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Crime analysis in the city of baton rouge and BREC park based on crime location quotient and hotspot method

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CRIME ANALYSIS IN THE CITY OF BATON ROUGE AND BREC PARK BASED ON CRIME LOCATION QUOTIENT AND HOTSPOT METHOD

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ABSTRACT

City parks provide intrinsic environmental, aesthetic, and recreation benefits to our cities and their inhabitants. Some researchers indicate that City parks serve as places of reduced crime and actually increase the safety of the surrounding area. Other researchers claim that city parks have been seen as contested space. The purpose of this thesis research is to study the relationship between parks and crime or comparing crime types between parks and their cities. First, this thesis research address the difference between crimes in city parks compared to crimes in the entire city. The second research question addresses the impact that parks have on crime in areas adjacent to them. The third research question is whether BREC parks could be identified as crime hotspot. The reported crime data analyzed in this study are from the city of Baton Rouge, LA, from January 1 2011 to December 31 2016. The parks data set is provided by the East Baton Rouge Parish Recreation and Park Commission (BREC). Statistical methods (Chi-Squared Test), "crime location quotient" (CLQ) and hotspot method (Gi^*-statistic) were applied to test the relationship between the density of crimes in parks, their surrounding areas, and the city. The main conclusion from this thesis research is that the composition of crime types for all BREC parks is significantly different from the composition if crime types for the city of Baton Rouge from 2011 to 2016 and for all six years, combined. The results from CLQ analysis confirms that crime does not seem to be clustered in BREC parks compared to the city of Baton Rouge, but the surrounding areas of parks (0-200 feet buffer, 201-400 feet buffer, 401-600 feet buffer) attract events of crime. Some parks could be identified as crime hotspots Based on analysis of Gi^* - statistic.

CHAPTER 1. INTRODUCTION

City parks provide intrinsic environmental, aesthetic, and recreation benefits to our cities and their inhabitants. They are also a source of positive economic benefits. They enhance property values, increase municipal revenue, bring in homebuyers and workers, and attract retirees (Crompton, 2001). City parks provide additional non-monetary benefits such as relaxation, public access to recreation, and a respite from the asphalt and concrete of the city environment (Burgess et al., 1988). Specifically, these parks provide a community area for people with no outdoor space that can call their own (Demotto and Davies, 2006; Jacobs, 1961). The community area where community members from various economic and social classes can interact and, through this interaction, promote the development of social cohesion and the formation of 'strong community identities' (Reeves, 2000).

City parks also serve as places of reduced crime and actually increase the safety of the surrounding area (Groff and McCord, 2012). For instance, Jacobs (1961) states that neighborhood parks may attract more families and conventional users to an area, and this increase in legitimate city park users may help both the park and surrounding neighborhood areas to become safer, because of added informal control and surveillance. What is more, parks with facilities such as sports infrastructures, children's playgrounds, and nighttime lighting should be attractive to conventional users, and contribute most to an increase in overall safety (Groff and McCord, 2012).

However, an opposing view is that city parks are identified as dangerous places because parks are public rather than private and they are often viewed as places with a high probability of crime activities (Knutsson, 1997). In these situation, parks produce fear to potential users. Although some studies have written about park and fear of crime (Westover, 1985), little

research directly and empirically examines the relationship between parks and crime. To better understand the connection between crime and city parks, local, regional, and national security authorities have turned to new decision support tools like Geographic Information Systems (GIS) to do crime analysis. Crime analysis is the qualitative and quantitative study of crime and police-related information in combination with socio-demographic and spatial factors to apprehend criminals, prevent crime, reduce disorder, and evaluate organizational procedures. When law enforcement agencies conduct crime analysis in city parks, they want to know whether parks are crime generators and what the impact of parks on crime in the areas adjacent to them is. Crime generators are places to which large numbers of people are attracted for reasons unrelated to criminal motivation. These places provide large numbers of opportunities for offenders and targets to come together in time and place which produces crime and disorder (Brantingham and Brantingham, 1995). In other words, some places including shopping malls, transportation hubs, festivals, and sports events attract many people that will, by definition, attract a certain proportion of people who are motivated offenders. Another concept that needs to be explained is crime attractor. Crime attractors are places affording many criminal opportunities that are well known to offenders (Brantingham and Brantingham, 1995). For example, bars, pawn shops, and large non-secure parking lots increase the number of potential offender drawn to them. On the contrary, crime detractors are objects or areas that discourage potential offenders for some reasons (Sypion-Dutkowska and Leitner, 2017). One possibility to address the above issues is by means of the location quotient which compares the characteristic of the sub-area under study to that of the larger, surrounding region (Groff and McCord, 2012). This quotient can be applied to indicate whether city parks being generators, attractors, or detractors of crime.

While the location quotient method can reveal the role that city parks play in shaping the crime profile of an area, it fails to reveal where crimes tend to occur. The spatial distribution of crime incidents across a geographic area is not even. This feature of crime events distribution can be described as an "inherent geographical quality" and is explained by theories such as the ecology of crime (Brantingham and Brantingham, 1981). Therefore, there are some areas that have high crime intensity, which are called crime hotspots. The common understanding of a hotspot is an area that has a greater than average number of criminal or disorder events, or an area where people have a higher than average risk of victimization (Eck et al., 2005). The concept of a hotspot is really useful in crime analysis for city parks. Firstly, people are somewhat aware of which places are safer and which places possess a higher risk of being a victim of a crime, so people visit or tend to live in some locations while they avoid others. Secondly, the concept of hotspot is beneficial to police tactics. Hotspots help law enforcement agencies understand crime distribution patterns, and police commanders can make appropriate decisions about allocating police resources. Because hotspot analysis uses statistical analysis in order to define areas of high occurrence versus areas of low occurrence, it is an important tool in crime mapping. Hotspot crime mapping is an effective and widely used analytical technique which uses retrospective crime data to identify crime hotspots. After finishing hotspot crime mapping, crime pattern theory allows making generalized statements about area hotspots, and hotspot areas can be predicted using crime pattern theory (Brantingham and Brantingham, 1999). Therefore, there is a possibility to forecast the occurrence of future crime events in city parks. In order to test the accuracy of prediction, the hit rate, which is the percentage of crime events that falls within hotspot areas produced from historical crime data, is used. Another evaluation measure is the predictive accuracy index (PAI), which provides a measure of how reliable a retrospective

hotspot is able to predict future crime events relative to the size of hotspots (Chainey and Tompson, 2008). Furthermore, Levine (2008) provides an improvement for PAI, which is called the recapture rate index (RRI). These two indices (PAI, RRI) provide a solid foundation for more comprehensive comparison of predictive hotspot methods across study areas.

Nevertheless, little research directly and empirically studying the relationship between parks and crime or comparing crime types between parks and their cities have been conducted so far. The research proposed in this Master Thesis seeks to answer the following three questions. The first question will address the difference between crimes in city parks compared to crimes in the entire city. There is a possibility that predominant crime types that occur in city parks are different from crime types happening in the city. The second research question addresses the impact that parks have on crime in areas adjacent to them. In general, it can be hypothesized that some city parks are crime generators and thus have significant crime rates. Therefore, crime will decrease as distance from parks increases. The third research question is whether BREC parks could be identified as crime hotspot using one popular hotspot method. Statistical methods and GIS were then applied to test the relationship between the density of crimes in parks, their surrounding areas, and the city.

CHAPTER 2. LITERATURE REVIEW

Evidence links parks and crime, usually though parks seem to be more dangerous than other areas of the city (Schroeder and Anderson, 1984). A possible reason is that city parks are often difficult to police because their boundaries are complex by comparison with streets and buildings. Often, the police do not have accurate data on exactly what crime is happening in city parks (Hilborn, 2009). Parks are also difficult to patrol, they are hard to look up crime occurring in city parks, and it is difficult to install alarm systems, because parks with more naturalistic settings often inhibit surveillance and closed-circuit television (CCTV) is unlikely to be able to cover the whole park (Burgess, 1994). In order to study the relationship between city parks and crime, some studies point out the following two perspectives: (1) How potential users view a park (Schroeder and Anderson, 1984), and (2) how potential offender view a park (Michael et al., 2001). Michael et al. (2001) examine the relationship between park setting and auto burglary. The result shows that situational features including surveillance, escape, concealment, and movement patterns are used by offenders and that offenders adapt their behaviors to the opportunities and risks provided by each setting in a city park. Hilborn (2009) focuses on the relationship between alcohol usage and crime risk in 28 parks in Chula Vista, CA. The author finds that violent crime and disorder are concentrated in a subset of parks, while most parks have litter crime problems.

Most previous research, however, does not test whether the perceived relationship between parks and safety is confirmed through official crime data or police calls-for-service data (Groff and McCord, 2012). Knutsson (1997) uses survey of residents near the park and local business owners and relate this information to park drug arrests for narcotics use and sales in the parks. One study researches the relationship between parks, crime, and property values by using

official crime data to quantify the distribution of crimes at parks (Troy and Grove, 2008). The author chooses parks with at least 50 percent vegetation and 4.9 acres in size. Crime is calculated as an average of robberies and rapes, because these indicators are most relevant to resident's perception and fear of crime in parks and both crimes can occur at random. The final result shows that parks of similar crime level (low, medium, high) are not spatially clustered in the same area of the city and that the crime level in parks is not correlated with the size or shape of parks. Another study tests the crime impact of the Boston South-West corridor parkland on large linearly-shaped parks, and finds that the proximity to large linearly-shaped parks resulted in a somewhat higher number of police call service (Crewe, 2001). Finally, Groff and McCord (2012) study the influence of neighborhood parks on three different crime types, including violent crime, property crime, and disorder crime. By using the location quotient method, the authors find that neighborhood parks are related with an increased level of crime, especially of disorder crime.

Parks are also mentioned in a series of studies attempting to explain the impact of parks on crime in areas adjacent to these parks. Some studies find a significant relationship between adjacency to open space and recreational areas and increased risk of victimization (Herbert, 1982). Crewe (2001) finds that urban, linearly-shaped parks and their neighborhoods show slightly lower level of property crime. In order to test the impact of parks on surrounding areas, Groff and McCord (2012) create different distance zones around neighborhood parks in the study area of Philadelphia, PA. Results show that neighborhood parks including their surrounding areas, measured as between 400 to 800 feet buffer areas, have high crime location quotients by comparison with the city. Another study evaluates crime incidences near parks in the US State of Kansas using GIS buffer analysis and proximity analysis. This study demonstrates that parks

that are surrounded by neighborhoods with extreme resource deprivation do not serve beneficial social roles (Demotto and Davies, 2006). The authors find that if parks are located in a neighborhood with high levels of resource deprivation, parks are associated with high level of social disorder. Therefore, these parks with high levels of density of crime may be serving as a criminal marketplace and not contributing social benefit to the society (Demotto and Davies, 2006).

Jacobs (1961) states that parks can be amenities or nuisances depending upon their design and on the urban area in which they are situated. In particular, she emphasizes how the surrounding land use is an important factor. Places with mixed land use tend to draw more "eyes on the street" because they draw a combination of visitors and residents who are on the street at different time periods during the day (Groff and McCord, 2012). The overall effect of places with mixed land use achieves a more consistent stream of "eyes on the street". In order to further explain the relationship between land use and the effects that parks have on crime, some researchers create a category of land use that includes business-oriented public land use, resident oriented-public land use, and separate parks from playgrounds and schools in order to examine each of them as individual variables. The present study estimates violent crime and burglary across 100 Seattle, Washington, neighborhoods. They find that parks increase violent crime, but it is moderated by neighborhood instability, which means that park in unstable neighborhoods are related to decrease violent crime. However, parks increase burglary in both business-oriented public land use, and resident oriented-public land use of neighborhoods (Wilcox et al., 2004). LaGrange (1999) tests the influence of neighborhoods, shopping malls, and public high schools on three crime types including mischief, transit vandalism, and park

vandalism by using multiple regression methods. He points out that high schools and mall areas located in neighborhoods with higher unemployment concentrate property crime.

Clarke (1983) points out that characteristics of parks may have influenced their capacity for situational crime prevention. For instance, bulletin boards are erected when the parks have a request by "friends of the park" groups (Groff and McCord, 2012). These visible signs in the park convey the message that government cares about the park and it may potential protect this area (Clarke, 1983). Lighting is another characteristics of parks may impact the level of crime. Field lighting and walkway lighting could help users see each other during darkness time and act as informal guardians for one another.

Some researchers have provided valuable ideas for dealing with the antisocial personality disorder (ASPD)[1] and criminal acts occurring in city parks (Hilborn, 2009). This study focuses on helping police to take an important leadership role in reclaiming a city park from crime and disorder and determining that the park's facilities can benefit a broad spectrum of citizens (Hilborn, 2009). The results of this study involve the direct intervention by motivated people, such as legitimate users and park personnel, who organized the take back effort. These people chose to become natural guardians of their parks. Knutsson (1997) also studied police actions in Vasaparken, Swed between the spring of 1990 and spring 1991. One result shows that "the placement of a dog toilet on the hill to encourage legitimate users to frequent the area where drug use was most prevalent and the redesign of the area around the drug- in bench to improve visibility" apparently decreased drug dealing in the park. A large number of qualitative problem-oriented policing strategies and their outcomes have been applied to specific troublesome parks

[1] ASPD is a personality disorder, characterized by a pervasive pattern of disregard for or violation of the rights of others.

(Pendleton and Thompson, 2000). The authors advise that the police could concentrate on blocking access to the park during the night or removing physical elements like elevator, interior corridors necessary for criminal behavior. In another case, drug use areas are opened up to natural surveillance through landscape management techniques (Pendleton and Thompson, 2000).

As mentioned above, the current exploration of relationship between parks and crime are different. Some studies show that neighborhood parks are associated with an increased level of crime. Another researches display that parks serve beneficial society role to community. Parks can be amenities or nuisances depending upon different factors, such as surrounding region and land use of park, crime type, and so on. The research proposed in this Master Thesis seeks to answer three questions which were discussed as a part of introduction. Even if some researches study the impact that parks have on crime in areas adjacent to them and the level of crime to specific characteristics of parks, there is no study concentrating on testing crimes in city parks compared to crimes in the entire city statistically.

CHAPTER 3. STUDY AREA, DATA, AND METHODS

3.1 The study area

The study area for this research is the city of Baton Rouge, LA, which is located on the eastern bank of the Mississippi river. The total area of the city is 87.91 square miles. The boundaries of the city of Baton Rouge extend from -91.235043 °W to -90.999351 ° E and from 30.338386 ° S to 30.558984 ° N (Figure 3.2). Based on 2010 US census data (https://www.census.gov/2010census/), there were 229,542 residents living in the city of Baton Rouge. The racial makeup of the city was 39.4% white, 54.5% black, 0.2% Native American, 3.3% Asian, 3.3% Hispanic, and 1.3% two or more races.

The city of Baton Rouge is located in the East Baton Rouge Parish (EBRP). EBRP is the largest parish in the U.S. state of Louisiana (Figure 3.1). As of the 2010 census, the area of the EBRP is 470 square miles. There were 440,770 residents in the EBRP. The racial makeup of the Parish was 49.5% white, 45.9% black, 0.3% Native American, 3.0% Asian, 3.8% Hispanic, and 1.2% two or more races. Besides the city of Baton Rouge, there are the cities of Baker, Zachary, and Central located in the EBRP but outside of the city of Baton Rouge (Figure 3.3).

The primary law enforcement agency serving the city of Baton Rouge is the Baton Rouge Police Department (BPRD), which overlaps with several other law enforcement agencies serving the city of Baton Rouge such as the Louisiana State University (LSU) Police Department and the East Baton Rouge Sheriff's Office. There are also some police departments outside of the BRPD but inside the EBRP. For instance, the Zachary Police Department serves the city of Zachary. The Baker Police Department serves the city of Baker. The EBRP Sheriff's Office provides quality law enforcement, detention, and court security services to the residents of the EBRP.

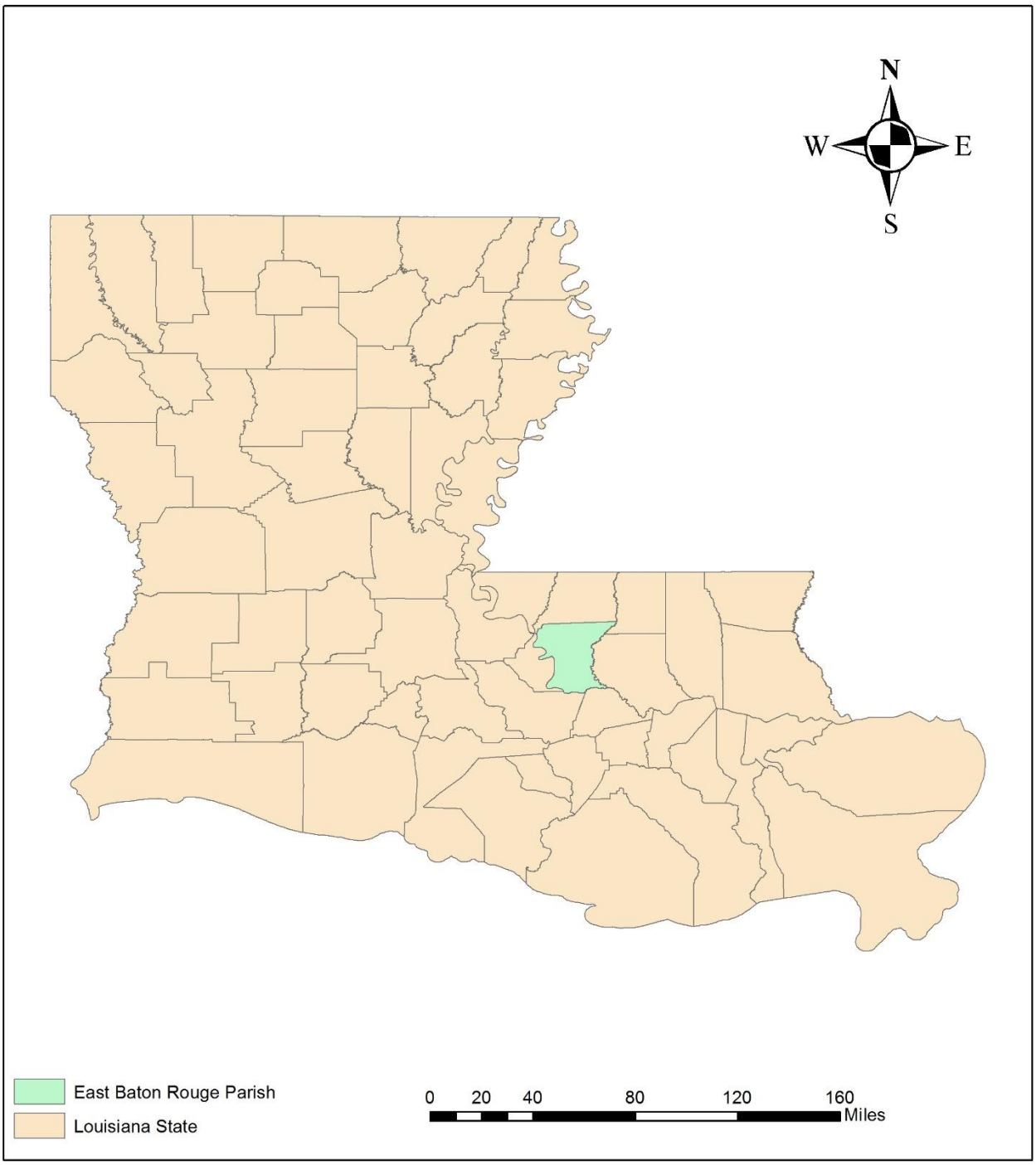


Figure 3.1. Geographic boundary of the state of Louisiana and the location of the EBRP in the state of Louisiana

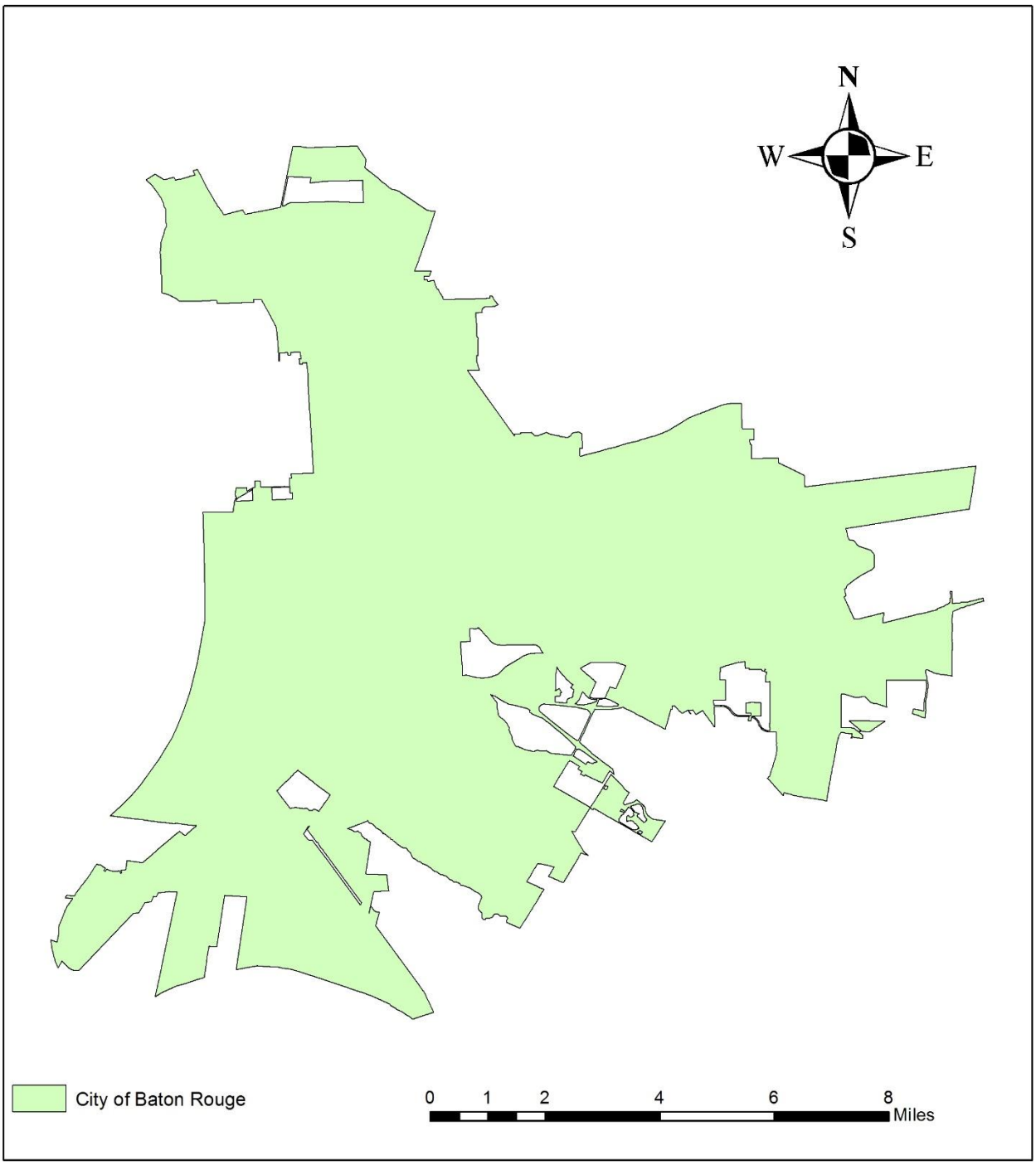


Figure 3.2. Geographic boundary of the study area of the city of Baton Rouge

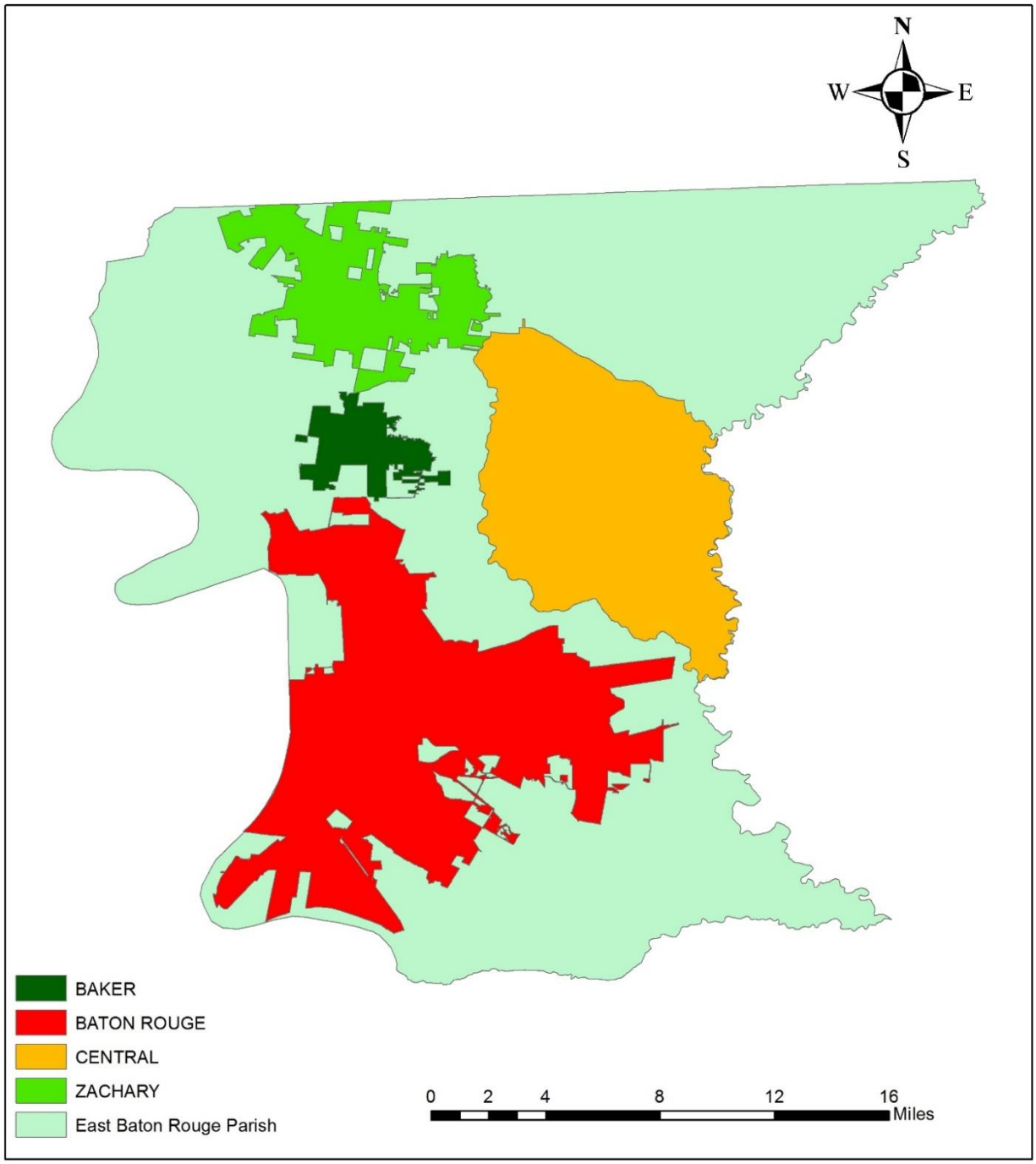


Figure 3.3. Geographic boundary of the East Baton Rouge Parish and cities

The parks data set is provided by the East Baton Rouge Parish Recreation and Park Commission (BREC) (http://www.brec.org/). This includes all parks, public golf courses,

community parks, neighborhood parks, conservation area, and special facilities such as the Baton Rouge Zoo (Figure 3.4).

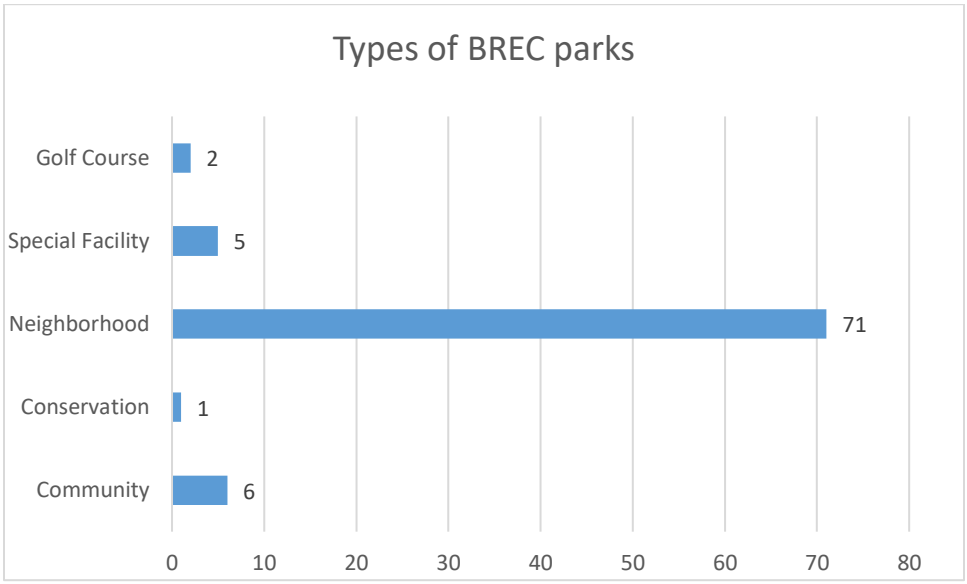


Figure 3.4. BREC parks in the city of Baton Rouge

From Figure 3.4 it can be seen that neighborhood parks are in the majority of all BREC parks (71). In addition, there are 6 community parks, 5 special facility parks, 2 golf parks, and just 1 conservation area. There are 182 parks, in total, in the EBRP. Of the 182 parks located in the EBRP, 85 parks are located in the city of Baton Rouge as shown in Figure 3.5. Most of BREC parks are in the middle and in the north of the city. Because the crime data were collected from the Baton Rouge Police Department, which jurisdiction is the city of Baton Rouge, only parks located inside in the city of Baton Rouge were chosen for this study.

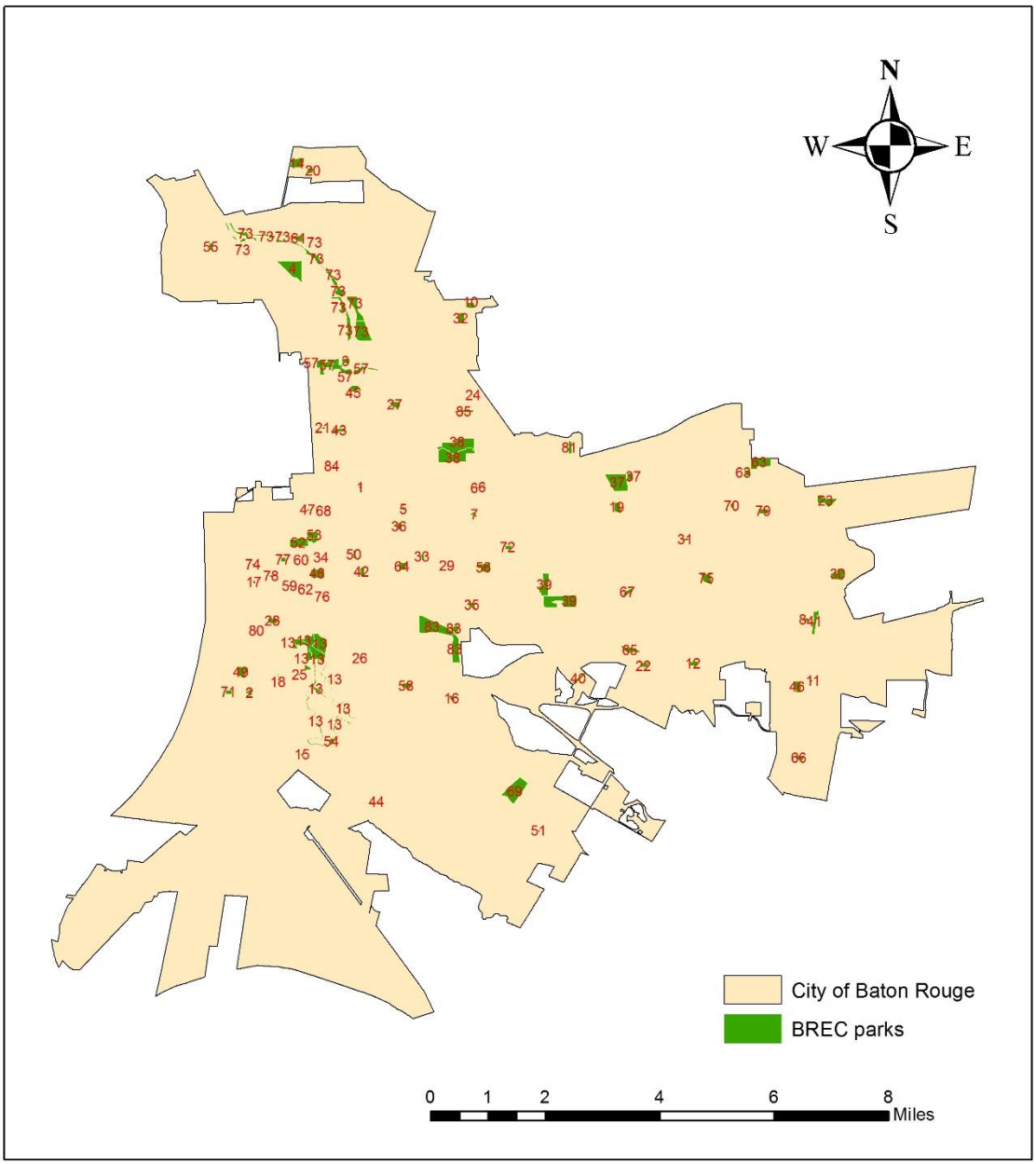


Figure 3.5. Spatial distribution of BREC parks and park index number in the city of Baton Rouge

In order to study whether parks are identified as crime hotspots, each park was labeled with park index number based on park name in alphabetical order (Figure 3.5). For instance, 1=Acadian Thruway Park, 2= Alaska Street Park, 3= Alexander Street Park, 4= Anna T. Jordan Community Park, 5= Belfair Park, 6= Bird Station Park, 7= Blueberry Street Park, 8= Boulevard De Province Park, 9= Buchanan Park, 10= Cadillac Street Park, 11= Camelot Park, 12=

Cedarcrest Park, 13= City-Brooks Community Park, 14= Clifford T. Seymour, Sr. Park, 15= College Town Park, 16= Congress Park, 17= Convention Street Park, 18= Corporate Parkway, 19= Cortana Place Park, 20= Cunard Avenue Park, 21= Dayton Street Park, 22= Drusilla Lane Park, 23= Duchess Drive Park, 24= East Brookstown Park, 25= East Polk Street Park, 26= Edward Avenue Park, 27= Evangeline Street Park, 28= Expressway Park, 29= Fairfax Park, 30= Fiesta Park, 31= Flanacher Road Park, 32= Fortune Addition Park, 33= Forty-Eighth Street Park, 34= Gayosa Street Park, 35= Goodwood Park, 36= Gus Young Park, 37= Hartley/Vey Sports Park, 38= Howell Community Park, 39= Independence Community Park, 40= Jefferson Highway Park, 41= Jones Creek Park, 42= Kernan Avenue Park, 43= Kerr Warren Park, 44= Leeward Drive Park, 45= Longfellow Park, 46= Longridge Park, 47= Madison Avenue Park, 48= Magnolia Cemetery, 49= Magnolia Mound Plantation, 50= Mary J. Lands Park, 51= Mary Ruth Park, 52= Memorial Sports Complex, 53= Memorial Sports, 54= Milford Wampold Memorial Park, 55= Mills Avenue Park, 56= Milton J. Womack Park, 57= Monte Sano Park, 58= Nairn Park, 59= North 14th Street Park, 60= North 18th Street Park, 61= North Baton Rouge Center, 62= North Boulevard Park, 63= North Sherwood Forest Community Park, 64= North Street Park, 65= Old Hammond Highway Park, 66= Parklawn Park, 67= Parkview Park,68= Pawnee Street Park, 69= Perkins Road Community Park, 70= Red Oaks Park, 71= Roosevelt Street Park, 72= Saia Park, 73= Scotlandville Parkway, 74= Seventh Street Park, 75= Sharp Road Park, 76= Spain Street Park, 77= Spanish Town Park, 78= Sports Academy, 79= Tams Drive Park, 80= Terrace Street Park, 81= Thomas Maher Park, 82= Tuscarora Street Park, 83= Webb Memorial Park And Golf Course, 84= Wenonah Street Park, and 85= West Brookstown Park.

