2016

Assessing the impact of a supermarket shuttle model on supermarket access within Cabell County, West Virginia

Doug Wiley
hiaidus7@gmail.com

ASSESSING THE IMPACT OF A SUPERMARKET SHUTTLE MODEL ON SUPERMARKET ACCESS WITHIN CABELL COUNTY, WEST VIRGINIA.

A thesis submitted to
The Graduate College of
Marshall University
In partial fulfillment of
The requirements for the degree of
Master of Science
in
Geography
by
Doug Wiley
Approved by
Dr. Godwin Djietror, Committee Chairperson
Dr. Anita Walz
Dr. James Leonard

Marshall University
May 2016

APPROVAL OF THESIS

We, the faculty supervising the work of Douglas Wiley, affirm that the thesis, *Assessing the Impact of a Supermarket Shuttle Model on Supermarket Access Within Cabell County, West Virginia*, meets the high academic standards for original scholarship and creative work established by the Master of Science and the College of Liberal Arts. This work also conforms to the editorial standards of our discipline and the Graduate College of Marshall University. With our signatures, we approve the manuscript for publication.

		5/4/16
Dr. Godwin Djietror, Department of Geography	Committee Chairperson	Date
		5-5-16
Dr. Anita Walz, Department of Geography	Committee Member	Date
		5/4/16
Dr. James Leonard, Department of Geography	Committee Member	Date

DEDICATION

This thesis is dedicated to my wife and children Kelly, Andrew and Katherine.

ACKNOWLEDGEMENTS

I would like to thank the faculty of the Marshall University Geography Department for their assistance in the preparation and revision of this thesis. I would like to thank all the faculty and staff members of Marshall University who have challenged and guided me throughout my academic career. I would like to thank all of my fellow students within the Geography Department for all of their help and support in the recent years. In particular, I would like to thank Dr. Djietror, Dr. Leonard and Dr. Walz for their help with this thesis and throughout my journey to this point.

CONTENTS

LIST OF FIGURES

ABSTRACT

Will the implementation of a grocery shuttle impact supermarket access for residents of Cabell County, West Virginia? The concentration of supermarkets in the City of Huntington has led to a service gap in the outlying census block groups of the study area. Supermarket access is concentrated in the City of Huntington and may provide a positive outcome for families living within the city. The study assesses the impact of the implementation of a supermarket shuttle on supermarket access within the study area, through spatial analysis of supermarkets, transportation networks, and census block groups. The transportation network data and census block group data used were obtained from the U.S. Census Bureau database. The vehicle availability, percentage of the population living under the poverty line and population data sets were obtained from the U.S. Census Bureau using the Summary File Data Retrieval Tool V1.0.0.8. Supermarket locations were obtained from business directories and were subject to ground truthing. The supermarket locations were geocoded and a 3,200 meter network distance buffer was applied to calculate the supermarket service areas within the study area. The supermarket shuttle locations were added to the supermarket locations and the 3,200 meter network distance buffer was again applied to create the supermarket and supermarket shuttle service areas. The supermarket shuttle locations expanded supermarket access in 19 census block groups within the study area. The proposed supermarket shuttle raised six census block groups above the 50% coverage threshold and these areas would no longer be classified as areas with low supermarket access. The supermarket shuttle model increased supermarket access for 13,238 persons within the study area.

CHAPTER I

INTRODUCTION

The definition of a food desert is fluid and does not have a specific set of parameters that are required. One definition of a food desert classifies a food desert as a geographic area with few or no full service food retail establishments (Schafft, et al. 2009). Another definition of a food desert is an area of a city where residents do not have adequate access to food shops (Coyle and Flowerdew, 2011). The 2008 Farm Bill, Section 7527, defines a food desert as an area with limited access to affordable and nutritious food, particularly such an area composed of predominantly lower income communities (U.S. Senate, 2008).

For the most vulnerable within a population, supermarket access may have a direct effect on the availability of fresh fruits and vegetables (Aggarwal et al. 2014; Thornton et al. 2012; Dimitri and Rogus, 2014). Improved access to supermarkets may increase the accessibility of healthful dietary options such as fresh fruits and vegetables available at supermarkets versus food options present at fast food retailers and discount stores (Schafft, et al, 2009). Limited access to supermarkets may compel vulnerable members of the population to patronize food retailers with lower quality products and less healthful options (Sharkey, et al. 2009; Bader, et al. 2010b). The effect of a diet low in fruits and vegetables may cost communities through increased health care costs and lower quality of life both in the short term and long term.

Objectives

The ultimate goal of this study is to assess the impact of the proposed supermarket shuttles on supermarket access of census block groups within Cabell County, West Virginia. In order to achieve this goal an analysis of the current supermarket access was conducted. The initial supermarket service area results serves as the baseline information on supermarket access to be compared to access after the supermarket shuttles have been modeled. Secondly, the area of each census block group with supermarket coverage and population with supermarket coverage will be compared before and after the supermarket shuttle model has been applied.

CHAPTER II

LITERATURE REVIEW

The search for food deserts has been conducted in many locales throughout the world. Studies have been conducted primarily in the United States, United Kingdom and Canada (Sharkey, et al. 2009, Coyle and Flowerdew, 2011, Larsen and Gilliland, 2008). Previous research typically seeks to identify areas of low access to supermarkets. Supermarket access may have an effect of an individual's ability to obtain healthful dietary options. The link between supermarket access and dietary outcomes based on fruit and vegetable intake has had mixed results (Sharkey, et al. 2009, Thornton, et al. 2012, Aggarwal et al. 2014, Schafft, et al. 2009). The delineation of food deserts has been achieved in a myriad of ways in the reviewed literature. One of the major trends in identifying food deserts is physical distance from supermarkets and other food outlets (Dimitri and Rogus, 2014, Larsen and Gilliland, 2008, Sharkey, et al. 2009).

In the reviewed literature, establishing the distance between the unit of analysis and food opportunities has been primarily accomplished through two distinct distance measurement methods. The first distance measure addressed is the proximity measure, which simply identifies the nearest supermarket or food outlet from a chosen area. In a rural study of southern Texas, proximity was used to identify the nearest food opportunity from a census block group within the study area. In this study, supermarkets, convenience stores, dollar stores, and pharmacies were all considered food opportunities (Sharkey, et al. 2009). In a similar study conducted in Seattle, Washington, researchers used the proximity technique to measure the distance between the nearest supermarket and home addresses (Drewnowski, et al. 2012). The study conducted by Drewnowski and colleagues also used the proximity measure to calculate the distance between respondents' home addresses and the self-reported supermarket of choice. Interestingly only 1 in 7 reported preferring the nearest supermarket (Drewnowski, et al. 2012).

The other method of identifying food deserts is the coverage technique. In this method, the presence of shopping opportunities within a distance band or buffer from the unit of analysis determines food access. The coverage technique allows researchers to identify the range of options available to their subjects. A key element of the coverage technique for assessing the food landscape is the ability to employ various distance bands that are designed to mimic different modes of travel. In a study conducted by Jiao and associates residents living in supermarket service areas in Seattle and King County, Washington were delineated by their ability to walk, bicycle, ride transit, or drive to a supermarket within 10 minutes (Jiao, et al. 2012). The research by Jiao and associates found a large disparity between the ability to reach a supermarket by private vehicle or public transit within 10 minutes and the ability to walk to a supermarket in the same time frame. A study conducted in Glasgow, Scotland, also utilized different distance buffers to identify supermarket access by differing transportation types. A study conducted by Thornton and colleagues used distance bands ranging from 0.4 km to 5 km to identify supermarket access within their area of interest (Thornton, et al. 2012).

The two previously discussed distance measurement strategies have more recently been achieved through network distances. The network distance approach allows researchers to more closely model the route that an individual would likely take to a food opportunity. Network distances have become the de facto measurement methodology in food access research (Jiao, et al. 2012, Sharkey, et al. 2009, Thornton, et al. 2012, Drewnowski, et al. 2012, Larsen and Gilliland, 2008, Aggarwal et al. 2014). Part of the reason for the adoption of the network distance approach for both the proximity and coverage techniques has been the expanded use of

Geographic Information Systems and the increase in spatially referenced data (Bader, et al. 2010b and Thornton, et al. 2012). The spatially referenced data that were the most important in network distance calculations were transportation grid data. Road network data can be created independently but is typically purchased from a vendor or acquired through a government agency such as the United States Census Bureau.

The starting point for the distance calculations contained in previous research has varied greatly. In the United States, the units of analysis most commonly used have been the individual, census block groups and zip codes (Schafft, et al. 2009, Sharkey, et al. 2009, Drewnowski, et al. 2012). Census block groups and zip codes have served as proxies for neighborhoods in previous studies. Individual level data do not have the modifiable areal unit problem associated with it that were inherent in census block group and zip code data. Individual level data may negate aggregation effects; however, individual level data were vulnerable to self-reporting errors associated with interviewer or interviewee bias.

Delineating the food environment requires the acquisition of food opportunity data. Previous research has compiled food opportunities, including supermarkets, supercenters, fast food restaurants, full service restaurants, pharmacies, discount stores, and convenience stores to represent the food environment (Sharkey, et al. 2009, Larsen and Gilliland, 2008, Jiao, et al. 2012). The most established food vendor used in the identification of the food environment is supermarkets. The data on supermarket address information, which were needed for distance based measures, come from three primary sources: business directories, commercial data sets and permitting registries. In the 2008 study by Larsen and Gilliland examining how the urban food environment had changed in Ontario, Canada since 1961 their supermarket data were obtained through current and archived business directories.

