Jack Irwin

Geob 479

Lab 3

Using Crimestat to Analyze and Visualize Crimes in Ottawa

The first order crimes are more spatially aggregated than expected, because the nearest neighbor index values are all well below a value of one, so there is evidence of clustering. Figure 1.1 plots the nearest neighbor index values against the order number for each crime up to the 25th order (nearest neighbor included). Robberies appear to be the most spatially clustered over the 25 orders given the plot in figure 1.1. This may be due to the spatial clustering of robberies in specific areas by densely populated parts of Ottawa where robberies occur and are reported more frequently. All of the crimes' index values increase incrementally in a logarithmic fashion along the plot in figure 1.1 as more nearest neighbors are accounted for. So, when more crime incidents are accounted for the nearest neighbor analyses show slightly less clustering for each crime. Commercial and residential breaking and entering crimes appear to logarithmically increase the most between their first and 25th order compared to robberies and car theft crimes, but their index values by the 25th nearest neighbor order remains below 0.5 which suggests clustering. Commercial breaking and entering crimes are limited to areas where there is commercial business, so one might expect this crime to be the most spatially clustered. Car theft crimes are also limited by where people can park their cars, so there is little opportunity for car thieves in more rural areas and one might also expect this crime to be more spatially clustered. However, these crimes rank second and third as more nearest neighbors are accounted for in the plot. This nearest neighbor analysis reflects how the organization of land use in a city and surrounding area influences the spatial incidence of different types of crime.

The correlogram results in figures 1.3, 1.4, 1.5, and 1.6 help inform crime analysts of the degree of spatial autocorrelation throughout Ottawa for each crime considering different distances between dissemination areas. The correlogram results differ from the nearest neighbor analyses conducted in figure 1.1 because rather than analyzing the specific location of individual crimes to determine the degree of clustering, the crimes are instead attributed to intensities in each dissemination area and then a Moran's I value is determined at different distances between dissemination areas.

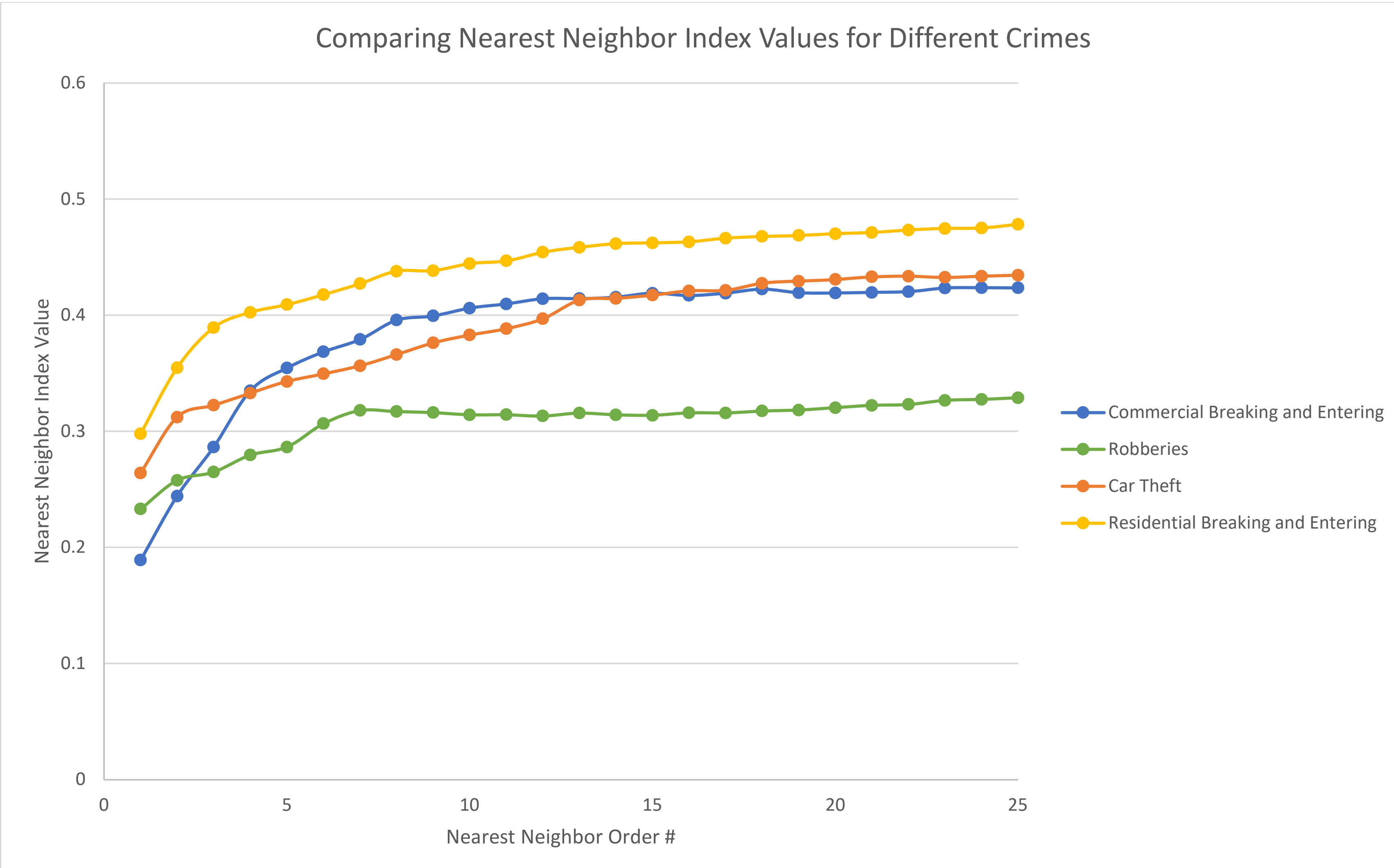
The results of both analyses are similar in showing the distribution of crimes throughout Ottawa are not randomly distributed. The correlograms show that when more space is accounted for, crimes become less spatially autocorrelated. While the nearest neighbor analyses show when more crimes are accounted for, the spatial distribution of different crimes become slightly less clustered. However, the nearest neighbor analyses are not comparing the nearest neighbor indexes with any measure of the distribution of the population. The correlogram showing Moran's I values for population help to provide a more nuanced comparison between the crimes because it provides a baseline for comparison based on population. The dissemination areas all have similar populations, so the correlogram results show a global Moran's I value that is extremely close to zero shown in figure 1.2, which resembles a random distribution.

