# THE IMPACT OF POOR STREET LIGHTING ON CRIME IN THE BRONX

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## INTRO

In this article, we investigate the relationship between poorly lit areas in The Bronx and crimes commonly thought to occur in the dark. Hot Spot Analysis, Inverse Distance Weighted interpolation, and slope are used to explore this relationship. Crimes such as larceny, burglary, robbery, and theft are considered. Throughout we will use the word "crime" to exclusively mean these crime types. We define poorly lit areas as areas that experience a high volume of 311 complaints regarding poor street light conditions due to a missing or damaged streetlight. We hypothesize that poorly lit areas are more susceptible to the crimes listed. The results, however, demonstrated the opposite: areas of more reported crime experienced fewer 311 complaints.

## DATA SOURCES

Four datasets were used from NYC Open Data to carry out this project: 311 complaints, NYPD complaints (crimes), NYC building footprints, and NYC boundaries. Before conducting any analyses, 311 complaints and NYPD complaints were properly queried in NYC open data for necessary information, exported to a shape file, and set with like projections (NAD83 State Plane NY LI).

Filtering for time with less sunlight, crime occurrences were selected between 6:00 PM and 6:00 AM. Both crime and 311 calls were queried from January 1st, 2018, to June 30th, 2018. June 30th,2018 was the latest date provided in the 311 datasets when this article was written.

## METHODOLOGY

We first created a study space to analyze the impact of poor street lighting on crime. Using ArcMap's "erase tool" building footprints were 'cut out' from the geographic boundary of the Bronx, excluding indoor spaces from our study space.

