MEASURING LOCATIONAL EQUITY AND ACCESSIBILITY OF NEIGHBORHOOD PARKS IN KANSAS CITY, MISSOURI

by

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A REPORT

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Abstract

Recent research has focused on assessing equity with regards to location of public services and the population served. Instead of equality, equity involves providing services in proportion to need, rather than equal access for everyone. This study uses three commonly identified measures of accessibility (minimum distance, travel cost, and gravity potential) to assess how equitable higher-need residential populations of Kansas City, MO are served by neighborhood parks. Using Census 2000, socio-economic block group data, areas with high population concentrations of African-American and Hispanic populations, as well as areas of high density and low income are characterized as having the most need. However, correlations of higher-need populations with the accessibility measures reveal patterns of equity within the Kansas City. MO study area. Results indicated that while most of the high need population was adequately and equitably served by neighborhood parks, there were still block groups that did not have access to this type of public resource. This research follows methods proposed in previous studies that utilize the spatial mapping and analysis capabilities of ArcGIS and promote the use of these tools for city planners and future park development and decisions.

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Dedication

To my favorite teacher, Richard Tredway.

Thanks Grandad!

Chapter 1 - Introduction

Parks have "long been recognized as major contributors to the physical and aesthetic quality of urban neighborhoods," however; a new trend has emerged that links parks with "larger urban policy objectives, such as job opportunities, youth development, public health, and community building" (Walker, 2004). Growing research is finding favor with parks for their ability to increase property values, use and tourism, build social capital, promote mental and physical health and exercise, and provide environmental assets within cities (Garvin, 2002; Sherer, 2004; Walker, 2004; Harnik, 2003, 2004, 2009). Unfortunately, recent studies have also found that these benefits are not being equitably distributed to different populations groups within the city. In fact, studies show that communities with lower incomes, higher poverty rates or higher concentrations of racial or ethnic minorities have the fewest opportunities for community-level physical activity (Health Research and Policy Centers, University of Chicago, 2004).

As a result of these disparities, the attainment of equity in the allocation of public resource is of key importance to planners, as questions arise of "who gets what, who ought to get what, and who pays." There are several complexities involved in this type of equitable allocation including how to define and measure equity, and how to incorporate it into public decision-making and policy recommendations. The paper seeks to address these complexities by providing a brief background on the various definitions of equity and a summary of measures of accessibility in literature. In a case study of Kansas City, Missouri, equity is defined by need, and access is measured in terms of three distance based calculations. Through application of geographic information systems and geo-spatial analysis tools, the distribution patterns of neighborhood parks and their accessibility to high-need populations is assessed.

In this study, need-based populations were defined according to socio-economic characteristics of income, race/ethnicity, and population density. In Kansas City, the population groups found to have the highest need for access to parks were African American, Hispanic, and low income populations living in higher density neighborhoods. Based on previous literature, the assumption was that neighborhood parks would be less equitably distributed among higher need populations, and negatively correlated with areas of high park access. However, it was found that neighborhood parks are generally well distributed among populations with higher need for access, revealing patterns of equity in Kansas City, MO. Through further analysis, specific areas of the city were identified where high need populations had both high levels and low levels of access. These types of correlations are valuable, as they provide guidance to planners and city officials for park development, maintenance, facilities location etc. and current and future patterns of equity.

Chapter 2 - Literature Review

The contribution of urban parks to both the health and vitality of cities and it's residents has been widely cited and includes benefits such as ecological and environmental (air pollution reduction, ecosystem and species protection), economic (increased property values, urbanization, renewal and revitalization efforts), personal (health, physical activity, psychological and mental), and social (community interaction and engagement, public investment), (Crompton and Wicks, 1988; Garvin, 2002; Harnik, 2003, 2004 and 2009; Kitchen and Hendon, 1967; Sherer, 2004; Smale and McLaren, 2005; Walker, 2004). Thus, as a public resources, providing equity in urban park provisions (and associated benefits accordingly) is a fundamental part of city park and planning departments.

Accessibility and Equity

The purpose of this study is to illustrate the use of GIS technology in the measurement of the levels of accessibility and equity of neighborhood parks in Kansas City, MO. These two principles were chosen due to their "general recognition as important components of a well-functioning urban system, particularly from a planning and management perspective" (Nicholls and Shafer, 2001, p. 104). As noted in Pred (1977, p. 10), "at the very least the quality of life in a city or region refers to the accessibility of its inhabitants to employment alternatives, educational and medical facilities, essential public social services, and nature or extensive recreational open space." Research suggests that park planning must determine which potential users need greater access (i.e. equitable distribution), in addition to mastering the equally challenging task of measuring accessibility (Comer and Skraastad-Jurney, 2008).

Until recently, measurements of accessibility and equity have typically been studied separately (Nicholls and Shafer, 2001). As noted by Talen (1998), absent from literature on planning, was an assessment of the relationship between spatial distribution of urban facilities and spatial distribution of referenced socioeconomic characteristics. It is necessary to look at these two concepts separately, and then discuss how they are complementary when analyzed simultaneously.

Concepts of Equity

As defined in the Dictionary of Human Geography, the term equity generally refers to fairness, justness, or impartiality of a situation (Smith, 1986). In planning, the provision of resources according to locational equity has been widely interpreted (Talen, 1998). With respect to the distribution of public services, questions arise of “who gets what?”, “who ought to get what?”, and “who pays?” (Laswell, 1958, in Nicholls and Shafer, 2001). “In a purest sense, equity can be achieved only after society has arrived at a consensus about what is fair” (Talen, 1998). As a result, a definitive meaning of equity is unrealistic, as what is “fair” and “just” are not always agreed upon. Researchers in various fields are continually exploring the definition and applicability of equity in the distribution of public resources. The most notable starting point for addressing typologies of equity can be traced to those suggested by William Lucy in 1981. Subsequent taxonomies relevant to planning have been proposed including Crompton and Wicks

(1988), Truelove (1993), Marsh and Schilling (1994), and Talen (1998). See Appendix A for a summary of previous literature.

Though planners often advocate equity, Lucy suggests that they are often less successful in actual implementation of equitable concepts in planning decisions; to address this, he offers ways of incorporating equity into the planning processes. Lucy proposes that equity is “an issue of distributive justice” and suggests five concepts of equity (equality, need, demand, preference, and willingness to pay) for planners addressing with issues with spatial dimensions (p. 448). While he acknowledges that these are not the only concepts of equity that planners use, he does note that these concepts were the most reoccurring in his interviews with planners in nine large jurisdictions. The concepts and methods he describes are most applicable to the spatial distribution of services and facilities, such as public utilities, transportation services, parks, recreation facilities, police and fire, libraries and solid waste collection (Lucy, 1981). Similarly, Crompton and Wicks (1988) provide a taxonomy of equity models in the context of the emergence of equity as a growing administrative concern. Like Lucy, Crompton and Wicks suggest that no model of equity stands in isolation and that it is up to the planner to select the most appropriate measure for allocating resources. The author suggests four types of equity models (equality, compensatory, demand, market), each that can be operationalized in additional ways.

Between the two authors, four common classes of equity with regard to the allocation of resources can be identified and will be discussed in detail. Figure 2.1 illustrates the four classes, (1) Equality; (2) Compensatory (Crompton and Wicks) or Need (Lucy); (3) Demand (including Lucy’s category of Preference); and (4) Market Criteria (including Lucy’s Willingness to Pay).

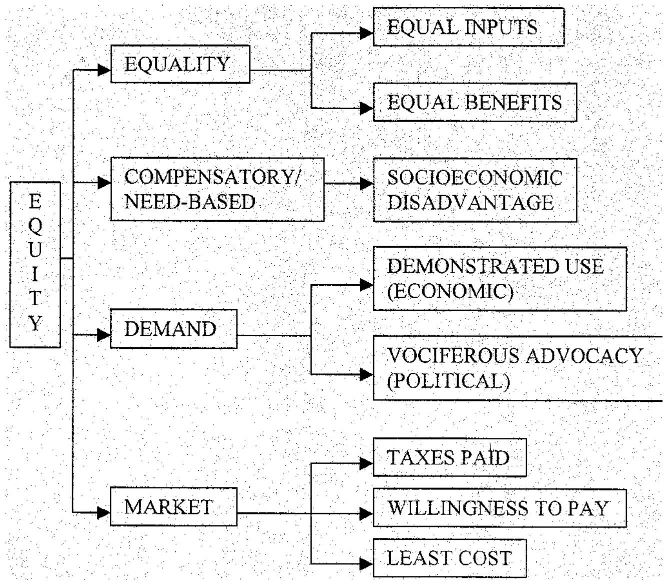


Figure 2.1 Taxonomy of Equity Models (Lucy, 1981; Crompton and Wicks, 1988) in Nicholls, 2001

Of the various concepts and models suggested by these authors, at least four categories of equitable distribution are distinguishable--equality, compensatory, demand, and market criteria (Talen, 1998). This first category is defined as **equality**, in which everyone receives the same benefit regardless of any other criteria. The widely recognized acceptance of equality as a standard for equity derived in part from the notion of 'democracy', 'fairness', and the 14th Amendment which guarantees equal protection and treatment under the law (Crompton and Wicks, 1988). In the field of local government services, it suggests that everyone should receive the same services. Crompton and Wicks indicate that equality entails allocating resources so that all residents receive equal inputs or equal benefits from leisure services. However, equality has several limitations; Lucy argues that it is inconsistent with other equity concepts and ultimately, physically impossible.

The second category of equitable distribution of public benefits is according to need, also termed **compensatory** by Crompton and Wicks (1988). Lucy suggests the concept of need is consistent with the idea that "unequals should be treated unequally," meaning that those needing more should receive more, rather than less (Lucy, 1981, p. 448). Making the case for need-based equity requires a defensible basis for identifying need and inequality; conditions, phenomena, or general indicators may be appropriate for identifying need. Crompton and Wicks proposed that compensatory equity deals with "allocating services so that economically disadvantaged groups, individuals, or areas receive extra increments of resources" (p. 290). They agree that the challenge with this model is deciding who is disadvantaged, as "need" can be interpreted in a variety of contradictory ways. For the purposes of the taxonomy by Crompton and Wicks (1988), they adopt an economic criterion to define need, as they argue "it offers a conceptually distinctive equity model which is different from the other seven...other potential qualifying criteria of need overlap at least in part with demand, equality, or market equity models" (p. 290).

The third category is the equitable distribution of services or facilities according to **demand** (Talen, 1998). Demand involves the notion that "active interest in a service should be rewarded" (Lucy, 1981, p. 449). As an equity model described by Crompton and Wicks, it involves allocating resources on the basis of demonstrated use (consumption) and vocal advocacy, associated with economics and politics respectively. Lucy also suggests that demand it is demonstrated in at least two ways, through the use of a service and in the form of request and complaints. Due to administrative convenience and apparent fairness, the demand equity models have been widely adopted (Crompton and Wicks, 1988). However, underlying allocation bias should be acknowledged in this model, as leisure services vary by demand.

Finally, equitable distribution can be defined by **market criteria**, where the cost of the service is a key factor (Talen, 1998). Willingness to pay corresponds to the idea that people whose use a service should pay for it and nonusers should not pay (Lucy, 1981). Distribution is defined according to the level people use (and therefore pay for) a particular service. Due to this, some believe that this is considered efficiency, not equity concept. It is "a basis for matching a quantity and quality of service with the willingness of consumption to purchase it" (Lucy, 1981, p. 450). This most frequently applies to services connected to a single user such as public utilities, public transportation, or library and recreational services. Market equity is a model proposed by Crompton and Wicks (1988) that entails allocating services to groups or areas in proportion to either taxes or the fee revenue that produce. This is similar to Lucy's 'Willingness to Pay' concept and draws from the idea that the market determines the pattern of service distribution. In this model, resources may be allocated on the basis of taxes paid, direct price paid, and the least cost alternative

Application of Equity Concepts

Space and area standards emerged as a concept for equitable distribution from the idea of equitably allocating public services and resources to people throughout the city. The first recorded recreation area standard was implemented by the Playground Association of America, in the plan developed for Washington, D.C. (Mertes and Hall, 1996). The plan recommended that every school district was to have at least one acre of land for each 2,000 children. Subsequently, the National Recreation and Parks Association (NRPA) established recommended space standards for playgrounds in neighborhoods of different populations. In 1979, the NRPA also prepared a standard of 10 acres of park and open space per 1,000 people within each city, in addition to equal area in parkways, large parks, forests, within or adjacent to cities (Mertes and Hall, 1996, p. 6). Based on a sample of more than one hundred local and state outdoor recreation plans in 1973, the NRPA standards were found to be a widely accepted method; at the time very few cities had deviated from these standards (Gold, 1973, in Lucy, 1981). While it is unknown to the degree to which this has changed, cities are beginning to take note of more innovative approaches to space standards and equitable distribution of services. In 1996, the NRPA adjusted their approach and called for local park standards to be based on a level-of-service analysis, "an improvement over the cookie-cutter method, but still not a perfect solution" (Eysenbach, 2004). Harnik (2004) illustrates the use of standards for addressing the maximum distance any resident should live from the nearest park. However, as of 2004, it was found that only 18 cities had a goal for the maximum distance and the standard ranged from as close as one-eighth of a mile to as far as a mile.

These methods reflect an equality conception of equity. As discussed above, this concept of "equality" is not realistic, or physically possible. While these measures are not invalid and may be appropriate in some instances, the limitations should be considered. For example, if a situation where two or more areas are underserved, how should priorities be established? Equity concepts are useful tools for aiding in decision making, particularly in situations where distribution cannot be reached through space or distance standards (Lucy, 1981.)

Studies involving accessibility have traditionally been conducted by geographers, solely in geometric terms (Nicholls and Shafer, 2001). Typically, this involved the use of mathematical models, specifically used to address efficiency of distributions and the maximization of system profits and minimization of system costs (Gregory, 1986; McAllister, 1976; Morrill and Symons, 1997, in Nicholls and Shafer, 2001). Many geographers however, recognized the limitations of the efficiency-based approach and stressed the "importance of identifying and understanding the social and economic dimensions of accessibility as they relate to users instead of thinking only in terms of geometry and profits" (Nicholls and Shafer, 2001, p. 106).

Access (as an Indicator of Equity)

Accessibility is a key tool for measuring equity and is often used an indicator of equitable distribution in many studies (Lindsey et. al., 2001; Nicholls, 2001). While accessibility can be interpreted in many ways, the key definition describes access as the relationship between an origin and destination. Accessibility refers to the ease with which a site or service may be reached or obtained; it can thus be said to measure the relative opportunity for interaction or contact with a given phenomenon such as a park (Gregory, 1986 in Nicholls, 2001). See Appendix A for a table summarizing previous literature on measures of accessibility.

One of the earliest examples of how maps could be used to display patterns of accessibility and equity of resource distribution was Knox (1978) who demonstrated how gravity-based measures of proximity to urban services could be used as indicators of social well-being in cities (in Talen, 1998). In this study, opportunity was assessed in terms of proximity to urban resources (in this case medical care), in order to create a comparative measure of "relative personal accessibility." An isometric map was used to indicate the levels of access to a specific service, thus indicating a trend towards the inclusion of a spatial component in equity analyses. Subsequently in 1993, Truelove demonstrated a basic approach to mapping spatial equity by counting the number of opportunities within a defined range of a particular facility and identifying areas that were more advantaged or disadvantaged based on location. Maps were presented showing regions of Toronto that were "covered" by day-care facilities. Truelove also included a comparison of these areas and socioeconomic characteristics to characterize the distributional bias (Talen, 1998).

Analysis tools are continually becoming more sophisticated and capable of displaying information in new ways. This shift was seen in the techniques used to study spatial distribution and accessibility of public services as more people became familiar with Geographic Information Systems. With regards to park and recreation planning, a 1993 article entitled *Geographic Information Systems: A Tool for Marketing, Managing, and Planning Municipal Park Systems* was key to outlining the potential for use of GIS for park and recreation administration. The following studies not only address concepts of equity and accessibility, but also strive to encourage the use of GIS in everyday planning activities, in specific regard to park and recreation planning.

As Talen (1998) suggests, the achievement of equity in the distribution of public resources is of central importance to planners. In planning, "equitable distribution entails locating resources or facilities so that as many different spatially defined social groups as possible benefit - i.e. have access" (p. 22). The use of maps is key to visualizing levels of equity and aiding in the decision making process. Talen presents a methodology that describes the basic technique of equity mapping, including a suggested interactive process for adapting to different criteria and variables. Through a case study of the city of Pueblo, CO, she demonstrates the application of the method. For this she employs a needs-based concept of equity, arguing that “distributive policy should recognize the fact that some citizens are more able than others to offset reductions in public facilities and services” (p. 25). Two primary analytical questions are posed, the first asks whether or not needs are met; the second questions whether or not distributional biases appear. To address these questions, Talen uses equity maps to display the distribution of accessibility measures in relation to the distribution of socioeconomic data. In contrast to other approaches, Talen also includes a comparison of proposed (i.e. planned), as well as achieved distribution of public services; she suggests that comparing planned accessibility with actual (achieved) accessibility patterns offers additional insight into planning decisions and plan implementation.

In creating the equity maps, Talen includes three types of variables, or data input. These include (1) locational information (distance between residents and parks etc.), (2) population and housing characteristics (socioeconomic data), and (3) facility characteristics. This is constructed as in “interactive process,” in which variables can be modified to reflect alternating methods of accessibility and definition of need. For example, for park facilities Talen suggests “the data may be characterize the more intensive space needs of higher-density areas, areas with smaller lots sizes, or areas with fewer opportunities for recreation” (Talen, 1998, p. 26). Figure 3.0 illustrates the equity mapping process proposed by Talen. Spatial clusters are identified, leading the analyst to investigate how changes in data input result in changes in equity patterns.

