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# Constructing geographic areas for homicide research : a case study of New Orleans

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CONSTRUCTING GEOGRAPHIC AREAS FOR HOMICIDE RESEARCH:  
A CASE STUDY OF NEW ORLEANS, LOUISIANA

A Thesis

Submitted to the Graduate Faculty of the  
Louisiana State University and  
Agricultural and Mechanical College  
in partial fulfillment of the  
requirements for the degree of  
Master of Science

in

The Department of Geography and Anthropology

by  
Lawrence Keenan Robert  
B.A., Louisiana State University, 2008  
May 2013

For my father,  
Lawrence C. Robert, Jr.  
1948 - 2011

*Light many lamps and gather round his bed.  
Lend him your eyes, warm blood, and will to live.  
Speak to him; rouse him; you may save him yet.*

*But death replied: 'I choose him.' So he went,  
And there was silence in the summer night;  
Silence and safety; and the veils of sleep.*

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## **Abstract**

Because homicides are rare events, criminologists must often deal with the Small Population Problem, which creates unreliable homicide rates based on arbitrarily delineated census tracts of low population. These rates lead to violations in several assumptions required in statistical analysis. This study proposes the Regionally Constrained Agglomerative Clustering and Partitioning (REDCAP) method to mitigate the Modifiable Areal Unit Problem and solve the Small Population Problem by constructing new, larger regions with sufficient minimum populations for homicide rate calculation. This method is used for a case study of New Orleans, Louisiana, to test the relationship between concentrated disadvantage and homicide. Ordinary Least Squares and Geographically Weighted Regressions are conducted with the data both before and after the REDCAP operation. Results for the standard census tract layer show a weak and insignificant relationship between concentrated disadvantage and homicide because of extremely unreliable rate estimates. After the REDCAP operation, variables show a more normal distribution and reduced variability; moreover, regression results confirm a strong and positive relationship between concentrated disadvantage and homicide. This study shows viability for REDCAP as a regionalization method for further studies on violent crime, namely its ability to provide more stable data for improved reliability in crime rate calculations. Additionally, this study provides implications for public policy, specifically social cohesion and efficacy policies, including community-oriented policing.

## **1. Introduction**

“...New York City, with more than 20 times the population of New Orleans, had 536 murders last year. If New York had New Orleans's homicide rate, more than 4,000 people would have been murdered there last year, about 11 every day.” (McCollam 2011)

After the world's 20 deadliest cities, all in Latin America, plagued by drug- and gang-related violence, New Orleans is the 21st deadliest city in the world and by far the deadliest city in the United States. In many cities, gang and drug violence is the dominant factor in driving up the violent crime and homicide rates; however, the New Orleans Police Department and many researchers believe that the problem is less linked to gang activity or narcotics than in other cities, although these factors likely contribute not insignificantly (McCollam 2011). Recently, the City of New Orleans including the New Orleans Police Department is increasingly aware that building trust between residents and the police is the key to reducing the murder rate (Elliott 2012, Maggi 2012, Newkirk 2012); however, the new policies have not been implemented long enough to ascertain whether they have had a significant effect on the number of homicides.

Sociologists have long tried to determine the causes of violence in urban areas. Drawing from the significant work in that academic discipline, this study intends to show that the link of the homicide rate to the structural characteristics of neighborhoods, namely the high concentration of disadvantage in certain neighborhoods in New Orleans. This extreme socio-economic disadvantage leads to a high level of social disorganization, with which researchers have long shown an association with high crime rates. Social disorganization and concentrated disadvantage are indicated by many socio-demographic factors including racial segregation, single parenthood, unemployment, and poverty. These indicators have been linked to lower levels of physical health, increased levels of depression, lower neighborhood cohesion, and lower neighborhood trust, all of which form the pathway to an intractable cycle of violent crime



and homicide in particular. This study will demonstrate the relationship between the concentrated disadvantage and elevated homicide rates in New Orleans, Louisiana.

## **1.1 Research Motivation**

The Port of New Orleans is one of the largest in the United States due to its strategic position at the mouth of the Mississippi River and near the oil production facilities in the Gulf of Mexico. The city is a major tourist destination and relies on tourism revenue to drive its economy. The annual Mardi Gras festival draws so many people in a short period of time that the total amount of garbage collected becomes a reliable metric of its economic impact. The city has hosted the National Football League Super Bowl ten times since 1970 – more than any other city except Miami. In 2012, tourism to the city had a record total economic impact of \$5.46 billion from 8.75 million people; moreover, the tourism industry employs more than 70,000 people, making it the metropolitan area’s biggest employer (Krupa 2012; NOCVB 2012).

Unfortunately, the consistently triple-digit homicide counts and other crime incidence have been the cause of a major concern for potential visitors to the city. On any given day of the week, a casual glance at the city’s long-time newspaper, *The Times-Picayune*, reveals tales of crime committed just hours before publishing. City business, political, and cultural leaders have lamented a common belief that crimes in New Orleans are geographically widespread rather than geographically concentrated. This misconception may deter many potential tourists from visiting the city in fear of widespread crime. In fact, most crimes involving tourists are petty thefts and do not correspond to areas of high crime rates in the city. Examining the geographic concentration of crime, including its most severe type, homicide, and its association with socioeconomic disadvantage has important implication in public policy. One major shift in criminal theories as well as policing strategies since the 1980s is from “offender-based” to

“place-based” approaches (Wang 2012). In this sense, this study lends support to targeted (hot-spot) policing and community-oriented policing, which have proven to be effective in various jurisdictions in the U.S.

## **1.2 Research Objectives**

The objectives of this study are twofold. The first is to test the relationship between the concentration of socioeconomic disadvantage and homicides in Orleans Parish, Louisiana using geo-statistical analysis techniques. The second objective of this study is to construct larger geographic areas from census tracts by a GIS-based automatic regionalization technique to obtain reliable homicide rates, which permit meaningful mapping and statistical analysis. Homicide researchers have frequently run into problems regarding the method of delineation of census tracts: small base populations in some tracts used in calculating homicide rates produce results that are sensitive to errors in the data and may violate the assumption of heterogeneity of error variance in regression analysis. The study sets forth two hypotheses. The first hypothesis is that there is a positive and significant relationship between concentrated socioeconomic disadvantage and the homicide rate in the study area. The second hypothesis is that the aforementioned problems are mitigated by the new analysis areas derived from the regionalization method.

## **2. Literature Review**

The hypotheses of this study require the discussion of two bodies of theoretical literature to understand what is being tested. The first hypothesis involves the exploration a large body of thought in sociological research beginning the 1940s which examines the causes of crime, specifically socioeconomic disadvantage and its relation to the structure of communities. This research begins with a theory known as social disorganization and leads to a set of more concrete indicators known as concentrated disadvantage. The second hypothesis deals with theoretical and applied research in geography which discusses methods to solve statistical issues that arrive from a fundamental problem in quantitative geographical research. The methods discussed involve approaches of mitigating the small population problem including creating new areas from smaller ones, so-called “regionalization” methods. Both of these bodies of literature are briefly introduced here and then discussed in detail.

Literature theoretically supporting the first hypothesis begins with the sociologists Shaw and McKay (1942), who pioneered the idea of “social disorganization,” a term referring to the link between poverty and other factors and the breakdown of societal organization. As the organization decreases, crime rates increase. The sociological literature shows that a set of factors called “concentrated disadvantage” best indicates the level of disorganization within a particular community. This is explained in depth in section 2.1. The theoretical basis of the second hypothesis draws from the substantial research in quantitative geography and criminology. Arbitrarily-defined areal units create error and bias in statistical observations as discussed in section 2.2. This study seeks to mitigate the issue by using a method for automatic regionalization of the census tracts in the study area as discussed in section 2.3.

## 2.1 Social Disorganization and Concentrated Disadvantage

Social disorganization can be defined as “the inability of a community structure to realize common values of its residents and maintain effective social controls” (Sampson and Groves 1989, 777). Social disorganization has long been used to link crime incidence with disadvantage in the population. This theory (Shaw & McKay 1942) was developed to show that certain factors, such as ethnic heterogeneity and poverty, lead to the breakdown of organization within the community and, therefore, increases in crime within that community (Sampson and Groves 1989). The opposite of this would be *social organization* or *collective efficacy*, which is defined as willingness of neighbors “to intervene on the behalf of the common good” and is thought to reduce neighborhood violence (Sampson et al. 1997, 918). Where disorder is perceived in the community and the built environment, indicators of social disorganization are increased. Higher levels of social disorganization are a source of neighborhood violence because it lowers the degree of informal social controls that would otherwise mitigate delinquent behavior (Hoffman 2003, Sampson et al 1997). Disorganized communities frequently show levels of trust, cohesion, mental health, and physical health; and thus increased crime rates, including those of violent crime (Bellair 1997, Hoffman 2003, Kawachi et al. 1999, Sampson and Groves 1989, Sampson et al. 1997, Swaroop and Morenoff 2006, Taylor 1996, Taylor and Covington 1993).

Research has linked social disorganization and concentrated levels of disadvantage (Hipp 2010, Sampson and Groves 1989, Sampson et al 1997). Concentrated disadvantage is a term for a number of structural factors within a community or neighborhood that lead to social disorganization. Sampson et al. (1999, 657) argued that “neighborhood disadvantage should be expanded beyond the simple notion of rates of poverty.” There is a significant body research

which examines indicators of concentrated disadvantage. For instance, scholars have discussed the ecological concentration of poverty in black neighborhoods.

Highly discriminatory broker-side housing market practices effectively segregate white and black communities, thus limiting the latter to disadvantaged neighborhoods; this has an effect on black homicide rates without a corresponding effect for whites. High unemployment has been an observed indicator of concentrated disadvantage: segregation has the effect of lowering employment, which can increase the homicide rate (Kriwo et al. 1998, Lee 2000, and Peterson and Krivo 1999). In addition to constrained choices of residence, lower employment, and poverty, single-parent families have been shown to be a significant indicator of concentrated disadvantage. The combination of poverty and single-parent households has been shown to be deleterious to social organization; moreover, concentrated disadvantage has been shown to increase out-of-wedlock births and single parentage as a result (De Coster et al. 2006, South 2001). This, in turn, can raise rates of depression in adults because of the stress of the perception of the disorder at the neighborhood level (Ross 2000).<sup>1</sup> An observed result of this ecological environment is an increase in individuals receiving public assistance (De Coster et al. 2006, Kubrin and Weitzer 2003).

Sampson et al. (1997) point to the level of social control and trust in advantaged neighborhoods as a predictor of lower violent crime rates. There are frequently lower levels of trust among residents in disadvantaged neighborhoods (Ross et al. 2001). As social control breaks down due to concentrated disadvantage, the frequency of informal conflict resolution increases. Homicide (and retaliatory homicide) increase with levels of concentrated disadvantage (Kubrin and Weitzer 2003). Hipp (2010) noted a reciprocal relationship between

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<sup>1</sup> A poor-quality built environment has also been linked to depression (Galea et al. 2005) and crime (Wei et al. 2005).

concentrated disadvantage and crime. Concentrated socioeconomic disadvantage is strongly linked to high homicide rates (Peterson and Krivo 1999, Krivo and Peterson 1996, Krivo and Peterson 2000).

## **2.2 The Small Population Problem**

A fundamental issue that comes into play in spatial analysis is the Modifiable Areal Unit Problem (MAUP), which arises when using point-based data that is aggregated into larger areas such as census tracts. Because these areas are subject to modification, research conducted on them may or may not be valid when examined independent of those areas, reflecting the dependency of any spatial study on those areas (Openshaw 1984). Unfortunately, there remains little ability to measure the effect of the MAUP on study results. However, the MAUP creates a measurable statistical bias in research of rare events, especially homicides, known as Small Population Problem. Frequently examined in crime and public health studies, this term refers to the base populations (denominator) used to calculate crime rates; and is not to be confused with the Small Numbers Problem, which refers to the homicide count (numerator). This problem raises several concerns. The first concern is that homicide rates calculated from small base populations are sensitive to errors in the data. The second is that rates of small population are equated to the rates of large populations, which causes a significant sampling error. Third, the ordinary least squares (OLS) regression analysis assumes homoscedasticity in the rate – an assumption violated by the errors created by small populations (Mu and Wang 2008, Wang 2005, and Wang and O'Brien 2005)

Researchers have devised several methods for dealing with these problems. One such method was to use total homicide counts rather than computing them per capita (Morenoff and Sampson 1997). This approach, however, misses the bigger picture because it does not measure

the number of homicides relative to the population (homicides per capita). Another method is removing small population samples (Harrel and Gouvis 1994, Morenoff and Sampson 1997). This avoids the problem of unreliable rates based on small populations but removes data that could possibly be critical to the analysis. Messner et al. (1999), and studies reviewed by Land et al. (1990) attempt to fix the problem by aggregating the data to a large geographical area, such as entire cities or states, or over longer time periods (see also Wang and Arnold 2008) – both of which are likely to reduce the resolution and accuracy of the analysis. Yet a fourth method for resolving the issue uses Poisson regressions to account for error variances in the variables (Land et al. 1996; Osgood 2000, Osgood & Chambers 2000). The final method discussed here is regionalization, that is to construct “areas with sufficiently large base populations” (Wang and O’Brien 2005), a method employed by Haining et al. (1994), Haining et al. (1998), Black et al. (1996), Sampson et al. (1997), Mu and Wang (2008), and Wang et al. (2012). This allows reliable rates to be calculated by setting a minimum threshold population, which provides for more accurate statistical analysis, particularly regressions. The next section is devoted to further discussion of the regionalization method as it is employed in this study.

### **2.3 Regionalization Methods and REDCAP**

Spatial analysts have several methods available for the construction of new geographical areas. Two similar methods use proximity as the main determinant of constructed regions. Black et al. (1996) and Haining et al. (1994) employed the *ISD*, or *Sheffield* method (named after the region in the study), which simply adds neighboring tracts the minimum threshold population is reached. Lam and Liu (1996) utilized the *spatial order* method to create regions of 50 HIV/AIDS cases per region and required roughly equal geographical size per region. This method makes use of space-filling curves to determine proximity of neighboring regions. Wang

and O'Brien (2005) employed both the ISD and the spatial order methods to construct regions of similar environmental classifications with minimum thresholds to analyze the "Herding Culture of Honor" hypothesis of homicide. Wang (2005) and Mu and Wang (2008) developed the *space-scale* method of regionalization, used by Wang (2005) in his study of Chicago homicide. This method is drawn from a smoothing process used in imagery interpretation and emphasizes homogeneity of attributes.<sup>2</sup> Haining et al. (1998) regionalized based on the Exploratory Spatial Data Analysis (ESDA) methods in the SAGE software package, which is a set of techniques that allows users to choose the use of local or global statistics and how proximity is defined.

In their study of cancer rates in Illinois, Wang et al. (2012) used the REDCAP method which this study proposes as an effective means to mitigate the Small Population Problem in its case study of New Orleans, LA. Guo (2008) developed Regionalization with Dynamically Constrained Agglomerative Clustering and Partitioning (REDCAP). Much like the *space-scale* method, REDCAP groups areas by homogeneity while retaining adjacency. There are two processes in the REDCAP method: first, the operation clusters regions based into a contiguity-constrained hierarchy; and second, the operation partitions that tree from the top down. There are four algorithms for clustering: SLK, ALK, CLK, and Ward; and two algorithms for partitioning: first-order and full-order (Guo 2008, Guo and Wang 2011). This method is discussed in detail in Chapter 5.