3.2 Crime data and preprocessing

This research utilizes all crimes reported to the BRPD from January 1 2011 to December 31 2016 and downloaded from the following website: https://data.brla.gov/Public-Safety/Baton-Rouge-Crime-Incidents/fabb-cnnu. During this six-year period, a total of 309,244 individual crimes have been reported to the BRPD. This is the crime data set to be analyzed in this study. The data set includes offense date, offense time, ZIP code, street address, and latitude and longitude information, where crimes have happened. It should be noted that the BRPD does not follow the Uniform Crime Reporting (UCR)[2] Program for reporting crime data. Crimes collected include vehicle burglaries, residential burglaries, non-residential burglaries, individual robberies, business robberies, theft, narcotics, vice crimes, assault, nuisance, battery, firearm, homicides, criminal damage to property, sexual assault, and juvenile. Burglary is an unlawful entry into a building for the purposes of committing an offence. Robbery is the crime of taking or attempting to take anything of value by force, threat of force or by putting the victim in fear. Theft is the action or crime of stealing. Narcotics is synthesized from opium for medicinal use. Vice is a behavior considered immoral, criminal, rue or degrading in the associated society. Assault can be defined as a person making a physical attack on another person. Nuisance is a class of common law offences in which injury, loss or damage is suffered by the local community as a whole rather than by individual victims. Battery is a criminal offence involving the unlawful physical acting upon a threat. Firearm is violence committed with the use of a firearm (gun or small arm). Homicide refers to one human killing another human. In this data set, homicide is divided into attempted and committed homicide. Criminal damage to property is damage to or the destruction

[2] UCR is "a nationwide, cooperative statistical effort of nearly 18,000 cities, university and college, county, state, tribal, and federal law enforcement agencies voluntarily reporting data on crimes brought to their attention".

of public or private property, caused either by a person who is not its owner or by natural phenomena. Sexual assault is a sexual act in which a person is coerced or physically forced to engage against their will, or non-consensual sexual touching of a person. Juvenile is a crime committed by young people below a specific age (18 in the U.S.). The crime data set includes a crime type called "other". This crime type includes car violations, extortions, fugitives, unauthorized entry of an inhabited dwelling and stalking. A car violation is any violation of the law committed by the driver of a vehicle when it is in motion. Extortion is a criminal offense of obtaining money or property through force or threats. Fugitive is a person who has escaped from a place or is in hiding, to avoid arrest or persecution. Unauthorized entry of an inhabited dwelling is the intentional entry by a person without authorization into any inhabited dwelling. Stalking is virtually any unwanted contact between two people that directly or indirectly communications a threat or places the victim in fear. In addition, it should be noted that if a single incident includes several criminal violations, those may appear as separate individual crimes in the crime dataset, even though all these crimes resulted from the same incident. For example, if someone robs a business, burglarizes a storage building, and then steals a car to escape, they will appear as three different crimes in the data set, namely as a nationally accredited robbery, a burglary, and an auto theft.

All definitions of these crime types are coming from the BRPD (http://www.brgov.com/dept/brpd/csr/definitions.htm). To avoid low counts of crime incidences and in order to get reliable results for this research, some original crime types are reclassified or removed from this analysis entirely. Vehicle burglaries, residential burglaries, and non-residential burglaries are combined to the new crime type "burglaries", and individual robberies, business robberies are combined to the new crime type "robberies". In order to protect the

privacy of sexual assault victims and juvenile victims, the related crime incidents are not geocoded or mapped, and will not be included in the research analysis. Therefore, this study tests 12 types of crime, including burglaries, robberies, theft, narcotics, vice crimes, assault, nuisance, battery, firearm, homicides, "other", and criminal damage to property.

In the case of crime events occurring in BREC parks, the police always record the location of the offense at the park address, which is the nearest street intersection. This means that all crimes happening within the park or along the park boundary are recorded to the nearest street intersection of the offense location. In order to identify crime events occurring in BREC parks from 2011 to 2016, the search box is applied to select all crimes occurring in BREC parks according to their park addresses. In total, 1,900 individual crimes were identified to have occurred in BREC parks from 2011 to 2016. Table 3.1 shows the frequency and percentage of crime incidents that occurred in BREC parks compared to the city of Baton Rouge from 2011 to 2016.

Table 3.1. Frequency and percentage of crimes for each crime type included in this study from 2011 to 2016

Crime type	Crimes in parks (total)	Crimes in parks (%)	Crimes in the city of Baton Rouge without parks (total)	Crimes in the city of Baton Rouge without parks (%)	Total number of crimes in Baton Rouge including parks
Assault	36	1.89	8,608	2.80	8,644
Battery	148	7.79	28,149	9.16	28,297
Individual robbery	43	2.26	4,787	1.56	4,830
Business robbery	8	0.42	725	0.24	733
Criminal damage to property	119	6.26	23,381	7.61	23,500
Firearm	97	5.11	8,259	2.69	8,356
Narcotics	242	12.74	28,497	9.27	28,739
Residential burglary	8	0.42	12,974	4.22	12,982
Vehicle burglary	189	9.95	15,680	5.10	15,869

(Table 3.1 continued)

Crime type	Crimes in parks (total)	Crimes in parks (%)	Crimes in the city of Baton Rouge without parks (total)	Crimes in the city of Baton Rouge without parks (%)	Total number of crimes in Baton Rouge including parks
Non-residential burglary	58	3.05	8,191	2.67	8,249
Nuisance	206	10.84	8,990	2.93	9,196
Other	466	24.53	91,165	29.66	91,631
Theft	257	13.53	60,051	19.54	60,308
Vice	8	0.42	1,249	0.41	1,257
Homicide	15	0.79	2,145	0.70	2,160
Juvenile			3,249	1.06	3,249
Sexual assault			1,244	0.40	1,244
All crimes	1,900	100	307,344	100	309,244

Table 3.2. Count of successfully geocoded crime by latitude/longitude and street address and the total number of crimes falling inside the boundaries of the city of Baton Rouge

The total number of original data	Successfully geocoded by latitude/longitude	Successfully geocoded by latitude/longitude and falling inside the city of Baton Rouge	Crime records without latitude/longitude information, but including street addresses	Successfully geocoded by street addresses only	Successfully geocoded by street addresses and falling inside the city of Baton Rouge
309,244	286,732	285,149	17,997	14,738	14,512

According to Table 3.1, the percentage of assaults, are somewhat higher among all city crimes (2.80%) compared to all BREC parks crimes (1.89%). Battery makes up 7.79 percentage of all crimes in BREC parks compared to 9.16 percentage of all crimes in the city. There are 51 robberies or 2.68 percentage of all crimes in all parks compared to 5,512 robberies equaling 1.80 percentage in the city. Narcotics make up 12.74 percentage of all crimes in BREC parks

compared to 9.27 percentage of all crimes in the city. In addition, crime damage to property, burglaries, vice, and homicides in all parks have relatively close percentages compared to the total crimes in the city. Relatively large differences in percentages were found for "Other" crimes (24.53% (parks), 29.66% (city)), and theft (13.53% (parks), 19.54% (city)). Especially, nuisance, with 10.84 percentage in all parks and "only" 2.93 percentage in the city, account for a larger proportion of crimes in parks compared to the city. Because sexual assault victims and juvenile victims are not geocoded or mapped, it was impossible to identify how many of their total crimes that have happened in the city can be attributed to all BREC parks. For this reason, the respective cells in Table 3.1 are left empty.

Before continuing with the analysis, crime data needed to be cleaned for geocoding / address matching. This included the correction of incorrect street addresses, the correction of spelling mistakes of street names, and the removal of duplicate records. After the cleaning process, crime data were geocoded. Geocoding is the process of transferring a postal address description to a direct geocode (e.g., x- and y-coordinates in, for example, geographic latitude and longitude degrees). In this thesis research, the original crime dataset includes geographic latitude and longitude information where a crime has happened. This means that these crime incidents can be displayed on the map directly. But not all crime data had x- and y-coordinates, and for these crime incidents without coordinates address-matching had to be done. These crime events with street addresses had to be geocoded. First, street network data needed to be downloaded from the US Census Bureau website (https://www.census.gov/geo/maps-data/data/tiger-line.html). Each county has a unique TIGER/Line identifier value. For EBRP, the identifier value is 22,033. The TIGER street network files contain all street information such as full name, ZIP code, address, and range. After acquisition, the geocoding of crime addresses to

the TIGER street network data could be performed by using ArcGIS 10.0.5. To perform geocoding in ArcGIS 10.0.5, several parameters are required to be entered. The spelling sensitivity was set to 80, and the minimum candidate score was set to 75. In order to have a high match rate, the minimum match score was set to 60 (Leitner and Helbich, 2011). The matched crime address represents the highest match score from all possible addresses.

Based on Table 3.2, the total number of crime events from the original data set is 309,244 over the entire six-year observation period (2011-16). Of those 286,732 crime events were successfully address-matched by latitude and longitude information. When crime locations with assigned x- and y- coordinates are displayed on the map, it was discovered that some crime data fell outside the boundaries of the city of Baton Rouge. There were 1,583 crime events, in total, that fell outside the city of Baton Rouge boundaries. These 1,583 crime events were thus removed from the data set, leaving 285,149 crime events. In addition, there were 22,512 crime incidents without latitude and longitude information. However, of those 22,512, 17,997 crime events had street addresses, and these could be geocoded based on TIGER street network data. Of those 17,997 crime events with street addresses, 14,738 crime events could be geocoded successfully. Of those, 14,512 crime incidents fell inside the boundaries of the city of Baton Rouge. All analysis in Chapter 4 is thus based on a total number of 299,661 crime events.

In sum, 9,583 crime events (the difference between 309,244 original crimes downloaded and 299,661 crimes that were successfully geocoded and falling inside the boundaries of the city of Baton Rouge) could not be geocoded and thus displayed on the map in ArcGIS 10.0.5 for further analysis. Some of these crimes not included in subsequent analysis are sexual assault and juvenile crimes that are not geocoded by the police, in order to protect the privacy of the

associated crime victims. Sexual assault and juvenile crime locations could thus not be mapped and hence, these crime types were not included in the analysis in Chapter 4.

Table 3.3. Frequency of crime events and counts and percentages of successfully geocoded crimes for the year 2011

	PARKS			**CITY OF BATON ROUGE WITHOUT PARKS**			**CITY OF BATON ROUGE INCLUDING PARKS**		
	Crimes (total)	Successfully geocoded (total)	Successfully geocoded (%)	Crimes (total)	Successfully geocoded (total)	Successfully geocoded (%)	Crimes (total)	Successfully geocoded (total)	Successfully geocoded (%)
CRIME TYPE									
Assault	5	5	100	1,849	1,837	99	1,854	1,842	100
Battery	30	29	97	5,548	5,521	100	5,578	5,550	97
Individual robbery	9	9	100	916	907	99	925	916	100
Business robbery	2	2	100	100	100	100	102	102	100
Criminal damage to property	18	18	100	4,353	4,325	99	4,371	4,343	100
Firearm	30	30	100	1,401	1,377	98	1,431	1,407	100
Narcotics	53	53	100	5,628	5,517	98	5,681	5,570	100
Residential burglary	3	3	100	3,707	3,704	100	3,710	3,707	100
Vehicle burglary	39	39	100	2,749	2,732	99	2,788	2,771	100
Non-residential burglary	4	4	100	1,343	1,337	100	1,347	1,341	100
Nuisance	61	61	100	3,006	3,000	100	3,067	3,061	100
Other	110	106	96	19,810	19,392	98	19,920	19,498	96
Theft	35	35	100	10,327	10,236	99	10,362	10,271	100
Vice	3	3	100	318	316	99	321	319	100
Homicide	4	4	100	422	419	99	426	423	100
Juvenile	0	0	0	494	0	0	494	0	0
Sexual assault	0	0	0	179	0	0	179	0	0
All crimes	406	401	99	62,150	60,720	98	62,556	61,121	99

Table 3.4. Frequency of crime events and counts and percentages of successfully geocoded crimes for the year 2012

	PARKS			CITY OF BATON ROUGE WITHOUT PARKS			CITY OF BATON ROUGE INCLUDING PARKS		
	Crimes (total)	Successfully geocoded (total)	Successfully geocoded (%)	Crimes (total)	Successfully geocoded (total)	Successfully geocoded (%)	Crimes (total)	Successfully geocoded (total)	Successfully geocoded (%)
CRIME TYPE									
Assault	11	11	100	1,569	1,563	100	1,580	1,574	100
Battery	17	17	100	5,250	5,212	99	5,267	5,229	99
Individual robbery	9	9	100	979	961	98	988	970	98
Business robbery	2	2	100	119	117	98	121	119	98
Criminal damage to property	22	22	100	4,257	4,222	99	4,279	4,244	99
Firearm	17	17	100	1,356	1,341	99	1,373	1,358	99
Narcotics	48	48	100	5,332	5,243	98	5,380	5,291	98
Residential burglary	2	2	100	2,863	2,858	100	2,865	2,860	100
Vehicle burglary	43	43	100	2,556	2,537	99	2,599	2,580	99
Non-residential burglary	9	9	100	1,403	1,396	100	1,412	1,405	100
Nuisance	26	26	100	1,869	1,859	99	1,895	1,885	99
Other	89	88	99	16,642	16,342	98	16,731	16,430	98
Theft	46	45	98	9,986	9,907	99	10,032	9,952	99
Vice	1	1	100	259	256	99	260	257	99
Homicide	4	4	100	369	367	99	373	371	99
Juvenile	0	0	0	544	0	0	544	0	0
Sexual assault	0	0	0	181	0	0	181	0	0
All crimes	346	344	99	55,534	54,181	98	55,880	54,525	98

Table 3.5. Frequency of crime events and counts and percentages of successfully geocoded crimes for the year 2013

	PARKS			CITY OF BATON ROUGE WITHOUT PARKS			CITY OF BATON ROUGE INCLUDING PARKS		
	Crimes (total)	Successfully geocoded (total)	Successfully geocoded (%)	Crimes (total)	Successfully geocoded (total)	Successfully geocoded (%)	Crimes (total)	Successfully geocoded (total)	Successfully geocoded (%)
CRIME TYPE									
Assault	8	8	100	1,369	1,355	99	1,377	1,363	99
Battery	31	31	100	4,640	4,601	99	4,671	4,632	99
Individual robbery	9	9	100	849	845	100	858	854	100
Business robbery	1	1	100	135	135	100	136	136	100
Criminal damage to property	16	16	100	3,910	3,854	99	3,926	3,870	99
Firearm	11	11	100	1,200	1,189	99	1,211	1,200	99
Narcotics	21	21	100	4,527	4,411	97	4,548	4,432	97
Residential burglary	1	1	100	2,202	2,186	99	2,203	2,187	99
Vehicle burglary	39	39	100	2,765	2,737	99	2,804	2,776	99
Non-residential burglary	9	9	100	1,395	1,384	99	1,404	1,393	99
Nuisance	28	28	100	1,266	1,247	98	1,294	1,275	99
Other	59	58	98	15,053	14,553	97	1,5112	14,611	97
Theft	56	56	100	9,796	9,695	99	9,852	9,751	99
Vice	1	1	100	176	171	97	177	172	97
Homicide	2	2	100	293	285	97	295	287	97
Juvenile	0	0	0	551	0	0	551	0	0
Sexual assault	0	0	0	191	0	0	191	0	0
All crimes	292	291	100	50,318	48,648	97	50,610	48,939	97

Table 3.6. Frequency of crime events and counts and percentages of successfully geocoded crimes for the year 2014

	PARKS			CITY OF BATON ROUGE WITHOUT PARKS			CITY OF BATON ROUGE INCLUDING PARKS		
	Crimes (total)	Successfully geocoded (total)	Successfully geocoded (%)	Crimes (total)	Successfully geocoded (total)	Successfully geocoded (%)	Crimes (total)	Successfully geocoded (total)	Successfully geocoded (%)
CRIME TYPE									
Assault	2	2	100	1,231	1,215	99	1,233	1,217	99
Battery	26	26	100	4,249	4,205	99	4,275	4,231	99
Individual robbery	9	9	100	750	742	99	759	751	99
Business robbery	1	1	100	129	127	98	130	128	98
Criminal damage to property	13	13	100	3,375	3,323	98	3,388	3,336	98
Firearm	16	15	94	1,199	1,170	98	1,215	1,185	98
Narcotics	49	49	100	4,471	4,317	97	4,520	4,366	97
Residential burglary	0	0	0	1,683	1,666	99	1,683	1,666	99
Vehicle burglary	29	29	100	2,242	2,215	99	2,271	2,244	99
Non-residential burglary	8	8	100	1,368	1,353	99	1,376	1,361	99
Nuisance	28	28	100	999	983	98	1,027	1,011	98
Other	86	86	100	13,559	13,074	96	13,645	13,160	96
Theft	40	39	98	10,289	10,131	98	10,329	10,170	98
Vice	2	2	100	175	167	95	177	169	95
Homicide	2	2	100	321	319	99	323	321	99
Juvenile	0	0	0	567	0	0	567	0	0
Sexual assault	0	0	0	219	0	0	219	0	0
All crimes	311	309	99	46,826	45,007	96	47,137	45,316	96

Table 3.7. Frequency of crime events and counts and percentages of successfully geocoded crimes for the year 2015

	PARKS			CITY OF BATON ROUGE WITHOUT PARKS			CITY OF BATON ROUGE INCLUDING PARKS		
	Crimes (total)	Successfully geocoded (total)	Successfully geocoded (%)	Crimes (total)	Successfully geocoded (total)	Successfully geocoded (%)	Crimes (total)	Successfully geocoded (total)	Successfully geocoded (%)
CRIME TYPE									
Assault	8	8	100	1,255	1,245	99	1,263	1,253	99
Battery	28	28	100	4,393	4,327	98	4,421	4,355	99
Individual robbery	3	3	100	669	666	100	672	669	100
Business robbery	2	2	100	118	117	99	120	119	99
Criminal damage to property	23	23	100	3,679	3,644	99	3,702	3,667	99
Firearm	13	13	100	1,380	1,344	97	1,393	1,357	97
Narcotics	45	45	100	4,630	4,491	97	4,675	4,536	97
Residential burglary	1	1	100	1,326	1,312	99	1,327	1,313	99
Vehicle burglary	13	13	100	2,824	2,800	99	2,837	2,813	99
Non-residential burglary	14	14	100	1,313	1,301	99	1,327	1,315	99
Nuisance	30	30	100	1,005	987	98	1,035	1,017	98
Other	71	71	100	13,576	13,155	97	13,647	13,226	97
Theft	44	44	100	10,125	10,000	99	10,169	10,044	99
Vice	0	0	100	163	159	98	163	159	98
Homicide	2	2	100	340	334	98	342	336	98
Juvenile	0	0	100	613	0	0	613	0	0
Sexual assault	0	0	100	241	0	0	241	0	0
All crimes	297	297	100	47,650	45,882	96	47,947	46,179	96

Table 3.8. Frequency of crime events and counts and percentages of successfully geocoded crimes for the year 2016

	PARKS			CITY OF BATON ROUGE WITHOUT PARKS			CITY OF BATON ROUGE INCLUDING PARKS		
	Crimes (total)	Successfully geocoded (total)	Successfully geocoded (%)	Crimes (total)	Successfully geocoded (total)	Successfully geocoded (%)	Crimes (total)	Successfully geocoded (total)	Successfully geocoded (%)
CRIME TYPE									
Assault	2	2	100	1,335	1313	98	1,337	1,315	98
Battery	16	16	100	4,069	4023	99	4,085	4,039	99
Individual robbery	4	4	100	624	621	100	628	625	100
Business robbery	0	0	0	124	124	100	124	124	100
Criminal damage to property	27	27	100	3,807	3,766	99	3,834	3,793	99
Firearm	10	10	100	1,723	1,696	98	1,733	1,706	98
Narcotics	26	26	100	3,909	3,796	97	3,935	3,822	97
Residential burglary	1	1	100	1,193	1,179	99	1,194	1,180	99
Vehicle burglary	26	26	100	2,544	2,504	98	2,570	2,530	98
Non-residential burglary	14	14	100	1,369	1,345	98	1,383	1,359	98
Nuisance	33	33	100	845	829	98	878	862	98
Other	51	51	100	12,525	12,162	97	12,576	12,213	97
Theft	36	36	100	9,528	9,426	99	9,564	9,462	99
Vice	1	1	100	158	156	99	159	157	99
Homicide	1	1	100	400	393	98	401	394	98
Juvenile	0	0	0	480	0	0	480	0	0
Sexual assault	0	0	0	233	0	0	233	0	0
All crimes	248	248	100	44,866	43,333	97	45,114	43,581	97

Table 3.9. Frequency of crime events and counts and percentages of successfully geocoded crimes for all six years

	PARKS			CITY OF BATON ROUGE WITHOUT PARKS			CITY OF BATON ROUGE INCLUDING PARKS		
	Crimes (total)	Successfully geocoded (total)	Successfully geocoded (%)	Crimes (total)	Successfully geocoded (total)	Successfully geocoded (%)	Crimes (total)	Successfully geocoded (total)	Successfully geocoded (%)
CRIME TYPE									
Assault	36	36	100	8,608	8,528	99	8,644	8,564	99
Battery	148	147	99	28,149	27,889	99	28,297	28,036	99
Individual robbery	43	43	100	4,787	4,742	99	4,830	4,785	99
Business robbery	8	8	100	725	720	99	733	728	99
Criminal damage to property	119	119	100	23,381	23,134	99	23,500	23,253	99
Firearm	97	96	99	8,259	8,117	98	8,356	8,213	98
Narcotics	242	242	100	28,497	27,775	97	28,739	28,017	97
Residential burglary	8	8	100	12,974	12,905	99	12,982	12,913	99
Vehicle burglary	189	189	100	15,680	15,525	99	15,869	15,714	99
Non-residential burglary	58	58	100	8,191	8,116	99	8,249	8,174	99
Nuisance	206	206	100	8,990	8,905	99	9,196	9,111	99
Other	466	460	99	91,165	88,678	97	91,631	89,138	97
Theft	257	255	99	60,051	59,395	99	60,308	59,650	99
Vice	8	8	100	1,249	1,225	98	1,257	1,233	98
Homicide	15	15	100	2,145	2,117	99	2,160	2,132	99
Juvenile	0	0	0	3,249	0	0	3,249	0	0
Sexual assault	0	0	0	1,244	0	0	1,244	0	0
All crimes	1,900	1,890	99	307,344	297,771	97	309,244	299,661	97

The Tables 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, and 3.9 list the number of crimes and the number of successfully address-matched crimes for each year from 2011 to 2016 and for all six years combined. The match rate for all crimes in parks are 99% and for all crimes in the city 98% for the year 2011 (Table 3.3). The "Other" crime type has a relatively low match rate of 96% in parks, and 98% in the city. In 2012, all parks and the city have the same successfully geocoded crime percentage as the year 2011 (Table 3.4). Table 3.5 indicates that the match rate of crimes in parks is 100% and for the city is 97% for the year 2013. In 2014, the city has the lowest match rate of 96%, but the successfully geocoded percentage for parks is 99% (Table 3.6). The match rate for parks increases to 100% in 2015 (Table 3.7). Table 3.8 shows the match rate for all crimes in parks to be 100% whereas for the city, it is 97% in 2016.

Based on Table 3.9, the match rates for all crime types, for all six years, and for both the city and parks combined achieved in this study are almost 97%, which is way above the 85% geocoding rate that Ratcliffe (2004) considers as an acceptable level for achieving reliable analysis results. The successful geocoding percentage is just above 99% for all parks and 97% for the city for all six years combined. Because most crime events occurring in parks were geocoded successfully, the following briefly discusses the geocoding percentage among crime types in the city. From 2011 to 2016, the lowest average geocoding rates was found for narcotics (97%) and "Other" crimes (97%). A possible reason is that many cases of drug crime occur in open spaces, like squares, or inside buildings. In such situations, the police maybe unable to identify an address of the crime event. In addition, the geocoding percentage of the crime type "Other" is also lower than the average geocoding percentage of all crime types for the city. The main reason maybe that for car violation and fugitive it is difficult to determine an address. As

already mentioned above, juvenile and sexual crime events are not geocoded, at all, in order to protect the privacy of the associated victims.

Summing up, study areas for this thesis research is the city of Baton Rouge and parks managed by the BREC. The BRPD is the main law enforcement agency serving the city of Baton Rouge. The crime dataset included in this research are reported crimes collected by the BRPD from January 1 2011 to December 31 2016. This study tests 12 different types of crime, including burglaries, robberies, theft, narcotics, vice crimes, assault, nuisance, battery, firearm, homicides, "other", and criminal damage to property. Finally, the average successful geocoding percentage is 99% for parks and 97% for the city of Baton Rouge for all crimes reported from 2011 to 2016.

3.3 Methods

3.3.1 Overview

The main goal of this section is to briefly introduce all statistical methods used to analyze crime data in Chapter 4. Research question 1 addresses whether differences exist between the compositions of crimes in all BREC parks compared to crimes in the city of Baton Rouge. This question will be answered using the Chi-Squared Test (see Section 3.3.2). Research question 2 discusses the impact that BREC parks have on crime in neighborhoods adjacent to them using the crime location quotient (CLQ) method (see Section 3.3.3). The third research question that studies whether BREC parks can be identified as crime hotspots is explored using one popular hotspot method which is Gi^* statistic method (see Section 3.3.4).

3.3.2 Comparing the crime composition between BREC parks and the city of Baton Rouge using the Chi-Squared Test

This research question studies the difference between crimes in all BREC parks compared to crimes in the city of Baton Rouge. This is accomplished with some non-spatial analysis, namely

the Chi-Squared Test. There are two types of Chi-Squared Tests. One is Chi-Squared Test for goodness of fit. This test is applied when one categorical variable from a single population is available. It is used to determine whether sample data are consistent with a hypothesized distribution. The second option is the Chi-Squared Test for independence. This is a statistical test used to compare the difference between observed categorical data and expected data based on a specific hypothesis. It determines if any relationship between two variables in a population or a difference between proportions for two or more populations exist (Plackett, 1983). The formula to calculate the Chi-Squared Test statistic is as follows:

$$x^2 = \sum \frac{(O_i - E_i)^2}{E_i} \qquad (3\text{-}1)$$

$$E = \frac{(N_a \times N_b)}{N} \qquad (3\text{-}2)$$

where *O* is the observed value, *E* is the expected value and "*i*" is the "i^{th}" position in the data, N_a is the total number of sample observation of variable A, N_b is the total number of sample observation of variable B, and N is the total sample size.

This research tests the difference between the crime composition in the all BREC parks and the crime composition in the city of Baton Rouge. Therefore, the Chi-Squared Test for independence will be utilized. The selected level of significance (α) is 0.01 and the hypotheses can be stated, as follows:

- H_0: The composition of crimes for BREC parks are not different from the composition of crimes for the city of Baton Rouge.
- H_1: The composition of crimes for BREC parks are different from the composition of crimes for the city of Baton Rouge.

The degrees of freedom (df) for the Chi-Squared Test for independence can be calculated as follows:

$$df = (rows - 1) \times (columns - 1) \qquad (3\text{-}3)$$

The Chi-Squared Test for independence will be applied to all 12 different crime types that have been successfully geocoded. It compares the 12 different crime types between all BREC parks and the city of Baton Rouge for each of the six years individually and for all six years together.

3.3.3 Measuring the influence that BREC parks have on crime using the crime location quotient

To explore whether crime is higher surrounding BREC parks, this research uses the crime location quotient method. The crime location quotient (CLQ) is a ratio, which compares the characteristic of a sub-area under study to that of a larger, surrounding region (Groff and McCord, 2012). In criminology, the advantage of the CLQ is that there is no need to obtain a count of the number of targets (e.g., population) as it is necessary in calculating a crime rate (Brantingham and Brantingham, 1998). The CLQ provides a measure that helps to identify whether a specific crime pattern is disproportionally high or low in a particular location or place (Brantingham and Brantingham, 1998). The purpose of the crime location quotient is to supplement the use of crime counts and crime rates rather than to replace them (Andresen, 2014). Finally, Brantingham and Brantingham (1998) state that "the CLQ is also an indicator or what attracts people, both locally and from a distance, to a particular location. Some crime sites are crime generators, whereas others are crime attractors". For this research, the CLQ is used to indicate whether city parks can be considered as being generators/attractors or detractors of crime.

Furthermore, the CLQ could be used to study the spatial distribution of crime. Cahill (2004) states that the CLQ provides much insight into crime profiles in the case of property crime in the city of Nashville, TN. The CLQ is also used to explore the evolution of area crime

careers by analyzing changes in the area crime structure over time. It finds that social- economic characteristics play an important role in shaping the crime profile of areas (Carcach and Muscat, 2002). The CLQ is also able to identify specialization in crime, even in the presence of a small crime count (Andresen, 2014). Zhang and Peterson (2007) use CLQs and crime density on neighborhood crime to point out that high crime neighborhoods associate with a diversified profile and low crime neighborhoods tend to have a specialized profile of crime.

The CLQ analysis is also related with concentric buffer analysis. Santiago et al. (2003) uses 500 and 2000 foot buffers surrounding 38 scattered, public housing sites to discuss that these facilities have no significant effect on the neighborhood crime rate. Rengert et al. (2005) find that drug markets in Wilmington, Delaware appear to show cluster of arrests when located within 400 feet of liquor stores, homeless shelters, and check-cashing stores. Groff and McCord (2012) create different distance zones surrounding neighborhood parks in the study area of Philadelphia, PA. Their results show that neighborhood parks with their surrounding areas, especially within 400 to 800 feet, result in a high crime location quotient as compared with the city, as a whole.

This study uses the following formula of the crime location quotient:

$$LQC_i = \frac{\frac{C_i}{A_i}}{\frac{C}{A}} \qquad (3\text{-}4)$$

where C_i is the number of events for all crimes within buffer zone i of all BREC parks. A_i is the area of buffer zone i around all BREC parks. C is the number of events for all crimes for the city of Baton Rouge. A is the area of the city of Baton Rouge. Through this process, individual parks as well as all parks combined are assigned a single CLQ value. A CLQ value of less than 1 indicates a lower crime density in parks as compared to the entire city and a value

greater than 1 indicates a higher crime density in parks than in the city. A CLQ value of 2 indicates that the crime density around a particular facility type is twice that of the region (McCord and Ratcliffe, 2009). Sypion-Dutkowska and Leitner (2017) classify the value of the CLQ into five classes according to its strength.

Table 3.10. Classification of the CLQ based on park influence and the direction on crime

LQC	**Strength and Direction of Influence of BREC park**
>3	Strong attraction
3.0-1.1	Attraction
1.0	Lack or balance of influence
0.9-0.5	Detraction
<0.5	Strong Detraction

In order to test the impact of parks on crime in the areas adjacent to them, distance zones are created outside all BREC parks by using multiple ring buffers in ArcGIS 10.0.5. This research examines the crime density in three different buffer zones around park boundaries at distances of 0-200 feet, 201-400 feet, and 401-600 feet (Figure 3.6). The selection of these three buffer areas are based on the above literature review. In order to avoid an overlap, ring buffers next to each other were merged with each other. Crime densities in both parks and buffer zones are compared to the crime density for the entire city of Baton Rouge and represented with the CLQ. Groff and McCord (2012) state that crime types have an effect on the CLQ analysis. For this reason, the CLQ will be computed for all 12 different crime types including burglaries, robberies, theft, narcotics, vice crimes, assault, nuisance, battery, firearm, homicides, “other”, and criminal damage to property. Altogether, crime location quotients for all crime types, for the

city and all parks, for each of the three distance zones, and for each of the six years and for all 6 years combined will be calculated and results presented in Chapter 4.

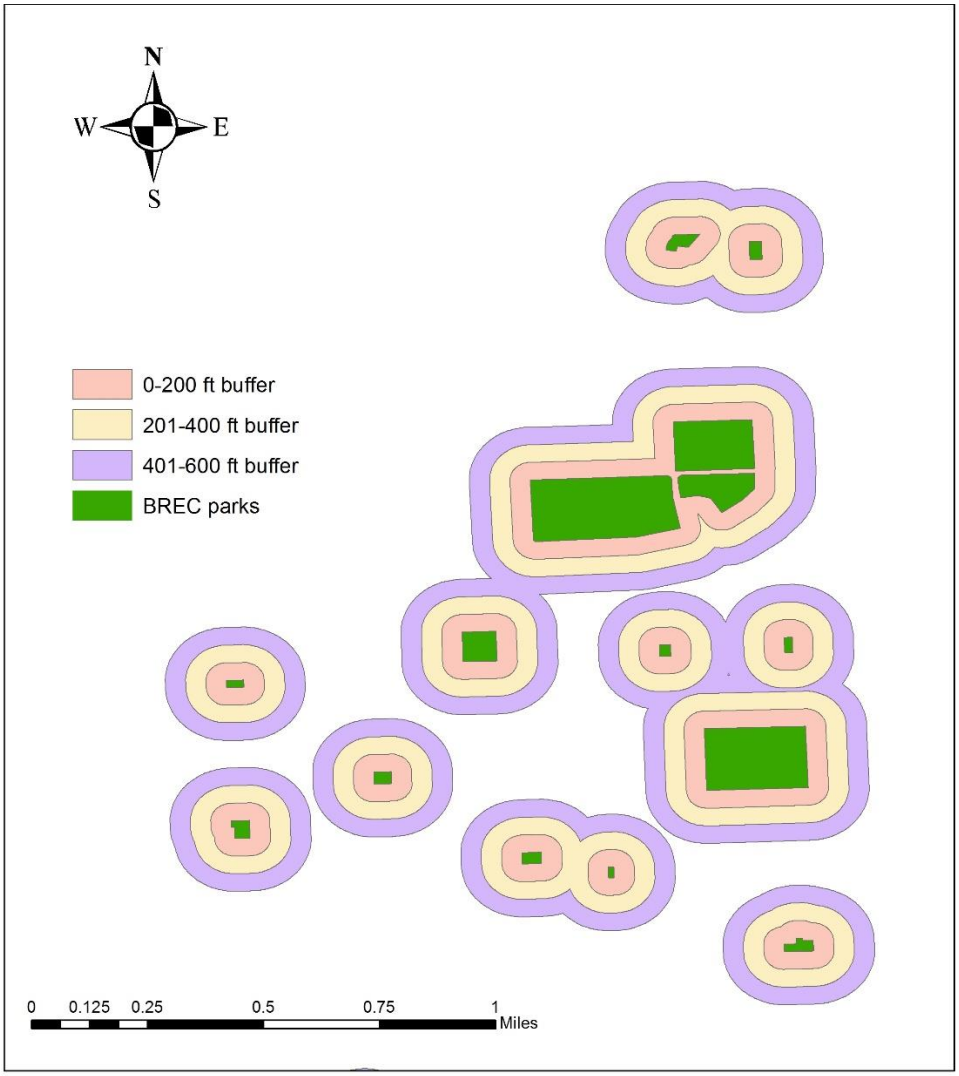


Figure 3.6. Buffer distances around BREC parks used in the calculation of the CLQ

3.3.4 The identification of BREC parks as possible crime hotspots using a hotspot method with local indicators

This section will discuss one standard hotspot method to analyze all crimes and all crime types collected for this research in order to find out whether city parks can be identified as crime hotspots.

