

ASSESSING THE ROLE OF SMALLER FORMAT RETAILERS ON THE FOOD
DESERT LANDSCAPE IN DALLAS, TEXAS

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Many policy and business decisions regarding food deserts in the U.S. are based on the United States Department of Agriculture (USDA) definition of a food desert. This definition only includes large/national chain grocery retailers, based on the assumption that these major retailers are the only affordable sources of food contributing to balanced diets. As alternative distribution channels, including smaller stores, start to include groceries in their product offering, the need to consider the role of other businesses in the food retailing environment should be addressed. This thesis assesses the role of smaller format grocery retailers (small local grocers, convenience stores, gas stations, dollar stores, and drug stores) in shaping the food desert landscape in Dallas, Texas. The analysis evaluates the products offered in these stores, and then identifies the difference these stores make when included in the USDA analysis. This was done by collecting in-store data to determine the variety of products offered, the affordability of those products, and the overall healthfulness of the store. In addition, the gaps in supply and demand were identified in the USDA-defined food deserts in order to identify the impact any smaller format retailer may have. The findings suggest that, overall, smaller format retailers do offer a variety of products needed for a balanced diet. However, the products in these stores are mostly not affordable, and most stores offer more unhealthy foods, than unhealthy. Overall, results suggest dollar stores may play a role in alleviating the impact of food deserts.

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CHAPTER I

INTRODUCTION

Various factors can be attributed to the unhealthy diets of Americans. Across all socioeconomic classes people are consuming less grains, fruits, vegetables, and dairy, and more fats, oils, and sweets, than is recommended for daily intake for a balanced diet (USDA 2009). The difficulty of choosing to eat healthy foods is compounded when a person does not have adequate access to healthful food options. In the United States, more than one-third of adults and approximately 17 percent of children and adolescents are obese. Also, diet related diseases such as heart disease, diabetes, and cancer are amongst the leading causes of death for Americans today—all of which are linked to obesity (Ogden et al. 2012). High body mass index measurements (BMIs)¹ are associated with socioeconomically distressed populations, and are highest amongst women and minorities (Chaix et al. 2012; Cummins and Macintyre 2006; Ford and Dzewaltowski 2009; Lee 2012; Richardson et al. 2012). This suggests that environmental influences outside of a person's biological makeup affect their health. The built environment plays a major role in this, specifically the food retail environment. As a result there is a large body of literature across several fields that focus on areas where there is limited access to affordable and healthful foods, calling these areas 'food deserts'.

Food deserts are a relatively recent phenomenon that is related to suburbanization. Over time grocery retailers have followed the more affluent consumers

¹BMI is a primary measure of obesity.

to the suburbs, leaving behind gaps in the food retailing environment (Alwitt and Donley 1997; Clarke 2004; Cummins and Macintyre 2002; Guy 2004; Larsen and Gilliland 2008; Leete et al. 2011; Powell et al. 2007). These areas are typically plagued with accessibility issues, especially regarding socioeconomic status and race or ethnicity. Poorer areas tend to have more liquor stores, less grocery stores, and a higher concentration of stores that provide mainly energy-dense foods, and as a result, they tend to be less healthy overall than wealthier areas (Moreland et al. 2002).

Food deserts are defined several ways in the literature. However, researchers define these zones most frequently as areas that have limited access to major grocery stores and have a low socioeconomic status (or high economic distress) (Jeeter and Cassady 2006; Larsen and Gilliland 2008; Larson et al. 2009, Leete et al. 2011; Smoyer-Tomic et al. 2006; USDA 2009). Past studies tend to focus on access to large national grocery retail chains, and usually exclude smaller grocery retailers (i.e. local grocery retailers, dollar stores, drug stores, and convenience stores). By definition, large chain stores provide a variety of healthful foods (i.e. perishable foods such as fresh fruits, veggies, meat, etc.) and typically have the most competitive pricing of food items due to the fact they can achieve a better economies of scale than a smaller retailer such as a convenience store (USDA 2009). Ignoring smaller food retailers could potentially omit an important source of food for consumers, especially in communities with income and mobility issues. Having such a limited definition of a food desert can lead to a fairly fragmented understanding of food deserts. This could be problematic for any decision maker (e.g. business, policy) wanting to address or alleviate issues associated with food deserts. There is little literature that actually surveys the product selection of these

smaller format retailers (none of which survey Dallas, Texas), especially more recently as we see major shifts in the food retailing industry coming out of this recession.

Developing a comprehensive understanding of the food environment as encountered by the consumer, including smaller grocery retailers, is essential to gaining a better perspective on the factors that shape food deserts. In this connection, store type matters, but it is also important to know about product offerings. All of this information can contribute to a full understanding of what is going on in local food environments.

This study examines the degree to which smaller format grocery retailers impact the geographic coverage of food deserts in the City of Dallas, Texas. It also surveys the contents of the smaller format stores in 11 neighborhood types to determine if these smaller stores can adequately provide healthful groceries to their communities in a way that is comparable to the larger grocery retailers. This includes measuring the variety of food items (i.e. fresh fruits, vegetables, whole grains, dairy, proteins, and other) identified as necessary for a healthful diet by the USDA. Surveying store contents should give a better insight as to how the food desert landscape might actually look and how these smaller format retailers function within the neighborhoods in which they operate. In addition to looking at the supply side, this study evaluates the demand for grocery items in Dallas, and identifies areas where there may be gaps in the service scape. Discovering how these stores function in the context of their geography is critical for understanding the formation of food deserts. Overall, this study aims to contribute to the discussion on food deserts by providing empirical evidence of the role of smaller

format retailers (and their associated store contents) play on the food retailing environment in one of the nation's largest cities.