This chapter discussed the literature that composes the theoretical bases of the study's hypotheses. The first hypothesis concerning concentrated disadvantage and homicide requires that several variables, including homicide rates and indicators of socioeconomic disadvantage, be operationalized for a quantitative study. The second hypothesis concerning the mitigation of the Small Population Problem requires acquisition and regionalization of study area data. These data

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<sup>2</sup> Discussed at length in Wang (2005) and Guo and Wang (2011).



and methods are discussed in Chapter 3, which pertains to the data sources; in Chapter 4, which pertains to the indicators of concentrated disadvantage; and in Chapter 5, which pertains to the regionalization of the study area. With these arguments and methods, the study will contribute both an explanation of homicide in New Orleans, Louisiana and empirical support for the use of REDCAP regionalization as an effective tool in criminological research.

### **3. Data Sources and Processing**

The previous chapter stated that this study requires several sources of data. First is the census data (section 3.1), which is provided by the United States Census Bureau. Second is the spatial data (section 3.2), which contains both the number and geolocation of the incidents. Third is the population and socioeconomic data taken from the 2010 Census (section 3.3). This data is particularly useful because it is data collected from the most recent Census. The processing (section 3.4) of these data is also discussed below.

#### **3.1 Population, Socioeconomic Data, and Concentrated Disadvantage**

Data on population and selected socioeconomic characteristics were taken from the 2010 Census American Community Survey (ACS) via the American FactFinder website (<http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml>). In years between censuses, the ACS provides estimated data with a margin of error; however, in Census years, the ACS provides the exact counts acquired without a margin of error. The specific socioeconomic indicators taken from the Census data are discussed further in Chapter 4.

#### **3.2 Spatial Data**

The spatial layers used for this study were acquired from the United States Census Bureau's TIGER/Line (Topologically Integrated Geographic Encoding and Referencing) Shapefile products. The extent of the study area is the boundaries of Orleans Parish, Louisiana, rather than the entire metropolitan statistical area. The city of New Orleans and Orleans Parish are coterminous. The extent was chosen based on the fact that the homicide data is for Orleans Parish only (see section 3.3). Layers for census tracts and area water were used for mapping, though area water is purely used for reference and not analytical purposes. All layers were

added into the GIS and projected into Universal Transverse Mercator. The homicide point layer was joined to the tract layer based on common spatial location. Census tracts 9801 (swamp) and 9900 (Lake Ponchartrain) were excluded from the study area because they are both uninhabited and contain no homicides.

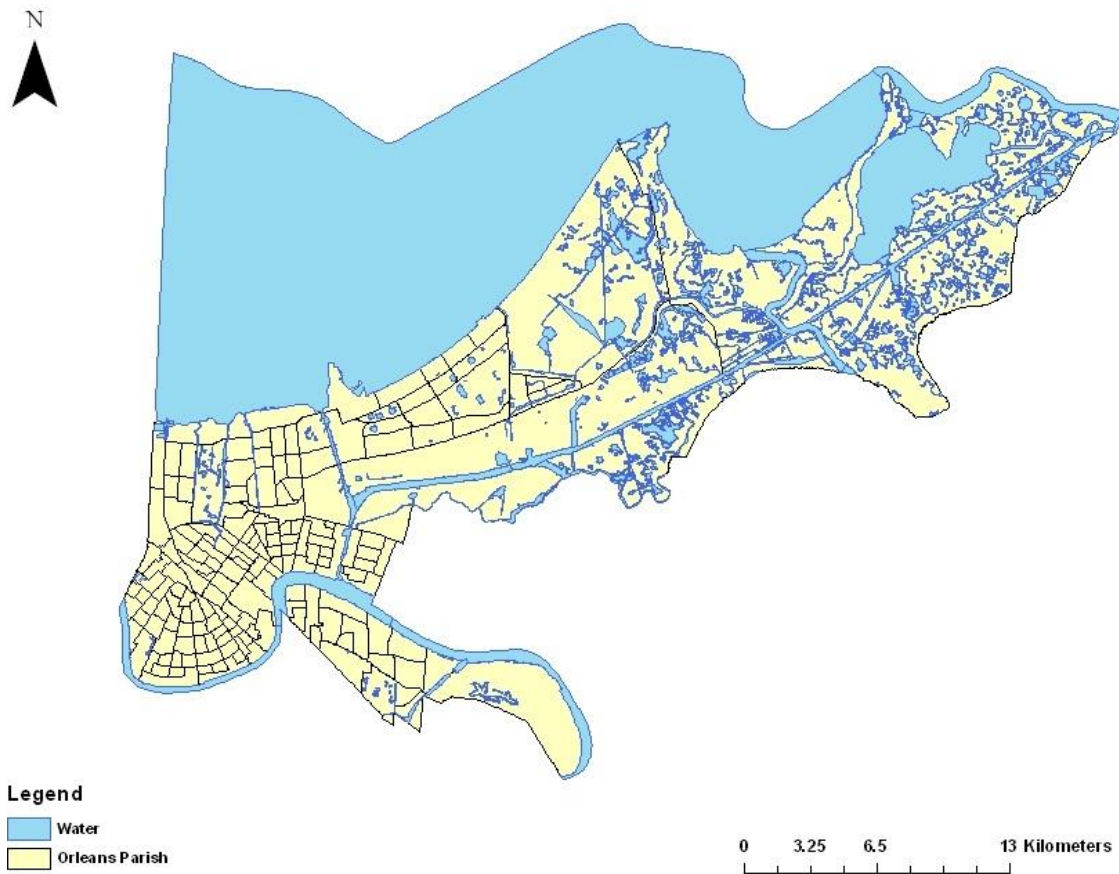


Figure 3.1: Orleans Parish, Louisiana

### 3.3 Homicide Data

A sample ( $n=708$ ) homicide events occurring between January 3, 2008 and March 24, 2012 in Orleans Parish, Louisiana was compiled and geocoded by The Times-Picayune newspaper, which placed the data online for public use. Data is victim-side only and includes date, age, address, neighborhood, time, and manner of death. Multiple homicides occurring at the same location events, which constituted 6.4% of the sample, were aggregated into single

events by the newspaper. Each event included in the data set was geocoded from the address of the crime by the Google Maps GIS. The data set also includes a URL to the newspaper report concerning each homicide. The data was processed into an ArcGIS Point Layer shapefile, projected to the Universal Transverse Mercator projection and added into the GIS.

The dataset may be found at

<https://www.google.com/fusiontables/DataSource?docid=182KOD7FP6GMNKeZw6mTaAiMZgQ1npuiRyBK1kQ>

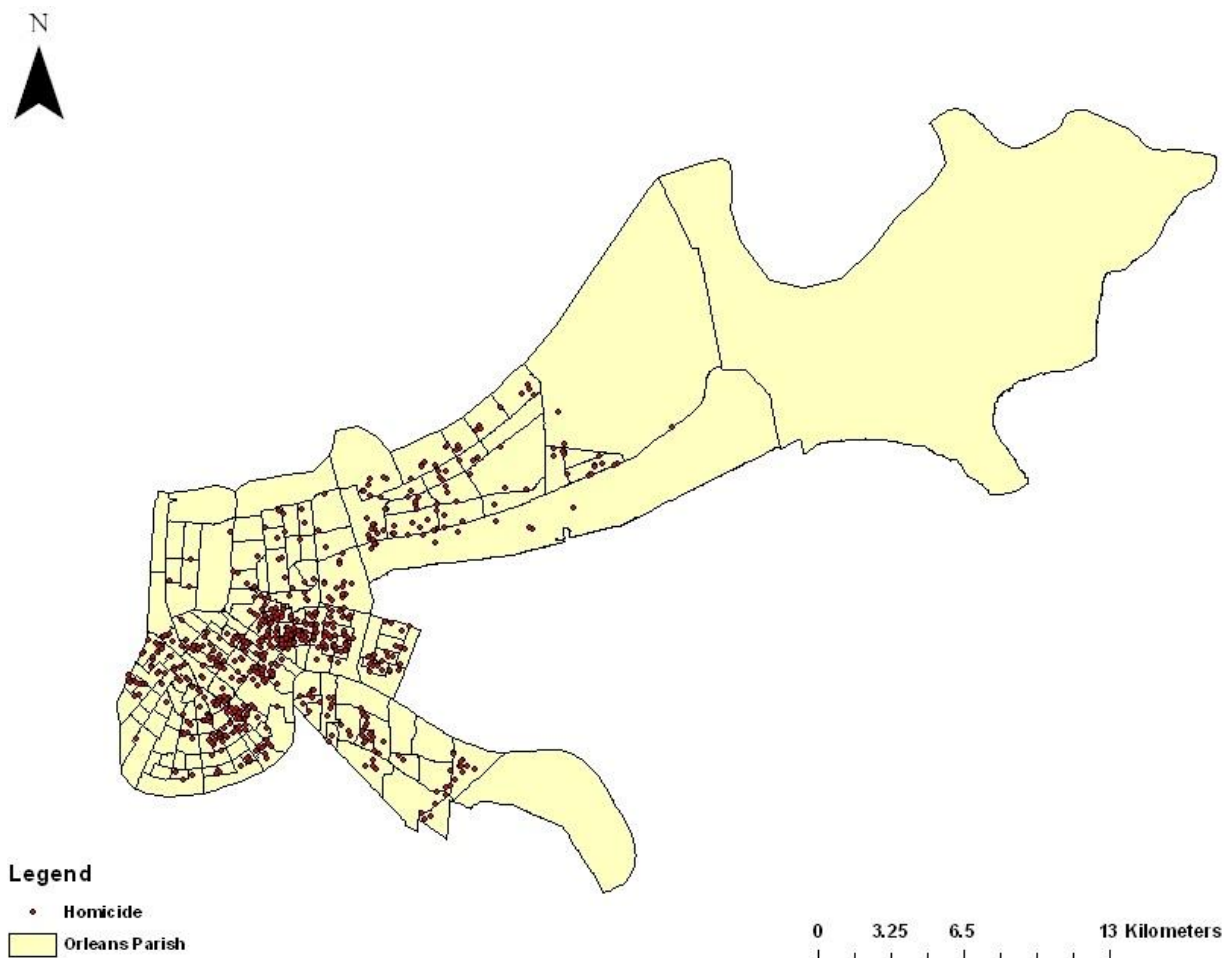


Figure 3.2: The Study Area and Homicide Incidents

### **3.4 Data Processing**

This thesis primarily uses the ArcGIS 10 for Desktop Geographical Information System (GIS) for the storing, display, and analysis of geographical data. The software, which is produced by ESRI, enables complex geographical statistical analysis of the data. More information on this package can be found at <http://www.esri.com/software/arcgis>. The java-based software package REDCAP (Regionalization with Dynamically Constrained Agglomerative Clustering & Partitioning) is used to further process the data as required for further analysis. This package is available free of charge at <http://www.spatialdatamining.org/software/redcap>. Regression analysis was performed via the Data Analysis package contained in the Microsoft Excel 2010 spreadsheet software.

#### **4. Defining the Concentrated Disadvantage Index**

There are a number of indicators of concentrated disadvantage as discussed in the literature review (Chapter 2). The experimental design process included an assessment of how to operationalize these indicators as variables in the study. To integrate these variables, a Concentrated Disadvantage Index (CDI) was created using the mean of the standard scores of each variable. Here the method is discussed in detail.

The method for creation of the CDI is drawn from and Swaroop and Morenoff (1996) and Benson and Fox (2004). The latter explained that “the crime-related effects of community disadvantage are not linear...rather, they tend to only appear in the most distressed neighborhoods as concentration effects” (Benson and Fox 2004, II-3-5). In their studies, the researchers selected variables that are indicators of concentrated disadvantage and extracted them from the ACS data. Those variables are percentage of people below the poverty line, percentage of African-American individuals, percentage of single-parent households, percentage on public assistance (both welfare and food stamps), and the unemployment rate. The authors then took the mean of the standard scores of each variable (Benson and Fox, 2004).

There are a couple of limitations to this method. First, no factor analysis was conducted on each variable to determine if weighting is appropriate. This was deemed not necessary in the experimental design as to follow the model as closely as possible. Second, some of the variables could have significant overlap. For instance, a large portion of individuals receiving public assistance are also unemployed and living in segregated areas. This might require exploratory regression analysis with multiple variables; however, given the dual hypotheses set forth in the research objectives, a multivariate regression analysis was deemed unnecessary and beyond the scope of this study. Finally, the population data itself may have limits as it is only the count of

individuals in residence. Andresen (2011) argues that the ambient population may be a better indicator of violent crime victimization than census population counts; this may be even more true when *routine activity theory* – the fact that offender and victim must be in the same place – is considered (Cohen and Felson 1979) however, given the difficulty of obtaining the data to calculate the population, this measure was foregone in the experimental design.

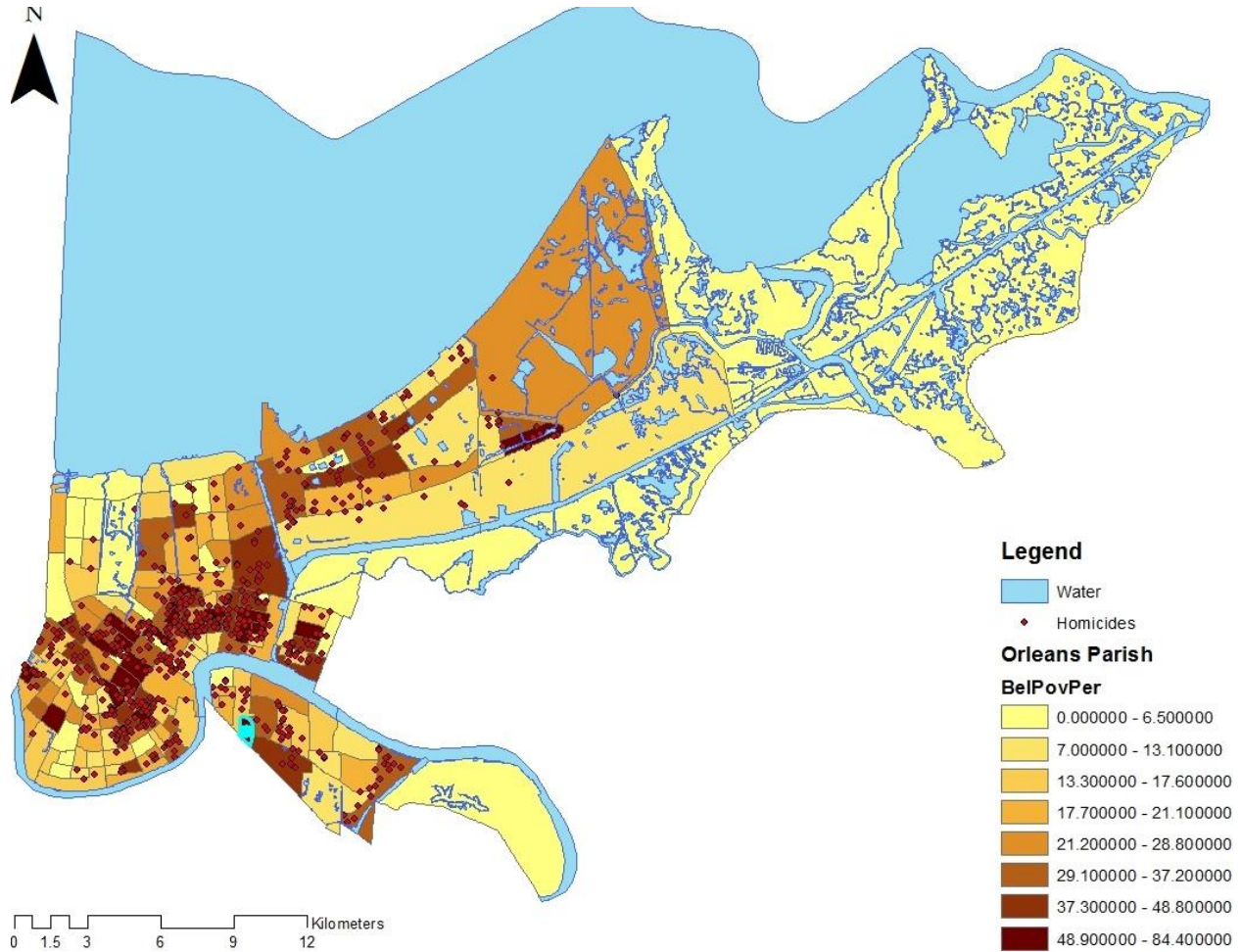


Figure 4.1: Spatial Distribution of the Percentage of Population Below the Poverty Line

Poverty is a strong indicator of concentrated disadvantage in neighborhoods. Clustering of poverty occurs in the Ninth Ward, Bywater, Treme/Fifth Ward, Mid-City, and Central City neighborhoods. Concentrations of poverty also occur in New Orleans East, especially in the West Lake Forest and Michoud neighborhoods. On the West Bank, high poverty rates occur



south and southwest of Algiers and southeast of Old Aurora. Note the observed clustering of homicides among more impoverished areas (Figure 4.1).