The selected hotspot method belongs to the group of local indicators of spatial association statistics (LISA). These statistics are a more advanced hotspot method (Anselin, 1995). LISA are useful in adding definition to crime hotspots and finding a spatial limit on those areas of highest crime events concentration (Ratcliffe and McCullagh, 1999). For this reason, LISA statistics is selected to analyze whether BREC parks are identified as possible crime hotspots. In general, LISA statistics study the existence of spatial clusters in the spatial arrangement of a variable. They provide a measure of extent around a specific location and study the association between one point and its neighbors within a defined distance. In this thesis, the Gi* is chosen because it is one of more applied LISA statistics on crime events (Ratcliffe and McCullagh, 1999). It applies the Getis-Ord "G" statistic to individual zones and evaluates whether particular zones are spatially related to nearby zones. The result shows a z-score, a p-value, and a confidence level bin (Gi_Bin) for each grid cell. The higher or lower the z-score, the more intense the spatial clustering is. A z-score near zero means no apparent spatial clustering. A high z-score associated with a small p-value for a grid cell indicates a spatial clustering of high values (i.e., a hotspot). A low negative z-score and a small p-value indicates a spatial clustering of low values (i.e., a cold spot).

In terms of parameter setting in ArcGIS 10.0.5, a fixed distance band is utilized. With a fixed distance band neighboring grid cell inside the specified critical distance receive a weight of one and exert influence on computations for the target grid cell. Neighboring grid cell outside the critical distance receive a weight of zero and have no influence on a target cell's computations. Thus, the search radius or distance band is very important for this method. The search distance usually is set to the distance of the diagonal of one grid cell size (Chainey and Ratcliffe, 2005). Therefore, one important part is to choose an appropriate grid cell size. Large cell sizes will

result in a coarser looking map, which may be appropriate for large scale maps. In contrast, smaller cell sizes result in a more detailed visualization but also create a large volume of data (Eck et al., 2005). Chainey and Ratcliffe (2005) suggest that grid cell sizes could be calculated by dividing the distance of the longest extent of map by 50. After some experimenting, 1,300 feet was selected as the grid cell size for this research, resulting in a search distance of 1,838 feet, which equals each gird cell's diagonal distance. The default value is the Euclidean distance that ensures that every cell has at least one neighbor. The thematic threshold of the Gi* statistic is set to larger than 99.9% significance.

For this thesis research, point crime data is analyzed in order to create an interpolated surface showing the density of occurrence to create a hot spot map. Each grid cell is assigned a z-score and p-value and the entire layer is visualized using a gradient. Therefore, the final results of hotspot are raster data.

CHAPTER 4. ANALYSIS RESULTS

4.1 Introduction

This section discusses all results of the analysis. Section 4.2 shows results comparing the crime composition between all BREC parks and the city of Baton Rouge using the Chi-Squared Test. Section 4.3 displays results measuring the influence that all BREC parks have on crime using the crime location quotient. Finally, Section 4.4 explores whether BREC parks are possible crime hotspots using one popular hotspot method.

4.2 Results of comparing the crime composition between all BREC parks and the city of Baton Rouge using the Chi-Squared Test

Figures 4.1 to 4.7 show percentages of 12 different crime types between all BREC parks and the city of Baton Rouge for 2011 to 2016 and for all six years, combined. Based on Figure 4.1, the largest difference was found for nuisance (15.21% for all parks and 4.94% for the city) in 2011.Theft in the city was associated with a higher proportion (16.86%) compared to parks (8.73%). The "Other" crime type, with 26.43% for all parks and 31.94% for the city, account for the largest proportion of crimes for both study area types. Vice and homicide have a lower percentage of all crimes for parks, when compared to the city. Figure 4.2 indicates that percentages of the 12 crime types for parks and the city for 2012 are similar to 2011 except for nuisance. The proportion of nuisance in parks have decreased from 15.21% in 2011 to 7.56% by 2012. In 2013, theft (19.24% for parks and 19.93% for the city), vice (0.34% for parks and 0.35% for the city), and homicide (0.69% for parks and 0.59% for the city) have similar percentage between parks and the city (see Figure 4.3). According to Figure 4.4, assault only makes up 0.65% of all crimes in parks compared to 2.70% of all crimes in the city in 2014. The percentage of narcotics (15.86%) and the percentage of nuisance (9.06%) of all crimes in parks are significantly higher than the

percentages of narcotics (9.59%) and of nuisance (2.18%) of all crimes in the city. In the year 2015, the proportion of all crimes do not change much from 2014 based on Figures 4.4 and 4.5. The only thing that needs to be emphasized is vice, which makes up zero percentage of all crimes in parks. In 2016 (Figure 4.6) nuisance, with 13.31% in all parks and 1.91% in the city, account for the largest proportion of crimes in both parks and the city. For all six years combined, proportions of assault (1.90% for parks and 2.86% for the city), (7.78% for parks and 9.37% for the city), robbery (2.70% for parks and 1.83% for the city), crime damage to property (6.30% for parks and 7.77% for the city), firearm (5.08% for parks, 2.73% for the city), narcotics (12.80% for parks and 9.33% for the city), burglary (13.49% for parks and 12.27% for the city), nuisance (10.90% for parks and 2.99% for the city), "other" (24.34% for parks and 29.78% for the city theft (13.49% for parks and 19.95% for the city), vice (0.42% for parks and 0.41% for the city), and homicide (0.79% for parks and 0.71% for the city) are displayed in Figure 4.7.

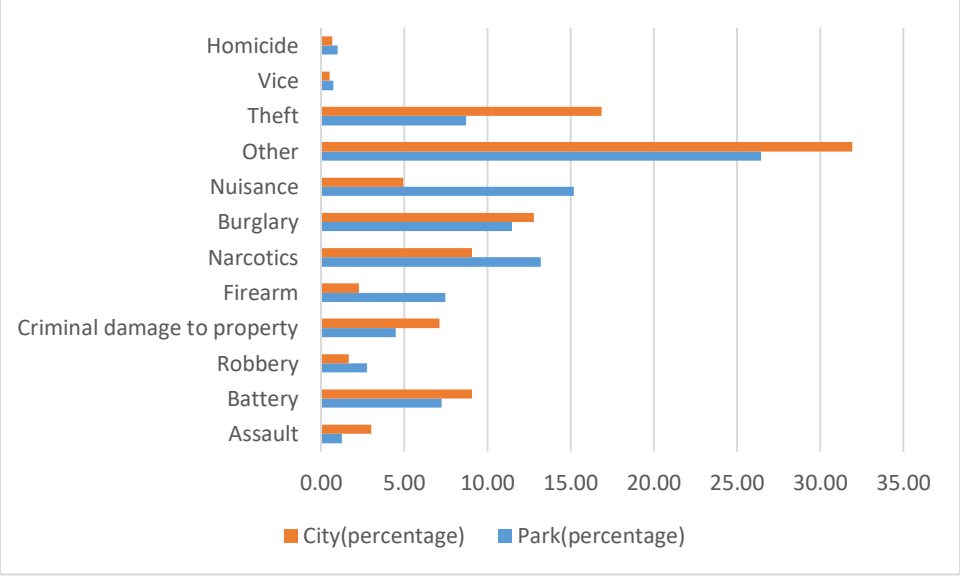


Figure 4.1. Comparing the percentage of twelve different crime types between all BREC parks and the city of Baton Rouge for 2011

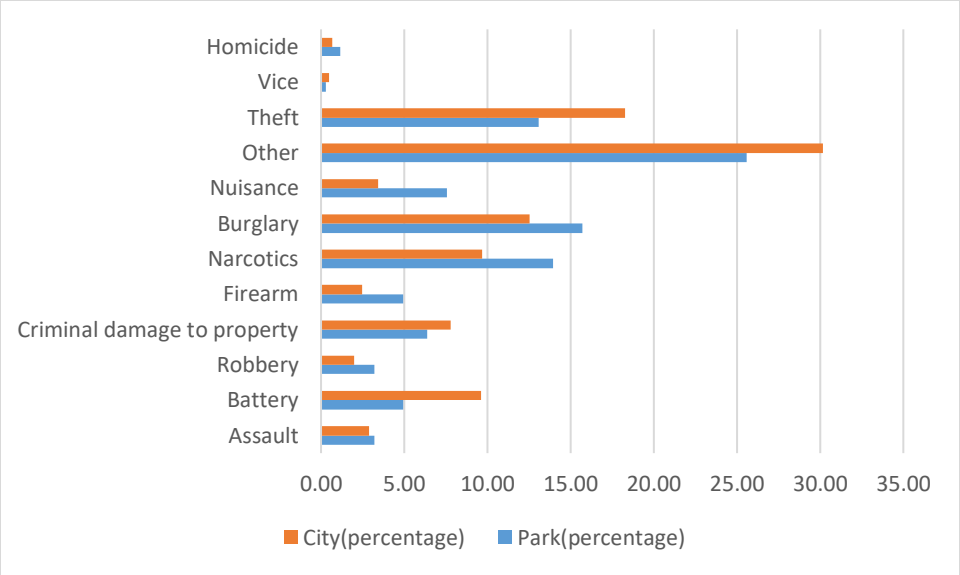


Figure 4.2. Comparing the percentage of twelve different crime types between all BREC parks and the city of Baton Rouge for 2012

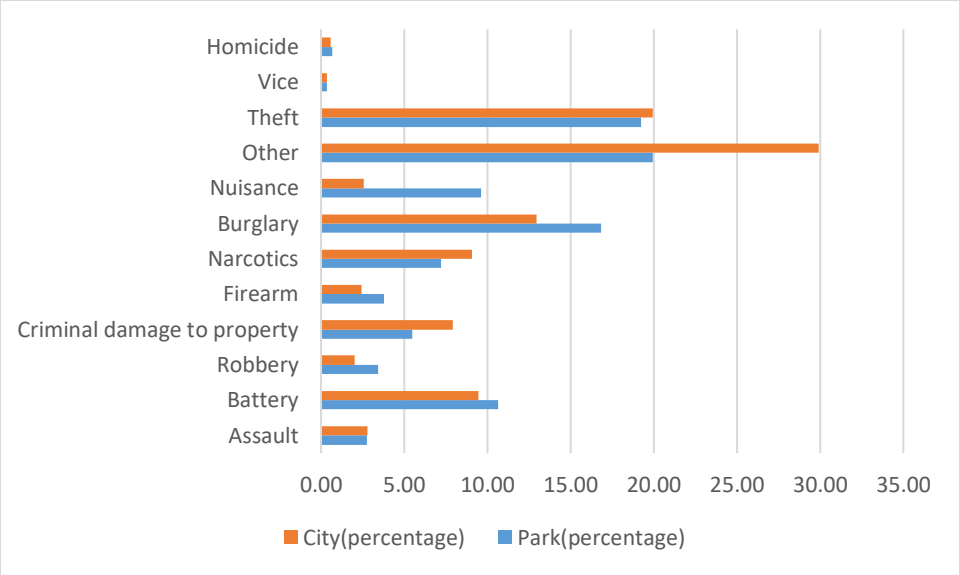


Figure 4.3. Comparing the percentage of twelve different crime types between all BREC parks and the city of Baton Rouge for 2013

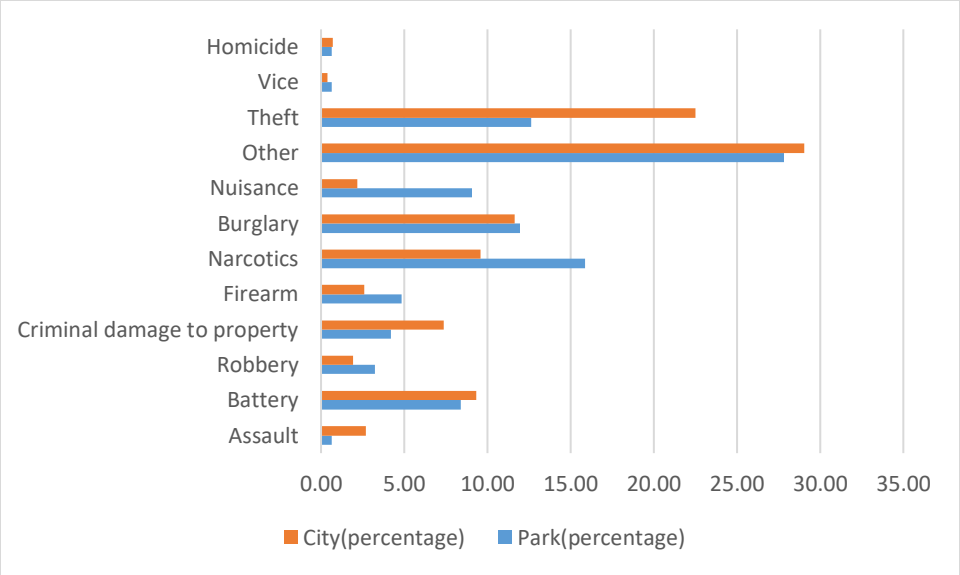


Figure 4.4. Comparing the percentage of twelve different crime types between all BREC parks and the city of Baton Rouge for 2014

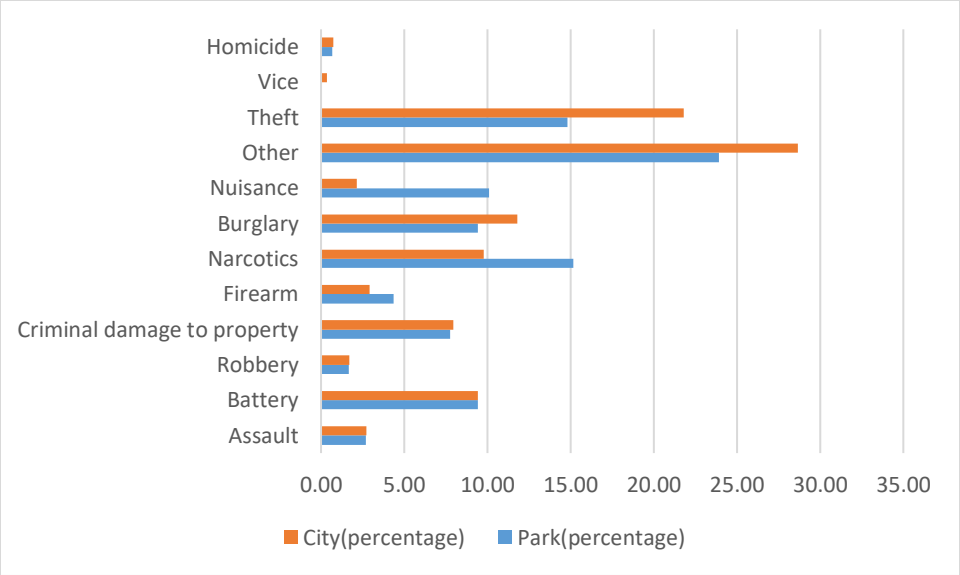


Figure 4.5. Comparing the percentage of twelve different crime types between all BREC parks and the city of Baton Rouge for 2015

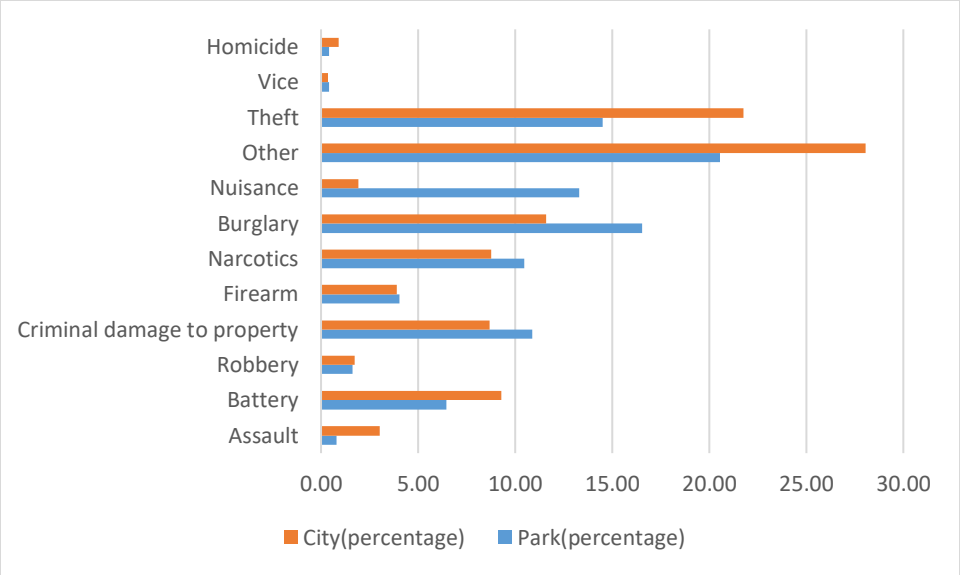


Figure 4.6. Comparing the percentage of twelve different crime types between all BREC parks and the city of Baton Rouge for 2016

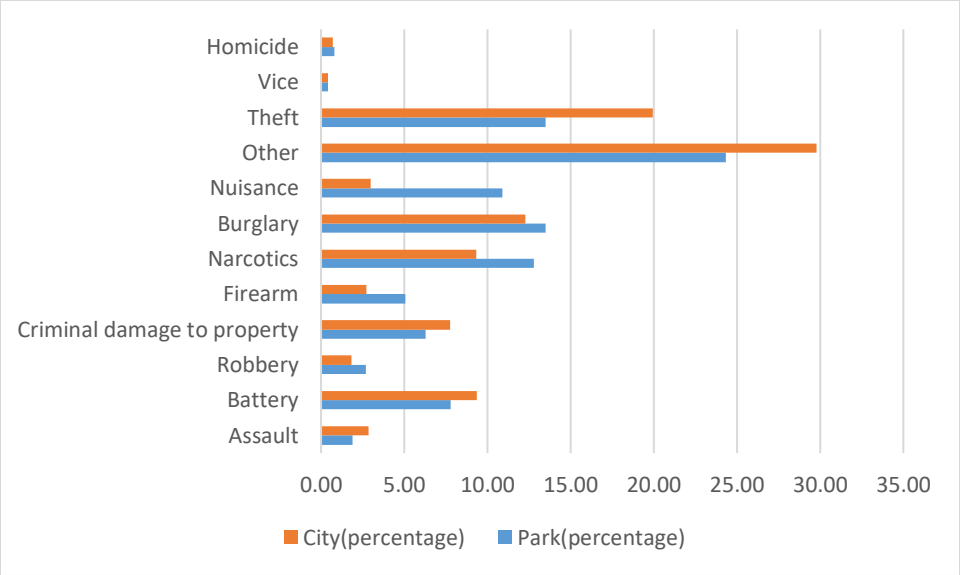


Figure 4.7. Comparing the percentage of twelve different crime types between all BREC parks and the city of Baton Rouge for all six years, combined

As discussed above in Chapter 3, the Chi-Squared Test for independence is used to compare the difference of crime type events between the city and the BREC parks for each of the six years and for all six years, combined. Tables 4.1 through 4.7 display the results.

Table 4.1. Result of the Chi-Squared Test comparing twelve different crime types between all BREC parks and the city of Baton Rouge for 2011

	Park (Observed frequency-O)	Park (Expected frequency-E)	$\frac{(O-E)^2}{E}$	City (Observed frequency-O)	City (Expected frequency-E)	$\frac{(O-E)^2}{E}$
Assault	5	12.08	4.15	1,837	1,829.92	0.03
Battery	29	36.41	1.51	5,521	5,513.59	0.01
Robbery	11	6.68	2.80	1,007	1,011.32	0.02
Criminal damage to property	18	28.49	3.86	4,325	4,314.51	0.03
Firearm	30	9.23	46.73	1,377	1,397.77	0.31
Narcotics	53	36.54	7.41	5,517	5,533.46	0.05
Burglary	46	51.30	0.55	7,773	7,767.70	0.00
Nuisance	61	20.08	83.37	3,000	3,040.92	0.55
Other	106	127.92	3.76	19,392	19,370.08	0.02
Theft	35	67.39	15.56	10,236	10,203.61	0.10
Vice	3	2.09	0.39	316	316.91	0.00
Homicide	4	2.78	0.54	419	420.22	0.00
Total	401		170.63	60,720		1.13

Table 4.2. Result of the Chi-Squared Test comparing twelve different crime types between all BREC parks and the city of Baton Rouge for 2012

	Park (Observed frequency-O)	Park (Expected frequency-E)	$\frac{(O-E)^2}{E}$	City (Observed frequency-O)	City (Expected frequency-E)	$\frac{(O-E)^2}{E}$
Assault	11	9.93	0.12	1,563	1,564.07	0.00
Battery	17	32.99	7.75	5,212	5,196.01	0.05
Robbery	11	6.87	2.48	1,078	1,082.13	0.02
Criminal damage to property	22	26.78	0.85	4,222	4,217.22	0.01
Firearm	17	8.57	8.30	1,341	1,349.43	0.05
Narcotics	48	33.38	6.40	5,243	5,257.62	0.04
Burglary	54	43.19	2.71	6,791	6,801.81	0.02
Nuisance	26	11.89	16.73	1,859	1,873.11	0.11
Other	88	103.66	2.37	16,342	16,326.34	0.02
Theft	45	62.79	5.04	9,907	9,889.21	0.03
Vice	1	1.62	0.24	256	255.38	0.00
Homicide	4	2.34	1.18	367	368.66	0.01
Total	344		54.16	54181		0.34

For 2011, the Chi-Squared Test statistic is 171.76, which is greater than 24.72, defining a level of significance (α) of 0.01. The 0-hypothesis is thus rejected in favor of H_1. This means that the composition of crime types for all BREC parks is statistically significantly different from the composition of crime types for the city of Baton Rouge in 2011. For example, the percentage of the crime type nuisance is very different between the city and all BREC parks based on Figure 4.1 and Table 4.1.

For 2012, the Chi-Squared Test statistic is 54.50, which is greater than 24.72, representing an α of 0.01. Again, the 0-hypothesis is rejected in favor of H_1. This means that the composition of crime types for all BREC parks is statistically significantly different from the composition of crime types for the city of Baton Rouge in 2012 (see Table 4.2). The city is apparently different from parks in the distribution of both crime types, battery and nuisance.

Table 4.3. Result of the Chi-Squared Test comparing twelve different crime types between all BREC parks and the city of Baton Rouge for 2013

	Park (Observed frequency-O)	Park (Expected frequency-E)	$\frac{(O-E)^2}{E}$	City (Observed frequency-O)	City (Expected frequency-E)	$\frac{(O-E)^2}{E}$
Assault	8	8.10	0.00	1,355	1,354.90	0.00
Battery	31	27.54	0.43	4,601	4,604.46	0.00
Robbery	10	5.89	2.87	980	984.11	0.02
Criminal damage to property	16	23.01	2.14	3,854	3,846.99	0.01
Firearm	11	7.14	2.09	1,189	1,192.86	0.01
Narcotics	21	26.35	1.09	4,411	4,405.65	0.01
Burglary	49	37.79	3.32	6,307	6,318.21	0.02
Nuisance	28	7.58	54.99	1,247	1,267.42	0.33
Other	58	86.88	9.60	14,553	14,524.12	0.06
Theft	56	57.98	0.07	9,695	9,693.02	0.00
Vice	1	1.02	0.00	171	170.98	0.00
Homicide	2	1.71	0.05	285	285.29	0.00
Total	291		76.66	48,648		0.46

For 2013, the Chi-Squared Test statistic of 77.12 is greater than 24.72, defining an α of 0.01. The null hypotheses is thus rejected and H_1 is accepted. This means that the composition of crime types for BREC parks is different from the composition of crime types for the city of Baton Rouge (see Table 4.3).

Table 4.4. Result of the Chi-Squared Test comparing twelve different crime types between all BREC parks and the city of Baton Rouge for 2014

	Park (Observed frequency-O)	Park (Expected frequency-E)	$\frac{(O-E)^2}{E}$	City (Observed frequency-O)	City (Expected frequency-E)	$\frac{(O-E)^2}{E}$
Assault	2	8.30	4.78	1,215	1,208.70	0.03
Battery	26	28.85	0.28	4,205	4,202.15	0.00
Robbery	10	5.99	2.68	869	873.01	0.02
Criminal damage to property	13	22.75	4.18	3,323	3,313.25	0.03
Firearm	15	8.08	5.93	1,170	1,176.92	0.04
Narcotics	49	29.77	12.42	4,317	4,336.23	0.09
Burglary	37	35.94	0.03	5,234	5,235.06	0.00
Nuisance	28	6.89	64.62	983	1,004.11	0.44
Other	86	89.74	0.16	13,074	13,070.26	0.00
Theft	39	69.35	13.28	10,131	10,100.65	0.09
Vice	2	1.15	0.62	167	167.85	0.00
Homicide	2	2.19	0.02	319	318.81	0.00
Total	309		108.99	45,007		0.75

For 2014, the composition of crime types for all BREC parks is statistically significantly different from the composition of crime types for the city of Baton Rouge because t the Chi-Squared Test statistic is 109.74, which is greater than 24.72 representing an α of 0.01 (see Table 4.4). A possible reason for this difference is that narcotics and nuisance make up different ratio between the city and parks.

Table 4.5. Result of the Chi-Squared Test comparing twelve different crime types between all BREC parks and the city of Baton Rouge for 2015

	Park (Observed frequency-O)	Park (Expected frequency-E)	$\frac{(O-E)^2}{E}$	City (*Observed* frequency-O)	City (Expected frequency-E)	$\frac{(O-E)^2}{E}$
Assault	8	8.06	0.00	1,245	1,244.94	0.00
Battery	28	28.01	0.00	4,327	4,326.99	0.00
Robbery	5	5.07	0.00	783	782.93	0.00
Criminal damage to property	23	23.58	0.01	3,644	3,643.42	0.00
Firearm	13	8.73	2.09	1,344	1,348.27	0.01
Narcotics	45	29.17	8.59	4,491	4,506.83	0.06
Burglary	28	34.99	1.40	5,413	5,406.01	0.01
Nuisance	30	6.54	84.14	987	1,010.46	0.54
Other	71	85.06	2.32	13,155	13,140.94	0.02
Theft	44	64.60	6.57	10,000	9,979.40	0.04
Vice	0	1.02	1.02	159	157.98	0.01
Homicide	2	2.16	0.01	334	333.84	0.00
Total	297		106.16	45,882		0.69

Table 4.6. Result of the Chi-Squared Test comparing twelve different crime types between all BREC parks and the city of Baton Rouge for 2016

	Park (Observed frequency-O)	Park (Expected frequency-E)	$\frac{(O-E)^2}{E}$	City (Observed frequency-O)	City (Expected frequency-E)	$\frac{(O-E)^2}{E}$
Assault	2	7.48	4.02	1,313	1,307.52	0.02
Battery	16	22.98	2.12	4,023	4,016.02	0.01
Robbery	4	4.26	0.02	745	744.74	0.00
Criminal damage to property	27	21.58	1.36	3,766	3,771.42	0.01
Firearm	10	9.71	0.01	1,696	1,696.29	0.00
Narcotics	26	21.75	0.83	3,796	3,800.25	0.00
Burglary	41	28.85	5.12	5,028	5,040.15	0.03
Nuisance	33	4.91	160.91	829	857.09	0.92
Other	51	69.50	4.92	12,162	12,143.50	0.03
Theft	36	53.84	5.91	9,426	9,408.16	0.03
Vice	1	0.89	0.01	156	156.11	0.00
Homicide	1	2.24	0.69	393	391.76	0.00
Total	248		185.93	43,333		1.06

For 2015, the Chi-Squared Test statistic of 106.85 is greater than 24.72, defining an α of 0.01. The null hypotheses is thus rejected and H_1 is accepted. This means that the composition of crime types for BREC parks is different from the composition of crime types for the city of Baton Rouge (see Table 4.5).

For 2016, the Chi-Squared Test statistic is 186.99, which is greater than 24.72, defining a level of significance (α) of 0.01. The 0-hypothesis is thus rejected in favor of H_1. This means that the composition of crime types for all BREC parks is statistically significantly different from the composition of crime types for the city of Baton Rouge in 2016 (see Table 4.6).

Table 4.7. Result of the Chi-Squared Test comparing twelve different crime types between all BREC parks and the city of Baton Rouge for all six years, combined

	Park (Observed frequency-O)	Park (Expected frequency-E)	$\frac{(O-E)^2}{E}$	City (Observed frequency-O)	City (Expected frequency-E)	$\frac{(O-E)^2}{E}$
Assault	36	54.01	6.01	8,528	8,509.99	0.04
Battery	147	176.83	5.03	27,889	27,859.17	0.03
Robbery	51	34.77	7.57	5,462	5,478.23	0.05
Criminal damage to property	119	146.66	5.22	23,134	23,106.34	0.03
Firearm	96	51.80	37.71	8,117	8,161.20	0.24
Narcotics	242	176.71	24.13	27,775	27,840.29	0.15
Burglary	255	232.11	2.26	36,546	36,568.89	0.01
Nuisance	206	57.46	383.94	8,905	9,053.54	2.44
Other	460	562.20	18.58	88,678	88,575.80	0.12
Theft	255	376.22	39.06	59,395	59,273.78	0.25
Vice	8	7.78	0.01	1,225	1,225.22	0.00
Homicide	15	13.45	0.18	2,117	2,118.55	0.00
Total	1890		529.69	297,771		3.36

Finally, for the all six years (2011-16), combined, the Chi-Squared Test statistic value is 532.95, which is greater than 24.72, representing an α of 0.01. The result means that parks are statistically significantly different from the composition of crime types for the city of Baton Rouge (see Table 4.7). The reason for this difference is that firearm, nuisance, and theft show very different proportions between the city and parks.

4.3 Results of measuring the influence that BREC parks have on crime using the crime location quotient

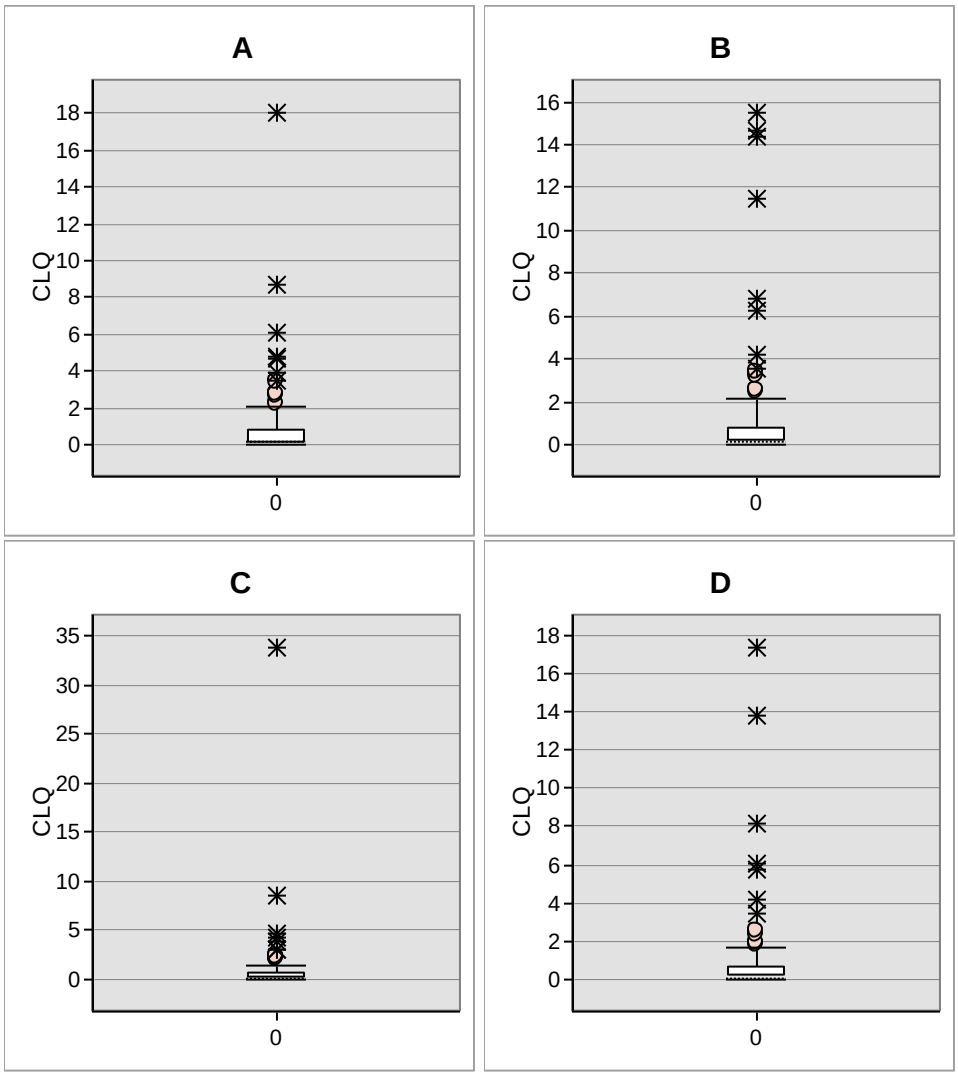
In this section, the results of the CLQ analysis will be discussed. According to Figure 4.8 and Table 4.8, the results from the CLQ analysis indicate that all BREC parks serve as a strong detractor (CLQ<0.5) of crimes. The values of the CLQ are 0.35, 0.34, 0.32, 0.36, 0.35, 0.30, and 0.33 from 2011 to 2016 and for all six years, combined (Table 4.8). The results from the CLQ analysis confirm that crime does not seem to be clustered in BREC parks compared to the city of Baton Rouge. It appears that most of BREC parks are safer than other areas of the city of Baton Rouge. When the value of the CLQ equals 1 then the density of crime incidents in parks is equal to that of the entire city. For individual parks, results show that 18.82%, 23.53%, 17.65%, 22.35%, 20.00%, 14.11%, and 27.06% of all parks have CLQ values greater than 1 from 2011 to 2016 and for all six years (Figure 4.8). Thus, increased crime density is only experienced by a few BREC parks. The majority of parks have lower densities than the city as whole. On the other hand, results indicate that parks are likely to produce dramatic reduction in park related crime (Braga, 2007). Even if some studies show that parks in an urban area would increase inside the park (Groff and McCord, 2012), this research does not support this previous research. However, for some specific parks, it cannot be denied that they have indeed high values of CLQs. For instance, Acadian Thruway Park, Wenohah Street Park, and North 14th Street Park seem to act as strong attractors of total crimes with a CLQ > 3.

