THE ECONOMIC IMPACT OF PARKS ON RESIDENTIAL PROPERTY VALUES: EVIDENCE FROM GAINESVILLE, FLORIDA

By

BRITTANY ANN MCMULLEN

A THESIS PRESENTED TO THE GRADUATE SCHOOL
OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF ARTS IN URBAN AND REGIONAL PLANNING

UNIVERSITY OF FLORIDA

2011

To my grandparents, who always supported my academic endeavors

ACKNOWLEDGMENTS

First and foremost, I thank my Chair, Andres Blanco, and my Co-Chair, Paul Zwick. I learned and accomplished more than I thought I could as a result of their guidance. I also thank my peers who supported me in this endeavor, especially Gareth Hanley, who helped me brainstorm ideas and provided encouragement when I needed it most, and Tina D’Auria, for always providing a listening ear and being my work buddy for countless nights at Panera. I also thank all of the teachers who have guided me throughout the duration of my educational experience, from kindergarten to graduate school. I truly could not have accomplished so much without them. Finally, I thank all of my friends and family who encouraged me throughout the process. I appreciate every person who helped in some way with this undertaking, no matter the magnitude of their contribution.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Abstract of Thesis Presented to the Graduate School
of the University of Florida in Partial Fulfillment of the
Requirements for the Degree of Master of Arts in Urban and Regional Planning

THE IMPACT OF PARKS ON RESIDENTIAL PROPERTY VALUES:
EVIDENCE FROM GAINESVILLE, FLORIDA

By

Brittany Ann McMullen

December 2011

Chair: Andres Blanco
Co-chair: Paul Zwick
Major: Urban and Regional Planning

Human behavior will always have an impact on the natural environment. However, actions taken by local governments can work to reduce the impact and provide for sustainable communities. Through the creation and maintenance of parks, natural resources are preserved, and result in the provision of ecosystem services for communities. In addition to serving environmental sustainability interests, parks contribute to our overall physical and psychology well-being. Factors such as air quality, water quality, access to recreational opportunities, and existence of spaces for community engagement affect our physical and mental health. Despite the benefits that parks provide, budget constraints can present a challenge to providing these necessities. Because of this, there is a need to quantify the benefits that parks provide. Capitalization of park value into housing prices is one way to accomplish this. The goal of this study was to estimate the economic impact of parks on residential property values, using Gainesville, FL as a case study. Relying on principles established in reviewed literature, regression analysis was utilized to measure the correlation between market value of single family residential homes and proximity to the nearest park.

Results showed that, in some instances, proximity to a park does increase the value of a home; however, the impact varies by location. Further consideration of the use of the park is needed to better understand the impact. These findings indicate that parks used primarily for recreation do not have a positive impact on property values; negative externalities such as noise or traffic make it less desirable to live in close proximity to these facilities. Conversely, living next to a natural resource or leisure activity based park does have a positive impact on housing value. Overall, there is potential for citizens and local governments to receive economic benefits as a result of the preservation of open spaces in communities. Home owners benefit from higher property values, and local governments receive an increased amount of property tax revenue as a result.

CHAPTER 1
INTRODUCTION

Problem

Recent acknowledgement of environmental issues such as climate change and resource depletion has prompted cities to contemplate how they can address sustainability in the built environment. The consideration of environmental issues can been guided by four laws of ecology, established by Barry Commoner in his 1971 book *The Closing Circle.* These laws remain timeless: everything is connected to everything else, everything must go somewhere, nature knows best, and there is no such thing as a free lunch. These basic principles have been used as a guiding point for many environmental issues, and refer to “the environment” not as an entity outside and separate from people, but something that we are a part of and exist symbiotically with. The ideas that “everything is connected to everything else” and “nature knows best” seem to have dissipated from the minds of some policy makers and others who influence the design and maintenance of the built environment. Although interest in environmental issues has recently increased, in past years strategies for sustainability and regeneration in urban settings have chiefly focused on manmade and built components (Chiesura, 2003, p.129). Permanently preserved open spaces such as parks can be used as a mechanism to address the need for environmentally sustainable cities. At the microenvironment level, they provide ecosystem services such as stormwater control and air control. The existence of soil and natural resources in areas that may otherwise be filled in with concrete or asphalt aides in the natural regulation of rainfall, which affects water quality and runoff issues. In addition, trees act as natural air quality control (Costanza, 1997). Open spaces are also essential in temperature regulation; trees and plants provide shade and maintain a certain degree of humidity (Morancho, 2003). They also provide for the preservation of habitats, especially when design is focused on the connectivity of existing and future parks.

Aside from the numerous benefits for habitats and natural resources, permanently preserved open spaces, such as parks, play an important role in addressing physical and psychological human health issues in urban settings. In regards to physical health, the recreational benefits that parks provide for communities are obvious. They promote healthy living by providing for the opportunity to exercise and engage in physical activities. The existence of parks, playgrounds, and organized sports in neighborhoods has been shown to play a key role in the prevention of childhood and adolescent obesity (Goodman, 2002), an issue that is gaining increased attention across the country. Not only do parks in urban settings impact physical health through the provision of recreational opportunities, they are also a contributing factor to psychological wellbeing; it has been argued that simply coming into contact with nature is a basic human need (Maller, 2003). Evidence has shown that the existence of natural resources in cities has the potential to reduce stress and foster overall psychological wellbeing by providing an “escape” from urban living (Parsons, 1991). Some research has gone so far as to suggest that having access to natural resources is not only important, but essential for long term human health and development (Driver et al., 1996). In addition, evidence has shown that the existence of natural settings in urban locations can reduce crime. Keo (2001) suggests that “greener” surroundings lead to lower levels of fear in residents, and behavior that is less violent. Parks also provide an outlet for community engagement through recreational activities and opportunities for interacting in informal meeting places. As Baum (1999) states, a key component of healthy communities is the provision of various opportunities for citizens to interact both formally and informally with each other; parks serve this interest. “People with access to nearby natural settings or parks have been found to be healthier overall than other individuals, and the long-term, indirect impacts of ‘nearby nature’ can include increased levels of satisfaction with one’s home, job, and with life in general” (Maller, 2009, p. 66). In short, permanently preserved open spaces in cities address environmental sustainability and human health issues in ways that manmade components cannot.

The idea that parks contribute positively to health is not a new one. Physical and psychological health justifications used today were used when parks were first designed in the nineteenth century. Many parks were developed based on the hope that they could provide positive physical and psychological health advantages, such as reduction of disease, recreational opportunities, and reduction of stresses associated with urban living; in essence being the ‘green lungs’ for a city (Maller et al., 2009, p. 54). Although the importance of parks in urban settings has been a notion recognized since the early stages of urban planning in the United States, the provision and maintenance of these resources is not always a top priority when other more pressing issues are present and budgets are limited. However, as Maller states

> Because our water quality, air quality, economic vitality, and personal well-being are as dependent on natural resources as they are on transportation, communications, and public safety systems, parks, by providing access to nature and protecting ecosystems, are an essential part of the infrastructure of our cities and communities. (p. 55)

Based on evidence of the importance of natural settings in urban environments, there are important questions to be answered about how to make environmental efforts appealing to governments, businesses, and individuals. While some make efforts to be environmentally responsible simply because they are aware of the necessity to do so, many do not see enough incentive to employ environmentally friendly practices, or may even find it cost prohibitive. Factors such as limited budgets can lead to a deficit in the existence and maintenance of parks and open spaces in a community (Tyrväinen and Väänänen, 1998). Aside from the fact that parks are a public amenity that are not a pressing issue compared to things such as safety or transportation, they are often seen as an investment that offers little to no financial return. Therefore, it is imperative that financial justification for parks and open spaces be provided in order for communities to find reason to successfully support these resources.

This leads to the major impetus for this research: how can the value of things such as improved water or air quality, protection of a habitat, flood control, the opportunity to interact with nature, or the various other physical and psychological health benefits to a community be quantified? Placing an estimated market value on a nonmarket good is difficult. While studies attempting to put an objective monetary value on parks have emerged largely in the last 45 years or so, the concept of developing parks with at least the partial intention of reaping economic benefits is in fact not a new concept. The initial development of parks in America was partially driven by the expectation of economic contributions to city tax revenues (Nicholls, and Crompton, 2005). However, this concept seems to have become less recognized in recent years, with parks being held low on the priority list during times of budget shortfalls. Much of the earlier research on this topic arose because of the fact that, although there was a general consensus that parks had a positive influence on the real estate values of the properties around them, there was a lack of evidence to back up the theory. Therefore, there was a desire to develop an objective method of evaluation in order to more accurately account for the benefits provided by such investments and provide this information to the public.

Calculating the market value of the human health and ecosystem services offered by parks and open spaces can be approached using a number of methods. There are two commonly used approaches. The first is the use of consumer surveys, which ask consumers to rank the importance of park or open space location in their decision to move to or visit an area. A 1995 study conducted by American Lives, Inc. found that a significant number or home buyers in a study area (77.7 percent) ranked open space as “essential” or “very important” in planned communities (Racca and Dhanju, 2006). Simply considering the fact that properties for sale are often advertised as having the benefit of nearby natural amenities is an indicator of the desirableness of these resources to consumers (Crompton, 2005). The second method used to estimate value is based on statistical theories, and relies on the use of hedonic pricing models. This method attempts to capitalize the value of nearby open spaces and other variables into property price. In a competitive housing market, prospective homebuyers will bid up the prices of homes with desirable surroundings, thereby capitalizing such externalities into the price (Anderson and West, 2006). Many studies utilizing hedonic methods have shown a positive relationship between recreational features and increased valuations of properties located near them. Crompton (2005) suggests that houses located in close proximity to a park can receive an added value of up to 20% (p. 203).

In addition to benefiting home owners, the increase in property values in turn results in an increase in government revenues due to the subsequent increase in property taxes. Some literature suggests that the increase in property tax revenues can absorb the cost of designating and maintaining the park itself (Crompton, 2000). Furthermore, some evidence proposes that the preservation of open space can be an alternative that is less expensive than development of the land because of the infrastructure that goes along with building homes (schools, roads, utilities, etc.). In this sense, it can be argued that parks and open spaces are essential in maintaining economic stability of communities rather than a drain on the budget (Crompton, 2000). It is for these reasons, Crompton argues, that creating and maintaining parks in communities can be economically sound.

Research Questions and Objectives

The purpose of this research was to examine whether or not parks have an economic impact on nearby residential properties, and what potential economic benefits can be seen by the community as a result. Research is based on the following questions:

- Do parks have an economic impact on proximate residential property values?
- If so, is the impact positive or negative?

Through the use of qualitative and quantitative analysis, using Gainesville, FL as a case study, these questions are answered. The hypothesis is that there is a negative correlation between distance to parks and property values; as distance goes up price is expected to go down. The relationship is expected to be nonlinear because of the positive and negative externalities resulting from the park.

Method

Housing is considered a multi-attribute good. Hedonic pricing models, or regression analyses, are used to estimate the economic value that each attribute contributes to the total price of the property. Analysis for this study was centered on the estimation of the value of a park located within a specified distance of residential properties, measuring distance to the nearest park in feet. Two regression analysis methods were utilized: ordinary least squares (OLS), and geographically weighted regression (GWR). Beginning with the ordinary least squares regression method, the relationship between the dependent variable (market value) and independent variables relating to structural, neighborhood, and park location attributes was tested. Using independent variables that were discovered to be statistically significant, geographically weighted regression analysis was then performed to improve upon the results. The use of this method allowed for a more in depth analysis of how specific parks of different types impact property values at different locations.

CHAPTER 2
LITERATURE REVIEW

Introduction

This chapter contains information substantiating the background and methods of this study. The first portion provides a basis for understanding the variables that affect residential property values. This includes a review of the basic components of property price, as well as a discussion of how a specific variable, such as distance to a park, impacts price. After establishing core principals, a review of case studies which have utilized hedonic pricing models is provided to allow for a better understanding of the application of these models, and to provide support for the hypothesis that parks have a positive economic impact on proximate property values.

Valuing Residential Property

To estimate the impact that an independent variable such as distance to a park has on the value of residential property, it is important to first have an understanding of the numerous variables that affect housing values. Housing is a multi-attribute good (Morancho, 2003). In other words, arriving at a final value for housing price takes into account a bundle of attributes. While the specific variables that are used may differ from one study to the next, there are general characteristics that apply to them all. According to Freeman (2003), housing prices are based on three basic categories of attributes: structural, neighborhood, and environmental (see figure 2-1).

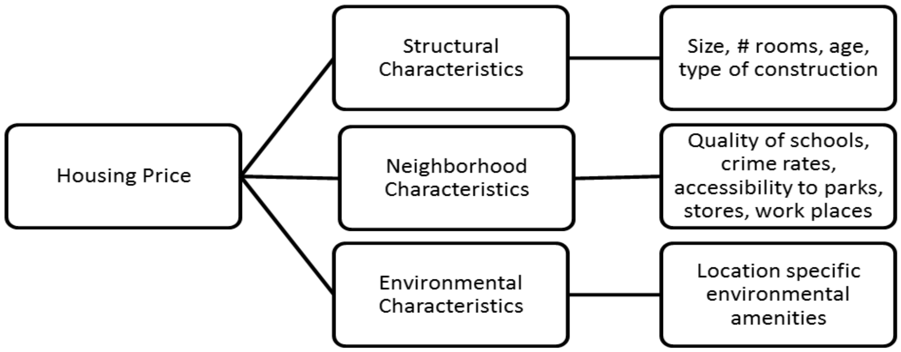


Figure 2-1. Determinants of property values. (Freeman 2003)

In this model, structural characteristics include features of the housing unit, such as age of the house, number of rooms, and type of construction. Neighborhood characteristics include features of the area in which the house is located. This can include quality of neighborhood schools, crime rates in the area, and accessibility to amenities such as parks, stores, and work places. Finally, in this model, environmental characteristics are location specific environmental amenities, such as air quality, water quality, etc. As Freeman notes, there is a challenge with assigning value to some environmental characteristics. For example, it is difficult to assign an exact number to a factor such as air quality, as it changes over time due to things such as emission levels or meteorological factors (Freeman, 2003). This speaks to the problem addressed by this research.

Nicholls (2002) expands on this concept, defining property price to be equal to structural, neighborhood, community, time related, environmental, and locational attributes (see figure 2-2).

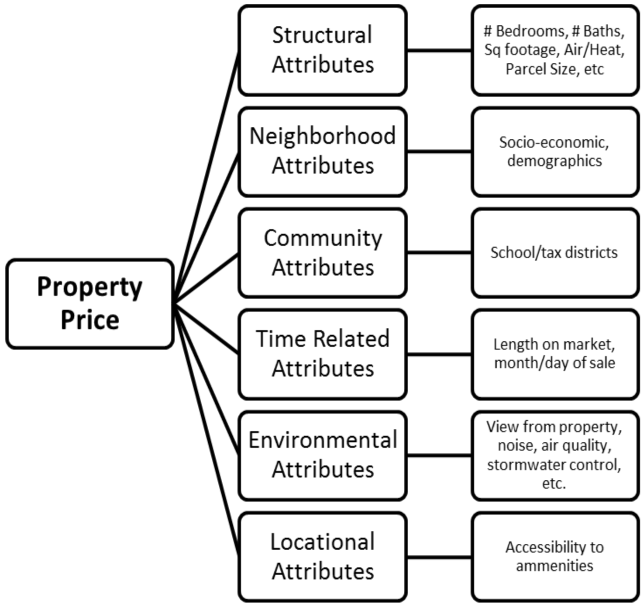


Figure 2-2. Determinants of property values (expanded). (Nicholls, 2002)

His definition of structural attributes is similar to the definition provided by Freeman, with a few additional considerations. In Nicholls' definition, structural attributes include number of bedrooms, number of bathrooms, square footage, existence of air conditioning/heat, and parcel size. Neighborhood attributes differ from Freeman's model however, accounting for variables such as the socio-economic and demographic characteristics of an area. For example, average income, poverty levels, ethnic composition, age, etc. would fall into this category. Neighborhood attributes can also include characteristics such as quality of neighboring structures, ownership versus rental composition, and population density. The third variable discussed by Nicholls is community attributes. These are factors such as school and tax districts. These do not need to be considered in areas which share the same attributes in this regard. Time related attributes are those which affect property values as they relate to the real estate market as a whole. These include the month and day of a sale and the length of time that the property was on the market. Environmental attributes are along the same lines as those discussed by Freeman, and include factors such as the view from a property, noise levels, pollution levels, and stormwater control. Locational attributes are the final variable discussed by Nicholls, and include characteristics that Freeman includes in the neighborhood characteristics category. These include things such as proximity and accessibility to various amenities or services. Brigham (1965) terms this the amenity value. As he states, the level of an amenity value is undoubtedly a factor that is subjectively determined by every individual. Proximity to such amenities can have a positive or negative effect on property values. For example, properties located in close proximity to a waste site would be expected to be negatively affected by such an amenity, while properties located near public transportation would be expected to exhibit positive benefits. Other examples of locational attributes provided by Nicholls include access to power lines, highways, shopping centers, and employment opportunities.

Estimating the impact of parks in particular can be accomplished by using characteristics of parks, such as distance, for one of the explanatory variables. The idea that parks have a positive impact on property values can be referred to as the proximate principle, which, as Crompton (2005) describes, is based on the theory that people are often willing to pay more for a home located close to a park than they are for a similar home that is located farther away. Following Nicholls' previously cited formula, parks fall into the category of either locational attributes or neighborhood attributes, in the context of accessibility to amenities. Parks could also be considered in environmental attributes as well because of their provision of views of nature and improved quality of things such as pollution levels and stormwater control. In the cases in which distance has been shown to increase values of proximate properties, Crompton suggests that the impact is not equally seen by all properties surrounding a park; this he terms the ‘net effects curve’. The positive impact to properties located directly adjacent to a park may be lower than the impact on properties located a short distance away (see figure 2-3). Homes located on the edge of a park may be subject to nuisances created by access points or the noise that results from park activities, thereby affecting the degree to which the properties benefit from the positive externalities.

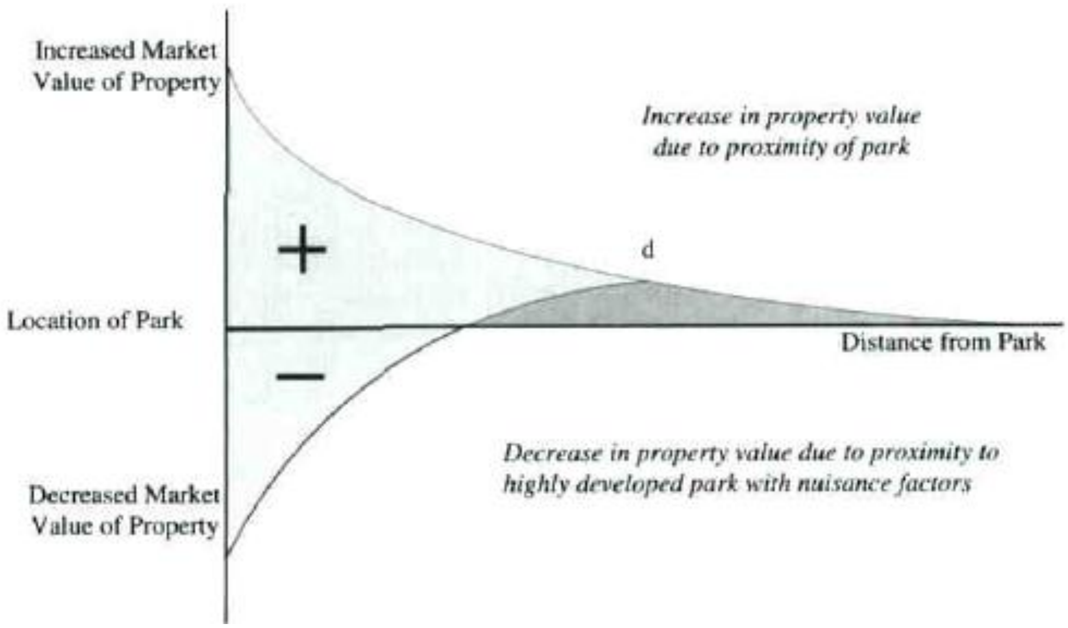


Figure 2-3. The Positive and Negative Impacts of Parks on Residential Property Values. (Crompton, 2005)

As previously discussed, the price of a good can be considered as the sum of the price paid for each individual characteristic. The use of regression models, more specifically hedonic pricing models, allows for the estimation of the marginal implicit price of a specific characteristic related to a differentiated market good (Irwin, 2002, p.466), which represents the buyer's marginal willingness-to-pay for a specific characteristic (Crompton, 2005). Put differently, these models allow one to isolate and quantify the effect that a specific variable or variables have on the price of a market good. In terms of real estate valuation, these models assume that housing prices are in equilibrium, meaning that individual consumers have purchased a home which is the most utility maximizing for them, given the prices of other housing locations, and that the price just clears the market considering the characteristics of the house and the existing stock of housing in the area (Freeman, 2003, p.357). In addition, these models traditionally assume that the study area is representative of a single market for housing (Bolitzer and Netusil, 2000, p.186). Freeman (2003) provides the following representation of a hedonic pricing model, based on theories proposed by Rubinfeld (1977), Polinsky and Rubinfeld (1977) and Witte et al. (1979):

$$Rh_j = Rh(S_j, N_j, Q_j) \qquad (2\text{-}1)$$

Where:

- (Rh_j) = Price of the j^{th} residential location
- (S) = Structural characteristics
- (N) = Neighborhood characteristics
- (Q) = Environmental characteristics.