Another indicator of concentrated disadvantage discussed in the literature review that is closely related to poverty is the unemployment rate. The spatial distribution of the unemployment rate is somewhat similar to that of the percentage below the poverty line; however, census tracts that have high levels of poverty may not have equally as high unemployment rates and vice-versa. Because there is not a one-to-one relationship between the two variables, using both of these as indicators of disadvantage is necessary and justified. Figure 4.2 displays the spatial distribution of the unemployment rate within Orleans Parish.

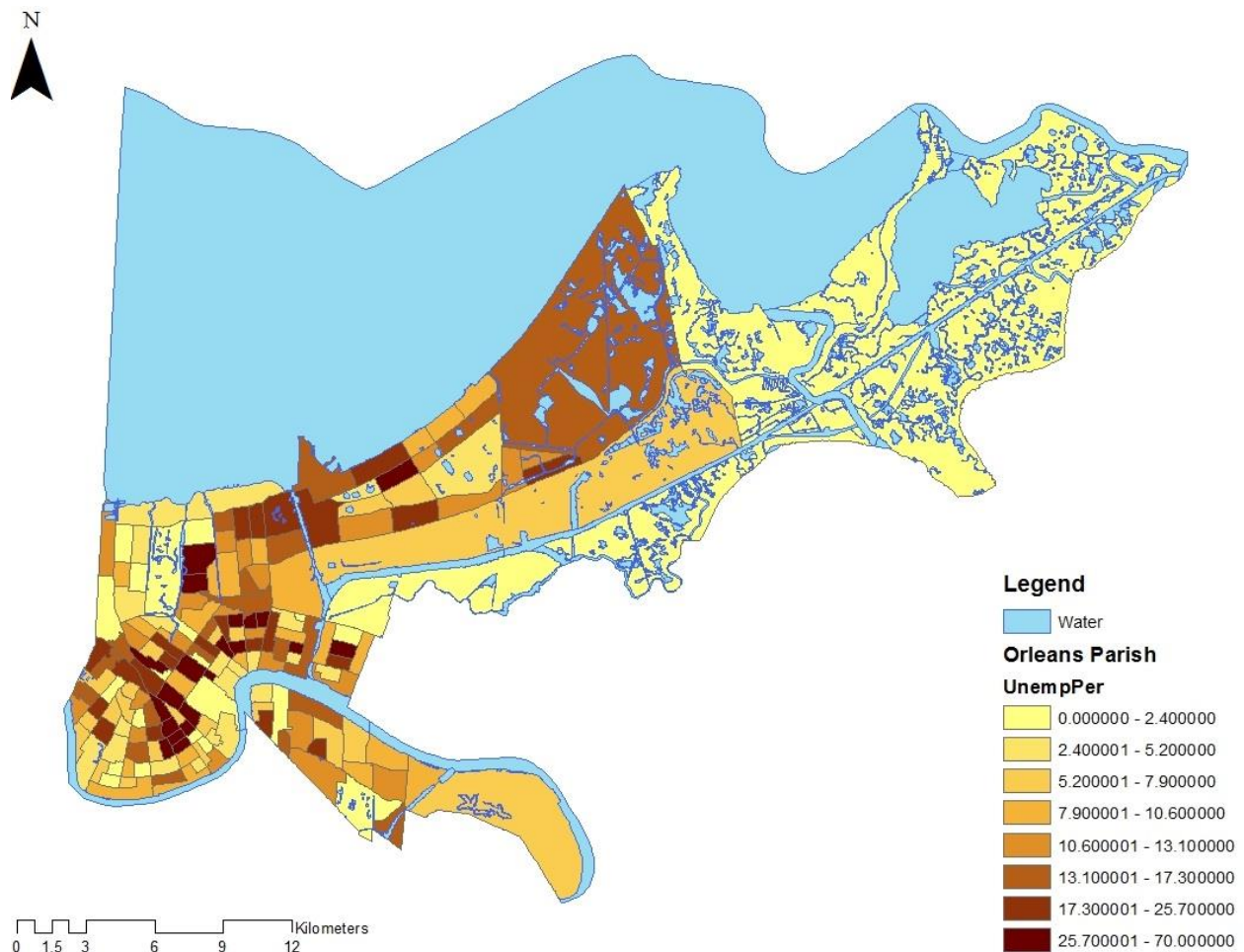


Figure 4.2: Spatial Distribution of the Unemployment Rate



Figures 4.3 and 4.4 (next page) show the distribution of the percentage of individuals receiving public assistance and the percentage of households headed by single parents. The literature review demonstrated how single-parent families have a deleterious effect on neighborhood organization and how when neighborhoods become less organized, the instance of individuals receiving welfare and food stamps increases.

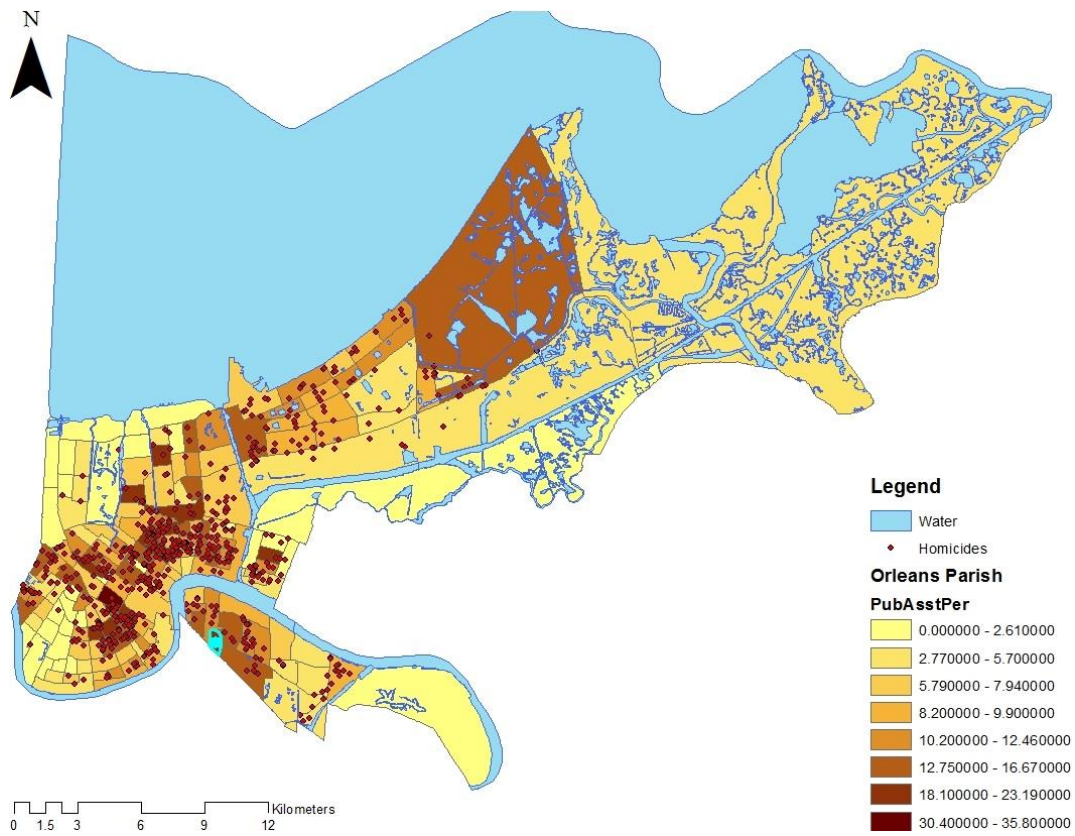


Figure 4.3: Percentage of individuals receiving public assistance

Another indicator of disadvantage is the level of segregation in a neighborhood. The percentage of population that is African-American represents is the variable used to represent segregation. New Orleans is a majority African-American city and is highly segregated.

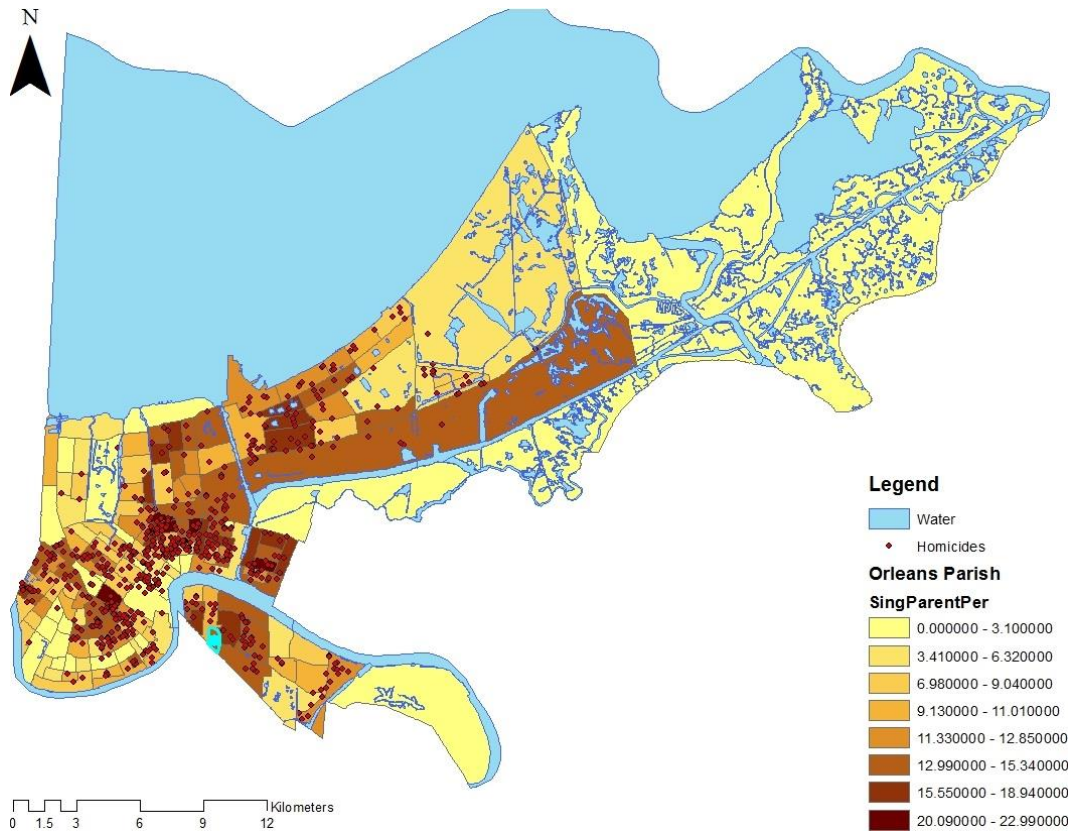


Figure 4.4: Percentage of single-parent-headed households

The only variable whose frequency distribution could be improved was the unemployment rate, so it was transformed by its log. The standard (z) scores were measured for each variable by census tract and the mean of those scores was used as the Index. Figure 4.5 shows the spatial distribution of the CDI in the study area.

Table 4.1: Sample of the Concentrated Disadvantage Index

Tract ID	% Below Poverty	% Black	% Single Parent	% Public Assistance	% Unemployed (log)	Index (Mean)
100	-1.09	-0.91	-0.53	-0.34	-0.85	-0.75
200	-0.43	0.80	0.91	0.53	-0.68	0.23
300	-0.26	0.96	1.33	0.88	0.55	0.69
400	-0.53	0.43	0.18	0.24	-1.08	-0.15
601	3.58	1.13	0.94	2.35	0.26	1.65

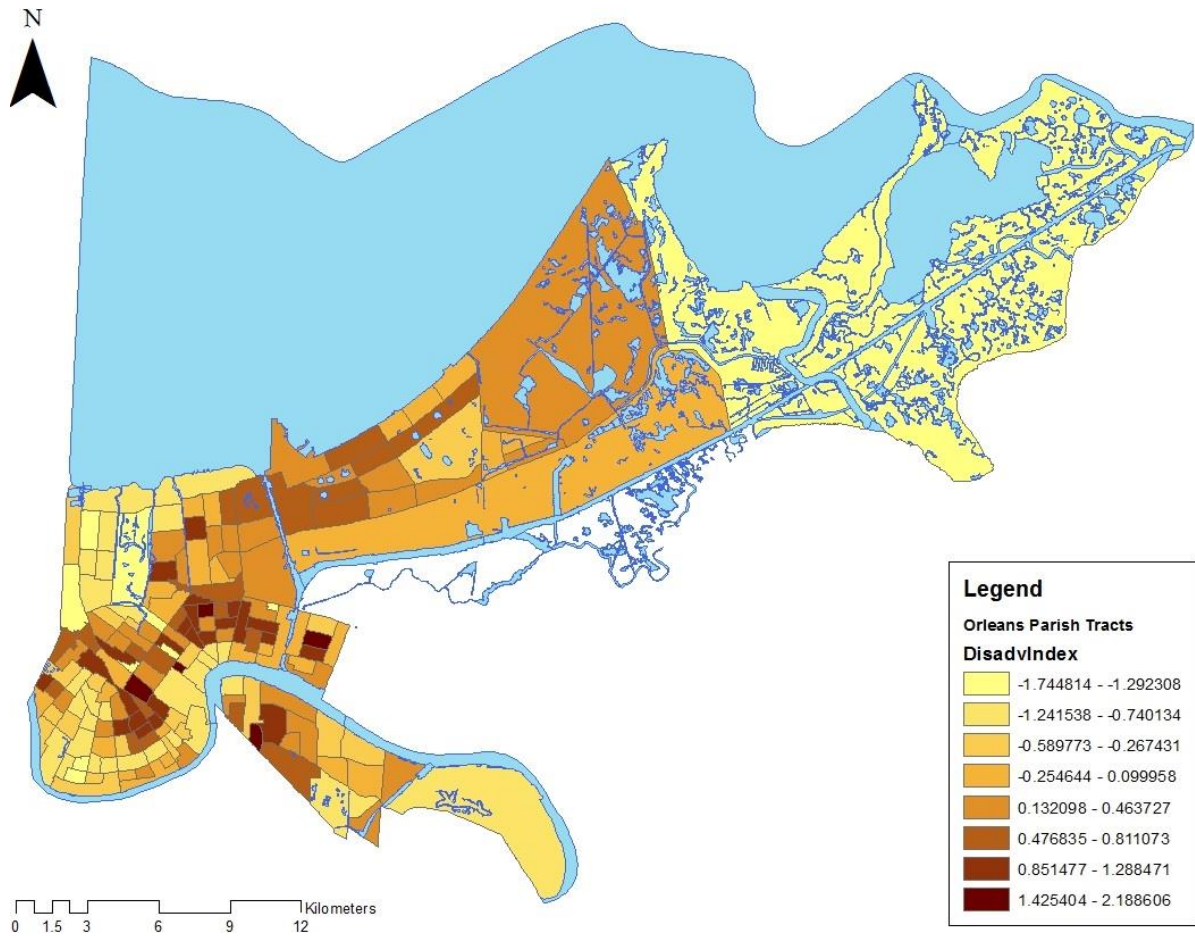


Figure 4.5: Spatial Distribution of CDI

## 5. Constructing New Geographic Areas from Census Tracts by REDCAP

The practical need and theoretical basis for regionalization was established in the literature review (Chapter 2). Here the REDCAP regionalization method is examined as it pertains to the study area. REDCAP regionalization is actually a set of several different methods. First, the particular method chosen in the experimental design process is discussed. Then, the outputs of the process are visualized and displayed for comparison purposes.