For the surrounding areas of parks (0-200 feet buffer, 201-400 feet buffer, 401-600 feet buffer), the results from the CLQ analysis are different from the ones for the actual park areas (see Table 4.8). In the 0-200 feet buffers, 201-400 feet buffers, and 401-600 feet buffers, the

values of the CLQ are 1.38, 1.38, and 1.69 for all six years combined. This indicates that the surrounding areas of parks attract events of crimes. From 2011 to 2016, results indicate a significant increase in CLQ values for all crime categories in the 0-200 feet buffers when compared to CLQ values inside parks. CLQ values for the 201-400 feet buffers are slightly lower compared to the 0-200 feet buffers, but increase for the 401-600 feet buffers from 2011 to 2014. However, for 2015 and 2016, results show a steady increase in CLQ values across all crime types from the 0-200 to the 201-600 feet, and, finally to the 401-600 feet buffer areas (Table 4.8).

When taking different crime types into consideration, the value of the CLQ apparently changes across parks and buffer areas. Tables 4.9 to 4.15 represent CLQ values for twelve different types of crime from 2011 to 2016, and for all six years combined. First, CLQ values of different crime types are discussed for inside park areas. There seems to appear a spatial concentration of the crime type nuisance in parks, according to Tables 4.9 to 4.15. All CLQ values for nuisance in parks are greater than 1 from 2011 to 2016, and for all six years combined, except for 2012 (CLQ=0.74). The CLQ value for nuisance is highest in 2016 with a value of 2.01, which is over twice as much as for the city. Therefore, by comparing with the city of Baton Rouge, parks are associated with a higher risk of nuisance. Results also indicate that the crime type firearm has a high CLQ value of 1.14 in parks in 2011 (Table 4.9). Otherwise, CLQ values of all the other crime types analyzed are all lower than 1. Parks do not seem to attract any of these crimes. The crime type theft has the lowest CLQ values for parks from 2011 to 2016. This means that parks do not attract thefts, at all. CLQ values of all 12 crime types across all buffer areas around parks have a relatively clear pattern from 2011 to 2016. Moving away from parks, most crimes exhibit highest CLQ values in the 401-600 feet buffer areas, but have somewhat lower CLQ values in the 0-200 feet buffer and the 201-400 feet buffer areas. For all six years

combined, CLQ values for assault, battery, firearm, theft, and vice increase with distance to parks. CLQ values for robbery, criminal damage to property, narcotics, burglary, nuisance, other, and homicide decrease for the 201-400 feet buffers, but increase for the third (401-600 feet) buffer areas.



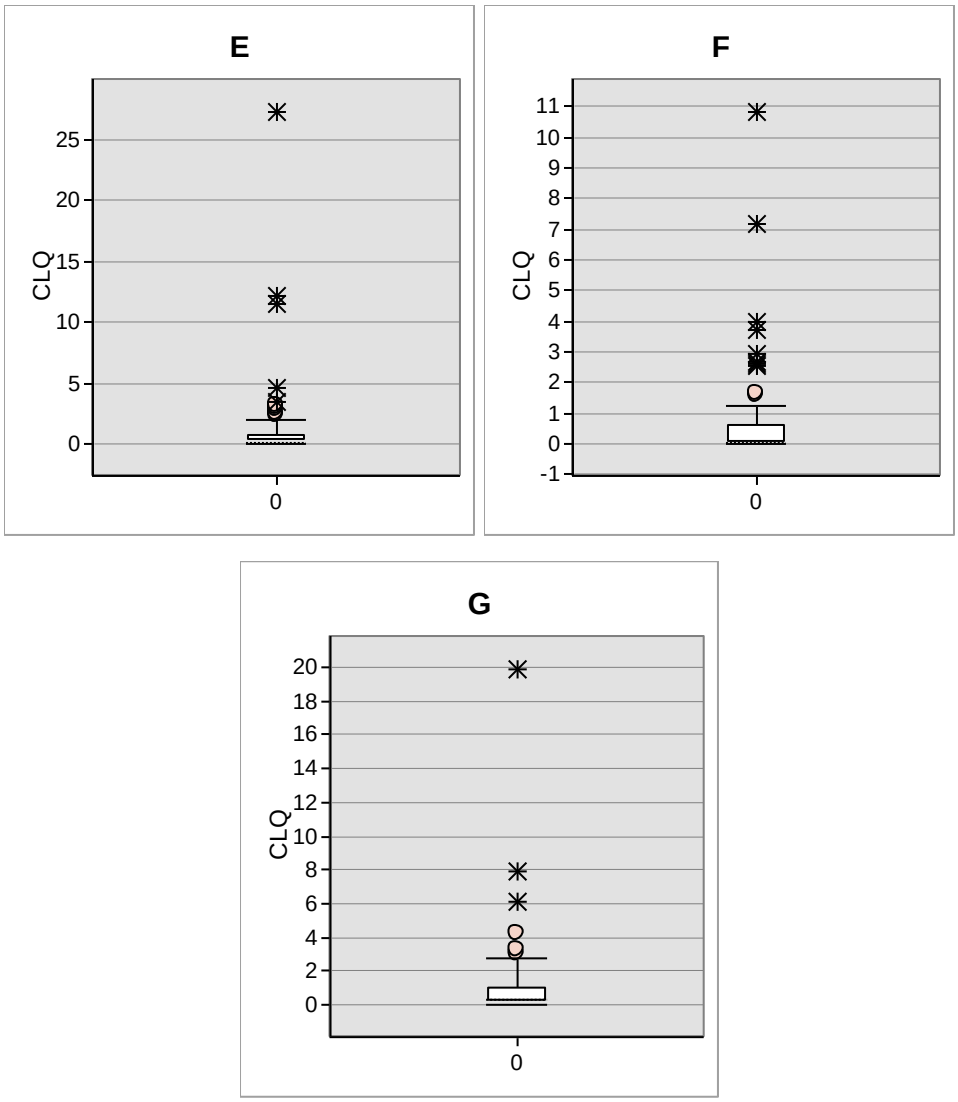


Figure 4.8. The distribution of CLQ values for individual BREC parks using box plots from 2011 to 2016 and all six years, combined. (A) 2011; (B) 2012; (C) 2013; (D) 2014; (E) 2015; (F) 2016; (G) all six years combined.

Table 4.8. Crime location quotients for all BREC parks and their buffer areas by total crimes and year

	2011	2012	2013	2014	2015	2016	All six years combined
Park	0.35	0.34	0.32	0.36	0.35	0.30	0.33
0-200 feet	1.35	1.48	1.38	1.49	1.27	1.32	1.38
201-400 feet	1.38	1.40	1.34	1.34	1.38	1.41	1.38
401-600 feet	1.73	1.74	1.76	1.70	1.55	1.61	1.69

Table 4.9. Crime location quotients by type of crime for 2011

	Park	0-200 feet	201-400 feet	401-600 feet
Assault	0.14	1.70	1.61	1.62
Battery	0.27	1.38	1.53	1.90
Robbery	0.58	1.42	1.56	2.01
Criminal damage to property	0.21	1.36	1.44	1.80
Firearm	1.14	1.38	1.48	1.75
Narcotics	0.52	1.47	1.63	2.42
Burglary	0.31	1.55	1.32	1.47
Nuisance	1.07	1.62	1.46	1.91
Other	0.30	1.30	1.37	1.73
Theft	0.18	1.04	1.10	1.38
Vice	0.52	1.58	1.66	2.31
Homicide	0.50	1.41	1.51	1.51

Table 4.10. Crime location quotients by type of crime for 2012

	Park	0-200 feet	201-400 feet	401-600 feet
Assault	0.37	1.27	1.69	1.84
Battery	0.17	1.71	1.54	2.07
Robbery	0.54	1.50	1.13	1.67
Criminal damage to property	0.27	1.45	1.41	1.90
Firearm	0.66	1.81	1.79	2.20
Narcotics	0.49	1.59	1.73	2.29
Burglary	0.41	1.37	1.28	1.57
Nuisance	0.74	1.51	1.91	1.96
Other	0.29	1.71	1.34	1.68
Theft	0.24	0.93	1.17	1.30
Vice	0.21	1.34	0.97	2.76
Homicide	0.57	2.88	1.95	1.79

Table 4.11. Crime location quotients by type of crime for 2013

	Park	0-200 feet	201-400 feet	401-600 feet
Assault	0.31	1.61	1.53	2.03
Battery	0.35	1.47	1.61	1.93
Robbery	0.54	1.30	1.66	2.06

(Table 4.11 continued)

	Park	0-200 feet	201-400 feet	401-600 feet
Criminal damage to property	0.22	1.75	1.52	1.86
Firearm	0.48	1.39	1.51	1.60
Narcotics	0.26	1.46	1.39	2.15
Burglary	0.40	1.27	1.24	1.71
Nuisance	1.17	1.95	1.35	1.66
Other	0.22	1.53	1.21	1.81
Theft	0.30	0.90	1.33	1.35
Vice	0.31	0.36	1.61	2.28
Homicide	0.37	1.97	0.97	2.05

Table 4.12. Crime location quotients by type of crime for 2014

	Park	0-200 feet	201-400 feet	401-600 feet
Assault	0.09	1.49	1.73	1.92
Battery	0.32	1.53	1.46	2.03
Robbery	0.61	1.97	1.52	1.88
Criminal damage to property	0.20	1.67	1.49	1.93
Firearm	0.67	1.94	1.58	2.08
Narcotics	0.62	2.01	1.27	1.98
Burglary	0.37	1.41	1.40	1.57
Nuisance	1.49	2.31	1.82	1.16
Other	0.36	1.66	1.18	1.75
Theft	0.20	0.86	1.32	1.31
Vice	0.64	0.75	0.83	2.19
Homicide	0.33	1.07	1.30	2.52

Table 4.13. Crime location quotients by type of crime for 2015

	Park	0-200 feet	201-400 feet	401-600 feet
Assault	0.33	1.20	1.88	1.80
Battery	0.34	1.31	1.37	1.73
Robbery	0.32	1.23	1.55	1.65
Criminal damage to property	0.33	1.48	1.57	1.71
Firearm	0.51	1.25	1.68	1.67
Narcotics	0.54	1.41	1.59	1.79
Burglary	0.27	1.45	1.33	1.61
Nuisance	1.57	1.58	1.20	1.45
Other	0.29	1.29	1.20	1.51

(Table 4.13 continued)

	Park	0-200 feet	201-400 feet	401-600 feet
Theft	0.23	0.96	1.37	1.29
Vice	0.00	0.20	1.73	1.84
Homicide	0.32	1.77	1.40	1.75

Table 4.14. Crime location quotients by type of crime for 2016

	Park	0-200 feet	201-400 feet	401-600 feet
Assault	0.08	1.30	1.41	1.83
Battery	0.21	1.51	1.66	1.80
Robbery	0.29	1.71	1.59	1.50
Criminal damage to property	0.37	1.59	1.46	1.54
Firearm	0.31	1.29	1.74	1.82
Narcotics	0.38	1.67	1.65	1.83
Burglary	0.42	1.42	1.30	1.77
Nuisance	2.01	1.28	1.40	1.67
Other	0.23	1.35	1.44	1.55
Theft	0.20	0.86	1.11	1.36
Vice	0.35	2.20	1.59	1.72
Homicide	0.13	1.27	1.61	2.17

Table 4.15. Crime location quotients by type of crime for all six years, combined

	Park	0-200 feet	201-400 feet	401-600 feet
Assault	0.22	1.44	1.64	1.83
Battery	0.28	1.49	1.53	1.91
Robbery	0.50	1.52	1.49	1.81
Criminal damage to property	0.27	1.54	1.48	1.79
Firearm	0.62	1.49	1.64	1.85
Narcotics	0.47	1.59	1.55	2.10
Burglary	0.36	1.42	1.31	1.61
Nuisance	1.21	1.68	1.55	1.73
Other	0.28	1.47	1.29	1.68
Theft	0.23	0.93	1.23	1.33
Vice	0.35	1.14	1.40	2.24
Homicide	0.37	1.72	1.49	1.94

4.4 The identification of BREC parks as possible crime hotspots using one popular hotspot method

For this section, crime hotspot maps for twelve different crime types and all crime types combined for a six years' period (2011-16), using the Gi*-statistic are shown. All other crime hotspot maps using the Gi*-statistic for the same crime types and all crime types combined for each individual year from 2011 to 2016 are shown in the Appendix.

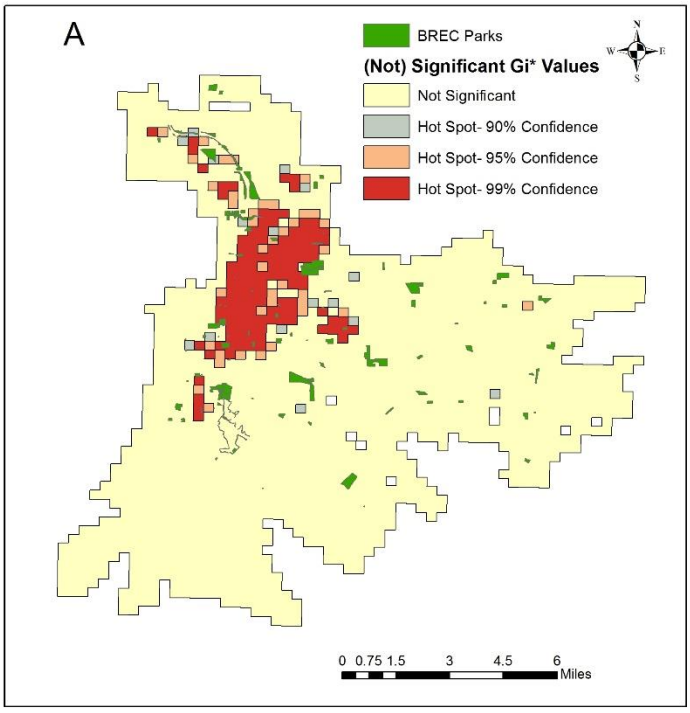


Figure 4.9. Crime hotspot maps for twelve different crime types and all crimes types combined using the Gi*-statistic from 2011-16. (A) Assault; (B) Battery; (C) Robbery; (D) Criminal damage to property; (E) Firearm; (F) Narcotic; (G) Burglary; (H) Nuisance; (I) Other; (J) Theft; (K) Vice; (L) Homicide; and (M) All crime types.

Figure 4.9 continues on following pages.

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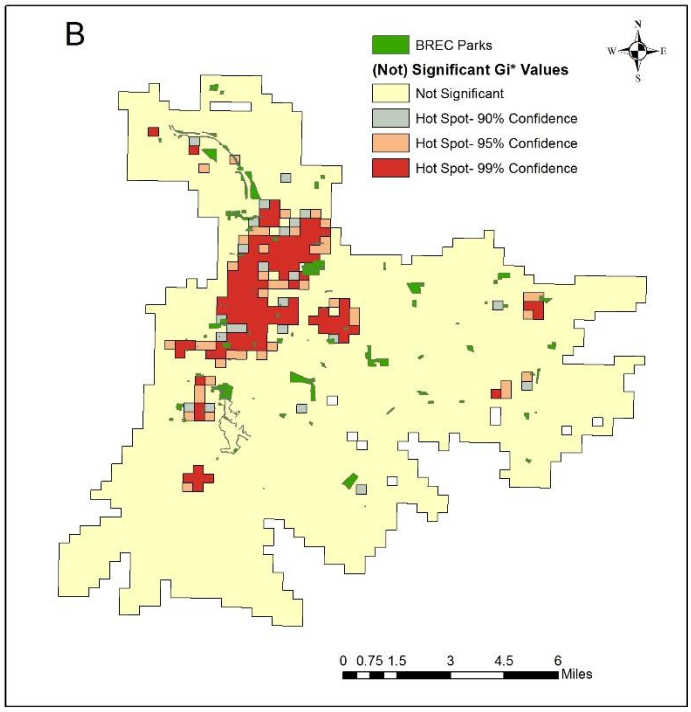
B
BREC Parks
(Not) Significant Gi* Values
Not Significant
Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
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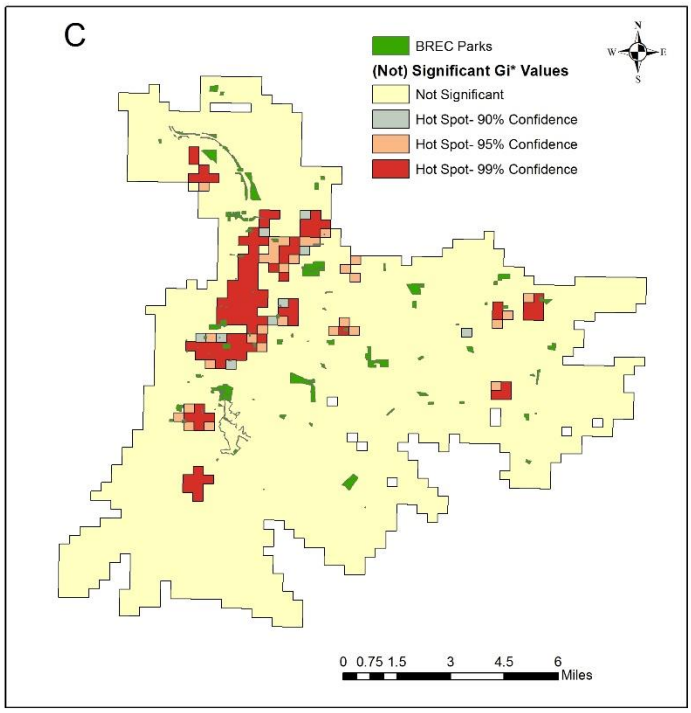
C
BREC Parks
(Not) Significant Gi* Values
Not Significant
Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
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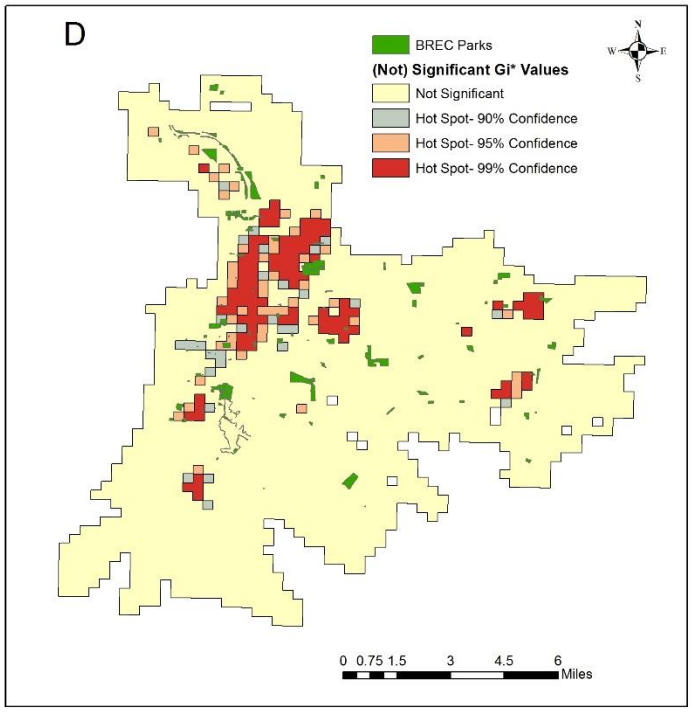
(Fig. cont'd.)


D
BREC Parks
(Not) Significant Gi* Values
Not Significant
Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
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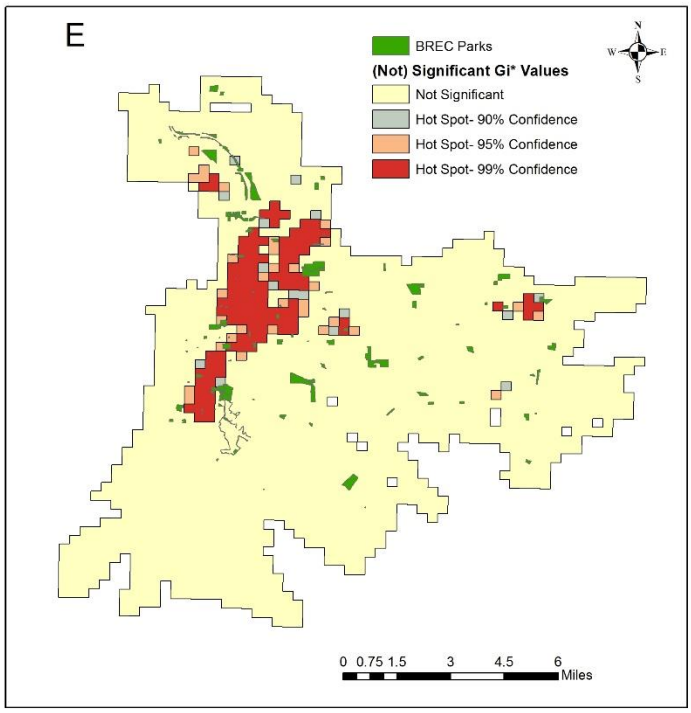
Miles


E
BREC Parks
(Not) Significant Gi* Values
Not Significant
Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
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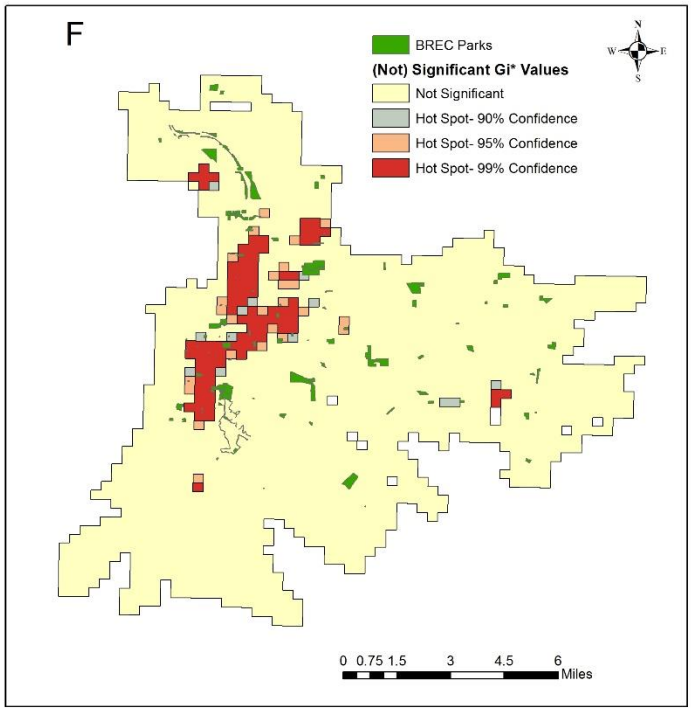
Miles

(Fig. cont'd.)


F
BREC Parks
(Not) Significant Gi* Values
Not Significant
Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
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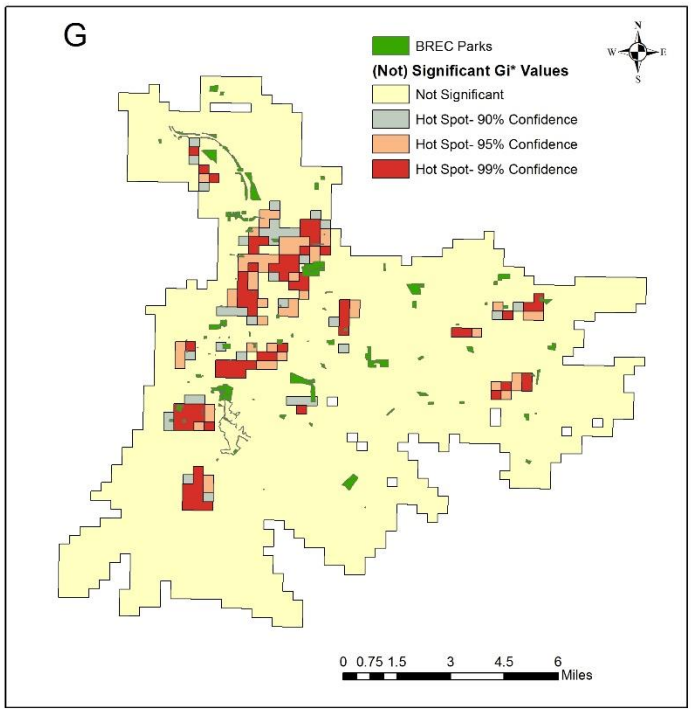
G
BREC Parks
(Not) Significant Gi* Values
Not Significant
Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
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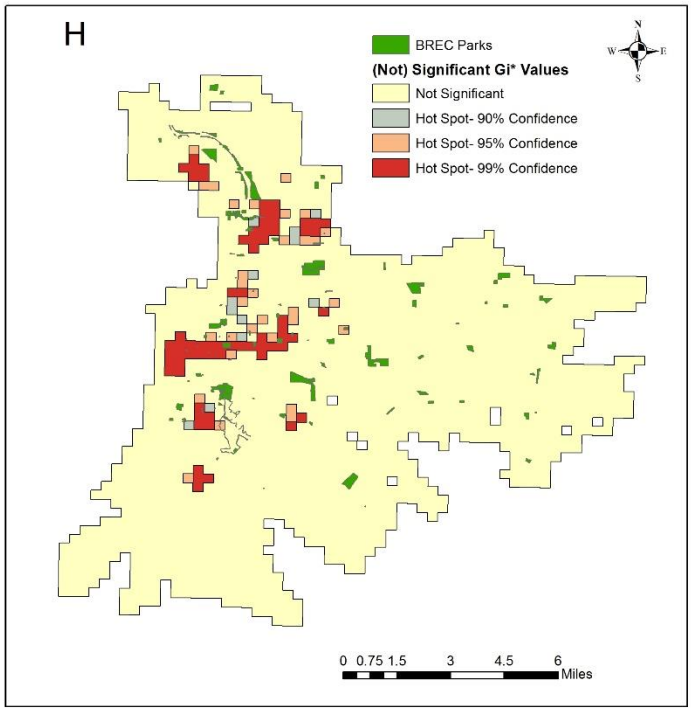
(Fig. cont'd.)


H
BREC Parks
(Not) Significant Gi* Values
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Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
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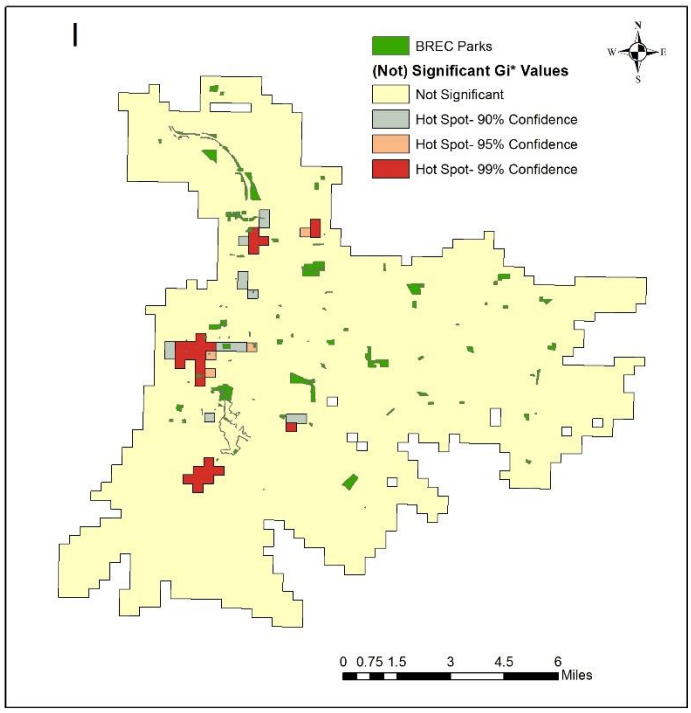
I
BREC Parks
(Not) Significant Gi* Values
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Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
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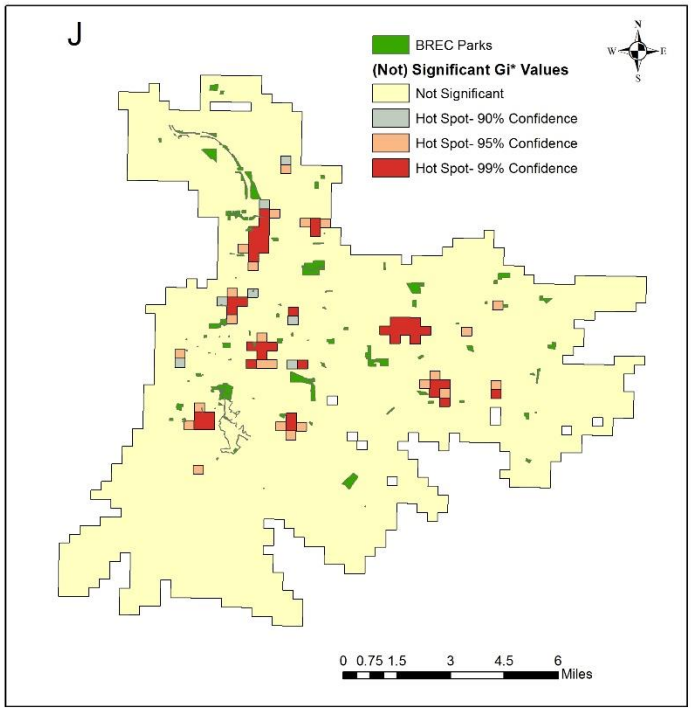
(Fig. cont'd.)


J
BREC Parks
(Not) Significant Gi* Values
Not Significant
Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
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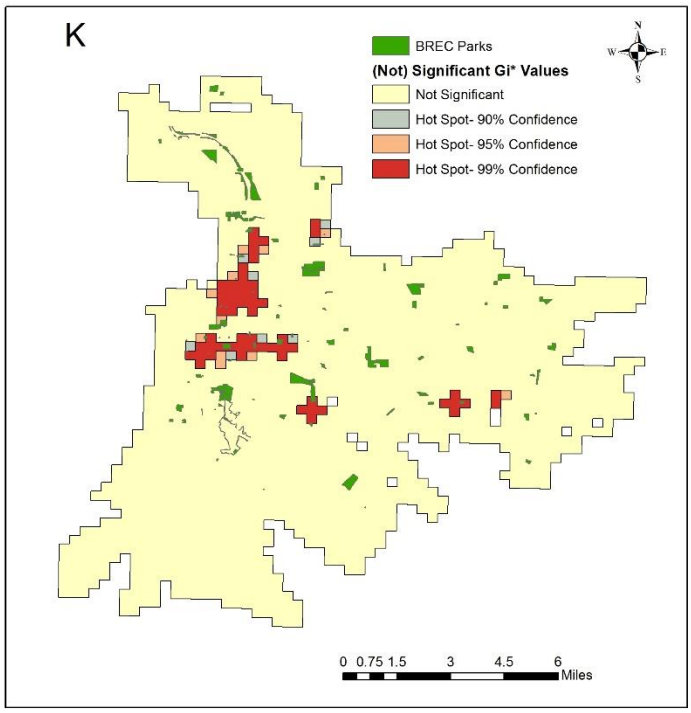
K
BREC Parks
(Not) Significant Gi* Values
Not Significant
Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
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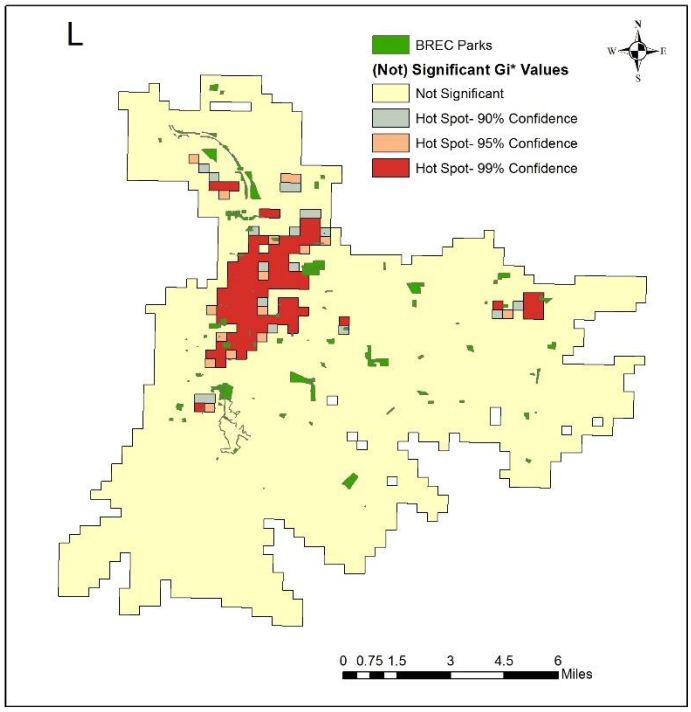
(Fig. cont'd.)