Nicholls (2002) uses a linear form of the model derived from the same premise:

$$P = \beta_1 + \beta_S X_S + \beta_N X_N + \beta_C X_C + \beta_L X_L + \beta_E X_E + \beta_R X_R + \mu \qquad (2\text{-}2)$$

where:

- P = observed property prices
- X_s = structural attributes
- X_N = neighborhood attributes
- X_C = community attributes
- X_L = locational attributes
- X_E = environmental attributes
- X_j = time attributes
- μ = stochastic disturbance term (variables that are not included in the model)
- β_1 = constant term
- β_x =estimates of relevant attributes' implicit marginal prices after differentiation.

In the case of these equations, residential property value is the dependent variable, and the attributes that make up that value are the explanatory, or independent, variables (Knaap, 1998). The hedonic variable is that which is being tested and, holding all other variables constant, allows for the estimation of its influence on market values (Morancho, 2003, p.36). In the case of estimating the value of proximity to parks, distance to a park is the hedonic variable. The specific variables that are used may differ depending on what is being tested and how groups of attributes are defined, but the basic concept remains the same for these types of market price valuations.

Different functional forms of a hedonic pricing model can be applied. Linear forms are commonly used. As Morancho (2003) describes, in linear methods, the willingness to pay remains constant; in other words, there is no dependence on the starting level of the marginal willingness to pay (p. 37). A commonly used linear modeling technique is the ordinary least squares regression method. As explained by Craven (2011), this method is "a generalized linear modeling technique that may be used to model a single response variable which has been recorded on at least an interval scale". It may be applied to one or to several explanatory variables as well as categorical explanatory variables (p.224). It operates on the basic assumption that the relationship between the response (dependent, or Y) variable and the continuous (independent, or X) variable can be represented using a line of best fit, where the response variable is predicted by the continuous variable (p.224). Craven provides this equation for representing the relationship mathematically:

$$Y = \alpha + \beta_x, \tag{2-3}$$

Where:

- α = the value of *Y* when *X* is equal to zero
- β = the slope of the line, or correlation coefficient

The correlation coefficient describes the change in *Y* that is associated with a unit change in *X*.

These types of models present limitations. Morancho (2003) suggests that one limitation stems from the assumption that the relationship between price and an environmental variable may be non-linear. It is because of this that logarithmic forms are often used. However, linear models are often chosen because the parameters are easier to interpret. Another common problem that is associated with regression models in general is multicollinearity. As explained by Sundberg (2002), multicollinearity refers to exact linear relationships within a set of variables, usually explanatory. This results in unstable coefficients, which are sensitive to minor changes in input data. It may also result in coefficients which are not uniquely defined or have inflated variances, leading to the impossibility to interpret them independently. As Sundberg goes on to explain, eliminating collinearity problems can be approached by eliminating one of the variables in a collinear relationship. The challenge resides in the ability to identify which variables are exhibiting multicollinearity. The box-cox flexible functional form along with utilizing a goodness of fit test has been used by many researchers to address this issue (Anderson, 1982, p. 334). However, Anderson warns of four major limitations of using the box-cox functional form. The first limitation is that best fit criterion cannot be relied upon to achieve accurate estimates of characteristic prices; in fact, accuracy is reduced by the large number of coefficients estimated with the Box-Cox functional form, possibly leading to inaccurate estimates of prices. Second, it is not appropriate to use with any dataset containing negative numbers because of the impossibility of raising a non-integer number to a non-integer power.   Third, because the result of the mean predicted value of the dependent variable may not equal the predicted value, the predicted value may be biased. Finally, the results of nonlinear transformations are often complex estimates of slopes and elasticities which are simply too cumbersome to use.

One of the more problematic limitations relating to linear models and techniques such as ordinary least squares is the issue of spatial heterogeneity. Hedonic pricing models assume that the study area is representative of a single market for housing, and therefore impose a constant price structure on all housing units. However, as Bitter (2007) states, increasing evidence has shown that more consideration should be given to spatial issues, because the marginal prices of many attributes vary over space.

> If spatial heterogeneity exists, stationary coefficient models will produce parameters that are in essence an ‘‘average’’ value of the parameter over all locations. A failure to incorporate spatial heterogeneity will result in biased coefficients and a loss of explanatory power and may obscure important dynamics relating to the operation of housing markets. (p. 8)

To account for this issue, the geographically weighted regression method can be used. This technique calculates correlation coefficients at each individual location by performing a regression at every observation point, rather than assigning a single coefficient that is in essence an average value of all locations. This method is a relatively new technique, having been introduced to geography literature in 1996 by

Brunsdon et al. (Wheeler and Páez, 2010). Overall, many options exist for employing regression techniques; as Anderson (1982) states, there is no globally accepted functional form to use in regards to hedonic pricing models. Therefore, he suggests the reasonable action is to try more than one form and ultimately use the model that shows the best performance.

Hedonic Pricing Models – Case Studies

Many case studies attempting to estimate the added value of parks use variations of the previously discussed models, and have shown that parks and other open spaces do have a positive impact on residential property values (Bolitzer and Netusil, 2000; Nicholls and Crompton, 2005; Anderson and West, 2006). Studies in this area have explored the effect of different types of open spaces, including parks, greenways, agricultural land, forest land, and lands with conservation easements. Their results suggest the economic impact that is realized can be partially dependent upon the type of park or open space. Geoghegan (2002) suggests two basic categories of open space: developable and permanent. He performed a case study regression analysis to distinguish between the impacts of the two categories. By his definition, developable open space includes designations such as agricultural cropland, pasture, and forest; permanent open space includes parks and lands with conservation easements (lands that have no chance of being developed in the future). The results from his model showed that individuals are willing to pay more, up to three times as much, to live in closer proximity to permanent open space than developable open space. Not only are there different categories of open space to consider, reviewed literature suggests that different categories of parks should be considered as well.

Parks are often distinguished by their size, the area that they provide service to (such as neighborhood or community), or use type. The following is a review of three case studies which utilize hedonic pricing analysis to estimate the economic value of open spaces, mainly parks or similar open space categories. The results of these studies provide evidence which supports the hypothesis that proximity to parks does have a positive economic impact on residential property values.

One of the earlier studies investigating this topic focused on a neighborhood park in Lubbock, Texas. Kitchen and Hendon (1967) conducted a case study for the purpose of estimating the economic benefits derived from the location of public recreation. They categorized the types of benefits received from parks as primary and secondary. Primary benefits are defined as those that benefit a user of the amenity. For example, this would include the benefits that one gets from utilizing the recreational facilities of a park, or someone who enjoys the scenic view. Secondary benefits are those affecting the local economy, such as increased tax revenues resulting from recreational developments. The focus of their study was secondary benefits. The hypothesis was that the value of land diminishes the further away a property is from a park. Their method involved estimating the distance to the park and performing correlations of house price and distance, house-assessed value and distance, and property value and distance. For this, they used a linear correlation analysis. As a basis for their analysis, they selected a 10 acre neighborhood park in a residential area that was considered to be mostly homogenous. The neighborhood included houses that were priced from $12,000 to $18,000 (in 1967 dollars), and were relatively new at the time, having been built since 1950. According to their observation, there were no other significant amenities contributing to value in the neighborhood besides the park. They created a "zone of influence", which was a 2 ½ block area around the park. They eliminated an area around a neighborhood school, as well as commercial areas, since those factors were predicted to have an impact on property values as well. The zone of influence resulted in an initial 550 properties to be included in the study. They collected three sets of data to analyze: access distance (in feet), sale price (of properties sold within the prior 5 years), and assessed value, which was retrieved from the county Property Appraiser. The final sample set included only data regarding properties that had been sold in the five years prior to the study (480 in total).

They first performed a linear analysis between access distance and value of parcels. This did not result in a significant statistical relationship between variables. Therefore, there was no support for the hypothesis in this case. A second analysis was performed using distance and sale price of parcels. This resulted in a statistically significant relationship with a positive correlation coefficient of .0541, indicating that the value of properties went up the farther a property was from the park; opposite of the hypothesis. They offered several reasons to explain why the two models did not result in strong relationships. First, they cited the lack of a method to test for homogeneity in the market area being examined. They also postulated that variations in time of development could result in weak relationships (p.360). To address these issues, they performed a final correlation between land values alone and distance to the park, as opposed to looking at housing value as a whole. After running a significance test, it was concluded that the resulting coefficient of -.17 was statistically significant; there was a negative, although small, correlation between land value and distance to the park. In other words, land value decreased by $17 for every foot increase in distance.

Overall, in terms of proving their hypothesis, they concluded that land value was the only dependent variable that was impacted positively by proximity to the park. One explanation provided for this outcome was that land values are arguably more homogenous and objective than housing values, which are influenced by a number of different variables and personal preferences. As they point out, although the influence of park distance is relatively low in comparison to other variables influencing land values, in the consideration of the costs and benefits of parks it is significant to note.

Kitchen and Hendon's study, as well as similar studies conducted during this time period, provided a basis for subsequent research seeking to determine the economic impact of open spaces on property values. Studies conducted since then have yielded similar results, and have provided evidence based on not only land values, but also housing values, including structural and neighborhood attributes. One such study conducted by Bolitzer and Netusil (2000) examined the degree to which open space proximity had an effect on the sale price of a home in Portland, Oregon. They divided the study area into five quadrants: north, south-east, north-east, south-west, north-west. The following hedonic pricing model was used to calculate the value of open space in this study:

$$P_i = P(S_i, Q_i, G_i, ON_i) \qquad \textit{(2-4)}$$

Where:

- P_i = Price of home
- S_i = structural characteristics
- Q_i = environmental characteristics
- N_i = neighborhood characteristics.

As they considered open space characteristics to be a subcategory of neighborhood characteristics, they subdivided "N_i" into a vector of open space characteristics (G_i) and a vector of other neighborhood characteristics (On_i). Structural characteristics included age of the house, number of bathrooms, number of fireplaces, lot acreage, and square footage of the structure. A nuisance dummy variable for traffic was included, reflecting street traffic near a house. A location variable and size of the closest open space were also used. To account for neighborhood characteristics, they combined the distance to the central business district with the quadrant in which the house was located.

For their analysis, they utilized two sources of data. The first was county tax assessor data of home sales that occurred between 1990 and 1992. This included the date of sale, as well as structural and neighborhood characteristics. The resulting dataset contained 17,953 homes; however, homes with a sale price that did not indicate an arms-length transaction (sales of $1), and homes that sold for less than their assessed land value were not used. In addition, they did not include records which clearly indicated recording errors. The final dataset contained 16,402 samples, with a mean sale price (in 1990 dollars) of $66,000.

The second set of data included information such as distance to open spaces and the central business district, and was obtained from the Geographic Information System (GIS) of the elected regional government, Metro. Using a search radius of 1500 feet (a little over a quarter mile) from the sample properties, 218 open spaces were selected. The decision to use 1500 feet stemmed from the authors definition of block size, 200 feet, multiplied by a search radius of 7.5 blocks. If a home fell within 1500 feet of more than one park, the closest park was used. Open space was divided into four categories: public park, private park, cemetery, and golf course. The category with the highest frequency was public parks, with a count of 193. The rest of the study area consisted of two private parks, fifteen cemeteries, and eight golf courses.

Based on the assumption that proximity to open space influences marginal implicit price nonlinearly because of resulting positive and negative externalities, they used seven zones to categorize distance: 100 feet or less, 101–400 feet, 401–700 feet, 701–1000 feet, 1001–1300 feet, 1301–1500 feet and more than 1500 feet. The expectation was that value would increase up to a certain point, and then would begin to decline. They tested for three different scenarios, using linear functional and semi-log functional forms of the pricing model for each.

The first scenario they tested was model A: the effect of any type of open space within 1500 feet of a property, using a dummy variable for the existence of open space within the specified search distance. The correlation coefficient for the dummy variable was positive, and was statistically significant in both the linear and semi-log models. The linear model showed that the selling price of a home located within 1500 feet of open space sold for $2,105 (in 1990 dollars) more than a home located at a distance of more than 1500 feet. Open space size was also a factor, adding an additional $28.33 for every additional acre. Combining these two factors, for a home located within 1500 feet of an open space that is 20 acres, the value increased by $2,607. The results of the semi-log model showed that homes within 1500 feet of an open space would sell for 1.43% more than a home located outside of the 1500 feet zone. Size had an influence in the semi-log model as well, adding $1,247 to the price of a home within 1500 feet of a 20 acre park.

Model B refined the analysis by distinguishing between the four categories of open space. The linear and semi-log models resulted in only the public park and public golf course coefficients being statically significant. The estimated added value to a home within 1500 feet of a public park was $2,262; homes within 1500 feet of a golf course had an added value of $3,400. Private parks and cemeteries did not have a statistically significant effect. The semi-log model showed that proximity to a public park provided an increased value of $845, and proximity to a public golf course added $3,940. Private parks and cemeteries were again not found to be statistically significant. The size of open space was again statistically significant in both the linear and semi-log models. Using mean sizes, homes located near a public park had an increased value of $2,780 in the linear model, and a $1,360 increase in the semi-log model. Using the mean sizes of public golf courses, an increase of $6,408 was observed in the linear model and $6,926 in the semi-log model.

Model C focused on the effect of distance from an open space using the six distance zone categories. The smallest distance variable of 100 feet was included to capture homes in very close proximity to a park; they hypothesized that the homes in this zone would be impacted by the negative externality of noise. This model did not include traffic and size of open space variables; reasoning for removing the traffic variable was based on the assumption that traffic variables in the first two models would pick up on that negative externality. Open space size was not included, as the sole purpose of this model was the effect of proximity to open space. Results of this model were as expected; value increased to a certain point, and then declined the greater the distance got. The zone of less than 100 feet was the only zone found to be not statistically significant, neither proving nor disproving their hypothesis at this distance.

An important point that is noted by Bolitzer and Netusil is the difficulty of measuring how the positives and negatives of marginal implicit price of open space characteristics, such as proximity and type, are accounted for. Residents living next to a public park may experience positive externalities from their close location to the park, but may also experience the negative externalities of traffic and noise. A resident located at a somewhat farther distance, perhaps two or three blocks, may experience the same positive externalities due to their proximity, but not the same negative externalities as those located directly adjacent to the park. These results provide evidence to support the aforementioned net effects curve. Their overall conclusion was that distance to an open space can have a statistically significant effect on the price of a home; however, the level of influence is dependent on the type of open space. In addition, the effect that is seen can vary depending on which functional form is used (linear or semi-log). Based on their results, they concluded that the semi-log form is more appropriate for these types of relationships; a linear model is restricted because the relationship between the explanatory and dependent variable is not constant.

Morancho (2003) conducted a similar study which used a hedonic pricing model to analyze the relationship between housing prices and urban green areas. The sample consisted of 810 properties in Castellón, Spain. Explanatory variables influencing housing price included: age, number of bedrooms and bathrooms, size, existence of an elevator, number of car spaces in a garage, what floor the dwelling was located on, whether it was an individual house versus a studio or apartment, square meters of the balcony, whether or not it was classified as protected by public policies (thereby making it more fiscally advantageous), existence of a storage room, and distance from the town center (in meters). Three separate hedonic variables were considered in regards to parks: a dummy variable for view of a garden or public park (assigning a value of 1 if the house overlooks a garden or public park), size of the closest green area (in meters-squared), and distance to the nearest green space (in meters). The following model was used as a basis for analysis, and applies the same theory as the previously discussed models:

$$P = f(x_1, x_2, \ldots, x_n, z) \qquad (2\text{-}5)$$

Assuming a linear model, the following formula was used:

- $P_i = b_1x_{1i} + b_2x_{2i} + b_3x_{3i} + \cdots + b_nx_{ni} + b_zz_i + \varepsilon_i$
- $i = 1, 2, \ldots, T$

where "x_{1i}, x_{2i}, . . ., x_{ni}"," z_i" are variables describing the attributes of housing "i", parameters "b_1, b_2, . . ., b_n, b_z" are the marginal willingness to pay for each attribute and "εi" is the error term. The marginal willingness to pay for an additional unit of the environmental good "z" is "b_z". They utilized the ordinary least squares (OLS) method to analyze the data. They chose this this procedure because

> among hedonic models parametric specifications, OLS estimations provide similar results on the goodness-of-fit, the mean quadratic error and the forecasting capacity of the model to those provided by other specifications which are more difficult to interpret such as those devised by Box-Cox and Wooldridge. (p.38)

Table 2-4. Price determinants after eliminating collinear regressors (Morancho, 2003, p. 38).

Variable	Coefficient	*t*-ratio
SIZE	101.33	20.6
M2BAL	133.88	6.8
AGE	-46.19	-3.3
BATHS	2912.68	8.3
STORE	951.03	3.3
ELEVATOR	2464.51	5.5
PROTECTED	-2234.60	-8.4
HOUSE	-3238.75	-5.2
GREENDIS	-3.28	-6.0
C	-2554.30	-3.9

R^2 = 0.743, adjusted *R-squared* = 0.740, *F*-ratio = 257.09, *n* = 810.

Table 2-4 shows the results of the analysis using the OLS method, after eliminating collinear or insignificant variables (rooms, existence of garage, unit floor, distance from town center, elevator, green space views, and size of green space). Variables found to be collinear were not elaborated upon. All coefficients were found to be statistically significant. The value for R-squared showed that 74% of the price variance could be attributed to the explanatory variables. The t-statistics showed that the variable with the greatest explanatory power was housing size; the coefficient of 101.33 meant that a larger size equaled an increased housing price. The only variable that was found to be relevant in regards to green space was distance. The coefficient of -3.28 suggests that for every 100 meters, housing price fell by 328,400 pesetas. Green space size and the existence of a view of green space or public park were not statistically significant. Morancho postulates that the fact that size was not significant, but location in proximity to a green space was, suggests that the existence of numerous small parks throughout a city may be more appropriate than a small number of larger parks.

Crompton (2005) supports this idea, suggesting that the size and number of parks are important to take into account for the aggregate increase in property value and subsequent increase in property taxes. Based on the results of a case study performed in the Dallas-Fort Worth area of 14 neighborhood parks by Miller (2001), he posits that although large parks add more value to a property than a small park, the added value is small in comparison to the premium added by proximity. Therefore, a greater number of small parks will lead to a higher added value overall than one large park that does not allow for as many houses in close proximity. Figure 2-4 illustrates this point by showing the potential for dividing 50 acres of parkland amongst 6 smaller parks rather than one large park.