Interestingly, the correlogram results for breaking and entering crimes in residential areas shown in figure 1.3 has the highest Moran's I value, which suggests the most spatial autocorrelation of all of the crimes analyzed. This differs entirely from the ranking of clustering in the nearest neighbor index analysis shown in figure 1.2 where residential breaking and entering crimes are ranked the lowest in clustering. This phenomenon may be due to the arbitrary borders of dissemination areas which influences the intensity of each crime measured.

Furthermore, commercial breaking and entering crime has the lowest Moran's I value shown in figure 1.6. This also differs from the nearest neighbor index results and might suggest that dissemination areas have organized the intensity of crimes related to commercial businesses more randomly than the actual instances of these crimes throughout the Ottawa region.

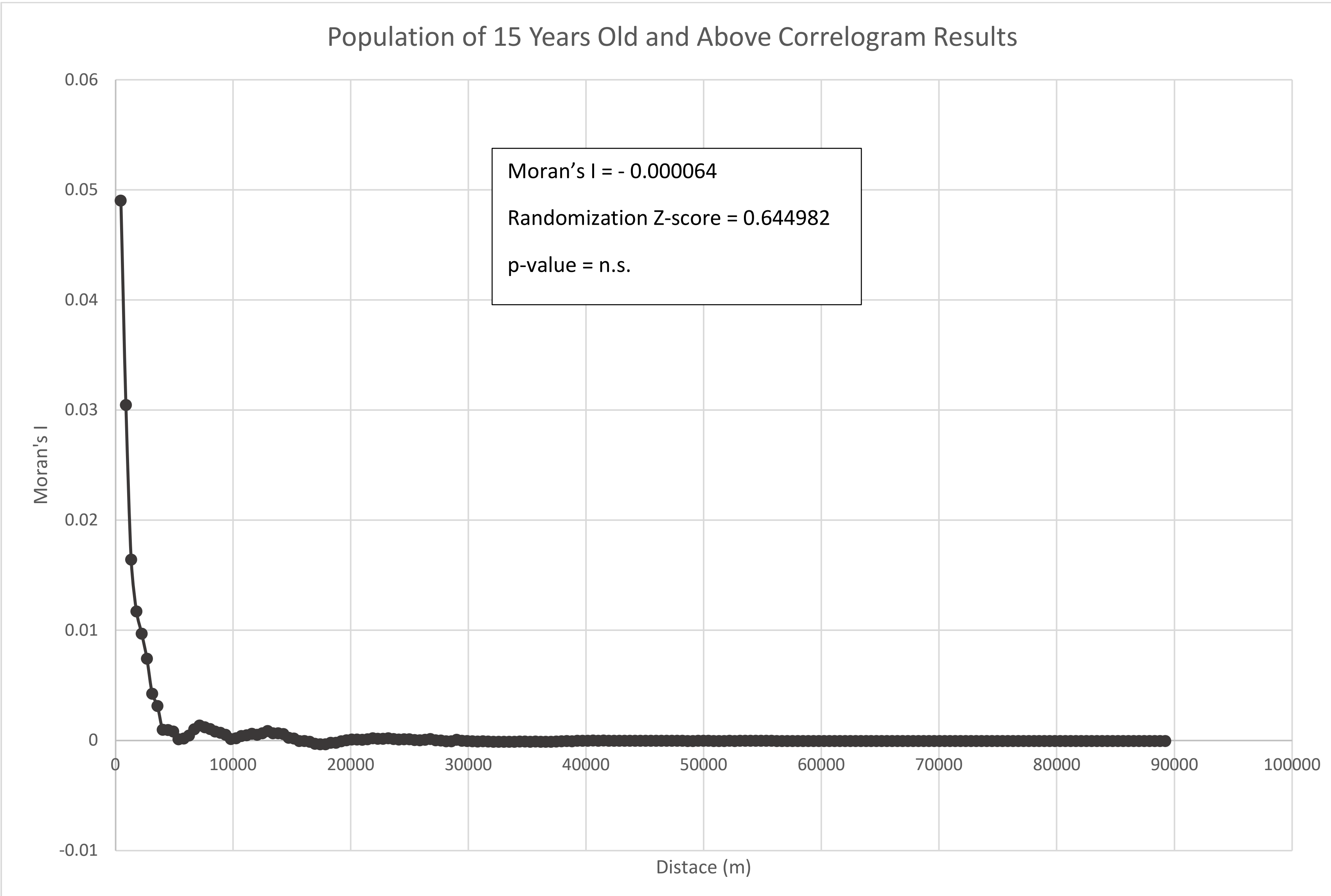
Figure 2.1 shows results for a hot spot analysis of residential breaking and entering crimes in central Ottawa. The bright red dots are slightly enlarged to show that there are two notable clusters of hot spots (i.e. red dots) where the frequency of residential breaking and entering crimes are highest in central Ottawa. Each dot resembles the location of a crime and the associated frequency of crimes found within a 750-meter radius of the crime. Residential areas just southwest and northeast of the two central red dotted clusters appear to show the second highest frequencies of hotspots with most dots appearing magenta. The map is underlaid with a land use categorization scheme meant to highlight the residential areas in central Ottawa, because residential breaking and entering crimes are being analyzed.