One of the underling aspects of research into food deserts is the effect that these areas have on vulnerable members of the population. The use of socioeconomic data to classify areas of increased susceptibility to food security issues was widespread within the literature concerning food deserts. Many variables have been used to approximate need in previous research. One of the more recent methodological advances has been the development of composite indexes of socioeconomic data (Sharkey, et al. 2009 and Drewnowski, et al. 2012). In the Drewnowski and associates identified that their index was created by combining income and education classification into the single variable: SES.

There is a need to control for food opportunities that exist outside of the study area but still produce a service area within the study extent. These border effects can be difficult to detect if caution is not taken and inspection of adjacent expanses for bordering food opportunities completed. The Schafft and colleagues study conducted in 2009 identified supermarkets in adjacent states and counties to control for service areas protruding into their study area (Schafft, et al. 2009). The controlling for border effects approach that was adopted in this study was the addition of a 3,200 meter buffer to the study area to capture border effects.

CHAPTER III

METHODOLOGY

Study Area

The focus of this research is Cabell County, West Virginia. Cabell County, West Virginia is bounded by the Ohio River and Wayne, Lincoln, Putnam, and Mason counties. Cabell County, West Virginia is the third most populous county within West Virginia the 2014 population estimate was 97,109. Cabell County, West Virginia covers an area of 745 square kilometers.

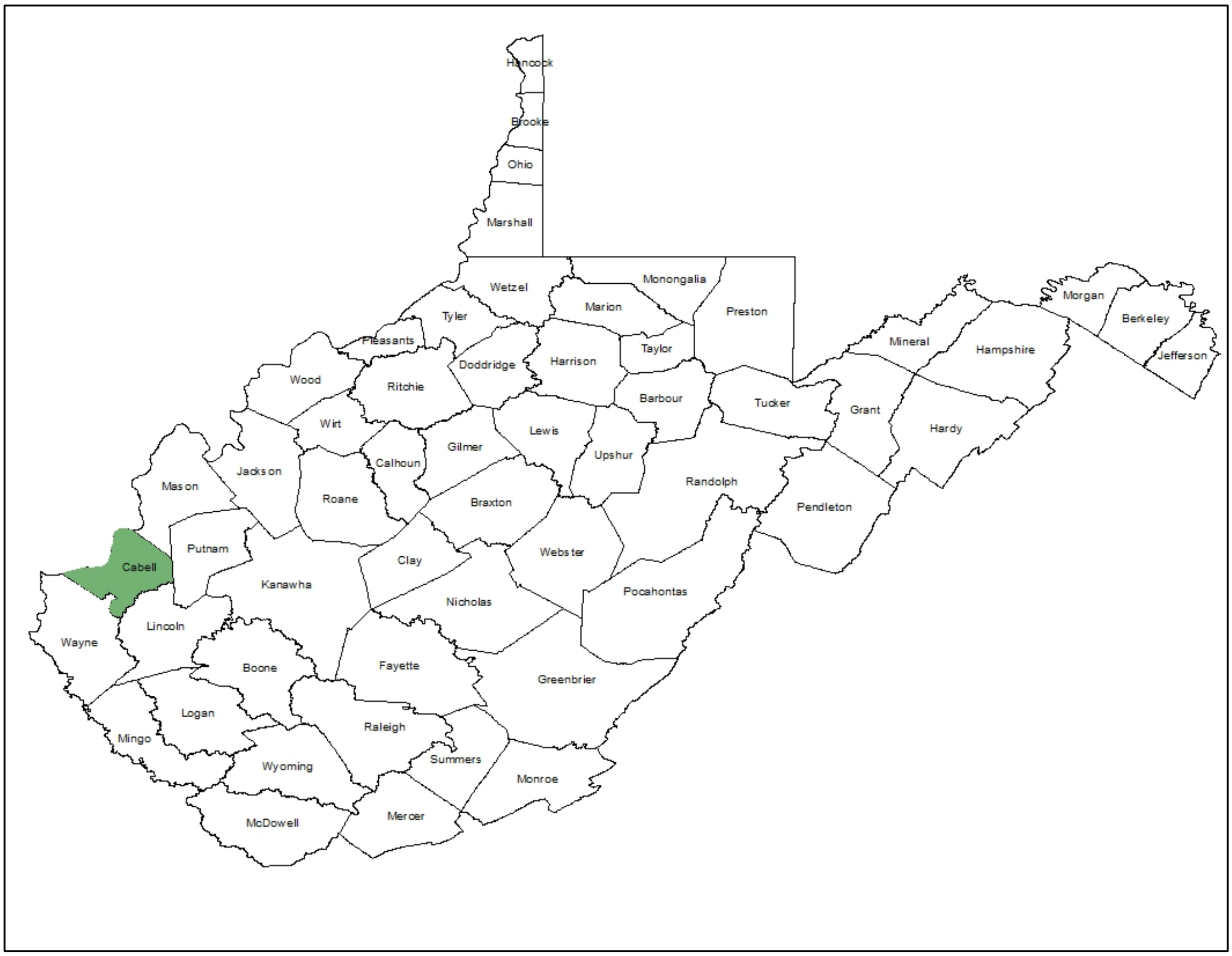

Figure 1: Map of West Virginia with Study Area Highlighted.

Data

The literature reviewed discussed methodologies for the acquisition of supermarket address data. The three primary methods for gathering supermarket addresses were utilizing commercially available data sets, permitting records and through business directories (Bader, et al. 2010a; Jiao, et al. 2012). A previous study did not identify a statistically significant difference in the quality of data obtained through a commercial data set and one created using business directories (Bader, et al. 2010a). Business directories were used to identify and geocode supermarket addresses in this study.

Geocoding is the placement of a point within a Geographic Information System based on a locational attribute. The two locational attributes that were used in the reviewed literature were supermarket address and "front door" coordinates (Bader, et al. 2010a; Jiao, et al. 2012; Larsen and Gilliland, 2008; Sharkey, et al. 2009). The reviewed literature does not promote one method of geocoding supermarket points. Geocoding was implemented in this research using supermarket addresses as the locational attribute input. Geocoding with addresses requires an address locator and a network dataset both of these tools were created in ArcCatalog 10.1.

To evaluate supermarket access within Cabell County, West Virginia, supermarket address information was required. Supermarket addresses obtained for the study area were subject to ground truthing. All 14 of the supermarket addresses obtained through business directories were checked through field observations. Field observations were required to investigate whether the individual supermarkets identified in business directories were still operating. The low number of stores affecting supermarket access within the study area made purchasing commercial data undesirable.

Assessing the spatial relationship between consumers and supermarkets has been conducted at many scales across the globe. In the United States much of the research has been conducted at either the census tract or census block group levels (Jiao, et al. 2012; Sharkey, et al. 2009; Bader, et al. 2010b). To reduce the effect of aggregate data errors the smallest unit is routinely used. The census block group is the unit of analysis for this research.

Spatial data concerning census block groups within the study area were obtained from the United States Census Bureau's TIGER/Line shapefiles. These shapefiles were projected into UTM Zone 17 North; this projection is one the three data standards that were adopted by the WV GIS Steering Committee in 2002. The data contained 82 census block groups, of which 42 had their centroid within the City of Huntington's city limits.

The use of economic indicators to classify census block groups, census tracts, and zip codes is constant in research conducted to analyze the effects of supermarket access. The identification of economic deficiency within study areas has been directed by indicators such as percentage of the population under the poverty line, vehicle availability, educational attainment, median income, percentage of homes with complete kitchens and percentage of homes with complete plumbing (Bader, et al. 2010b; White, 2007; Schafft, et al. 2009; Larsen and Gilliland, 2008; Sharkey, et al. 2009). Throughout the reviewed literature the percentage of the population under the poverty line and vehicle access were consistently used to assess the socioeconomic status of census block groups. Demographic and socioeconomic data for the census block groups were obtained through the United States Census Bureau's American Community Survey. The demographic variable of interest for this research was total population. The 2006-2010 5 year estimates were used for the two socioeconomic variables. These variables were Vehicles

Available and Percentage of the Population under the Poverty Line. These data were appended to the TIGER shapefiles within the study area.

The transportation data were obtained from the United States Census Bureau's TIGER/Line directory. The data were statewide in extent and were clipped using the Cabell County shapefile with a 3,200 meter Euclidian buffer applied. The network buffer applied to the study area allowed for the inclusion of supermarkets which were not within the study area but whose service areas extend into the area of interest (Schafft, et al. 2009). The network buffer also allowed for the transportation network to more accurately capture border effects associated with vehicle routing.

Methodology

Network Data Set

A transportation network was used in this research as the basis for calculating supermarket access. The use of network distance instead of Euclidian distance has one important advantage. Network distance is calculated using a transportation grid that an individual will typically travel to a shopping opportunity (Jiao, et al. 2012; Larsen & Gilliland, 2008; Sharkey, et al. 2013; Sharkey, et al. 2009; Drewnowski, et al. 2012; Thornton, et al. 2012). Network distance provides a more accurate distance measure than Euclidian measures which follow straight line distances, which may or may not be accessible transportation routes. The network data set for this research was constructed using the all roads data set obtained from the U.S. Census Bureau. The network data set was constructed in ArcCatalog 10.1. Figure 2 shows the road network used within the network analyst extension for distance calculations.