In this study, the needs-based equity was adopted as a measurement of locational distribution of facilities relative to the location of different socioeconomic groups. Talen suggests that in order to relate the location of facilities to these varying population groups in a meaningful way, a second analysis of accessibility must be used. While a variety of accessibility measures are addressed, four are employed in this study—the gravity potential formula and three objective measures (minimizing travel cost, covering objectives, and minimum distance). The measures of accessibility described below were proposed by Talen for “ease of interpretation, their prolific use in the literature, and their lack of computational burden and data requirements” (p. 27).

Gravity Model: This model, which is perhaps the most widely used model of spatial interaction (Talen, 1998), interaction between locations is weighted by distance. The “force of attraction” between residents location and park location is proportional to park attractiveness (e.g., size), and inversely proportional to the square of the distance between them. This suggests that the demand for parks will decline as distance increases. In terms of accessibility, the access will be lower where distance to parks is greater.

Minimizing Cost Model: This is simply a measure of the average distance between each origin (e.g., census block) and each destination (i.e. public facility). Talen uses the average straight-line distance between the census block and every park to measure travel cost; the limitations and suggestions for improvement of this measure will be discussed later. Since the goal of improving accessibility is to minimize the cost of travel, the lower the score the better.

Covering Objectives: The covering model relies on a covering radius used to identify the facilities that are included within this range and the critical distance for each demand point (i.e. census block). This model seeks to maximize the number of people covered, so that as many people as possible have a facility located within a given distance. This assumes however, that the facility is equally used within the covering range, and beyond the covering radius the use in diminished.

Minimum distance: While inequity of access is inevitable (some blocks will always be closer than others to the destination), locational equity seeks to minimize this inequality by choosing a location that reduces the longest journey of any consumer. Talen defines this simply as the minimum distance between each point of origin (i.e. census block) and the nearest park facility.

Nicholls (2001) expands on the suitable use of GIS for leisure services proposed by Talen (1998) in a study that demonstrates the application of the technology to the measurement of accessibility and equity and the distributional equity offered by a public park system. Nicholls argues that the "level of access to public parks is an important indicator of the effectiveness of their provisions. Similarly, the degree of equity, or fairness, afforded by the distribution of facilities is a central concern of public leisure service providers" (Nicholls, 2001). Similar to Talen (1998), Nicholls stresses the relative simplicity of methods used, as to suggest that they could be utilized daily by planners and practitioners with limited time and/or resources.

Nicholls reiterates the equity models of Lucy (1981) and Crompton and Wicks (1988), illustrating the indeterminate nature of the concept of distributional equity. In accord with Talen, Nicholls employs a compensatory or need-based model of equity. The least advantaged were defined according to socio-economic characteristics of age, income, race/ethnicity, and population density; the groups considered were young, elderly, minorities and those living in areas of higher population density. However, Nichols varied in the approach to measuring accessibility, critiquing the methods employed by Talen and suggesting more sophisticated measures to complement the increases in GIS technology.

As discussed previously, the most basic standard with regards to provision of parks is the recommendation from the NRPA the 10 acres of open space should be available per 1,000 residents. In accord with Talen and Anselin (1998), this "container" approach assumes that benefits of services are allocated to only residents within a certain zone, without account of any external spatial factors. While some park and recreation departments do create maps illustrating accessibility of their facilities with consideration of spatial dimensions, access is typically defined according to each park's service area (Nicholls, 2001). This may be represented by a radius, and is referred to as the covering model discussed by Hodgart (1978) (in Talen, 1998). While this method has advantages over the use of ratios of parkland to population, Nicholls addresses several limitations to the method. The radius method provides only an approximate representation of the park's service area, assuming "as the crow flies" movement. In reality, people do not travel in straight lines, but instead move along predefined public right of ways, navigating barriers such as railway lines, highways, or rivers and other natural features (Nicholls, 2001). The actual travel distance is almost always greater than the direct distance (Clift, 1994, in Nicholls, 2001). The second disadvantage assumes that parks are open to access at all points along their boundaries, where in fact there are times when users must travel to a specific point to enter. Similarly, the third disadvantage to the covering method is that distance is measured from the center of the park rather that its boundaries, the results being underestimation of a park's service area. Finally, this model does not take into account the park's shape; the less regular the park becomes, the higher the degree of inaccuracy of the service area; an example of a linear park is given (Nicholls, 2001).

Nicholls argues that "the configuration of a park, and the position of its points of access, as well as the realistic measurement of distance to it, are important factors not considered under the traditional, radius method" (p. 207). To address and minimize these limitations, the network analysis approach is proposed. In this approach distance is measured along the roads and other public right of ways surrounding parks, so that they more closely follow actual pedestrian travel patterns. Furthermore, distance can be measure to or from each access point. Nicholls proposes using this level of accessibility as a criterion against which the degree of equity is assessed. The methods involves an identification of levels of accessibility using a buffering technique (comparing both the radius model and the network analysis) and then a subsequent assessment of the degree of equity based upon these levels of access (comparing the differences between the two approaches to access). The assessment involves comparing characteristics of those residents within service areas who are considered to have good access, with those outside the service area for whom access is held to be inadequate. Nicholls addresses this using a two-sample statistical test, an approach drawn from Werner (1998) who analyzed the equity implications of discontinuing a public bus service in Ramsey County Minnesota.

The case study presented by Nicholls addresses the level of accessibility and equity of public parks in Bryan, Texas. The covering model and the network-analysis approach were done at two levels. The neighborhood park as the basic unit was considered alone; mini neighborhood and community parks were then combined and analyzed as well. In both cases, one half mile was used as the maximum walking distance; in this study, the ability to walk to a park was emphasized thus the distance standard (Nicholls, 2001). The equity analysis was carried out using the Mann-Whitney U test in SPSS (Statistical Package for the Social Sciences). For each variable, the median value for census blocks outside the service area was compared to the median value for blocks within the service area, and the extent to which the medians differed was computed. Nicholls choose nine variables for the equity analysis: (*1*) population density, (*2*) percent non-White (i.e. Blacks, Asians, American Indians, and all other races), (*3*) percent Black, (*4*) percent Hispanic, (*5*) percent under 18, (*6*) percent over 64, (*7*) percent of housing units renter occupied, (*8*) means housing value (for owner occupied units), and (*9*) mean contract rent (for rental units). Similar to Talen, these represent the accepted indictors of distributional equity (socio-economic variables, housing characteristics, and locational information.) Groups considered most likely to be in need of better average access to parks were "non-Whites, those earning low incomes (approximate by those who rent as opposed to own their home, and those whose property or rental value is lower than average), the young and the elderly, and those residing in more densely populated areas and less likely to have a private garden" (Nicholls, 2001, p. 211).

The Bryan, TX case study indicates the differences in levels of accessibility produced by the two approaches, the 'straight-line' covering model and the network-analysis model. The median values of the variables inside and outside service areas where used to determine whether equity or inequity was indicated in those instances where a significant difference between the two groups was found ($p < 0.05$). Given the definition of equity Nicholls employs, equitable distribution was suggested when the proportion of the need-based population was significantly higher within the service area than outside of it. Inversely, inequity was considered to be demonstrated when no significant difference was indicated. These results were interpreted to suggest that those most disadvantaged groups considered in most need of access to parks were receiving equal opportunities compared to other portions of the community. In terms of accessibility, the results suggest that if leisure service departments use these kinds of techniques to access facility location, they should use the more accurate network analysis technique.

In application to Bryan, TX, the distribution of parks appeared to be quite equitable. For neighborhood parks alone, non-Whites (though not Hispanics or those with lower housing values or rents) have significantly higher levels of access to park facilities as their White, higher income neighbors (Nicholls, 2001). There appeared to be no significant variation in access with population density or age. When considering all three park types, those living in more densely populated areas also appeared to be particularly well served, in addition to minorities and those with lower incomes. Nicholls proposes that the consistency of results between the methods and park types suggests that those groups considered most in need tend to be located within relatively homogeneous census blocks close to parks.

This study demonstrates the utility of GIS as a means of measuring levels of accessibility and equity and highlights the need to measure distance and access as accurately as possible. While Nicholls does suggest these methods as superior to the ratios or circular buffers, further exploration is also considered. The methods employed in this case do not take into account the characteristics of parks, as they are primarily concerned with areas and the populations that have access to them. Overall, this is a well presented illustration of the use of GIS in the field of park and recreation planning and should be considered for exploration of approaches to access and equity.

In the same vein of Nicholls (2001), Comer and Skraastad-Jurney (2008) present a study of the application of GIS for assessing the locational equity of community parks. The work builds on the methods discussed previously and the recent work on spatial analysis of public services. The work of Nicholls (2001) and Nicholls and Shafer (2001) is recognized for the demonstrated usefulness of GIS and simple methods of access and equity within a park system, including the "where" element of equity that few researchers to date had addressed (Comer and Skraastad-Jurney, 2008). Specifically, the distribution of community parks in the greater Oklahoma City metropolitan area is assessed to determine equity of access to parks by various need based groups. The methods presented here develop from previous research and offer yet another method of using GIS technology for exploration.

Comer and Skraastad-Jurney acknowledge the work of Smoyer-Tomic, Hewko, and Hodgson (2004) and Talen and Anselin (1998), who serve as a basis for their research in this area. Talen and Anselin (1998) analyzed playgrounds, using methods of spatial autocorrelation statistics and several accessibility measures to identify clusters of similar or dissimilar values. In comparison, Smoyer-Tomic et al (2004) used a variety of accessibility measures to study playgrounds to determine the level of access of higher need groups. Similar to the Comer and Skraastad-Jurney study is the use of several accessibility measures used to compute scores for census blocks, and local spatial autocorrelation statistics to determine spatial clustering or dispersion with respect to high and low needs of accessibility. However, Comer and Skraastad-Jurney vary in the type of accessibility measures employed and the increased integration of GIS into the analysis process.

Comer and Skraastad-Jurney apply a more "sophisticated analysis method to the study of location assessment" in their research (p. 126). In this study access is defined as a function of road network distance between users and facilities. Using three distance-based metrics, spatial unit-specific accessibility measures are employed; the three measures are discussed below. Comparable to previous works, the census block group is used as the spatial unit of the residents' origin and the community park is indicated as their destination.

Minimum Distance: This is a proximity measure that assumes people of a given block group will visit the park closest to their residence, or minimize $d_{ii,}$ where d_{ii} is the distance between each origin block group *i* and each park destination *j*. A lower score for a block group indicates greater access. As an example, if there are six total parks and block group *i* is located 2, 4, 5, 6, 9, and 13 miles from these parks, block group *i*'s minimum distance would be 2.

Travel Cost: Travel cost sums the distance between each block group *i* and all parks *j,* or the sum of d_{ii}. Again, a lower score indicates there is a greater overall accessibility to parks for a given block group. Having the same number of parks for everyone is equality, however, Comer and Skraastad-Jurney suggest that by finding the cumulative distance from each block group to every park is one way to expose inequity. Using the previous example, block group *i*'s travel cost would be 2 +4 + 5 + 6 + 9 + 13 = 39.

Gravity Potential: This is the sum of the number of parks (*S*) divided by the distance from each block group *i* to each park *j*. In this metric, distance acts as a deterrent for residents; while every park is technically able to be used, some parks are simply farther away than others for any given block group. An additional effect, distance decay, is employed in this model that varies depending on local transportation and movement. It is commonly set to values of 1 (slight distance decay) or 2 (stronger distance decay) (Comer and Skraastad-Jurney, 2008). In this study, the value is set to 2 because of the focus on comparing accessibility rather than on distance decay (see Talen and Anselin, 1998). In contrast to the other measures, a higher score indicates greater accessibility for parks to for that block group. Continuing with the example, the gravity potential value for block group *i* would be $(6/2^2) + (6/4^2) + (6/5^2) + (6/6^2) + (6/9^2) + (6/13^2) = 2.4$.

The metrics proposed by Comer and Skraastad-Jurney are intended to provide different perspectives on the definition of accessibility, though for simplicity, the analysis ignores physical and physiological barriers as well as qualitative differences, an approach common to others (Nicholls, 2001; Wolch et al, 2005). These measures provide information unto themselves, but are limited in the fact that they "do not permit direct statistical evaluation of the significance of their values, they are un-standardizable and not directly comparable and they permit only visual, mapped evidence of clustering of similar values" (Comer and Skraastad-Jurney, 2008, p. 128). A response to this limitation is the use of spatial autocorrelation statistics.

Spatial autocorrelation is a "two-dimensional version of the traditional autocorrelation or time series problem, in which the value of an observation at time *t* is a least partially dependent on the value of that same observation at time *t-1* (Comer and Skraastad-Jurney, 2008). More clearly, spatial autocorrelation measures the relationship among values of variables according to the spatial arrangement. The relationship may be described as highly correlated if like values are spatially close to each other, and independent or random if no pattern can be discerned from the arrangement of values (Chang, 2006). It is thus proposed that scores for the accessibility measures (minimum distance, total distance, and gravity potential) should display some degree of spatial autocorrelation that is "detectable and testable for statistical significance" (p. 128). Two types of spatial autocorrelation exist. Positive autocorrelation exists when similar values of a variable occur in proximity to one another; this can occur when values are notably above (high-high) or below (low-low) the global average. Negative spatial autocorrelation results when a low value of x is surrounded by high values of x, or vice versa (Griffith, 1987 in Comer and Skraastad-Jurney, 2008). The interest in this study was in identifying both types of positive spatial autocorrelation (hot spots of high-high values and cold spots of low-low values) and correlating these areas with similar hot and cold spots of socio-economic variables related to their equity goals and the need based populations in which they were interested.

The study area used by Comer and Skraastad-Jurney (2008) is the metropolitan area of Oklahoma City. Census blocks are used as the basic spatial unit, as they "represent a scale that most closely approximates a neighborhood or housing development that should have relatively homogenous demographic characteristics" (p. 131). In contrast to Nicholls (2001), Comer and Skraastad-Jurney use community as opposed to neighborhood parks, primarily because these parks serve a wider population base due to size and amenities. Based on past literature, the groups in higher need of access to public facilities were identified as minorities and low income groups because "their higher population densities result in less open space and because their poor economic status makes them less mobile and more dependent on public transportation" (Comer and Skraastad-Jurney, 2008 from Lindsey et. al., 2001; Nicholls, 2001; Smoyer-Tomic et. al., 2004; Talen, 1997, 1998; Wolch et. al., 2005). Comer and Skraastad-Jurney indirectly tested this assumption by correlating racial and ethnic variables with per capita income and population density across all of the census blocks. It was presumed that "population groups that have negative correlations with income and positive correlations with density should be those with the highest need for good access to parks based on past research" (p. 132).

The analysis was separated into two complementary approaches, first looking at the spatial patterns of accessibility and equity variables and then employing spatial autocorrelation measures in the second. Through application of these approaches, it was found that the minimum distance and the gravity potential measures revealed distinct clusters of high-access groups, while travel cost indicated a concentric pattern of higher access centered on downtown Oklahoma City. Comer and Skraastad-Jurney point out that while these methods are useful for decision makers to view the issue from several angles. The results also allowed the researchers to formulate future patterns of park equity and develop recommendations for the Oklahoma City. The use of GIS was reiterated and encouraged as a viable method for park planners and administrators.

Chapter 3 - Methodology

As discussed previously, the studies by Nicholls (2001), Nicholls and Shafer (2001), and Comer and Skraastad-Jurney (2008) best represent the application of Geographic Information Systems in measurement and analysis of accessibility and locational equity of community and neighborhood parks. Nicholls (2001) and Nicholls and Shafer (2001) present a relatively simple method for identifying underserved areas and populations, illustrated in a case study of the park system in Bryan, Texas. Similarly, Comer and Skraastad-Jurney (2008) further the research by applying more evolved measures, incorporating an element of spatial autocorrelation and enhanced network analysis tools through ArcGIS. As articulated in their study, "directly analyzing accessibility measures with spatial autocorrelation statistics is an area in which geography can contribute to the analysis of public goods provisions, especially parks," and which results in end-user maps that are important in presenting information to the public (Comer and Skraastad-Jurney, 2008, p. 126-127). The following methodology is drawn from the contributions of these studies.

Research Question

As evidence of previous research, parks are a valuable resource for all residents who benefit from increase property values, direct use, health, environmental benefits, and increased community cohesion. However, research also indicates that often times, parks are not equitably distributed and populations that might be in most need do not have adequate access to this type of public resource.

The research question for this study asks:

> *Are neighborhood parks in the Kansas City, Missouri area equitably distributed with regards to need-based demographic and socio-economic groups and to what degree are these population groups correlated with high or low areas of park access?*

Based on previous research, I would hypothesize that:

> *Neighborhood parks are less equitably distributed among higher need populations and thus negatively correlated with areas of high park access.*

Definitions

The level of access to public parks is an important indicator of their effectiveness; similarly the degree of equity through distribution is a growing concern of parks and recreation departments (Nicholls, 2001). These two principles, equity and access, were selected because both are widely recognized as important indicators of a successful urban system (Comer and Skraastad-Jurney, 2008; Crompton and Wicks, 1988; Forsyth, 2000; Lindsey et. al, 2000; Lucy, 1981; Mertes and Hall, 1996; Nicholls, 2001; Nicholls and Shafer, 2001; Smoyer-Tomic et. al, 2004; Talen and Anselin, 1998; and Wolch et al, 2005).

> ***Accessibility*** refers to the ease with which a site or service may be reached or obtained; it can be used to measure the opportunity for interaction or contact with a phenomenon, in this case a park (Gregory, 1986; Nicholls, 2001).

> ***Equity*** means that not all citizens will have equal access to parks, but rather those demographic groups who have a greater need should have greater access (Comer-Skraastad-Jurney, 2008; Crompton and Wicks, 1988; Lucy, 1981; Nicholls, 2001).