Figure 1.1



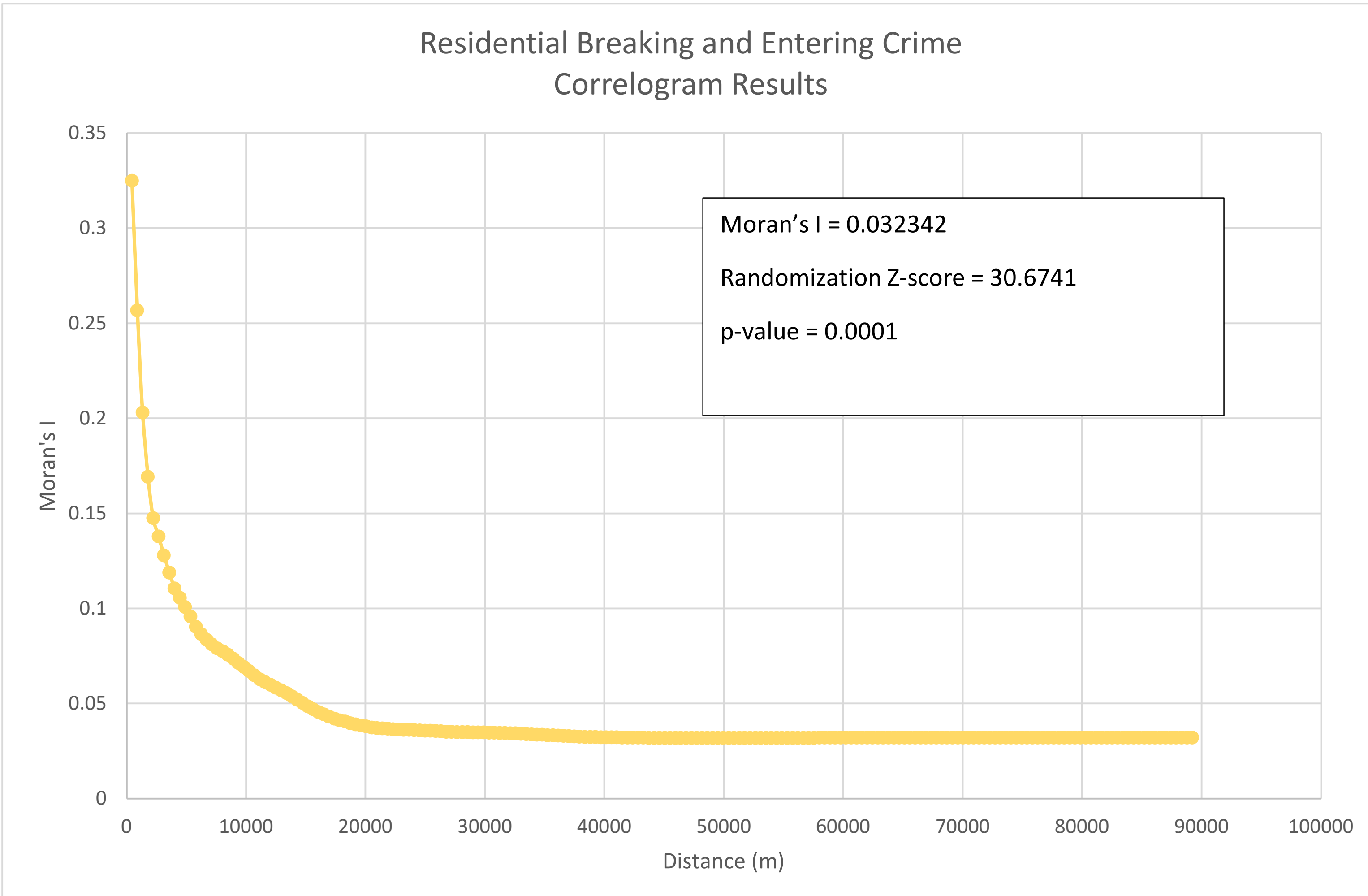
Comparing Nearest Neighbor Index Values for Different Crimes
0.6
0.5
0.4
0.3
0.2
0.1
0
Nearest Neighbor Index Value
0
5
10
15
20
25
Nearest Neighbor Order #
Commercial Breaking and Entering
Robberies
Car Theft
Residential Breaking and Entering