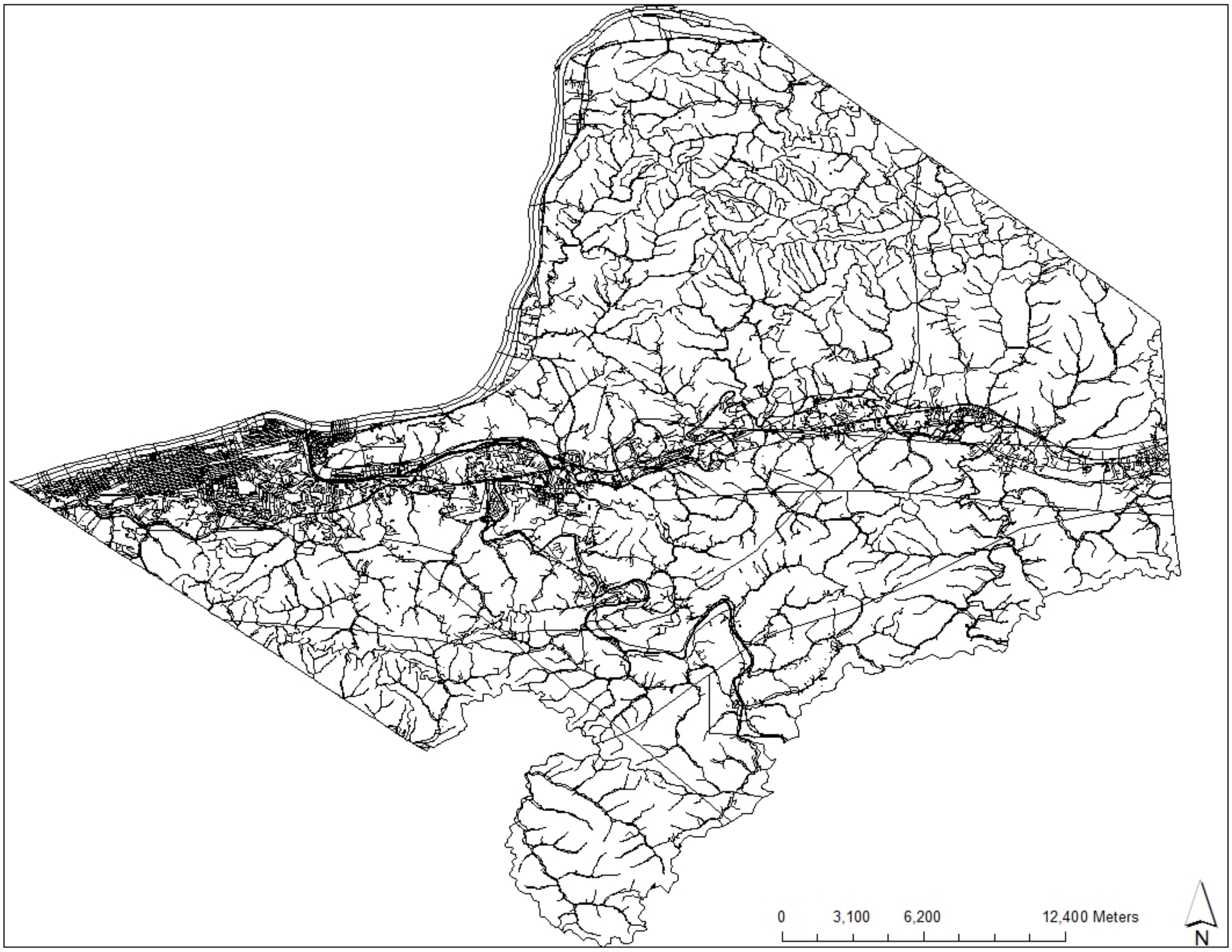

Figure 2: Road Network Used for Supermarket Access Delineation.

Geocoding and Address Locator

In order to investigate supermarket access within the study area the locations of supermarkets needed to be located within ArcGIS 10.1. An address locator is a tool within a GIS that matches arbitrary address information to a real world location. The address locator for this research was built in ArcCatalog 10.1. The address locator constructed is a dual range locator. A dual range locator allows for the GIS to identify whether a location is on the right or left side of a street.

The supermarket address information obtained through business directories was entered into Microsoft Excel and geocoded using the dual range address locator. The address locator was able to match 6 of the 14 supermarkets to their location in the network data set. The remaining eight points were matched by using satellite imagery as a base map within the GIS and selecting the supermarket location manually (See Figure 3).

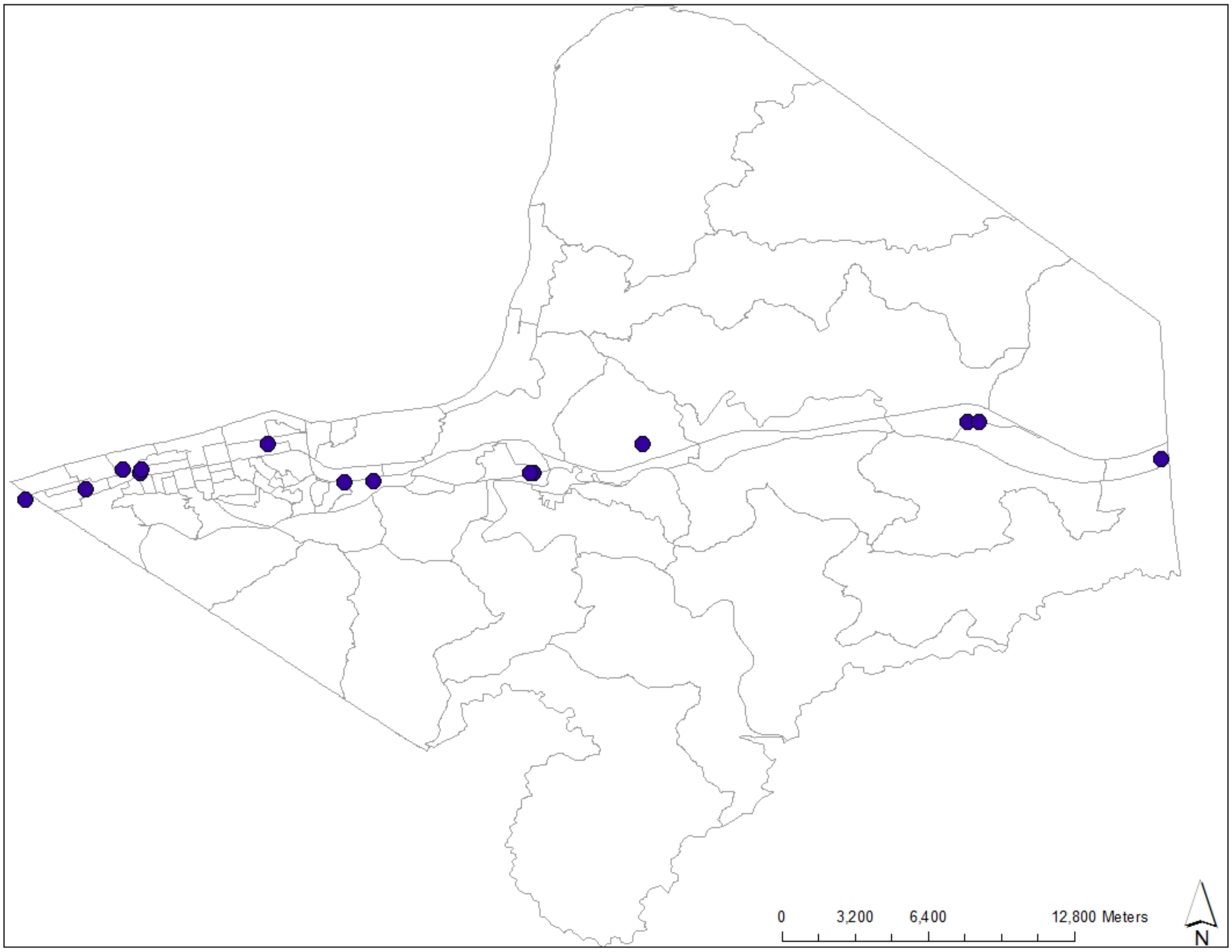

Figure 3: Supermarkets Used in Network Distance Calculations.

Supermarket Access Coverage Method

The measure of supermarket access that is used in this research is the coverage method. The coverage technique calculates specific distance bands from supermarket locations or from census block group centroids. These buffers represent the range of a supermarkets service area or can be used to determine the number of supermarkets within a specific distance of a census block group. The supermarket service area for this research was measured at the 3,200 meter distance band. A network buffer is extended from each facility in all directions following the road network (See Figure 4). Length is the only cost attribute computed in the network analysis.