L
BREC Parks
(Not) Significant Gi* Values
Not Significant
Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
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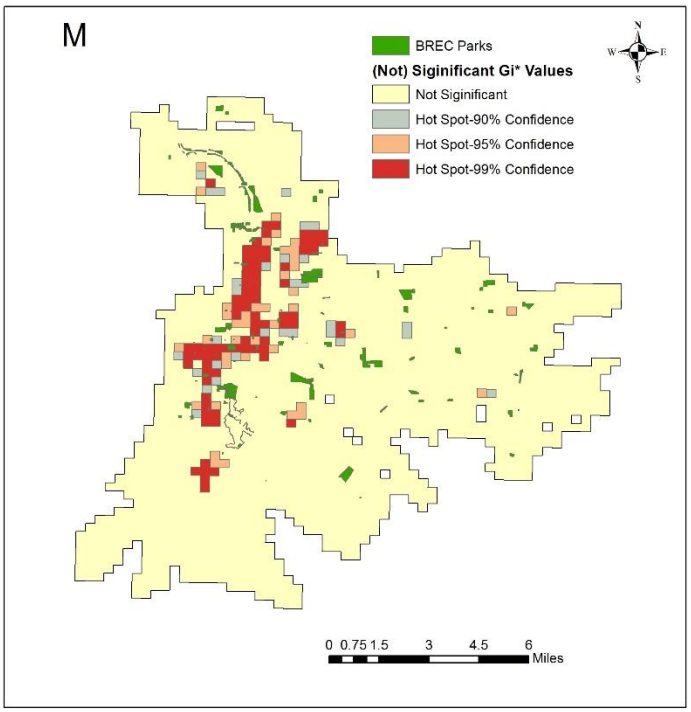
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BREC Parks
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Hot Spot-90% Confidence
Hot Spot-95% Confidence
Hot Spot-99% Confidence
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Miles

Figure 4.9 indicates whether any of the BREC parks fall into crime hotspots as calculated by the Gi^*-statistic for the time period from 2011-16. The crime type "assault" is concentrated in the north of the city. Sports Academy, North 14th Street Park, North Boulevard Park, Magnolia Cemetery, Mary J. Lands Park, Gayosa Street Park, Kernan Avenue Park, Gus Young Park, Pawnee Street Park, Pawnee Street Park, Wenonah Street Park, Belfair Park, East Brookstown Park, Memorial Sports Complex, West Brookstown Park, Saia Park, and Corporate Parkway are inside hotspots of assaults using the 99% confidence level. The battery hotspot map is similar to the assault hotspot map, except that Sports Academy, Memorial Sports Complex and Belfair Park do not fall inside battery hotspots. For robbery, most parks which are identified as crime hotspots are the same parks that also fall into assault hotspots. The difference is that small robbery hotspots concentrate in the east of the city. Thus, Duchess Drive Park, for example, is inside a robbery hotspot. Criminal damage to property are concentrated in the north and the east of the city. Duchess Drive Park, Saia Park, Blueberry Street Park, Kernan Avenue Park, Mary J. Lands Park, Acadian Thruway Park, and East Brookstown Park are all located inside hotspots of criminal damage to property. For the firearm map, the Expressway Park is identified as the only park falling inside a hotspot. However, the same park has not been identified as a crime hotspot for assault, battery, robbery, and crime damage to property. A great number of parks which are identified as crime hotspots for narcotics are located in the west of the city, including Corporate Parkway, Expressway Park, North Boulevard Park, North 14th Street Park, Sports Academy, Convention Street Park, and Magnolia Cemetery. There are a few parks identified as crime hotspots for burglary, such as Alaska Street Park, Magnolia Mound Plantation, Saia Park, and Corporate Parkway. Nuisance is foremost concentrated in the west-north of the city. Some parks that are located in the west-north of the city including Convention Street Park, Sports Academy,

North 14th Street Park, North Boulevard Park, Magnolia Cemetery, Kernan Avenue Park, and North Street Park can be identified as crime hotspots for nuisance. As far the "Other" crime category is concerned, just a handful of hotspots can be found in parks, including Expressway Park, Sports Academy, and Convention Street Park. The only theft hotspot can be identified in the Kernan Avenue Park. Convention Street Park, Sports Academy, North 14th Street Park, Magnolia Cemetery, Kernan Avenue Park, North Street Park, Acadian Thruway Park, Pawnee Street Park, and Park Madison Avenue Park are in vice hotspots. Homicide hotspots show a similar spatial pattern to the hotspots of assault. For all crime types, combined, Corporate Parkway, Expressway Park, Convention Street Park, Sports Academy, North 14th Street Park, North Boulevard Park, Magnolia Cemetery, Kernan Avenue Park, Acadian Thruway Park, East Brookstown Park, and Saia Park fall inside hotspot areas.

CHAPTER 5. CONCLUSIONS

In general, this thesis research analyzes a large number of crimes from different crime types reported to the BPRD in the city of Baton Rouge, LA, from January 1 2011 to December 31 2016. The primary goal of this thesis research has been to examine the question of whether differences exist between the composition of crimes and crime types in the city of Baton Rouge with all BREC parks, located in the same city. A second goal of this thesis focused on the impact that BREC parks have on crime in neighborhoods adjacent to them, and whether BREC parks are crime generators in the urban area of Baton Rouge. A third and final goal was whether BREC parks can be identified as crime hotspots inside the city of Baton Rouge.

The results from this thesis research indicate that the composition of crime types for all BREC parks is significantly different from the composition of crime types for the city of Baton Rouge for each year from 2011 to 2016 and for all six years, combined. The main reason for this difference is that crime types “firearm”, “nuisance”, and “theft” possess different proportions compared between the city and all BREC parks. “Firearm” and “nuisance” in parks were associated with a higher proportion compared to the city. On the contrary, the theft in the city was associated with a higher proportion compared to parks.

The results from CLQ analysis confirms that crime does not seem to be clustered inside BREC parks compared to the city of Baton Rouge. BREC parks serve as a strong detractor of crimes. The results indicate that parks are likely to produce dramatic reduction in park related crime (Braga, 2007). A possible reason is that parks may attract more families and conventional users to an area, and this increase in legitimate city park users may help park to become safer, because of added informal control and surveillance (Jacobs, 1961). However, some specific parks have indeed high values of CLQs. For example, Acadian Thruway Park, Wenohah Street

Park, and North 14th Street Park seem to act as strong attractors of total crimes with a CLQ > 3. One explanation for this finding is that these parks have relatively small areas, and Demotto and Davies (2006) state that parks greater than 0.012 square miles appear to have a greater influence on reducing crime than smaller parks. However, the surrounding areas of parks (0-200 feet buffer, 201-400 feet buffer, 401-600 feet buffer) attract crime events based on values of the CLQ. Groff and McCord (2012) present similar results in their research, which show that neighborhood parks with their surrounding areas, especially within 400 to 800 feet, result in a high crime location quotient as compared with the city, as a whole.

This thesis shows some indication that one specific crime type affects the value of the CLQ across parks and their buffer areas. For example, park areas seem to have a spatial concentration of the crime type nuisance. Specifically, it appears that parks are associated with a higher risk of nuisance. Travers (2005) claims that parks are related with small time criminals like recurring nuisance because bushes obscure visibility in some parts of parks. This seems to be the only exception, since CLQ values of all the other crime types analyzed are all lower than 1 for park areas. The crime type theft has the lowest CLQ values for parks from 2011 to 2016. This means that parks do not attract. A possible reason for this result is that in the U.S., people go to park for running or jogging and often do not bring valuable things.

Outside of park areas, most crime types exhibit the highest CLQ values in the 401-600 feet buffer areas, with somewhat lower CLQ values in both the 0-200 and the 201-400 feet buffer areas. For all six years combined, CLQ values for assault, battery, firearm, theft, and vice increase with distance to parks, which is supported by research of Demotto and Davies (2006). CLQ values for robbery, criminal damage to property, narcotics, burglary, nuisance, other, and homicide decrease for the 201-400 feet buffers, but increase for the 401-600 feet buffer areas.

Based on the analysis of Gi^* statistic, some BREC parks could be identified as crime hotspots for all six years, combined. For instance, Expressway Park, Convention Street Park, Sports Academy, North 14th Street Park, North Boulevard Park, and Magnolia Cemetery are associated with crime hotspots for all 12-crime types analyzed. According to hotspot maps, crime are strongly concentrated in the north and west of the city of Baton Rouge. The reason is that west of the city area is the downtown area, where many different land use types potentially attract crime (Sypion-Dutkowska and Leitner, 2017). Another reason is that the hotspot area which extend north are relative poor area with a different social economic structure, which attract crimes.

The results of this thesis could possibly provide useful ideas for law enforcement agencies in the city of Baton Rouge. If a park is associated with a high CLQ value, or could be identified as a crime hotspot for all crime types such as Acadian Thruway Park and North 14th Street Park, this park should receive more attention by law enforcement agencies. Moreover, the police should allocate their limited resources to the surrounding areas of parks, rather than to parks, because the surrounding areas of parks attract a higher number of crime events compared to parks. On the other hand, for one specific crime types, namely nuisance, law enforcement agencies of the city of Baton Rouge should pay much attention to BREC parks. Of all twelve-crime types analyzed, nuisance seems to be the only crime type that is higher in parks than in their surroundings.

While this thesis answered three innovative research questions about parks and the city in which they are located, it has its limitations. First, crime events occurring in parks were selected based on the official park address. The total number of crimes that happened in parks maybe underrepresented, since the police may have incorrectly recorded the offense location at an

address that is different from the actual park address. Second, there are some limitations with official crime data. Some of the sexual assault victims and juvenile victims are not geocoded or mapped by the police in order to protect the privacy of the associated crime victims. For this reason, these crime types may not provide valuable and complete information for spatial analysis. Third, the study area is limited to the city of Baton Rouge. The results of this thesis research may not be applicable to other urban study areas. Other cities may have higher CLQ values in the parks when compared with cities in which they are located. For instance, Groff and McCord (2012) claim that neighborhood parks are associated with increased level of crime in park areas compared to the city of Philadelphia. Finally, this thesis could not deny the relationship between crime and social economic content. For instance, Bad economies lead to more property crimes and robberies as criminals steal coveted items they cannot afford. The economic anxiety of bad times leads to more domestic violence and greater consumption of mind-altering substances, leading to more violence in general.

Future research could identify whether specific facilities in parks, such as recreation centers, playgrounds, restrooms, indoor basketball courts, outdoor basketball courts, unlit baseball courts, lighted baseball courts, tennis courts, and walking paths can be associated with different levels of crime. In addition, future research may focus on collecting information on the number of park users in order to calculate a relative measure of crime, such as the crime rate, which may be seen as a more appropriate indicator for safety concerns compared to the actual number of crimes. Finally, specific land use types surrounding parks and their influence on crime could be tested in future research.

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APPENDIX: THE HOTSPOT RESULTS

All other crime hotspot maps using the Gi*-statistic for the same crime types and all crime types combined for each individual year from 2011 to 2016 are shown in the Appendix.

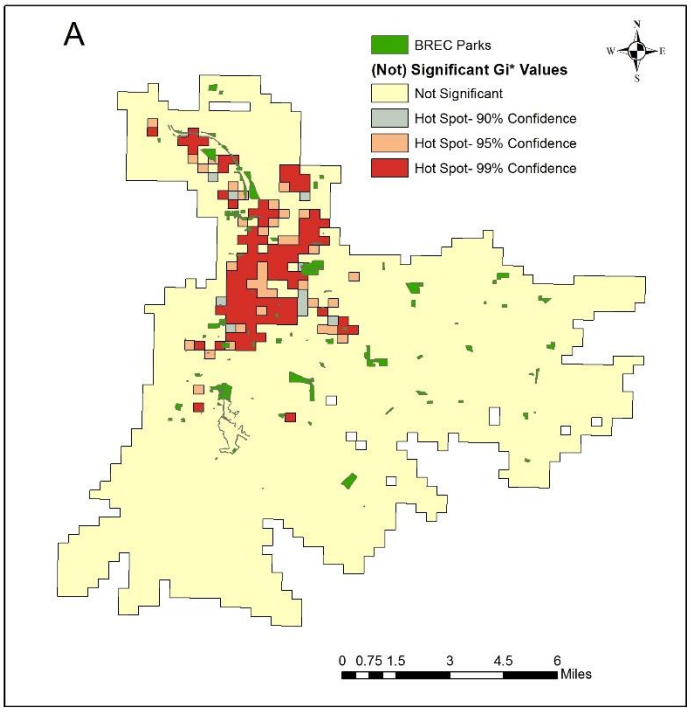

Figure A.1. Crime hotspot maps for twelve different crime types and all crimes types combined using the Gi*-statistic for the year 2011. (A) Assault; (B) Battery; (C) Robbery; (D) Criminal damage to property; (E) Firearm; (F) Narcotic; (G) Burglary; (H) Nuisance; (I) Other; (J) Theft; (K) Vice; (L) Homicide; (M) All crime types.

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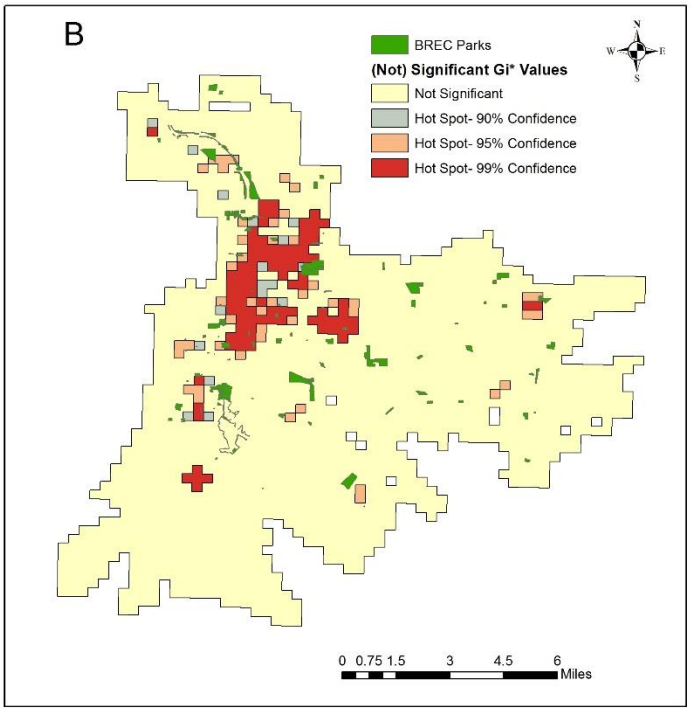
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(Not) Significant Gi* Values
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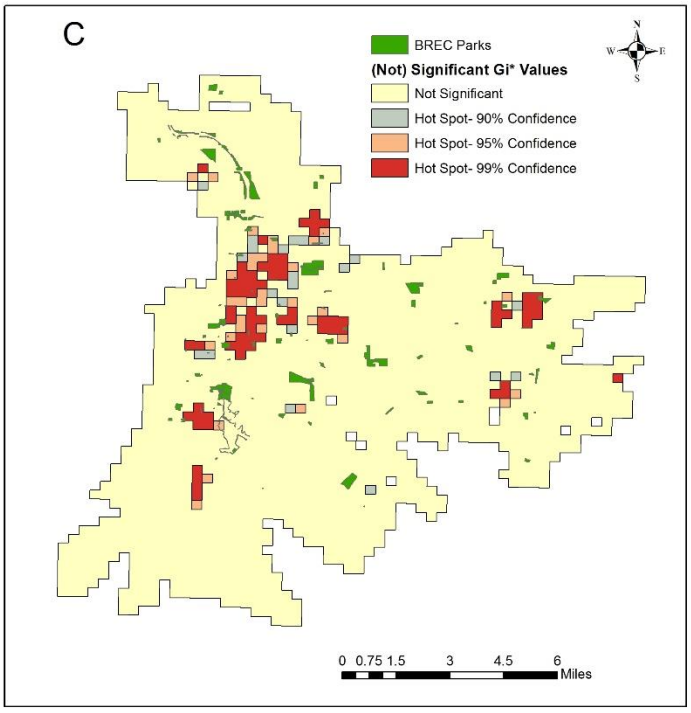
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BREC Parks
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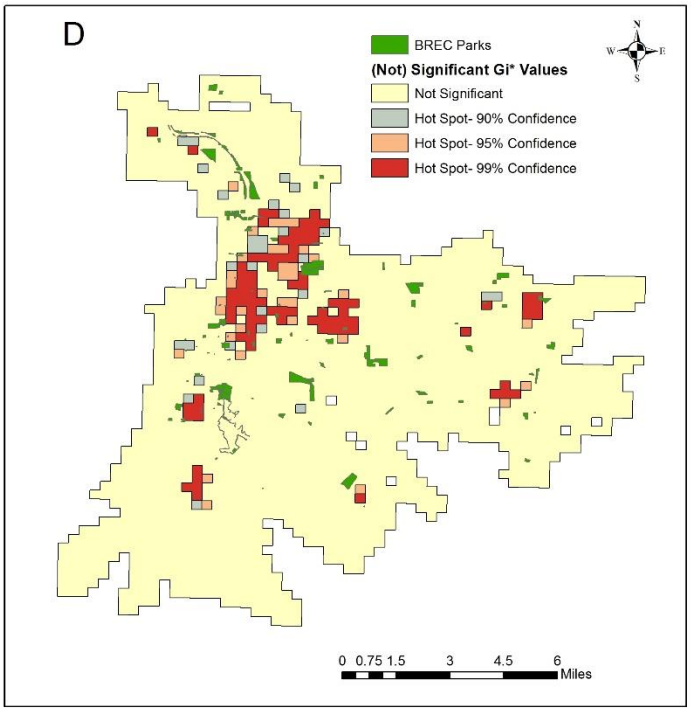
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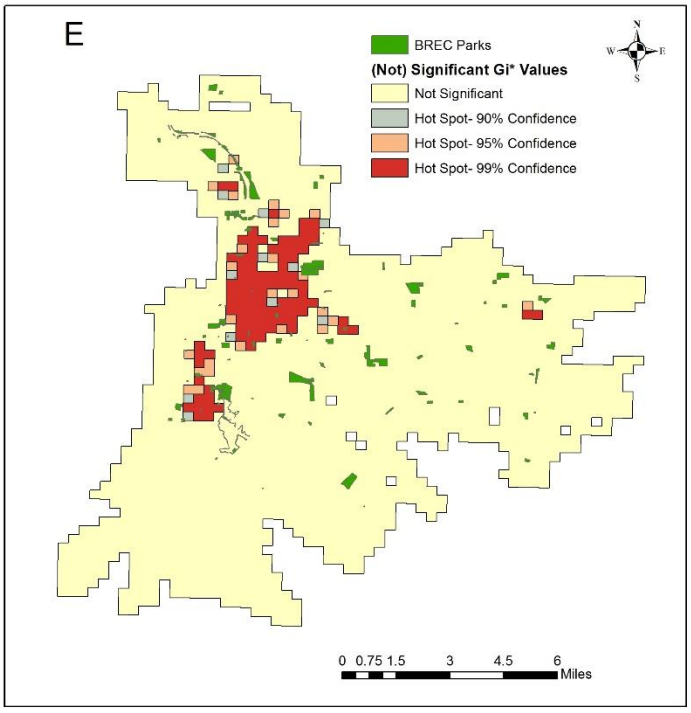
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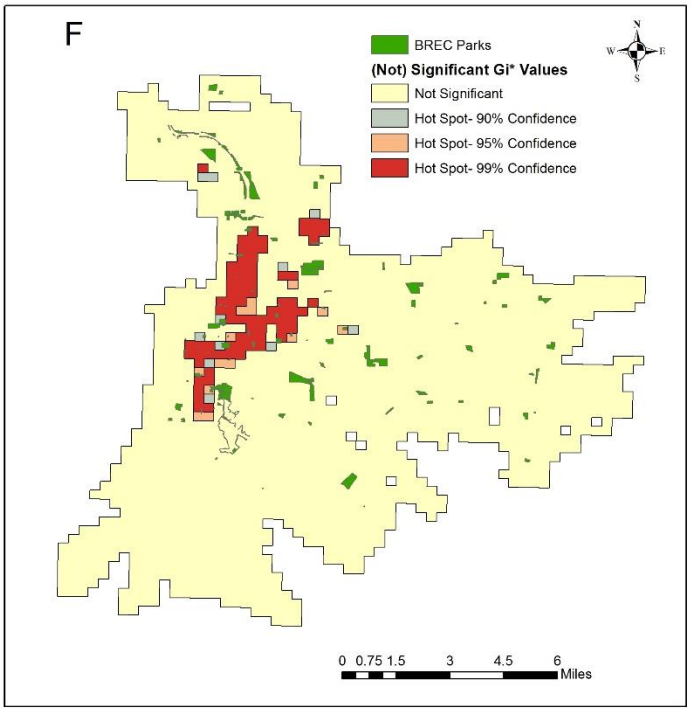
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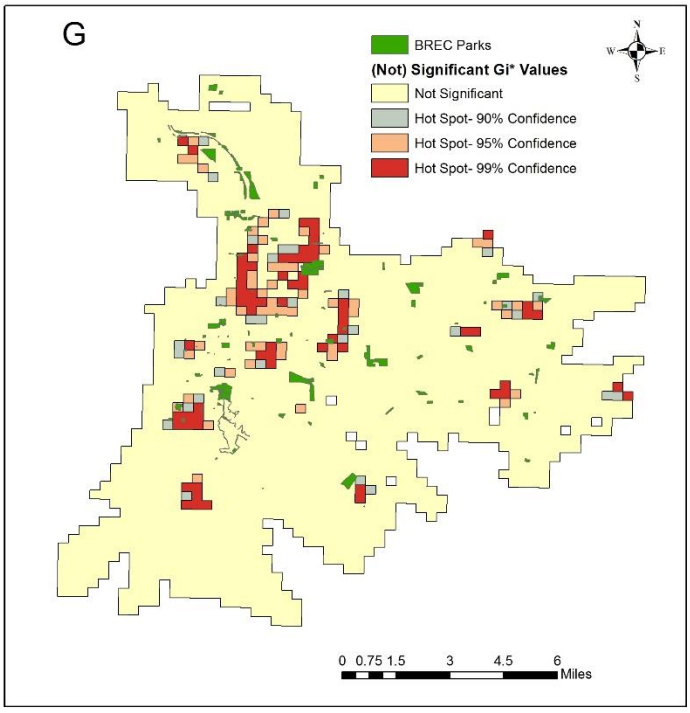
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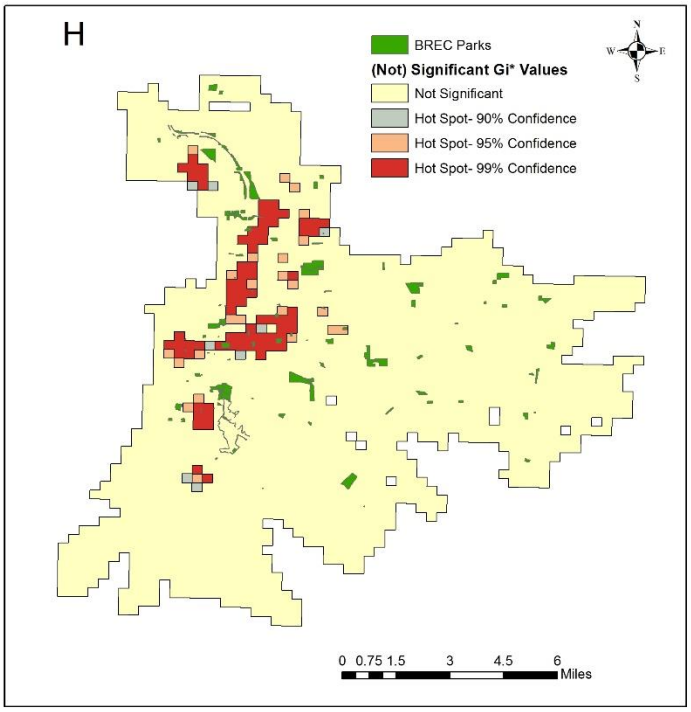
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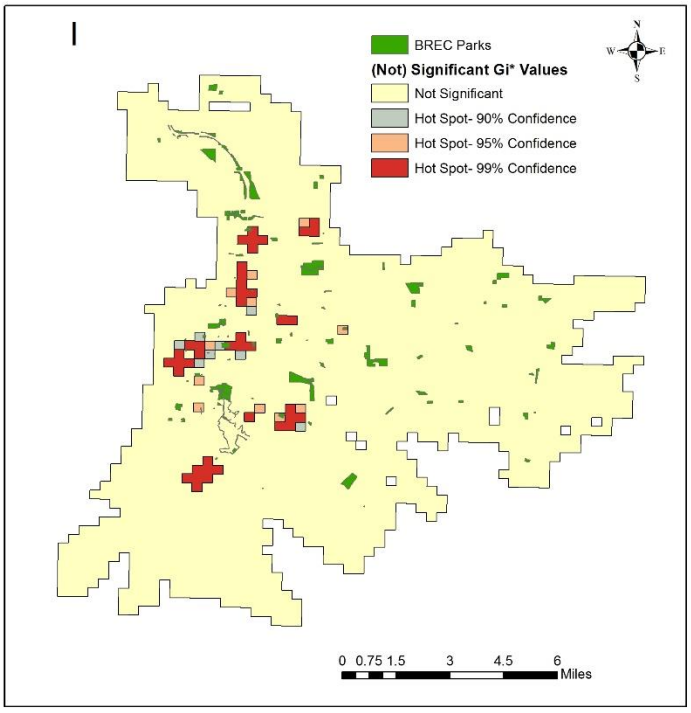
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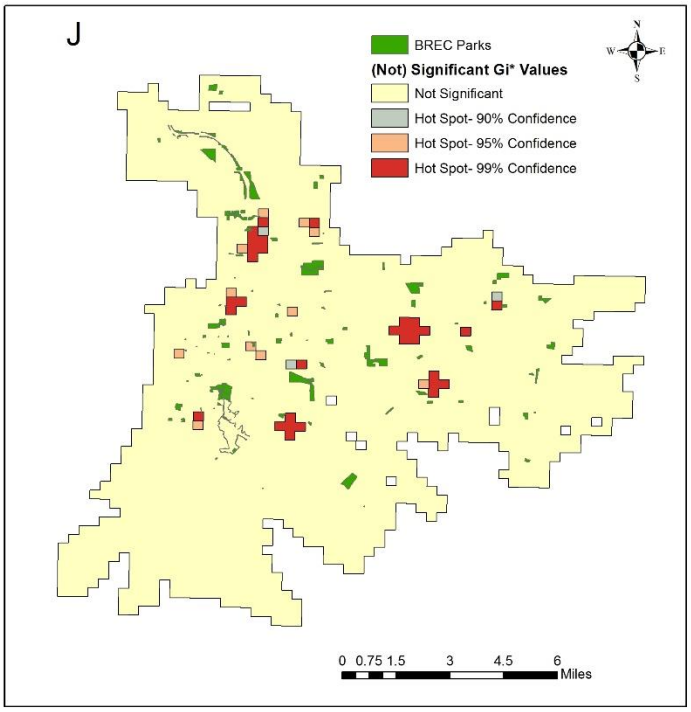
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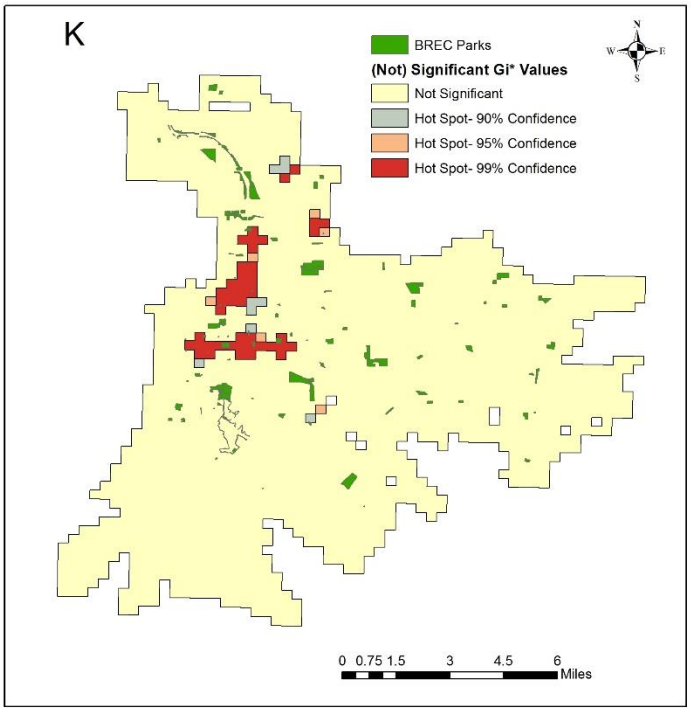
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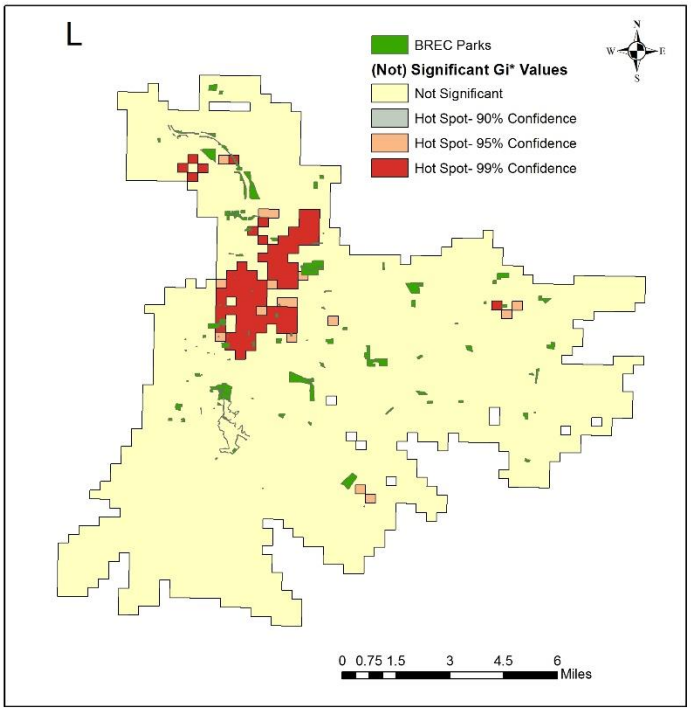
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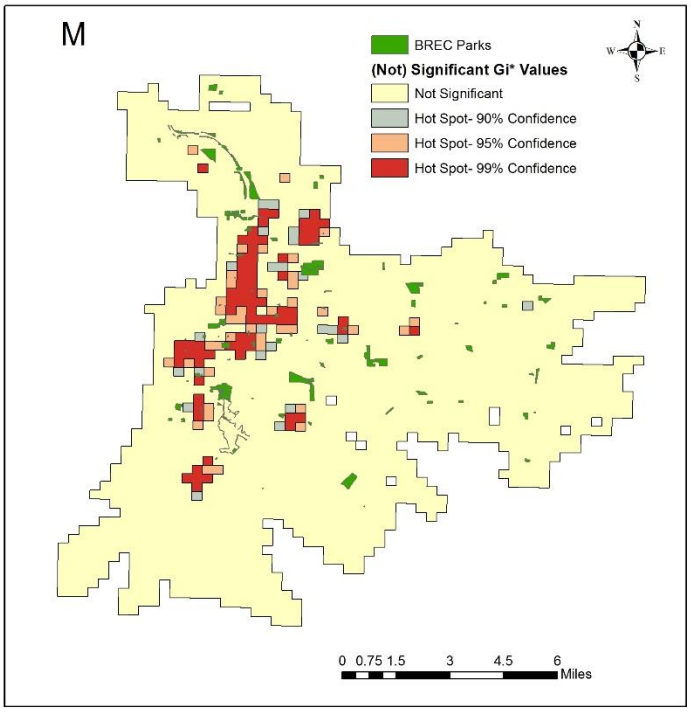
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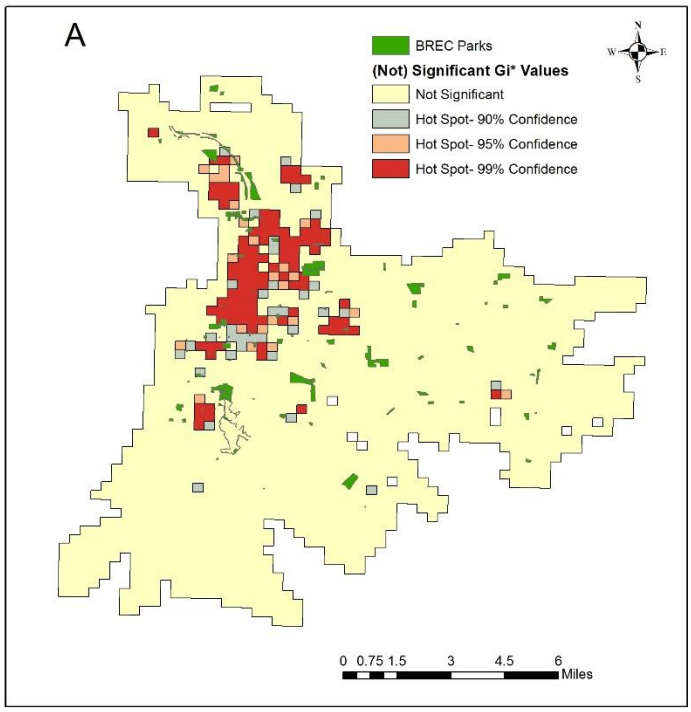

Figure A.2. Crime hotspot maps for twelve different crime types and all crimes types combined using the Gi*-statistic for the year 2012. (A) Assault; (B) Battery; (C) Robbery; (D) Criminal damage to property; (E) Firearm; (F) Narcotic; (G) Burglary; (H) Nuisance; (I) Other; (J) Theft; (K) Vice; (L) Homicide; (M) All crime types.