Accessibility Measures

Measures of accessibility used in previous studies have included covering, proximity and locational models, the container approach, minimum distance, travel cost, and gravity potential calculations (Hogart, 1978; Knox, 1978; Talen and Anselin, 1998; Lindsey et. al., 2001; Nicholls, 2001; Nicholls and Shafer, 2001; Comer and Skraastad-Jurney, 2008). The use of various accessibility measures demonstrates notable differences in the findings of each researcher. As suggested by Comer and Skraastad-Jurney (2008), "conflicting results between [accessibility] metrics opens avenues of investigation into the nature of equity in the study area and of the inherent differences in what the metrics measure" (p. 127). Thus, the choice of 'metrics' depends in part on the area of study, measurement, and analytic strategy. For this study, the container approach defined by Talen and Anselin is not applicable, as is simply counts the number of facilities in a given area. In accordance with Comer and Skraastad-Jurney (2008), the study area is not divided into service zones; each spatial unit (census block group) has the same score for this type of accessibility measure (i.e. the same number of parks in study area). Instead, three distance-based accessibility measures are employed, using census block groups at the spatial units of the residents' origins and neighborhood parks as the destination in order to evaluate how equitably neighborhood parks serve various need based populations.

The distance based accessibility measures are as follows:

Minimum Distance: A proximity measure that assumes residents of a given block group will visit the park closest to them, or minimize $d_{ii,}$ where d_{ii} is the distance between each origin block group *I* and each park destination *j*. A lower score for a given block group indicates greater access.

<u>Travel Cost</u>: Sums the distance between each block group *i* and all parks *j,* or the sum of d_{ij}. Again, a lower score indicates there is a greater overall accessibility to parks for a given block group. Having the same number of parks for everyone is equality; however, Comer and Skraastad-Jurney (2008) suggest that by finding the cumulative distance from each block group to every park is one way to expose inequity.

<u>Gravity Potential</u>: Summation of the number of parks (S) divided by the distance from each block group *i* to each park *j*. Distance acts as a deterrent for residents; every park able to be used, but some parks are farther away than others for any given block group. In contrast, a higher score indicates greater accessibility to parks for that block group.

These accessibility measures allow for visual and mapped display of clustering of similar values of accessibility. However, the spatial attributes of the block groups and their context in terms of their surroundings is ignored. As suggested by Comer and Skraastad-Jurney (2008), the use of spatial autocorrelation can be used as a "solution" to involving a spatial element and exploring accessibility and equity on another level.

Measuring Equity through Spatial Autocorrelation

While correlation suggests a relationship or connection between two things, spatial autocorrelation shows the correlation within variables across "georeferenced space" (Getis, 2008). Of the many definitions in literature, Getis (2008) suggests one by Hubert, Golledge, and Constanza (1981) as the most concise:

> "Given a set *S* containing *n* geographical units, spatial autocorrelation refers to the relationship between some variable observed in each of the *n* localities and a measure of geographical proximity defined for all *n*(*n*-1) pairs chosen from *n*." (p. 224, in Getis (2008), p. 298).

Since the 1990s, spatial autocorrelation and the field of spatial statistics have begun to appear in research across many disciplines, including geography, ecology, sociology, epidemiology, environmental studies, and urban planning (Getis, 2008). For this study, this tool will be applied to measure accessibility and locational equity related to the distribution of neighborhood parks.

Also called *spatial association* or *spatial dependence,* spatial autocorrelation considers both the origin point locations and the variation of an attribute at the locations, measuring the relationship among values according to the spatial arrangement of the values (Cliff and Ord, 1973; Chang, 2006). While the statistics were originally designed to identify when no spatial autocorrelation is present, in practice, the statistics are used to "test hypotheses of no spatial autocorrelation but also gauge the degree of spatial autocorrelation existing in the georeferenced data" (Getis, 2008, p. 298). In this analysis, the influence of one point or observation on another is bi-directional, thus each point can influence and be influenced by a neighboring point. As a results, scores for the three accessibility measures (minimum distance, travel cost, and gravity potential) should show some degree of spatial autocorrelation that is evident and testable for statistical significance (Comer and Skraastad-Jurney, 2008).

There are two types of spatial autocorrelation that exist, positive and negative. Positive autocorrelation results when similar values of a variable occur in proximity to another; this occurs both when values are above (high-high) and below (low-low) the global average. Inversely, negative correlation exists when low values of the variable are surrounded by high values of the variable, or vice versa (Griffith, 1987 in Comer andSkraastad-Jurney, 2008). The greater the correspondence (or non-correspondence) between the variables, the greater the degree of positive (negative) spatial autocorrelation present (Getis, 2008). When the variables show no pattern or sign of similarity or dissimilarity, then no spatial autocorrelation is evident. For this study, the interest is in identifying both types of positive spatial autocorrelation, the "hot" spots of high-high values and the "cold" spots of low-low values and correlating these areas with relevant socio-economic variables thereafter.

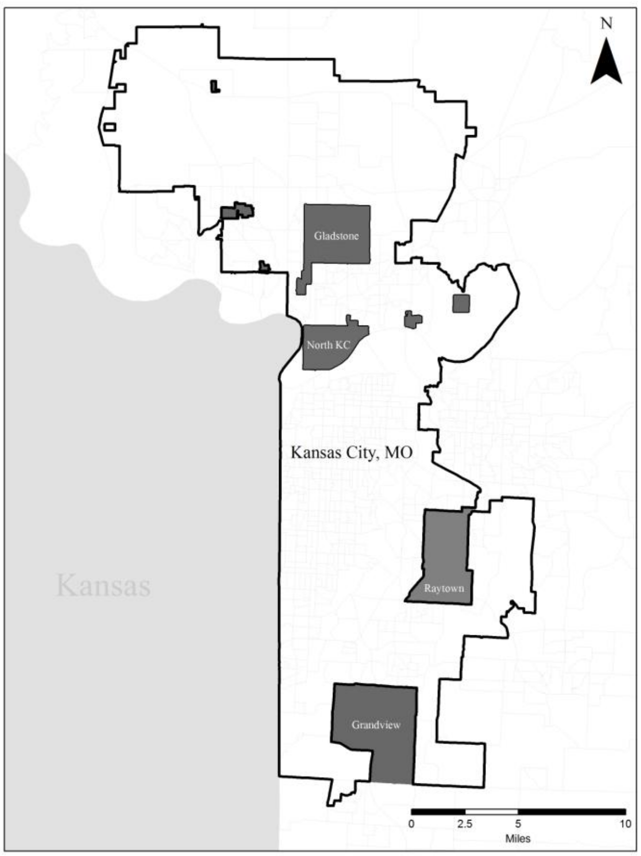


Figure 3.1 Study Area, Kansas City, MO

Study Area

Known for its extensive system of Parks and Boulevards designed by landscape planner George Kessler, Kansas City has a rich history and tradition of parks and recreation planning. Throughout 1895 and 1915, Kansas City appropriated over $15 million to build a park a system to rival those in both the United States and Europe

(Harnik. 2000); that legacy continues to define the urban landscape of Kansas City, Missouri today.

The Kansas City Metropolitan Statistical Area (KC MSA) covers a substantial, fifteen county area that lies on both sides of the border between Missouri and Kansas (see Figure 3.1). As a result of its large footprint, this metro area has a very low population density; approximately 1,843,000 people occupying 8,000 square miles, or about 215 people per square mile (U.S. Census Bureau, 2000). The land encompassed by the KC MSA is highly variable and the development is discontinuous, stretching from an urban downtown, through sprawling suburbs to rural farms. For this reason, the study area described below represents a more focused, and limited scope that, in contrast, has a much smaller footprint and more similarly related land use and scale.

The study area is formed by the municipal boundaries of the City of Kansas City, Missouri, which anchors the Kansas City Metropolitan Area on the east side of State Line, encompassing

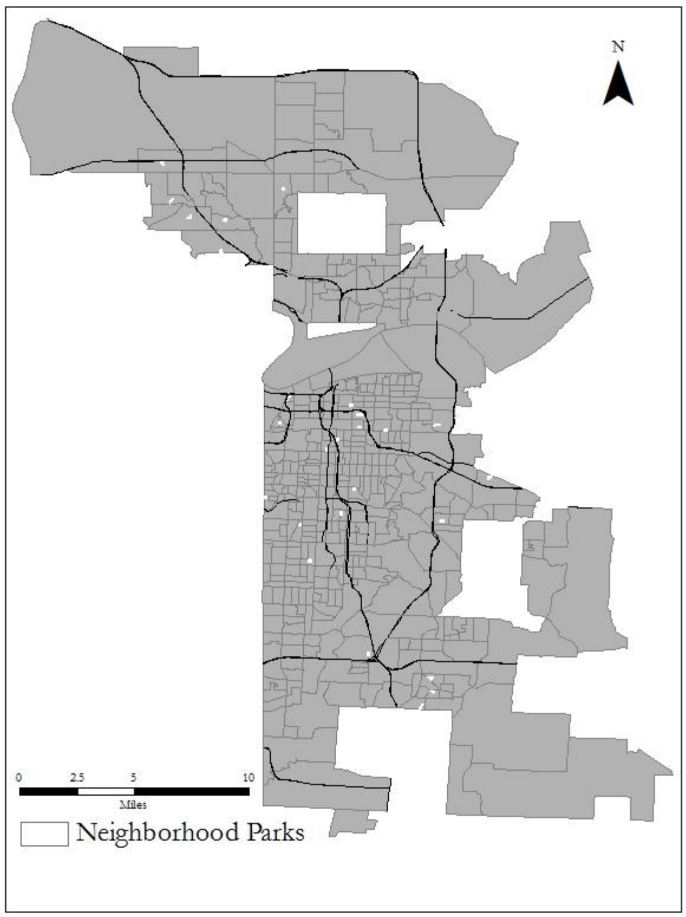


Figure 3.2 Neighborhood Parks in Study Area

450 square miles in parts of Cass, Clay, Jackson, and Platte counties. It is comprised of over 240 neighborhoods and 442 block groups with a total population estimated at 489,300 residents, for an average density of 1,100 people per square mile. While the cities of North Kansas City, Gladstone, Avondale, and Raytown lie within this boundary, they are not included in this study chiefly because they are politically distinct communities and their parks systems are not managed by the Kansas City, MO Department of Parks, Recreation, and Boulevards, on which this study focuses.

Sample Unit: Neighborhood Parks

Within the study area, there are a total of 219 parks, comprising of approximately 10,000 acres of land (Kansas City Parks and Recreation Department, 2010). This study however is focused just on 26 neighborhood parks within Kansas City, MO ranging from 5 to 10 acres, with an average size of 7.5 acres (see Table 3.1); in order to be compatible with the demographic and socio-economic data, only parks acquired/built prior to 1999 were included in this study. This unit of analysis was chosen primarily because this type of park is envisioned to reflect its immediate surroundings and serve the neighborhood population. As described by the Kansas City Parks Master Plan 2017 neighborhood parks seek to “match the demographics of the surrounding area and the corresponding preferences of those who live there.” As discussed previously, this aligns with the National Recreation and Parks Association (NRPA) standards, which characterize neighborhood parks as “the basic unit of the park system,” serving as “the recreational and social focus of the neighborhood” (Mertes and Hall, 1996, p. 98). Ideally, this type park in centrally located within its service area, which encompasses a ¼ to ½ mile distance surrounding the park. While demographics and population density are the primary determinants of size, 7 to 10 acres is considered optimal; generally 5 acres is accepted as the minimum size necessary to provide space for services and amenities offer at these parks. For a comparable look at different park classifications, as defined by the National Recreation and Park Association, see Appendix B.

Table 3.1 Neighborhood Parks

County	Name	Year Acquired	Acres	Park District
Jackson	The Grove Park	1898	9.9	Central
Jackson	Observation Park	1899	8.8	Central
Jackson	West Terrace Park (Ermine Case Jr)	1900	9.9	Central
Jackson	Troost Park	1901	6.7	Central
Jackson	Nelson C. Crews Square	1902	6.3	Central
Jackson	Ashland Square Park	1913	7.5	Central
Jackson	Montgall Park	1920	6.0	Central
Jackson	Holmes Park	1944	9.5	South
Jackson	Oak Park	1945	6.4	Central
Jackson	Blue Hills Park	1946	9.8	Central
Jackson	Westwood Park	1948	8.8	Central
Jackson	Brookside Park	1951	6.7	Central
Clay	Creekwood Park	1957	6.1	North
Jackson	Corrington Park	1967	9.6	Central
Jackson	Prospect Plaza Park	1973	8.0	North
Jackson	Scott Park	1974	6.3	South

Jackson	Ruskin Way Park	1977	5.1	South
Jackson	Sycamore Park	1977	8.5	South
Jackson	Ingels Park	1977	5.7	South
Platte	Green Hills Park	1977	5.8	North
Platte	Woodsmoke Park	1978	8.8	North
Platte	Wildberry Park	1979	7.9	North
Jackson	Fairview Park	1982	9.5	Central
Platte	Park Forest Park	1983	5.5	North
Jackson	Palmer Park	1985	5.9	Central
Platte	Northwood Park	1988	5.6	North

The sampling unit for this study is block group, as defined by the U.S. Census Bureau (2011) as "statistical divisions of census tracts, generally defined to contain between 600 and 3,000 people and use to present data and control block numbering." This sample unit represents a scale that most closely approximates a neighborhood or housing development that should have relatively similar demographic characteristics; furthermore, block groups provide a reasonably number of observation units that are readable and able to be analyzed through mapping (Comer and Skraastad-Jurney, 2008). The block group corresponds with the use of the neighborhood park and reflects the potential range of users that would be served by this type of park. Additionally, in order to be comparable to previous studies and relate to their findings, the same unit of analysis shall be used.

Data

Digital shapefiles for all of the parks within the city were provided through the GIS Department at the Mid-America Regional Council in Kansas City, MO. The addresses for the parks in the study area were supplied in the Reference Book published by the Kansas City, MO Department of Parks and Recreation. Block group shapefiles and road network shapefiles were downloaded through the TIGER/Line Shapefiles database provided by the U.S. Census Bureau (2010). The demographic and economic data for each block group in Kansas City, MO for 2000 were available from the U.S. Census Bureau as well. Distances between the block group centroids and community parks were found using the Network Analyst extension of ArcGIS (ESRI, 2009). The distances were used to compute the accessibility scores for all of the 442 block groups, for all three accessibility measures (minimum distance, travel cost, and gravity potential).

After computing the accessibility measures for all block groups within the study area, the G_i* spatial autocorrelation statistics was used to identify hot and cold spots of correlation within the data. The G_i* statistic was calculated using a buffer approach to identify “neighboring” block groups. As explained by Fotheringham (2000) the size of the buffer is affected by the size of the spatial units, the variables being analyzed, and the spatial arrangement of the spatial units (in Comer and Skraastad-Jurney, 2008). For this study, a buffer radius of two miles was used. Similar to the study by Comer and Skraastad-Jurney (2008), the average block group in the study is just smaller than one square mile (0.96); by extending a buffer of two miles out from each block group, all contiguous neighboring block groups will be included.

Defining Need

The most basic standard with regards to provision of urban parks can be traced to the early recommendations by the National Recreation and Parks Association (NRPA) that specified 10 acres of open space be available per every 1,000 people. This guideline meant general equality and encouraged equal access for all citizens. While a valuable ambition, these standards did not address who might use parks or whether certain groups might benefit from greater access than others (Comer and Skraastad-Jurney, 2008). More recently, NRPA has endorsed a more "needs based" approach that calls for more equitable distribution of quality parks (Mertes and Hall, 1996). This notion of equity is different from equality and means that not all citizens will have equal access to parks, but rather those demographic groups with a greater need should have greater access. While researcher have acknowledged a variety of types of need, this study will address need-based equity following Talen's (1998), Nicholls; (2001), and Comer and Skraastad's (2008) rationale and identify groups in the study area that have a higher need for access to parks. Before proceeding with the analysis, the definition of need, as it applies to this study should further be addressed.

Previous research and literature commonly identifies minorities and low income groups as having the highest need for good access to public facilities, because their higher population densities result in less open space and because their poor economic status makes them less mobile and more dependent on public transportation (Comer and Skraastad-Jurney, 2008; Forsyth, 2000; Lindsey et. al, 2000; Lucy, 1981; Nicholls, 2001; Nicholls and Shafer, 2001; Smoyer-Tomic et. al, 200; and Wolch et al, 2005). As in the methods of Comer and Skraastad-

Jurney (2008), this assumption was indirectly tested by correlating racial/ethnic variables with population density and per capita income across all 442 block groups (Table 3.2). Based on previous research and assumptions, the population groups with negative correlations with per capita income and positive correlations with population density should be those with the highest need for good access to parks.

Table 3.2 Correlations of Per Capita Income and Density with Racial/Ethnic Percentages for All Block Groups (n=442)

Racial/Ethnic Group	Percent African American	Percent Asian	Percent Hispanic	Percent White
Per Capita Income	**-0.479**	0.009	**-0.217**	0.559
Population Density	**0.125**	**0.130**	**0.290**	-0.201

In this study, areas with high African American populations and lower incomes have the highest need, as this group correlated negatively with per capita income and positively with population density. Similarly, the Hispanic population has some need, having lower incomes and living in notably higher density areas. The Asian population is slightly positively correlated with income, and also lives in higher density neighborhoods, thus can be consider as having some need-based access to parks. Areas with high concentrations of a White population have the least need based on their higher incomes, lower densities. It is the hypothesis that through the application of hot spot analysis and spatial autocorrelation tools, the high need-based population will be negatively correlated with areas of high access to parks. If this proves true, patterns of inequity will be revealed.

Chapter 4 - Analysis and Findings

The analysis is presented in two parts. The first section presents the mapped accessibility scores for each block group with subsequent correlation to socio-demographic data in order to assess the general trends of accessibility and equity for the high need groups, defined in Table 3.2. This approach is similar to Comer and Skraastad-Jurney (2008), who also derived their approach in part from Nicholls and Shafer (2001). The fairly straightforward approach addresses basic measures of accessibility based on distance between block groups as the origin, and neighborhood parks as the destination. However, as indicated by Comer and Skraastad-Jurney (2008), "this approach ignores the influence of neighboring block groups and neither indicates nor quantifies the degree to which certain socio-economic characteristics or accessibility scores are spatially and statistically significantly clustered." To this end, use of spatial autocorrelation (Moran's I) and hot spot analysis tools with ArcGIS make up the second part of the analysis. Collectively, these complementary approaches may help identify different patterns of equity or inequity with regards to access to neighborhood parks.