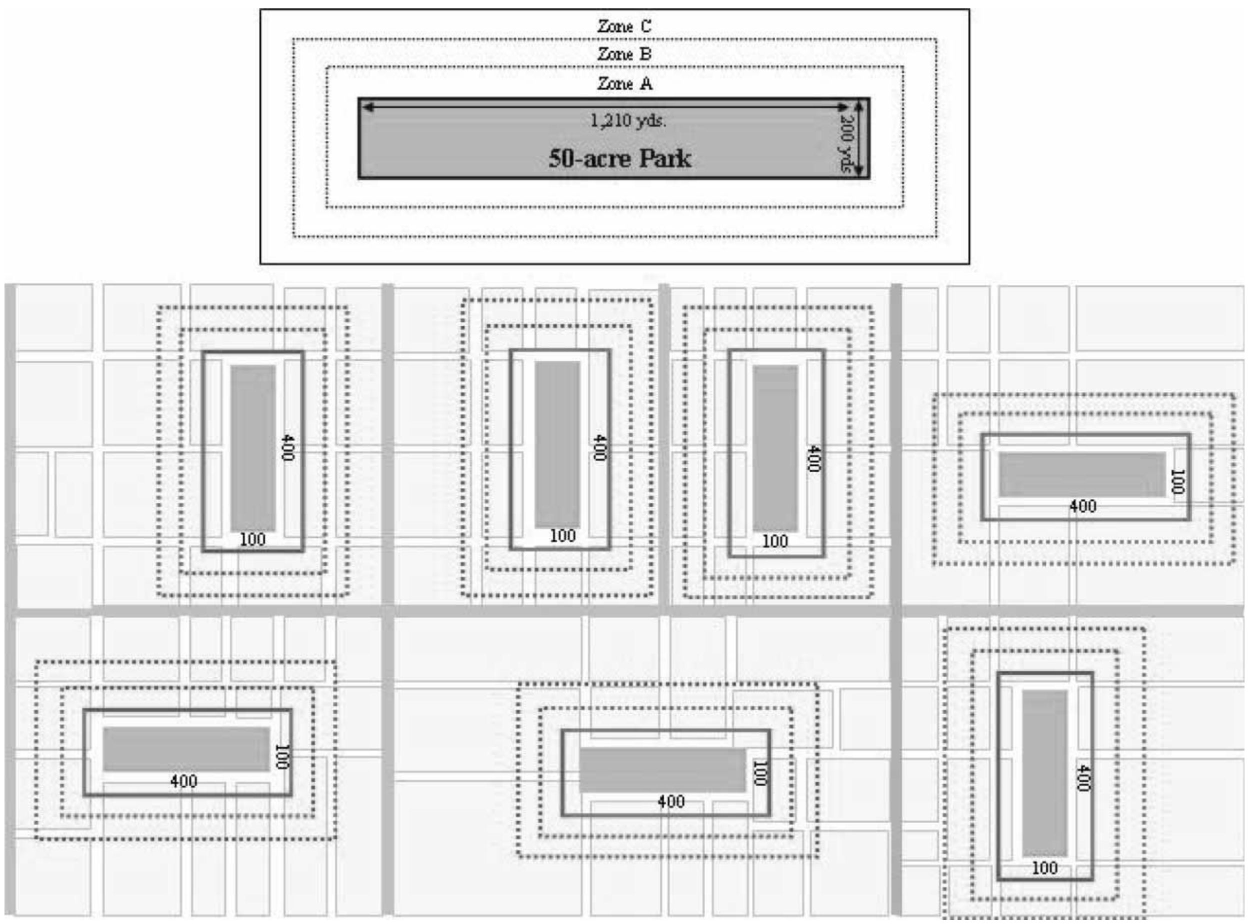


Figure 2-4. Implications for the proximate preminus. (Crompton, 2005, p. 210)

CHAPTER 3
METHODOLOGY

This study seeks to assess the economic impact of parks on residential property values. Based on noted evidence, the hypothesis is that proximity to a park will have a positive economic impact on the value of nearby properties. The relationship is expected to be nonlinear because of the positive and negative externalities resulting from the proximate park. As previously mentioned, there are two commonly used methods to approach this question: household surveys and hedonic pricing, or regression, models. Studies using household surveys are designed to elicit personal values or preferences and have qualities that might be more useful in a qualitative discussion of this issue. Since the aim of this study was to quantify the value of parks, and due to the fact that the reviewed literature utilized quantitative methods, regression methods were used for this analysis. Ordinary least squares (OLS) regression was first utilized to test the degree to which park distance is significant to housing prices. Because this method lacks the ability to account for spatial variants, geographically weighted regression (GWR) was subsequently used to achieve the most accurately defined model. In order to test for the impact of park distance on housing values, a case study of properties in Gainesville, FL was used.

Case Study

Gainesville is the largest city and county seat of Alachua County. It is approximately 62 square miles. According to 2010 Census data, the population is 134,297, with 55,296 households, and 62,322 housing units. Population density is 2,028.5 per square mile. The median age is 26, and the average household size is 1.6. It is the location of the University of Florida, the state's largest and oldest university, as well as Santa Fe College. Being the location of two educational institutions, there is a sizeable student population: 50,116 at UF (Office of Institutional Planning and Research, 2011), and 17,630 at Santa Fe College (Santa Fe College, 2011).

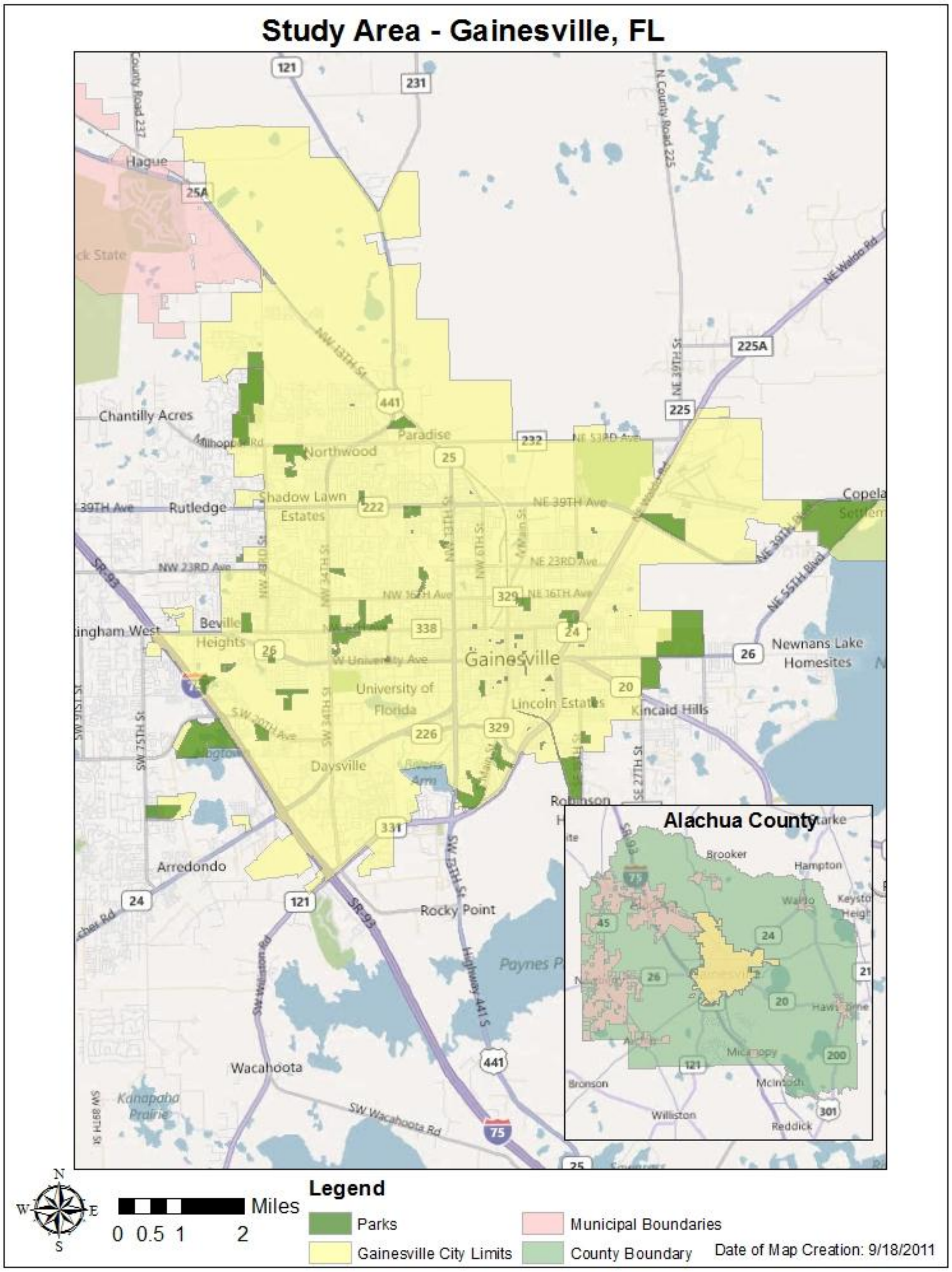


Figure 3-1. Map of Study Area

Data

Two datasets are pertinent to this study: single family residential properties in Alachua County, and existing parks within the Gainesville city limits. Property data was retrieved from the Alachua County Property Appraiser's master appraisal file. Neighborhoods are defined by census blocks, using 2010 Census data. This data was joined with property data to create one layer of properties and their respective neighborhoods. Parcel data was modified to include only parcels located in Gainesville, with the property use of single family residential (SFR), reflecting qualified sales, with the designation of "improved", and with a lot size greater than .10 acres. According to the Alachua County Property Appraiser's definition, sales are qualified if the price is reflective of a dollar amount relative to the assessed market value. For example, a sale between family members which results in a sale price lower than the market value would be considered unqualified. Properties classified as unqualified sales were removed because initial analysis was focused on sales price for one particular year. However, upon conducting further research, it was decided that using sales price would present a challenge in data analysis because of the variations in the real estate market over different years. As a result, properties from all sales years were used, and market value was used as the dependent variable. Market value is determined by the Alachua County Property Appraiser using a computer assisted mass appraisal (CAMA) system, and includes the consideration of the cost to reproduce the property, the ability of the property to earn income, and sales prices of other similar properties in the area. The average difference between the sale price and market value in this dataset was $761.66.

Data regarding parks was retrieved from the Alachua County Growth Management Geographic Information System (GIS) database. This database contains a dataset of 66 parks located within the city limits of Gainesville. They are owned and managed by public and private organizations, including Alachua County, the City of Gainesville, State of Florida, Boys Club of Alachua County, Girls Club of Alachua County, Gainesville Housing Authority, and the Florida Audubon Society. The largest park in Gainesville is Gum Root Park, a community natural resource park owned by the City of Gainesville, and is 370 acres. The smallest park is “Mini Park #09”, a neighborhood child recreation park owned by the City of Gainesville, and is .10 acres. Alachua County separates parks into three classifications based on the region that they serve: neighborhood, community, and regional. The Countywide Recreation Master Plan defines neighborhood parks as being small parks usually between 5 and 9 acres, and if recreation based, providing resources on a small scale. This can include practice areas, green spaces, and playing courts. They are typically located in close proximity to elementary schools and are designed to be accessible by a short bicycle or car commute. Community parks are designed to provide service on a wider scale. If the park provides recreational resources, it is for activities such as team sports. They can include facilities such as athletic fields, swimming pools, and recreation centers. They are usually between 20 and 50 acres in size, and are typically located near schools or other community services, such as libraries. In addition to these classifications, parks are placed in the following categories based on their use and resources: child recreation, leisure, mixed recreation, natural resources, public use facilities, and sports recreation. The category with the highest frequency and the greatest number of acres is natural resources, accounting for 17 of Gainesville's parks and 1,524 of total park acreage.

Table 3-1. Park categories in study area.

Park Type	Number of Parks	Acreage
Child Recreation	13	198.10
Leisure	8	135.50
Mixed Recreation	14	347.40
Mixed Resources	1	102.80
Natural Resources	17	1,524.20
Public Use Facilities	7	125.10
Sports Recreation	6	102.70
Total	66	2,433

Regression Analysis

Two methods were utilized to perform regression analysis: ordinary least squares (OLS) and geographically weighted regression (GWR). Applying the principles established in reviewed literature, OLS was used as the first approach to answer the research question. The following model is used as a basis for analysis:

$$Hp_i = f(S_i, N_i, L_i) \qquad \textit{(3-1)}$$

Where:

- Hp_i = Market Value of the i^{th} property
- S_i = Structural attributes
- N_i = Neighborhood Attributes
- L_i = Locational Attributes

Market value was used as the dependent variable in this model. Independent variables included structural attributes, neighborhood attributes, and locational attributes, specifically park attributes. Structural attributes included parcel size in acres, building size in square feet, building age in years, number of bedrooms, number of bathrooms, and building stories. Parcel size, square footage, number of bedrooms, number of bedrooms, and number of stories were expected to have a positive correlation with market value. Age was expected to have a negative correlation. Neighborhood variables included population density and percentage minority. Population density was calculated as the number of people in a census block divided by the number of acres. This variable was expected to exhibit a positive correlation coefficient because of Gainesville being the location of the University of Florida, which employs residents throughout Alachua County. It is more desirable to live in the city and be in closer proximity to the UF campus; therefore demand is higher, resulting in higher prices. Alachua County's population density is 279 people per square mile, compared to Gainesville's population density of 2,028.5 per square mile. Census data was limited to demographic information at the time of this study; therefore, percent minority was used as a proxy for low income. Because of this, a negative correlation coefficient was expected for this variable. (See figures 3-2 and 3-3 for maps illustrating population density and percent minority variables). Distance to the nearest park was used as the locational variable. Additional locational variables were considered, including type of the nearest park, size of the nearest park, and distance to the University of Florida campus. Results of this alternative model were compared to initial results in terms of the degree of spatial autocorrelation and the observed level of reliability of the models. After comparing results, the final model used for analysis of specific park locations included only distance to park as a locational variable.

Table 3-2. Variables used in regression analysis.

Variable Name	Variable Description	Variable Type	Expected Relationship
ACRES_CALC	Parcel size in acres	Independent	+
SQFT	Building size in square feet	Independent	+
AGE	Building age in years	Independent	-
BEDS	Number of bedrooms	Independent	+
BATHS	Number of bathrooms	Independent	+
STORIES	Building stories	Independent	+
DENPOP2010	Neighborhood population density	Independent	+
PCT_MNRTY	Percentage minority in census block	Independent	-
PARK_DIST	Distance to nearest park	Independent	-
MKTVAL	Assessed Market Value	Dependent	N/A

Three distances were considered for analysis: 500ft, ¼ mile, and ½ mile. Crompton (2005) suggests that the ½ mile distance has been generally accepted as being equivalent to a 5 minute walk. Distance was calculated using the “near” function in ArcGIS, which determines the distance from the nearest feature that is specified (in this case, distance was calculated between parcels and the nearest park within the specified distances). Considering the maximum search distance of ½ mile, there were 9,317 properties in the dataset (see table 3-3).

Table 3-3. Descriptive statistics of dataset.

	Minimum	Maximum	Mean	Std. Deviation
Acres	.10	11.12	.32	.30
Market Value	7900	805900	138880.12	64949.22
Sqft	399	10282	2141.41	850.04
Age	0	110	41.39	49.12
Beds	1	5	3.08	.60
Baths	1	7	1.91	.56
Population Density	0	62.96	5.60	3.14
Percent Minority	0	100	32.12	24.55
Distance to Nearest Park (ft)	26.16	2639.87	1355.25	707.03

n = 9,317

As noted by Bitter (2007) and Wheeler and Páez, (2010), the use of ordinary least squares presents a problem when considering spatial relationships because of spatial heterogeneity. This method assigns a global correlation coefficient to each variable, which is essentially an average of the coefficients of all points in the dataset. In order to account for spatial variation, geographically weighted regression was utilized. This method expands upon the ordinary least squares model by providing coefficients for each variable at each location. Because the relationship between variables fluctuates over space, three park locations were chosen for further analysis. The first two parks were chosen based on the fact that they were categorized as natural and leisure resources, categories that would be expected to have a lower comparative level of recreation use, and in turn a lower level of negative externalities such as noise or privacy reduction. In addition, upon reviewing results of geographically weighted regression analysis, both parks exhibited a variation in positive and negative coefficients regarding park distance. The third location was chosen based on the fact that it is a public use facility with the primary goal of providing for child care and recreation, as well as the fact that the majority of properties located within ½ mile of a park exhibited positive coefficients in regards to the park distance variable. It was expected that the first two parks would exhibit a variation of positive and negative correlation coefficients, and that a majority of correlation coefficients for the third location would be positive (indicating that properties do not benefit from living adjacent to that facility).

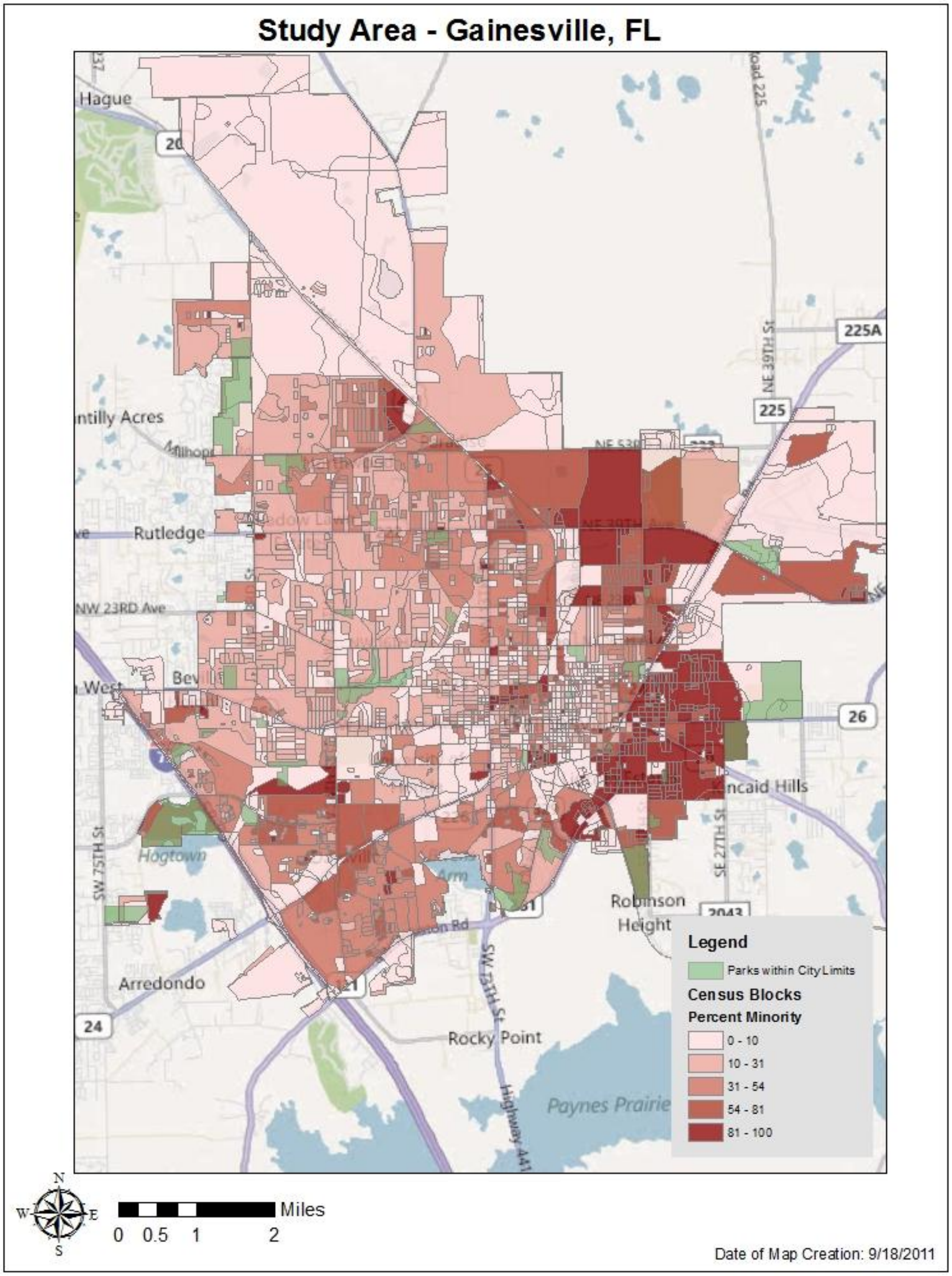


Figure 3-2. Map of study area – minority percentages by census block.