### 5.1 Full-Order Average Linkage Clustering Method

The small populations created by the default delineation of census tracts in Orleans Parish provide for extremely unreliable homicide rate observations. REDCAP allows researchers to aggregate geographical units of a minimum threshold population and a desired measure of homogeneity. This allows observation of patterns that may be confounded by the heterogeneity of variables in the data set (Guo 2008, Guo and Wang 2011). REDCAP requires the construction of a contiguity matrix of the spatial layer based on either Rook or Queen contiguity. Both the shapefile of the Orleans Parish census tract layer and its contiguity matrix are loaded into the REDCAP application. In this case, the desired measure of homogeneity is the CDI. There are several methods of regionalization available in the software, but in this case the Full-Order Average Linkage Cluster (ALK) method was sufficient to regionalize based on a single variable. A discussion of the Full-Order ALK operation follows below.<sup>3</sup>

Guo (2008) defines *first-order* contiguity as two neighbors that share an edge. The first step in the REDCAP operation is to create a contiguity matrix of regions in the input data (in this case, rook contiguity is sufficient for this operation, and is faster than queen contiguity). A spatially contiguous hierarchy is one that is connected by first-order edges; clusters are spatially

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<sup>3</sup> For an exhaustive discussion of the REDCAP method, see Guo (2008) and Guo and Wang (2011).

contiguous if they consist of two hierarchies that share a first-order edge. These edges are removed in the beginning of the regionalization process, as opposed to the *full-order* operation, where the edge removal process is iterative, and edges are considered throughout the entire operation (Guo 2008).

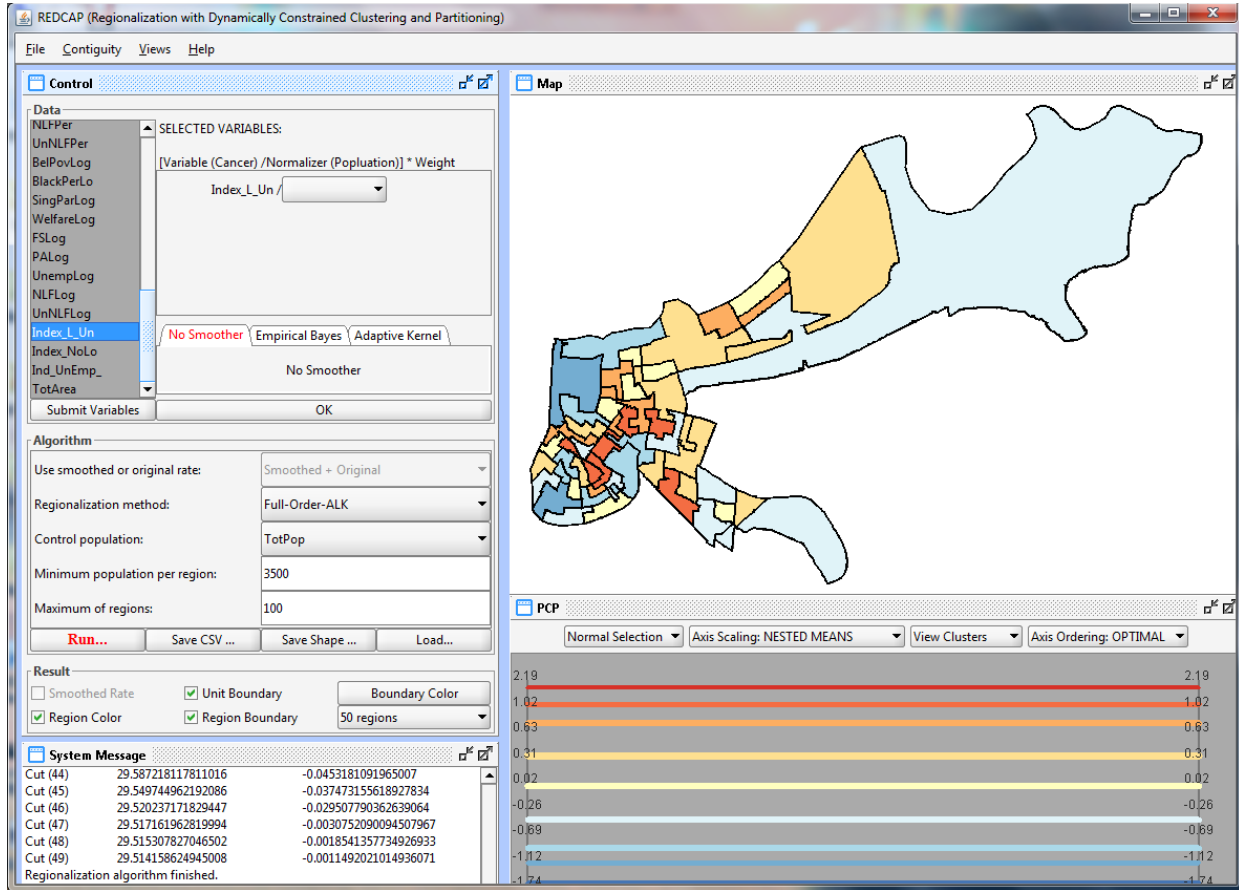


Figure 5.1: The Full-Order-ALK REDCAP operation

The agglomerative clustering operation is chosen on its method of creating regions. Each operation defines the distance between data points separately. The *complete linkage clustering* (CLK) method defines the distance as the dissimilarity between data points which are situated furthest from each other. The *single linkage* (SLK) method defines the distance as the dissimilarity between points which are situated closest to each other. The *average linkage*

*clustering* (ALK) is a good compromise between the two, as it defines the distance as the average of the dissimilarity of all data points on an intra-cluster basis. The ALK method is defined as

$$d_{ALK}(L, M) = \frac{1}{|L||M|} \sum_{u \in L} \sum_{v \in M} d_{UV} \quad (1)$$

Where  $|L|$  and  $|M|$  are the number of data points in clusters L and M,  $u \in L$  and  $v \in M$  are data points, and  $d_{uv}$  is the dissimilarity. While this operation is taking place, REDCAP takes the measure of heterogeneity and the gain in homogeneity of the regions to optimize the objective function of construction homogenous regions as defined in Guo (2008).

## 5.2 Processing Parameters and Output

A natural consequence of constructing new regions from old ones is that the total number of regions is reduced. When conducting the REDCAP operation, there was careful consideration of the need to balance a significant reduction of the homicide rate while preventing too few regions from existing. Too few regions would obfuscate the statistical analysis by lowering the resolution of the study, while having too much variability in the homicide rate would defeat the purpose of the operation. In particular, a low number of regions creates problems for Geographically Weighted Regression by having too few neighbors to evaluate local correlations. Trial-and-error runs of the REDCAP software determined that a fair minimum threshold population per aggregated region is 3500, as the standard deviation was sufficiently reduced for reliable observations in the homicide rate (Table 5.1). The maximum number of regions was specified to 100; however, 50 regions were produced by the Full-Order-ALK algorithm at the specified threshold (Figure 5.2). This number is on the low side of desired regions for a GWR but is within the acceptable limit to produce accurate results. Lower threshold populations

produced larger numbers of regions, but the variability in the homicide rate was unacceptably high.

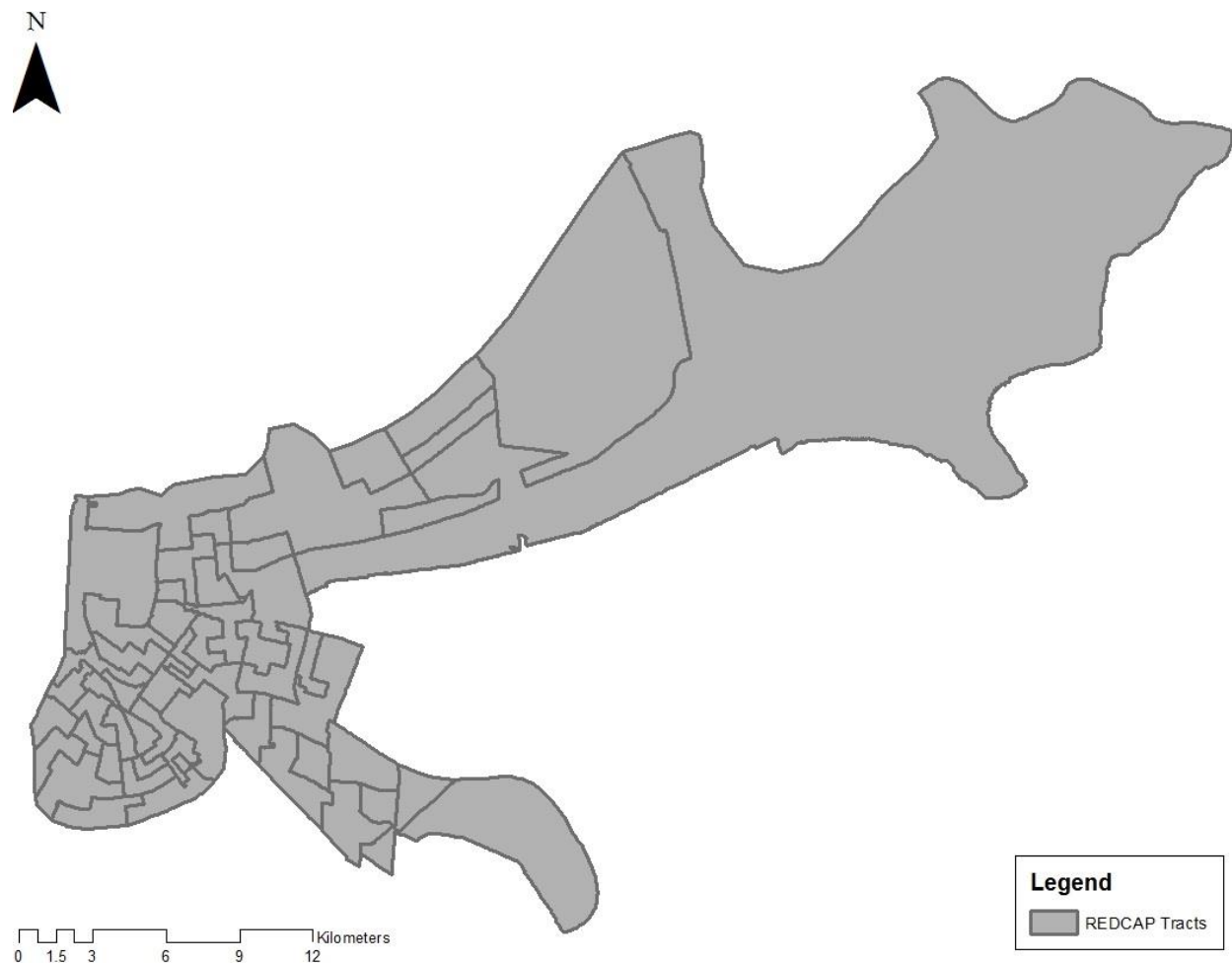


Figure 5.2: REDCAP Regionalization of the Study Area

Table 5.1: Statistics for Homicide Rate, CDI, and Population; Census vs. New Regions

	<b>Orleans Homicide</b>	<b>Orleans CDI</b>	<b>Orleans Population</b>	<b>New Area Homicide</b>	<b>New Area CDI</b>	<b>New Area Population</b>
<b>Observations</b>	173 <sup>4</sup>	175	175	50	50	50
<b>Minimum</b>	0	-1.75	0	0	-1.27	3570
<b>Maximum</b>	11111.11	2.19	4980	855.53	1.34	13691
<b>Mean</b>	435.34	0.02	1687.34	245.64	0.03	5905.7
<b>Std. Dev/CV<sup>5</sup></b>	1132.86	0.80	.57	220.26	0.67	.32

<sup>4</sup> There are 175 total census tracts; however, two census tracts have no homicide rate observation because of division-by-zero when trying to calculate a rate with null population.

<sup>5</sup> Standard deviation is listed for the homicide rates and CDI. Coefficient of Variation (CV) is listed for the population.



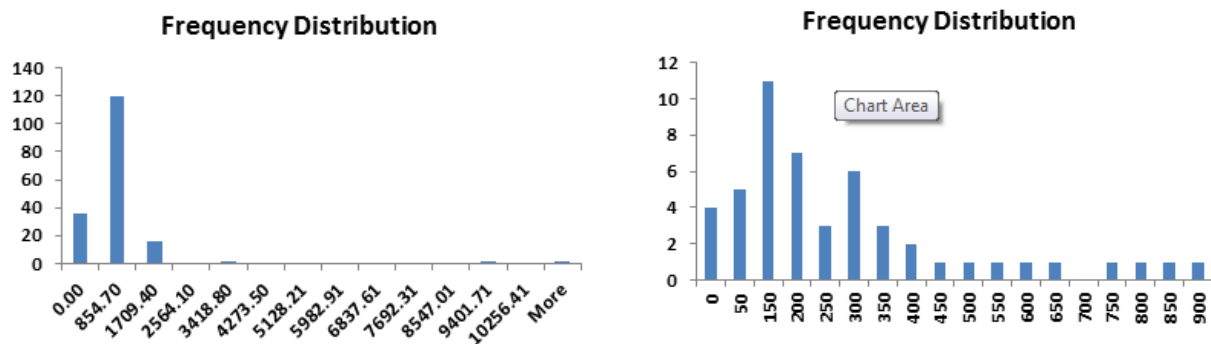


Figure 5.3: Frequency distribution of homicide rate for Census (left) and new areas (right)

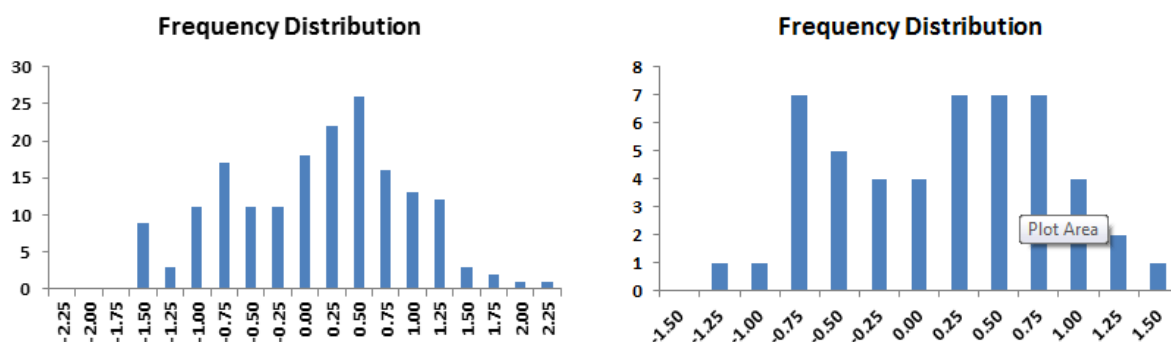


Figure 5.4: Frequency distribution of CDI for Census (left) and new areas (right)

The REDCAP operation takes the sum and the average of the variables indicated (Guo and Wang 2011). In this case, population, homicide incidents per census tract, and the CDI were exported with the new shapefile and added into the GIS. The sum of the CDI and the average number of homicides are discarded. The homicide rate is then calculated as  $100000 * (\text{Total Homicides} / \text{Total Population})$ . This method, while reducing the number of total observations, reduces extreme variation in the observed homicide rates across the study area. Additionally, variation in the CDI is reduced. The minimum threshold population of 3500 reduced the coefficient of variation (CV) of the population figures from .57 (census) to .32 (REDCAP). The



minimum population actually achieved was extremely close to the specified input setting (Table 5.1, Figure 5.3, Figure 5.4). The next section will discuss the spatial variations in homicide rates as they appear in the census tract layer and in the newly-created REDCAP layer.