Mapping Accessibility Scores

Figures 4.1 through 4.3 shows the mapped accessibility scores (minimum distance, travel cost, and gravity potential) for each of the 442 block groups within the study area. Most simply, these figures represent the distances scores between the block groups and parks without the inclusion of demographic or economic characteristics. This is valuable in understanding the general geographic distribution of neighborhood parks and acknowledge any preliminary inferences. However, absent of socio-economic data, this is simply a measure of distance and does not yet further the investigation in terms of equity or inequity of the population served.

Minimum Distance Proximity Measure

Mapping the distance between each block group and the nearest park, Figure 4.1 indicates several zones of high access to parks (the darkest shading). Predictably, block groups closest to the parks have a high access score and those further away have lower scores. For this series of maps, classes are based on the natural groupings inherent in the data (Natural Breaks), and thus group similar values and highlight differences in data. The block groups with the darkest shading indicates that these residents are generally within one-half mile of a neighborhood park; this is a meaningful finding for planners, as a half mile walking distance is typically associated with "walkability" of a neighborhood. Furthermore, as specifically stated by the NPRA, neighborhood parks most immediately serve those within a ¼ to ½ mile distance. This map can be used to show which residents are within a certain level of service, while others may be outside that boundary. While this map only provides a general overview, it does offer insight into a simple proximity and access measure. It also reflects a national trend of evaluation, as many cities are recognizing proximity as an important measure, even outweighing total acreage of parkland (Harnik, 2004). In general, there are three zones of high accessibility; roughly these include an area to the northwest of downtown, one centered on downtown, and one zone to the southeast of the downtown area (downtown is considered the Central Business District, within the loop of I-35, I-70/670 and I-29). Within each of these zones, further definition of areas of access can be seen. It is particularly interesting to note the corridor of high access, which exhibits a winding pattern through the downtown and midtown area; this can perhaps be attributed to the historic parks and boulevard system, which will be discussed subsequently.

Travel Cost Proximity Measure

Figure 4.2 in contrast, shows a different account of accessibility as it maps the distance from each block group to every park (Travel Cost). Not surprisingly, the block groups that are more centrally located have a better (low) accessibility score than those on the edge of the study area; thus explaining the concentric pattern of scores. Even though the minimum distance scores highlighted three separate zones of higher accessibility, they were not significantly clustered enough to alter the concentric pattern focused on the center of the study area. The darkest area of this map, indicating the area of highest access, contains 13 of the 26 parks represented in the study. It is interesting to note that of these parks, nine were acquired or built prior to 1950, a time that represents a notably different development pattern and movement out from the city center. The concentric scores may reflect this shift and growth.

Gravity Potential Proximity Measure

Figure 4.3 shows the scores for the gravity potential of each block group and park. As discussed previously, in this model, distance acts as a deterrent, assuming that while every park is technically accessible for use, some parks are further away than others for any given block group. In contrast to the previous two measures, a higher gravity potential score indicates greater potential access to parks for that block group. Figure 4.3 more closely resembles the minimum distance map, indicating similar areas of high accessibility. Noticeable from this map is the fact that almost all of the block groups with the highest gravity potential accessibility score are those that contain one of the study area's neighborhood parks. Specifically, 36 block groups are characterized as having the highest accessibility to neighborhood parks in terms of this proximity measure. While resembling the Minimum Distance map, this does not have the same continuous pattern of access within the downtown area, or larger clusters to the northwest and southeast of downtown. It is necessary to note that the true gravity potential scores ranged from eight to over six million; the natural logarithm is used for mapping purpose in that the logarithms represent more manageable numbers, ranging from two to sixteen instead.

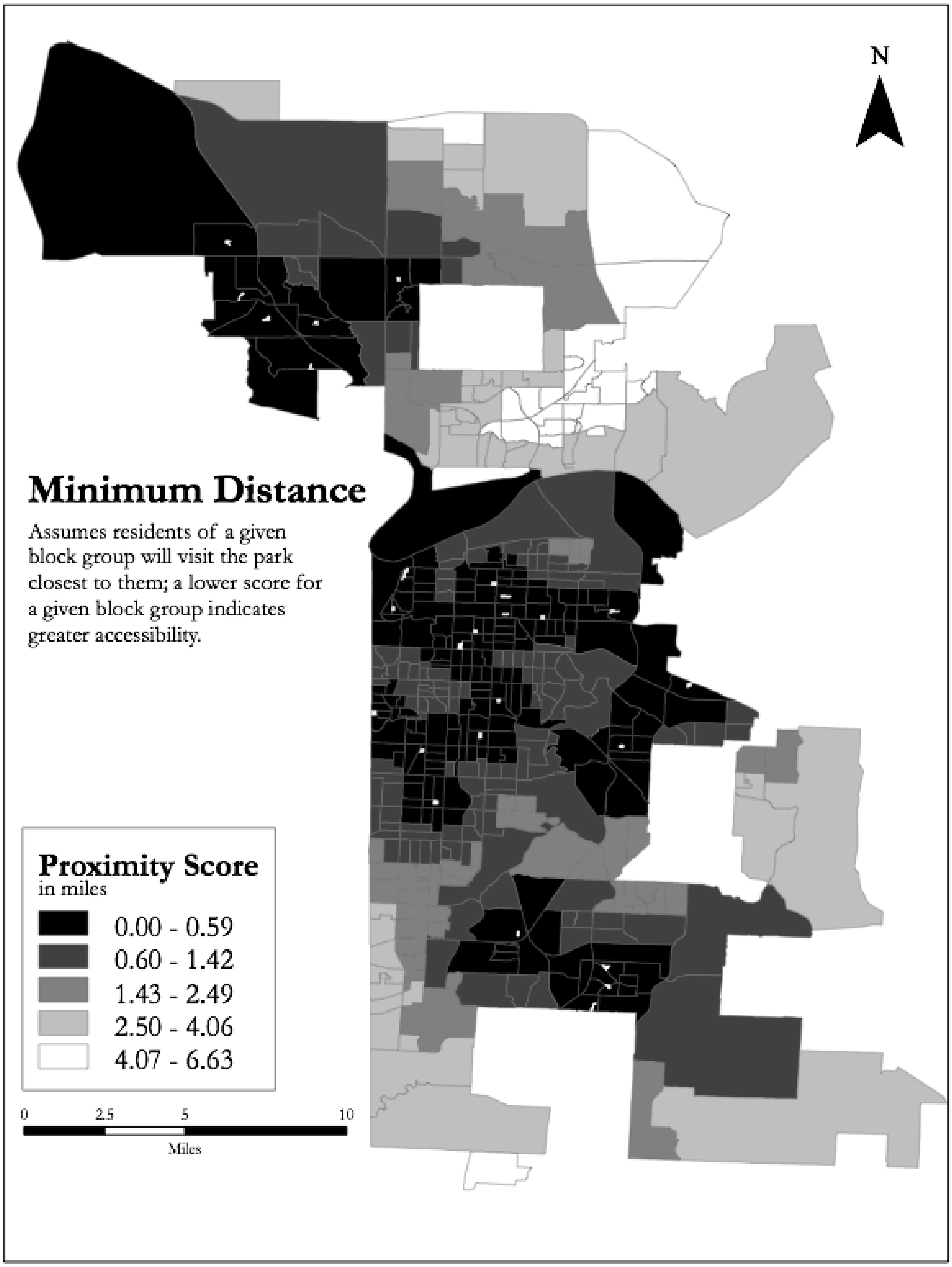


Figure 4.1 Minimum Distance Proximity Map

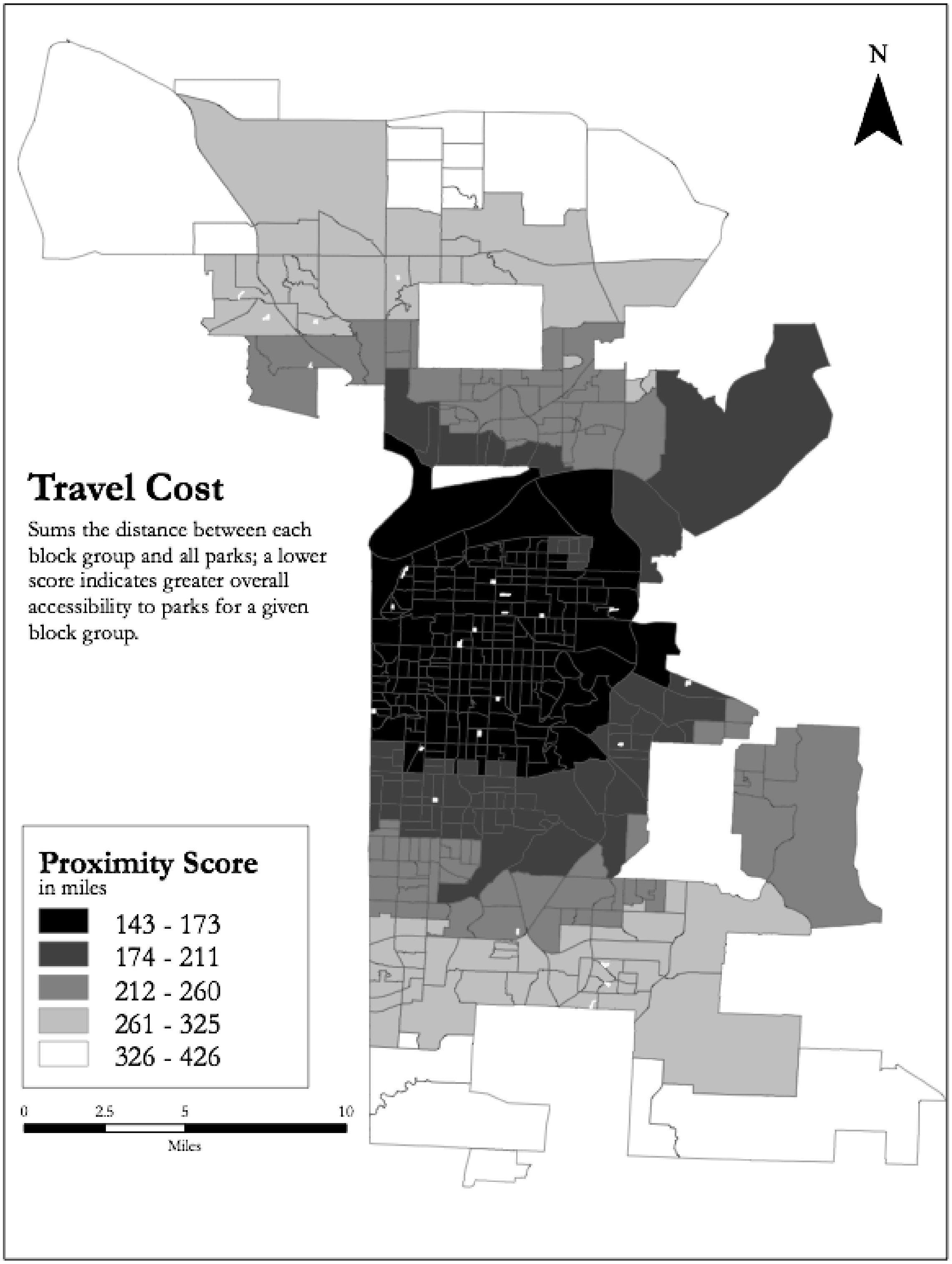


Figure 4.2 Travel Cost Proximity Map

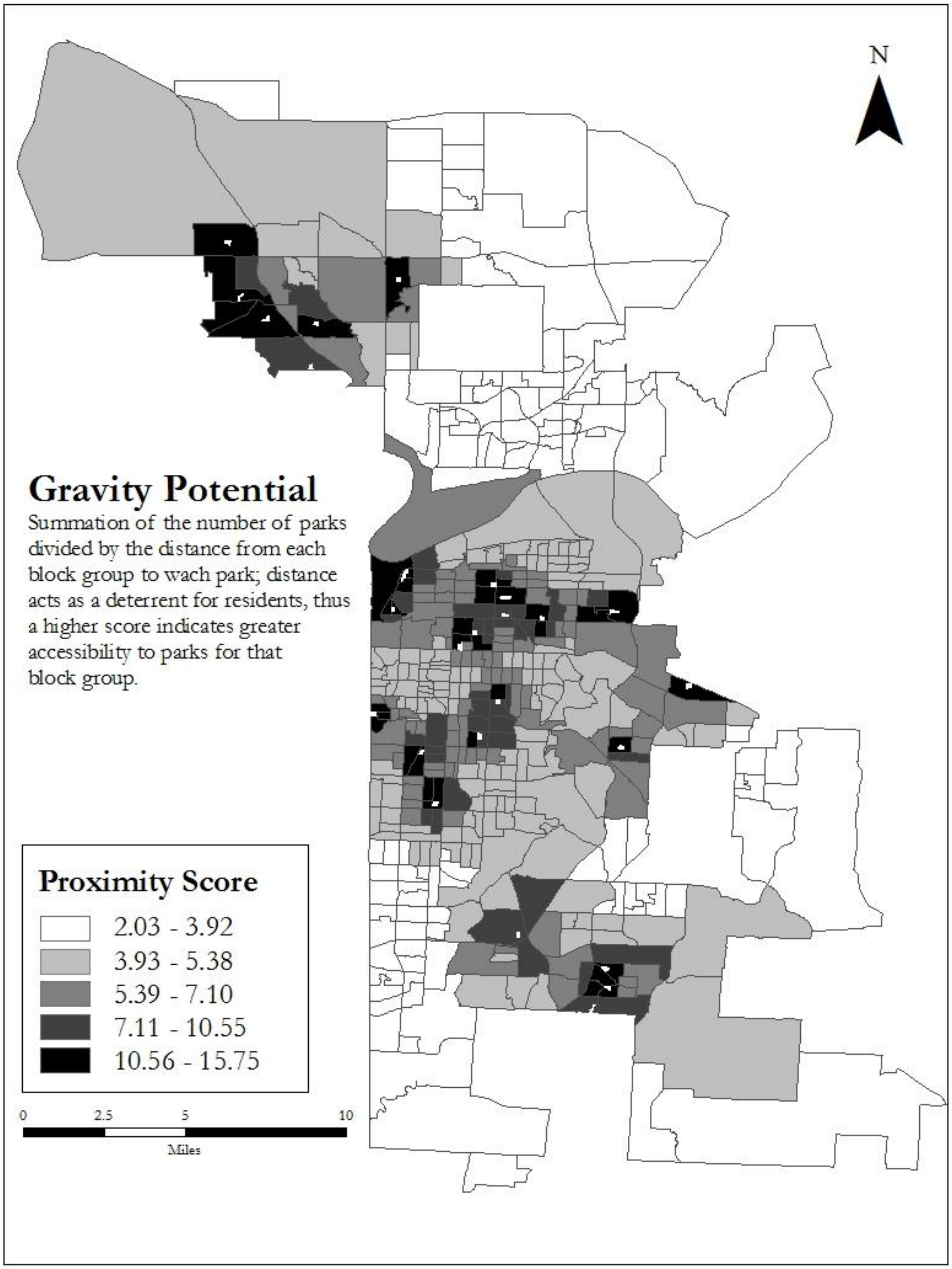


Figure 4.3 Gravity Potential Map

Correlation of Accessibility and Socio-Economic Variables

As each block group now has three accessibility measures, in addition to socio-demographic data from the U.S. Census Bureau, a simple correlation test can be used to help determine whether there is a relationship between the high need populations and the accessibility scores. By these means, it can be uncovered whether block groups with high need populations (as defined as low income, high density, and minorities) have corresponding low accessibility scores; if this is the case, evidence of inequity may be present. However, if the correlations show high access for high need groups, then patterns of equity may be present. Table 3.2 shows the correlation between each of the accessibility measures with separate demographic variables (Percent African American, Percent Asian, Percent Hispanic, Percent White, Per Capita Income and Population Density). Due to the large number of observations (442 block groups) for each correlation, even relatively low correlation coefficients (*r*) values are significant. Furthermore, since the number of observations is always the same for each correlation, each *r* value can be compared directly to detect the strongest and weakest correlations between variables in this study.

As discussed previously, lower minimum distance and travel cost scores reflect higher access to parks while higher gravity potential scores indicate greater access. Thus, if equity was present it would be expected then that negative correlations would occur between minimum distance and travel cost and the high need population groups, i.e. with Percent African American, Percent Asian, Percent Hispanic and Population Density. Positive correlations should appear between percent white and higher income block groups if equity is present as well. In contrast, the gravity potential score should reflect positive correlations between the high need groups and negative correlations with percent white and per capita income, reflecting the assumption that scores are higher for block groups with greater access to neighborhood parks.

Table 4.1 Correlations of Accessibility Scores and Socio-Economic Variables (n=442)

Accessibility Measure	Percent African American	Percent Asian	Percent Hispanic	Percent White	Per Capita Income	Population Density
Minimum Distance	-0.37	0.01	-0.12	*0.41*	*0.07*	-0.22
Travel Cost	-0.42	-0.06	-0.25	*0.50*	*0.22*	-0.43
Gravity Potential	0.20	*-0.02*	0.11	*-0.22*	*0.01*	0.13

Table 4.1 reveals correlations that show that there is a pattern of equitable distribution between neighborhood parks and high need populations. All of the variables behave in accordance with what is expected for equity; the high need groups show negative correlations with minimum distance and travel cost and conversely, a positive correlation with gravity potential. Unlike previous studies measuring these variables, all of the metrics carry the expected signs if equity is present (however, it is to be noted that other studies measured community parks as opposed to neighborhood parks used in this study). As shown in Table 3.2 (p. 42), areas with high African American populations and lower incomes had the highest need for high access to neighborhood parks, as this group correlated negatively with per capita income and positively with population density. However, it is evident in Table 4.1, that the African American population may be more equitably served than expected, as block groups with a higher

African American population are actually negatively correlated with minimum distance and travel cost, and positively with gravity potential, indicating equity.