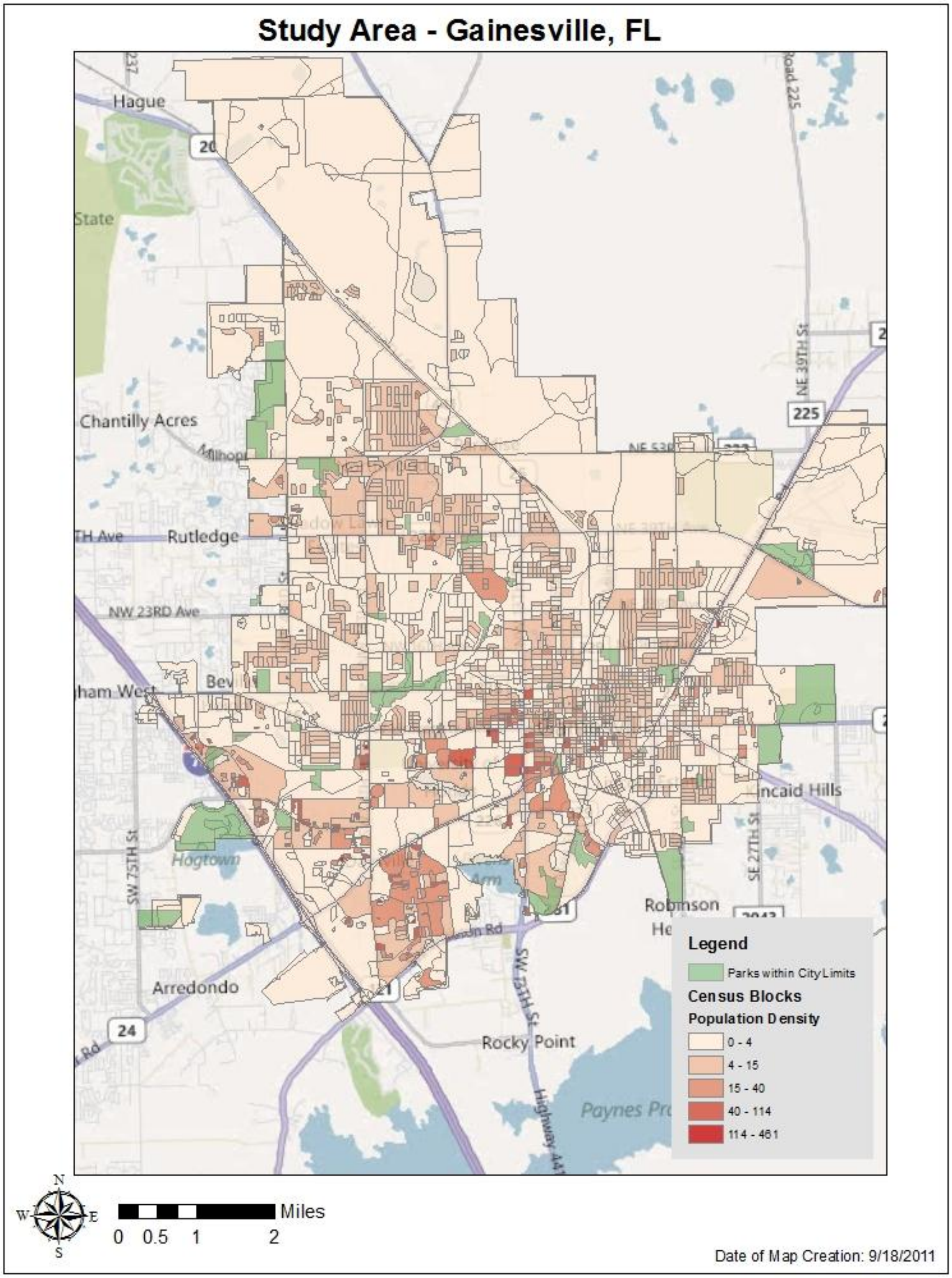


Figure 3-3. Map of study area – population density by census block.

CHAPTER 4
FINDINGS AND RESULTS

Ordinary Least Squares (OLS)

The primary concern of this study was the impact of proximity to parks; therefore, the first regression analysis that was performed included distance to the nearest park as the locational explanatory variable. Using the first search distance of 500ft resulted in a dataset of 1,290 properties with an average market value of $139,318. Average distance to the nearest park was about 295ft (see Table 4-1).

Table 4-1. Descriptive statistics of properties located within 500ft of a park.

	Minimum	Maximum	Mean	Std. Deviation
Acres	.10	3.44	.35	.33
Market Value	7,900	709,500	139,318	75894.40
Sqft	440	9105	2,150	1000
Age	1	110	44	20.33
Beds	0	5	3	.67
Baths	0	5	1.87	.62
Population Density	0	31.22	5.50	3.65
Percent Minority	0	100	34.32	27.11
Distance to Nearest Park (ft)	26.15	500	294.50	133.73

n = 1290

Results of OLS regression analysis indicated an adjusted R-squared value of .82, meaning that 82% of market value could be explained by the variables used in this model. Number of bedrooms, bathrooms, square footage, population density, and percent minority were found to be statistically significant at the .01 level. The variable with the most influence in this model was square feet, which had a t-statistic of 36.43. According to these results, every square foot added to a property equates to an added value of $58.88. Number of stories, age, and park distance were not found to be statistically significant in this case; the probabilities for these variables were all above .05 (see table 4-2).

Table 4-2. OLS results for properties within 500ft of a park.

Variable	Coefficient	Probability	T-Statistic
ACRES_CALC	-1702.46	.60	-.84
BEDS	-4911.80	.00*	-2.96
BATHS	17380.86	.00*	8.46
STORIES	3492.98	.12	1.70
SQFT_1	58.88	.00*	39.43
DENPOP2010	784.59	.00*	3.03
PCT_MNRTY	-375.03	.00*	-10.33
AGE	-17.25	.15	-1.45
PARK_DIST	-0.70	.99	-0.01

Adjusted R^2 = .82, n=1290
*Indicates statistical significance. (See Appendix for full results.)

The second OLS regression analysis performed included properties within a ¼ mile search radius of a park. This dataset included 4,563 parcels with market values ranging from $7,900 to $805,900, and an average market value of $139,318. Average distance to the nearest park for these properties was 736.55. (See table 4-3).

Table 4-3. Descriptive statistics of properties located within ¼ mile of a park.

	Minimum	Maximum	Mean	Std. Deviation
Acres	.10	5.27	.33	.29
Market Value	7,900	805,900	139,318.33	71410.00
Sqft	440	10,282	2138.80	932.21
Age	0	110	43	18.16
Beds	0	5	3.07	.63
Baths	0	7	1.88	.60
Population Density	0	31.22	5.63	3.13
Percent Minority	0	100	33.03	26.90
Distance to Nearest Park (ft)	26.16	1320.54	736.55	348.62

n = 4563

The adjusted R-squared value for this model was the same as the previous model, .82. All variables except for park distance were found to be statistically significant. All but the age variable were significant at the .01 level. The variable with the greatest influence in this case was again square feet, with a t-statistic of 99.93; every additional square foot in a house was worth an additional $59.15, consistent with results at the 500ft search radius. However, relationships between structural variables and market value were not all consistent with expected outcomes. Number of bedrooms exhibited a negative correlation coefficient, suggesting that more bedrooms equated to a lower property value. This was a sign that the model may not be completely reliable.

Table 4-4. OLS results for properties within ¼ miles of a park.

Variable	Coefficient	Probability	T-Statistic
ACRES_CALC	6218.71	.00*	4.30
BEDS	-2696.95	.00*	-4.85
BATHS	11280.32	.00*	13.03
STORIES	3707.83	.00*	6.61
SQFT_1	59.15	.00*	99.93
DENPOP2010	1237.18	.00*	9.98
PCT_MNRTY	-389.14	.00*	-27.65
AGE	-20.44	.04*	-3.16
PARK_DIST	.98	.47	-2.26

Adjusted R^2 = .82, n=4563
*Indicates statistical significance. (See Appendix for full results.)

The final OLS regression analysis performed included properties within a ½ mile search radius of the nearest park. This dataset included 9,317 parcels with market values ranging from $7,900 to $805,900, and a mean market value of $138,880.12. Average distance to the nearest park for these properties was 736.55 feet (see figure 4-5).

Table 4-5. Descriptive statistics of properties located within ½ mile of a park.

	Minimum	Maximum	Mean	Std. Deviation
Acres	.10	11.12	.32	.30
Market Value	7,900	805,900	138,880.12	64945.72
Sqft	399	10,282	2141.41	850
Age	0	110	40	18.20
Beds	0	5	3.08	.60
Baths	0	7	1.90	.56
Population Density	0	63	5.57	3.14
Percent Minority	0	100	33.03	26.90
Distance to Nearest Park (ft)	26.16	1320.54	736.55	348.62

n = 9317

Results indicated an adjusted R-squared value of .80, suggesting that 80% of the relationship between variables was explained by the model. All explanatory variables exhibited statistical significance at this level. Park distance was significant at the .05 level, and all other variables were significant at the .01 level. The variable with the greatest predictive power in this model was again square feet, with a t-statistic of 99.3. The result for this variable was as expected; the positive coefficient of 59 indicated that for every square foot, property value goes up by $59.

Table 4-6. OLS results for properties within ½ mile of a park.

Variable	Coefficient	Probability	T-Statistic
ACRES_CALC	5020.93	.00*	4.30
BEDS	-3125.35	.00*	-4.85
BATHS	9879.47	.00*	13.03
STORIES	5505.82	.00*	6.61
SQFT_1	59.30	.00*	99.93
DENPOP2010	1051.31	.00*	9.98
PCT_MNRTY	-386.30	.00*	-27.65
AGE	-18.93	.00*	-3.16
PARK_DIST	-1.01	.02*	-2.26

Adjusted R^2 = .80, n=9317
*Indicates statistical significance. (See Appendix for full results.)

Park distance was negatively correlated, though by a small amount. The correlation coefficient of -1.01 suggested that for every foot increase in distance from a park, market value dropped by about $1. Although all variables were indicated as being statistically significant, some relationship directions were not consistent with expected results. The coefficient for number of bedrooms indicated an inverse relationship, consistent with results from the first two models. Variables with positive coefficient values, including parcel size, number of bathrooms, number of stories, square feet, and population density, were consistent with expected results. Negatively correlated variables were accurate to predictions as well. Age would be expected to relate negatively to market value, with value going down as age increases. Finally, using percent minority as an indicator of income levels, the resulting negative coefficients make sense; residents with lower income will live in homes with a lower market value.

Results of the three tested models exhibited signs of unreliability. Firstly, proven variable relationships were not shown to be true. In the first model using a dataset of properties within 500ft of a park, parcel size and age of the structure were not indicated as being statistically significant; it can rationally be expected that both of these variables would be significant in determining market value. Age can be expected to exhibit a negative correlation; newer housing units are generally viewed as being more desirable, resulting in an added premium. Additionally, parcel size normally exhibits a positive relationship with value; the greater the size, the greater the value. The second model, analyzing attributes of properties within ¼ mile of a park, did result in all structural and neighborhood variables being significant; however, there was again inconsistency between proven relationships and actual results. Furthermore, all models resulted in a negative correlation coefficient for number of bedrooms. In addition to questionable correlation coefficients, the utilization of a spatial autocorrelation test, Moran's I, indicated that data was not randomly distributed in any of the three models. Z-scores for standard deviations in the model exhibited high values, indicating that the data was clustered, and suggested that there was less than a 1% chance that the pattern could be a result of random chance. In other words, the model cannot be fully relied upon.

In an attempt to define a better performing model which did not exhibit the aforementioned issues, especially the issues of spatial autocorrelation, three additional explanatory variables were included for analysis: distance to the University of Florida, park size, and park type. Keeping consistent with the previous models, the dataset for properties within a ½ mile search distance of a park were used. There were seven types of parks according to the Alachua County Growth Management database. Dummy variables were used to represent these types. Because of the large number of categories, and the fact that some of them were closely related in terms of type, collinearity problems arose and these variables were not able to be used. Results indicated the significance of all variables at the .01 level except for park distance, which was not found to be significant using this model (See table 4-7). However, use of these variables did not improve upon model performance. Number of bedrooms still exhibited a negative correlation, raising concerns over the reliability of the model, and results of the Moran's I test of spatial autocorrelation again indicated that data was not normally distributed.

Table 4-7. OLS results for properties within ½ mile of a park (alternative model).

Variable	Coefficient	Probability	T-Statistic
ACRES_CALC	5020.93	.00*	3.18
BEDS	-3125.35	.00*	-3.45
BATHS	9879.47	.00*	7.79
STORIES	5505.82	.00*	4.49
SQFT_1	59.30	.00*	46.02
DENPOP2010	1051.31	.00*	9.04
PCT_MNRTY	-386.30	.59	-26.91
AGE	-18.93	.00*	-8.32
PARK_DIST	-1.01	.00*	-2.26
ACRES	44	.00*	6.09
UF_DIST	-0.83	.00*	.068

Adjusted R^2 = .80, n=9,317

Geographically Weighted Regression (GWR)

Because results of OLS models exhibited signs of inconsistency and spatial autocorrelation, a geographically weighted regression analysis was utilized to account for spatial variants. GWR was performed using the variables that were identified as being significant in the previously discussed OLS models. Park distance was only indicated as being significant when using the ½ mile search radius, therefore this was the dataset utilized for GWR. 748 of the parcels in this dataset exhibited correlation coefficients of -1.797693e+308; these were removed from the dataset, leaving 8,569 properties (see table 4-6).

Table 4-8. Descriptive statistics for revised dataset after GWR.

	Minimum	Maximum	Mean	Std. Deviation
Acres	.10	11.12	.33	.31
Market Value	7,900	805,900	143,020	65751.44
Sqft	399	10,282	2,181.84	867.41
Age	0	110	40	18.72
Beds	0	5	3.08	.01
Baths	0	7	1.92	.57
Population Density	0	63	5.42	3.13
Percent Minority	0	100	29.24	22.61
Distance to Nearest Park (ft)	26.15	2639.880	1339.58	704.67

n = 8,569

Use of this method resulted in a higher adjusted R-squared value of .92, indicating that 92% of the relationship could be explained by the included explanatory variables. Considering mean values for the coefficients of each variable, the average coefficient relationships were as expected for structural and neighborhood attributes. All coefficients were positive, with the exception of percent minority, which was expected to be negative. As for the locational variable, park distance, the average of the correlation coefficients was positive. Although the value was small, 1.60, these results were contrary to the hypothesis. However, the benefit of using GWR is the ability to identify relationships at different locations instead of applying an average to an entire geographic area. Out of 8,569 total properties, 3,246, or about 38%, exhibited a negative correlation with park distance. In other words, 38% of properties exhibited increased property values as a result of proximity to a park (see figure 4-1). Coefficients for park distance ranged between -43.83 and 52.70. Looking only at properties with negative correlation coefficients, average distance was 1326ft, or about ¼ mile. Using this mean distance and the mean negative correlation coefficient of -7, the average added value of parks to properties can be estimated at $9,289. Added value to properties with a positive correlation coefficient, on average, was $6.80 per foot; an average of $9,159. However, as exhibited by results of this model, averages cannot be fully relied upon; therefore, further analysis of specific geographic locations was needed.

In an effort to define the best representation of the relationship between variables, the alternative model including the variables of size of park and distance to the University of Florida was also analyzed using geographically weighted regression. Dummy variables for type of park were not included as they presented problems of collinearity. This analysis resulted in an adjusted R-squared value of .78, and a sigma value of 38,345.23. The original model, which had an R-squared value of .92 and a sigma value of 26,958.51, was judged to be the better performing model, and thus was used for the further analysis of specific locations. However, postulations can still be made regarding the relationship of these variables on market value. The relationship between proximity to the UF campus and market value likely involves multiple variables, and could lead to a separate study of how distance to the campus impacts market value or rental prices. Variables relating to the rental market no doubt have an impact on housing values in locations which are in close proximity to the campus. The population occupying properties in close proximity to UF is largely characterized by young college students that are renting apartments, single family homes, or condos, many of which are shared with roommates. This portion of the population is likely to pay higher rents to live closer to UF for the added benefits of being able to walk to campus, nearby restaurants, and other establishments. Results for the distance to UF explanatory variable may not have accurately represented the relationship because analysis only included single family homes, which leaves out a large portion of the dwelling units that are occupied by students, such as apartments or condos.

The rental market in Gainesville is also unlike rental markets in cities which do not house major universities. Many properties with multiple bedrooms are rented under individual leases, charging a higher premium for each roommate, resulting in an overall higher rental price than would normally be seen. In addition, the portion of the population that is not made up of students has different preferences. Based on personal knowledge of the area, a majority of non-transitory residents do not live in the areas directly surrounding the UF campus. Although preferences vary, for those residents that are not affiliated with the university, as well as for some that are, it is more desirable to live farther from campus rather than in walking distance or a similar proximity. This preference may be based on multiple factors, which are difficult to control for. Traffic levels around the campus can be a deterrent, as well as the existence of many pedestrians and bikers in the area. In addition, the atmosphere of some areas may dissuade residents from locating there who have families and are thus seeking a more family oriented location, and have different amenity needs such as schools, daycares, etc. Furthermore, residents who are older or simply those that desire to live in a quiet location would likely choose other parts of Gainesville to reside.

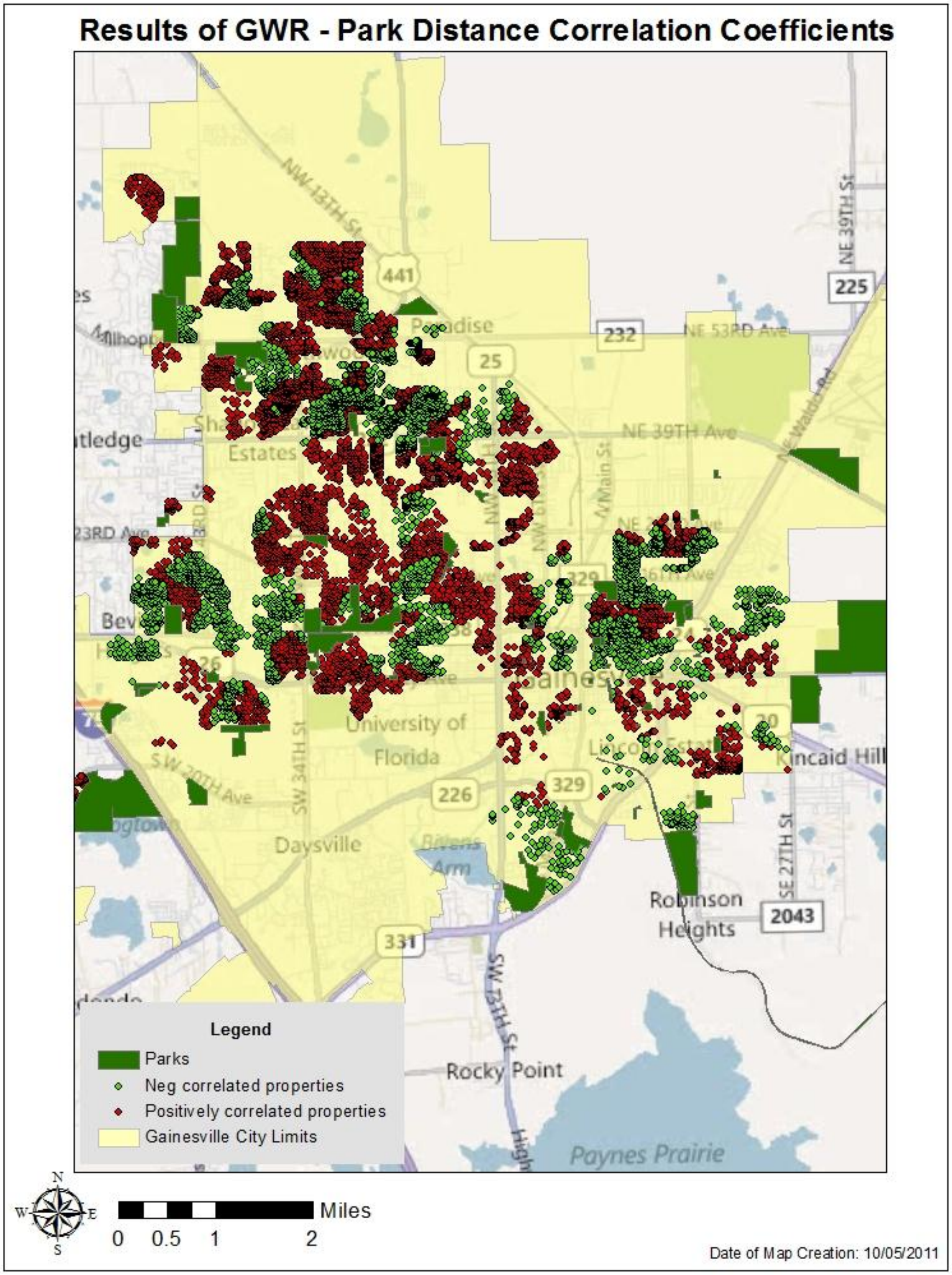


Figure 4-1. Park distance correlation coefficients for properties within ½ mile search radius.