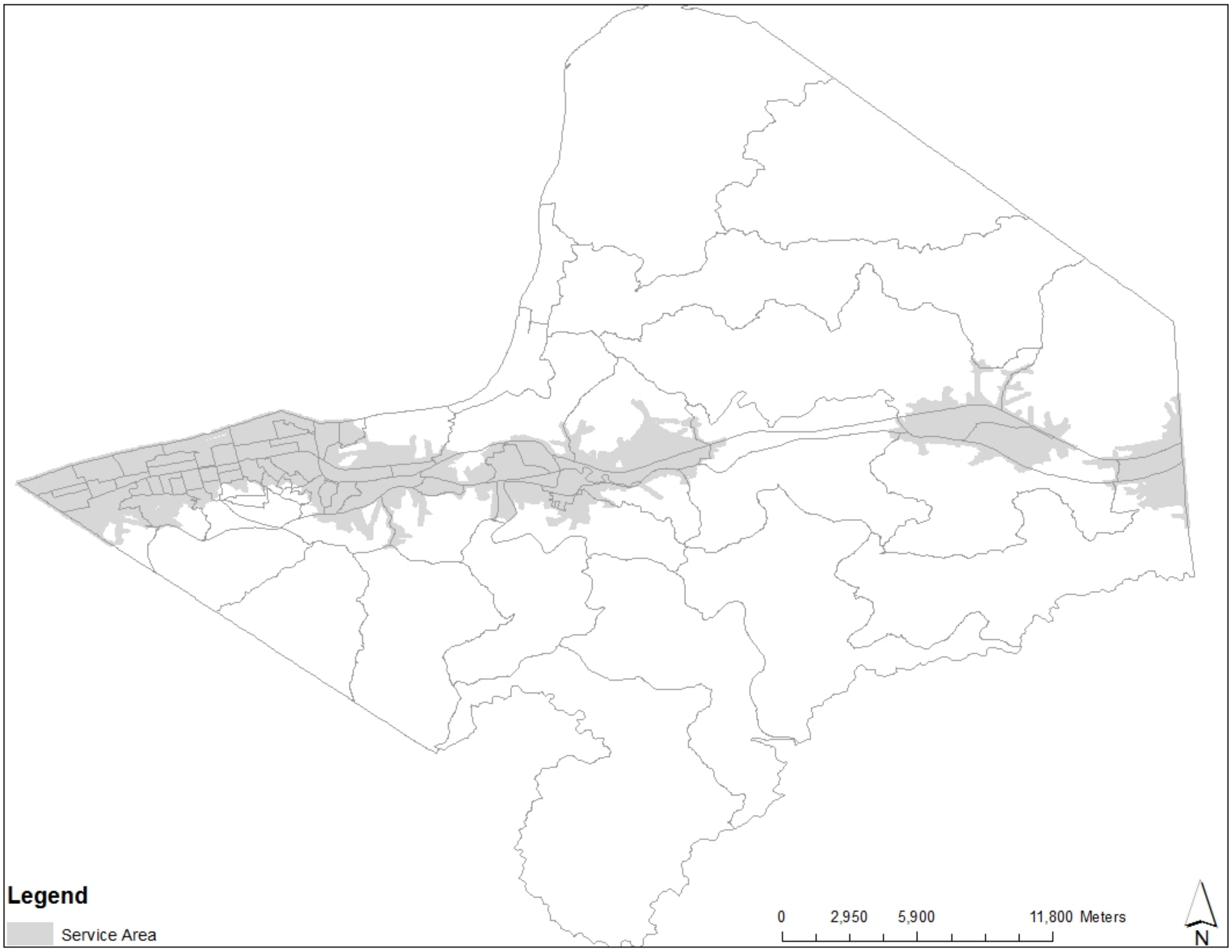

Figure 4: 3200 Meter Supermarket Service Areas.

The supermarket service area layer was used to identify census block groups with low supermarket access. Low supermarket access in this research is defined as a census block group that had less than 50% coverage by the supermarket service area. These coverage measures were calculated in ArcGIS 10.1. The first step in identifying the low supermarket access census block groups was to perform and intersect of the supermarket service area and the census block groups in the study area. The intersect performed resulted in 74 census block groups with supermarket access. The next step was to calculate the percentage of supermarket service area for each census block group. The calculation of the supermarket service areas for each census block group was achieved by adding a field to the attribute table of the intersect area layer in ArcGIS 10.1. The calculate geometry function was used to provide the area in meters squared that the supermarket service area covered for each census block group. Next, another field was added to the intersect area layer and the field calculator was employed to calculate the percentage of coverage for each census block group. The results of the supermarket service area percentage were used to identify census block groups with less than 50% coverage.

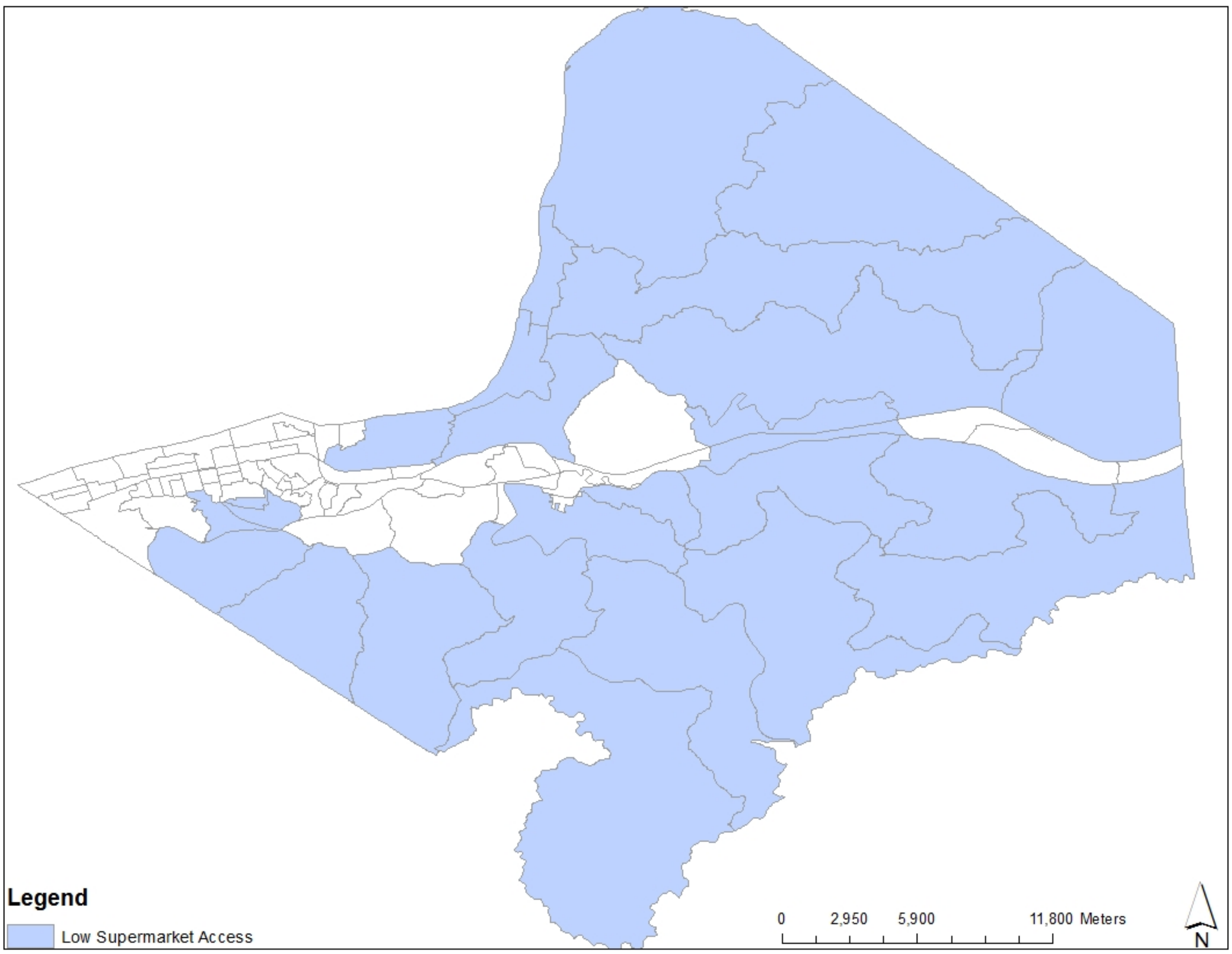

Figure 5: Low Supermarket Access Census Block Groups.

Demographic Data

The demographic variable used to assess the impact of the modeled supermarket shuttle was population density. The number of persons with supermarket access at the 3,200 meter network distance was compared to the number of persons with supermarket access after the supermarket shuttle model is employed. The population data provided insight into the amount of extended access the supermarket shuttle model could provide.