Similarly, the Hispanic population indicated some need, having lower incomes and living in notably higher densities. When correlated to the accessibility scores, the Hispanic population shows some evidence of equity, though perhaps not as strongly as the correlations shown between the African American population and accessibility scores. The Asian population, while displaying lower need (see Table 3.2) shows slightly positive correlation with minimum distance and negative correlation with travel cost and to a small extent with gravity potential. This gives some indication that inequity may be present. Areas with high concentrations of White populations showed the least need based on their high correlation with income and lower population density. Corresponding to expectations in terms of equity, the White population shows positive correlations with minimum distance and travel cost, and a negative correlation with gravity potential.

Historical Legacy of Access

The previous accessibility maps make reference to the long history of parks and boulevards planning and growth patterns in Kansas City. Before continuing with the spatial autocorrelation analysis, it is beneficial to take a closer look at the geographic distribution of parks, particularly because the initial correlation of accessibility scores and socio-economic variables resulted in contrasting results that was not consistent with what was expected.

The maps of the raw metric scores allow for inferences to be made about how the parks reflect a legacy of a park plan that dates back to the 1900s. Notable is the influence of plans laid out by landscape architect George Kessler (1862-1923), who is credited for the design of many of Kansas City's most famous parks, boulevards, and neighborhoods. The early framework of Kansas City was built around this City Beautiful prototype, which advocated for parks, public spaces, wide streets, plazas, and open spaces as part of the comprehensive city plan (Mobley, 1991). This was transformative to the growth of Kansas City as it "helped define the natural demarcations among commercial, industrial, and residential sections, and was a boon to neighborhood stability in the years before effective zoning (Wilson, 1964).

The 1893 Report of the Board of Park and Boulevard Commissioners offers a detailed and comprehensive study of Kansas City's topography, traffic patterns, population density and growth, land use, and plans for future development. A noted in the report, the "Park Movement" was intended to serve the city population and provide a quiet respite from city life, as "many of the ills of mind and body that are the direct outcome of life in a crowded city can be avoided or palliated by access to surroundings completely differing from those found in the city, surroundings that invite to rest and quiet contemplation and the droppings of all business cares" (Kessler and Meyers, 1893, p. 7). Despite suggestion from F. L. Olmsted (1822-1903), The Board of Park Commissioners respectfully declined the recommendation of a large scenic park and instead confined their recommendations "to more urgently needed public spaces and local parks within the city, the embellishment of character points, and the establishment of parkways and boulevards" (Kessler and Meyers, 1893, p.9). This is a valuable point, as it confirms the early recognition of the importance and attention to developing the neighborhood parks that are existent today.

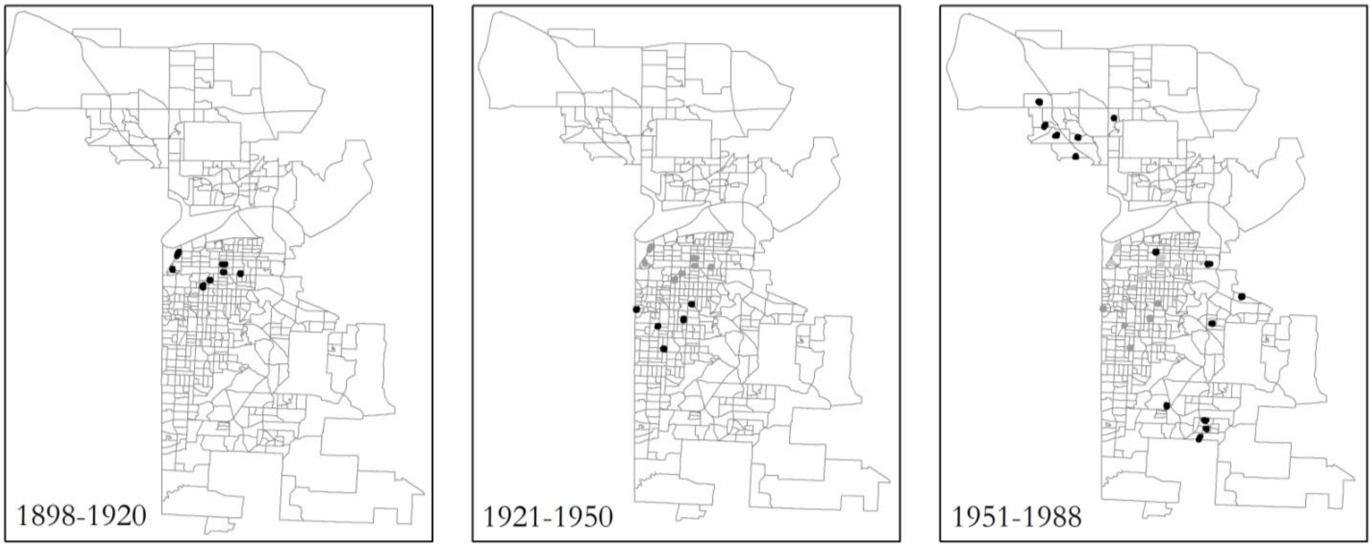


Figure 4.4 Neighborhood Parks by Year

Within this study, seven of the twenty-six parks were acquired prior to 1920, and eleven prior to 1950 (see Figure 4.4). The early parks were developed under the direction of George Kessler, in harmony with his plan set forth in the 1893 Plan and the collective vision of the Board. At the time, there was not "within the city a single reservation for public use" (Kessler and Meyers, 1893, p. 9). Kessler took advantage of the unique topography of cliffs, bluffs, and ravines, proposing use as public land that would preserve natural land and provide recreation opportunities for city residents (Observation Park, West Terrace Park). Likewise, the boulevard system was designed to complement and adapt to the topography, define neighborhoods and commercial areas, and provide a framework for future development and growth (Crews Square, The Grove, Troost Park). Kessler envisioned that the parks and boulevard system would "check the tendency to spread out and to build residences in the suburbs, by producing the opposite tendency, that is, to build within the city." This would allow for compact development to be built up around the parks and along the boulevards, with "the best and most expensive residences along boulevards…with a decided effect upon the character of the residences to a considerable distance on each side" (Kessler and Meyers, 1983, p. 14-15).

While this framework still informs much of the original footprint, a new pattern that favored low-density development and the automobile significantly changed Kansas City post World War II. In the 1950s, Kansas City annexed a large amount of land north of the Missouri River, though ironically, economic and social forces encouraged population growth south and west of the state (Harnik, 2000). Many affluent residents began to move further out from the urban core, to areas like Johnson County, Kansas and eastern parts of Jackson County, Missouri. The most remarkable being Overland Park, Kansas (unincorporated farmland south of Kansas City in 1950, that fifty years later became the state's second largest city (Shortridge, 2004)). Like many cities at this time, the inner city significantly dropped in population, while the metropolitan region gained as a whole. As reflected simply in the diagrams showing Neighborhood Parks by Years (Figure 4.4) parks followed the outward trend from the 1900s in the city center to the 1980s further north and south of the urban core.

While these parks may have been intentioned for a different original user, their location and purpose help to explain why there is a pattern of equity rather than inequity in the distribution of parks. The equitable pattern of access that is seen today is largely attributed to historic planning within the city as well as the changes in demographics and neighborhood transition over time. In fact, it is due to the forethought of Kansas City planners that there is a foundation of equity in terms of neighborhood parks in the area. The second part of the analysis will inform the current equity and accessibility patterns in terms of a more local context.

Spatial Autocorrelation Analysis

While these results as consistent with the definition of equity used in this study (*not all citizens will have equal access to parks, but rather those demographic groups who have a greater need should have greater access*), the relationship between a block group's characteristics and those within its immediate surroundings are ignored. The results above provide overall indicators of patterns of equity with respect to neighborhood parks within the study area; however lack a spatial element that distinguishes this from a basic statistic test. Spatial autocorrelation can be used to detect clustering of accessibility scores or socio-demographic characteristics and to correlate areas of high and low access to parks with corresponding groups of high or low need groups. In contrast to the correlation coefficient trends exhibited previously, block groups are evaluated as part of their surroundings or local context rather than isolated observations with no connection to their neighbors.

As argued by Comer and Skraastad-Jurney (2008), "the use of appropriate and valid spatial autocorrelation statistics permits a more meaningful evaluation of the equitable distribution of parks because the statistics explicitly account for the presence of spatial autocorrelation" (p. 136). For this study both Moran's I and Hot Spot Analysis Tools were used to detect clustering of the accessibility and socio-economic variables, thus providing both global and local spatial autocorrelation statistics. While both these measures complement each other, significant positive global spatial autocorrelation, through the use of Moran's I, can indicate that local positive spatial autocorrelation is almost surely present as well. As presented previously, Moran's I range from a value of one for perfect positive spatial autocorrelation to negative one for perfect negative autocorrelation, similar to the standard correlation coefficient (Griffith, 1987, in Comer and Skraastad-Jurney, 2008). Table 4.2 shows both the Moran's I and the Z score for all of the socio-economic variables and accessibility measures.

Table 4.2 Moran's I and Z Scores

Variables	Moran's I	Z Score
Minimum Distance	0.69	51.38
Travel Cost	0.74	55.27
Gravity Potential	0.39	29.59
Percent African American	0.82	60.69
Percent Asian	0.71	52.79
Percent Hispanic	0.65	57.57
Percent White	0.87	64.28
Per Capita Income	0.96	71.43

As evident in Table 4.2, all variables show significant positive spatial autocorrelation; the large Z scores for Moran's I for all of the variables are significant to reject the null hypothesis of no global spatial autocorrelation and suggest that areas of positive spatial autocorrelation are also present at the local level. Using the Hot Spot Analysis Tool, the G_i* statistic can be used to detect and quantify the strength of clustering in these spots.

Using the Hot Spot Analysis (Getis-Ord Gi*) tool within the Spatial Statistics catalog, spatial clusters of high values (hot spots) and low values (cold spots) emerge. Through this tool, ArcGIS calculates and saves a z score for each observation (i.e. block group); both very large (z

> 2) and very small (z < -2) values of z indicate zones of positive spatial autocorrelation and represent hot spots of cluster and cold spots respectively. In terms of hot spot analysis, the z score represents the statistical significance of clustering for a specified distance. A benefit to using this model is that z scores of two or greater (in absolute value) will reject the null hypothesis of no significant spatial autocorrelation at the 95% confidence level. Additionally, because the z scores are unitless, it allows for direct comparison among different variables and maps. Figures 4.6 through 4.11 show the mapped distribution of the z scores of the Gi* statistic for socio-economic variables, compared to mapped distribution of z scores of the Gi* statistic for each accessibility measure. The smaller panels showing the z scores of the accessibility measures, (a. Minimum Distance), (b. Travel Cost), and (c. Gravity Potential), are identical across all figures in order to facilitate comparison to the socio-economic variable.