As previously mentioned, in order to gain a better understanding of the varying degrees of impact that park location may have, three separate parks of different type and size were identified for a more detailed analysis. The first park was Cofrin Nature Park, owned by the City of Gainesville. Cofrin Nature Park is 30 acres, and is designated by Alachua County as a natural resources park which serves the community region. Its amenities include a half mile long hiking trail, as well as a playground, and seepage wetlands above Beville Heights Creek, which support growths of plants and wildflowers (City of Gainesville, 2011). According to 2010 Census data, the average population density for this area is 4.6 people per acre; an average of 15% of the population was made up of minorities.

525 properties were located within a ½ mile search radius of the park, with a mean value of $176,739.61. 405 properties (77%) exhibited negative correlations between market value and park distance (see figure 4-3). Considering properties with negative correlations, on average, for every foot increase in proximity to the park, $13.50 was added to market value. Using the average park distance of 1449.82, this equates to an average of $19,572.57 added value. Although negative correlations are seen at varying distances within the ½ mile radius, positive correlations start to become less prevalent around 1200ft distance (see figure 4-2).

Figures 4-3 and 4-4 illustrate the degree of variance among correlation coefficients for park distance. Properties north of 8th Avenue are of particular importance in this location and provide a solid example of why specific locations should be further analyzed. 8th Avenue, which is to the south of the park, as well as Newberry Road, also to the south, create a division between properties that are located within the

½ mile search distance and indicate that the two areas should not be considered in the same way. Properties located to the south of the park do not have the same level of accessibility as those located on the northern side in terms of walkability; residents of this area must either cross Newberry and/or 8th Avenue, or drive to the park. As for properties to the north of 8th Avenue, houses on the western side of the park are not located on the direct perimeter, but are buffered by properties with a smaller parcel size, less than .10 acres (which is why these properties were not included in the dataset) (see figure 4-4). Following the net effects curve theory, the smaller properties which are directly adjacent to the park act as a buffer for nuisance variables such as noise or access points. Properties on the northern and eastern perimeter, on the other hand, do not have this barrier, and exhibit positive correlation coefficients. Additional locational variables may impact the relationship between variables in this case, such as the location of a daycare near the park, which provides services for different ages of children and likely results in increased noise as well.

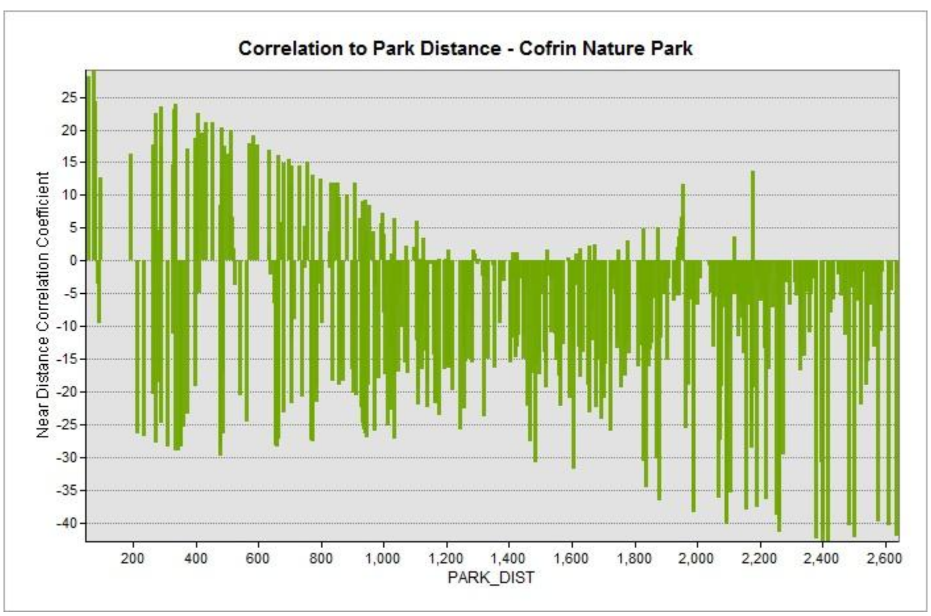


Figure 4-2. Park distance correlation coefficients – Cofrin Nature Park.

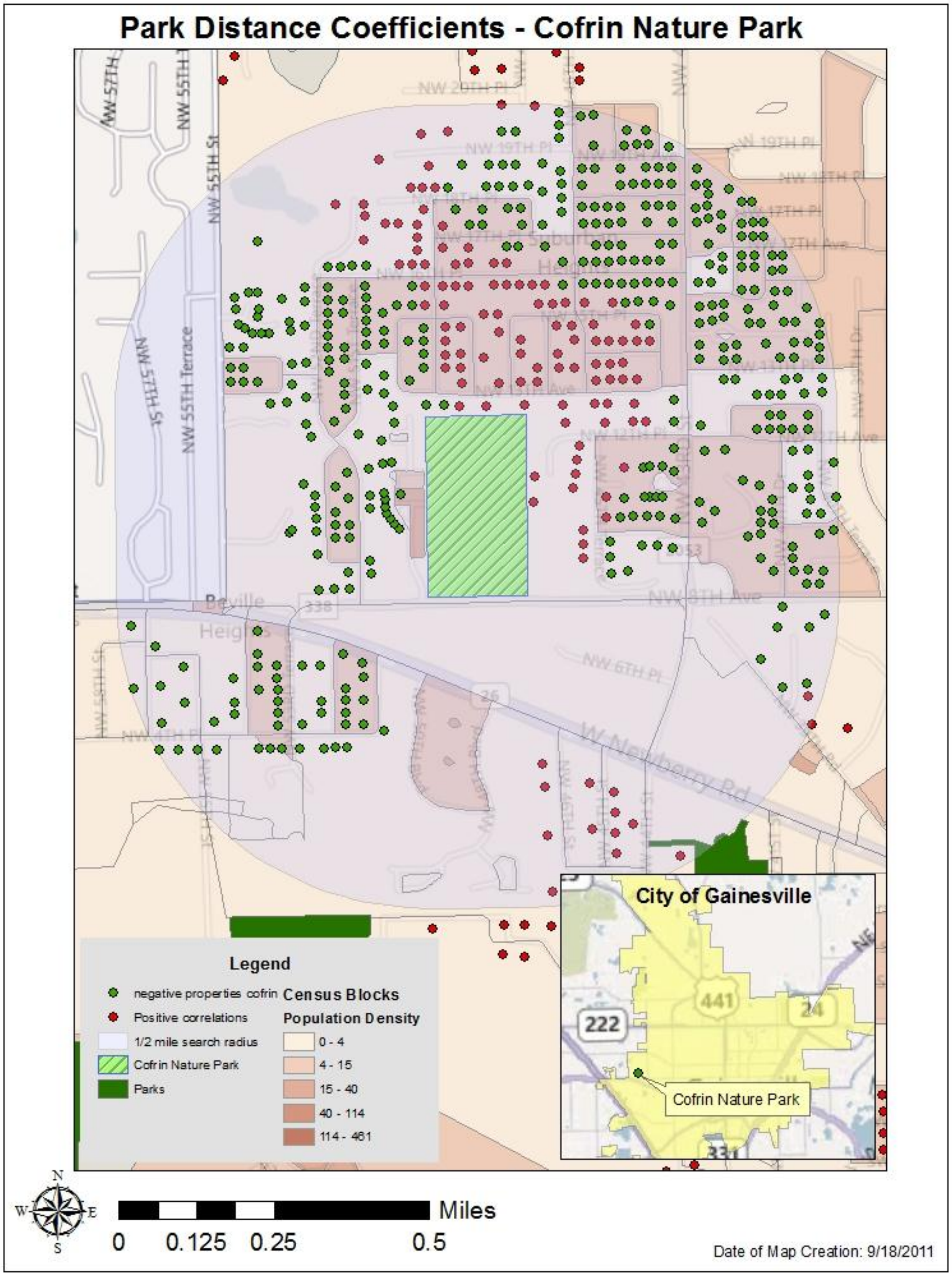


Figure 4-3. Park distance correlation coefficients for properties within ½ mile of Cofrin Nature Park.

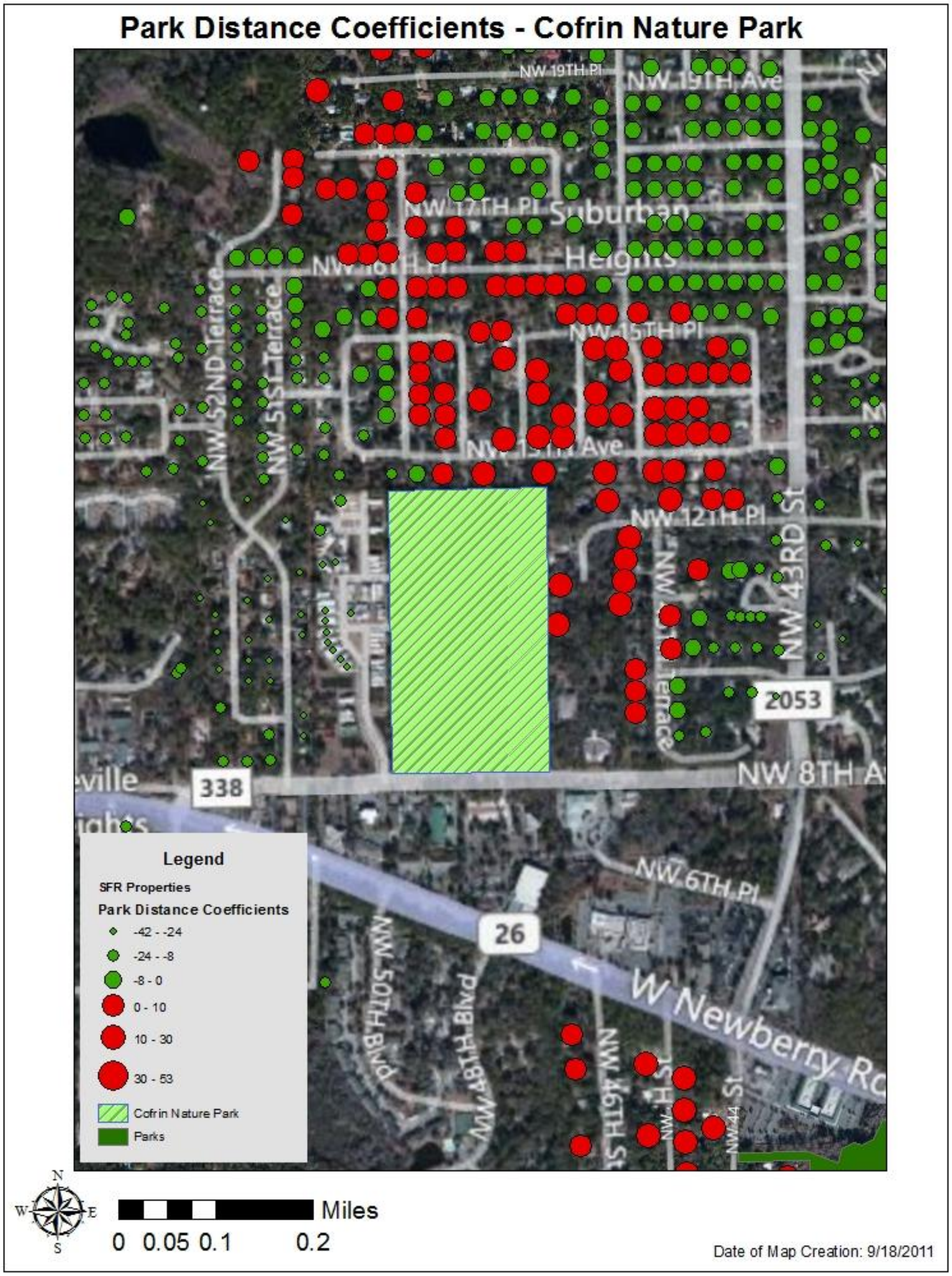


Figure 4-4. Graduated park distance correlation coefficients for properties within ½ mile of Cofrin Nature Park.

The second park that was identified for further analysis was Springtree Park, located on the north-west side of Gainesville. Owned by the City of Gainesville, it is an 11 acre neighborhood park and falls in the type category of natural resources. Amenities located for public use on the site include a small playground and picnic area. In addition, there are nature trails which pass through areas surrounding Three Lakes Creek, a tributary of Possum Creek (City of Gainesville, 2011). The average population density of this area is 5.6 people per acre. 874 properties were located within the ½ mile search distance of the park, with an average market value of $124,560.64. Results for correlation coefficients in this model were as expected. Using mean values, structural attributes including parcel size, number of bedrooms, number of bathrooms, number of stories, square feet, and population density exhibited positive correlation coefficients. Average values for correlation coefficients of age, percentage minority, and distance to parks were negative. Of the 874 properties, about 50% exhibited negative correlations between market value and park distance, meaning that the value contributed by the park got smaller as distance increased, consistent with the hypothesis (see figure 4-5). Correlation coefficients ranged from -19.15 to 16.23. The first notable observation in this case is the division of impact between properties located on the north and south side of 39th Avenue. Positive and negative correlations are seen on the north side; however, almost all properties on the south side exhibit park distance coefficients with positive values. Figure 4-6 shows the varying degrees of park distance coefficients. Similar to the previous example, it is suggested that the area north of 39th Avenue should be the focus of this analysis as it is the location of Springtree neighborhood. Based on personal knowledge of the area, 39th Avenue, along with NW

34th Street and NW 53rd Avenue, acts as an edge to the Springtree neighborhood; there is a clear mental boundary between this neighborhood and locations south of 39th Avenue. Also of particular interest in this case is the point at which park distance coefficients become negative. A majority of properties on the perimeter of the park do not benefit positively from the park. Considering only the properties to the north of 39th Avenue, 41 properties within 583ft of the park exhibited positive correlation coefficients for the park distance value. As the net effects theory suggests, this could be a result of negative externalities from the park. In this case, living on the edge of the park provides for easier access; many residents can walk from their backyard directly into the park area. However, being located on the park's perimeter may result in issues such as unwanted noise and reduced privacy levels. There are not specific access points to this park; patrons can access it by walking through the backyards of residents on the perimeter. In addition to the characteristics of this park, some of the relationship may be explained by the existence of a small field used for outdoor activities by the neighboring property, a religious establishment located to the east of the park. Based on personal observation, when this activity field is in use, the noise generated is highly audible to the properties located on the park's perimeter. Residents living in close proximity but not directly on the perimeter still experience the positive externalities of easy accessibility to natural amenities, but are not subject to the negative externalities that affect properties directly abutting the park. Using the average correlation coefficient and park distances for negatively correlated properties, -4.7 and 1341.20 respectively, the average estimated added value of parks to a property in this area is $6,303.64.

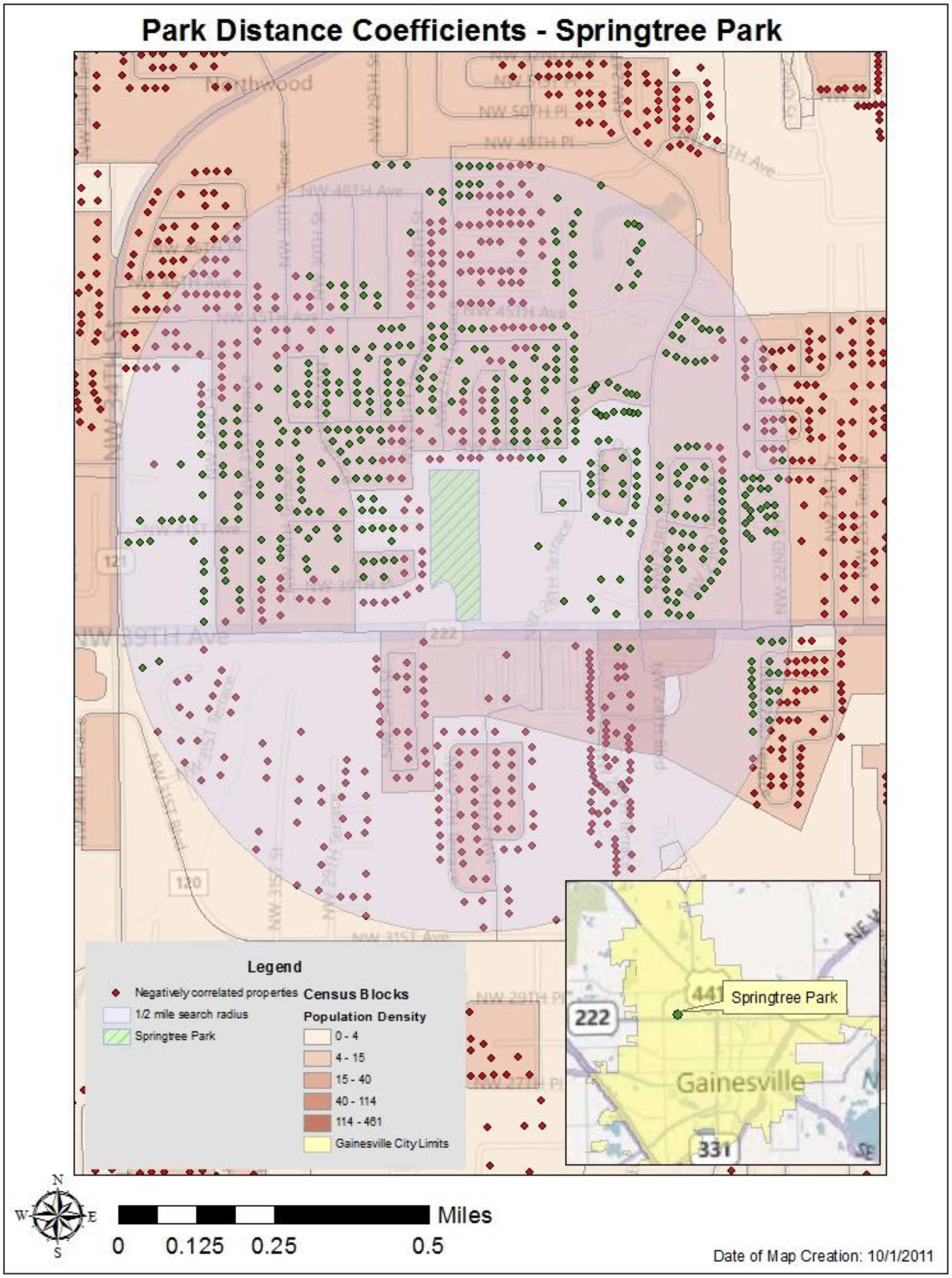


Figure 4-5. Park distance correlation coefficients for properties within ½ mile of Springtree Park.