## 6. Analysis of Spatial Distribution of Homicides

This study employed several powerful tools for geovisualization and descriptive analysis. First the mean center and direction distribution of the homicide rates was plotted. Then an interpolated surface trend was generated to compare homicide rates between regions of the study area. This surface trend was generated for both the Census layer and the REDCAP layer to show the reduction in variability. Finally, two tests of spatial autocorrelation of the variables are conducted to ensure that the analysis in Chapter 7 does not violate any statistical assumptions.

### 6.1 Mean Center and Directional Distribution

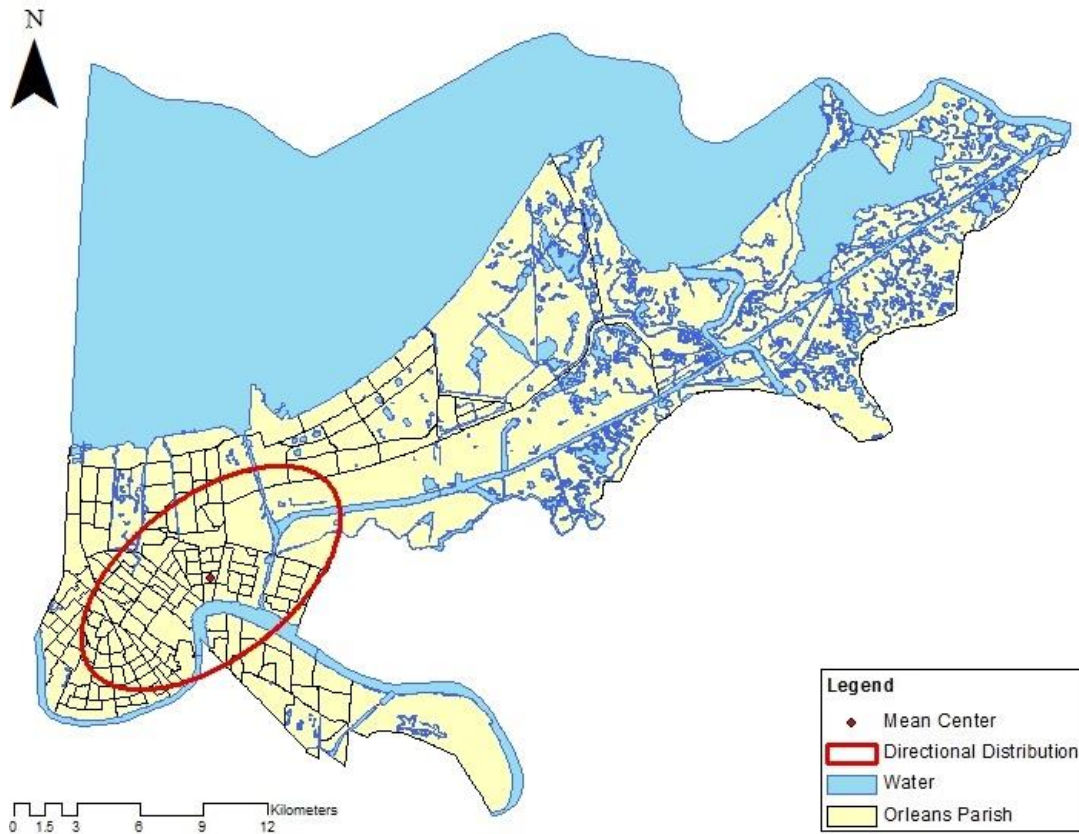


Figure 6.1: Mean Center and Directional Distribution of Homicide

The general spatial distribution of homicide incidents has its mean center in the St. Roch neighborhood, located in the block bounded at the southeast corner by Urquhart Street and St.

Roch Avenue and bounded at the northwest corner by Spain Street and North Villere Street. The direction distribution falls in an oblong ellipse from southwest to northeast of the Parish. This descriptive analysis provides very little detail concerning the distribution of homicide, so more complex analysis follows. Note that the mean center of incidents does not change based on the spatial layer, whether it is census tracts or REDCAP regions.

## 6.2 Geovisualization of Homicide Rates

To provide a clearer picture of the spatial patterns of homicide, a surface displaying the trends in homicide rates across the census tracts and the REDCAP layer was generated. To do so, the ArcGIS Feature to Point tool was used to create tract and region centroids for the study area, in which the homicide rate is encoded. Using the Geostatistical Analyst plugin for ArcGIS, the Inverse Distance Weighting (IDW) method, which is a deterministic method of interpolation, was applied with the following results:

Table 6.1: Prediction Error of the IDW Operation

	Census	New Area
<b>Observations</b>	173	50
<b>Power</b>	7	7
<b>Mean</b>	-112.84	15.99
<b>RMS</b>	1140.77	246.11

Seventh-order polynomials were used for the operation. The extreme variability in the homicide rates in the census layer is shown by both the large divergence in the average standard error (mean) and the Root Mean Square (RMS) of the continuously varying function. The regionalization operation reduced the variability in rates, as demonstrated by the mean and RMS of the function for the REDCAP layer. This is also demonstrable by the geovisualization of the function by the output rasters in Figures 6.2 and 6.3.

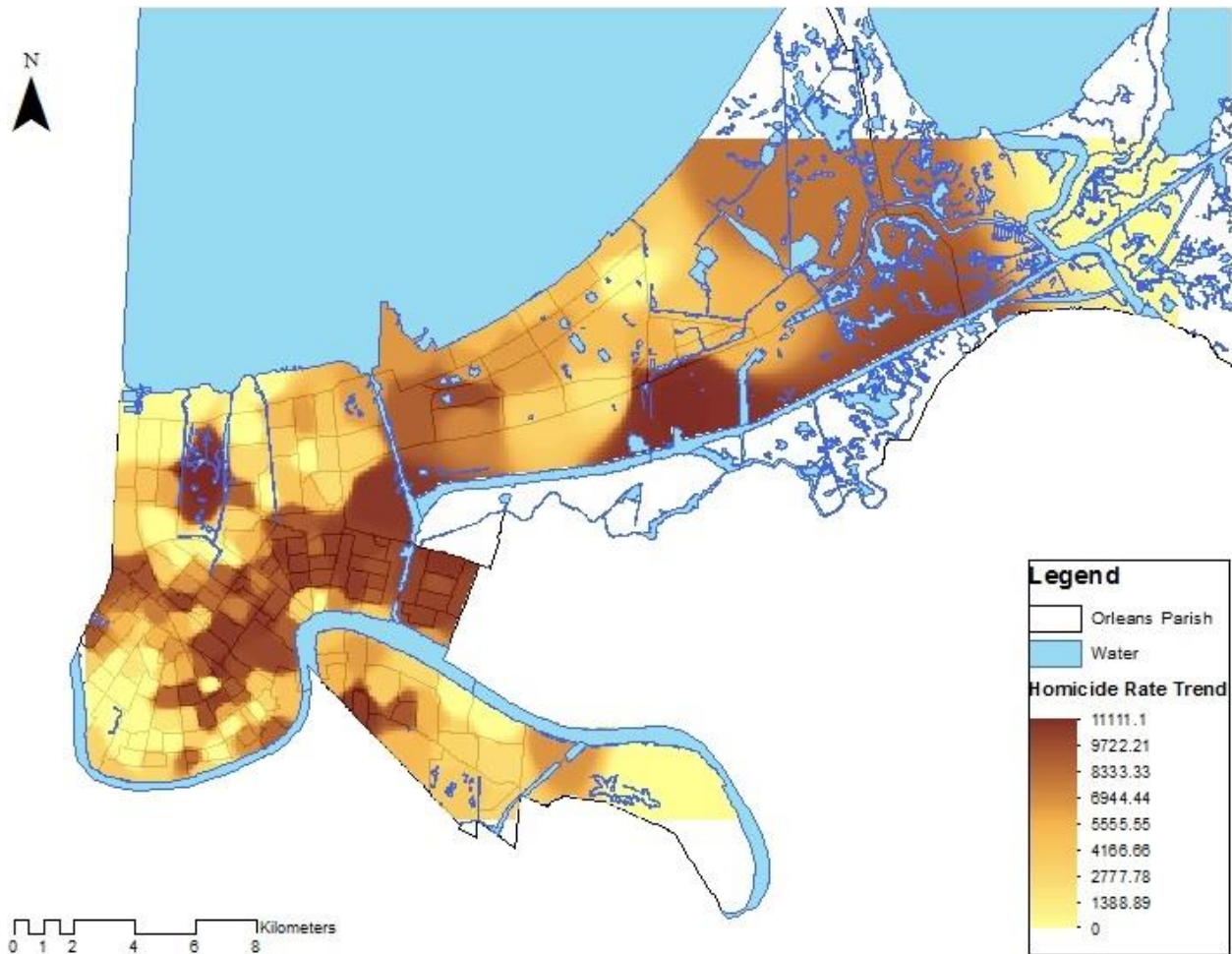


Figure 6.2: Homicide Rate Trends in the Census Layer

The highest observed homicide rate trend is City Park, which can be identified as the large dark area in the northwest corner of the study area. High homicide rates are also observed in a swath starting in Central City (southwest of the Central Business District), proceeding northeast through the CBD, and continuing through the Mid-City, Bywater, and Lower Ninth Ward neighborhoods. Enclaves of high rates are observed in the Hollygrove, Lakewood, and Mid-City neighborhoods. In New Orleans East, high rates occur in the Lake Forest and Venetian isles neighborhoods.

Conversely, low homicide rate trends are observed in the Uptown/Carrollton area, which is in the southwestern most portion of the city. Lakeview (northwest) also enjoys typically low

rates, as does the French Quarter and Bywater districts northeast of the CBD. Most of the West Bank of Orleans Parish enjoys a low homicide rate; however, the Fischer Housing Development portion of that side of the river has a fairly high rate.

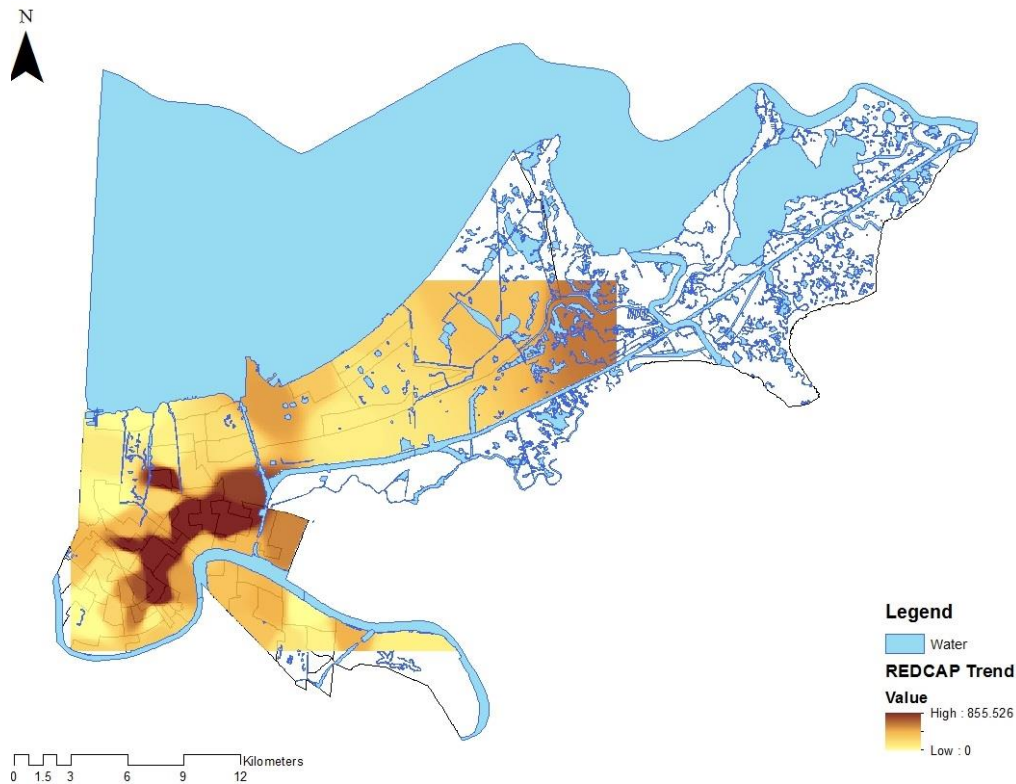


Figure 6.3: New Area Surface Trend

The spuriously high homicide rates that were observed in the areas of low population, namely City Park and the Venetian Isles (light portion east of the intracoastal canal) have been reduced, as well as those of the Fisher Housing Development neighborhood on the West Bank of the Mississippi river. Rates remain high in other formerly small-population areas, but are no longer spurious observations. Overall, the REDCAP surface trend is smoother than the census layer trend, which is highly irregular and coarse. This demonstrates the utility of REDCAP in reducing variability in the homicide rates – highlighting the utility of the operation for statistical analysis.

### 6.3 Spatial Autocorrelation of the Variables

The Moran's *I* statistic (Moran 1950) is used to create an index of spatial autocorrelation in the data, that is, to test whether there is spatial dependency in the variables. The tool is included in the GIS and measures values of features and their locations to detect the degree of clustering or dispersion. An index, z-score, and p-value are calculated. In the case of the Moran's test, the null hypothesis is that data values occur at random. The scores are interpreted according to Table 7.1.

Table 6.2: Interpretation of Moran's *I* Output

<b>Positive Index</b>	Similar values cluster
<b>Negative Index</b>	Dissimilar values cluster
<b>Zero Index</b>	Total Randomness
<b>Positive z-score</b>	Values are clustered and not random
<b>Negative z-score</b>	Values are dispersed and not random
<b>Insignificant p-value</b>	No assumption other than random

The first Moran's test was conducted with the homicide rates in both the census and REDCAP layers with a distance threshold of 5000 meters. As we can see from table 5.2, the rates in the census layer appear to occur at random; conversely, rates in the REDCAP layer are clustered.

