

Crime Pattern Analysis in Binghamton Area by Exploiting Exploratory Spatial Data Analysis

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Introduction

Crime has been a global phenomenon for centuries. Governments try to reduce crime rate in order to guarantee a better living environment for residents. As for individuals, choosing a place with low rates of criminal activity is always important for them and their families.

Uniform Crime Reporting (UCR) of Federal Bureau of Investigation (FBI) declares that violent crime rate **increased 1.7 percent** in the number of crimes filed in records during the first half-year in 2015 when compared with statistics published for the same period in 2014. The cardinal number of property crime is **2,478,661**.

Data

20 days for onsite data collection

448 violent crimes in record

2088 property crimes in record

38829 parcels in the study area

Data source:

Crime Data (2013):
The City of Binghamton and the Village of Johnson City Police Departments.

Demographic Data :
U.S. Census Bureau
Parcel data from GIS Portal in Broome County;
Onsite visit for every sample location in person;

Null Hypotheses

H_{01} : There is no spatial clustering of the crime points.

H_{02} : Existence of dogs has no relationship with crime points.

H_{03} : Existence of Garage has no relationship with crime points.

H_{04} : Vegetation has no relationship with crime points.

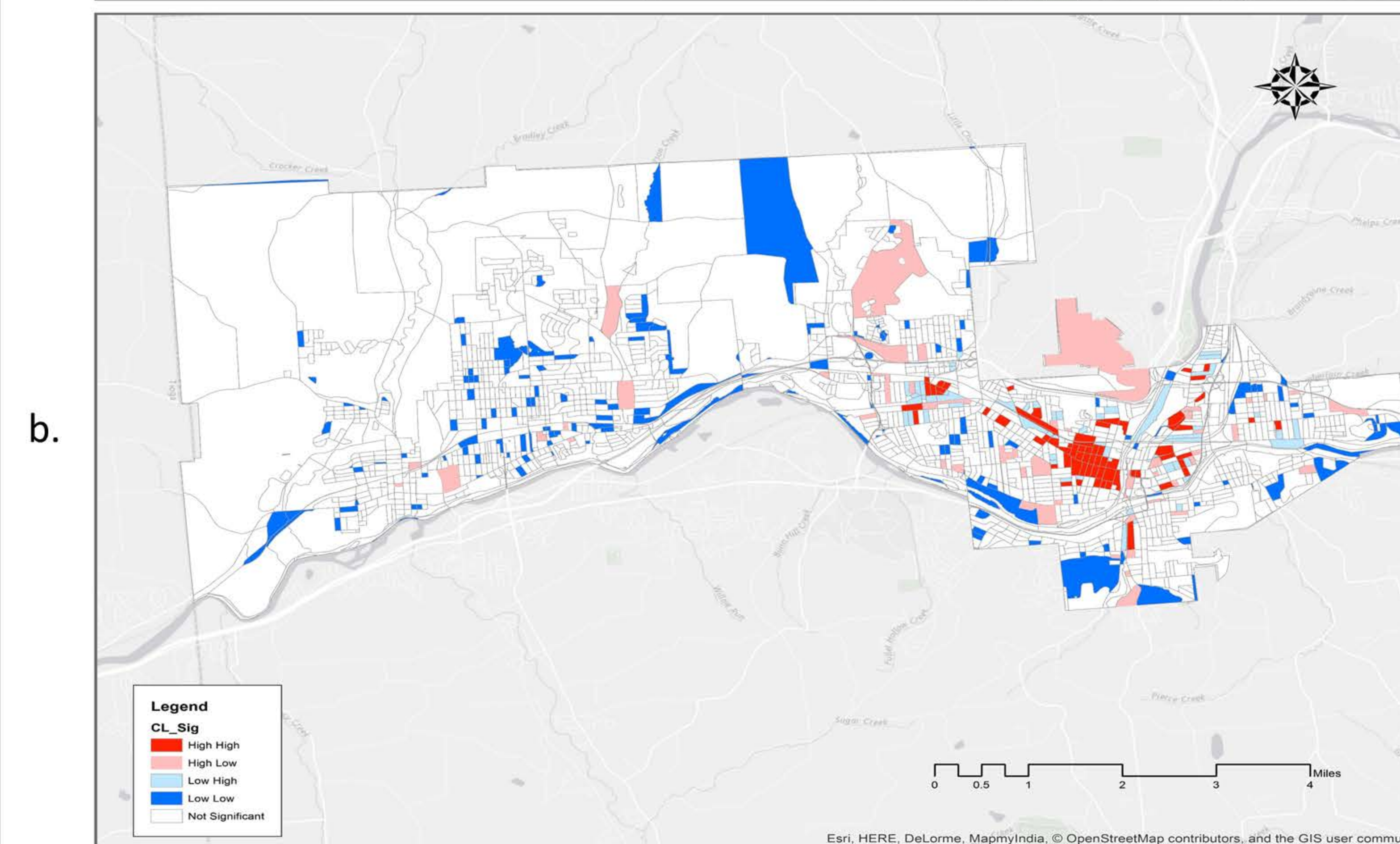
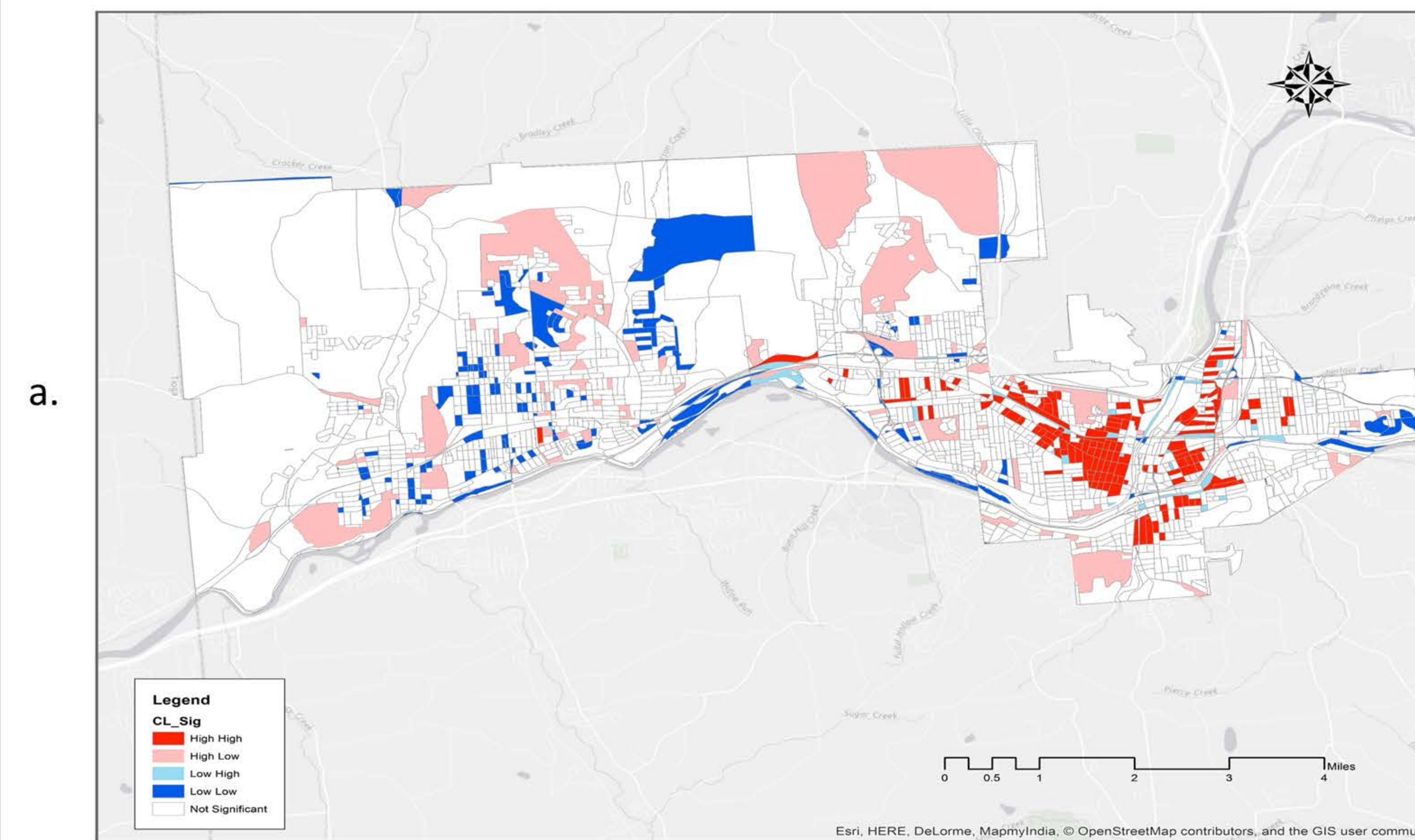
Methodology