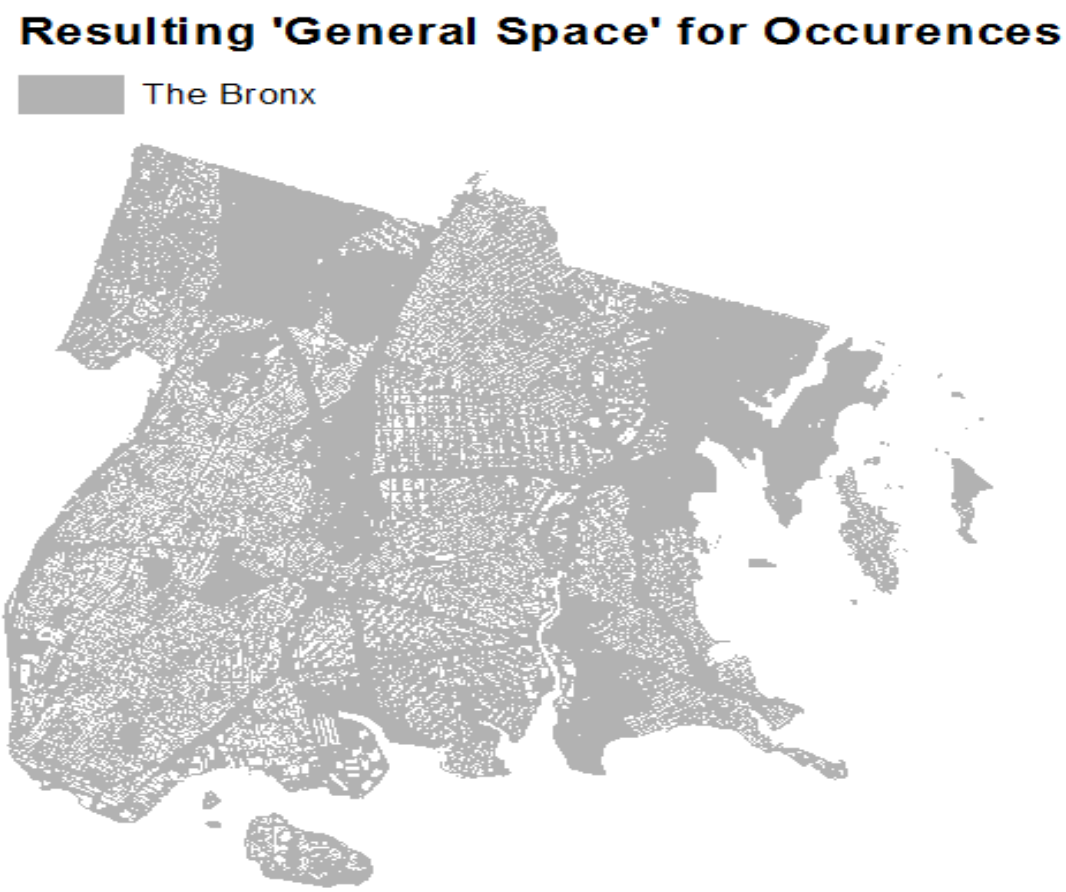


*Figure 1. Study space.*

Two optimized hot-spot analyses were performed using ArcMap: one for crime locations and another for 311 complaint locations. ‘Hot’ and ‘Cold’ spots were determined using the Getis-Ord Gi* statistic at confidence intervals 90%,95%, and 99%, signifying the spatial clustering is likely based upon a ‘pattern’ of low or high occurrences. For Instance, if a 90% confidence interval is given for a weighted point location, then it is 90% likely that location is related to a spatially correlated cluster; with a 10% probability that it is not. Figures 2 and 3 display the results of the optimized hot-spot analyses, for crime occurrences and 311 complaints, respectively.