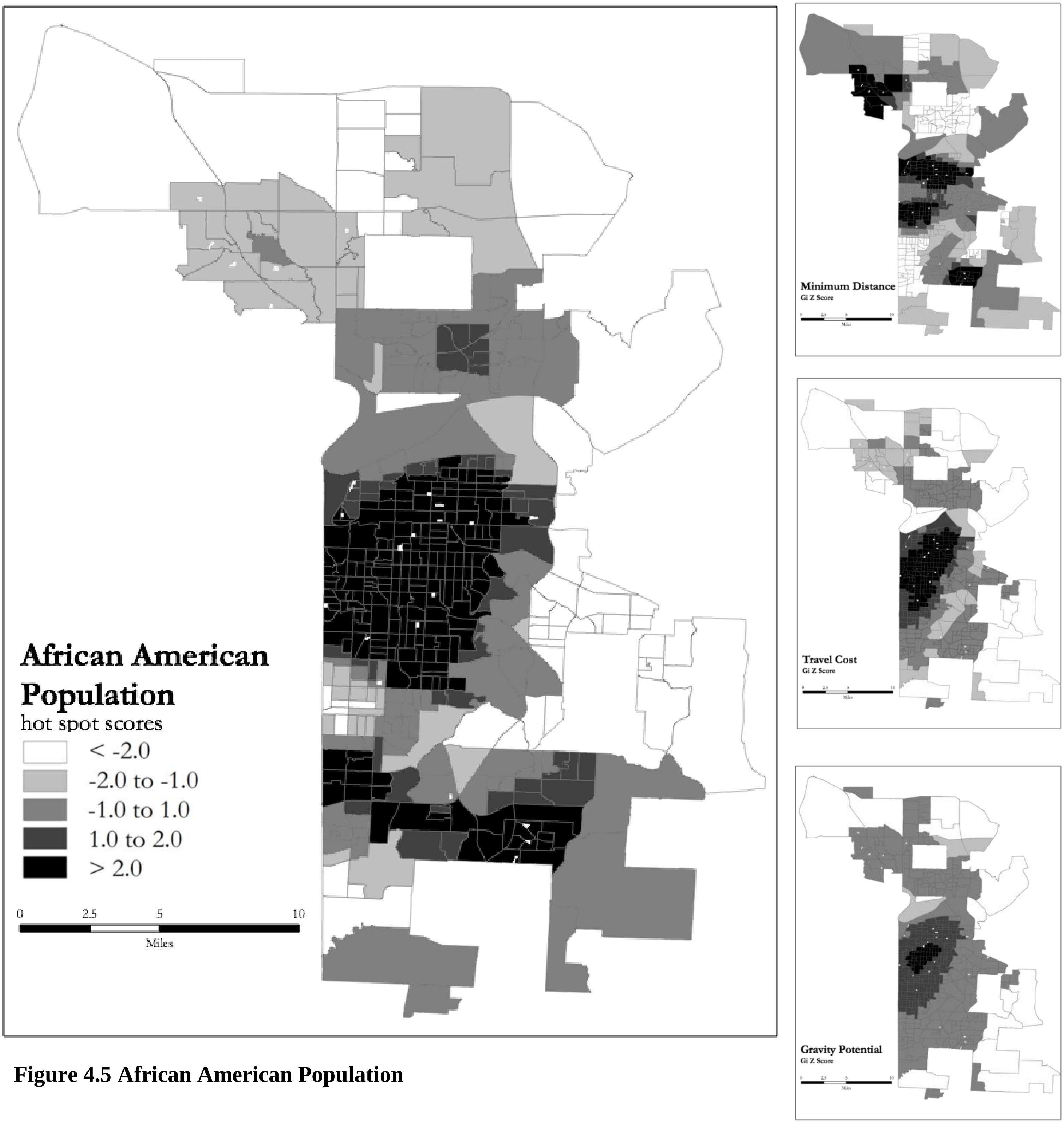


Figure 4.5 African American Population

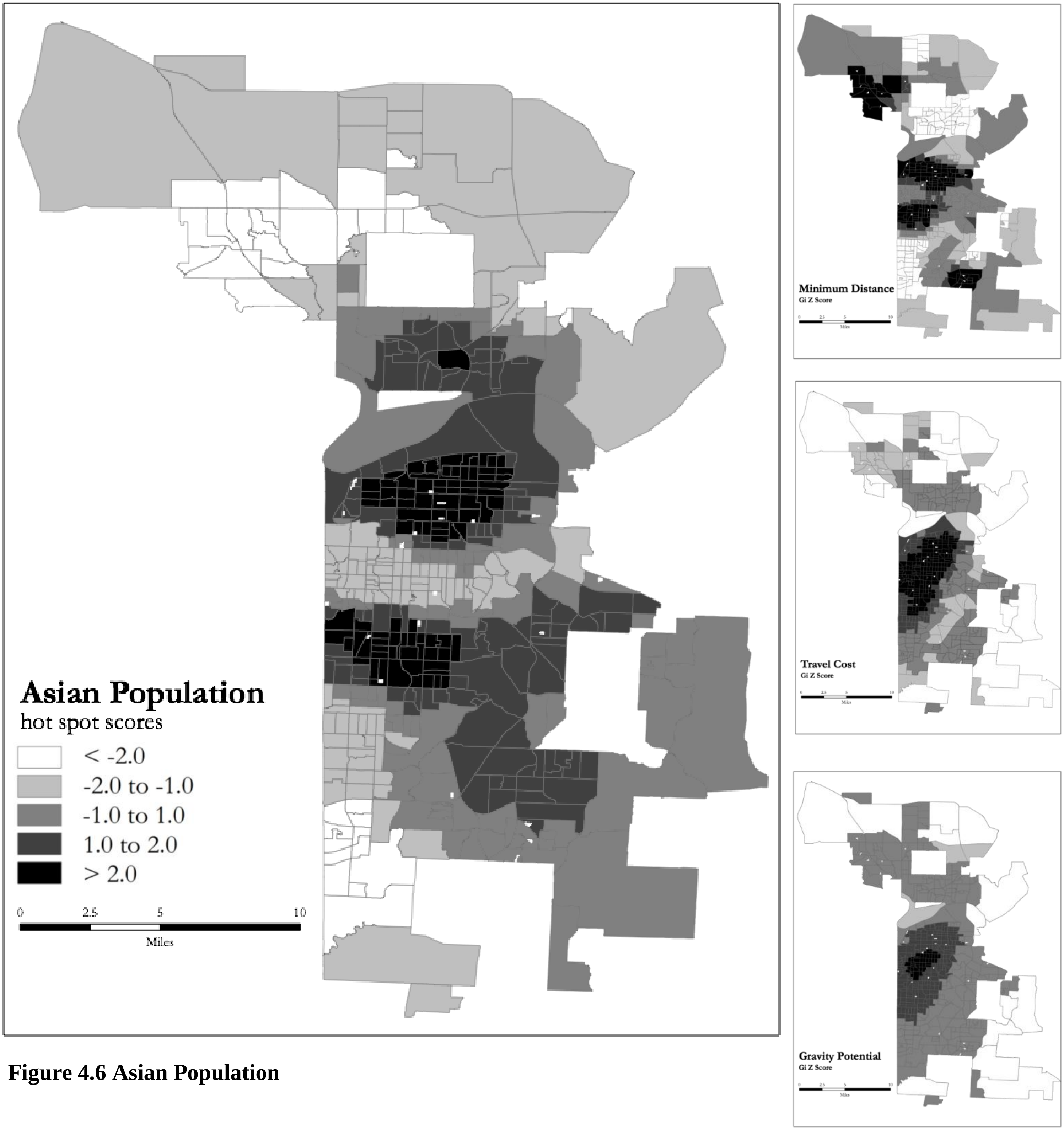
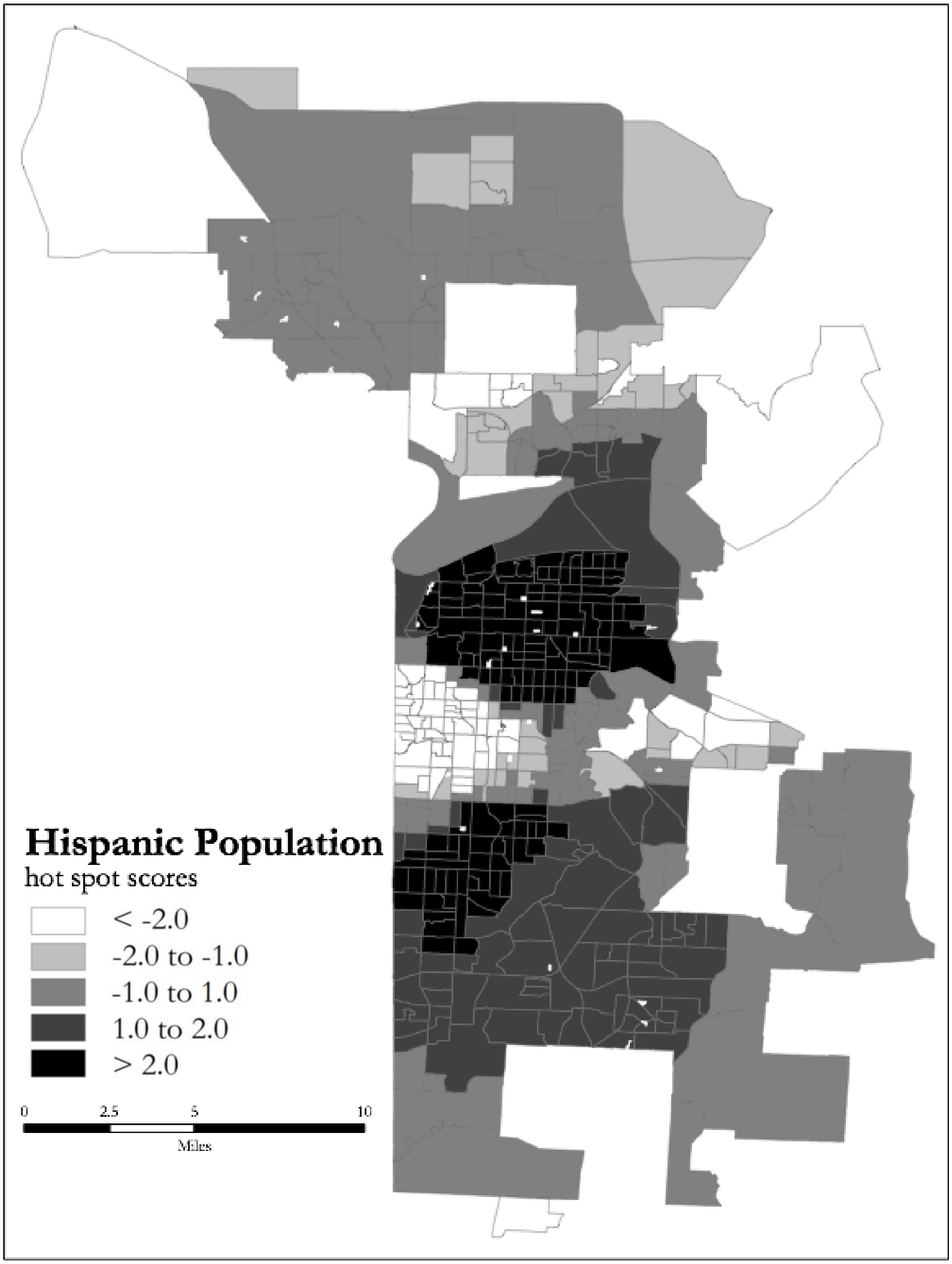


Figure 4.6 Asian Population



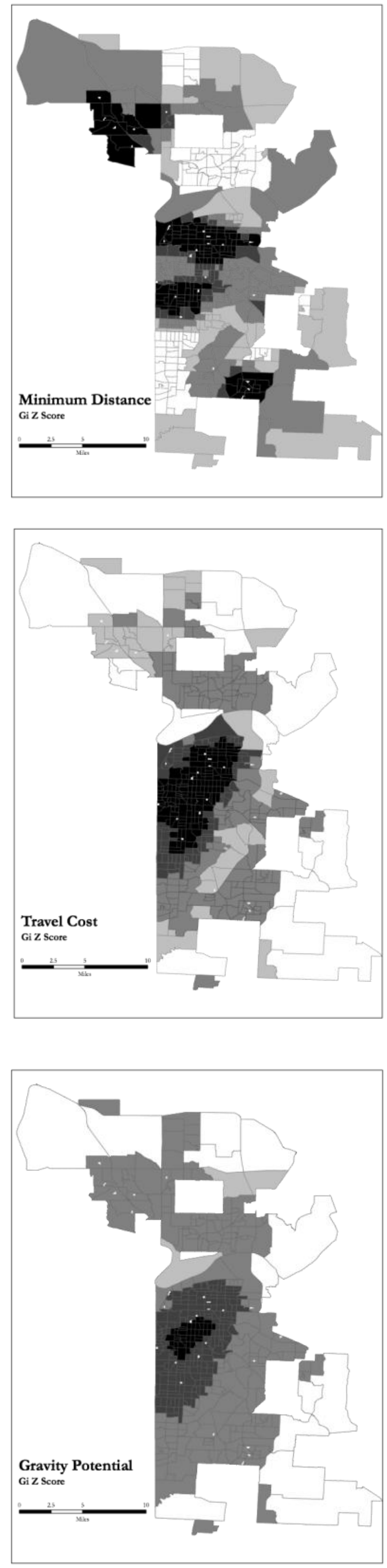
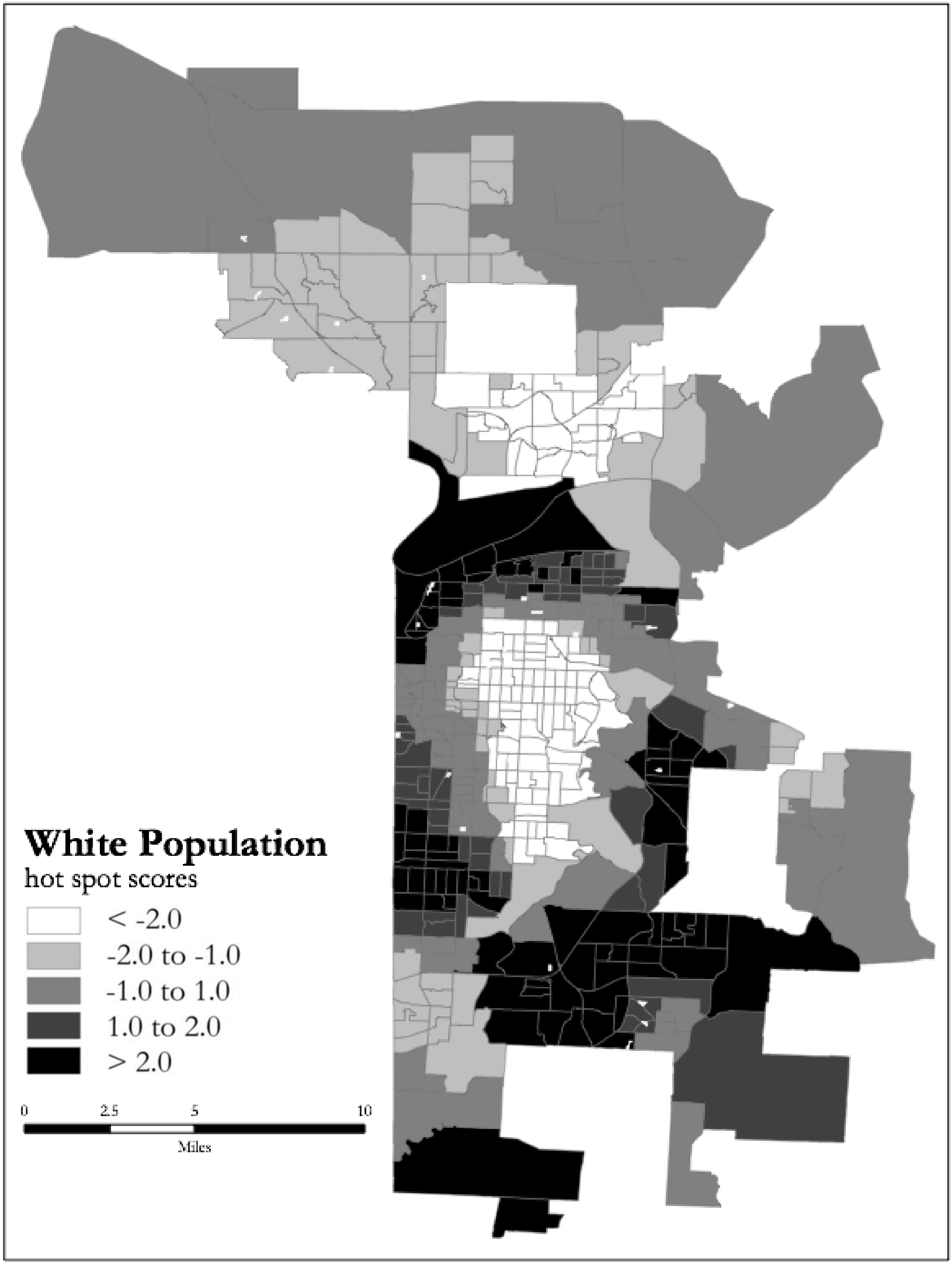


Figure 4.7 Hispanic Population



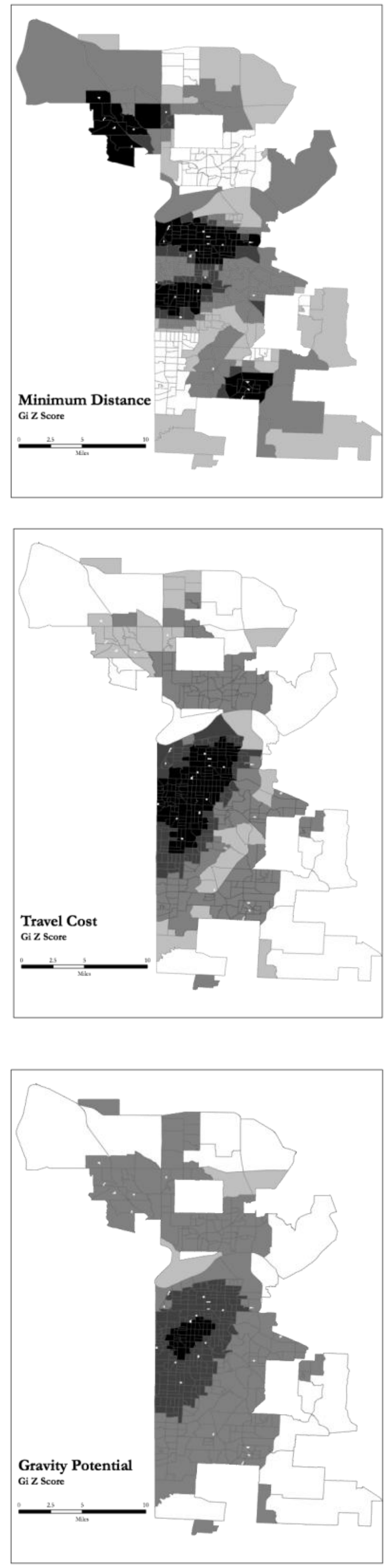
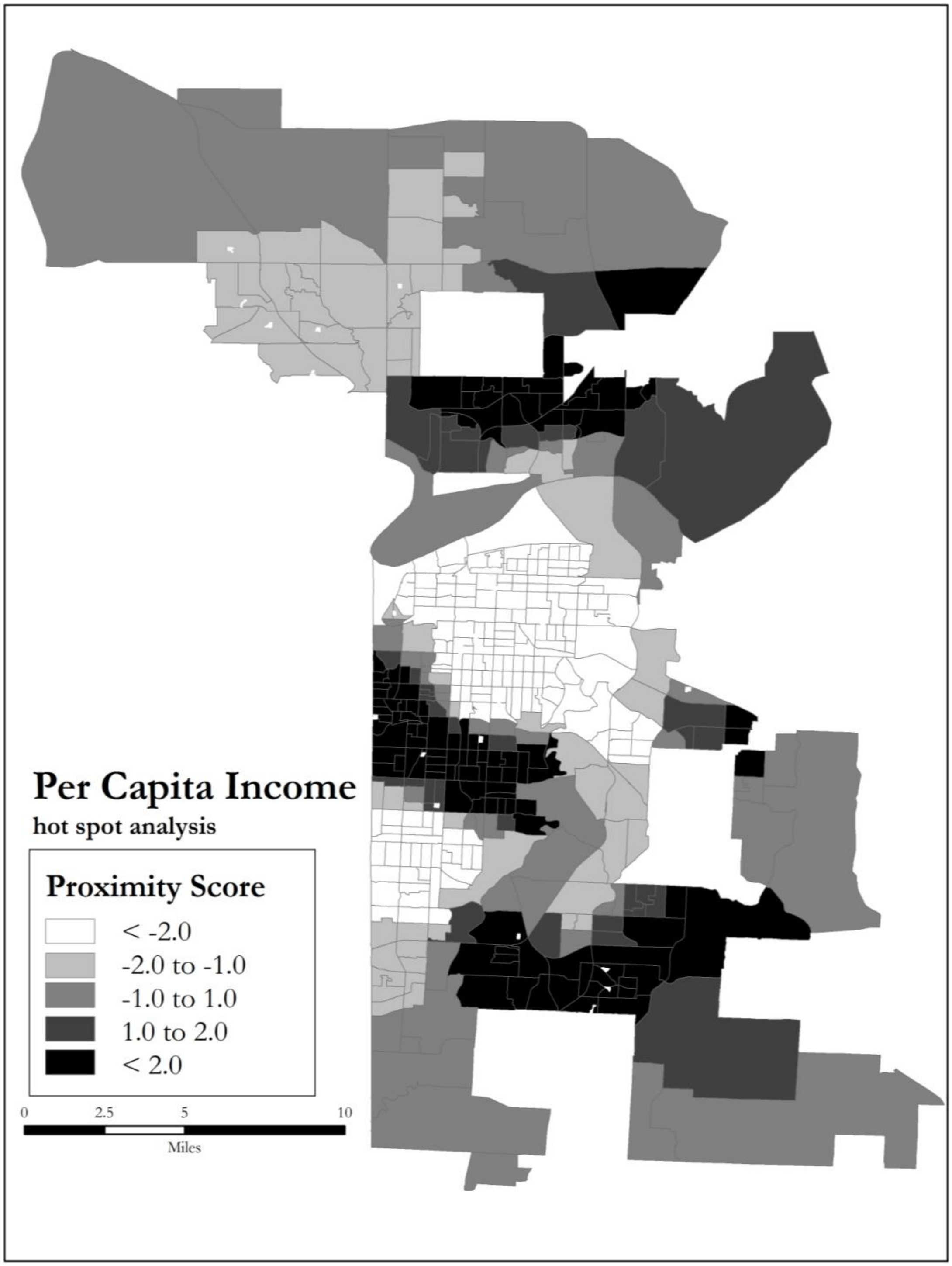