- Using exploratory spatial data analysis (ESDA) to examine if crime events clustered in the Binghamton metropolitan area.
- Using Logistic Regression to explore the link between crime events and variables in the list.

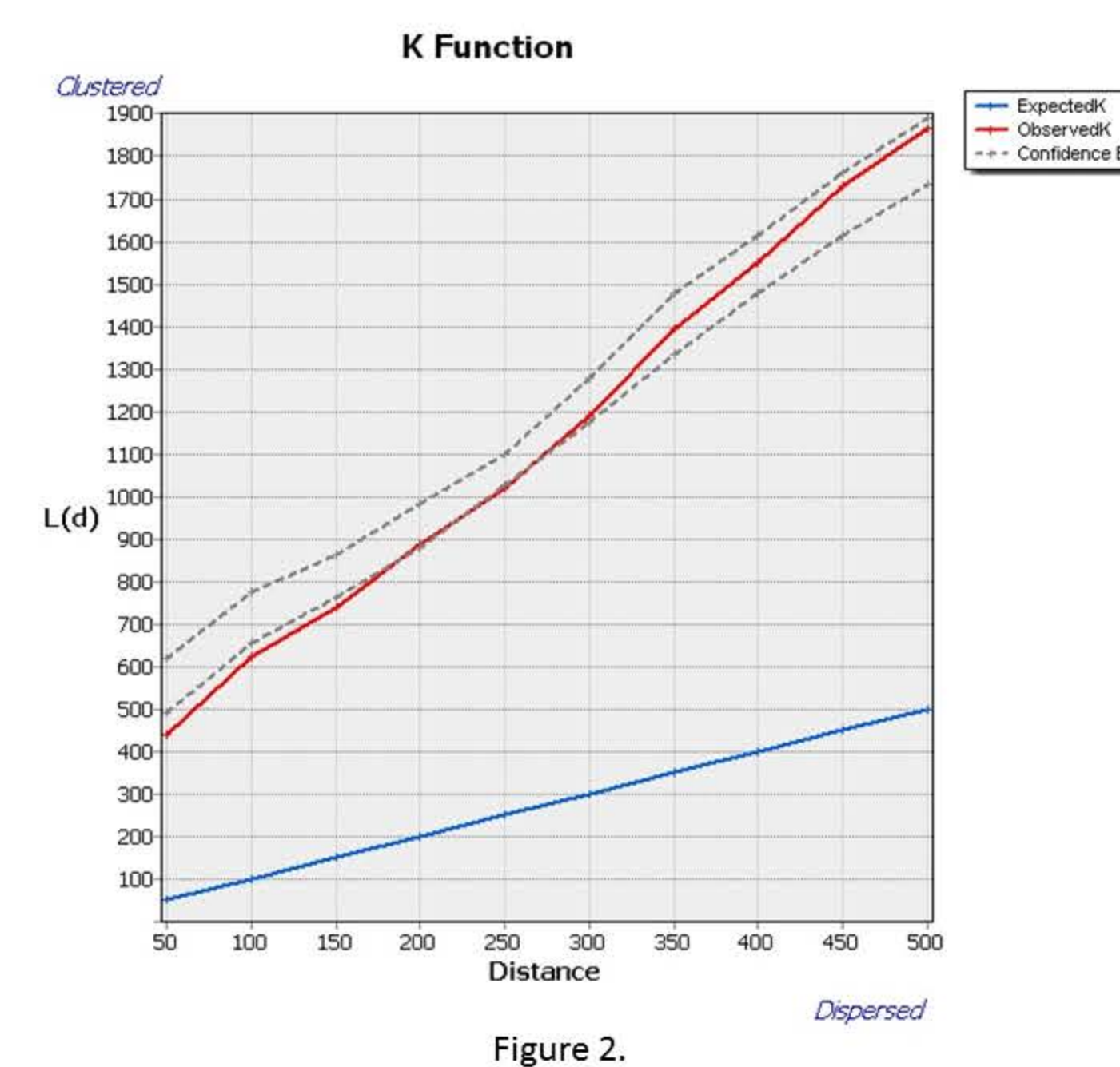
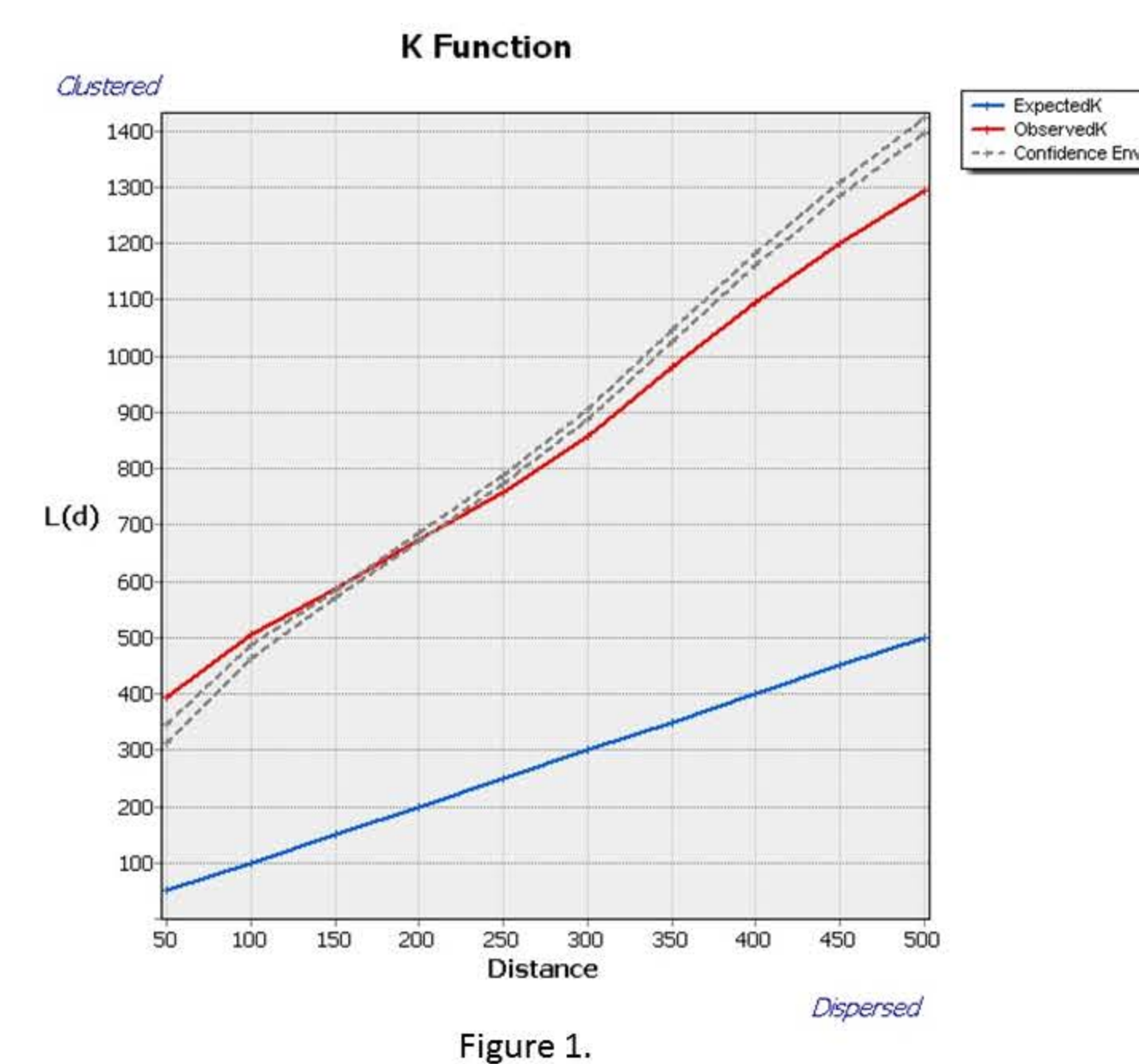
- Demographic variables: Housing age, Total House Value, Year of the House, House Size
- Environmental variables: Garage, Driveway, Window bar, Existence of Alarm, Neighborhood Watch Sticker, Existence of Porch, Vision of the front door, Vision of the house, Existence of Fence/Walls, Percentage of vegetation in the block,
- Other variables: Existence of Dogs/sign of 'Be aware of dogs'