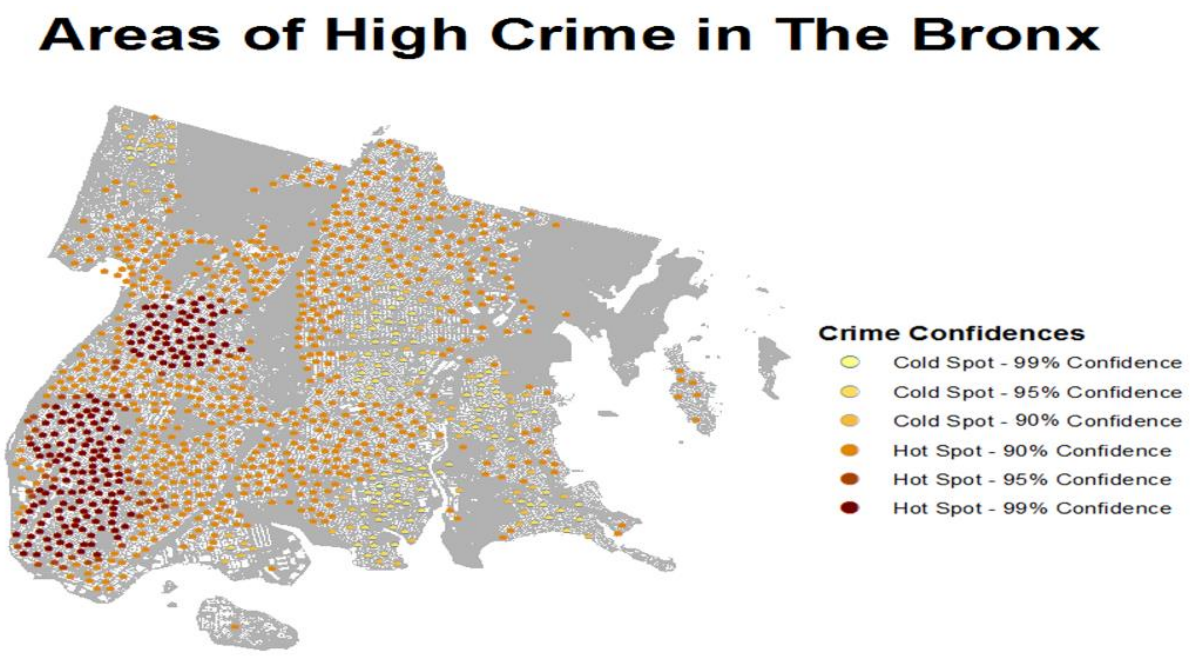


Figure 2

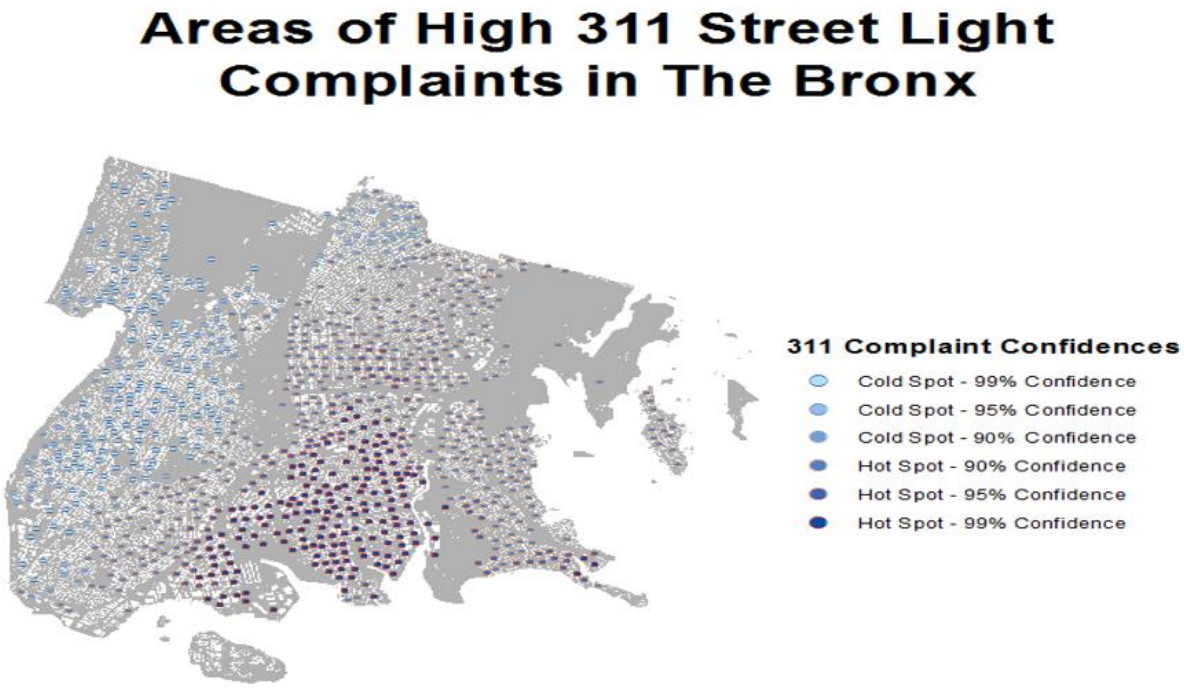


*Figure 3*

Both figures 2 and 3 represent weighted points, a parameter option of the optimized hot spot analysis from ArcMap's spatial statistics toolset. The weight points should not be taken as the locations of crime or 311 complaints.

Once the weighted points were interpolated, an Inverse Distance Weighted (IDW) tool was used to forecast crime and 311 calls throughout The Bronx. IDW creates a forecasted cell surface (raster) based on the weighted average of known values with a given distance. The weights are based on the inverse of the distance to each known point with a neighborhood. IDW assumes closer points are more related to each other than those farther apart.

Figures 4 and 5 demonstrate our results for crime and 311 complaint locations, respectively. Resulting from the IDW analyses were forecasted z-scores, which were then converted into confidence intervals.