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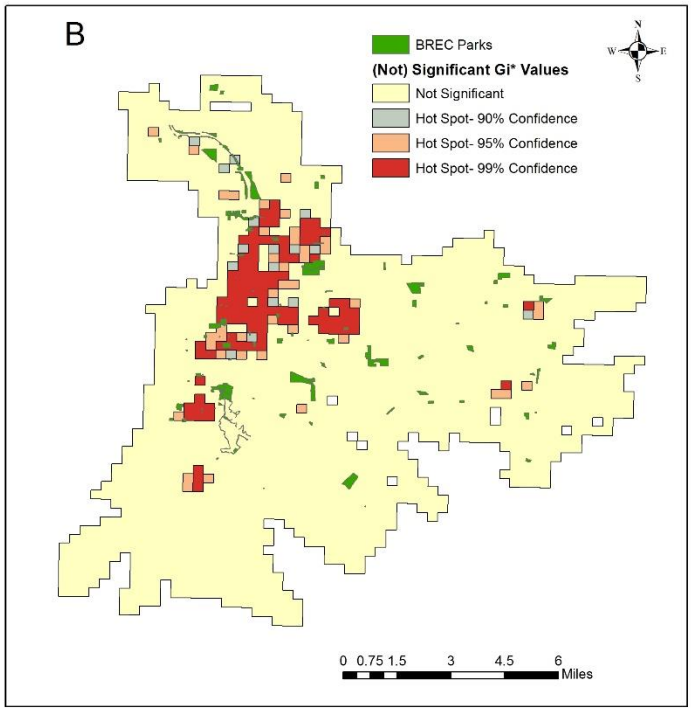
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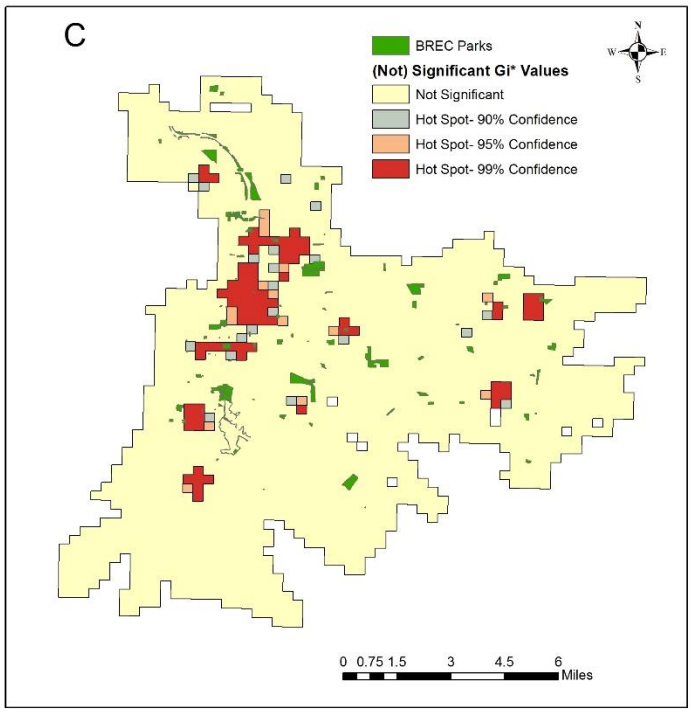
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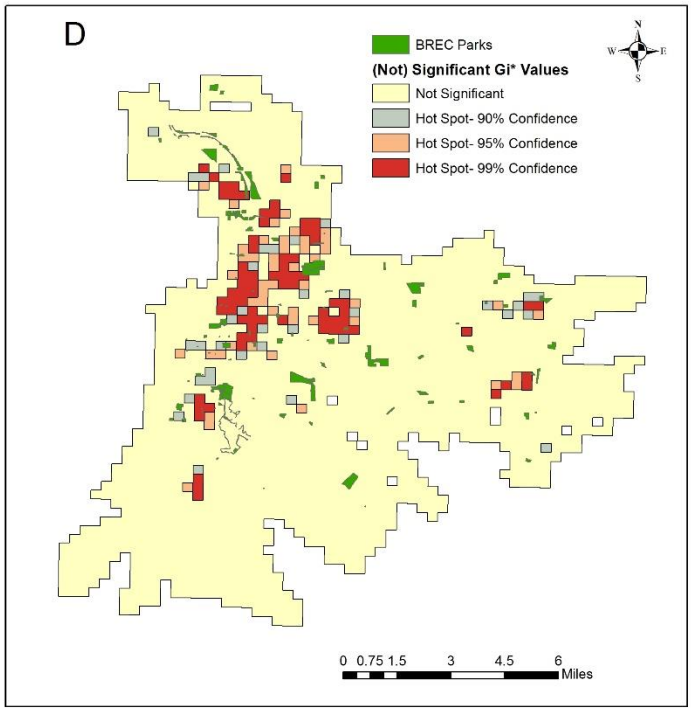
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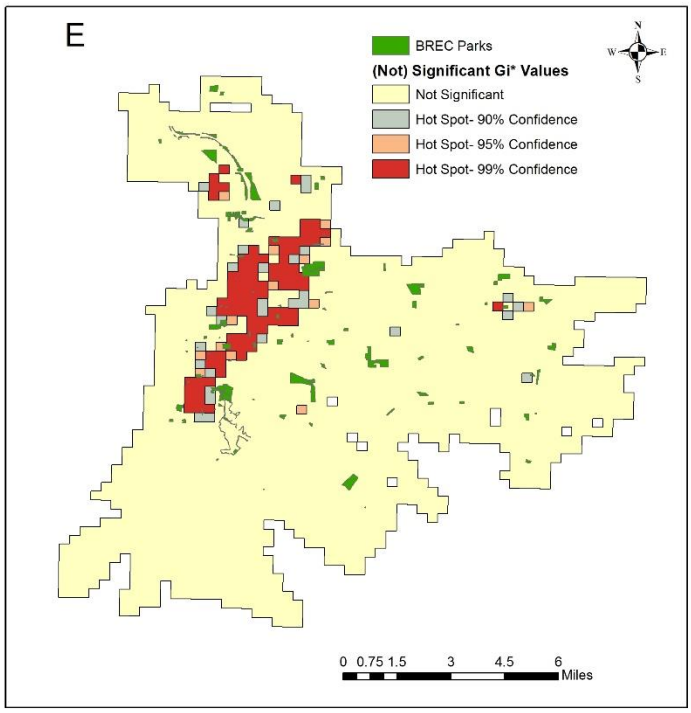
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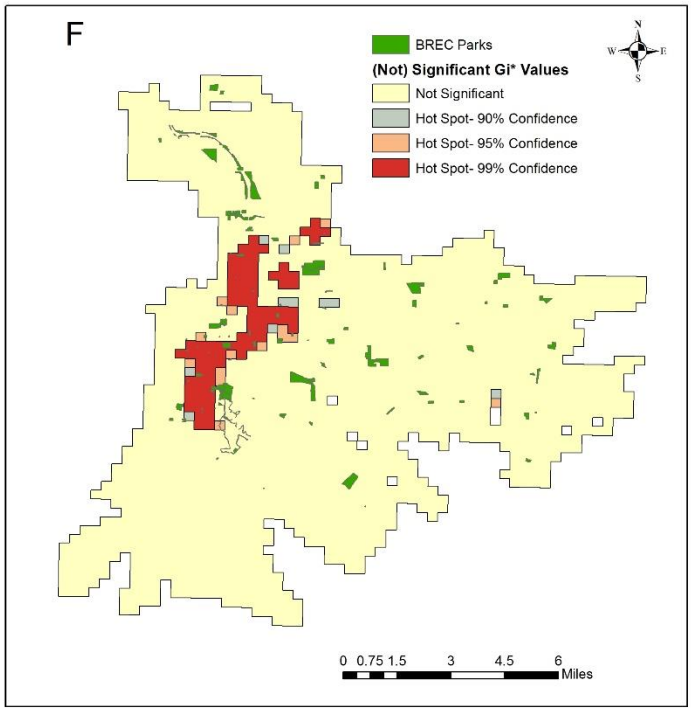
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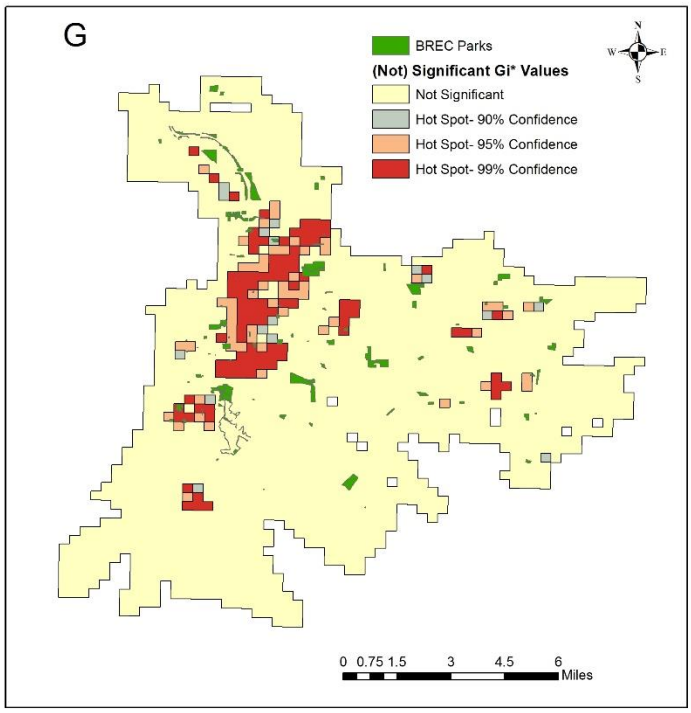
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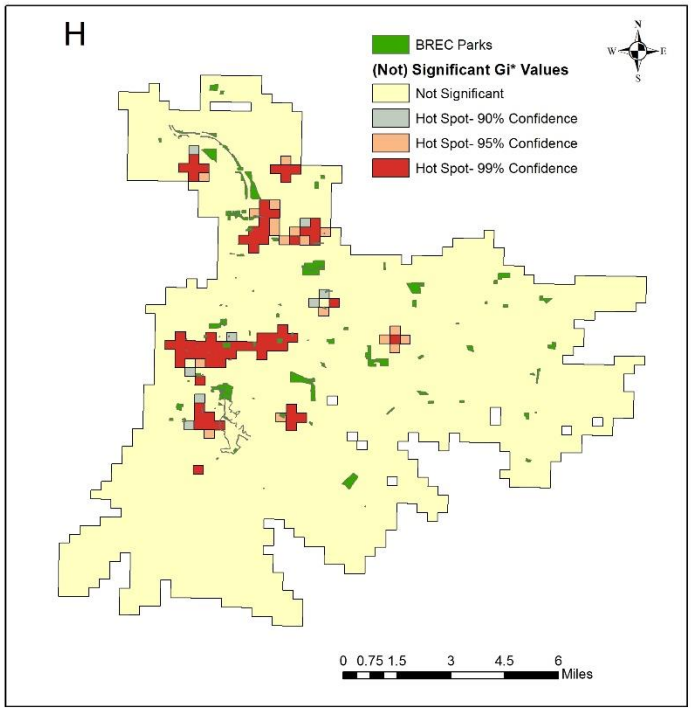
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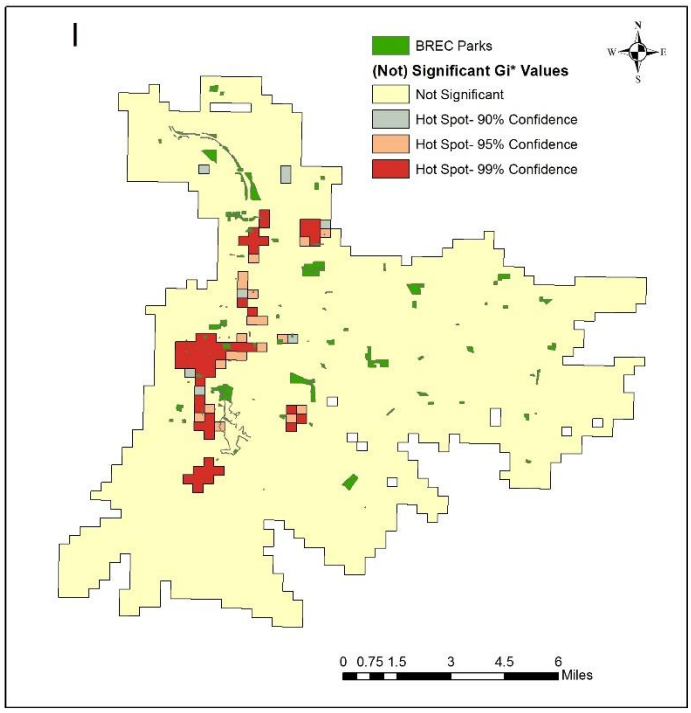
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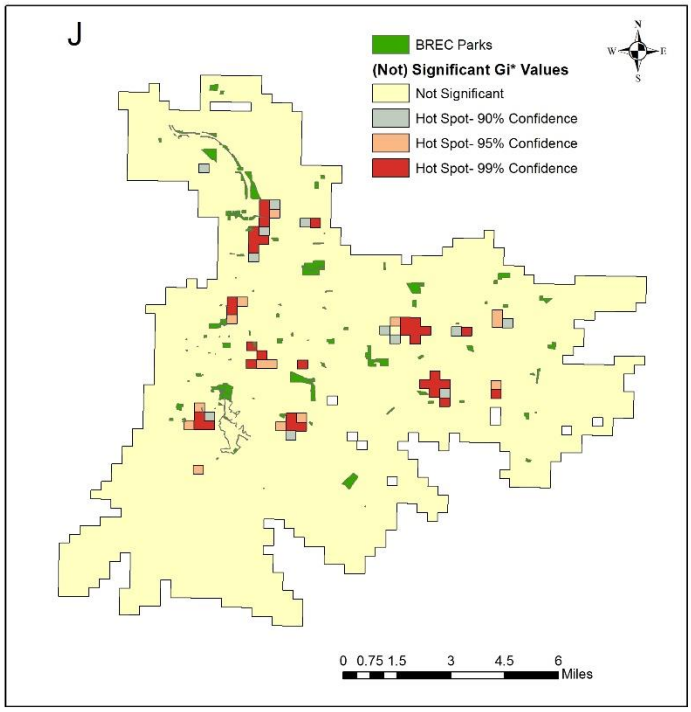
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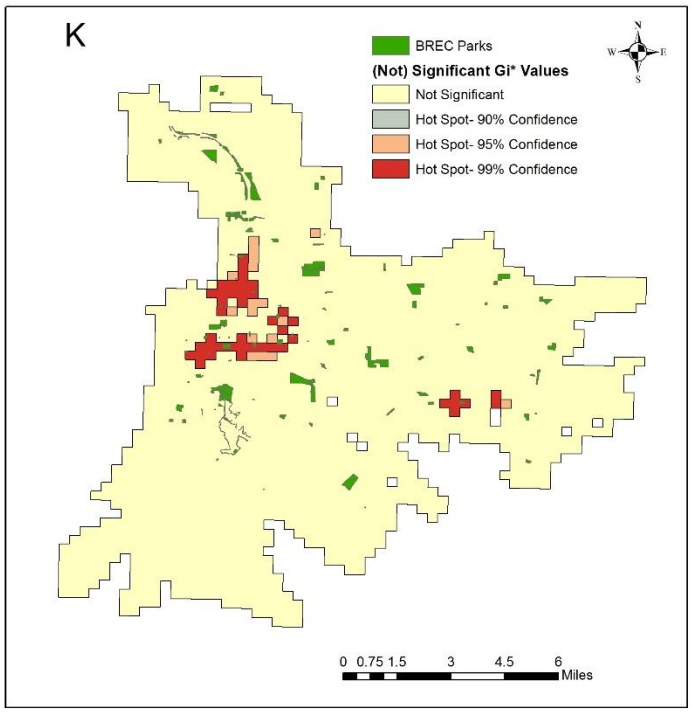
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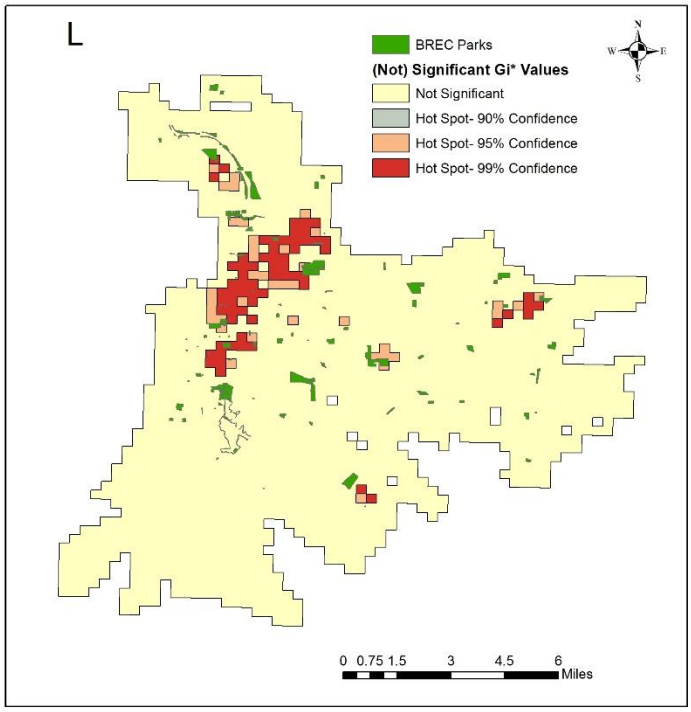
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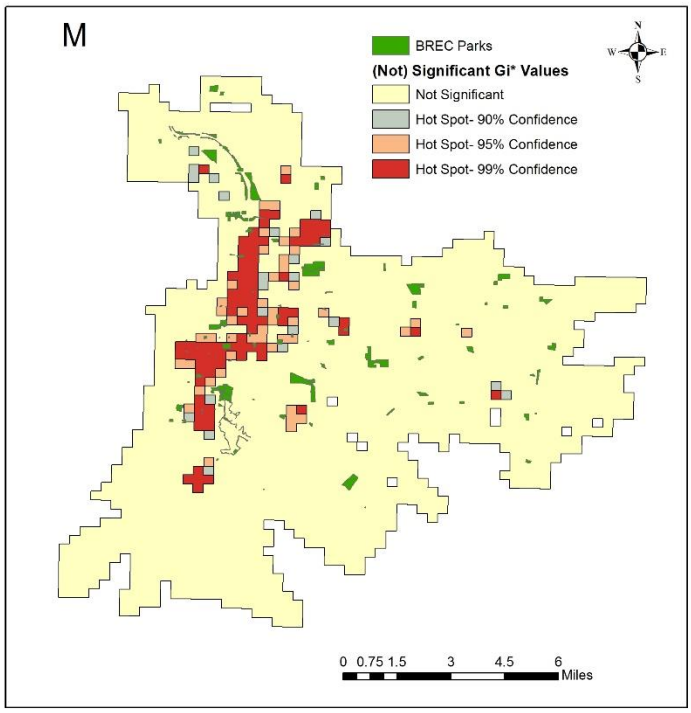
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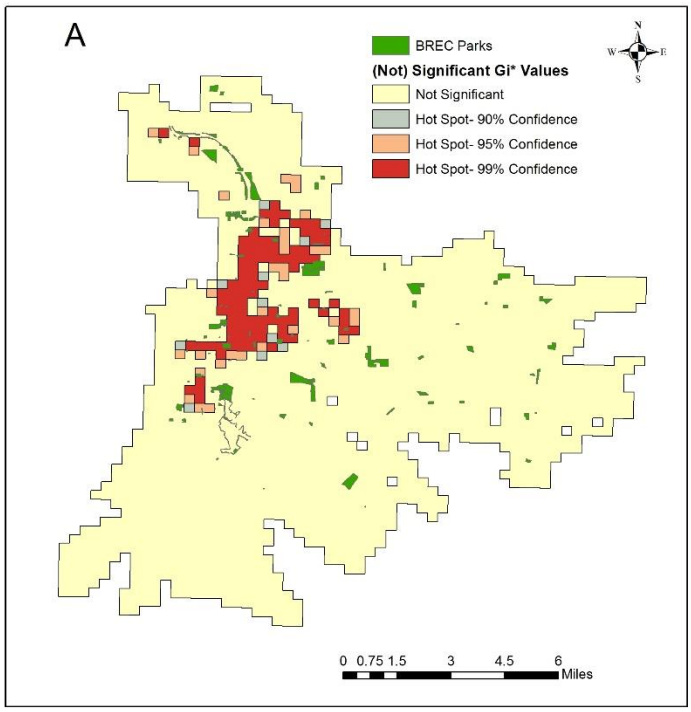

Figure A.3. Crime hotspot maps for twelve different crime types and all crimes types combined using the Gi*-statistic for the year 2013. (A) Assault; (B) Battery; (C) Robbery; (D) Criminal damage to property; (E) Firearm; (F) Narcotic; (G) Burglary; (H) Nuisance; (I) Other; (J) Theft; (K) Vice; (L) Homicide; (M) All crime types.

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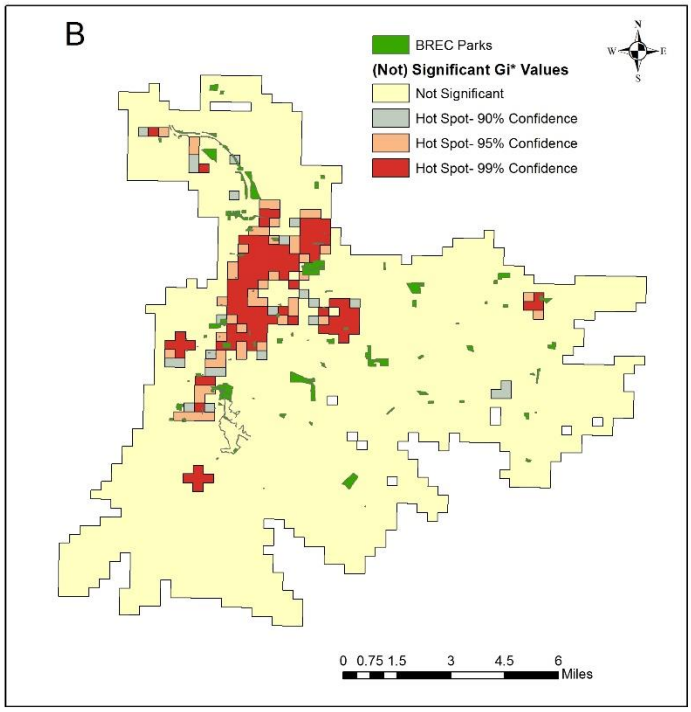
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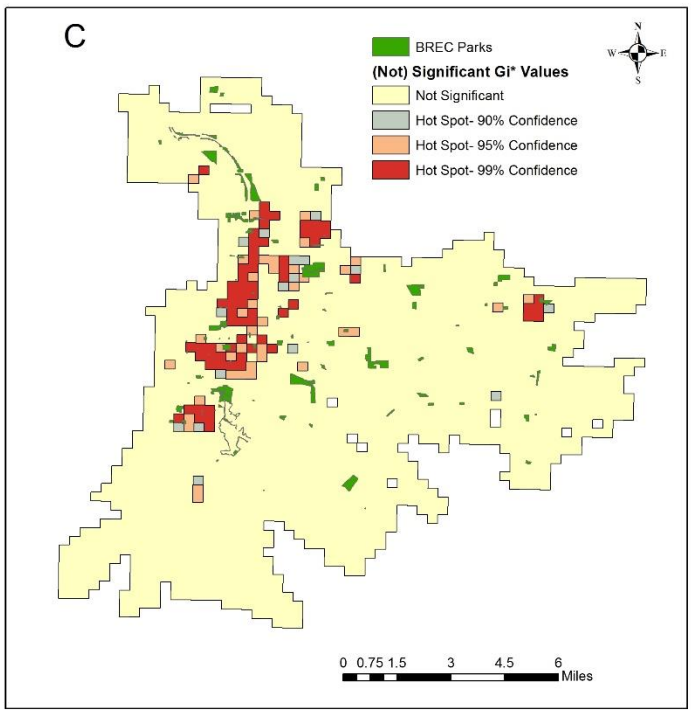
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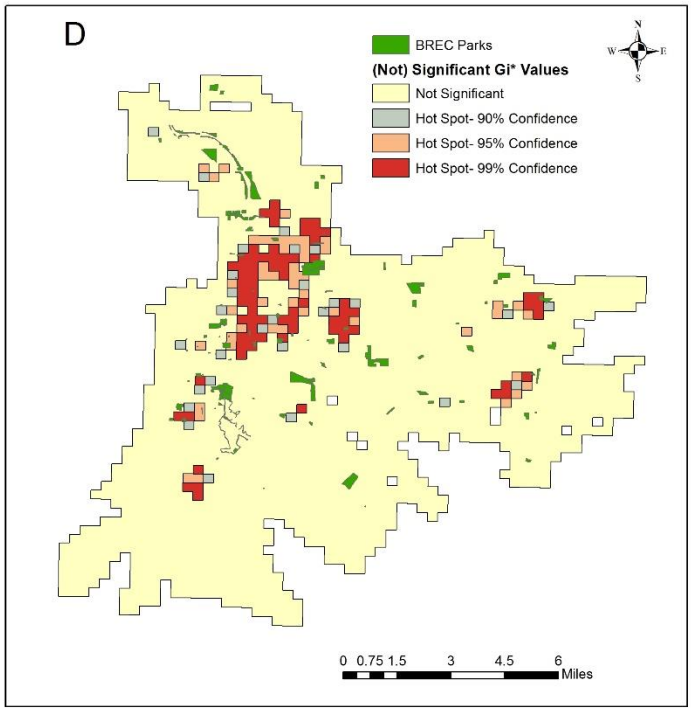
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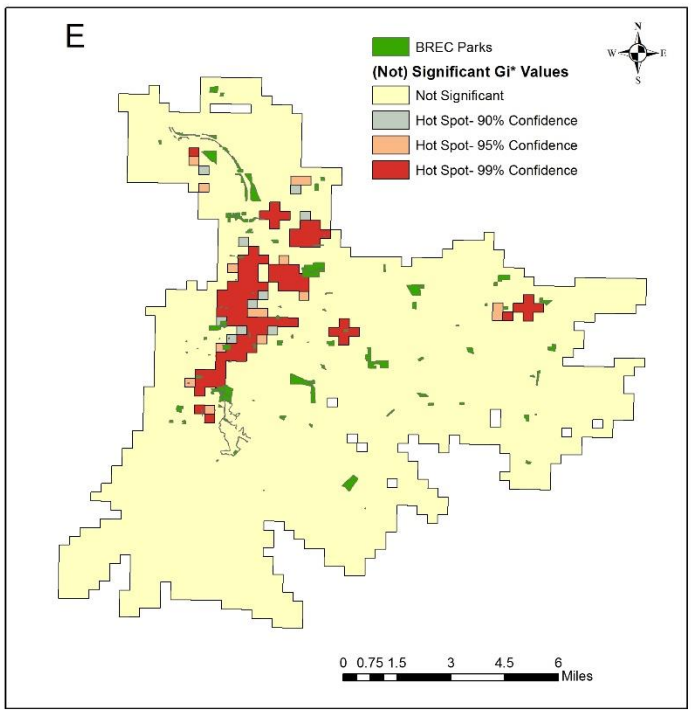
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Miles

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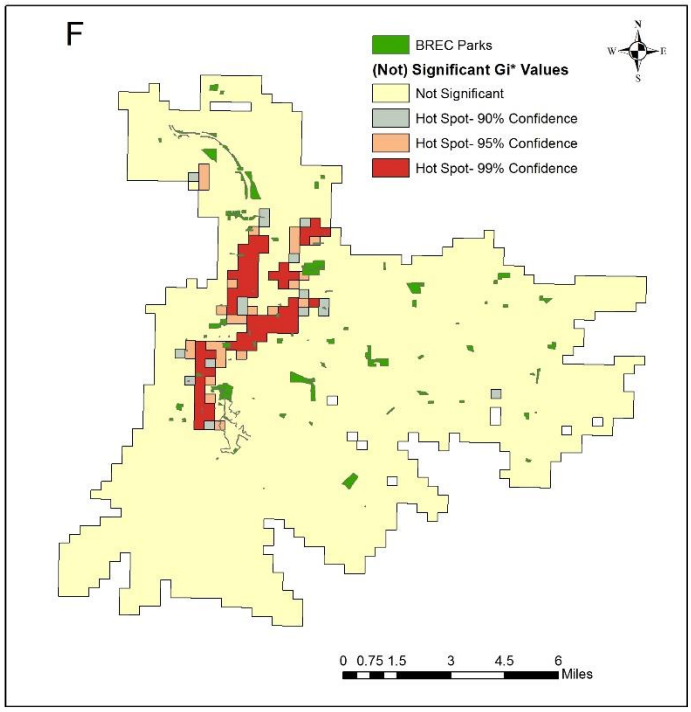
F
BREC Parks
(Not) Significant Gi* Values
Not Significant
Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
N
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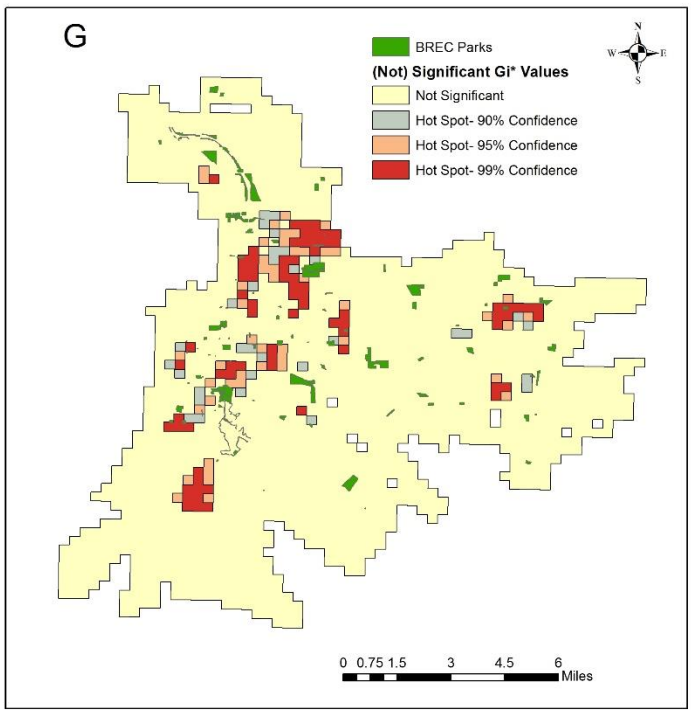
Miles


G
BREC Parks
(Not) Significant Gi* Values
Not Significant
Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
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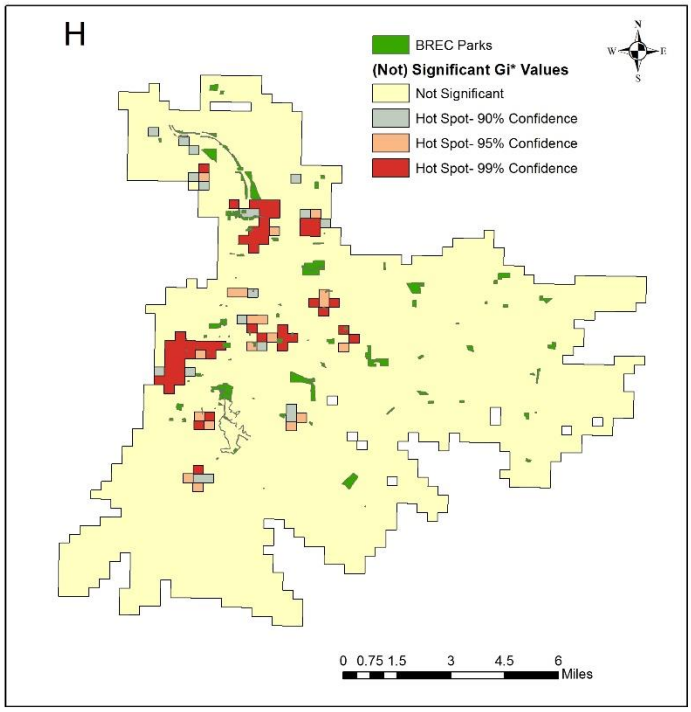
Miles

(Fig. cont'd.)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BREC Parks
(Not) Significant Gi* Values
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Hot Spot- 99% Confidence
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S
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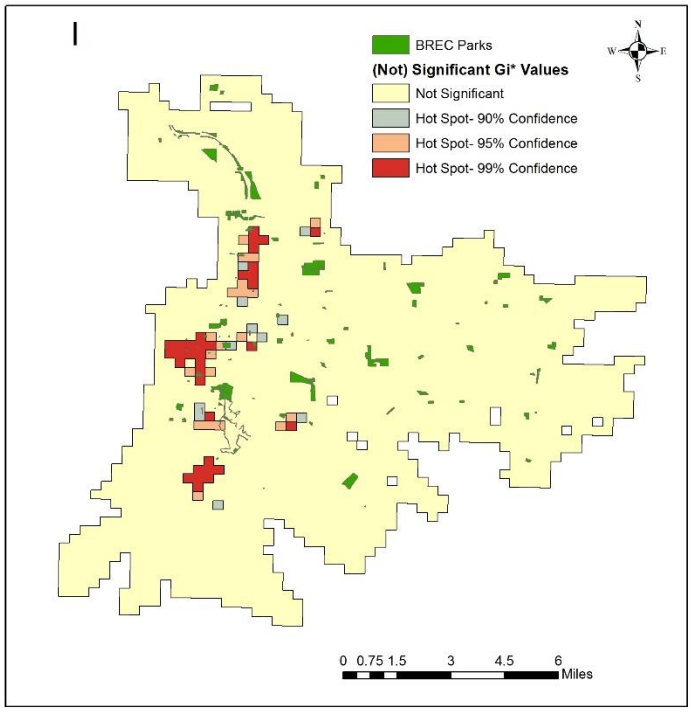
Miles


I
BREC Parks
(Not) Significant Gi* Values
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Hot Spot- 90% Confidence
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Hot Spot- 99% Confidence
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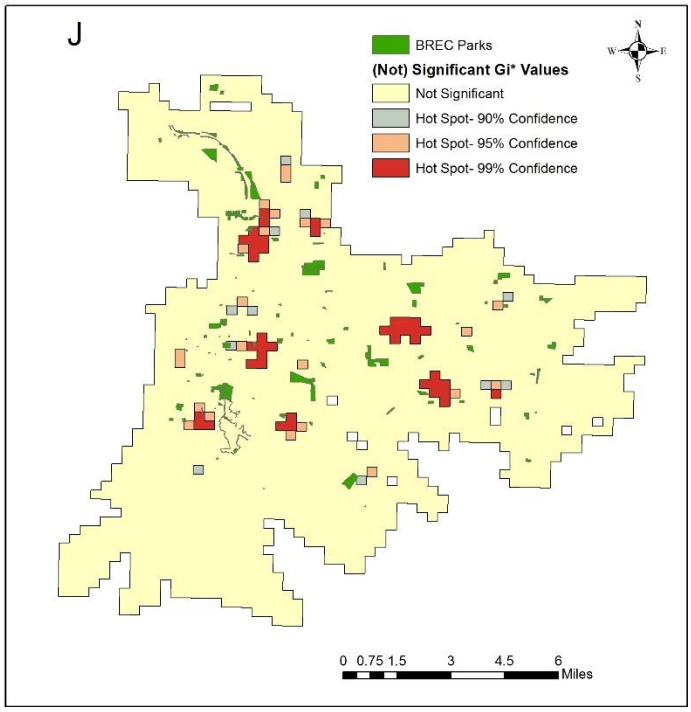
Miles

(Fig. cont'd.)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BREC Parks
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Hot Spot- 99% Confidence
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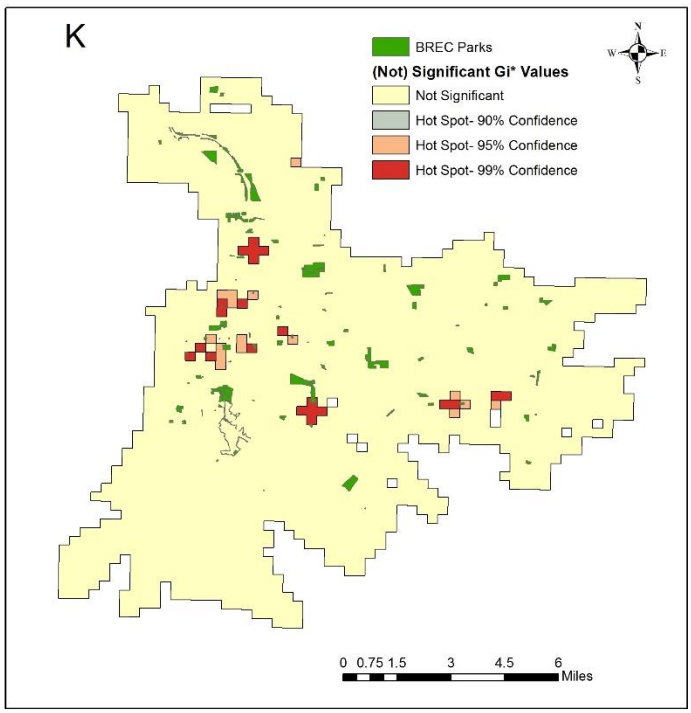
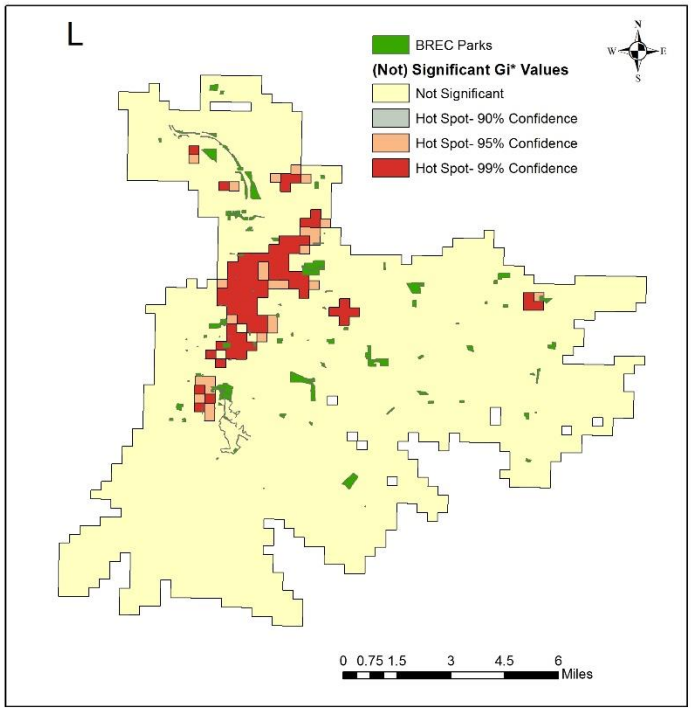
Miles