Table 6.3: Moran's *I* for Homicide Rates

	<b>Census</b>	<b>New Areas</b>
<b>Index:</b>	0.01	0.13
<b>z-score:</b>	1.06	3.30
<b>p-value (&lt; .05):</b>	0.29	0.00

The insignificance of the test for the census layer means that the rates appear to occur completely randomly, which, given the spatial pattern of homicide incidences in Chapter 3, is a poor assumption. The REDCAP test is significant with a positive index and z-score, meaning that homicides do cluster. We should expect to see a clustering of homicides because, although homicide is statistically a rare event, it is rarely a random one in New Orleans – especially given the assumption of retaliatory homicides. No one paying attention to homicide patterns in the city

can assume that these patterns are independent observations. Here the REDCAP regionalization provides us patterns in the data that would otherwise be obscured by small populations and somewhat arbitrarily delineated tracts<sup>6</sup>. Next, the Moran's *I* test was conducted for the CDI for the census and REDCAP layers with the same distance threshold as the homicide rates: 5000 meters. The output is in Table 6.4.

Table 6.4: Moran's *I* for the CDI

	Census	New Areas
<b>Index:</b>	0.11	0.25
<b>z-score:</b>	8.19	0.65
<b>p-value (&lt; .05):</b>	0	0.51

Results for the census layer indicate a significant clustering of concentrated disadvantage; while the REDCAP layer shows disadvantage occurring at random. There are two possible interpretations for these outcomes. First, depending on one's own interpretation of the spatial patterns of disadvantage in Orleans Parish, one could reasonably argue that disadvantage is clustered or random, depending on the area of the city. Certain parts of the city (such as the Lower 9<sup>th</sup> Ward) have long time been disadvantaged areas, while others show randomness in advantage and disadvantage (Uptown, Riverbend, Mid-City). One might expect an insignificant test for the REDCAP layer because the CDI is the variable used to create homogeneous regions with minimum threshold populations. One eventuality is that the REDCAP operation revealed that concentrated disadvantage does occur randomly throughout the city; the other is that the spatial resolution of the CDI is simply not high enough to accurately detect the true patterns of concentrated disadvantage.

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<sup>6</sup> Census tract delineation is not entirely arbitrary. Officials attempt to construct tracts of consistent socio-economic structure; however, population changes such as migration and gentrification can cause these groupings to become unreliable.

## 6.4 Local Test of Spatial Autocorrelation

Anselin (1995) developed a local version of the Moran's  $I$  referred to as Local Indicators of Spatial Association (LISA) to test for spatial clusters and spatial outliers in a given data set. When performed on each variable, this test allows assessment of spatial autocorrelation when maps are compared. The test was performed on the homicide rate and CDI for both layers.

Clustering of the CDI (Figure 6.4) is insignificant for most of the spatial area with a few notable exceptions. The CDI displays high values clustering near other high values in the Bywater, as well as Lower Ninth Ward, Fischer Projects (Westbank), Little Woods, and Pines Village (New Orleans East). Low values clustered near other low values concentrate in the Uptown/Carrollton area in the southwest and the Lakeview neighborhood in the northwest. Clustering of low values near high values occurs in the Central Business District, Lake Terrace-

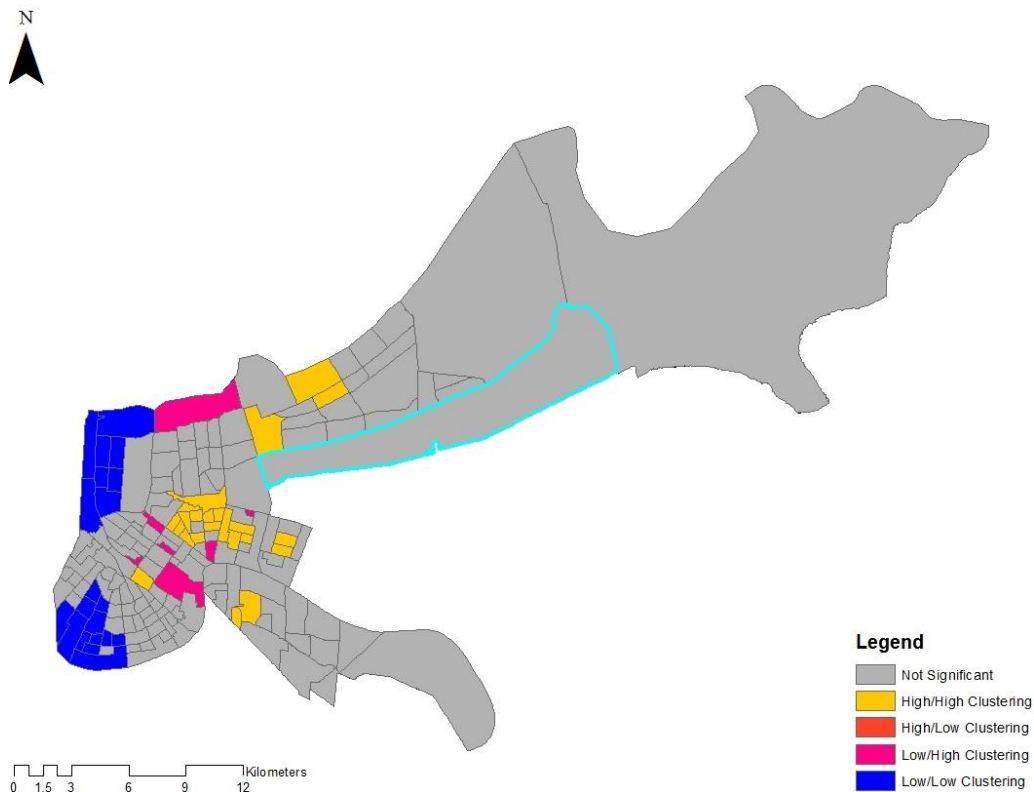


Figure 6.4: Anselin Local Moran's  $I$  for Census CDI



Oaks neighborhood (New Orleans East), and patches throughout the Mid-City area.

The results for the homicide rates (Figure 6.5) in the Census layer also show insignificant clustering with only two exceptions: Tract 9800 (City Park), Tract 17.51, Tract 44.02, and Tract 16, which show high values near low values. These tracts have populations of 9, 203, 0, and 0 respectively; and homicide rates of 11,111.1, 9359.61, null<sup>7</sup>, and null, respectively. These clusters are spurious results created by the Small Population Problem; therefore, assuming no significant clustering of homicide rate is reasonable. Thus there is no evidence to suggest that the variables are spatially autocorrelated in the Census layer.

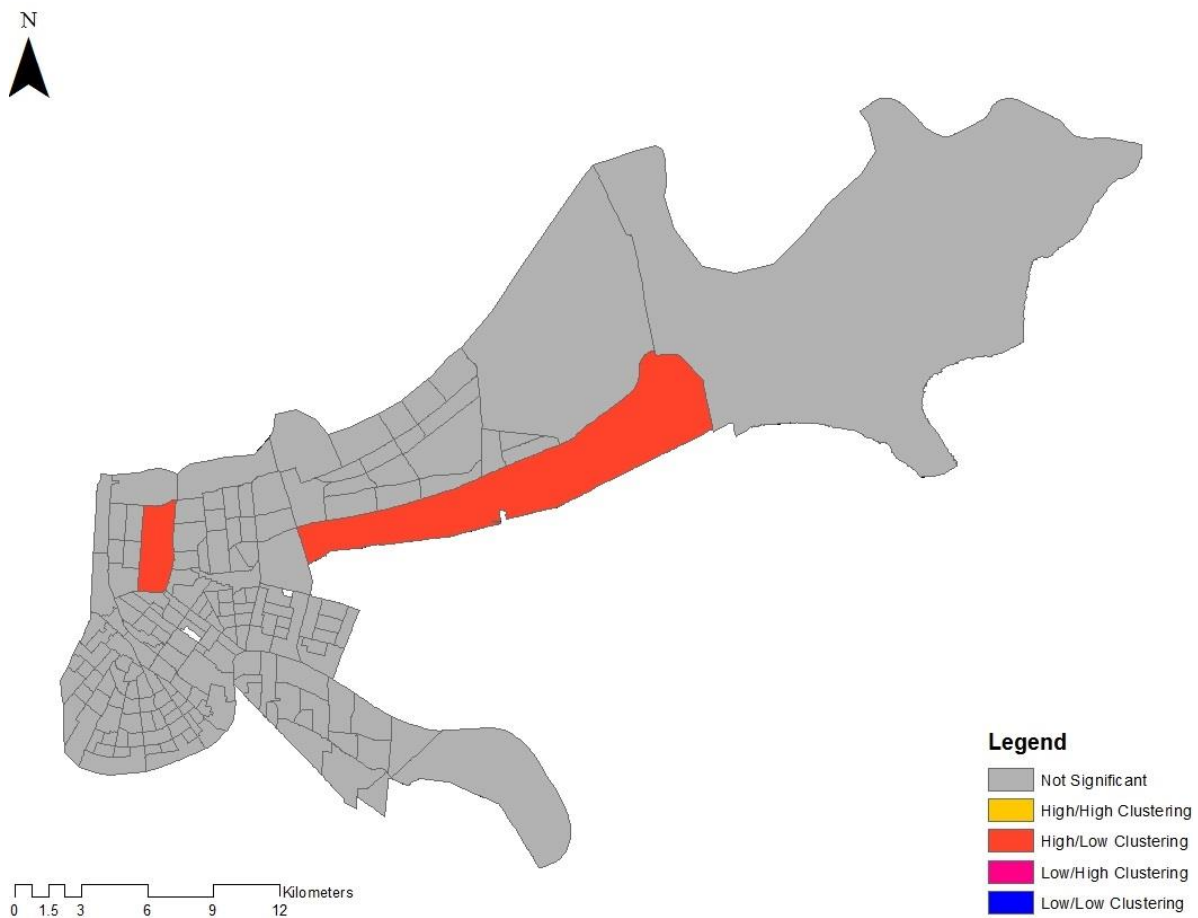


Figure 6.5: Anselin Local Moran's *I* for Census Homicide Rate

<sup>7</sup> Null value calculated for these tracts to avoid divide-by-zero error.

The results for the tests on the REDCAP layer (Figure 6.6) show insignificant clustering of the CDI except for region 49 (in the south central part of the map), the majority of which is the Central Business district and the French Quarter.

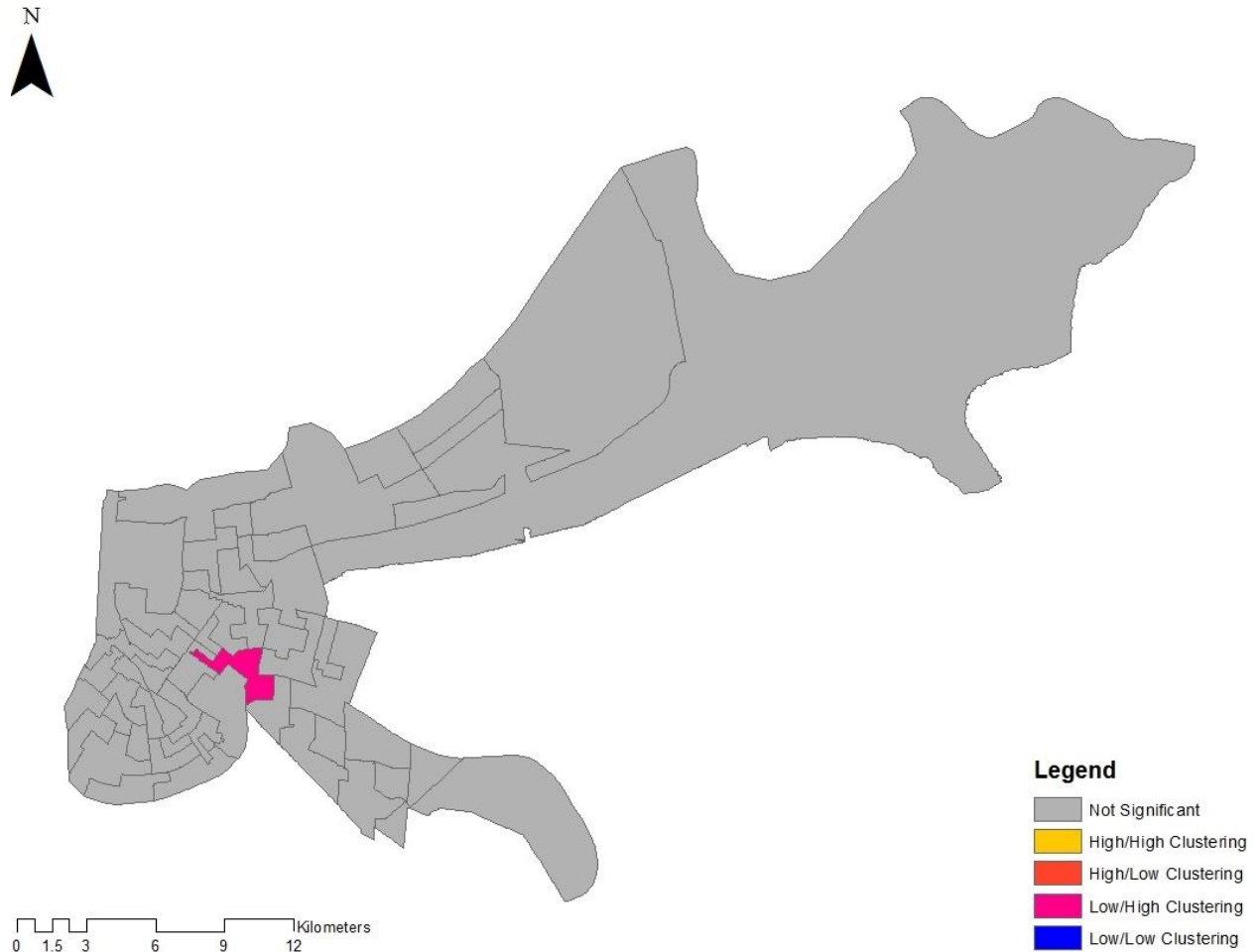


Figure 6.6: Anselin Local Moran's  $I$  for New Area CDI

Figure 6.7 (next page) maps the local clustering of homicide rates in the REDCAP layer. As with all other results, most of the study area contains insignificant clustering; however, significant clustering of high rates near other high rates in the Central City, Tulane-Gravier, Seventh Ward, St. Roch, St. Claude, Ninth Ward, Gentilly Terrace, and Gentilly Woods neighborhoods. This clustering corresponds almost directly to the interpolated surface trend generated for the REDCAP layer (see section 6.2; figure 6.3).