Results

1. Anselin Moran's I



2. Ripley's K function



Results

Figure 3. Violent Crime

| | B | S.E. | df |
|---------------------------------------|---------|----------|----|
| Existence/Signs of Dog | -24.314 | 2008.627 | 1 |
| House Hidden by Objects | -8.116 | 4.289 | 1 |
| Front Door Visible | -60.946 | 3661.303 | 1 |
| Access to Bus Stop | 34.61 | 2903.762 | 1 |
| Percentage of Vegetation in One Block | -78.833 | 39.659 | 1 |

Figure 4. Property Crime

| | B | S.E. | df |
|------------------------|--------|-------|----|
| Existence of Garage | -0.52 | 0.184 | 1 |
| Existence/Signs of Dog | -1.295 | 0.259 | 1 |
| Existence of Porch | -0.635 | 0.192 | 1 |
| House Hidden | -1.27 | 0.178 | 1 |

3. Logistic Regression

Discussions & Conclusions

- Discussions
 - We reject the first null hypothesis and claim that the crime data are spatial clustering in the study area.
 - We reject H_{02} H_{03} H_{04} and accept that the variables are statistically related to crime occurrences.
- Conclusions
 - Crime occurrence shows highly aggregation in the center of the Binghamton, Endicott and Johnson City and low clustering at the edge of the study area.
 - Ripley's K function graphics showcase that crime events are significantly (90% confidence interval) clustered at block group level (the average radius of block group is about 350 meters). Property crimes cluster at the distance between 200 and 250 meters. Violent crimes aggregate at the distance between 200 and 500 meters.
 - Vegetation percentage in a neighborhood has a strong negative relationship with violent crime. If the door of a house is visible, the chance of occurrence of violent crime decreases. We also find out that concentrated bus stop locations could facilitate violent crimes. Additionally, according to the statistical analysis, having a dog can significantly reduce crime occurrence.
 - Vision of a house may be blocked by trees and fences around the houses by the owners. However, the fences and trees indicate the territory lines among the houses to prevent crimes. Porches allow for outdoor entertainment which could increase the surveillance on potential crimes.

References

- Deng, C & Ma, J. (2014). Viewing urban decay from the sky: A multi-scale analysis of residential vacancy in a shrinking U.S. city. *Landscape and Urban Planning* 141, 88–99
- Yao, J; Murray, A. T; Agadjanian, V; & Hayford S. R. (2012). Geographic influences on sexual and reproductive health service utilization in rural Mozambique. *Applied Geography* 32 601-607.

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