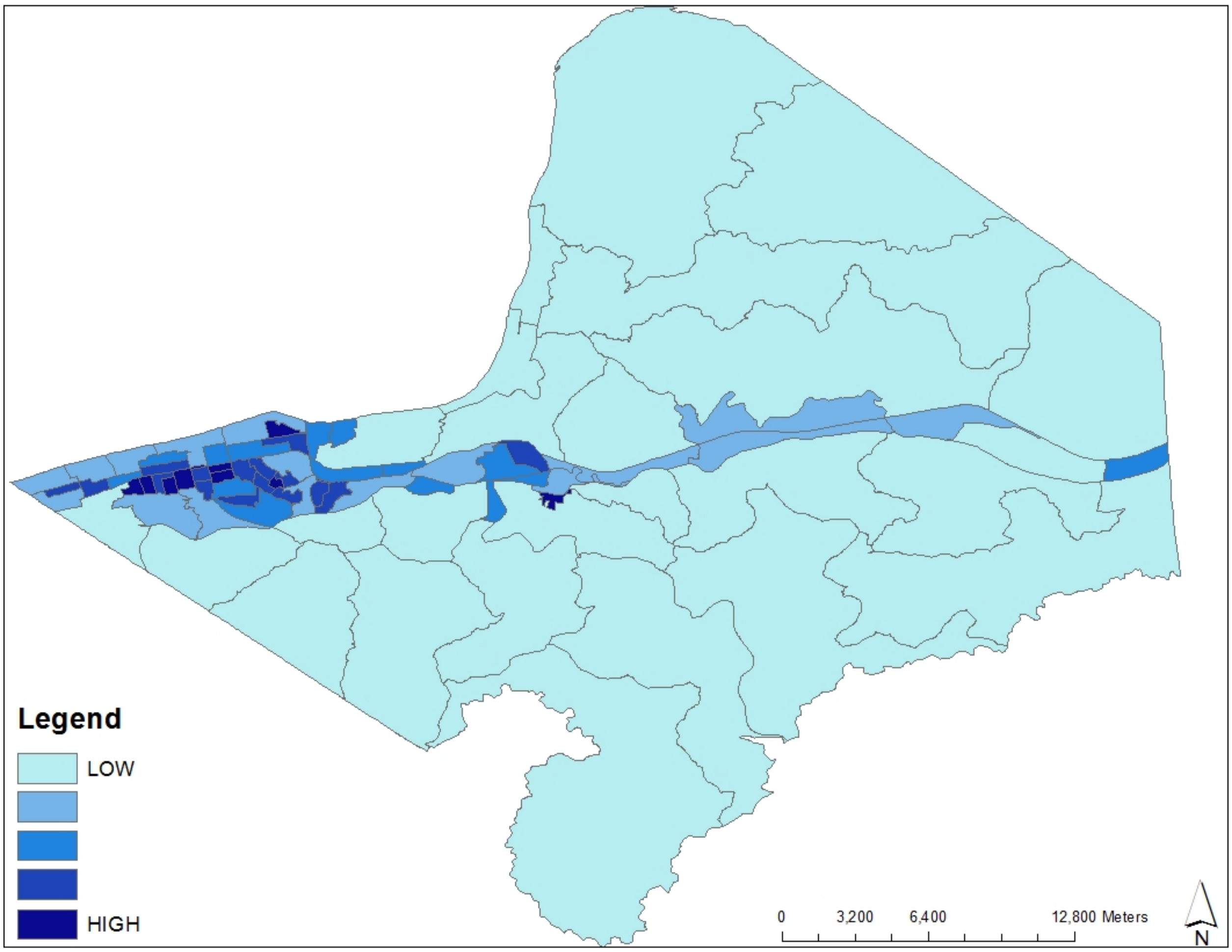

Figure 6: Population Density.

Supermarket Shuttle Location Selection

To identify optimal supermarket shuttle locations the location allocation tool was used within ArcGIS 10.1. To achieve this goal the census block groups with acceptable levels of supermarket access were removed from the data set. The next step was to append population data to the centroid shapefile. The prospective supermarket shuttle location had a service area created to delineate the extent of their network range. The centroids service areas were then intersected with the census block groups to identify the percentage of each neighboring census block group, this was achieved by adding a field to the attribute table of the intersect area layer in ArcGIS 10.1. The calculate geometry function was used to provide the area in meters squared that the centroid service area covered for each census block group. Next, another field was added to the centroid intersect area layer and the field calculator was employed to calculate the percentage of coverage for each census block group. The dissolve function was used to combine the service area sections that extended into other census block groups. The sum statistic was calculated for population of each census block group during the dissolve process. The resulting centroid service area data were appended to the low supermarket access centroid shapefile to be used in the location allocation analysis (Figure 7).

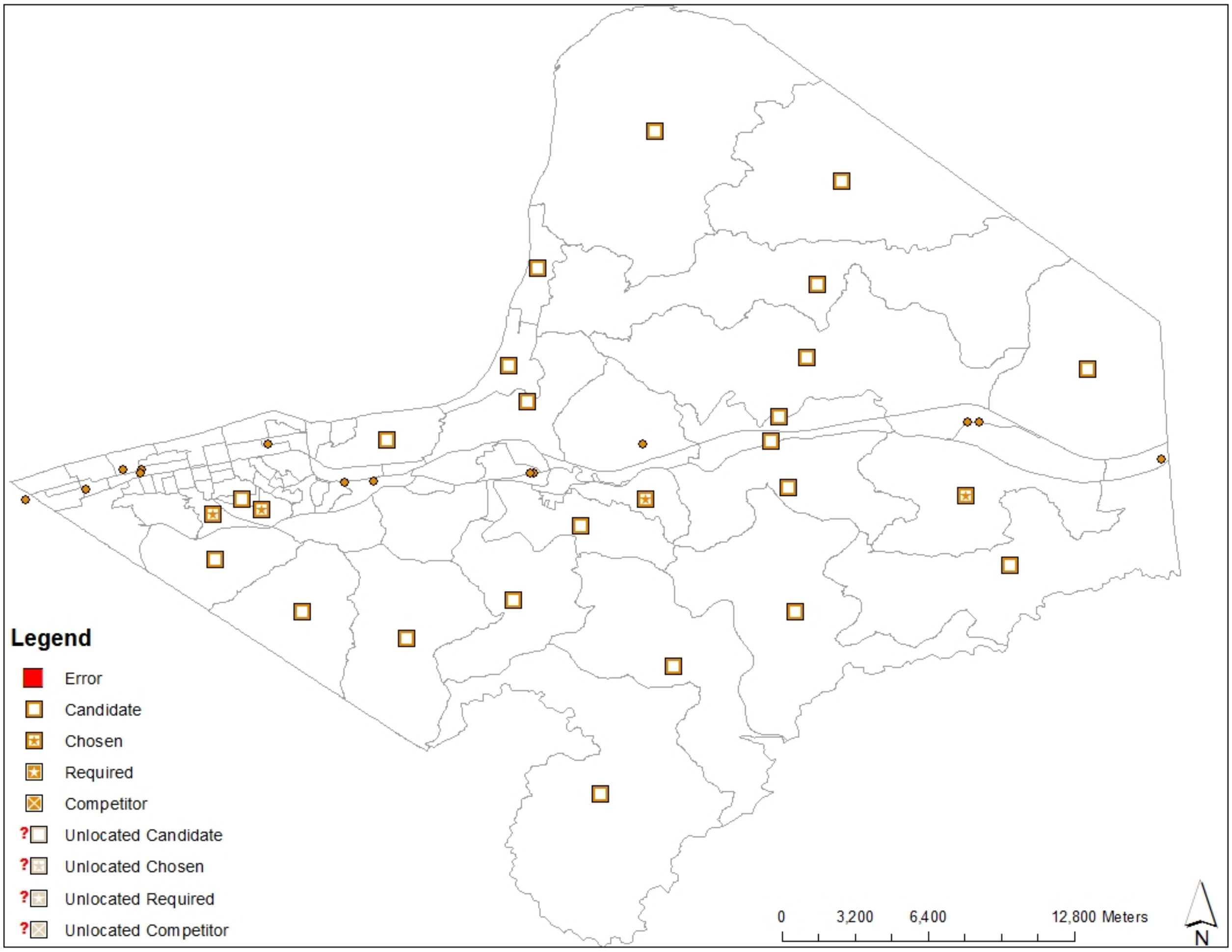

Figure 7: Supermarket Shuttle Location Allocation Analysis.

The population data allowed for the location allocation tool to give possible supermarket shuttle locations higher preference for serving a larger population. The low supermarket access census block group centroids served as the supermarket facilities layer for this analysis. The demand data input for the location allocation of this analysis were the supermarket locations. Within the tool the maximum attendance option was selected and the number of shuttles was set to four. Figure 8 illustrates the results of this analysis. The identification of supermarket shuttle locations allowed for the supermarket service areas and the supermarket shuttle service areas to be merged within ArcGIS 10.1. Figure 9 displays the supermarket and supermarket shuttle service areas combined.