K
BREC Parks
(Not) Significant Gi* Values
Not Significant
Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
N
W
E
S
0 0.75 1.5 3 4.5 6
Miles

(Fig. cont'd.)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BREC Parks
(Not) Significant Gi* Values
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Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
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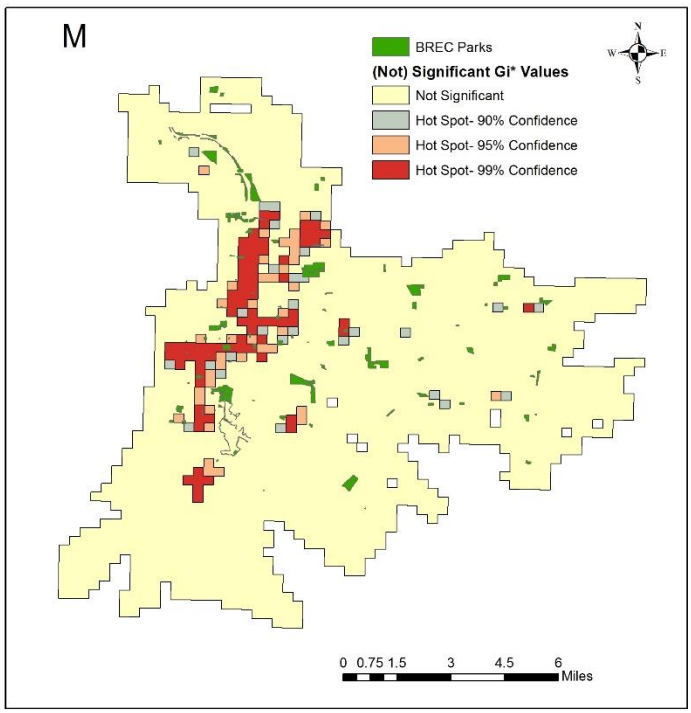
Miles


M
BREC Parks
(Not) Significant Gi* Values
Not Significant
Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
N
W
E
S
0 0.75 1.5 3 4.5 6
Miles

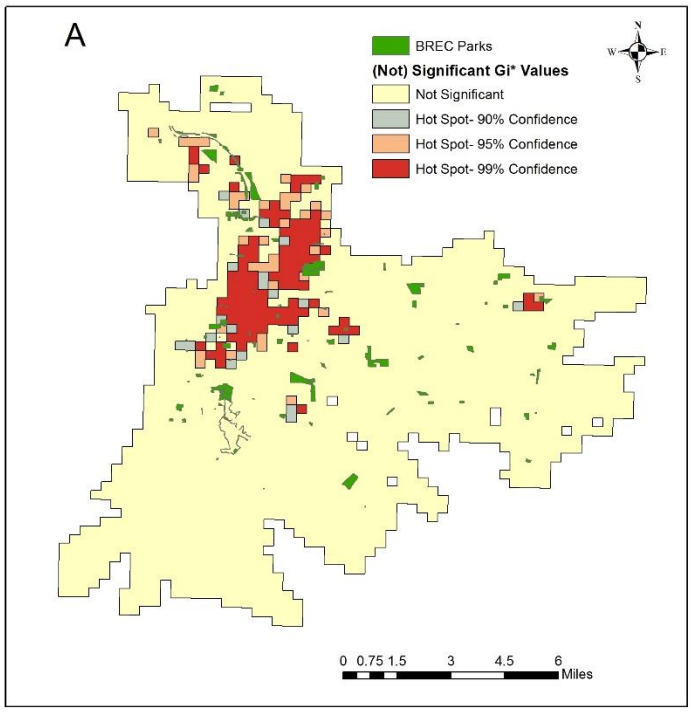
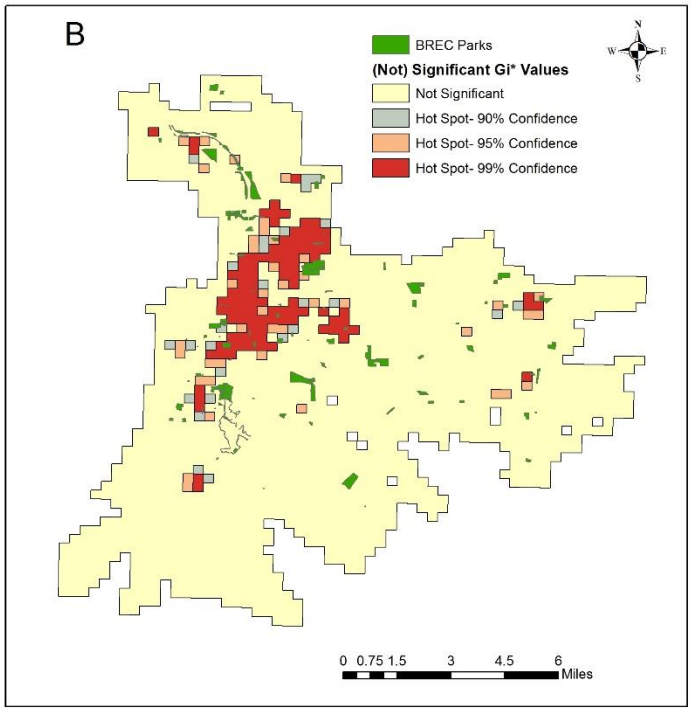


Figure A.4. Crime hotspot maps for twelve different crime types and all crimes types combined using the Gi*-statistic for the year 2014. (A) Assault; (B) Battery; (C) Robbery; (D) Criminal damage to property; (E) Firearm; (F) Narcotic; (G) Burglary; (H) Nuisance; (I) Other; (J) Theft; (K) Vice; (L) Homicide; (M) All crime types.

Figure A.4 continues on following pages.

(Fig. cont'd.)


B
BREC Parks
(Not) Significant Gi* Values
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Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
N
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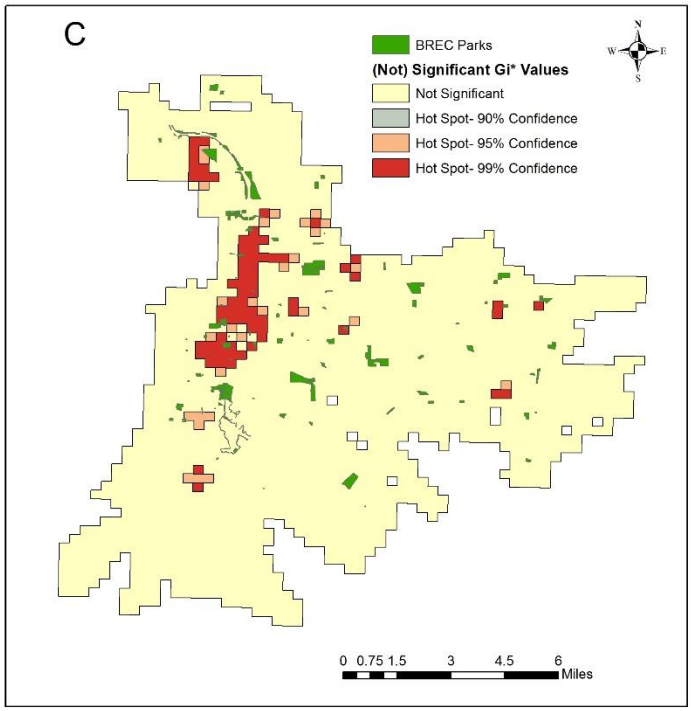
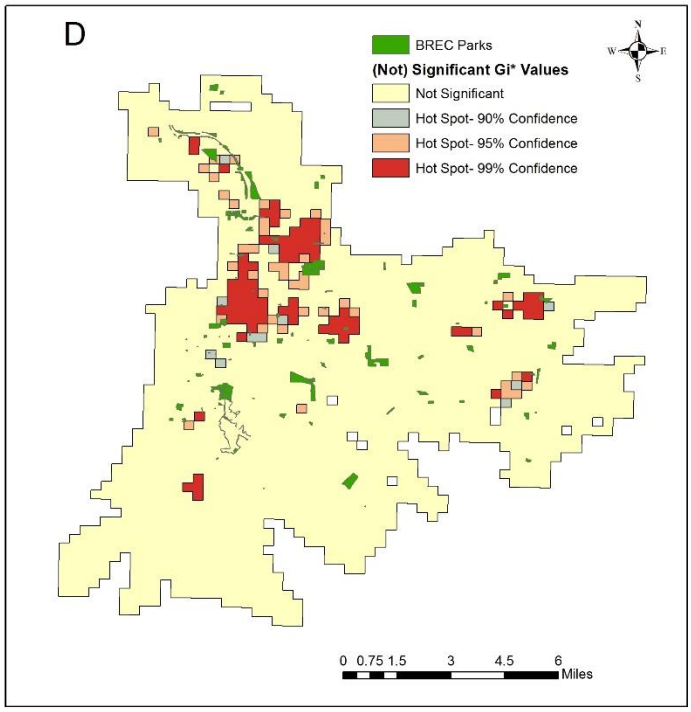
0 0.75 1.5 3 4.5 6
Miles


C
BREC Parks
(Not) Significant Gi* Values
Not Significant
Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
N
W
E
S
0 0.75 1.5 3 4.5 6
Miles

(Fig. cont'd.)


D
BREC Parks
(Not) Significant Gi* Values
Not Significant
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Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
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E
S
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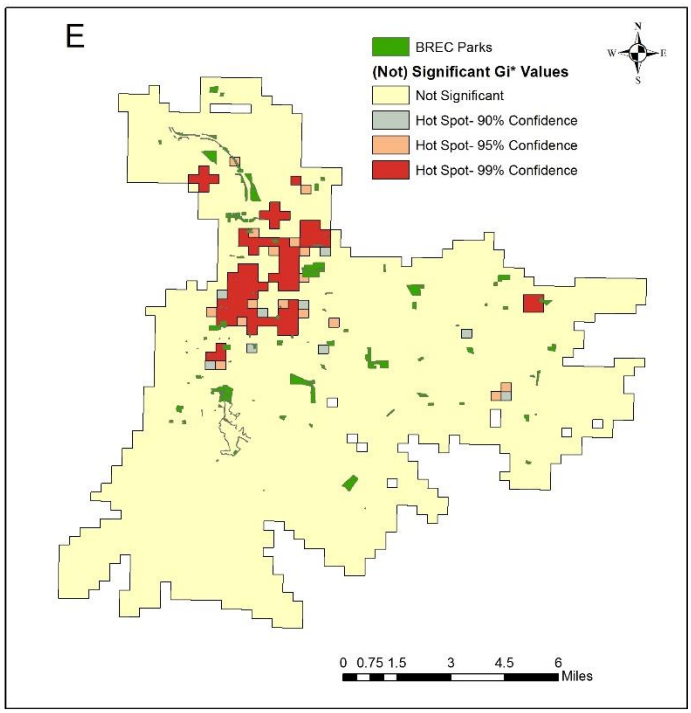
Miles


E
BREC Parks
(Not) Significant Gi* Values
Not Significant
Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
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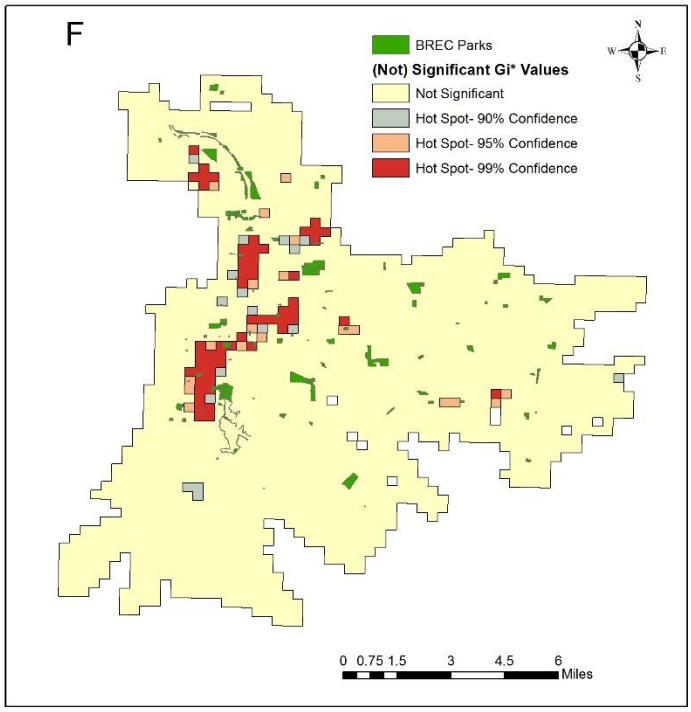
S
0 0.75 1.5 3 4.5 6
Miles

(Fig. cont'd.)


F
BREC Parks
(Not) Significant Gi* Values
Not Significant
Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
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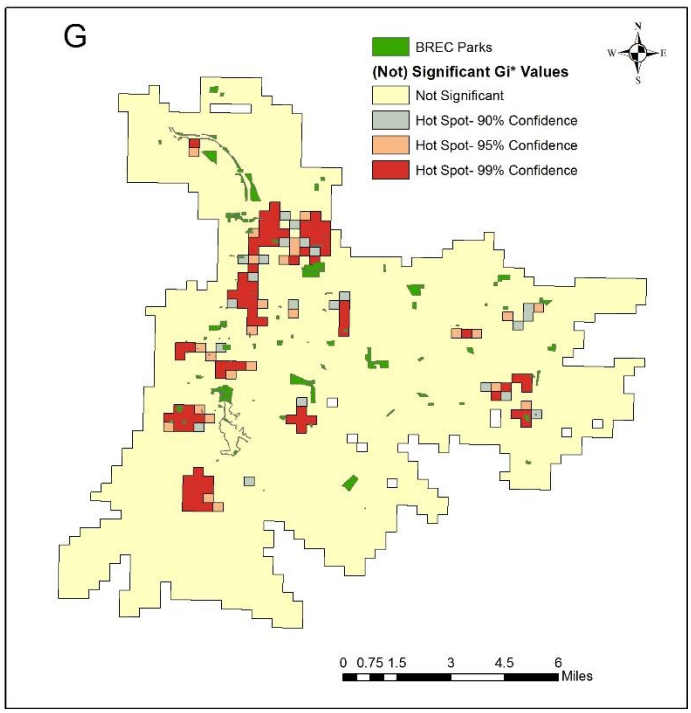
Miles


G
BREC Parks
(Not) Significant Gi* Values
Not Significant
Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
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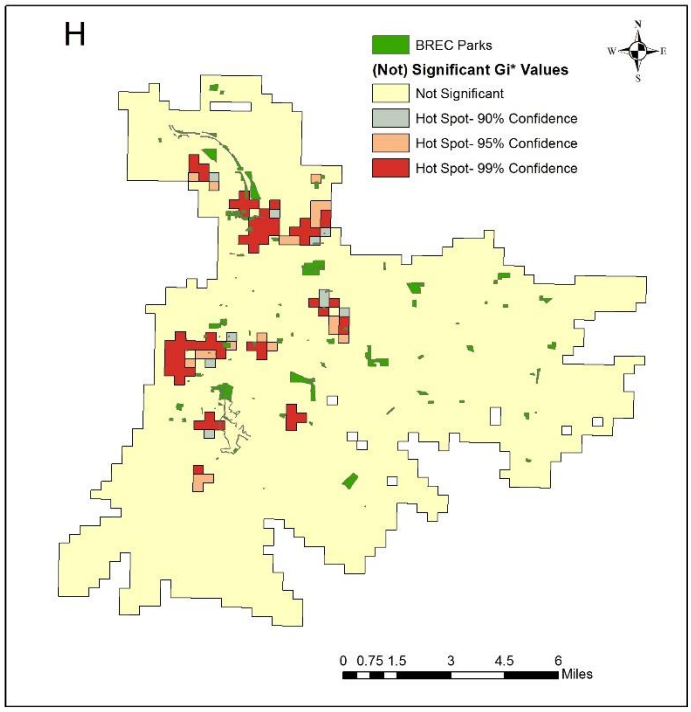
0 0.75 1.5 3 4.5 6
Miles

(Fig. cont'd.)


H
BREC Parks
(Not) Significant Gi* Values
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Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
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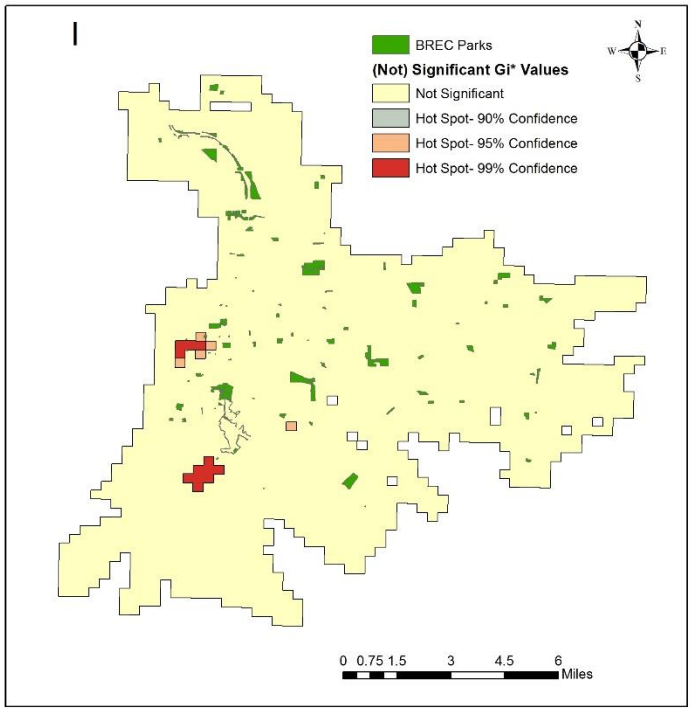
Miles


I
BREC Parks
(Not) Significant Gi* Values
Not Significant
Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
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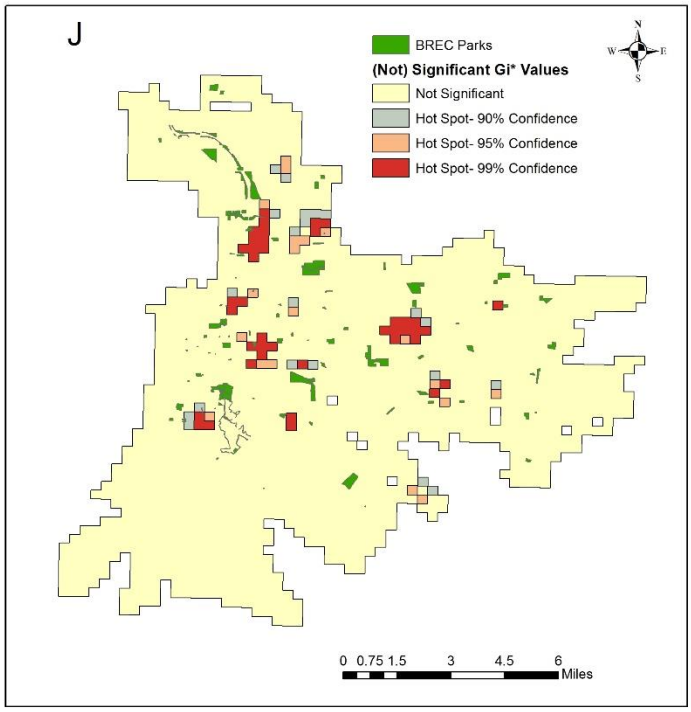
0 0.75 1.5 3 4.5 6
Miles

(Fig. cont'd.)


J
BREC Parks
(Not) Significant Gi* Values
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Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
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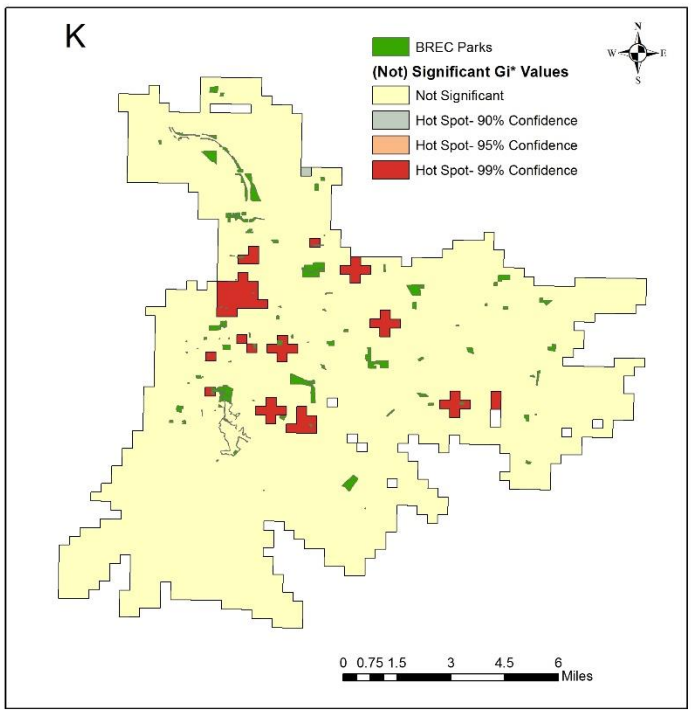
Miles


K
BREC Parks
(Not) Significant Gi* Values
Not Significant
Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
N
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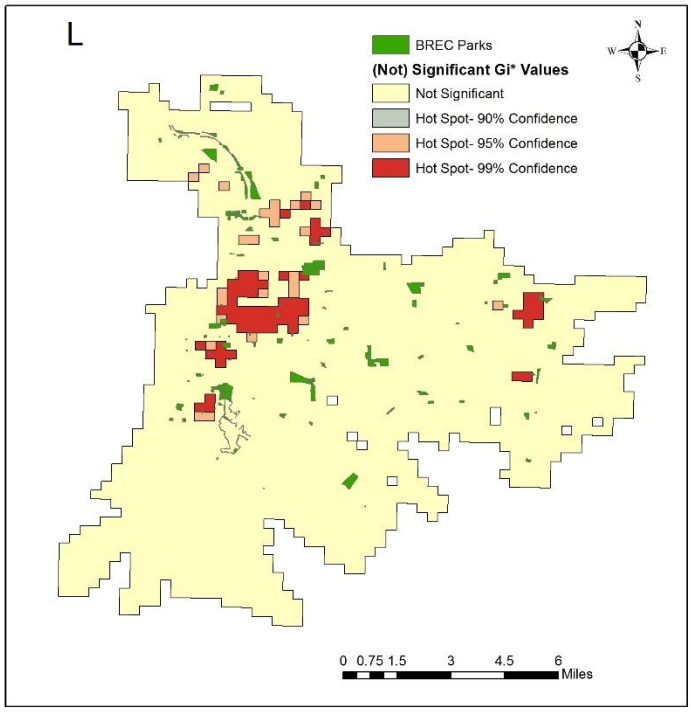
Miles

(Fig. cont'd.)


L
BREC Parks
(Not) Significant Gi* Values
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Hot Spot- 99% Confidence
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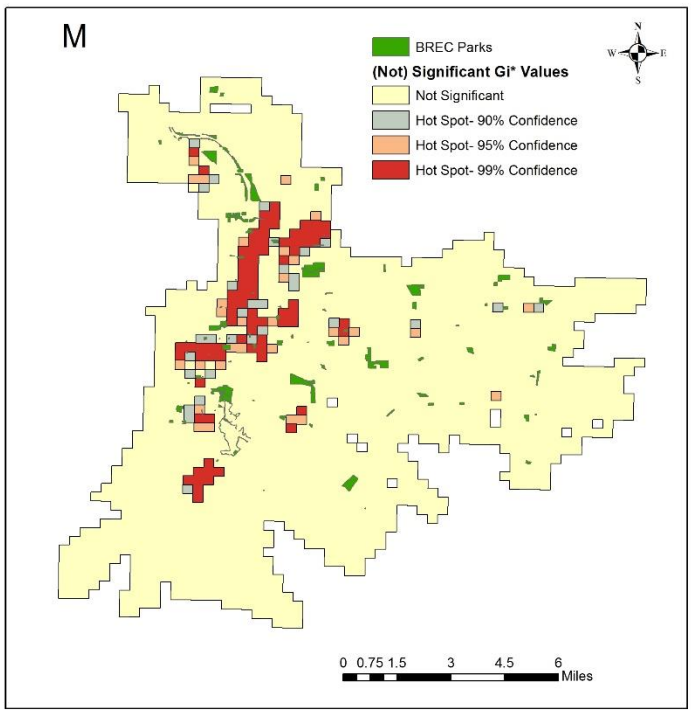
Miles


M
BREC Parks
(Not) Significant Gi* Values
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Hot Spot- 99% Confidence
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Miles

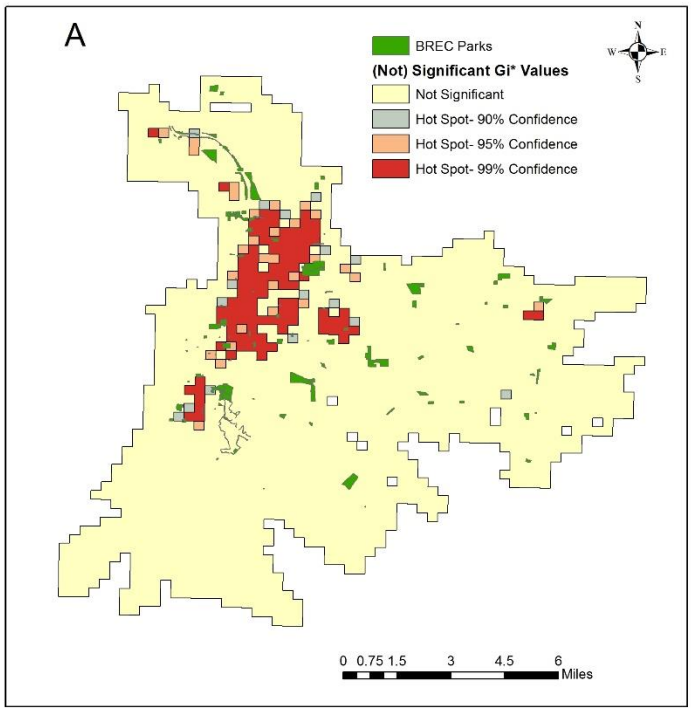
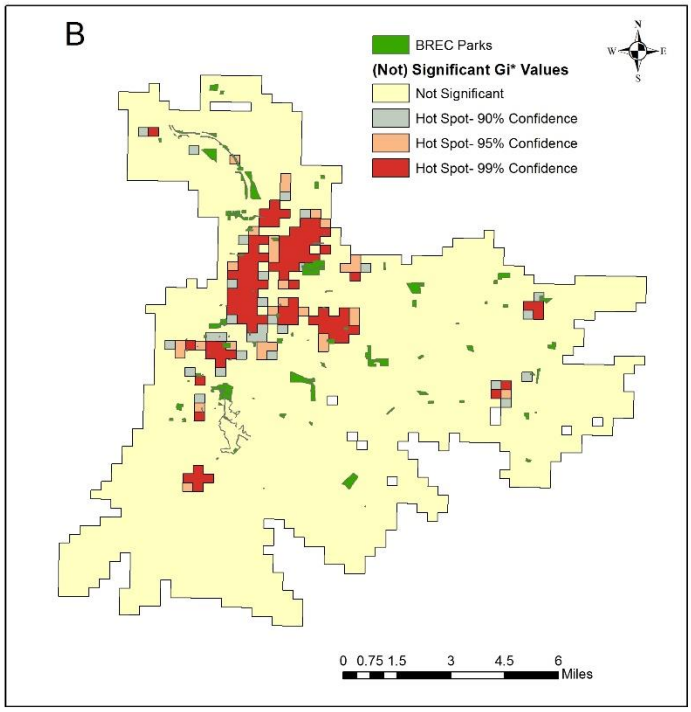


Figure A.5. Crime hotspot maps for twelve different crime types and all crimes types combined using the Gi*-statistic for the year 2015. (A) Assault; (B) Battery; (C) Robbery; (D) Criminal damage to property; (E) Firearm; (F) Narcotic; (G) Burglary; (H) Nuisance; (I) Other; (J) Theft; (K) Vice; (L) Homicide; (M) All crime types.

Figure A.5 continues on following pages.

(Fig. cont'd.)


B
BREC Parks
(Not) Significant Gi* Values
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Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
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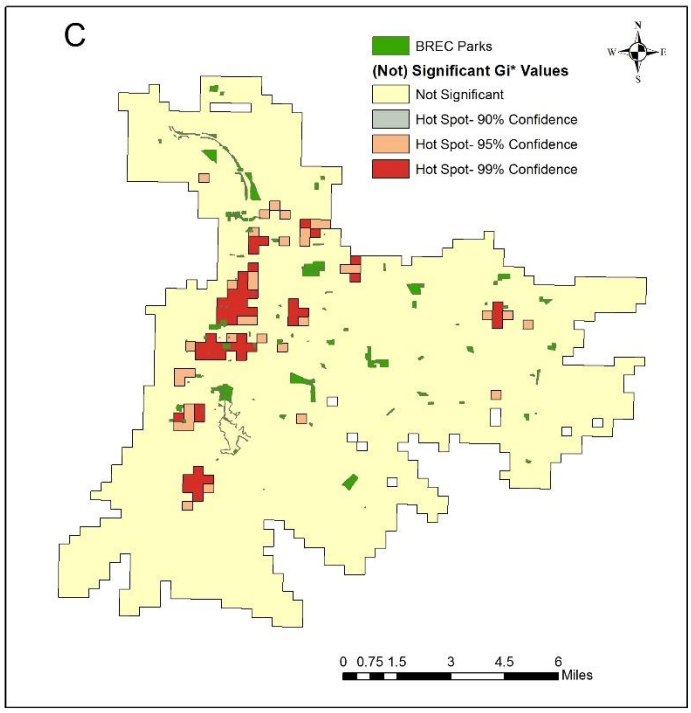
Miles


C
BREC Parks
(Not) Significant Gi* Values
Not Significant
Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
N
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0 0.75 1.5 3 4.5 6
Miles

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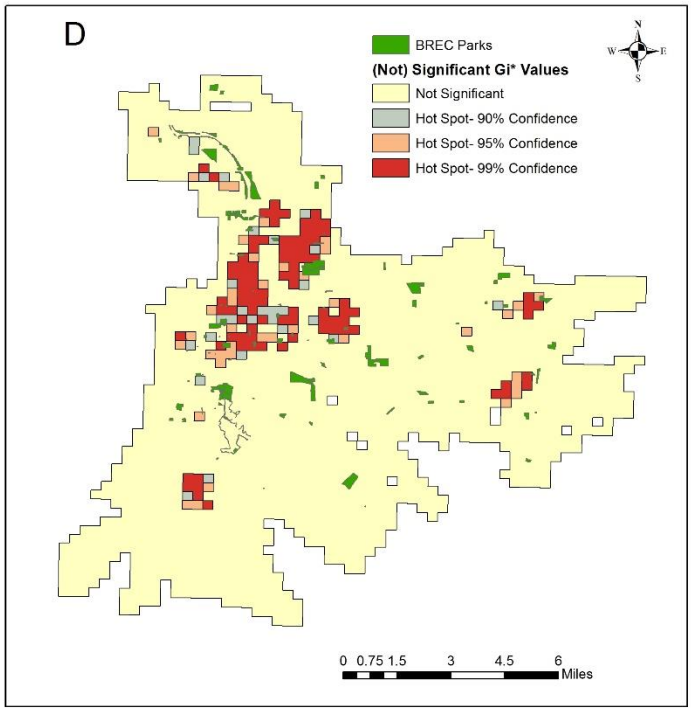
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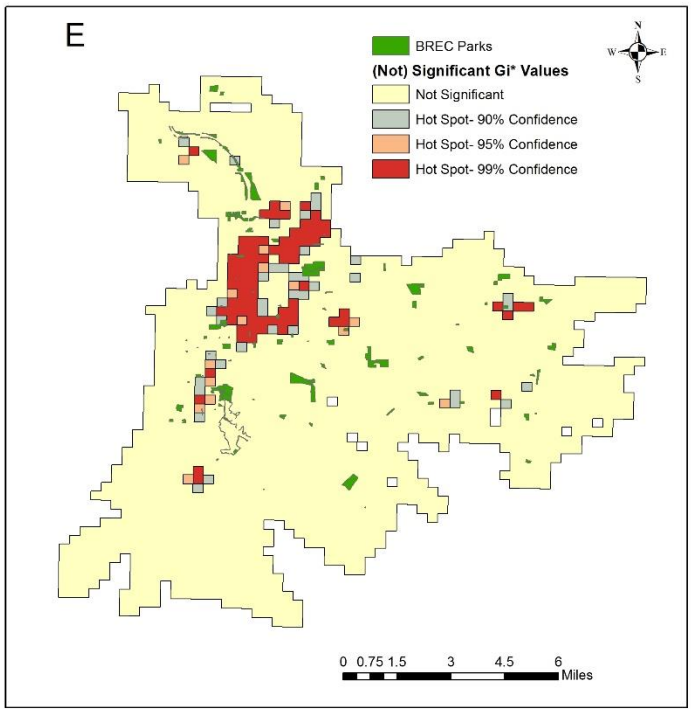
Miles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BREC Parks
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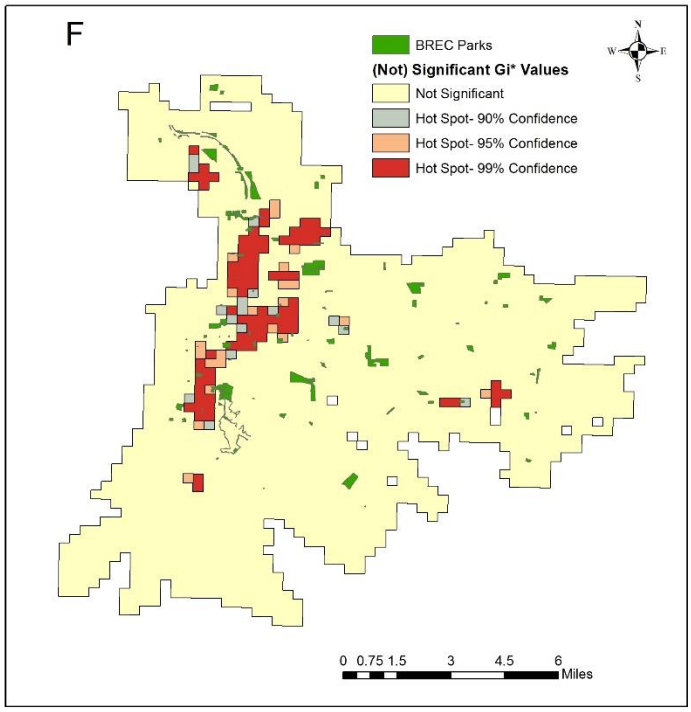
Miles

(Fig. cont'd.)