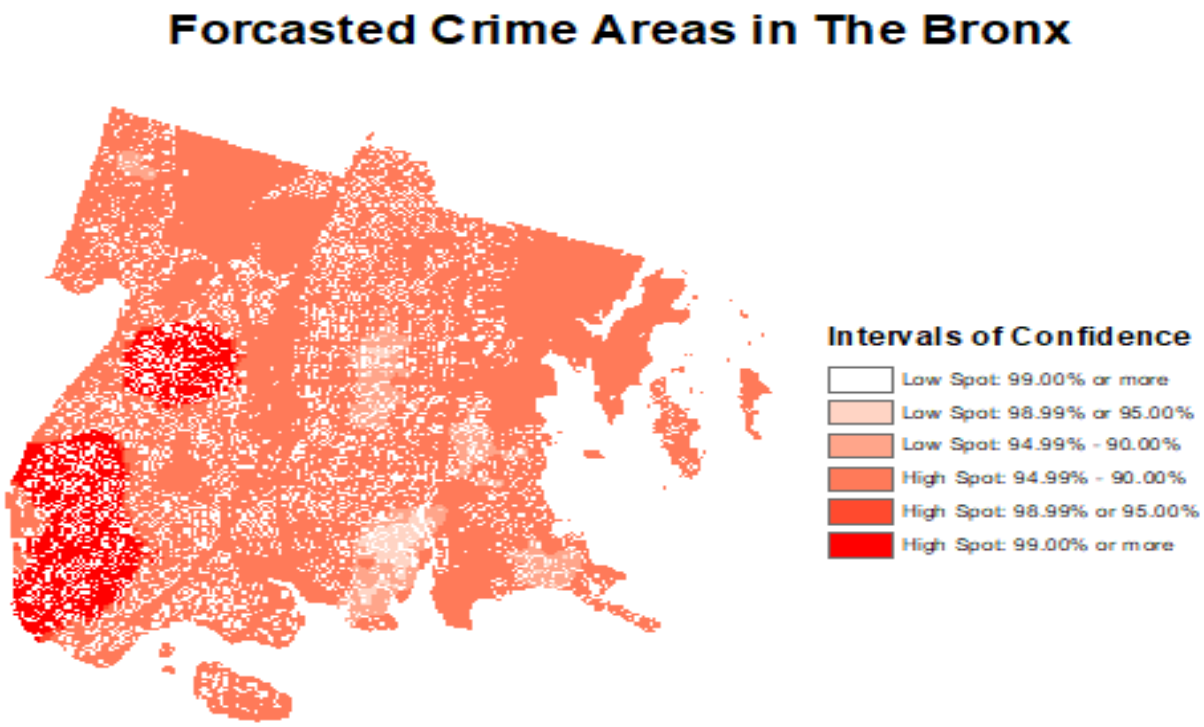


*Figure 4*

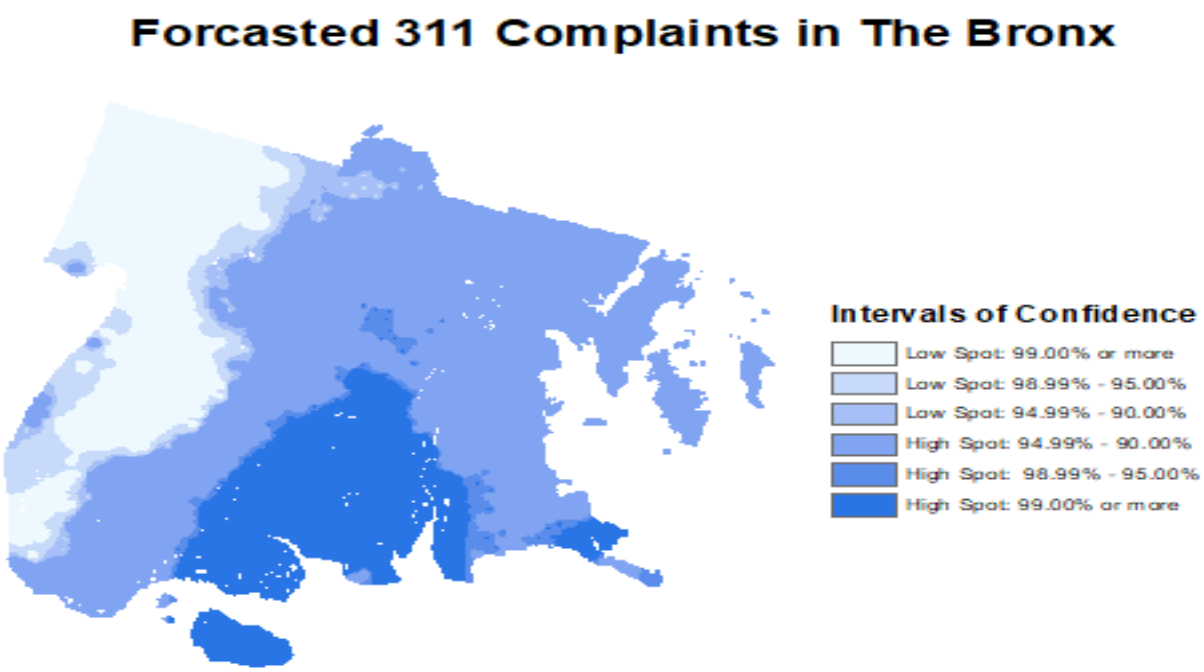


*Figure 5*

## RESULTS

Figures 2-5 show that the hypothesis is largely disproven. In the South Bronx Crime "hot spots" with a 99% confidence level are found in "cold spots" of 311 complaint locations with a 99% confidence level. In North Riverdale, Riverdale, Fieldston, Kingsbridge, and Spuyten Duyvil we observe cold spots of 311 complaint locations. 311 calls seem constant in these areas. Crime fluctuates in the North Riverdale area where we see cold spots with 90%, 95%, and 99% confidence intervals. However, a little south of North Riverdale, we observe crime hot spots with a 90% confidence interval in Riverdale, Fieldston, Kingsbridge, and Spuyten Duyvil. In other words, areas that experience less 311 calls regarding poor lighting also experience a mixture of high and low levels of crime. The inverse claim can be made. Areas that experience high levels of 311 calls experience also experience a mixture of high and low levels of crime. We see this in neighborhoods like Soundview, Castle Hill, Union Port, and Hunts Point. We will explore some reasons why the data does not support the hypothesis.

NYPD complaint (crime) data are ***reports*** of crime made by the public eye. This means that in areas with poor street light conditions, it is more probable that residents ***cannot*** see the crimes occurring to report them accurately, especially in urban settings. 311 complaints are also just reports of an incident. Someone can call about the same incident multiple times. Depending on the neighborhood, residents may consider poor street lighting to be the least of their worries.

## FUTURE INVESTIGATIONS

We will compare the rate of changes (slopes) of crime and 311 calls to assess if there is any spatial relationship between the two. In Figure 6 we see ring-like areas in yellow, orange, and red which represent significant change in crime rate. The continuous green surface represents where the slope is unchanging (near zero). The outer-ring areas experience less crime at a constant rate(see Figures 2 and 4). Conversely, the inner-ring areas experience more crime at a constant rate (see Figures 3 and 5).