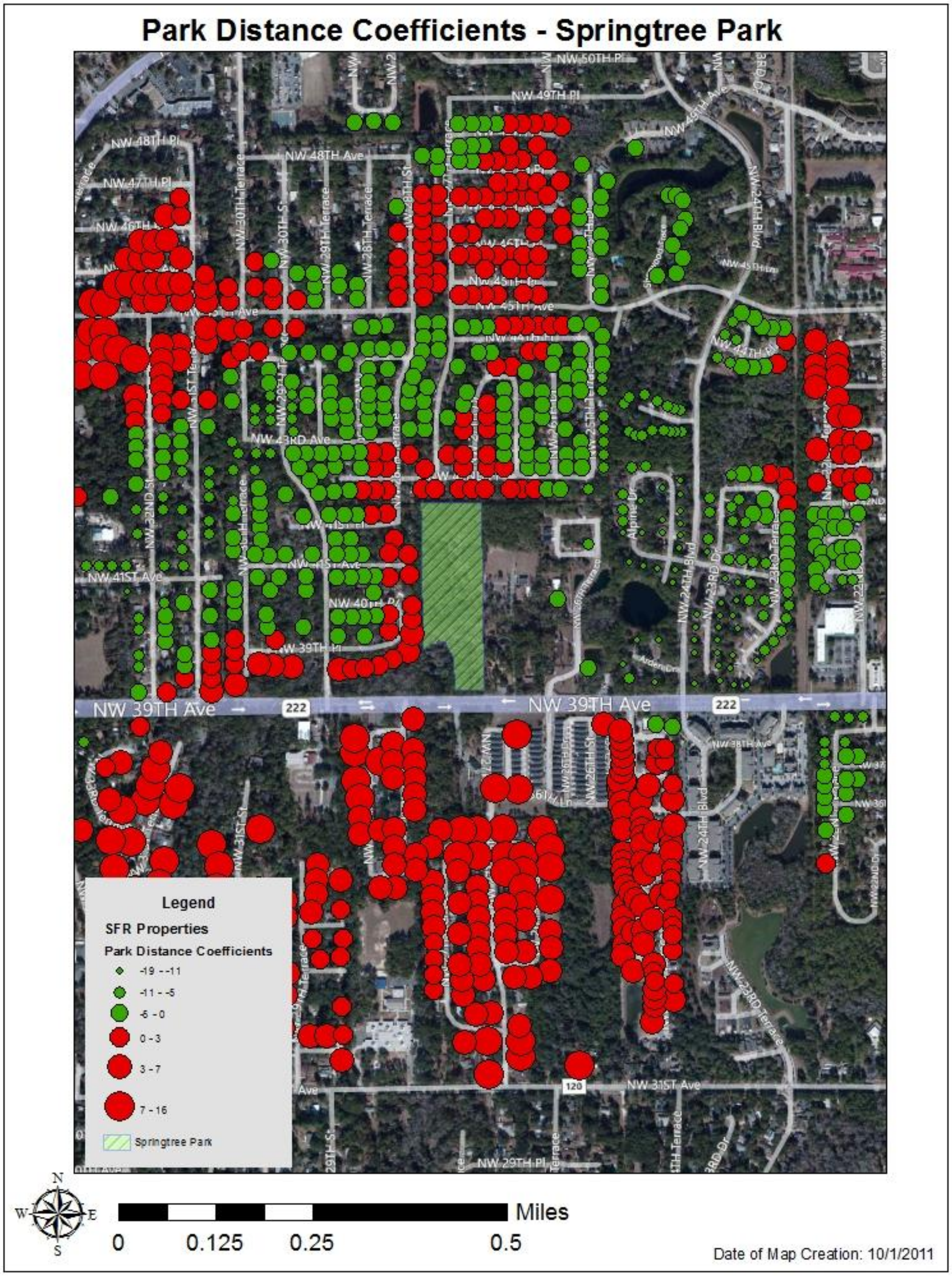


Figure 4-6. Graduated park distance correlation coefficients for properties within ½ mile of Springtree Park.

The third park chosen for further analysis was the Boys Club of Alachua County, a 6.4 acre public facility on the south-east side of Gainesville. This facility was chosen as a comparison to the aforementioned natural resource and leisure activity parks because of its designation as a “public facility”, and the significant amount positive correlation coefficients for properties in the ½ mile search area. 164 properties were located within the search distance, with a mean value of $78,023. The relationship between market value and park distance was as expected in this case; 82% of properties exhibited a positive correlation with park distance (see figures 4-7 and 4-8). In other words, they were not positively impacted by their location proximate to the park. Again using the net effects principle as a basis, this may be the result negative externalities. While positive externalities are produced by the preservation of open space, the facility’s use as a child recreation based facility presents nuisance issues including unwanted noise, traffic, or privacy issues for residents living in houses around it. Comparing the results of all three park analyses provides support for the hypothesis that the degree of negative externalities does affect the impact of the park distance variable. While the first two parks do have a recreation component, their primary characteristic is the preservation of natural resources. In addition, they are both larger, Springtree Park being 11 acres and Cofrin Nature Park being 30 acres. The extra open space containing trees and vegetation may act as a buffer to the recreational activities that do exist on these properties. In contrast, the Boys Club is only 6 acres, and is characterized largely by cleared open space, providing less opportunity for negative externalities to be buffered. Finally, the nature of the park as a non-profit owned facility, as opposed to a publicly owned and accessible park like the first two examples, likely makes a difference in the desirability of living near it.

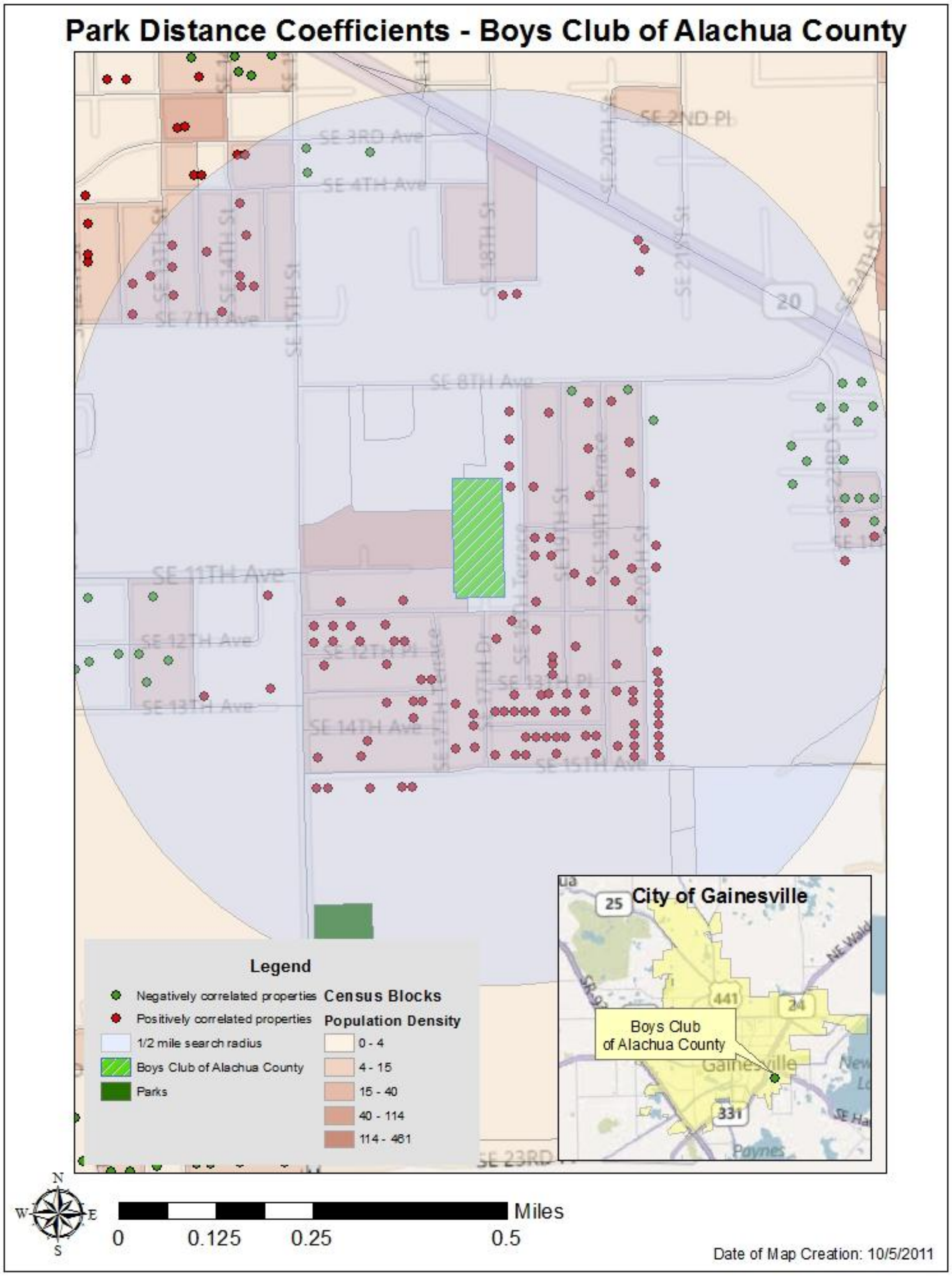


Figure 4-7. Park distance correlation coefficients for properties within ½ mile of the Boys Club of Alachua County.

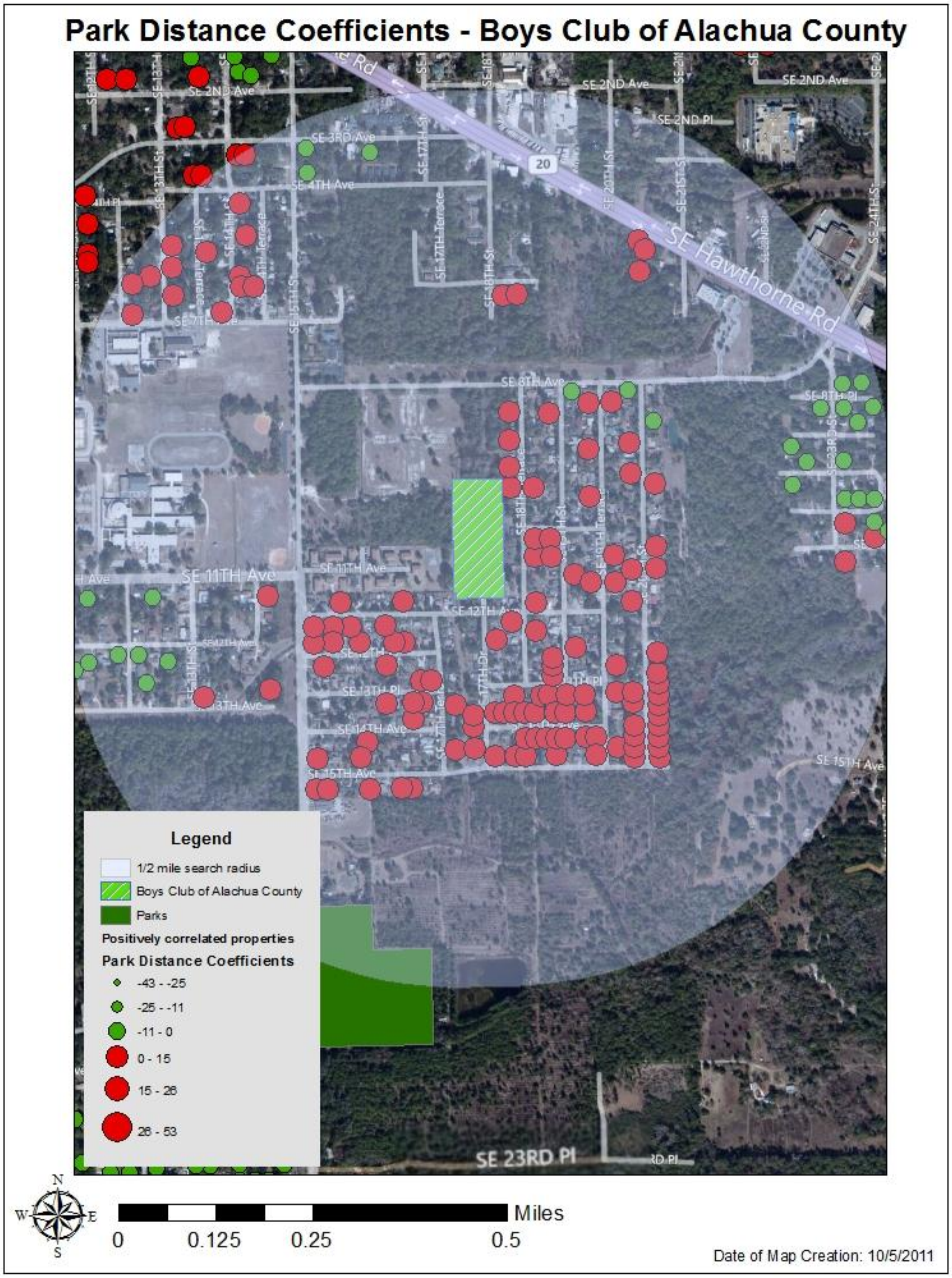


Figure 4-8. Graduate park distance correlation coefficients for properties within ½ mile of the Boys Club of Alachua County.

CHAPTER 5
DISCUSSIONS AND CONCLUSIONS

Discussions

It has been established that housing is a multi-attribute good. The total value of a house is the result of the values of the bundle of attributes that make it up. Review of literature has shown that the attributes with the largest contribution to price are usually structural characteristics, such as square footage, acreage, and number of bedrooms. Neighborhood characteristics such as income levels and population density have been shown to be significant contributing factors as well. Locational or environmental factors, such as proximity to amenities like parks, while not as significant, have also been shown to contribute to total value. Interest in determining a quantifiable value of parks gained attention in the 1960's, starting with one of the earlier studies conducted by Kitchen and Hendon in 1967. Their study utilized simple regression analysis to model the relationship between park proximity and the value of housing and land; housing and neighborhood characteristics were not taken into consideration. Their results showed that land values alone were positively impacted by the proximity of a neighborhood park. The lack of a method to account for housing heterogeneity was cited as reasoning for their results. As these methods evolved, results which included a more complex analysis of housing values began to surface; many of which suggested that not only land, but also housing values, are positively impacted by proximity to parks. Morancho (2003) and Bolitzer and Netusil (2000), among several others, provide evidence supporting this hypothesis. Not only have more modern studies provided evidence to support the theory that proximity to parks increases housing values, they have also suggested that the value which is seen is dependent upon the size and/or type of park. The reviewed studies, along with others cited, have used regression analysis methods such as ordinary least squares (OLS), and variations thereof, to provide these results. As methods continue to evolve, so too do the opportunities to keep improving upon these models. Geographically weighted regression (GWR) has been presented as a method which addresses a problem that stationary coefficient models cannot – spatial heterogeneity. Rather than apply one coefficient to each variable at a global level, geographically weighted regression applies a correlation coefficient to every feature in a dataset. This method can address model issues such as omitted variables, and otherwise unidentifiable spatial issues suggested as a result of spatial autocorrelation tests such as Moran's I.

The primary concern of this study was to test the hypothesis that proximity to a park has a positive impact on housing value. Using foundations laid by reviewed literature, this relationship was tested using the market value of single family homes in Gainesville, FL. As in the cited studies, variables included in analysis reflected structural, neighborhood, and locational attributes. Results of ordinary least squares regressions considering properties within 500ft and ¼ mile of a park indicated that there was not a significant statistical correlation between market value and park distance. Using a search distance of ½ mile showed that not only was there a significant relationship between the two variables, but also that there was, although small, an inverse relationship between housing value and park distance. This suggests that as distance from a park increases, market value decreases. The adjusted R-squared value of .80 was strong; however, indications of unreliability were present in results; some variables were inconsistent with expected findings. For instance, in all ordinary least squares models, the correlation coefficient for number of bedrooms was negative. This is contrary to the logical assumption that number of bedrooms adds to housing value. In addition, a test of spatial autocorrelation (Moran's I) for all three models indicated that the data was not randomly disbursed. Thus, further research was needed to achieve more reliable model results. Utilization of geographically weighted regression improved upon the OLS model by assigning a coefficient at every feature in the dataset, allowing for further analysis of the relationship between variables at specific locations. The results showed that relationships vary over space; where OLS assigns one coefficient for a variable at all locations, GWR shows that the coefficients for these variables can actually be negative in some places, and positive in others. Considering mean values for the coefficients of each variable showed that the average coefficient relationships were as expected for structural and neighborhood attributes. All coefficients were positive, with the exception of percentage minority. Using this variable as a proxy for income, the resulting negative coefficients make sense; residents with lower income would be expected to live in homes with a lower market value. Three parks were chosen for further analysis in order to take into account different types and characteristics. Resulting coefficients showed that while park distance can have a positive impact on some properties, it is not uniform over the entire study area. In regards to Cofrin Nature Park and Springtree Park, properties on the perimeter are negatively impacted by the parks location, while properties a short distance away are positively impacted

The character and size of parks likely does affect the economic impact to proximate properties because of the externalities they present. Recreation based parks, especially community parks that provide for recreation activities on a larger scale than a single basketball court or small field, present a higher degree of negative externalities due to noise, access point traffic, and reduced privacy levels. Properties located directly adjacent to parks that provide for team sports, child recreation, or public use facilities may be especially subject to these disadvantages. Results of the analysis of parks within ½ mile of the Boy's Club support this hypothesis. Homes located directly adjacent to larger natural resource or leisure activity based parks are more likely to be positively impacted as a result of the positive externalities such as stormwater control, air quality, and even the reduction of noise pollution from parks, which can act as a buffer between properties and roads, commercial activity, or otherwise noise producing elements. Smaller, resource based parks may create a greater degree of negative externalities for the properties located on the park perimeter because of their neighborhood level character. Using Springtree Park as an example, properties which are on the direct perimeter of a park with no designated access points are subject to the negative externality of loss of privacy and exclusive use of a property's backyard.

Limitations

There are several limitations associated with using regression models, including the choice of which functional form is used, problems associated with collinearity, and the difficulty of including all variables that may be pertinent. In addition, the issue of spatial heterogeneity is important to consider, and should lead to the use of regression models that take spatial variants into account. Reviewed literature did not account for spatial variants, but instead utilized models that assumed homogeneity among properties. As seen in the results of this study, results vary based on which method is used.

Availability of data was also a limitation. Census data from 2010 regarding demographics were available; however, data relating to income and poverty levels were not. Percentage minority has been suggested as an acceptable proxy for income data; however, the utilization of actual income data may have resulted in a more accurate model. In addition, applying a specific model to multiple localities in general presents a limitation in itself because of the varying character and preferences of communities. Gainesville is considered to be a “college town”; since a substantial amount of the population is made up of students attending the University of Florida or Santa Fe College, distance to those campuses may be important to residents in some areas, but not others. Students of the University of Florida may be more willing to pay a higher rent to live close to the campus than employees, who might prefer to live farther from the student housing areas surrounding it. In short, variable relationships cannot be globally summarized.

Conclusions

The potential for parks and other permanently preserved open spaces to provide necessary ecosystem services in terms of environmental sustainability as well as human health needs is notable. Considerable evidence has affirmed this fact. However, as with many environmental resources, the benefit is difficult to define if not translated into economic terms; therein lies the problem. How can a non-market good (such as access to recreational opportunities or increased air quality) be quantified? By utilizing hedonic pricing models, the value of parks can be estimated as the added value to residential properties. Several studies have shown that there is a significant statistical correlation between the distance from a home to a park or open space and housing value, sometimes dependent upon various factors such as size or the type of park. This study addresses the issue by asking the following research questions: do parks have an economic impact on proximate residential property values? If so, is the impact positive or negative? Results indicate that parks do have an economic impact on proximate properties. The answer to the question of whether the impact is positive or negative is not as straightforward. 38% of properties in the dataset of single family residential homes utilized for this study exhibited an inverse relationship between park distance and market value, indicating that as distance increases, market value decreases. Further, 77% of properties within ½ mile of Cofrin Nature Park and 50% of properties within ½ mile of Springtree Park exhibit this negative correlation coefficient for park distance. However, 82% of properties within ½ mile of the Boys Club were positively correlated with distance, indicating that these properties did not benefit from their location near this resource. Additional consideration of the character of these parks and the residential areas that surround them provides a better understanding of the relationship.

Which method should be used to estimate the value of a specific attribute in terms of housing price is debatable. Numerous studies utilizing linear techniques have concluded that homes located near parks tend to be positively influenced by proximity; however, the challenge with these models lies in the fact that a majority of the models used do not account for spatial heterogeneity. Review of literature for this study found no examples of the use of methods which take into account spatial variations. The outcomes presented here show the degree to which results can vary depending on which method is used. When estimating the relationship between park distance and residential properties in Gainesville using the ordinary least squares technique, there was an inverse relationship at one distance, ½ mile, but no significant relationship was found using datasets of properties located within a smaller distance. Utilization of the geographically weighted regression method for the same dataset provided compelling evidence that the relationship between independent and dependent variables, specifically a locational variable in this case, can be positive or negative. These results suggest that the direction of correlation between park distance and market value can vary based on the type and characteristics of the park, including variables such as how much noise is generated from the various amenities that the park provides, as well as the way in which the park is accessed. Further examination of three specific parks in Gainesville provided evidence that natural resource parks are more desirable to live near than parks with public use functions that lead to increased negative externalities. The most important conclusion drawn from this study is that locational attributes cannot be assessed on a global scale, but rather should be investigated on a case by case basis, taking into account variations in spatial relationships.