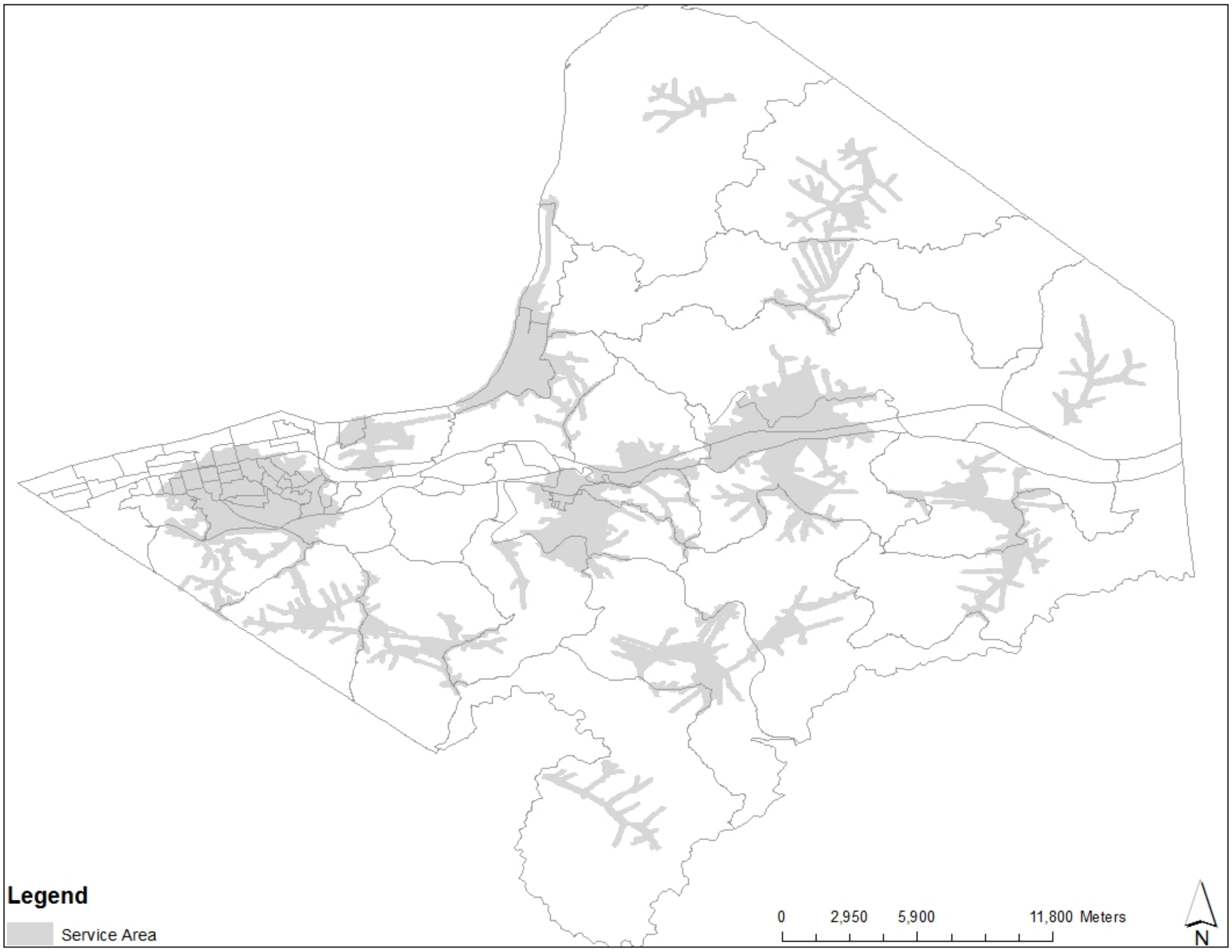

Figure 8: Prospective Supermarket Shuttle Service Areas.

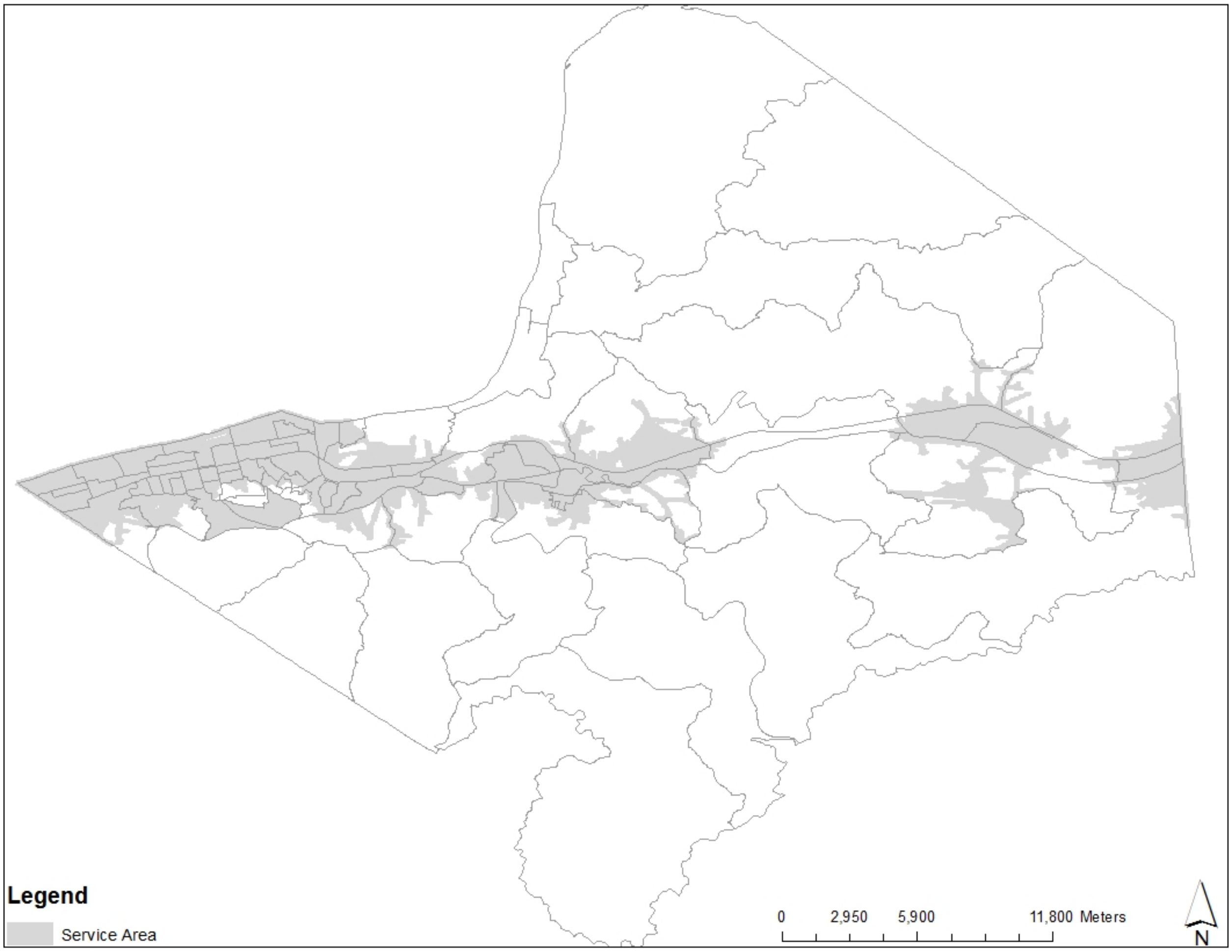

Figure 9: 3200 Meter Supermarket Shuttle and Supermarket Service Area.

Supermarket Access with Supermarket Shuttle Model

To model supermarket access after the supermarket shuttle locations had been identified the supermarket shuttle locations were added to the supermarket locations in the network analyst (Figure 10). The service areas were then recalculated with the new facilities added to the analysis layer. The supermarket shuttles modeled resulted in expanded supermarket access for 19 census block groups within the study area. The supermarket service and supermarket shuttle areas were then used to select census block groups with low supermarket access. To identify low supermarket access, an intersect function was performed using the expanded service areas and the census block groups in the study area. The supermarket shuttle model resulted in 76 census block groups with supermarket access. The next step was to calculate the percentage of expanded supermarket service area for each census block group. Calculating the expanded supermarket service area was achieved by adding a field to the attribute table of the intersect area layer in ArcGIS 10.1. The calculate geometry function was used to provide the area in meters squared that the new supermarket service area covered for each census block group. Next, another field was added to the intersect area layer and the field calculator was employed to calculate the percentage of coverage for each census block group. The results of the expanded supermarket service areas percentage were used to identify census block groups with less than 50% coverage (Figure 11).