Figure 4.8 White Population



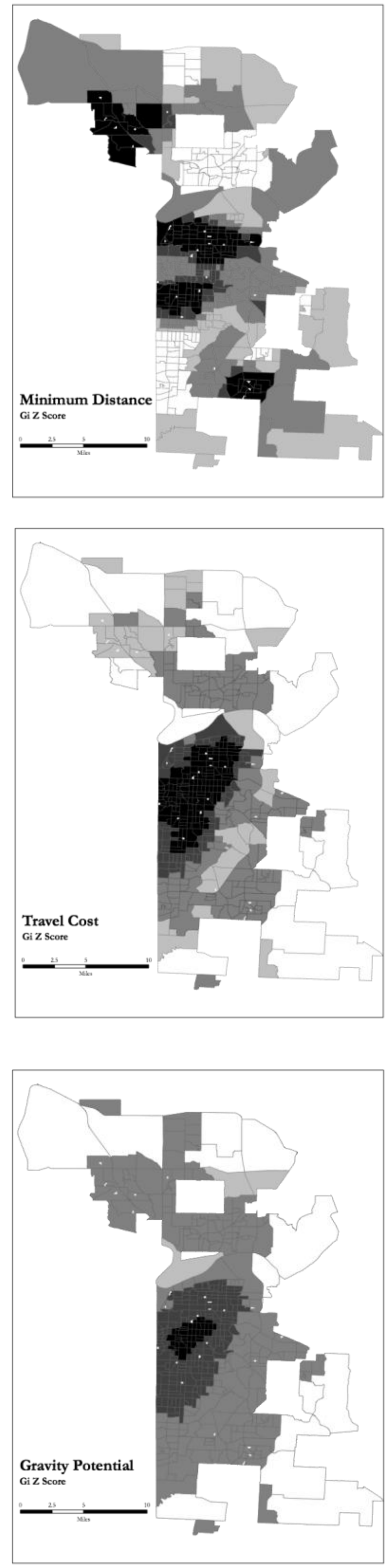
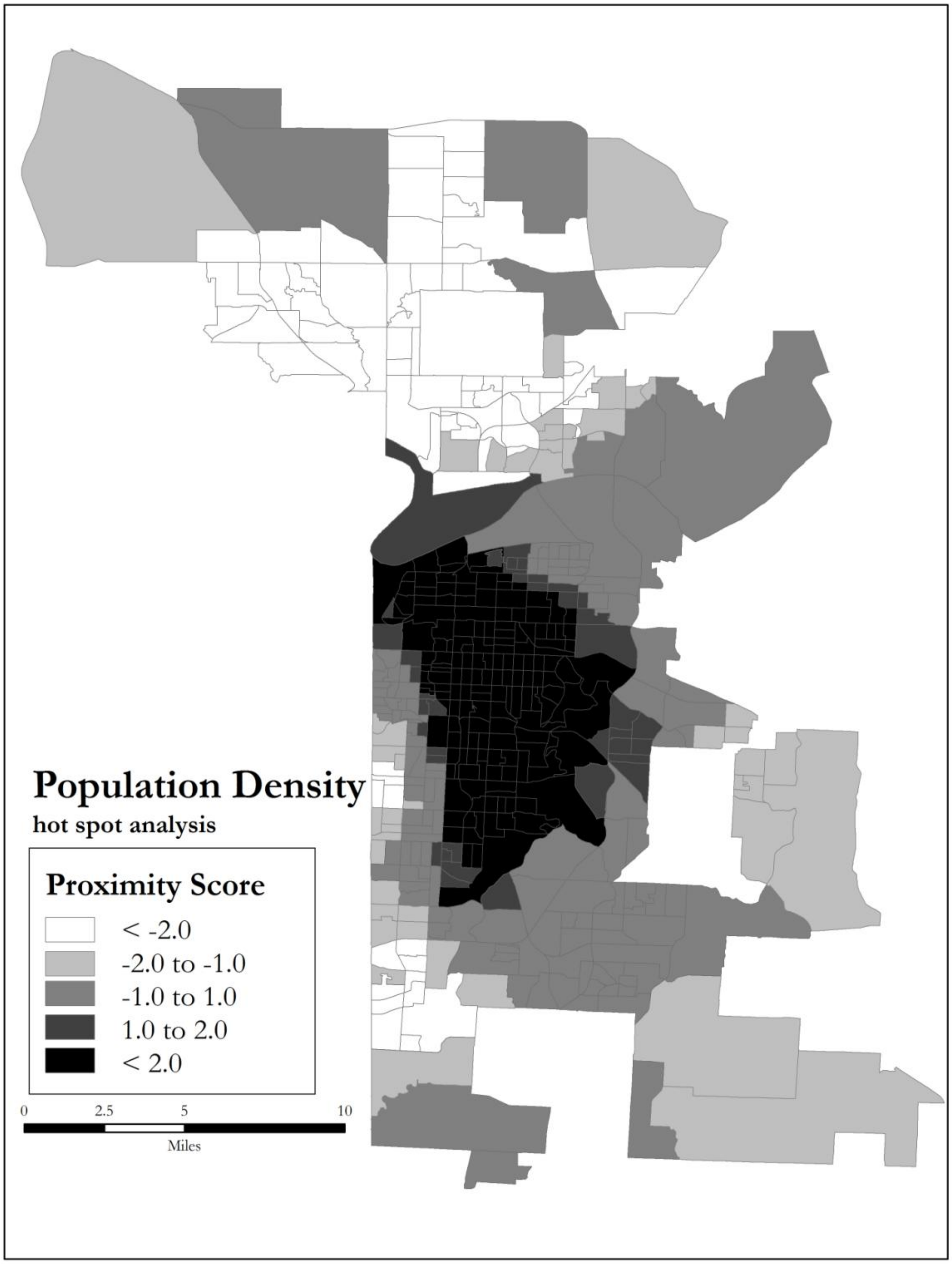


Figure 4.9 Per Capita Income



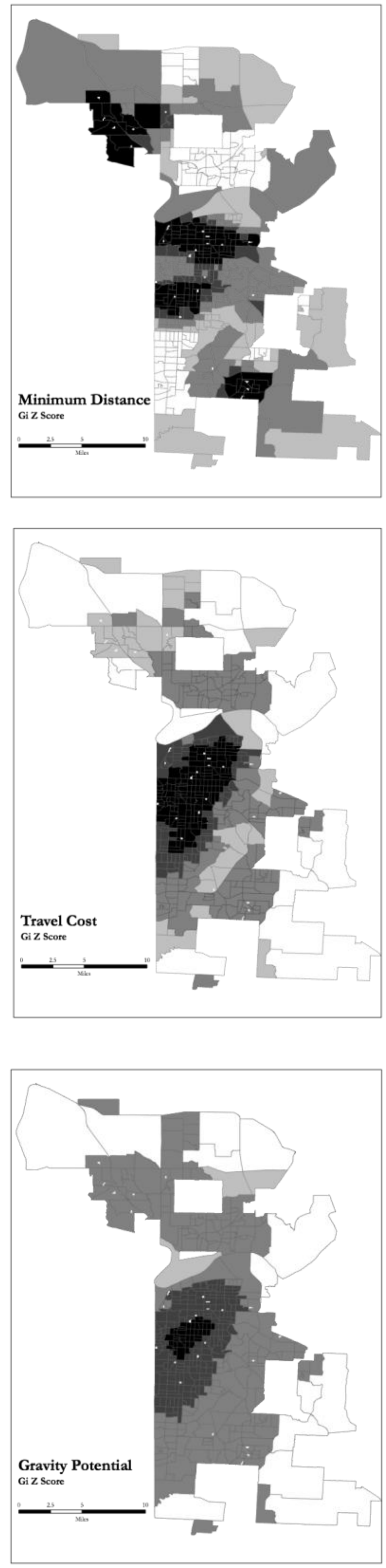


Figure 4.10 Population Density

Findings

The second series of maps, which now include the socio-economic variables and a spatial element of distribution allow for further inferences to be made about neighborhood park equity in the Kansas City area. An initial comparison of the distance- based accessibility maps (Figure 4.6 through 4.11) and the spatial autocorrelation hot spot maps reveal small, yet statistical important differences. As mentioned previously, the z score for the G_i* statistic are unitless, with classes broken at one and two standard errors above and below the mean (0). In contrast to the distance maps showing miles and classified by natural breaks, the hot spot maps can be compared directly to one another. The G_i* statistics are computed for each block group within the context of its neighbors, thus patterns appear smoother in Figure 4.6 through 4.11. Amongst the three accessibility measures the travel cost map and the gravity potential map look most similar, reaffirming the influence of the more centrally located neighborhood parks. The minimum distance map reveals a similar pattern as it did in Figure 4.1, but more clearly indicates four zones where park access is the highest and two areas (north of the river and south of downtown) where there is statistically significant low park access (white shaded block groups).

Visual Comparison of Results

For the purposes of this study, of key focus is the comparison of the socio-economic hot spot maps with the three accessibility maps. By identifying overlapping clusters of high need groups and low park access, it can provide direction for planners and city officials as to what areas of the city are in need of park facilities. The specific interest is highlighting areas where there is an overlap of high need areas with high access (areas of equitable distribution) and high need areas with low access (patterns of inequity). First, each map will be discussed individual and then the results will be discussed as they overlap and related to each other.

African American Population

The African American population is heavily concentrated towards the center of the study area, south of the Missouri River within the urban core or downtown, midtown, and to the east of downtown; a hot spot of large, positive (< 2.0) z scores shaded black (see Figure 4.6). There is also a large population cluster just north of Grandview towards the south end of the study area, though it is disconnected with the previous population hot spot; represented by the block groups shaded white, cold spots of large, negative (> -2.0) z scores. When compared to the three accessibility measures, the equitable distribution is evident as the African American hot spots largely correlate with the hot spots of the high access scores. All three measures show high access throughout the central section of the study area, the areas of high African American population concentrations. While this population concentration could be attributed to infill of minority populations after decentralization of the early residents, it is notable to mention that the high African American population in the urban core can be traced back to the 1920s where 18th and Vine and the Jazz District served as the historic and cultural center of the early African American population in Kansas City. During the time of the Park Movement in Kansas City in the early 1900's through 1950, these neighborhoods remained distinctly African American. Evident to the strong cultural history, one of the early parks (Nelson C. Crews Square, E. 27th and Woodland Ave; 1902) is in fact named for Nelson C. Crews (1875-1923), editor of an

African American newspaper, *The Kansas City Sun,* civil rights speaker and activist (Missouri Valley Special Collections, Kansas City Public Library).

Asian Population

Figure 4.7 shows the mapped hot spots of the Asian population within the study areas, with notably two distinct areas of population concentration. The first just south of the Missouri River including the downtown loop and the area east and the second, south of the Country Club Plaza. The Asian population was found to have lower need in comparison to the Hispanic and African American population; however the correlation with the accessibility scores indicated that some inequity in regards to neighborhood parks may be present. In comparison to the three accessibility measures, the two Asian population clusters overlap with high access scores but extend further to the Northeast of the northern access hot spot and further south with regards to the other access hot spot. In relation to the gravity potential map, the Asian Population seems to be just outside of the highest access spot, reflecting its negative correlation with gravity potential. While the Asian population remains clustered towards the center of the city, residents are clustered towards the edges of the African American population. This could be attributed a later time of infill and immigration or movement of the Asian population. Where the heavily African American neighborhoods remained, perhaps the Asian population concentrated in other areas of the city; for example, just north of the downtown loop in the River Market, where a high ethnic population resides.

Hispanic Population

Similar to the Asian population, the Hispanic population is concentrated in two areas of the study area (see Figure 4.8). The largest concentration mirrors both previously discussed population concentrations centered on the downtown area, through midtown and north of the Country Club Plaza. There is also a large population concentration towards the mid-south of the study area, extending into the southern part of Kansas City, MO. There is a notable area of low Hispanic population that divides these two population hot spots, which previously showed a larger concentration of the Asian population. The Westside neighborhood, located along Southwest Boulevard, just southwest of the downtown loop is characterized by its vibrant and historic Hispanic population and is reflected in this map. The Hispanic population showed the second highest need, after the African American population, however was largely, positively correlated with high park access. In a visual comparison with the accessibility maps, it is apparent that Hispanic hot spots overlap with all three of the metrics at some location.

White Population

As discussed previously, Kansas City experienced a period of decentralization, including the dispersal of the White population towards the outer edges of the city, and most notably the suburbs of Johnson County, Kansas and eastern Jackson County, Missouri. Figure 4.9 and 4.10 reflects this pattern of movement of the white and the middle class populations towards the edges of the study area; notice the significant cold spot of population in the center of the study area. In comparison to the accessibility figures, the White population and per capita income hot spots, largely lie outside of the highest access score hot spots, particularly for travel cost and gravity potential. Since both the White Population and middle to upper class populations were not indicated as high need populations this does indicate patterns of equity.

Overlay of Positive Spatial Autocorrelation

The ultimate interest of this study is to identify both types of positive spatial autocorrelation, i.e. "hot spots" of high-high values and "cold spots" of low-low scores and correlating these areas with similar hot and cold spots of related socio-economic variables related to equity. Figure 4.12 shows block groups where all three accessibility measures overlap at high and low hot spots, highlighting block groups with highest access (red) and lowest access (blue) to neighborhood parks. In this case, high access means overlapping low minimum distance and travel cost, and high gravity potential scores; low access including the opposite. Similar to what has been displayed before, high access to neighborhood parks remains concentrated towards the center of the study area while lower access areas are on the periphery. However, in this map, specific block groups are highlighted for commonly high or low access scores across all three measures.

In Figure 4.12, block groups hot spots of need based populations are overlapped with high and low access scores, showing block groups displaying patterns of equity and inequity with regards to neighborhood parks. In the top figure, the red block groups indicate where there are statistically significant patterns of equitable distribution. The large map shows overlapping block groups of high park access; the four smaller figures show high access block groups with correlated with significantly high population concentrations. Predictably, high access for all demographic groups trends towards two distinct areas, one including part of the downtown loop and the area to its east, and within includes the Country Club Plaza and area to the south.

Comparatively, in the figure below, the block groups shaded blue indicate where there are statistically significant patterns of inequitable distribution. The large map shows overlapping block groups of low park access; the four smaller figures show block groups with low access with correlated significantly high population concentrations. In this case, block groups with lower access to parks are notably north of the Missouri River, and on the south side of the study area. The smaller maps show specific block groups where there are concentrations of high minority populations that do not have access to neighborhood parks. While general patterns of equity were revealed (See Table), they were not perfectly correlated and thus some areas of the city are still underserved.