APPENDIX A
RESULTS OF ORDINARY LEAST SQUARES REGRESSION ANALYSIS

Summary of OLS Results

Variable	Coefficient	StdError	t-Statistic	Probability	Robust_SE	Robust_t	Robust_Pr	VIF [1]
Intercept	534.049438	5362.885868	0.099582	0.920675	7084.516910	0.075383	0.939906	--------
ACRES_CALC	-2692.909494	3203.788859	-0.840539	0.400749	6260.769500	-0.430124	0.667193	1.606958
BEDS	-4902.215937	1656.641461	-2.959129	0.003151*	2763.412113	-1.773972	0.076311	1.728419
BATHS	17319.703314	2046.431102	8.463370	0.000000*	2962.456929	5.846398	0.000000*	2.278244
STORIES	3808.816635	2235.594595	1.703715	0.088687	3853.386939	0.988433	0.323115	1.286941
SQFT_1	59.037122	1.496906	39.439442	0.000000*	3.242962	18.204691	0.000000*	3.107991
DENPOP2010	775.835252	256.215026	3.028063	0.002522*	277.432550	2.796482	0.005246*	1.218595
PCT_MNRTY	-366.294692	35.476547	-10.324982	0.000000*	34.191224	-10.713120	0.000000*	1.285605
AGE	-15.620694	10.782703	-1.448681	0.147686	5.318695	-2.936941	0.003382*	1.031650
PARK_DIST	-0.068543	6.437735	-0.010647	0.991502	6.032100	-0.011363	0.990931	1.024054

OLS Diagnostics

Number of Observations:	1290	Number of Variables:	10
Degrees of Freedom:	1280	Akaike's Information Criterion (AIC) [2]:	30309.823687
Multiple R-Squared [2]:	0.839373	Adjusted R-Squared [2]:	0.838244
Joint F-Statistic [3]:	743.197902	Prob(>F), (9,1280) degrees of freedom:	0.000000*
Joint Wald Statistic [4]:	3405.060303	Prob(>chi-squared), (9) degrees of freedom:	0.000000*
Koenker (BP) Statistic [5]:	290.092788	Prob(>chi-squared), (9) degrees of freedom:	0.000000*
Jarque-Bera Statistic [6]:	3087.939372	Prob(>chi-squared), (2) degrees of freedom:	0.000000*

Notes on Interpretation

* Statistically significant at the 0.05 level.
[1] Large VIF (> 7.5, for example) indicates explanatory variable redundancy.
[2] Measure of model fit/performance.
[3] Significant p-value indicates overall model significance.
[4] Significant p-value indicates robust overall model significance.
[5] Significant p-value indicates biased standard errors; use robust estimates.
[6] Significant p-value indicates residuals deviate from a normal distribution.

Figure A-1. Ordinary Least Squares results, 500ft search radius

Summary of OLS Results

Variable	Coefficient	StdError	t-Statistic	Probability	Robust_SE	Robust_t	Robust_Pr	VIF [1]
Intercept	-310.903112	3066.546513	-0.101385	0.919232	4237.519751	-0.073369	0.941499	--------
ACRES_CALC	6218.707330	1961.889211	3.169755	0.001551*	3709.667017	1.676352	0.093749	1.531071
BEDS	-2696.953398	936.122447	-2.880984	0.003990*	1448.693522	-1.861645	0.062717	1.715153
BATHS	11280.318688	1103.437437	10.222889	0.000000*	1682.886051	6.702960	0.000000*	2.165916
STORIES	3707.834248	1211.521959	3.060476	0.002236*	1827.067821	2.029391	0.042466*	1.194265
SQFT_1	59.150342	0.855010	69.180887	0.000000*	1.777530	33.276701	0.000000*	3.104652
DENPOP2010	1237.183676	158.923951	7.784753	0.000000*	193.373289	6.397904	0.000000*	1.210150
PCT_MNRTY	-389.143402	19.013720	-20.466452	0.000000*	19.361212	-20.099124	0.000000*	1.277643
AGE	-20.435544	10.259208	-1.991922	0.046431*	6.078140	-3.362138	0.000796*	1.041454
PARK_DIST	0.937312	1.306238	0.717566	0.473054	1.281464	0.731438	0.464541	1.013445

OLS Diagnostics

Number of Observations:	4563	Number of Variables:	10
Degrees of Freedom:	4553	Akaike's Information Criterion (AIC) [2]:	107206.464752
Multiple R-Squared [2]:	0.817302	Adjusted R-Squared [2]:	0.816941
Joint F-Statistic [3]:	2263.107879	Prob(>F), (9,4553) degrees of freedom:	0.000000*
Joint Wald Statistic [4]:	9929.128690	Prob(>chi-squared), (9) degrees of freedom:	0.000000*
Koenker (BP) Statistic [5]:	917.530123	Prob(>chi-squared), (9) degrees of freedom:	0.000000*
Jarque-Bera Statistic [6]:	14732.512784	Prob(>chi-squared), (2) degrees of freedom:	0.000000*

Notes on Interpretation

* Statistically significant at the 0.05 level.
[1] Large VIF (> 7.5, for example) indicates explanatory variable redundancy.
[2] Measure of model fit/performance.
[3] Significant p-value indicates overall model significance.
[4] Significant p-value indicates robust overall model significance.
[5] Significant p-value indicates biased standard errors; use robust estimates.
[6] Significant p-value indicates residuals deviate from a normal distribution.

Figure A-2. Ordinary Least Squares results, ¼ mile search radius.

Summary of OLS Results

Variable	Coefficient	StdError	t-Statistic	Probability	Robust_SE	Robust_t	Robust_Pr	VIF [1]
Intercept	3718.061863	2070.095243	1.796083	0.072518	2768.081142	1.343191	0.179254	--------
ACRES_CALC	5020.928241	1163.091628	4.316881	0.000020*	2059.628219	2.437784	0.014782*	1.361991
BEDS	-3125.349702	647.749420	-4.824936	0.000002*	958.671574	-3.260084	0.001134*	1.681549
BATHS	9879.468474	760.620601	12.988694	0.000000*	1100.782204	8.974953	0.000000*	2.049916
STORIES	5505.820662	827.738510	6.651643	0.000000*	1242.467483	4.431360	0.000012*	1.153519
SQFT_1	59.301080	0.593237	99.961835	0.000000*	1.183454	50.108488	0.000000*	2.838789
DENPOP2010	1051.305759	102.938683	10.212932	0.000000*	143.590842	7.321538	0.000000*	1.167616
PCT_MNRTY	-386.296785	13.509830	-28.593756	0.000000*	13.869290	-27.852671	0.000000*	1.228161
AGE	-18.925511	6.189710	-3.057577	0.002251*	8.608942	-2.198355	0.027932*	1.031764
PARK_DIST	-1.012856	0.426606	-2.374218	0.017591*	0.415172	-2.439609	0.014708*	1.015727

OLS Diagnostics

Number of Observations:	9317	Number of Variables:	10
Degrees of Freedom:	9307	Akaike's Information Criterion (AIC) [2]:	217843.678591
Multiple R-Squared [2]:	0.802364	Adjusted R-Squared [2]:	0.802173
Joint F-Statistic [3]:	4198.282321	Prob(>F), (9,9307) degrees of freedom:	0.000000*
Joint Wald Statistic [4]:	15968.895520	Prob(>chi-squared), (9) degrees of freedom:	0.000000*
Koenker (BP) Statistic [5]:	1539.913756	Prob(>chi-squared), (9) degrees of freedom:	0.000000*
Jarque-Bera Statistic [6]:	25398.290209	Prob(>chi-squared), (2) degrees of freedom:	0.000000*

Notes on Interpretation

* Statistically significant at the 0.05 level.
[1] Large VIF (> 7.5, for example) indicates explanatory variable redundancy.
[2] Measure of model fit/performance.
[3] Significant p-value indicates overall model significance.
[4] Significant p-value indicates robust overall model significance.
[5] Significant p-value indicates biased standard errors; use robust estimates.
[6] Significant p-value indicates residuals deviate from a normal distribution.

Figure A-3 Ordinary Least Squares results, ½ mile search radius

Summary of OLS Results

Variable	Coefficient	StdError	t-Statistic	Probability	Robust_SE	Robust_t	Robust_Pr	VIF [1]
Intercept	24152.575653	2612.216912	9.246007	0.000000*	3713.276554	6.504384	0.000000*	--------
ACRES_CALC	6783.795132	1161.437548	5.840861	0.000000*	2129.512440	3.185610	0.001465*	1.396034
BEDS	-3308.971336	639.381217	-5.175271	0.000001*	958.119591	-3.453610	0.000572*	1.684121
BATHS	9053.911080	778.906015	11.623881	0.000000*	1162.105255	7.790956	0.000000*	2.209673
STORIES	5552.666855	822.513694	6.750850	0.000000*	1235.657365	4.493695	0.000010*	1.170800
SQFT_1	57.631628	0.595684	96.748695	0.000000*	1.252381	46.017643	0.000000*	2.942158
DENPOP2010	1246.023290	104.101100	11.969358	0.000000*	137.801371	9.042169	0.000000*	1.227472
PCT_MNRTY	-363.306874	13.781464	-26.361994	0.000000*	13.500555	-26.910515	0.000000*	1.313725
AGE	-258.359221	21.599443	-11.961383	0.000000*	31.040331	-8.323340	0.000000*	1.774338
PARK_DIST	-0.231460	0.431977	-0.535815	0.592109	0.430625	-0.537497	0.590947	1.070536
ACRES_1_13	43.988539	6.701759	6.563731	0.000000*	7.215848	6.096101	0.000000*	1.170615
NEAR_DIST	-0.830378	0.060772	-13.663842	0.000000*	0.067881	-12.232812	0.000000*	1.623373

OLS Diagnostics

Number of Observations:	9317	Number of Variables:	12
Degrees of Freedom:	9305	Akaike's Information Criterion (AIC) [2]:	217589.137850
Multiple R-Squared [2]:	0.807773	Adjusted R-Squared [2]:	0.807545
Joint F-Statistic [3]:	3554.654198	Prob(>F), (11,9305) degrees of freedom:	0.000000*
Joint Wald Statistic [4]:	19455.829071	Prob(>chi-squared), (11) degrees of freedom:	0.000000*
Koenker (BP) Statistic [5]:	1815.772972	Prob(>chi-squared), (11) degrees of freedom:	0.000000*
Jarque-Bera Statistic [6]:	28616.010175	Prob(>chi-squared), (2) degrees of freedom:	0.000000*

Notes on Interpretation

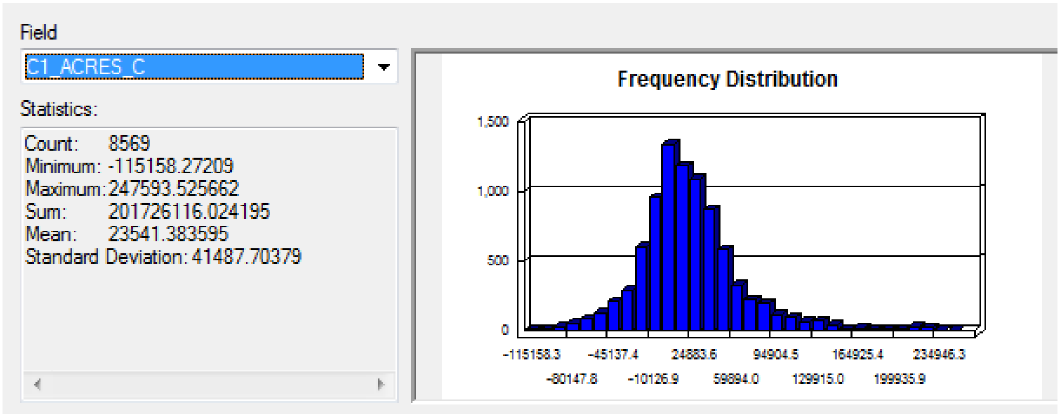
* Statistically significant at the 0.05 level.
[1] Large VIF (> 7.5, for example) indicates explanatory variable redundancy.
[2] Measure of model fit/performance.
[3] Significant p-value indicates overall model significance.
[4] Significant p-value indicates robust overall model significance.
[5] Significant p-value indicates biased standard errors; use robust estimates.
[6] Significant p-value indicates residuals deviate from a normal distribution.

Figure A-4. Ordinary least squares results, using alternative explanatory variables, ½ mile search radius.

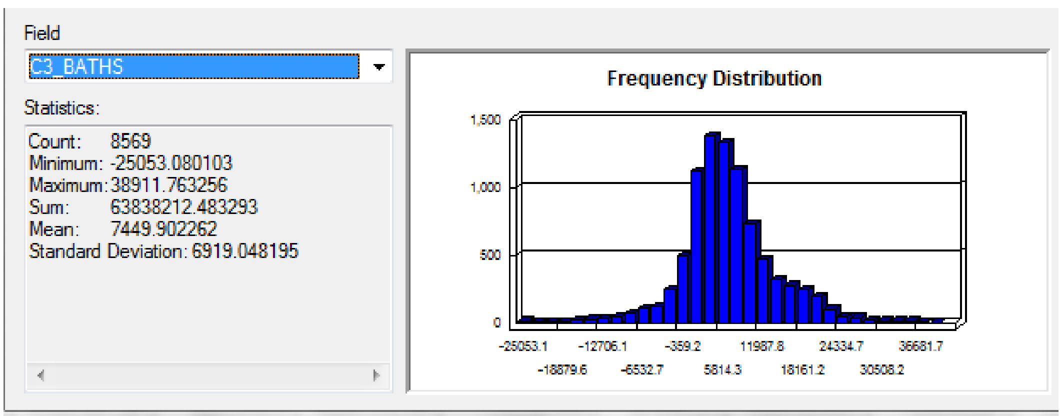
APPENDIX B
RESULTS OF GEOGRAPHICALLY WEIGHTED REGRESSION ANALYSIS

VARNAME	VARIABLE	DEFINITION
Neighbors	200.00	
ResidualSquares	759966069962.00	
EffectiveNumber	181.31	
Sigma	26958.51	
AICc	28642.27	
R2	0.93	
R2Adjusted	0.92	
Dependent Field	0.00	MARKETVAL
Explanatory Field	1.00	ACRES_CALC
Explanatory Field	2.00	BEDS
Explanatory Field	3.00	BATHS
Explanatory Field	4.00	STORIES
Explanatory Field	5.00	SQFT_1
Explanatory Field	6.00	DENPOP2010
Explanatory Field	7.00	PCT_MNRTY
Explanatory Field	8.00	Age
Explanatory Field	9.00	NEAR_DIST

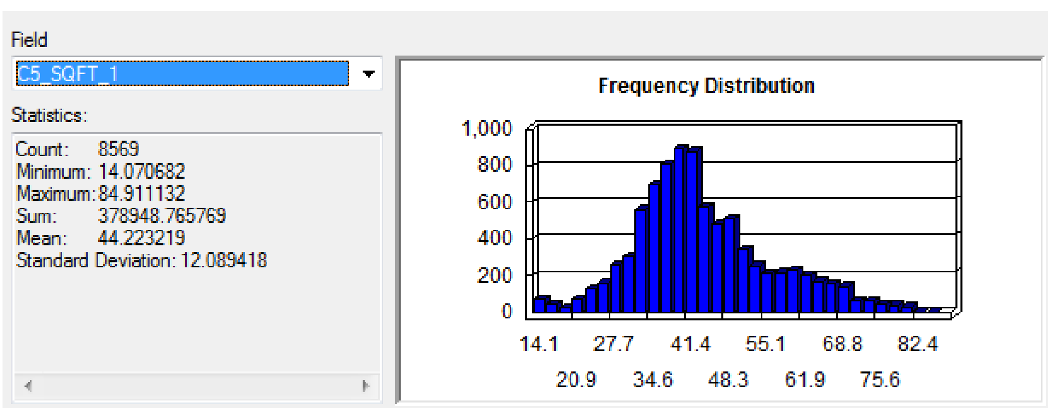
Figure B-1. Geographically Weighted Regression Results for properties within a ½ mile search radius


Field
C1_ACRES_C
Statistics:
Count: 8569
Minimum: -115158.27209
Maximum: 247593.525662
Sum: 201726116.024195
Mean: 23541.383595
Standard Deviation: 41487.70379
Frequency Distribution
1,500
1,000
500
0
-115158.3
-45137.4
24883.6
94904.5
164925.4
234946.3
-80147.8
-10126.9
59894.0
129915.0
199935.9

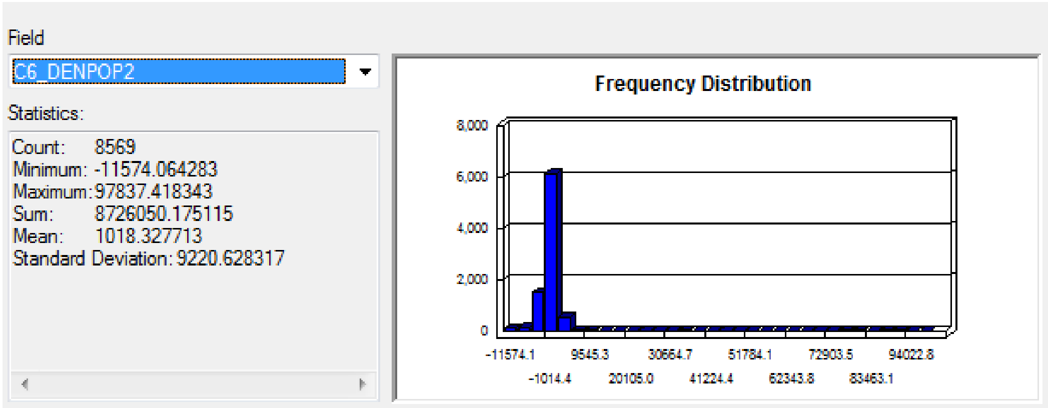
A


Field
C3_BATHS
Statistics:
Count: 8569
Minimum: -25053.080103
Maximum: 38911.763256
Sum: 63838212.483293
Mean: 7449.902262
Standard Deviation: 6919.048195
Frequency Distribution
1,500
1,000
500
0
-25053.1
-12706.1
-359.2
11987.8
24334.7
36681.7
-18879.6
-6532.7
5814.3
18161.2
30508.2

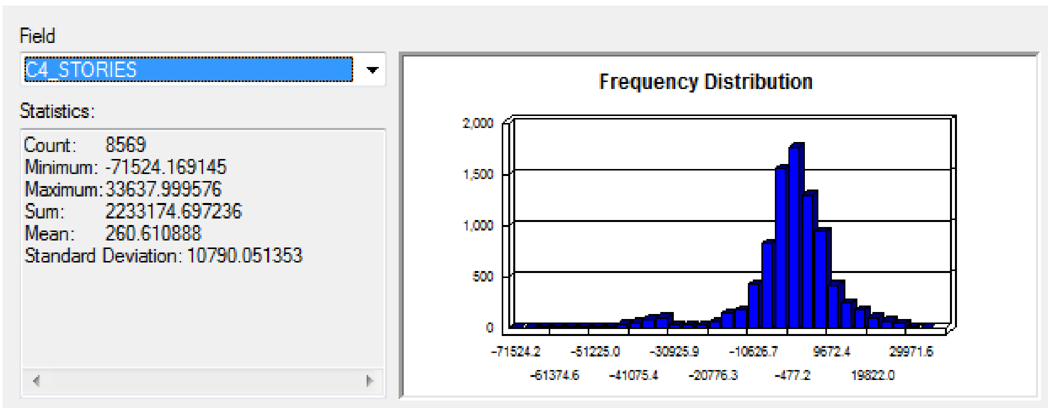
B


Field
C5_SQFT_1
Statistics:
Count: 8569
Minimum: 14.070682
Maximum: 84.911132
Sum: 378948.765769
Mean: 44.223219
Standard Deviation: 12.089418
Frequency Distribution
1,000
800
600
400
200
0
14.1
27.7
41.4
55.1
68.8
82.4
20.9
34.6
48.3
61.9
75.6

