low crime areas of the city. I found that 86% of block groups in this category overlapped with areas of the city with low food access. Only two block groups found to be high crime outliers were located within areas of the city which have adequate access to food. Ample access to food within a community can increase social cohesiveness and cooperation, while lack of access may have the opposite effect; making people feel as though they are in direct competition for scarce resources. “McIntosh (1996) expounded upon the theory of the sociology of food by arguing that food has the ability to make or break relationships on a social level...The ability to access food without regard to time or place determines what social group people align themselves with” (2). The negative consequences of hunger and low food access are not limited to individuals and families, but communities and cities as a whole. On the other hand, it appears that many of the destabilizing effects of hunger can be addressed simply by increasing the access of impoverished communities to food. This decreases the competition for basic financial and material resources which often flares up as violence and crime and has a measurable positive effect on the security and safety of communities.

References:

(1) Dylan B. Jackson, Jamie Newsome, Michael G. Vaughn, Kecia R. Johnson, *Considering the role of food insecurity in low self-control and early delinquency*, Journal of Criminal Justice Volume 56, May-June 2018, Pages 127-139

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(2) Jonathan R. Caughron, *An Examination of Food Insecurity and its Impact on Violent Crime in American Communities*, Clemson University. ProQuest Publications December 2016, Pages 10 – 11.

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<https://www.sciencedirect.com/science/article/abs/pii/S0167629604000530>

(4) Bernetta D. Kent, *Food Insecurity as a Factor in Felonious or Misdemeanor Juvenile Crimes*, Walden University. ProQuest Dissertations Publishing, 2013, Pages 60 – 67.

<https://www.proquest.com/openview/e35365802664ba3f1162f3aab0cfa93f/1?pq-origsite=gscholar&cbl=18750>

(5) District of Columbia, Office of the Chief Technology Officer, GIS Data Coordinator *Crime Incidents in 2020*, [vector digital data] published January 1 2020, information last updated December 31 2020.

<https://opendata.dc.gov/datasets/crime-incidents-in-2020/explore?location=38.879245%2C-76.977740%2C13.94>

(6) District of Columbia, Office of the Chief Technology Officer, GIS Data Coordinator *Census Block Groups in 2020*, [vector digital data] published September 1, 2021. Data last updated September 28, 2021.

<https://opendata.dc.gov/datasets/census-block-groups-in-2020/explore?location=38.890695%2C-77.031102%2C12.30>

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14, 2021. <https://opendata.dc.gov/datasets/low-food-access-areas/explore?location=38.890927%2C-77.026467%2C12.57>

(8) District of Columbia, DC Office of Planning, *ACS Economic Characteristics DC Census Tract* [vector digital data], published January 27, 2021, Last updated September 28 2021. <https://opendata.dc.gov/datasets/acs-economic-characteristics-dc-census-tract/explore?location=38.867492%2C-76.973878%2C14.13>

(9) District of Columbia, Office of the Chief Technology Officer, GIS Data Coordinator, Roadway SubBlock, [vector digital data], published July 6, 2021 last updated October 18 2021. <https://opendata.dc.gov/datasets/roadway-subblock/explore?location=38.823841%2C-77.011697%2C16.39>