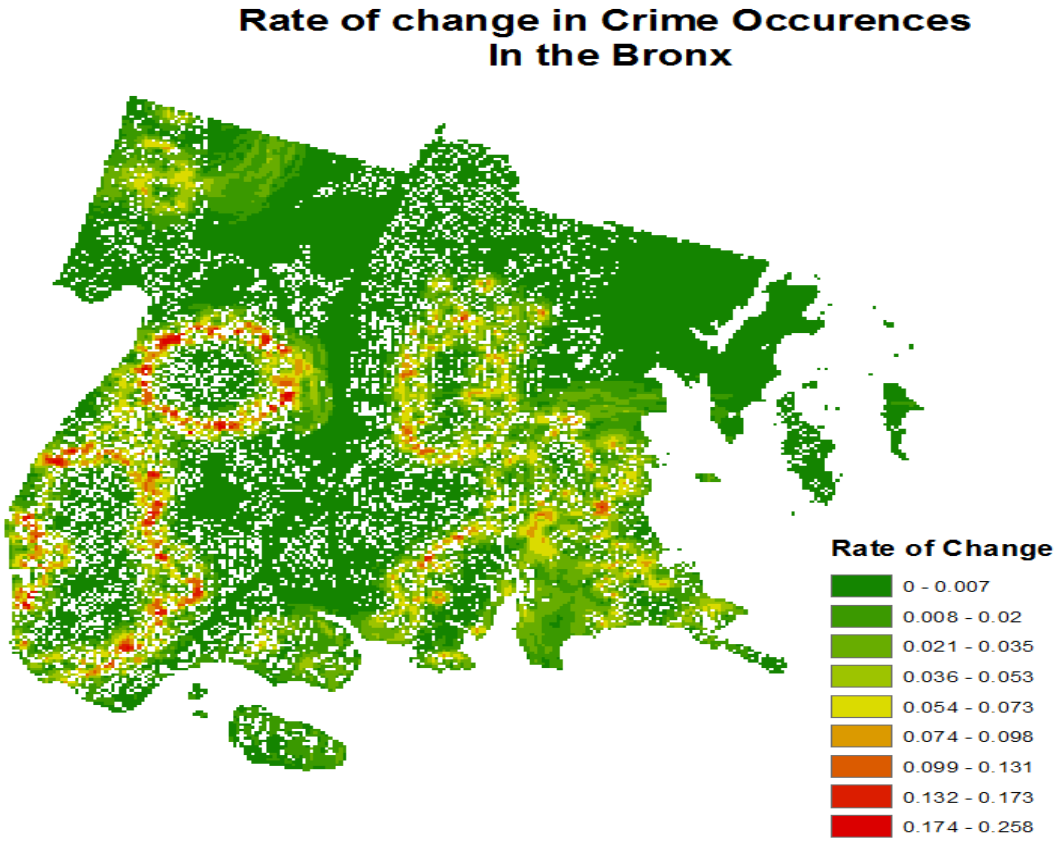

*Figure 6*

In Figure 7 we do not see significant slope changes in 311 complaint calls. Call rates gradually transition from high to low volume across the Bronx. This was not apparent in Figures 3 and 5.

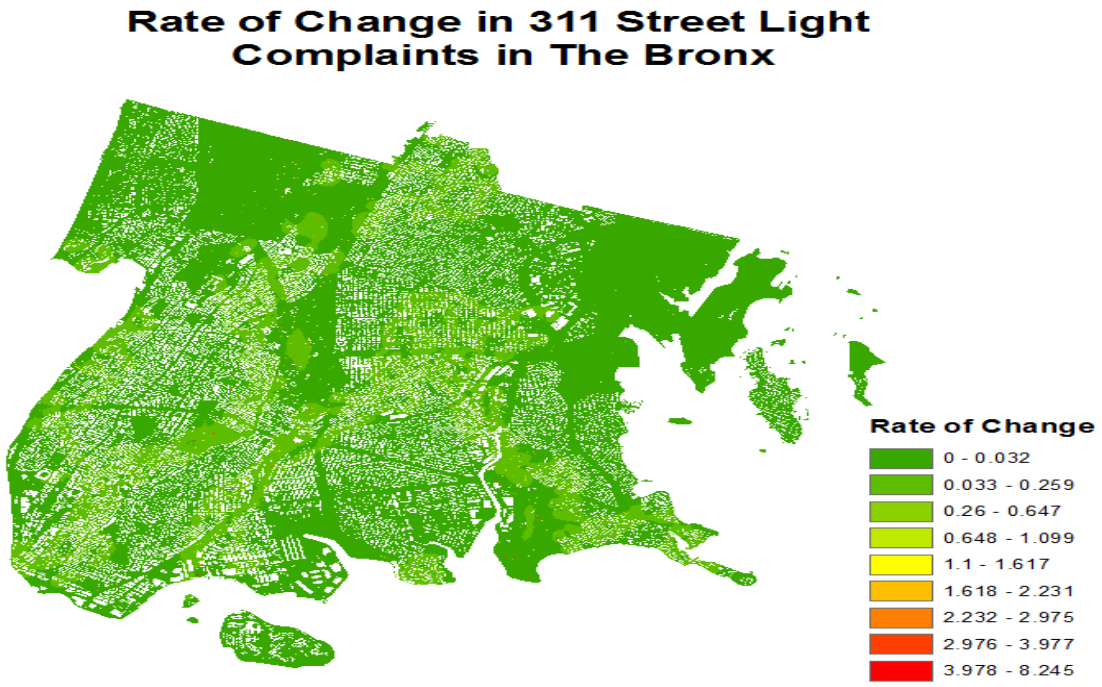


*Figure 7*

In a future study, we may reduce our study to residential areas and adjust the date range for 311 calls. A call can be made weeks or months prior to crime, so adjusting to 6 months prior (June 2017) may change our results. We can also look to normalize the data using population since crime may vary in more populous areas.