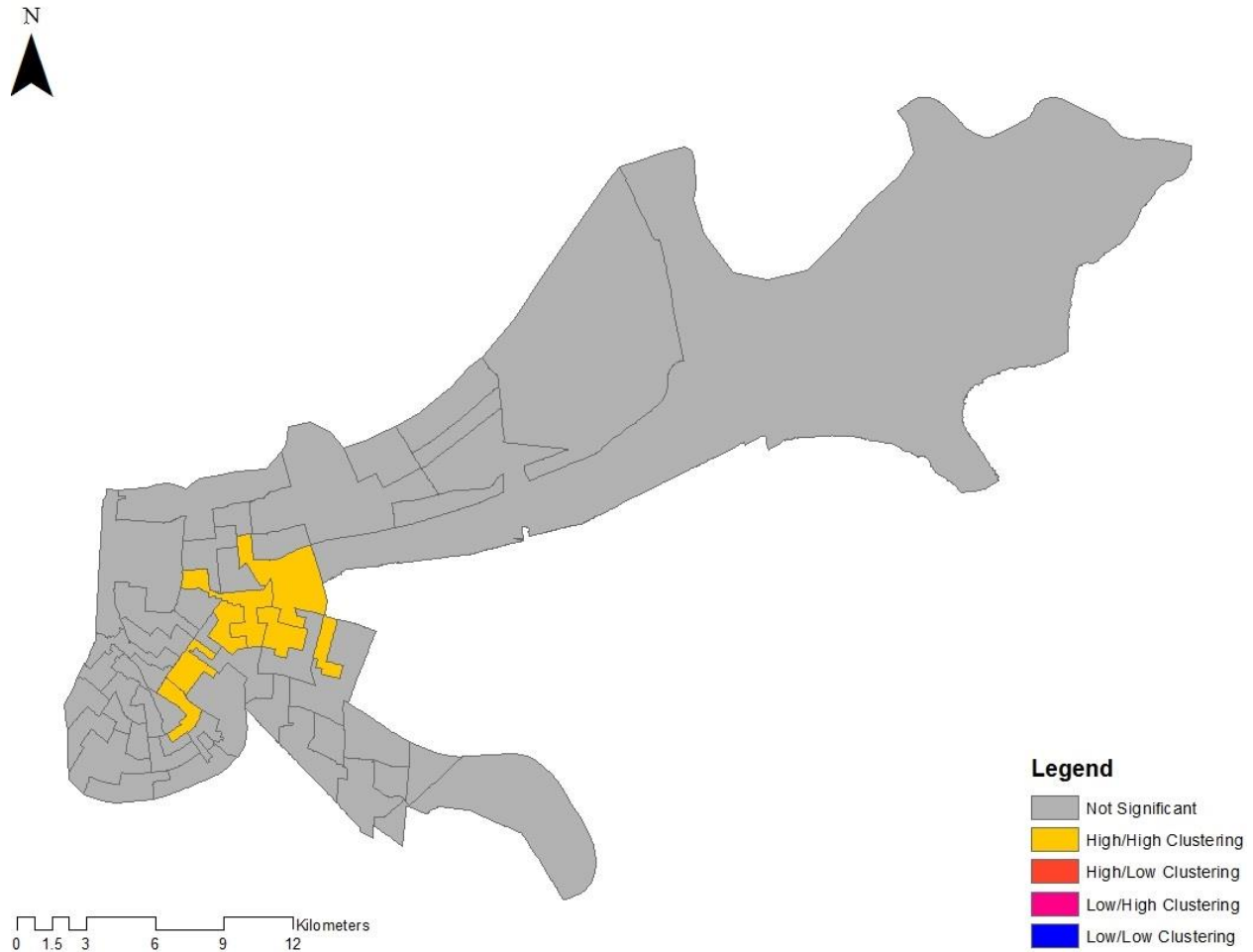


Figure 6.7: Anselin Local Moran's  $I$  for New Area Homicide Rate

The Local Moran's  $I$  confirms that there is significant, non-random clustering of homicide rates. This violates the assumption of independence of observations, but follows the First Law of Geography that “everything is related to everything else, but near things are more related than distant things” (Tobler 1970). The assumption here is that some other mechanism is taking place over geographic space than random chance. This autocorrelation of homicide rates is limited in spatial area and constitutes only a small portion of the study area. There is almost no observed autocorrelation in the CDI. Taking into account the results of these tests, the study proceeds to the statistical analysis in chapter 7.

## 7. Analysis of Association between Concentrated Disadvantage and Homicide Rate

The experimental spatial analysis in this study employs several different methods. First a simple OLS regression analysis was performed to test whether the homicide rate can be explained by concentrated disadvantage – again for both layers. Last, a Geographically Weighted Regression was used to test this relationship in a spatially disaggregated manner. The outputs of these analyses are visualized and discussed.

### 7.1 OLS Regression Analysis

Table 7.1: Regression Statistics, Census vs. New Areas

	Census	REDCAP
<b>Multiple R</b>	0.04	0.67
<b><math>R^2</math></b>	0.001	0.47
<b>Adjusted <math>R^2</math></b>	-0.005	0.46
<b>Standard Error</b>	1141.32	164.16
<b>Observations</b>	172	49
<b>p-Value (&lt; .05)</b>	0.65	0.00

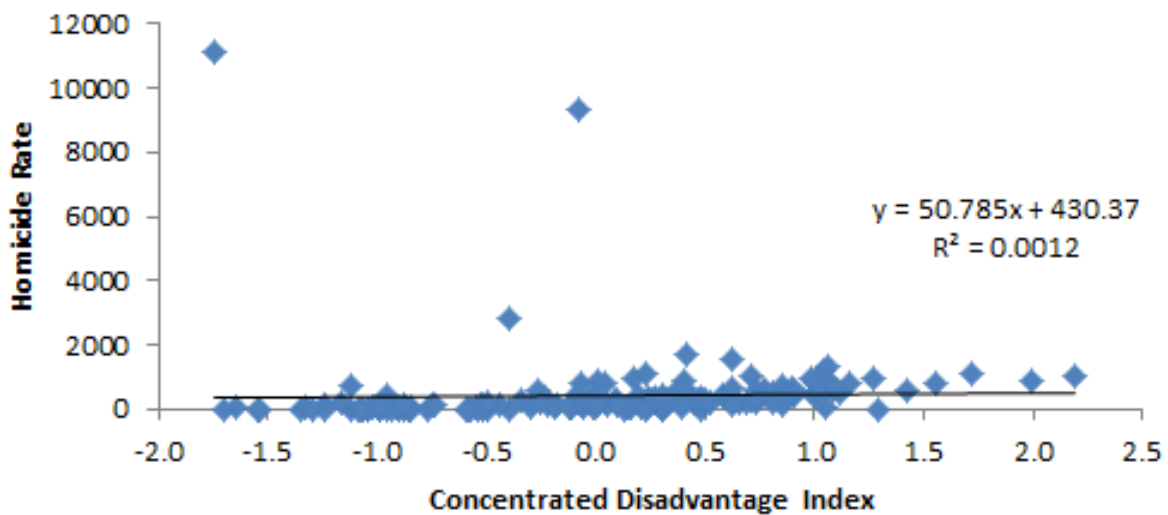


Figure 7.1: Census Tract Layer Regression Plot

A cursory examination of the results of the regression analysis shows that for the Orleans Parish Census Tracts, there is a positive, yet weak and insignificant ( $p > .05$ ) correlation between

the homicide rates and the CDI. The results of the analysis do not support the hypothesis that homicide rates can be explained by levels of concentrated disadvantage. Note that this analysis does not include observations at two census tracts; zero population in these prevented a homicide rate from being calculated. We also observe the Small Population Problem skewing the homicide rates at low levels ( $\leq 0$ ) of disadvantage. The model is also a very poor fit with an  $R^2$  value of less than .01 (and a negative adjusted  $R^2$  value).

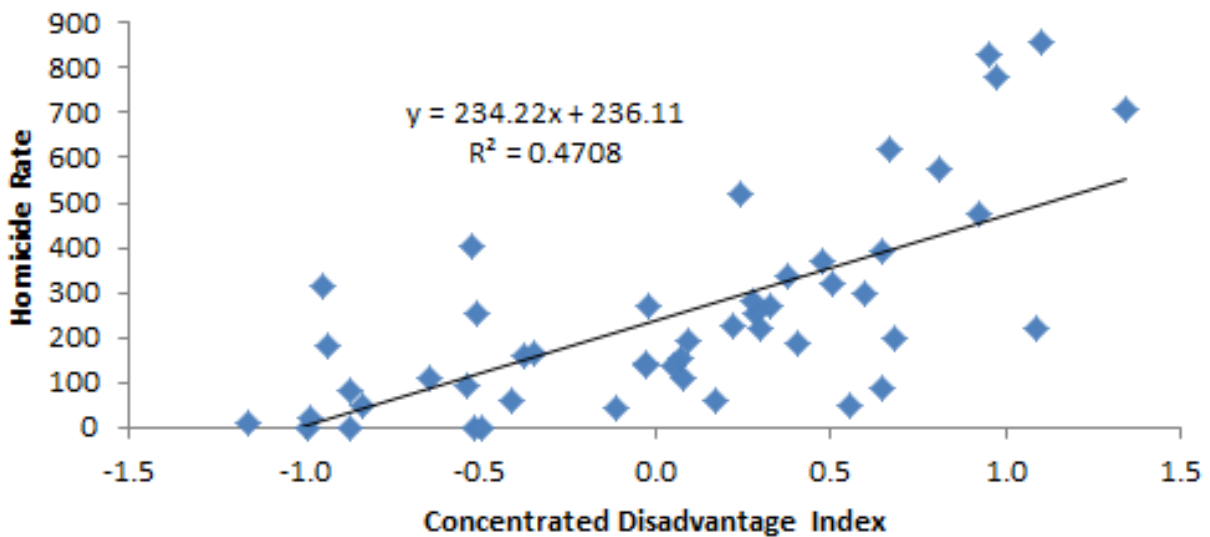


Figure 7.2: REDCAP Layer Regression Plot

Regression results on the REDCAP layer show a positive and significant ( $p < .05$ ) correlation between the homicide rates and the CDI. The results of the analysis support the hypothesis that homicide rates are associated with the level of concentrated disadvantage, and the relationship is statistically significant. The REDCAP operation allowed the model to account for more of the variance than the census tracts alone because the regionalization created more reliable observations. The  $R^2$  (.47) is a significant improvement in fit over the Census layer (.001). The adjusted  $R^2$  (.46) is close to the original, indicating a good fit and lack of shrinkage.

## 7.2 Geographically Weighted Regression: Evaluating Spatial Non-stationarity

One way to test correlation between the variables without regard to their spatial autocorrelation is to use a tool provided in the GIS called Geographically Weighted Regression (GWR) developed by Brundson, Fotheringham, and Charlton (1998). This method generates a regression model at each feature in the layer rather than at the aggregate, which avoids the problem of spatial dependency in the variables, whether or not we expect that dependency to appear in one or all of them. An adaptive kernel was specified to create the model based on nearest neighbors, rather than a fixed kernel, which specifies the model for a certain distance. Results can be interpreted in a fashion nearly equal to a linear regression. An additional benefit is the availability to use the Moran's *I* on the local regression residuals as a test of robustness (Mei and Zhang 2000); a randomly dispersed residual set generally indicates a properly-specified model. The Sigma value may be interpreted as the standard deviation of the local residuals. The results of the regression and the spatial autocorrelation test of the residuals are in Table 5.4<sup>8</sup>.

	<b>Orleans</b>	<b>New Areas</b>
<b>Neighbors</b>	144	17
<b><i>R</i><sup>2</sup></b>	0.06	0.81
<b>Sigma</b>	1120.28	120.96
<b>AICc</b>	2926.30	644.07
<b>Moran's <i>I</i></b>	-0.007	-0.04
<b>Moran's <i>I</i> z-Score</b>	-0.22	-0.65
<b>Moran's <i>I</i> p-Value</b>	0.83	0.52

Table 7.2: GWR and Moran's *I* Output

Even a spatially disaggregated regression shows little correlation between homicide rates and the CDI on the Orleans Census Tract layer. Although the *R*<sup>2</sup> (.063 versus .001) is improved, the standard deviation in the residuals is still extremely high. The REDCAP layer, however, has

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<sup>8</sup> ArcGIS does not report significance tests for Geographically Weighted Regressions. See <http://forums.arcgis.com/threads/43712-Significance-for-Parameter-Estimates-in-GWR>

a significantly improved  $R^2$  value (.81 vs. versus .47). The Sigma score is low, which we would expect to see from assuming that the REDCAP operation reduces the error variance. The AICc score is reduced in the REDCAP model, indicating a better fit than that of the Orleans model. According to the Moran's  $I$  output for both layers, the p-values are insignificant; therefore, the test is robust because the residuals are randomly distributed.

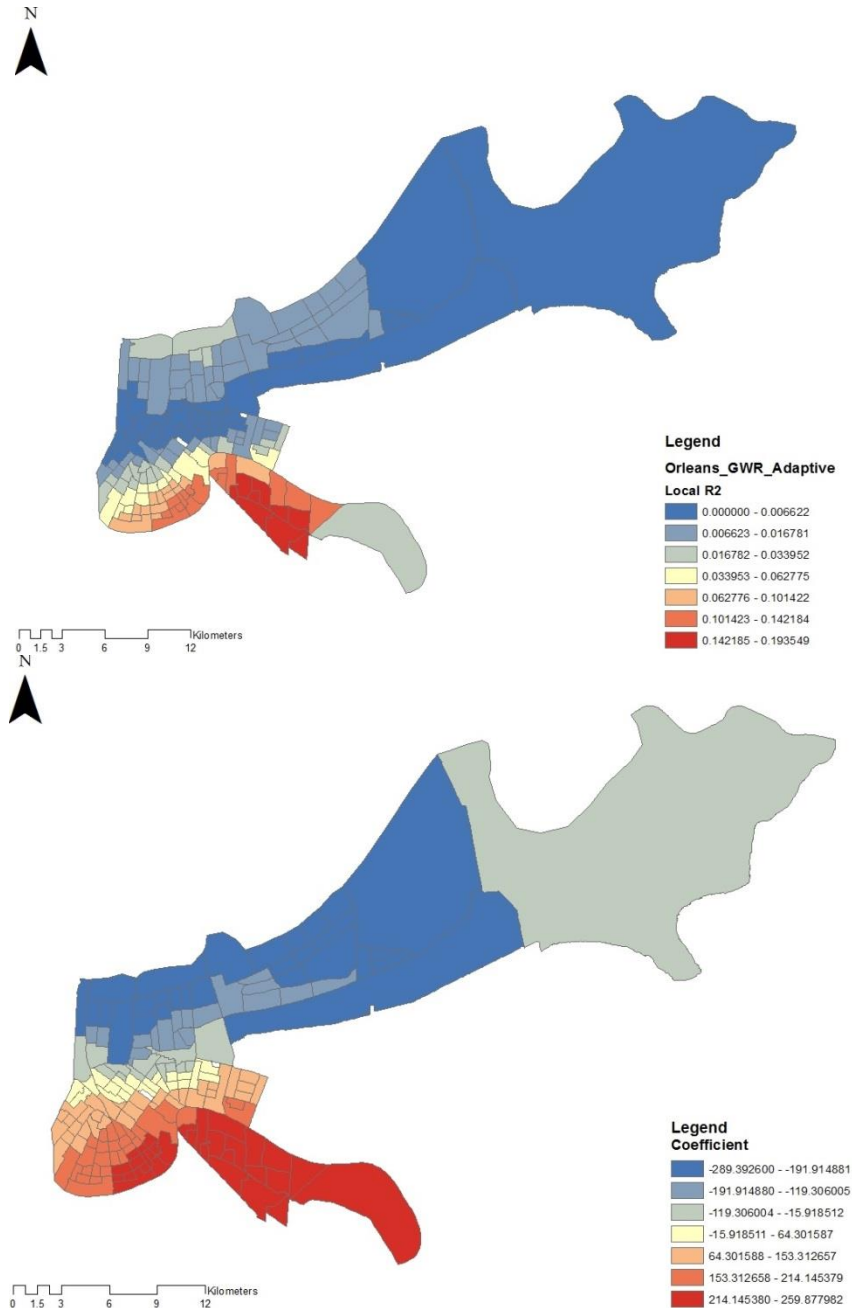


Figure 7.3: Local  $R^2$  (top) and Coefficients (bottom) for the Census layer

The GWR model for the census layer accounts for a very low percentage of the dependent variable. In addition, the spatial pattern of the local  $R^2$  (Figure 7.3) seems to exhibit a cascading north-south pattern that does not make very much sense. The coefficients are largely negative which indicates that there is no relationship between the independent and dependent variables. However, in the REDCAP layer (figure 7.4), the smallest regions by area (indicating higher population density) have the highest  $R^2$  values ( $> .5$ ). The coefficients are positive for the vast majority of the map. Negative coefficients are seen in New Orleans East and the western portion of the West Bank region. The highest coefficients are seen in those areas with the highest homicide rate trends (see section 6.2). Figure 7.4 provides information about both the degree of the non-stationarity of the relationships between the variables and the ability of the REDCAP process to reveal patterns in the data that would otherwise be hidden.