Figure 1.2



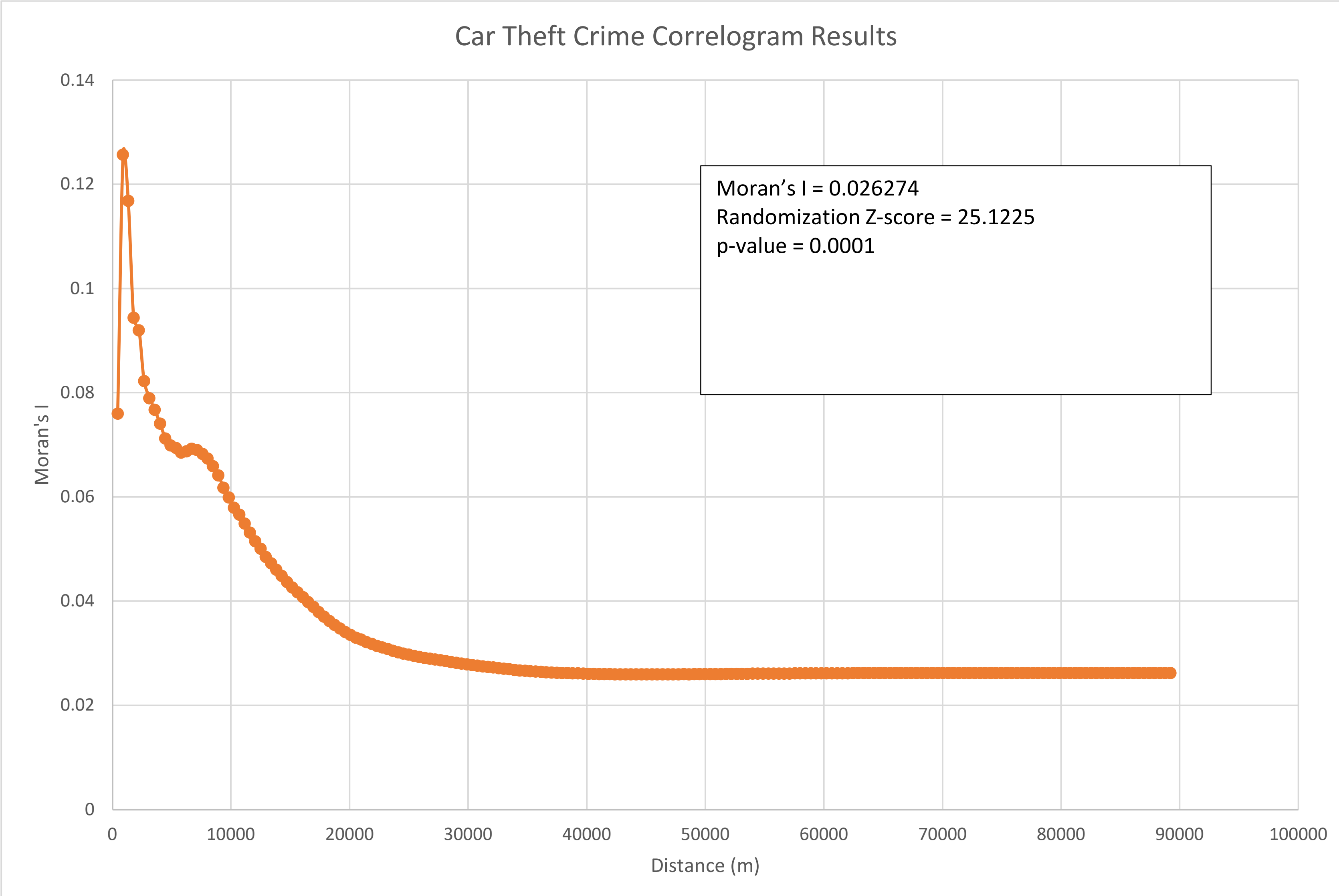
Population of 15 Years Old and Above Correlogram Results
Moran's I = - 0.000064
Randomization Z-score = 0.644982
p-value = n.s.
Moran's I
0.06
0.05
0.04
0.03
0.02
0.01
0
-0.01
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
100000
Distace (m)

Figure 1.3



Residential Breaking and Entering Crime
Correlogram Results
Moran's I = 0.032342
Randomization Z-score = 30.6741
p-value = 0.0001
Moran's I
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
100000
Distance (m)

Figure 1.4



Car Theft Crime Correlogram Results
Moran's I = 0.026274
Randomization Z-score = 25.1225
p-value = 0.0001
Moran's I
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
100000
Distance (m)