F
BREC Parks
(Not) Significant Gi* Values
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Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
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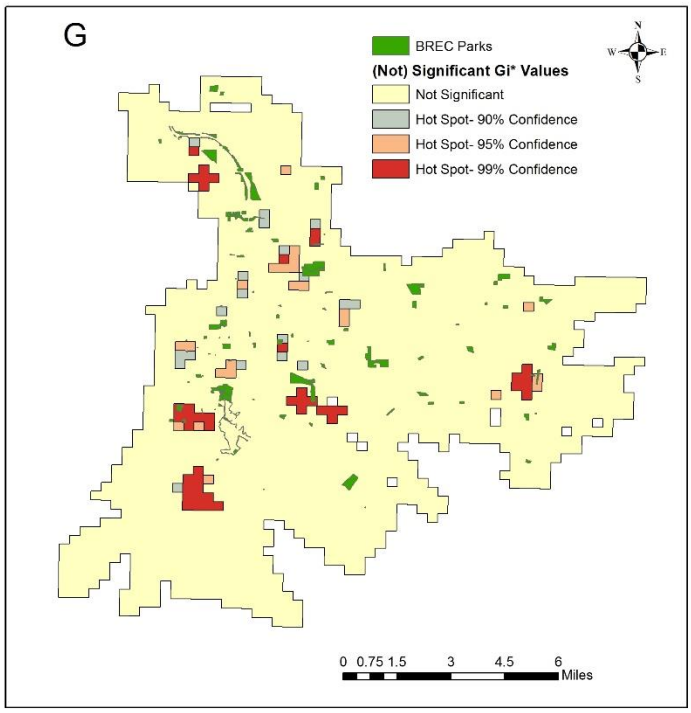
Miles


G
BREC Parks
(Not) Significant Gi* Values
Not Significant
Hot Spot- 90% Confidence
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Hot Spot- 99% Confidence
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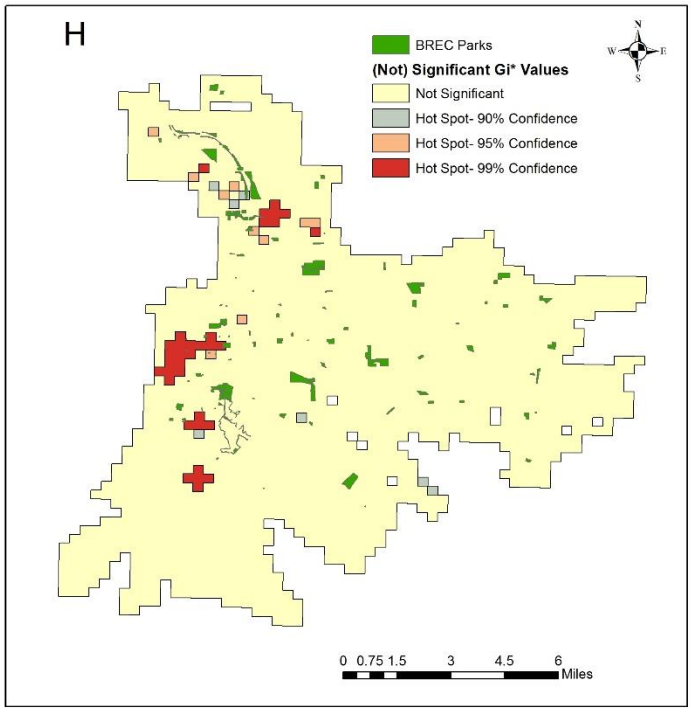
Miles

(Fig. cont'd.)


H
BREC Parks
(Not) Significant Gi* Values
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Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
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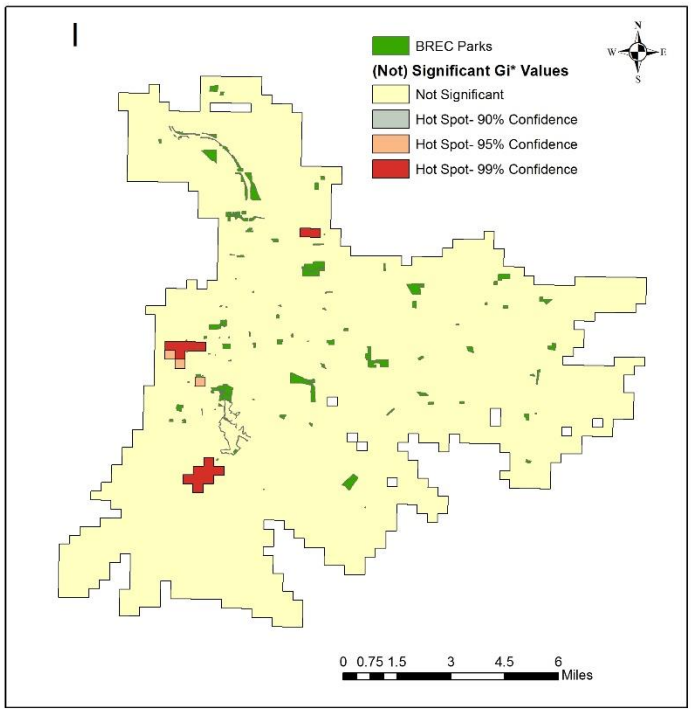
Miles


I
BREC Parks
(Not) Significant Gi* Values
Not Significant
Hot Spot- 90% Confidence
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Hot Spot- 99% Confidence
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W
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0 0.75 1.5 3 4.5 6
Miles

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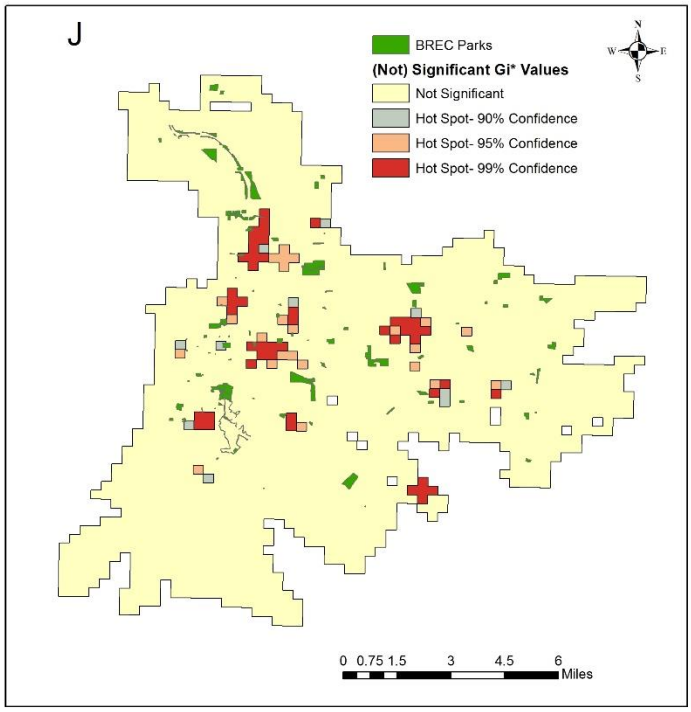
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BREC Parks
(Not) Significant Gi* Values
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Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
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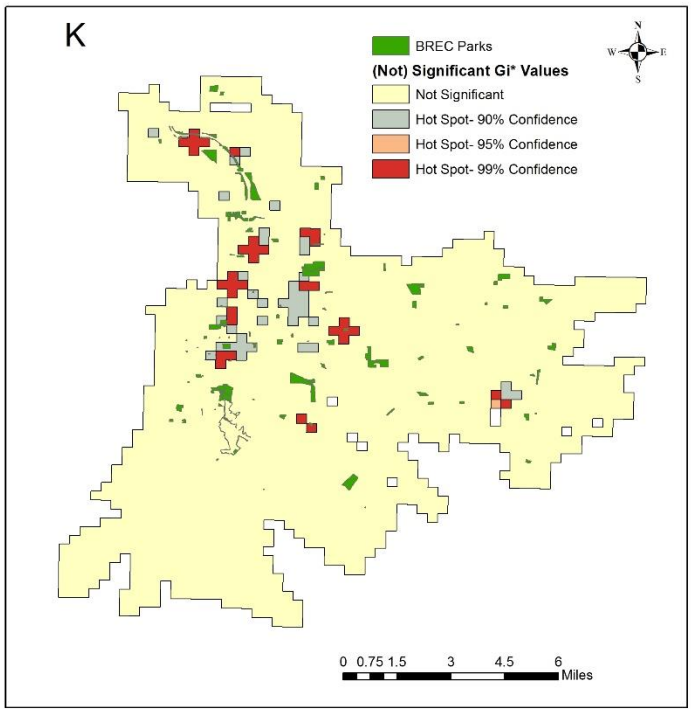
Miles


K
BREC Parks
(Not) Significant Gi* Values
Not Significant
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W
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Miles

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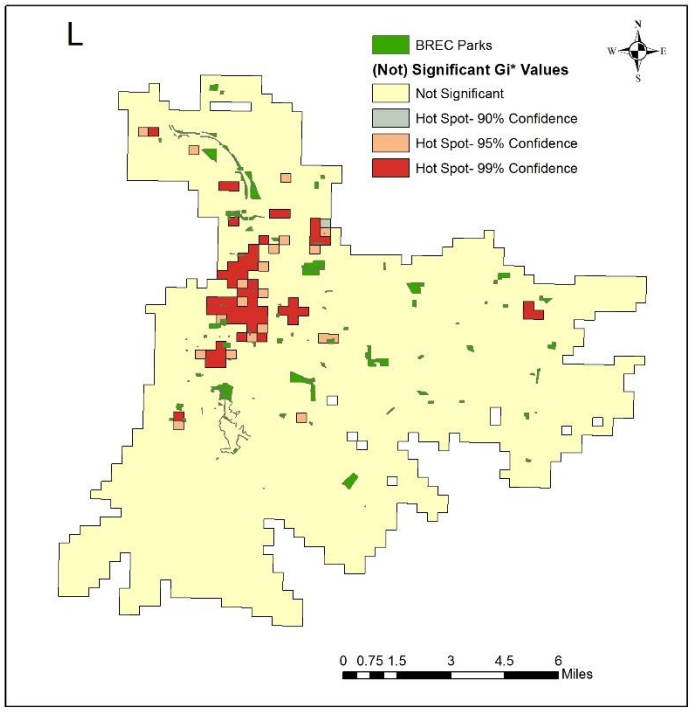
L
BREC Parks
(Not) Significant Gi* Values
Not Significant
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Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
N
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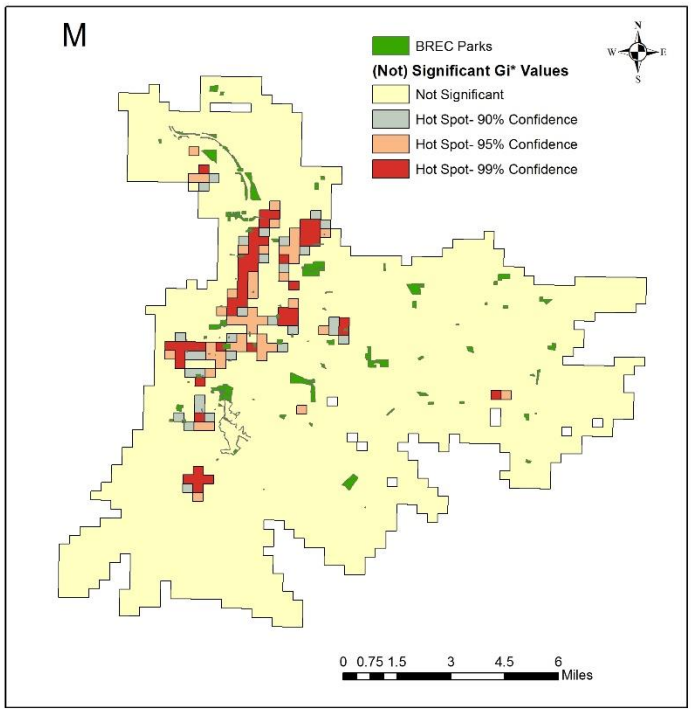
Miles


M
BREC Parks
(Not) Significant Gi* Values
Not Significant
Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
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Miles

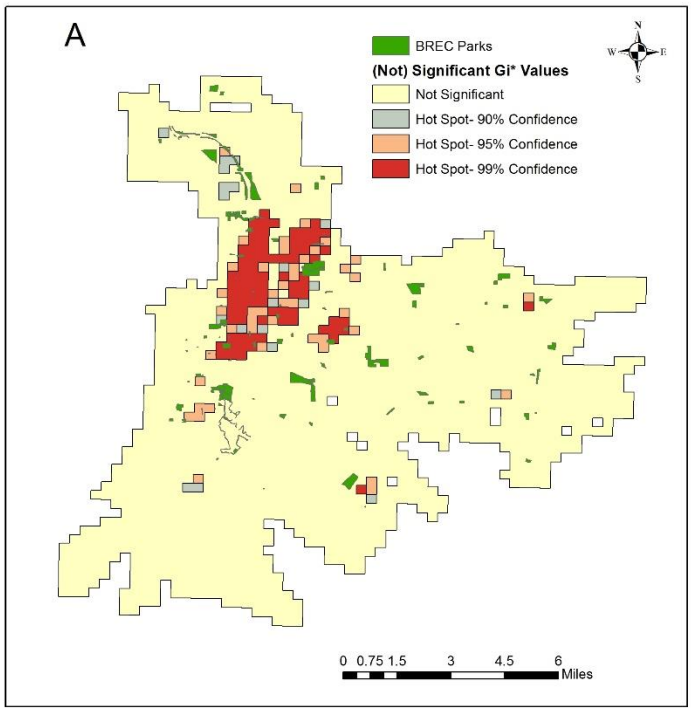
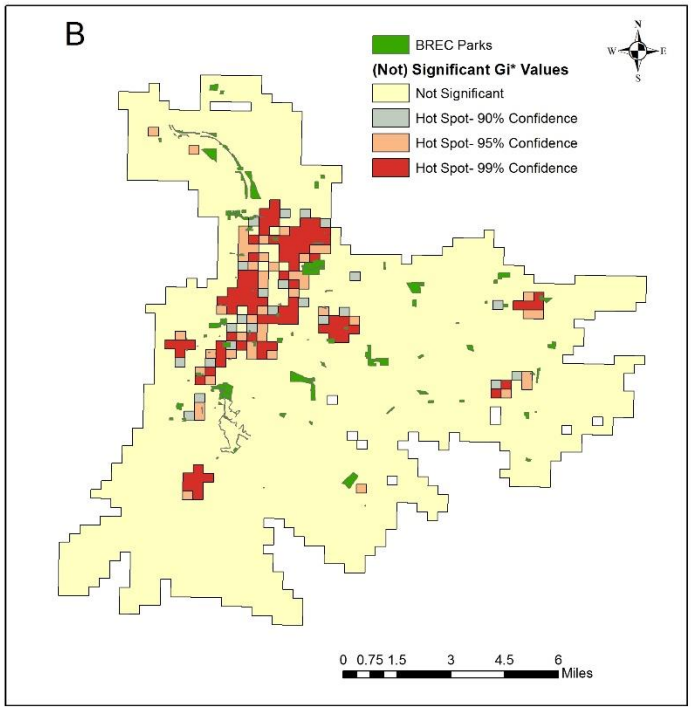


Figure A.6. Crime hotspot maps for twelve different crime types and all crimes types combined using the Gi*-statistic for the year 2016. (A) Assault; (B) Battery; (C) Robbery; (D) Criminal damage to property; (E) Firearm; (F) Narcotic; (G) Burglary; (H) Nuisance; (I) Other; (J) Theft; (K) Vice; (L) Homicide; (M) All crime types.

Figure A.6 continues on following pages.


B
BREC Parks
(Not) Significant Gi* Values
Not Significant
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Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
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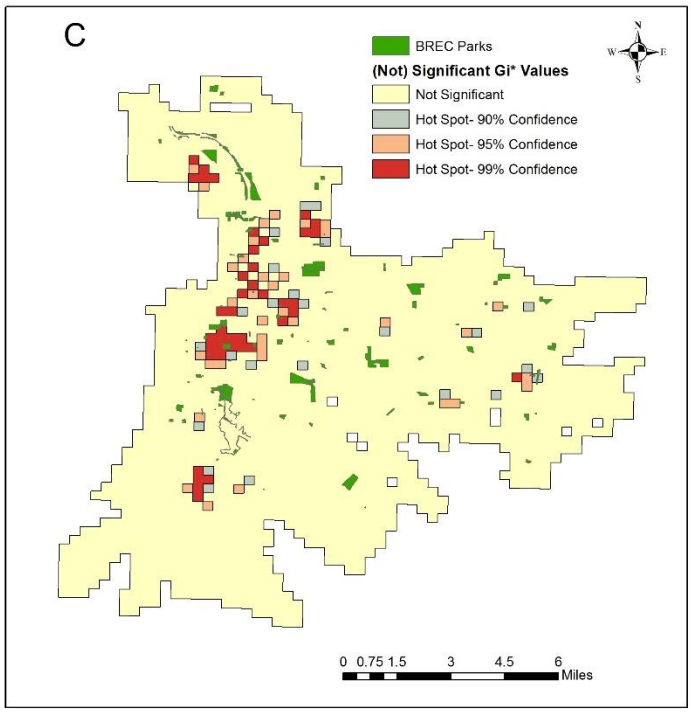
0 0.75 1.5 3 4.5 6
Miles


C
BREC Parks
(Not) Significant Gi* Values
Not Significant
Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
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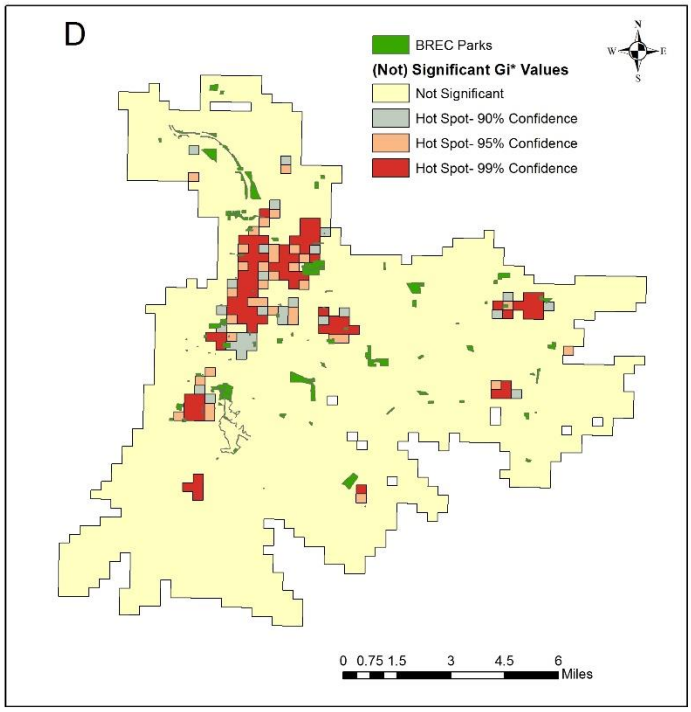
0 0.75 1.5 3 4.5 6
Miles

(Fig. cont'd.)


D
BREC Parks
(Not) Significant Gi* Values
Not Significant
Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
N
W
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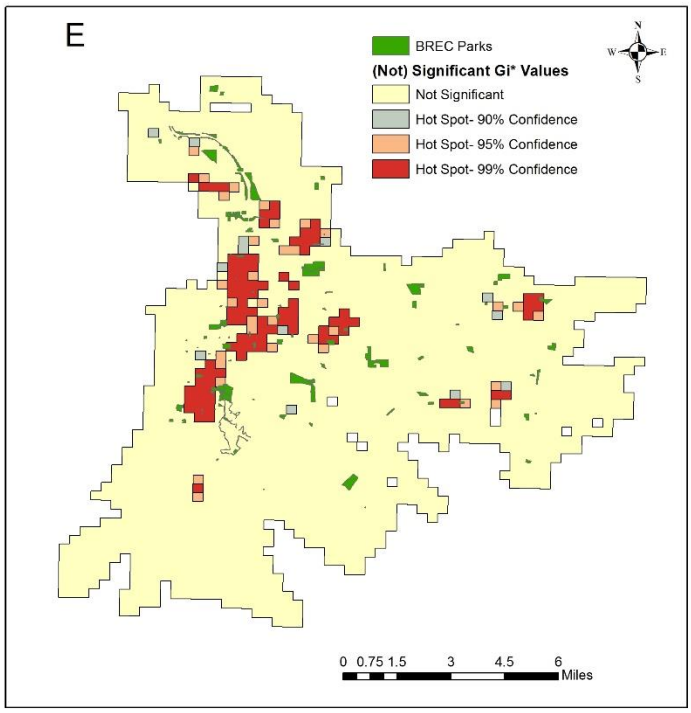
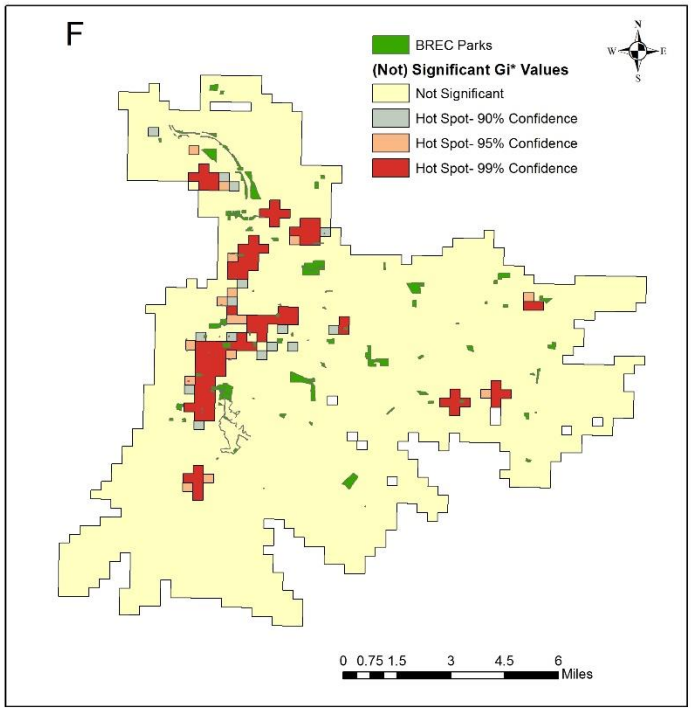
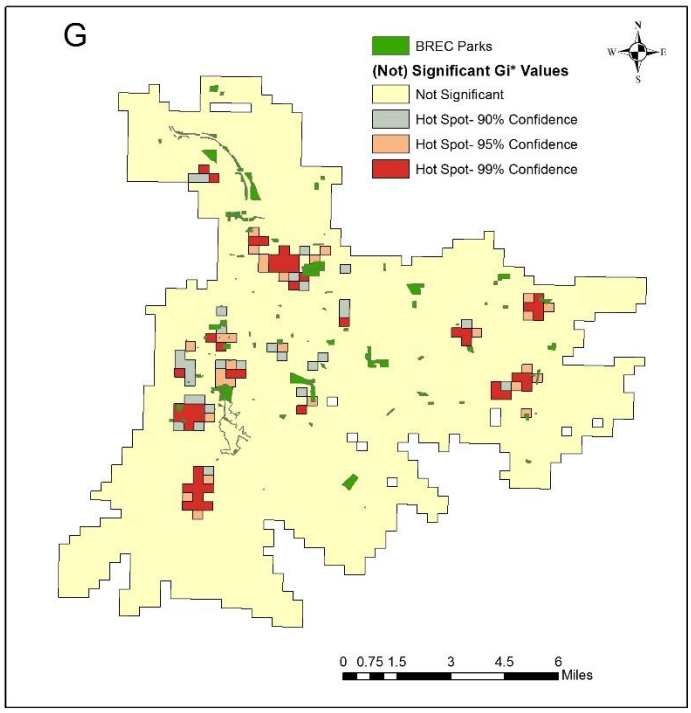
0 0.75 1.5 3 4.5 6
Miles

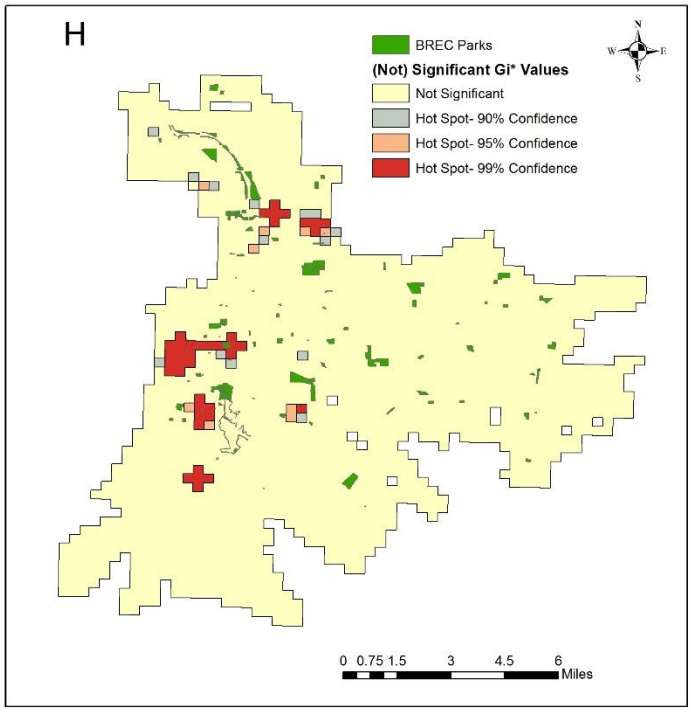

E
BREC Parks
(Not) Significant Gi* Values
Not Significant
Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
N
W
E
S
0 0.75 1.5 3 4.5 6
Miles

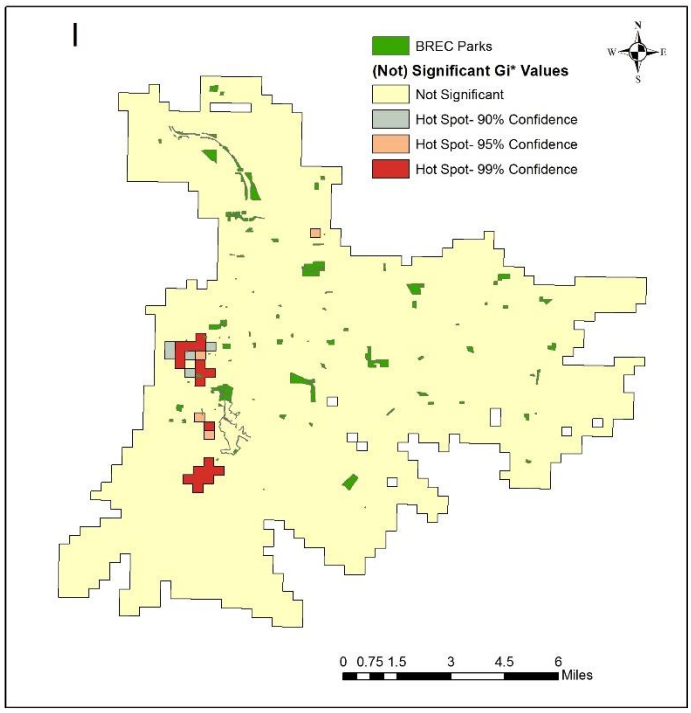
(Fig. cont'd.)


F
BREC Parks
(Not) Significant Gi* Values
Not Significant
Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
N
W
E
S
0 0.75 1.5 3 4.5 6
Miles

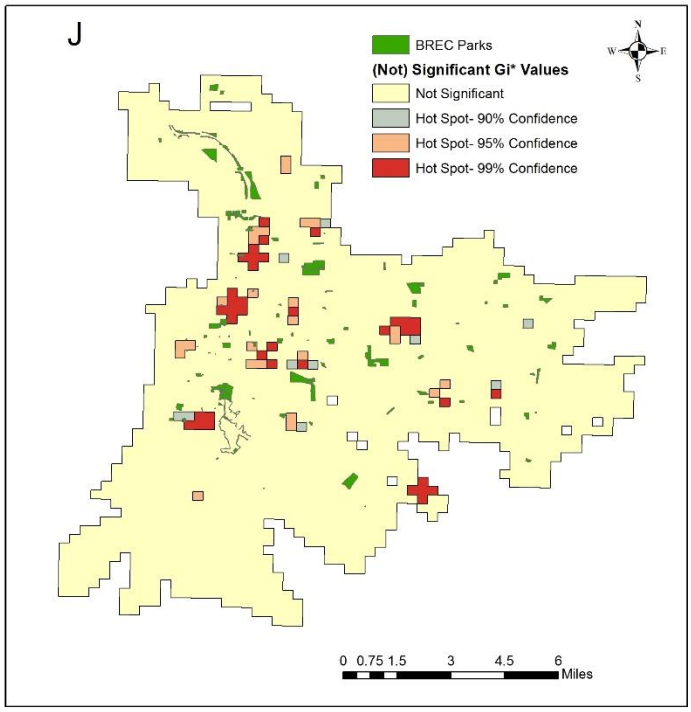

G
BREC Parks
(Not) Significant Gi* Values
Not Significant
Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
N
W
E
S
0 0.75 1.5 3 4.5 6
Miles

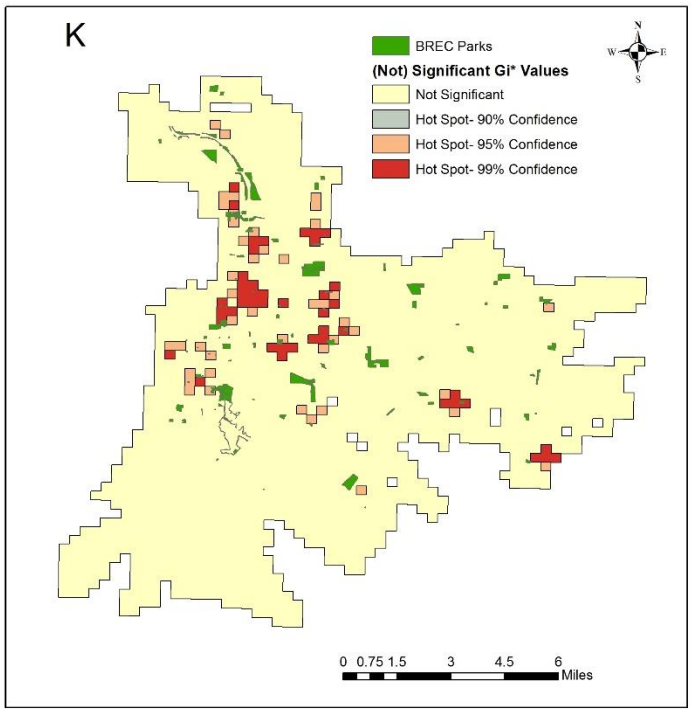
(Fig. cont'd.)


H
BREC Parks
(Not) Significant Gi* Values
Not Significant
Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
N
W
E
S
0 0.75 1.5 3 4.5 6
Miles

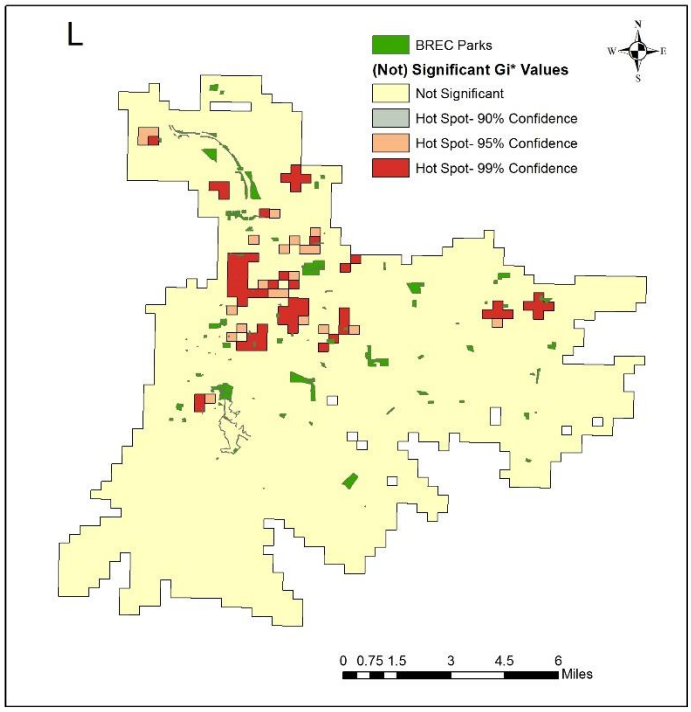

I
BREC Parks
(Not) Significant Gi* Values
Not Significant
Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
N
W
E
S
0 0.75 1.5 3 4.5 6
Miles

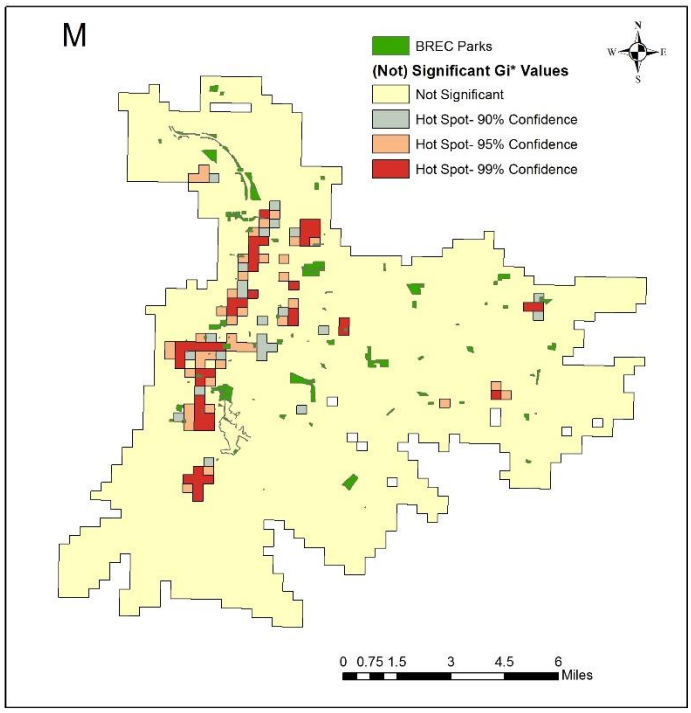
(Fig. cont'd.)


J
BREC Parks
(Not) Significant Gi* Values
Not Significant
Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
N
W
E
S
0 0.75 1.5 3 4.5 6
Miles


K
BREC Parks
(Not) Significant Gi* Values
Not Significant
Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
N
W
E
S
0 0.75 1.5 3 4.5 6
Miles

(Fig. cont'd.)


L
BREC Parks
(Not) Significant Gi* Values
Not Significant
Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
N
W
E
S
0 0.75 1.5 3 4.5 6
Miles


M
BREC Parks
(Not) Significant Gi* Values
Not Significant
Hot Spot- 90% Confidence
Hot Spot- 95% Confidence
Hot Spot- 99% Confidence
N
W
E
S
0 0.75 1.5 3 4.5 6
Miles

VITA

Anliu Jiang received his bachelor's degree of remote sensing from China University of Geosciences in 2015. Currently, he is a Master student majoring in Geography in the Department of Geography and Anthropology at Louisiana State University, and plans to graduate in August 2017.