Several conclusions can be drawn from the GWR process in this case study. That the homicide rates in the Census layer are extremely unreliable has been established; spatial non-stationarity cannot be evaluated accurately at the bandwidth. Although the model was shown to be properly specified, it has a poor goodness of fit. Additionally, the coefficients show a negative relationship between the variables, regardless of what the linear regression stated. The model was discussed here mostly for comparison purposes because the GWR is an effective tool at evaluating the non-stationarity in the REDCAP layer. The  $R^2$  is significantly improved over the linear regression and the coefficients are largely positive. The model is a far better fit than of the Census layer. The GWR shows us that the homicide rate's dependence on the CDI is spatially correlated in the REDCAP layer.



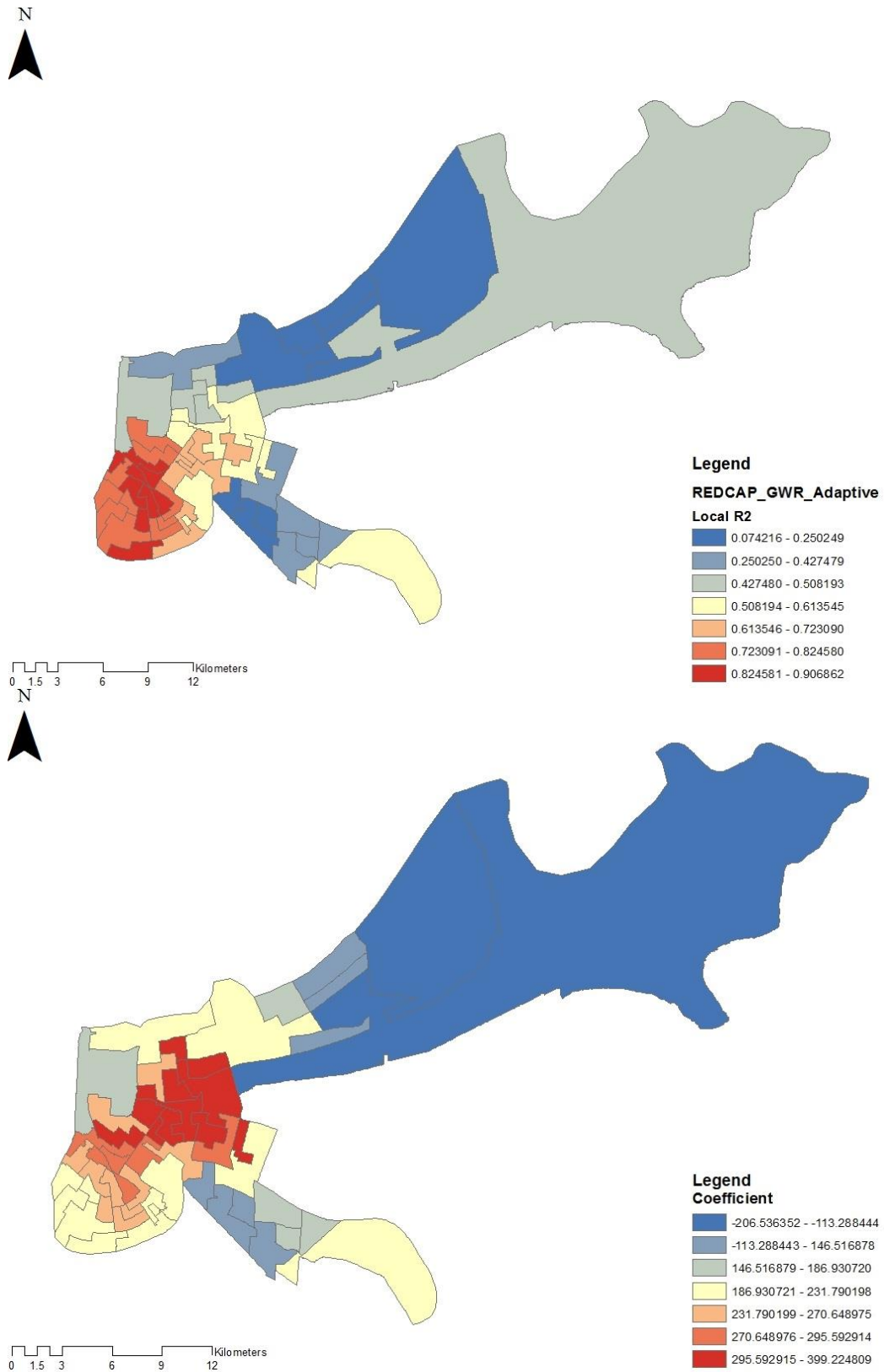


Figure 7.4: Local  $R^2$  for (top) and Coefficients (bottom) for the new areas

The maps of the local  $R^2$  and coefficients for the census layer tell us nothing about the spatial pattern of correlation. This is likely due to the confounding of patterns in the data due to the issues created by the Small Population Problem and the MAUP. However, an examination of the local  $R^2$  and coefficients in the REDCAP layer provides more information about the spatial non-stationarity of the correlation between the homicide rate and the CDI. First, the lowest fit of the model ( $R^2 \leq .5$ ) and lowest coefficients tend to occur in the same place: on the peripheral areas in the northwest, north, east, and south central. Second, the best fit of the model ( $\geq .51$ ) occurs in the southwest, central, and far southeast portions of the study area. More interesting is the fact that the regression coefficients are highest both in the areas surrounding the highest homicide rate trend (Figure 6.3) but also the areas surrounding those where the homicide rate is spatially autocorrelated (Figure 6.7). This indicates that the correlation in the REDCAP layer is not likely the result of random chance, as homicide events are probably not autocorrelated by random chance, but because they are in fact a consequence of concentrated disadvantage in that area. For the areas of lower correlation, there is no clear explanation of this phenomenon other than that the homicide rate might be the result of other factors than Concentrated Disadvantage, or other indicators for which the CDI did not account.

## **8. Conclusion**

This study has demonstrated, first and foremost, the significant problem of homicide in New Orleans, Louisiana. The city frequently holds the title of the murder capital of the United States – a fact regretted not only by local residents who hold the city so dear to their hearts, but also by the city’s political and business leaders. The first objective of this study was to provide an explanation for the cause of the problem. A large body of sociological research demonstrates that high levels of social disorganization, indicated by concentrated socioeconomic disadvantage, tends to increase violent crime rates, including those of homicide. The second objective of this study was to assess the viability of the Regionalization with Dynamically Constrained Agglomerative Clustering and Partitioning (REDCAP) method of automatic region building as a tool for mitigating the statistical issues created by the Modifiable Areal Unit Problem and the Small Population Problem. Thus there were two hypotheses.

The first hypothesis was that there is a positive and significant relationship between Concentrated Disadvantage and the homicide rate in the study area. This hypothesis was not confirmed for the Orleans Parish census tract layer; however, it was confirmed in the newly constructed region layer. The second hypothesis was that the REDCAP successfully mitigates problems with homicide rate calculations in census tracts. This was confirmed by the reduction in variability in the variables used in regression analyses, as well as the significant fact that the first hypothesis was confirmed for the post-REDCAP regions, but not the census layer.

The concentrated disadvantage in certain neighborhoods of the city is a clear explanation for the homicide rate. When factors such as segregation, poverty, single-parent families, and high unemployment concentrate spatially, disadvantage is so concentrated that the very organization of the society breaks down. This in turn leads to poor outcomes in mental health of

residents and trust between residents. This combined with low level of trust of the police force results in residents seeking informal means of conflict resolution, specifically murder. This study has clearly established the link between concentrated disadvantage and the homicide rate in New Orleans. Regression analyses showed a high correlation between the two in the REDCAP layer, especially in the results of the Geographically Weighted Regression which reported an  $R^2$  value of .81.

In addition, this study has shown the efficacy of the Regionalization with Dynamically Constrained Agglomerative Clustering and Partitioning (REDCAP) method of automatic region building as a tool for homicide research. REDCAP provides an efficient solution to the problems that result from the Small Population Problem, in particular, the creation of unstable homicide rate observations calculated in arbitrarily delineated census tracts. By creating more stable homicide rates, REDCAP allows the analysis of patterns that would otherwise be hidden within the data sets. REDCAP's viability as a tool in homicide research is demonstrated throughout the study. Its utility was first demonstrated by the creation of a more stable and reliable interpolated surface trend with lower variation than the census layer. Most importantly, it allowed the first hypothesis to be confirmed after its use, as it resulted in the reductions in the variability in the variables used in the regression analyses. This demonstrates its potential for use in more rigorous statistical analysis, such as those with factor analysis or multivariate regressions. For example, REDCAP can enable researchers to conduct exploratory regressions in the ArcGIS package with several variables to determine which of those in the Concentrated Disadvantage Index are more salient in explaining the homicide rate.

This study also provides implications for public policy decisions. By providing more reliable statistics concerning the homicide problem, the study provides better information to

those in positions of responsibility in public policy to make more informed decisions regarding the homicide problem.

There were 193 murders not including justifiable homicides and accidents in 2012 – a roughly 3% decrease from 2011 (Vargas 2012). Police investigated 42 murders in the first quarter of 2013, most of which were in those areas shown in this study to have a high correlation between Concentrated Disadvantage and homicide. The fact that homicide exhibits a fairly consistent spatial pattern allows government to target certain areas with different policing methods, such as community-oriented policing. The New Orleans Police Department (NOPD) has started employing this method in some of the most disadvantaged, most deadly neighborhoods in the city (Elliott 2012). This study shows specifically which areas should be targeted by these methods. However, it is unclear whether this new action by the NOPD has had a significant effect so far. It is the sincere hope of this researcher that the results of this study will help officials to stem the homicide problem in New Orleans, Louisiana.

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## Appendix: New Orleans Neighborhoods

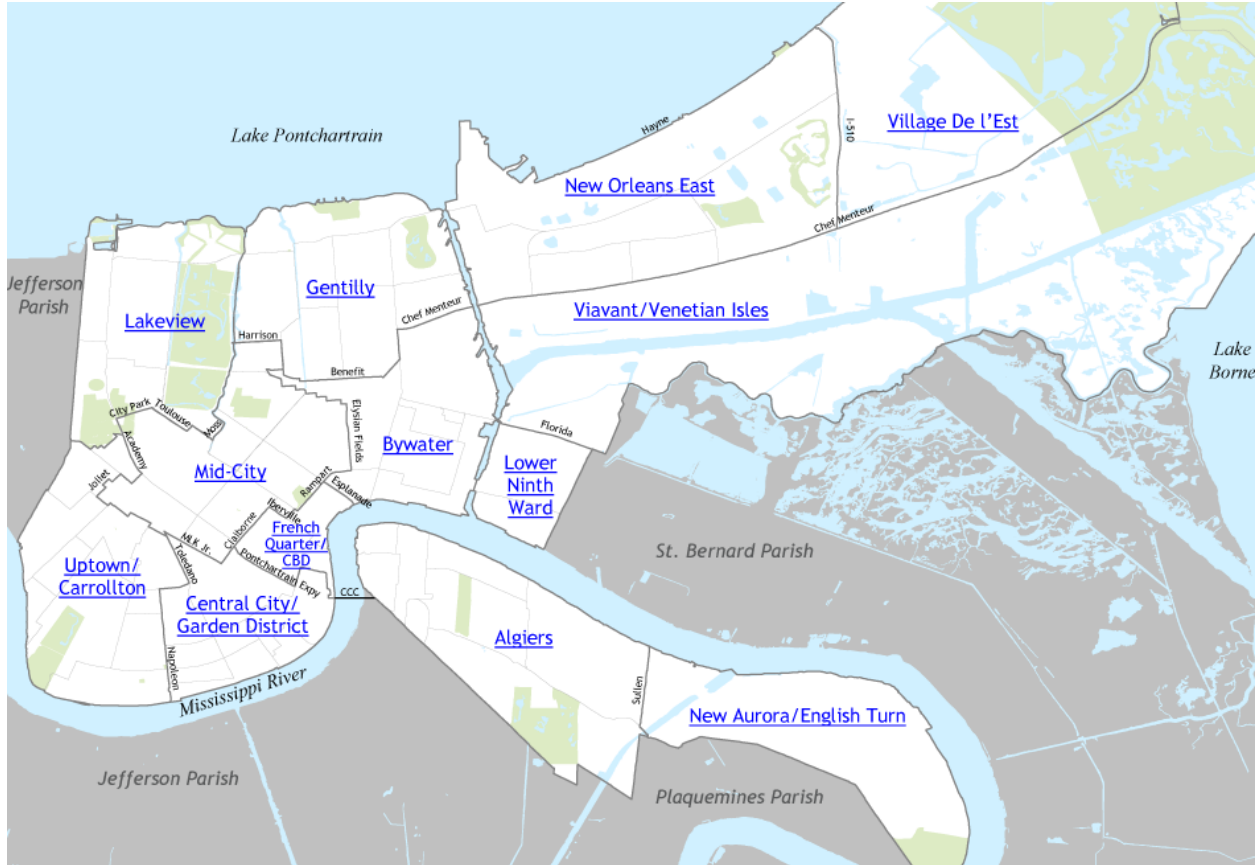


Figure A.1: New Orleans Neighborhood Map (GNOCDC 2012)

## **Vita**

Lawrence Keenan Robert was born and raised in New Orleans, Louisiana. In 2008, he received a Bachelor of Arts in International Studies with a concentration in Europe from Louisiana State University. During that time, he studied the Italian and German languages; he also conducted an in-depth geostrategic and geopolitical open-source intelligence analysis of the 2006-2007 phase of the Somali Civil War.

Mr. Robert traveled to Prague, Czech Republic in 2009 and earned a certification in Teaching English as a Foreign Language. He taught students from the beginner through advanced levels and gained a working knowledge of the Czech language. In 2010, he entered the graduate program in Geography at Louisiana State University. In the spring 2012 semester, he was a graduate assistant for Dr. Fahui Wang and Dr. Craig Colten. Mr. Robert lectured on the Middle East, Central Asia, and the Caucasus in the Geography 1003: Africa and Asia introductory course.

During his graduate studies, Mr. Robert conducted research on the indigenous religions of Kurdistan, the geography of the European Monetary Union, geostrategy in Central Asia, pipeline geopolitics in the South Caucasus and Central Asia, the Post-Soviet wars, and the death of the Svan language. He also independently studied the Georgian language and the culture of Georgia. In the summer of 2012, he returned to Georgia to conduct independent research on cultural and political ecology, vernacular architecture, religion, gender, transit, immigration, urbanization, infrastructure, and security. He also gained a limited working knowledge of the Georgian language as well as beginner proficiency in the Russian language.

Mr. Robert expects to earn a Master of Science in Geography in the spring of 2013. He has relocated to the District of Columbia to seek employment in service of the United States.