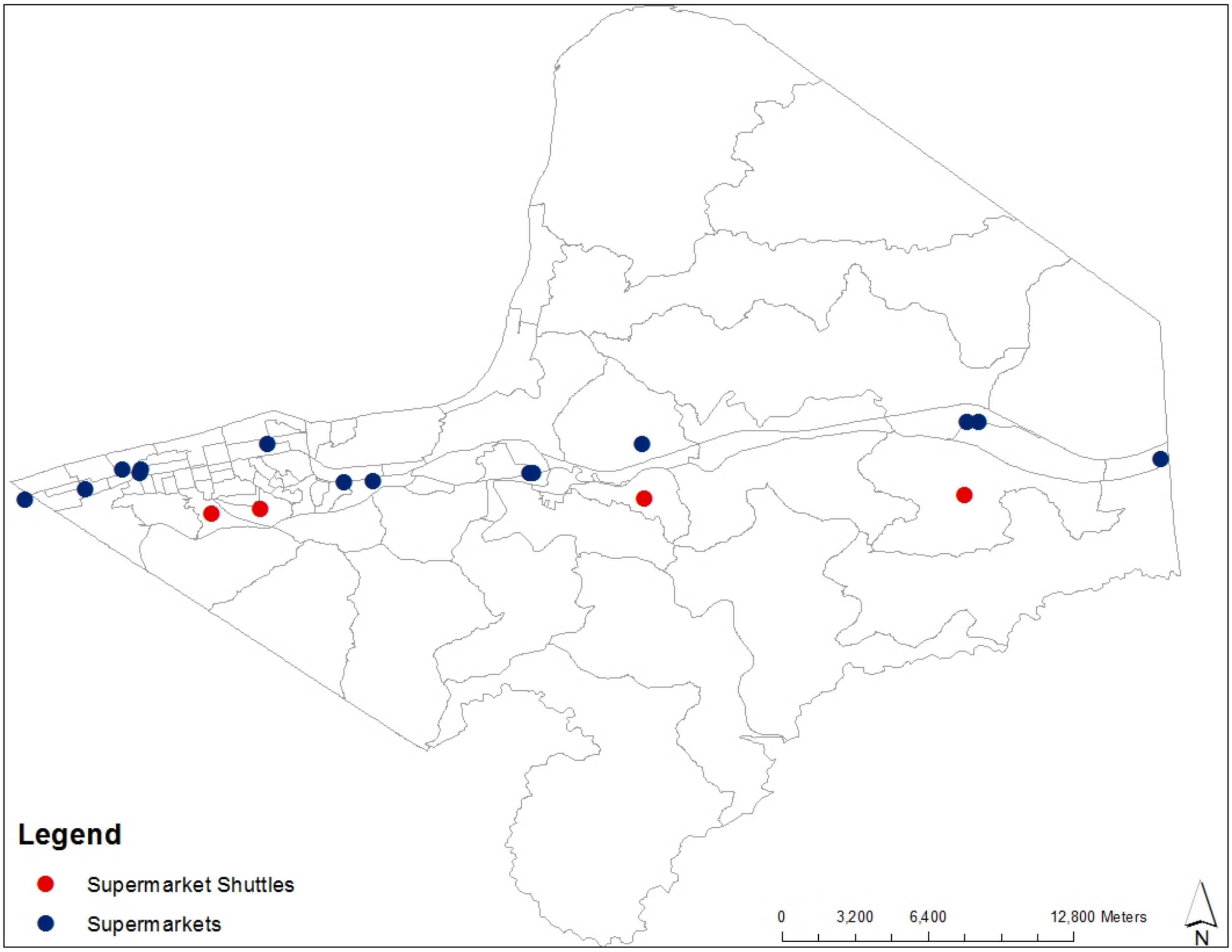

Figure 10: Supermarket Shuttles and Supermarkets.

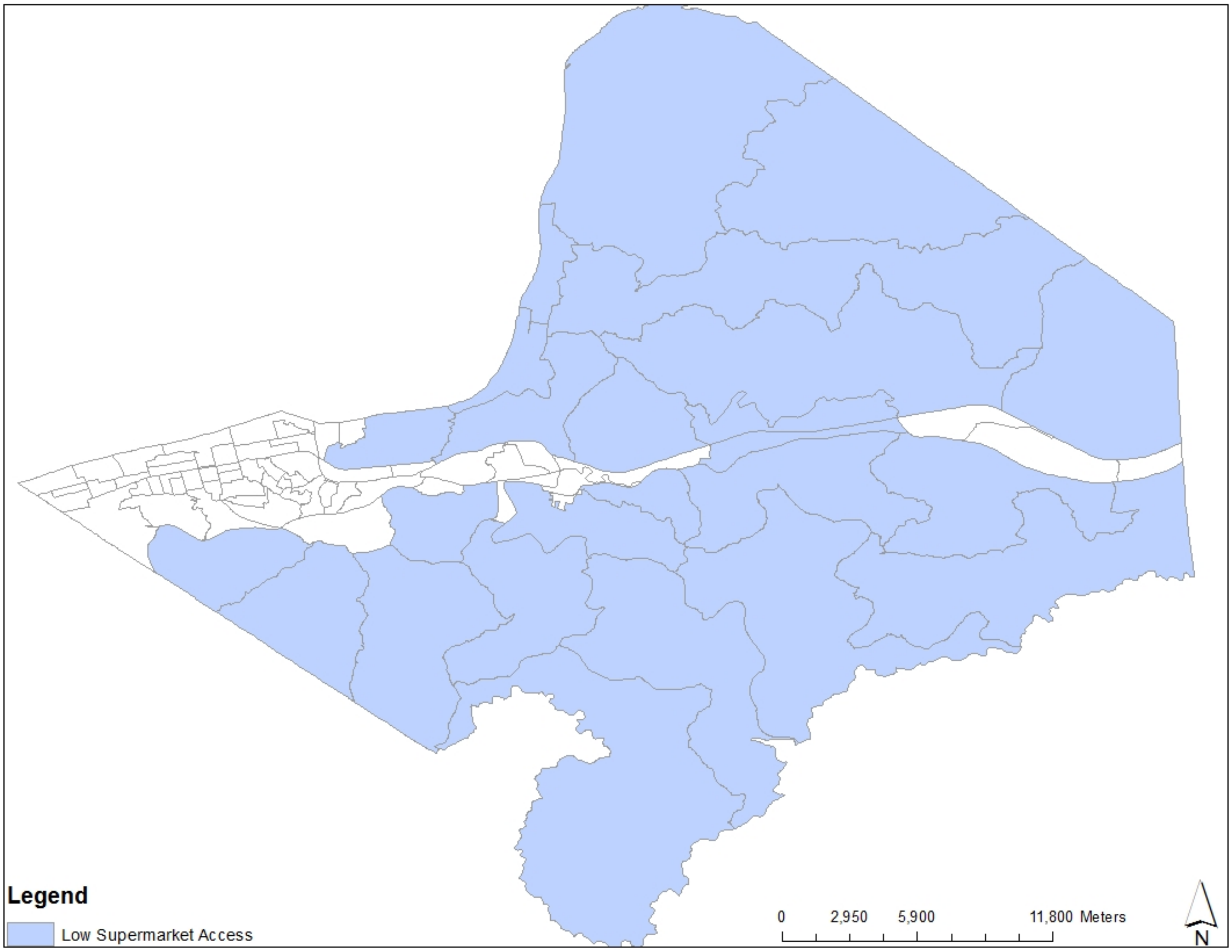

Figure 11: Low Supermarket Access Census Block Groups after Proposed Supermarket Shuttle.

CHAPTER IV

RESULTS

The four supermarket shuttle locations modeled increased supermarket access in 19 census block groups within the study area. The increase in supermarket access in the 19 census block groups ranged from 1% to 100%. The supermarket shuttle model increased 11 of the 19 census block groups with expanded to 100% coverage at the 3200 meter distance band. There were six census block groups that transitioned out of the low supermarket access classification. Figure 12 is a proportional symbol map displaying the supermarket access population change. The number of persons with supermarket access before the supermarket shuttle model was employed was 55,996. After the added supermarket service area provided by the supermarket shuttle locations the total number of persons with supermarket access increased to 69,234. The supermarket shuttle modeled increased supermarket access for 13,238 persons within the study area. The supermarket shuttle model expanded service area increase accounts for 14.2% of the population within the study area. The area of the 19 census block groups with increased supermarket access after the implementation of the supermarket shuttle accounted for 18.9 km sq.