Figure 1.5

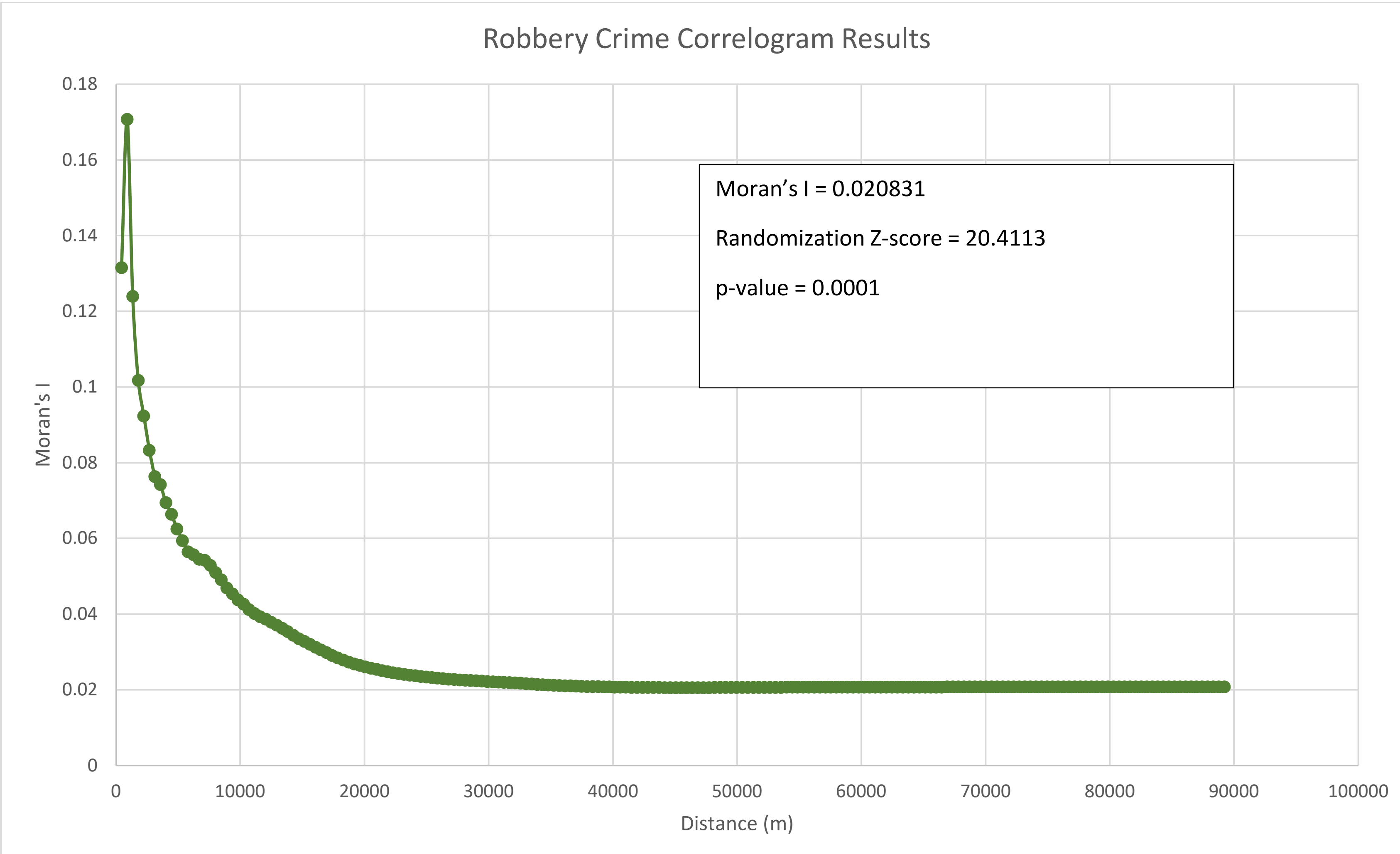

Robbery Crime Correlogram Results
Moran's I = 0.020831
Randomization Z-score = 20.4113
p-value = 0.0001
Moran's I
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
100000
Distance (m)