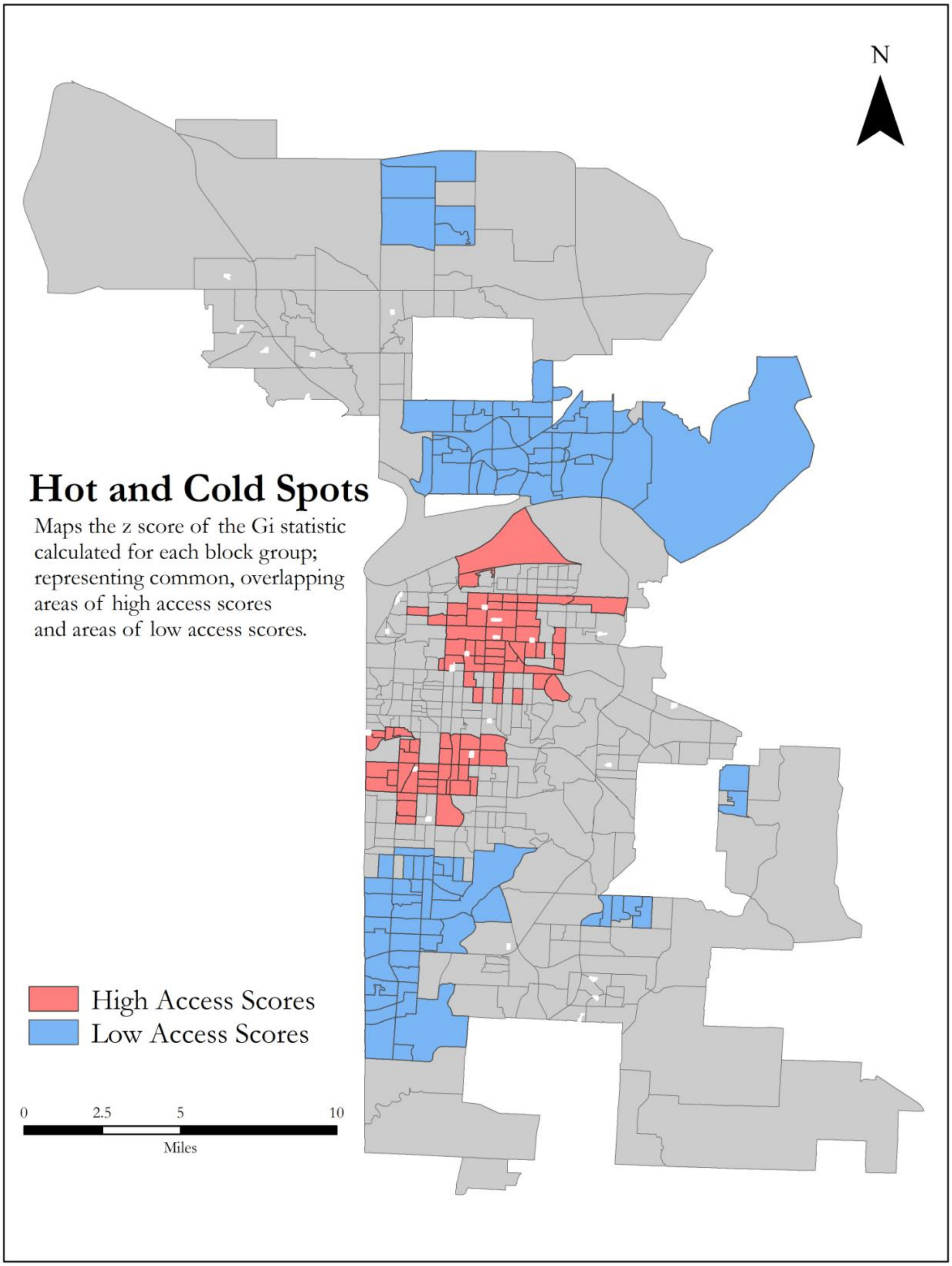


Figure 4.11 Hot and Cold Spot Map

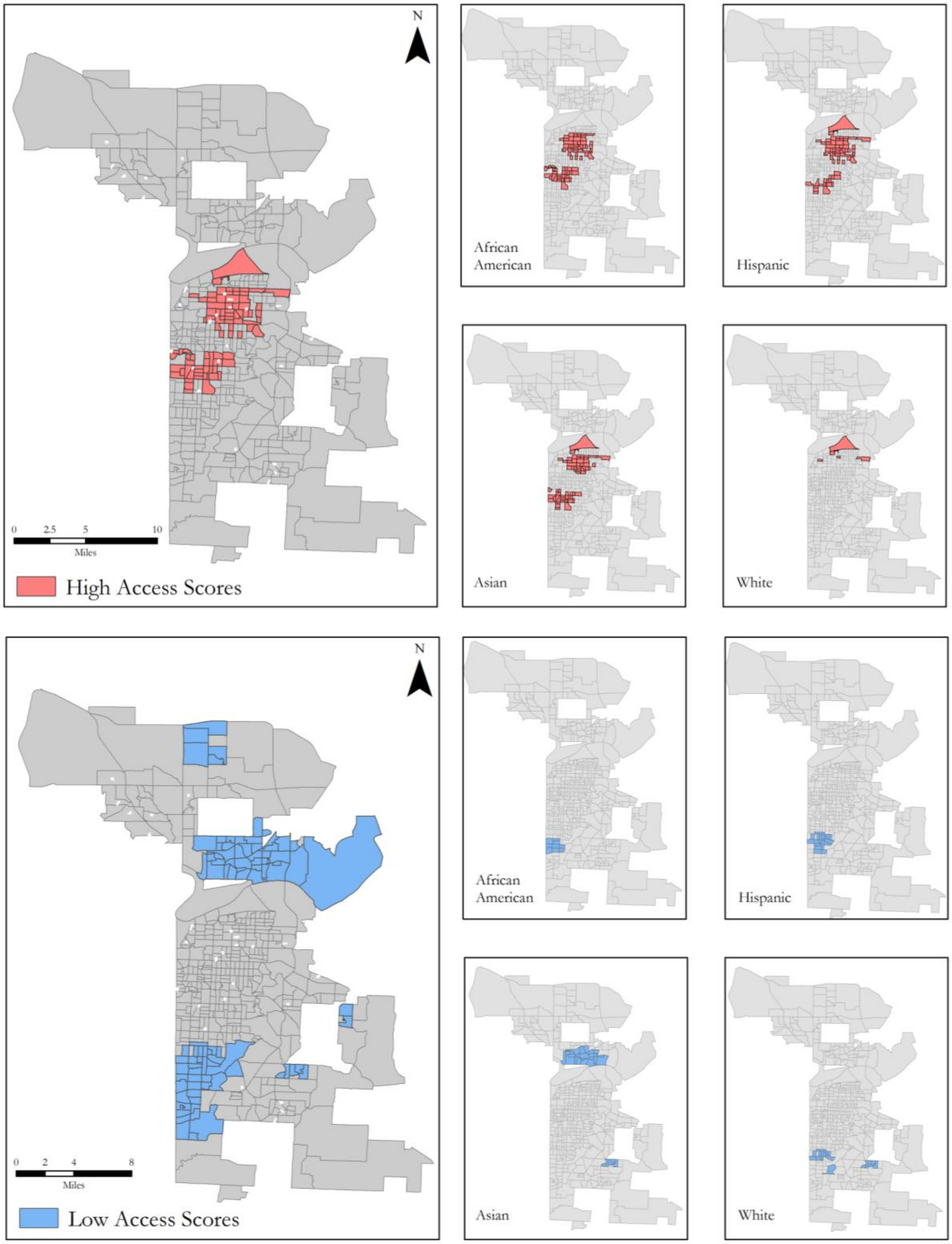


Figure 4.12 High/High and High/Low Hot Spot Overlays

Chapter 5 - Discussions and Conclusions

Summary of Key Findings

The analysis presented two complementary methods of considering the distribution of neighborhood parks in the Kansas City, MO area. In the first, the mapped accessibility scores for each block group began to reveal patterns of distribution, noting areas of high and low access based on simple distance calculations. From this it was evident that areas of high access were concentrated around the urban core, with clusters of access both to the north and south as well. Both the minimum distance and gravity potential maps showed that high access radiated out from each neighborhood park while the travel cost map revealed a concentric pattern of access centered on downtown and the midtown area. The second part of the analysis considered both the spatial element of the parks location in addition to the local context and socio-demographic characteristics of its surroundings to investigate patterns of equitable distribution. As cited by many researchers, equity involves need, meaning that not all citizens should have equal access to parks, but rather those demographic groups who have a greater need should have greater access. Based on this assumption, the population groups with negative correlations with per capita income and positive correlations with population density should be those with the highest need for good access to parks. When population groups were correlated with per capita income and population density it was found that African Americans, then Hispanic populations groups exhibited the highest need for access; the Asian population showed some need (see Chapter 3, Table 3.2). However, when the block groups were correlated with accessibility scores for minimum distance, travel cost, and gravity potential, patterns of equity were revealed. Below are listed the key findings:

- African American population was more equitably served than expected, as block groups with a higher African American population were negatively correlated with minimum distance and travel cost, and positively with gravity potential, indicating equity
- The Hispanic population showed some evidence of equity, though not as strongly as the correlations shown between the African American population and accessibility scores.
- The Asian population, while displaying lower need, showed slightly positive correlation with minimum distance and negative correlation with travel cost and to a small extent with gravity potential.
- Areas with high concentrations of White populations showed the least need based on their high correlation with income and lower population density. Corresponding to expectations in terms of equity, the White population showed positive correlations with minimum distance and travel cost, and a negative correlation with gravity potential.

When the accessibility scores were correlated with the socio-economic patterns, the results were contradictory to what hypothesized, as the block groups with high need based populations were actually positively correlated with areas of high access. Discussion of the legacy of the Parks and Boulevard System indicated that the distribution of parks is largely a result of the early era of planning in Kansas City. Additionally, the demographic patterns of Kansas City today are, in part, a result of the decentralization and movement out of the central core that redefined the neighborhoods surrounding the parks over time. Pattern of parks acquisition and development also mirror the city's growth, exhibiting preference towards the edges of Kansas City.

However, since the results did not exhibit perfect spatial correlation, spots of inequity were still potentially present. By overlapping areas of high-need population concentrations with high and low park access, areas of well served residents and underserved residents were revealed. Several significant clusters were found where minority populations are underserved by neighborhood parks.

Implications and Policy Recommendations

Evident in the comprehensive City plans and the Park and Recreation master plans, Kansas City is dedicated to continuing the long tradition of parks and boulevard planning and serving as a widely-recognized leader in this field. As part of their efforts, neighborhood parks remain a priority and are recognized as the "primary interface with citizens and a priority component of the parks and boulevard system" (Kansas City Master Plan 2017). Due to funding challenges and budget cuts, it is essential to continue to revisit priorities and update policies in response to changing conditions. While it was found that overall, minority populations are equitably served by neighborhood parks, there are areas that could be investigated further. Based on the findings in this report, the following policies have been recommended for park planning in Kansas City, MO.

Policy Recommendation 1: Value

Recognize the importance of neighborhood parks within communities, within the context of the parks and boulevards system, and within Kansas City as a whole.

Neighborhood parks should reflect the surrounding character, culture, demographics, and needs of their immediate surroundings. As building blocks of the park system, these areas should be designed, or re-designed to reflect the needs of the neighboring residents from a standpoint promoting the health and quality of communities in terms of economic stability, environmental protection, increased physical activity, as well as safety and provision of recreation opportunities. Neighborhood parks should be connected to trails, greenways, and boulevards where possible to foster a system of connectivity throughout the Kansas City area.

Policy Recommendation 2: Equity

Apply need-based equity standard to park planning decisions, particularly in terms of new facility location.

Need based equity means that not all citizens will have equal access to parks, but rather those demographic groups who have a greater need should have greater access. This type of equitable distribution should play a key role as decisions are made regarding the type of parks and recreation programs provided by the Department of Parks and Recreation throughout Kansas City, MO. It should be recognized that need based populations may change depending on the circumstances, this is not limed to the socio-economic groups discussed in this study, but also group may include other minority populations, children, elderly, handicapped or disabled, or other populations within the local context.

Policy Recommendation 3: Access

Placement of new facilities and re-development of existing facilities and surroundings should target areas that improve residents' access to neighborhood parks.

Access refers to the ease with which a site or service may be reached or obtained. In this case, neighborhood parks should be easily accessible by local roads, sidewalks, public transportation, trails or other methods that encourage walking, biking or using public roads and transportation to reach parks. Minimum distance standards of ½ mile to 1 mile should be established for all parks of throughout the city, especially those with a high concentration of need-based populations, as defined by the local context or situation. Additionally, points of connectivity with greenway systems, bike trails, and public transportation routes should be created. Access should be influenced by the context of the neighborhood and respond to the needs of the surrounding population.

Policy Recommendation 4: Outreach

Develop partnerships for parks with local community stakeholders, conservation groups, city departments, or regional planning organizations.

Through collaboration, park agencies, non-profit organizations, and citizen groups can provide support of parks even in times of limited funding. As neighborhood parks are a direct reflection of the neighborhoods they serve, community input, investment, and action in necessary for continuing success and viability of the park system. Neighborhood parks should be an integral part of developing neighborhoods, culture, interaction and connections while providing opportunities for all residents and visitors to enjoy common spaces. Input will help define the context and direction of park improvements in neighborhoods in addition to encouraging involvement and action at the local level.

Policy Recommendation 5: Future

Focus on neighborhood stability, revitalization efforts and new growth in the urban core through the continued investment in neighborhood parks.

In terms of long-range planning, efforts should focus on rehabilitating existing parks and developing new parks with regards to access and equity goals, new growth, and neighborhood and city transition. Emphasize providing places for both active and passive recreation that promotes physical activity and is in close proximity to residences as well as public transportation, schools, public housing, jobs, and areas of activity. Community based investment should be encouraged and supported through programs and projects that educate and engage citizens about the history, heritage and future of the Kansas City Parks and Boulevard System. Priorities should align with comprehensive plans and policies and parks should be an integral part of long-range planning processes at the local, state, and federal level. The Department should continue to seek grants for the purpose of rehabilitating existing facilities and ultimately continue to acquire additional recreation land specifically for neighborhood parks to accommodate the needs of current and future residents with regard to location of facilities, access and equity of population served.

Since Kessler's 1893 Report, the Kansas City Department of Parks and Recreation has continued to update the Parks and Boulevards Master Plan on a decennial basis, the most recent version being published in 2003. The current plan maintains that since the first historic report was laid out, the reasons for creating the master plan have not changed drastically. Planners, community stakeholders, and officials still recognize the need to make educated decisions about the future of Kansas City's park system, based on a continuing desire to connect people with places, improve the quality of life, encourage investment, and provide opportunities for all residents to enjoy these resources. The Department has faced funding challenges and increasing budget cuts in recent years, significantly decreasing the quantity of recreation programs and services provided. However, the master plan outlines goals to improve basic services with limited resources, while additionally addressing issues facing Kansas City.

Related to neighborhood park planning, the action plan addresses the importance of these types of parks, especially as related to the idea of community, stressing the importance of meeting the needs of the surrounding area and providing basic services in each neighborhood. The methods presented in this study can provide useful tools for making decisions regarding service allocation and further presenting that information to the public with sound reasoning.

Study Limitations

While this study presents interesting findings about the degree of accessibility of high-need based populations in Kansas City, it should be acknowledged that this couldn't have been done without an element of bias. Due to the nature of the variables used, data availability and scope of analysis, decisions were made that influenced how the study was conducted and the concluding outcomes. As discussed in the literature review, a definitive meaning of equity is unrealistic, as what is fair or just is highly variable and contextual. In accordance with methods presented in previous research, this study employs a compensatory or need based approach to equity; need is limited to socio-economic variables (race, per capita income, and population density). The use of accessibility measures also represents a bias, as other distance-based metrics could also haven been used to address accessibility to neighborhood parks. In terms of socio-economic information, it was limited to Census 2000 data, as the Census 2010 data was not yet completely released at the start of this research. It is likely that the population has changed over the past ten years, yielding continued growth patterns that tend to favor the suburbs over the urban core; however, use of this data still presents valid findings that could be compared to more recent data when it becomes available. Similarly, due to time constraints and manageability of data, the scope was limited to Kansas City, MO. The study area was defined as to emphasize the generalizability to a single jurisdiction and Parks and Recreation Department. While it doesn't allow for comparison across municipalities, it does address specific issues related to Kansas City MO and thus directly outlines how their resources serve their residents.

Future Research Opportunities

In response to findings and study limitations, this project frames new opportunities and questions for future research in this field and for the Kansas City area. This study serves to address need and equity of neighborhood parks and reveals areas where park access is both high and where access is low. While this is a valuable contribution to park planning in terms of equitable distribution, it ignores qualitative differences in parks that would be interesting to explore. Even though parks may be accessible or equitably distributed in terms of their location, no conclusions can be made about whether parks are serving their surrounding populations in terms of amenities or facilities are provided, safety, maintenance etc. Due to limitations, location and distance were selected as the key variables to address access to parks; the results of this study could be further addressed as specific sites of low access could be analyzed, addressing potential opportunities for new parks that would provide access to surrounding neighborhoods. This study draws conclusions about population groups within the study area and how neighborhood transition over time has influenced the patterns of accessibility to neighborhood parks today. By expanding the study area to include other cities, particularly those characterized by low-density, non-contiguous development, it might provide a valuable comparison of urban and suburban patterns of distribution and access. Where as this study can only be generalized to the Kansas City, MO area, increasing the scope would allow for conclusions to be drawn about the Kansas City Metropolitan area as a whole.

Conclusions

Parks provide open space and recreational opportunities for city residents and serve as one of the most basic elements of public infrastructure needed to make cities livable. However, as evident in many studies, parks are not always equitably distributed to various populations throughout the city. Whether this is a result of accidental or intentional actions, allocation of parks as a public resource is a fundamental responsibility of city officials and planners. While this study reveals a current pattern of equitable distribution, it is important to recognize the trends and implications on park planning in Kansas City that will influence future patterns. Notably are demographic and population changes that have occurred in the urban core; while there has not been as significant decline, there has also not been marked increase in recent years. As Kansas City strives to make their downtown and surrounding neighborhoods viable, they will have to consider how to retain and grow their population, as well as draw people back to the center. In light of changes, there will need to be greater focus on needs based considerations that link planning decisions to community values and goals; as neighborhoods continue to change, it will also be important to account for groups limited by income, mobility, language and/or cultural barriers. These changes will continue to alter patterns of equity and access that planners will have to consider.

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Appendix A- Summary of Previous Literature

Author	Study	Measurement Definitions	Variables	Notes
Laswell, 1958	Politics: Who Gets What, When, How	Accessibility of Public Resources		Who, What, When of Public Resources Unable to retrieve original work
Hodgart, 1978	Optimizing Access to Public Services: A review of problems, models, and methods of locating central facilities	Levels of Accessibility	Minimizing Travel Costs, Maximizing Demand, Minimizing maximum distance, covering, spatial interaction techniques	Used in Nicholls and Shafer Unable to retrieve original work
Knox, 1978	The restless urban landscape: Economic and socio-cultural change and the transformation of metropolitan Washington	Accessibility and Equity in Resource Distribution	Gravity, Proximity and Locational Model	Demonstrated how gravity-based measures of proximity to urban services could be used as indicators of social well-being in cities
Lucy, 1981	Equity and Planning for Local Services	Equity	Equality, Need, Demand, Preference, Willingness to Pay	How equity can be incorporated into local planning decisions. Applicable to the spatial distribution of services and facilities
Crompton and Wicks, 1988	Implementing a Preferred Equity Model for the Delivery of Leisure Services in the US Context	Equity	Equality, Compensatory, Demand, Market Equity	Emergence of equity as an administrative concern, context of leisure services in US,

Author	Study	Measurement Definitions	Variables	Notes
Truelove, 1993	Measurement of Spatial Equity	Equity Spatial Mapping	Equality, Compensatory, Demand, Market Equity	Spatial Equity of a Facilities System
Marsh and Schilling, 1994	Equity Measurement in a facility location analysis: A review and framework	Equity	Equity, Effect, Group Locational Models	Selecting sites for facilities through diff. measures of equitable distribution
Talen, 1998	Visualizing Fairness: Equity Mapping for Planners	Equity Accessibility Spatial Mapping	Equity: Equality, Need, Demand, Market Accessibility: Gravity Model, Minimum Travel Cost, Covering, Minimum Distance	Equitable distribution, locating resources or facilities so that as many different spatially defined groups as possible benefit
Talen and Anselin, 1998	Accessing spatial equity: An evaluation of measures of accessibility to playgrounds	Equity Accessibility Spatial Mapping	Equity measures Locational and distributional modeling	Move beyond discrete notion of access to one where access is measured in a continuous manner over space
Lindsey et. al., 2001	Access, Equity and Urban Greenways: An Exploratory Analysis	Equity Accessibility Spatial Mapping	Proximity as a measure of access GIS, locational measures	The study uses proximity as a measure of access and simple GIS analyses of census and other data to assess equality of access. Evidence is provided that suggests that minorities and the poor have disproportionate access to trails.

Author	Study	Measurement Definitions	Variables	Notes
Nicholls, 2001	Measuring the accessibility and equity of public parks: a case study using GIS	Equity Accessibility Spatial Mapping	Need based equity Locational accessibility measures	least advantaged defined according to socio-economic characteristics of age, income, race/ethnicity, and population density the groups considered were young, elderly, minorities and those living in areas of higher population density
Nicholls and Shafer, 2001	Measuring access and equity in a local park system: the utility of Geospatial Technologies to Park and Recreation Professionals	Equity Accessibility Spatial Mapping	Need based equity Locational accessibility measures	Planning for parks that are accessible is increasingly important Use of GIS
Comer and Skraastad-Jurney, 2008	Accessing the Locational Equity of Community Parks through application of GIS	Equity Accessibility Spatial Mapping Spatial Autocorrelation	Need based equity Locational accessibility measures Spatial autocorrelation	Increased use of GIS technology, variety of accessibility models integrated with spatial autocorrelation

Appendix B – Park Types

Classification	General Description	Location Criteria	Size Criteria
Mini Park	Used to address limited, isolated or unique recreational needs	Less that ¼ mile distance in residential setting	Between 2,500 sq. ft. And one acre
Neighborhood Park	Serves as the recreational and social focus of the neighborhood. Focus is on informal active and passive recreation.	¼ to ½ mile distance and uninterrupted non-residential roads and other physical barriers	5 acres is considered minimum size. 5 to 10 acres in optimal
Community Park	Serves broader purpose than neighborhood parks. Focus is on meeting community-based recreation need, as well as preserving unique landscapes and open spaces.	Determined by the quality and suitability of the site. Usually serves two or more neighborhoods and ½ to 3 mile distance	As needed to accommodate desired uses. Usually between 30 and 50 acres.