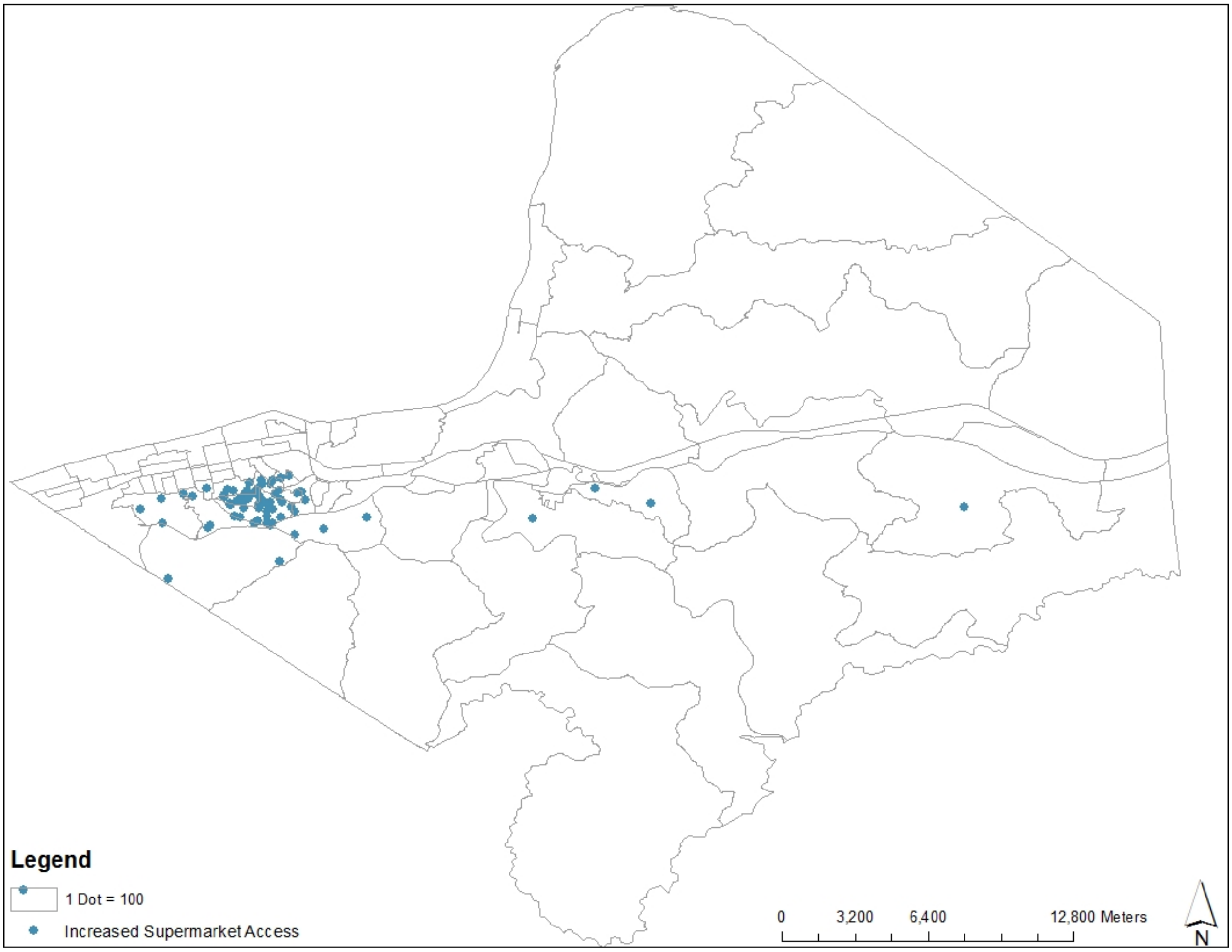

Figure 12: Dot Density Map Illustration of Supermarket Access Increase

CHAPTER V

DISCUSSION

The research conducted concerning supermarket access within Cabell County, West Virginia has followed the methodological practices of previous research. The use of network buffers, U.S. Census Bureau demographic data and the census block group unit of analysis were well documented in the relevant literature (Sharkey, et al. 2013; Thornton et al. 2012; Jiao, et al. 2012). The results of the initial supermarket access modeling found a large disparity between supermarket access for census block groups in the City of Huntington and the remainder of the study area. The concentration of supermarkets in the City of Huntington suggests that the location of supermarkets within Cabell County, West Virginia have not shifted toward the periphery in the same way as in other locales (Larsen and Gilliland, 2008; Bedore, 2013). The concentration of supermarkets has led to a service gap in many of the outlying census block groups.

The service gap identified may lead some individuals to less healthful shopping opportunities or place upon them an increased burden to access more nutritious and less expensive options. The increased supermarket access within Huntington undoubtedly helps many of the residents within the city. A large portion of the census block groups within Huntington were in the two highest quintiles of percentage under the poverty line. The implementation of the supermarket shuttle model in this research could expanded supermarket access in 19 census block groups which accounts for over 13,000 residents.

The supermarket shuttle model aimed to increase supermarket access for those who were most susceptible to food security issues. The site selection process of the proposed supermarket shuttle locations is a key component in extending supermarket access. The location allocation analysis for maximum attendance provides researchers and policy makers with a tool that can identify areas that are not only in need of assistance but also allow for maximum return on their investment.

REFERENCES

Aggarwal, Anju Cook, A; Jiao, J; Seguin, R; Vernez Moudon, A; Hurvitz, P.; Drewnowski, A.2014. "Access to Supermarkets and Fruit and Vegetable Consumption. " *American Journal of Public Health*. http://ezproxy.marshall.edu:2117/ehost/detail/detail?vid=3&sid=36b0b4cd-9674-4df9-9088-32ea706669bb%40sessionmgr111&hid=123&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#db=aph&AN=95476007 (March 30, 2015).

Bader, Michael;Ailshire, J; Morenoff, J; House, J S. 2010a."Measurement of the Local Food Environment: A Comparison of Existing Data Sources." *American Journal of Epidemiology*. http://ezproxy.marshall.edu:2111/ehost/detail/detail?vid=6&sid=b578d076-184c-4cd0-af43-8675d05ef97b%40sessionmgr4003&hid=4109&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#db=aph&AN=48718139 (March 30, 2015).

Bader, Michael; Purciel, M; Yousefzadeh, P; Neckerman, K. 2010b. "Disparities in Neighborhood Food Environments: Implications of Measurement Strategies." *Economic Geography*. http://ezproxy.marshall.edu:2111/ehost/detail/detail?vid=25&sid=b578d076-184c-4cd0-af43-8675d05ef97b%40sessionmgr4003&hid=4109&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#db=aph&AN=64879817 (March 30, 2015).

Bedore, Melanie. 2013. "Geographies of Capital Formation and Rescaling: A Historical-Geographical Approach to the Food Desert Problem." *The Canadian Geographer*. http://ezproxy.marshall.edu:2111/ehost/detail/detail?vid=31&sid=b578d076-184c-4cd0-af43-8675d05ef97b%40sessionmgr4003&hid=4109&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#db=aph&AN=87798851 (March 30, 2015).

Coyle, Lindsay; Flowerdew, R. 2011. "Food Deserts in Dundee." *Scottish Geographical Journal*. http://ezproxy.marshall.edu:2111/ehost/detail/detail?vid=23&sid=b578d076-184c-4cd0-af43-8675d05ef97b%40sessionmgr4003&hid=4109&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#db=aph&AN=61012062 (March 30, 2015).

Dimitri, Carolyn; Rogus, S. 2014. "Food Choices, Food Security, and Food Policy." *Journal of International Affairs*. http://ezproxy.marshall.edu:2111/ehost/detail/detail?vid=18&sid=b578d076-184c-4cd0-af43-8675d05ef97b%40sessionmgr4003&hid=4109&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#db=aph&AN=95804635 (March 30, 2015).

Drewnowski, A; Aggarwal, A.; Hurvitz, P. M.; Monsivais, P.; Moudon, A .2012. "Obesity and Supermarket Access: Proximity or Price? "*American Journal of Public Health*. http://ezproxy.marshall.edu:2117/ehost/detail/detail?vid=9&sid=36b0b4cd-9674-4df9-9088-32ea706669bb%40sessionmgr111&hid=123&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#db=aph&AN=78243197 (March 30, 2015).

Jiao, Junfeng; Moudon, A; Ulmer, J; Hurvitz, P.; Drewnowski, A. 2012. "How to Identify Food Deserts: Measuring Physical and Economic Access to Supermarkets in King County, Washington." *American Journal of Public Health.* http://ezproxy.marshall.edu:2111/ehost/detail/detail?vid=21&sid=b578d076-184c-4cd0-af43-8675d05ef97b%40sessionmgr4003&hid=4109&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#db=aph&AN=82049284 (March 30, 2015).

Larsen, Kristian; Gilliand, J. 2008. "Mapping the Evolution of 'Food Deserts' in a Canadian City: Supermarket Accessibility in London, Ontario, 1961–2005." *International Journal of Health Geographics 2008, 7:16.* http://www.ij-healthgeographics.com/content/7/1/16 (March 30, 2015).

Schafft, Kai; Jensen, E; Hinrichs, C. 2009. "Food Deserts and Overweight Schoolchildren: Evidence from Pennsylvania." *Rural Sociology*. http://ezproxy.marshall.edu:2117/ehost/detail/detail?vid=7&sid=36b0b4cd-9674-4df9-9088-32ea706669bb%40sessionmgr111&hid=123&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#db=aph&AN=42009321 (March 30, 2015).

Sharkey, Joseph; Horel, S; Han, D; Huber, J. 2009. "Association between Neighborhood Need and Spatial Access to Food Stores and Fast Food Restaurants in Neighborhoods of Colonias." *International Journal of Health Geographics.* http://www.ij-healthgeographics.com/content/8/1/9 (March 30, 2015).

Sharkey, Joseph; Dean, W; Nalty, C; Xu, J. 2013. "Convenience Stores are the Key Food Environment Influence on Nutrients Available from Household Food Supplies in Texas Border Colonias." *BMC Public Health.* http://www.biomedcentral.com/1471-2458/13/45 (March 30, 2015).

Thornton, Lukar; Pearce, J.; Macdonald, L.; Lamb, K.; and Ellaway, A.2012. "Does the Choice of Neighborhood Supermarket Access Measure Influence Associations with Individual-Level Fruit and Vegetable Consumption? A Case Study From Glasgow." *International Journal of Health Geographics*. http://ezproxy.marshall.edu:2117/ehost/detail/detail?vid=5&sid=36b0b4cd-9674-4df9-9088-32ea706669bb%40sessionmgr111&hid=123&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#db=aph&AN=82470311 (March 30, 2015).

White, Martin. 2007 "Food Access and Obesity." *The International Association for the Study of Obesity*. http://ezproxy.marshall.edu:2111/ehost/detail/detail?vid=14&sid=b578d076-184c-4cd0-af43-8675d05ef97b%40sessionmgr4003&hid=4109&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#db=aph&AN=24029239 (March 30, 2015).

APPENDIX A

MARSHALL UNIVERSITY®
www.marshall.edu

Office of Research Integrity

March 29, 2016

Doug Wiley
1819 Buffington Avenue
Huntington, WV 25703

Dear Mr. Wiley:

This letter is in response to the submitted thesis abstract to assess whether the implementation of a grocery shuttle will impact supermarket access for residents of Cabell County, West Virginia. After assessing the abstract it has been deemed not to be human subject research and therefore exempt from oversight of the Marshall University Institutional Review Board (IRB). The Code of Federal Regulations (45CFR46) has set forth the criteria utilized in making this determination. Since the information in this study does not involve human subjects as defined in the above referenced instruction it is not considered human subject research. If there are any changes to the abstract you provided then you would need to resubmit that information to the Office of Research Integrity for review and a determination.

I appreciate your willingness to submit the abstract for determination. Please feel free to contact the Office of Research Integrity if you have any questions regarding future protocols that may require IRB review.

Sincerely,

Bruce F. Day, ThD, CIP
Director

WE ARE... MARSHALL.

One John Marshall Drive • Huntington, West Virginia 25755 • Tel 304/696-4303
A State University of West Virginia • An Affirmative Action/Equal Opportunity Employer