Figure 1.6

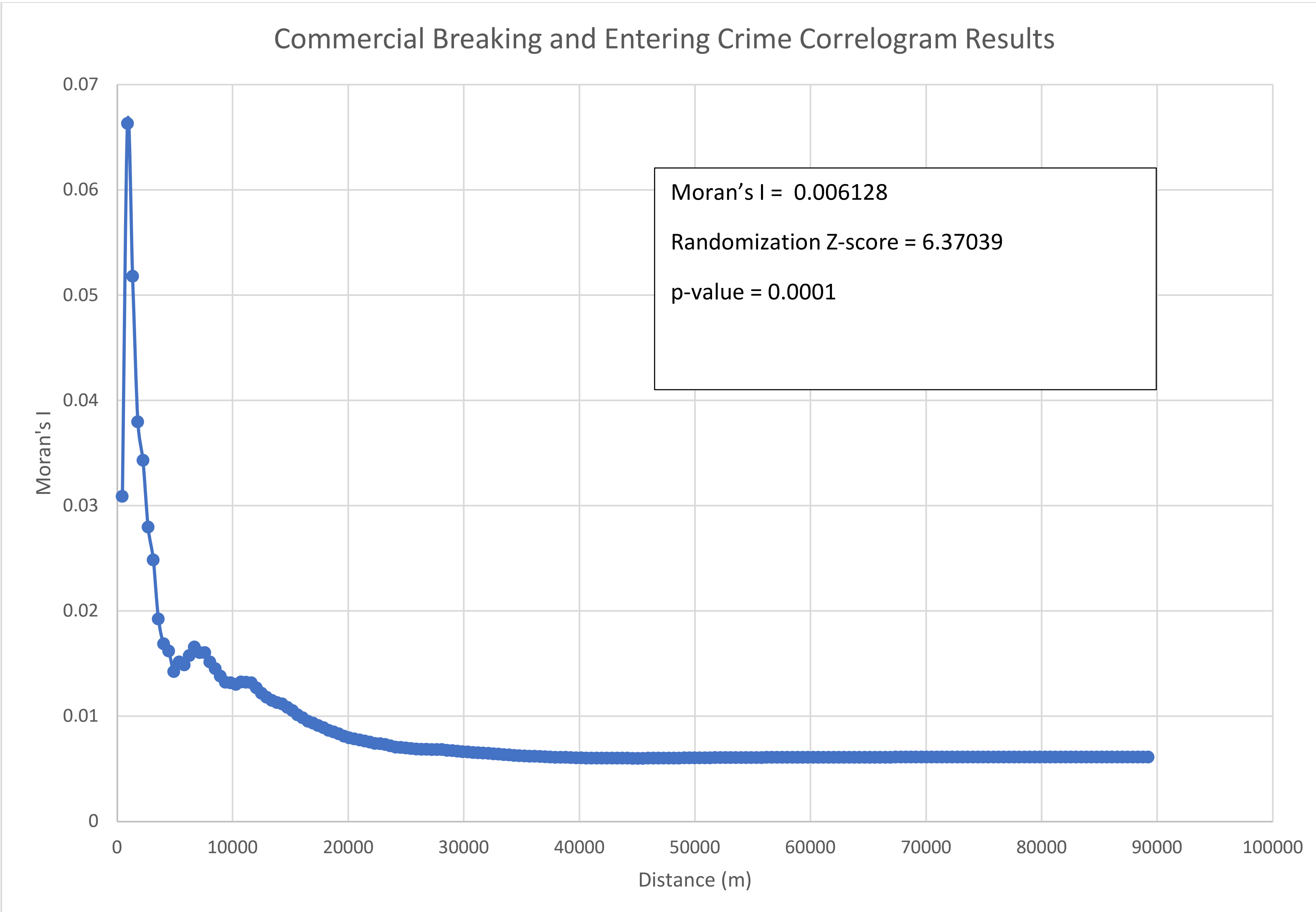
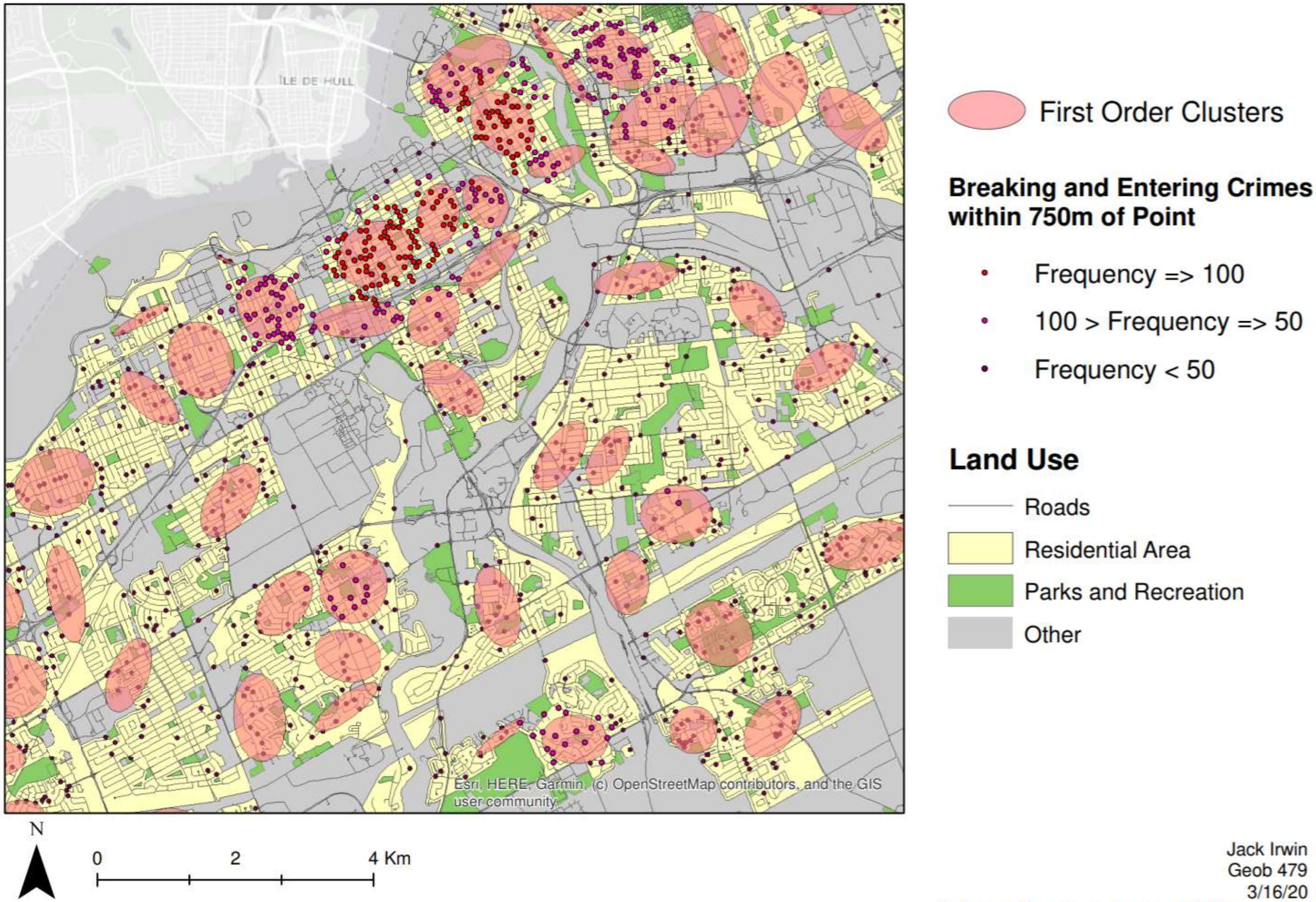