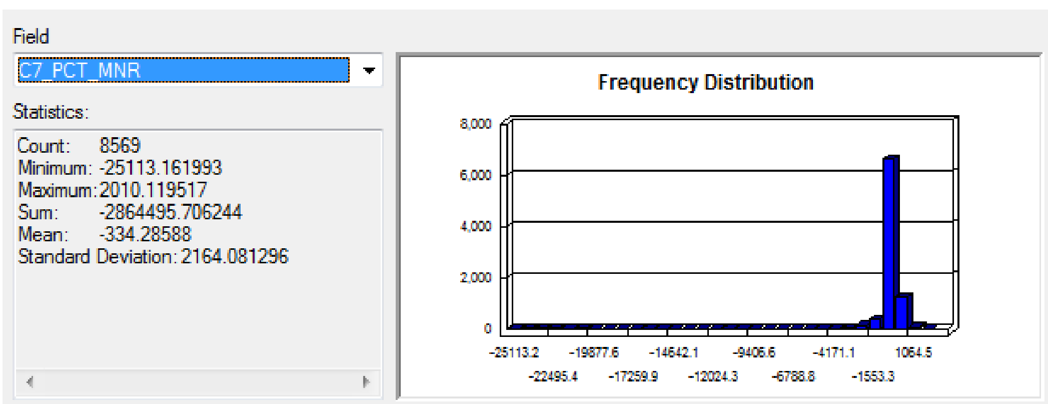
C


Field
C6_DENPOP2
Statistics:
Count: 8569
Minimum: -11574.064283
Maximum: 97837.418343
Sum: 8726050.175115
Mean: 1018.327713
Standard Deviation: 9220.628317
Frequency Distribution
8,000
6,000
4,000
2,000
0
-11574.1
9545.3
30664.7
51784.1
72903.5
94022.8
-1014.4
20105.0
41224.4
62343.8
83463.1

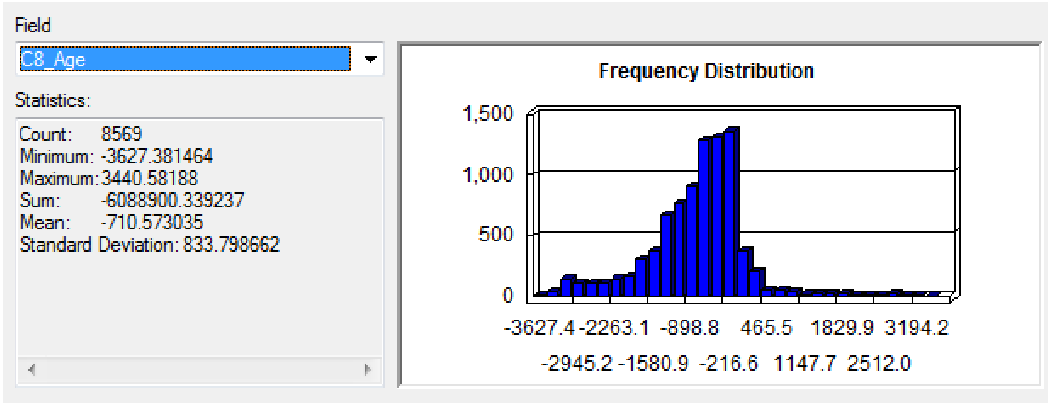
D


Field
C4_STORIES
Statistics:
Count: 8569
Minimum: -71524.169145
Maximum: 33637.999576
Sum: 2233174.697236
Mean: 260.610888
Standard Deviation: 10790.051353
Frequency Distribution
2,000
1,500
1,000
500
0
-71524.2
-51225.0
-30925.9
-10626.7
9672.4
29971.6
-61374.6
-41075.4
-20776.3
-477.2
19822.0

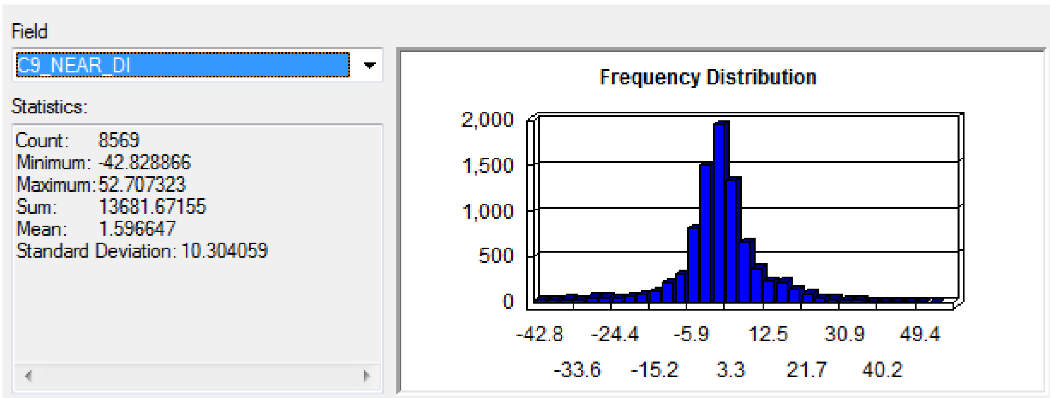
E


Field
C7_PCT_MNR
Statistics:
Count: 8569
Minimum: -25113.161993
Maximum: 2010.119517
Sum: -2864495.706244
Mean: -334.28588
Standard Deviation: 2164.081296
Frequency Distribution
8,000
6,000
4,000
2,000
0
-25113.2
-19877.6
-14642.1
-9406.6
-4171.1
1064.5
-22495.4
-17259.9
-12024.3
-6788.8
-1553.3

F



G



H

Figure B-2. Geographically Weighted Regression Results – Frequency Distributions.

VARNAME	VARIABLE	DEFINITION
Neighbors	200.00	
ResidualSquares	111919033574.00	
EffectiveNumber	15.88	
Sigma	38345.23	
AICc	2217.41	
R2	0.82	
R2Adjusted	0.78	
Dependent Field	0.00	MARKETVAL
Explanatory Field	1.00	ACRES_CALC
Explanatory Field	2.00	BEDS
Explanatory Field	3.00	BATHS
Explanatory Field	4.00	STORIES
Explanatory Field	5.00	SQFT_1
Explanatory Field	6.00	DENPOP2010
Explanatory Field	7.00	PCT_MNRTY
Explanatory Field	8.00	Age
Explanatory Field	9.00	PARK_DIST
Explanatory Field	10.00	ACRES_1_13
Explanatory Field	11.00	NEAR_DIST

Figure B-3. Geographically Weighted Regression Results – ½ mile search radius for alternative model including additional explanatory variables.

APPENDIX C
PARKS IN GAINESVILLE, FL

NAME	ACRES	TYPE	REGION	OWNER	ADDRESS
Girl Scouts Kiwanis Park	2.30	CR	Nhd	City of Gainesville	810 NW 8th St
Mini Park #02	0.50	CR	Nhd	City of Gainesville	832 SE 9th St
Mini Park #04	0.20	CR	Nhd	City of Gainesville	424 NW 6th Ave
Mini Park #05 / Barbara Higgins Park	0.60	CR	Nhd	City of Gainesville	1360 SE 2nd St
Mini Park #06	0.60	CR	Nhd	City of Gainesville	2003 NW 32nd Pl
Mini Park #07	0.20	CR	Nhd	City of Gainesville	318 SW 7th Pl
Mini Park #09	0.10	CR	Nhd	City of Gainesville	820 NW 4th Ave
Mini Park #3 / Pleasant Park	1.10	CR	Nhd	City of Gainesville	510 NW 2nd St
Mini Park #8	0.20	CR	Nhd	City of Gainesville	1645 NE 8th Ave
Oak Hill Park	0.30	CR	Nhd	City of Gainesville	4100 NW 9th St
Roper Park	1.60	CR	Nhd	City of Gainesville	401 NE 2nd St
San Felasco Park	185.50	CR	Nhd	Alachua County	6400 NW 43rd Way
Smokey Bear Park	4.90	CR	Nhd	State of Florida	2327 NE 15th St
Cedar Grove Park	1.90	LA	Nhd	City of Gainesville	1200 Block NE 22nd St
Chapman's Pond at Kanapaha Park	42.50	LA	Cmnty	City of Gainesville	7100 SW 41st Pl
Lynch Park	1.40	LA	Nhd	City of Gainesville	450 S Main St
Possum Creek Park	74.70	LA	Cmnty	City of Gainesville	4009 NW 53rd Av
Springhill Nhd Park	3.60	LA	Nhd	City of Gainesville	900 Block SE 4th Ave
Sweetwater Park	3.20	LA	Cmnty	City of Gainesville	501 E University Ave
Thomas Center Gardens	5.70	LA	Cmnty	City of Gainesville	306 NE 6th Ave
University Park Arboretum	2.50	LA	Nhd	State of Florida	124 NW 23rd St
A.N.N.E (Mini-Park)	0.90	MR	Nhd	City of Gainesville	6310 NW 28th Ter
Fred Cone Park @ Eastside Recreation Center	91.40	MR	Cmnty	City of Gainesville	2841 E University Ave
Green Acres Park	38.80	MR	Nhd	City of Gainesville	3704 SW 8th Ave

NAME	ACRES	TYPE	REGION	OWNER	ADDRESS
Mini Park #01	1.00	MR	Nhd	City of Gainesville	1504 NE 4thAve
NE 31st Ave Park	2.20	MR	Cmnty	City of Gainesville	1710 NE 31st Ave
NE Cmnty Center	0.50	MR	Cmnty	City of Gainesville	1701 NW 8th Av
Northside Park	31.50	MR	Cmnty	City of Gainesville	5701 NW 34th St
Porter's Cmnty Center and Park	1.30	MR	Cmnty	City of Gainesville	512 SW 6th Ave
Rosa Williams Park	0.90	MR	Nhd	City of Gainesville	524 NW 1st St
T.B. McPherson Park	14.60	MR	Cmnty	City of Gainesville	1717 SE 15th St
Tumblin Creek Park	9.60	MR	Cmnty	City of Gainesville	600 SW Depot Rd
Veteran's Park at Kanapaha	23.00	MR	Cmnty	Alachua County	7400 SW 41st Pl
Westside Park	26.10	MR	Cmnty	City of Gainesville	1001 NW 34th St
Woodlawn Park	2.80	MR	Cmnty	Gainesville Housing Authority	1900 SE 4th St
Boulware Springs NP	102.80	MRE	Cmnty	City of Gainesville	3500 SE 15th St
Alfred Ring Park	20.60	NR	Cmnty	City of Gainesville	2002 NW 16th Ave
Bivens Arm Nature Park	80.30	NR	Cmnty	City of Gainesville	3650 S Main St
Clear Lake Nature Park	12.90	NR	Nhd	City of Gainesville	5480 SW 1st Ave
Cofrin Nature Center	30.30	NR	Cmnty	City of Gainesville	4810 NW 8th Ave
Colclough Pond Audubon Sanctuary	35.40	NR	Cmnty	Florida Audubon Society	2315 S Main St
Colclough Pond Nature Park	4.80	NR	Cmnty	City of Gainesville	2315 S Main St
Devil's Millhopper State Park	69.40	NR	Rgnl	State of Florida	4732 NW 53rd Ave
Gum Root Park	370.10	NR	Cmnty	City of Gainesville	7300 NE 27th Ave
Hawthorne Rail Trail	195.60	NR	Rgnl	State of Florida	3500 SE 15th St
John Mahon Nature Park	8.10	NR	Nhd	City of Gainesville	4300 W Newberry Rd
Loblolly Woods Nature Park	128.00	NR	Cmnty	City of Gainesville	3315 NW 5th Av
Morningside Nature Center	275.30	NR	Cmnty	City of Gainesville	3540 E University Ave
NW 29th Road Nature Park	5.60	NR	Nhd	City of Gainesville	1502 NW 29th Rd
Possum Creek Preservation	11.50	NR	Cmnty	City of Gainesville	2219 NW 34th St
Split Rock Conservation Area	240.10	NR	Cmnty	City of Gainesville	SW 20th Ave

NAME	ACRES	TYPE	REGION	OWNER	ADDRESS
Springtree Park	10.70	NR	Nhd	City of Gainesville	2700 NW 39th Ave
Terwilliger Pond	25.50	NR	Nhd	City of Gainesville	460 SW 62nd Blvd
Alachua County Fairgrounds	103.90	PU	Rgnl	Alachua County	2900 NE 39th Ave
Boys Club NW	6.80	PU	Cmnty	Boys Club of Alachua County	2601 NW 51st St
Boys Club SE	6.40	PU	Cmnty	Boys Club of Alachua County	1100 SE 17th Dr
Cmnty Plaza	1.20	PU	Cmnty	City of Gainesville	111 E University Ave
Girls Club of Alachua County	5.10	PU	Cmnty	Girls Club of Alachua County	2101 NW 39th Ave
Sharmie Ffar Park	0.70	PU	Cmnty	City of Gainesville	925 NW 4th Pl
Thelma Boltin center	1.00	PU	Cmnty	City of Gainesville	516 NE 2nd Ave
Citizen's Field	7.00	SR	Cmnty	City of Gainesville	1000 Waldo Rd
Forest Park	26.60	SR	Cmnty	Alachua County	4501 SW 20th Ave
Greentree Park / Kiwanis Challenge Playground	21.60	SR	Cmnty	City of Gainesville	1901 NW 39th Ave
MLK Recreation Center	25.10	SR	Cmnty	City of Gainesville	1028 NE 14th St
Mini Park #10 / Forest Pines Park	0.20	SR	Nhd	Gainesville Housing Authority	1110 NE 25th St
Northeast Park	22.20	SR	Cmnty	City of Gainesville	501 NE 16th Ave

CR = Child Recreation
LA = Leisure Activities
MR = Mixed Recreation
MRE = Mixed Resources
NR = Natural Resources
PU = Public Use Facilities
SR = Sports Recreation

LIST OF REFERENCES

Alachua County. (2010). *Countywide recreation master plan.* Retrieved 10/7, 2011, from http://www.alachuacounty.us/Depts/PW/Documents/parks/phaseI.pdf

Anderson, J. E. (1985). On testing the convexity of hedonic price functions. *Journal of Urban Economics, 18*(3), 334-337.

Anderson, S. T., & West, S. E. (2006). Open space, residential property values, and spatial context. *Regional Science and Urban Economics, 36*(6), 773-789.

Baum, F. (1999). Social capital and health: Implications for health in rural australia. presented at the *Proceedings of the Fifth National Rural Health Conference,* 96-109.

Bitter, C., Mulligan, G. F., & Dall'erba, S. (2007). Incorporating spatial variation in housing attribute prices: A comparison of geographically weighted regression and the spatial expansion method. *Journal of Geographical Systems, 9*(1), 7-27.

Bolitzer, B., & Netusil, N. R. (2000). The impact of open spaces on property values in Portland, Oregon. *Journal of Environmental Management, 59*(3), 185-193.

Brigham, E. F. (1965). The determinants of residential land values. *Land Economics, 41*(4), pp. 325-334. Retrieved from http://www.jstor.org/stable/3144665

Chiesura, A. (2004). The role of urban parks for the sustainable city. *Landscape and Urban Planning, 68*(1), 129-138.

City of Gainesville. *Parks Facilities*, 2011, from http://www.cityofgainesville.org/tabid/182/Default.aspx

Commoner, B. (1971). The closing circle: Nature, man, and technology. *New York, 141*, 265-268.

Costanza, R., d'Arge, R., De Groot, R., Farber, S., Grasso, M., Hannon, B., et al. (1997). The value of the world's ecosystem services and natural capital. *Nature*, 387(6630), 253-260.

Craven, B., & Islam, S. M. N. (2011). ORDINARY LEAST-SQUARES REGRESSION. The SAGE Dictionary of Quantitative Management Research, 224-228.

Crompton, J. (2000). *The impact of parks and open space on property values and the property tax base* Natl Recreation & Park Assn.

Crompton, J. (2005). The impact of parks on property values: Empirical evidence from the past two decades in the united states. Managing Leisure, 10(4), 203-218.

Driver, B.L., D. Dustin, T. Baltic, G. Elsner, and G.L. Peterson. 1996. *Nature and the Human Spirit: Toward an Expanded Land Management Ethic.* State College, Pa.: Venture.

Freeman, A. M. (2003). *The measurement of environmental and resource values: Theory and methods.* RFF press.

Geoghegan, J. (2002). The value of open spaces in residential land use. *Land use Policy, 19*(1), 91-98.

Goodman, E., & Whitaker, R. C. (2002). A prospective study of the role of depression in the development and persistence of adolescent obesity. *Pediatrics*, 110(3), 497.

Irwin, E. G. (2002). The effects of open space on residential property values. *Land Economics, 78*(4), 465.

Kitchen, J. W., & Hendon, W. S. (1967). Land values adjacent to an urbanmneighborhood park. *Land Economics, 43*(3), pp. 357-360. Retrieved from http://www.jstor.org/stable/3145164

Knaap, G. (1998). The determinants of residential property values: Implications for metropolitan planning. *Journal of Planning Literature*, 12(3), 267-282. doi:10.1177/088541229801200301

Kuo, F. E., & Sullivan, W. C. (2001). Environment and crime in the inner city. *Environment and Behavior, 33*(3), 343.

Maller, C., Townsend, M., Brown, P., & St Leger, L. (2009). Healthy parks healthy people: The health benefits of contact with nature in a park context. *Burwood (Australia): Faculty of Health and Behavioural Sciences, Deakin University*

Miller, A. R. (2001) *Valuing open space: Land economics and neighborhood parks*, Cambridge, MA, MIT Center for Real Estate.

Milon, J. W., Gressel, J., & Mulkey, D. (1984). Hedonic amenity valuation and functional form specification. *Land Economics, 60*(4), 378-387.

Morancho, A. B. (2003). A hedonic valuation of urban green areas. *Landscape and Urban Planning, 66*(1), 35-41.

Nicholls, S., & Crompton, J. L. (2005). The impact of greenways on property values: Evidence from austin, texas. *Journal of Leisure Research*, 37(3), 321.

Nicholls, S. (2002) Does open space pay? Measuring the impacts of green spaces on property values and the property tax base, College Station, TX, Texas A&M University, PhD dissertation.

Office of Institutional Planning and Research. (2011). *University of florida fact book.* Retrieved 10/6, 2011, from http://www.ir.ufl.edu/oirapps/factbooktest/enrollment/fb_enrollment.aspx

Parsons, R. (1991). The potential influences of environmental perception on human health. *Journal of Environmental Psychology, 11*(1), 1-23. doi:10.1016/S0272-4944(05)80002-7

Polinsky, A. M., & Rubinfeld, D. L. (1975). *Property values and the benefits of environmental improvements: Theory and measurement* Institute of Public Policy Studies, University of Michigan.

Racca, D. P., & Dhanju, A. (2006). Project report for property Value/Desirability effects of bike paths adjacent to residential areas.

Rosen, S. (1974). Hedonic prices and implicit markets: Product differentiation in pure competition. *The Journal of Political Economy, 82*(1), 34-55.

Santa Fe College. (2011). *Santa fe college facts.* Retrieved 10/6, 2011, from http://www.sfcollege.edu/facts/content/media/mugs/Facts%20-%20Fall%20Closing%202010.pdf

Sundberg, R. (2002). Collinearity. Encyclopedia of Environmetrics.

Tyrväinen, L., & Väänänen, H. (1998). The economic value of urban forest amenities: An application of the contingent valuation method. *Landscape and Urban Planning, 43*(1-3), 105-118.

Wheeler, D. C., & Páez, A. (2010). Geographically weighted regression. *Handbook of Applied Spatial Analysis,* , 461-486.

BIOGRAPHICAL SKETCH

Brittany McMullen is currently pursuing a Master of Arts in Urban and Regional Planning, as well as the interdisciplinary concentration and certificate in historic preservation, at the University of Florida. She has served as an intern for Alachua County Growth Management where she assisted in the evaluation and appraisal report process for updating the county's comprehensive plan. She was also an intern for the city of Gainesville's planning department, specifically assisting with historic preservation planning. She obtained a Bachelor of Arts in political science, also from the University of Florida, with a minor in business administration.