Commercial Breaking and Entering Crime Correlogram Results
Moran's I
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
100000
Distance (m)
Moran's I = 0.006128
Randomization Z-score = 6.37039
p-value = 0.0001

Figure 1.7

First Order Clusters of Breaking and Entering Crimes in Central Ottawa



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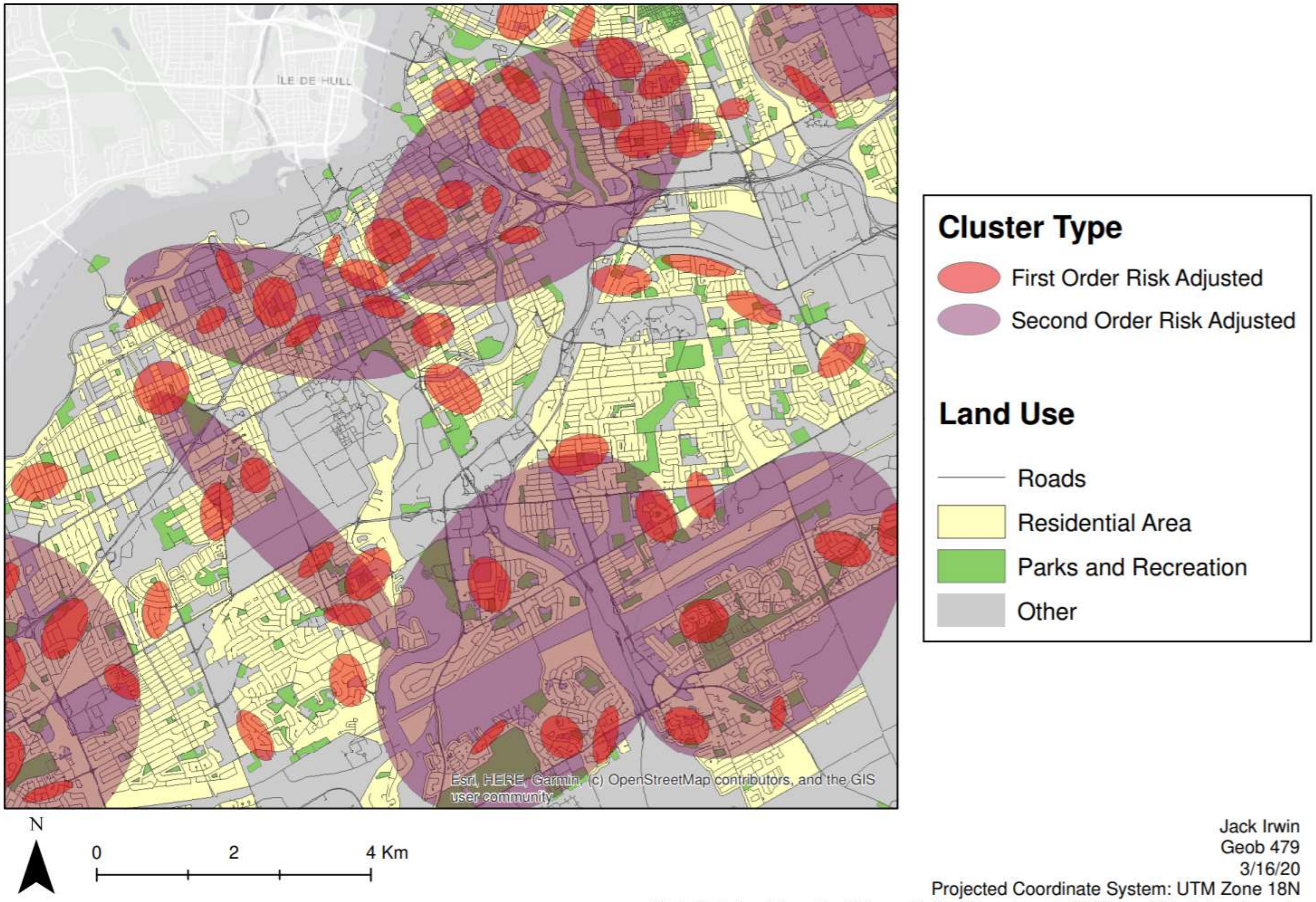
Projected Coordinate System: UTM Zone 18N
Data Retreived from the Ottawa Police Department, DMTI, and Statistics Canada

Figure 1.8

First and Second Order Clusters of Breaking and Entering Crimes in Central Ottawa Adjusted for Population



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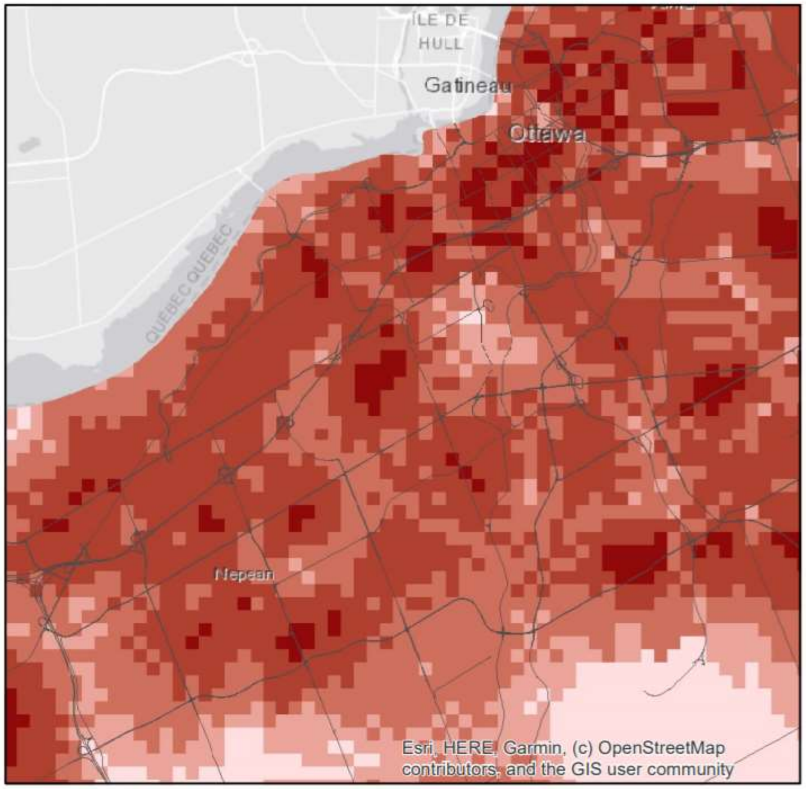
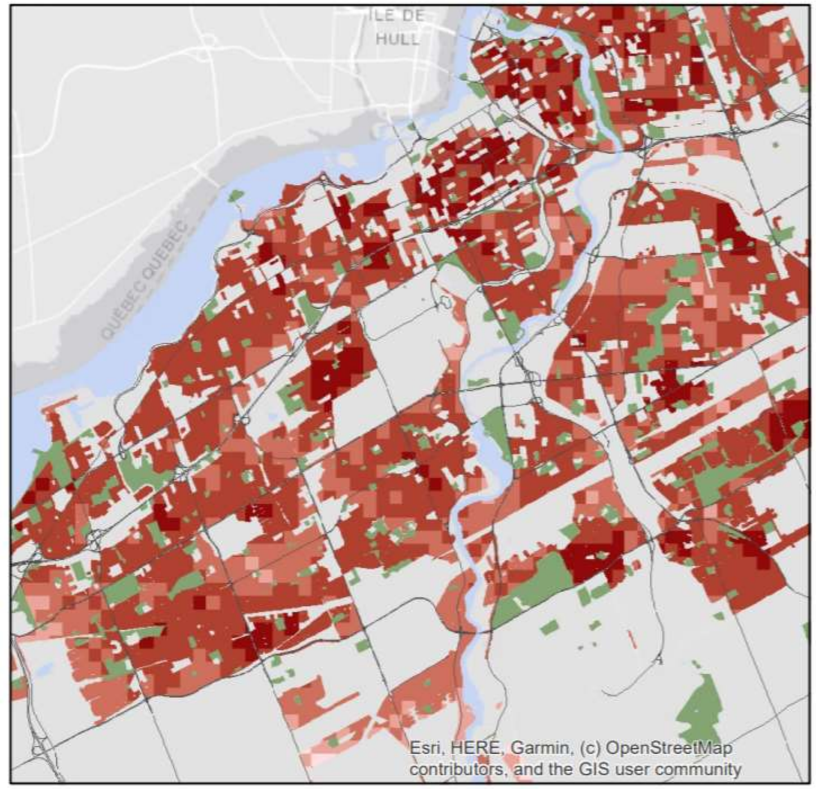
Projected Coordinate System: UTM Zone 18N
Data Retreived from the Ottawa Police Department, DMTI, and Statistics Canada

A Kernel Density Surface Analysis of the Potential Risk for Residential Break-ins in Ottawa

2.1 A full view of Greater Ottawa and the kernel density surface of Residential Break-ins interpolated via CrimeStat III



2.2 The same kernel density surface as 2.1, but clipped to the residential areas of Greater Ottawa. Other land use areas also defined.



Potential Risk of Residential Break-in

- 1% - 2%
- 2% - 3%
- 3% - 4.5%
- 4.5% - 6.5%
- 6.5% - 10%

Land Use

- Water Body
- Parks and Recreation
- Other
- Main Roads

Jack Irwin
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3/20/20
Projected Coordinate System: UTM Zone 18
Data retrieved from Ottawa Police Department, DMTI, and Statistics Candada