CHAPTER II

LITERATURE REVIEW

Socioeconomic and Demographic Factors

How a food desert is defined varies greatly throughout the literature. This diversity might be attributed to the many backgrounds of the authors contributing to the body of work on food deserts. Some researchers focus mainly on socioeconomic factors, where some are more concerned with the nutritional value of the food, or even geographic scale. While the specifics of the actual definitions employed in each study vary, food deserts are generally defined as socioeconomically distressed areas with limited access to healthful food (Jeeter and Cassady 2005; Larsen and Gilliland 2008; Larson et al. 2009; Leete et al. 2011; Smoyer-Tomic et al. 2006).

One key factor where differences in definition exist relate to socioeconomic threshold. Larsen and Gilliland (2008) define food deserts as disadvantaged areas of cities with relatively poor access to healthy and affordable food. Their analysis goes on to further articulate that their use of “disadvantaged” refers to a household income that is relatively low. This is how many other authors have addressed this variable, by defining low income as relative to other incomes in the area. For example, the USDA’s definition of a food desert (discussed below) defines the poverty threshold relative to the surrounding income of the area that the potential food desert is in. Defining a food desert this way is helpful for creating information that is comparative for that area, and assigns more meaning to the data.

Knowing where areas of high-consumption costs are located seems to be a better indicator of where food deserts are because they measure true accessibility and

affordability. African American neighborhoods tend to have the least access to grocery stores (on average live 1.1 miles further than the average white neighborhoods), but some studies in the North America found that African-Americans were more likely to eat a healthy diet when they had better access to a local supermarket than restaurants (Larson et al. 2009; Moore and Diez Roux 2006; Zenk et al. 2005) This indicates that access affects purchase decisions, however the degree to which that decision is affected depend on many more variables other than spatial proximity.

Race and ethnicity play a major role in the food desert literature. Several studies look at the relationship between race/ethnicity and food access or diets (Johnson 2012; Haas et al. 2003; Zenk et al. 2005). In the U.S., regardless of income, African Americans have access to about half (52%) as many chain grocery retailers as whites do, and Hispanics only have access to about one-third (32%) the amount of chain grocery retailers relative to non-Hispanics. They also tend to have better access to non-chain grocery retailers (Powell et al. 2006). Another study found that minority children and adolescents are more likely to be overweight than white children or adolescents, again pointing out the gaps in racial/ethnic groups (Haas et al. 2003). Though these studies look at demographic factors when analyzing food deserts, a study that looks at change over time has not been found. Having a better grasp on how neighborhoods change over time should allow for better planning and strategy for decision makers.

Access to a vehicle/vehicle ownership is another means of determining accessibility. This makes sense because people in the U.S. are accustomed to making large, less frequent purchases when grocery shopping. This is based on the fact that the automobile allows for this convenience and has shaped the way in which many

cities in the U.S. were developed after the wide acceptance of the vehicle. People living in low-income areas realize a higher cost of accessing food than those who do not. This is based on the idea that vehicle ownership makes up a larger portion of the consumer's income, or that car ownership is non-existent, and the consumer will spend more time traveling to the store because they may have to walk or use public transportation (Bader et al. 2010; Berg and Murdoch 2008).

Some research has looked at actualized travel habits of specific (very limited) areas. For example, participants in northern Philadelphia surveyed in a study by The University of Pennsylvania traveled more than one mile on average, and if they didn't have access to a vehicle, they received a ride from a friend or family member with a vehicle in order to do their grocery shopping (Hillier et al. 2011). Many articles argue that proximity does not necessarily translate into accessibility and therefore actual consumption of food nearest the consumers. This suggests that different areas need to use a different approach when assessing the accessibility and consumption patterns in food retail environments of different areas in the U.S.

These socioeconomic and demographic factors looked at in these studies are closely related to evaluating access. The next section discusses some of the studies that focus on measurements and distinguish the difference between various ways of looking at accessibility.

Evaluating Access

Most of the literature on food deserts defines a food desert based on the accessibility and affordability of food, usually from grocery stores (Drewnowski et al. 2012; Hallett and McDermott 2011; Hendrickson et al. 2006; Johnson 2012; Kaufman et

al. 1997; Walker et al. 2010; Weatherspoon et al. 2012). These variables differ from author to author and type of area that is studied. Some authors even use them interchangeably. This is probably because even if food is geographically accessible, it may not be monetarily accessible to consumers, especially in low-income areas. Accessibility deals more with the geographical and transportation issues in the area of study, whereas affordability refers to the actual cost of consuming the good.

A large portion of the literature on food deserts defines accessibility based on a one-mile radius around a grocery store, or a one-mile radius in a census tract because it is assumed that one mile is a reasonable distance if the consumer had to walk (Bader et al. 2010; Neckerman et al. 2009; USDA 2009). Only using a one-mile radius to identify food deserts excludes additional geographic barriers that may not be realized if not included in the analysis. For example, a one-mile radius can overlap a highway or a river. Both the highways and river can act as a barrier for pedestrians or increase the actual distance traveled by the consumer; therefore a straight-line distance is not a good indicator of accessibility.

Many studies use a variety of different measurements including geographical information systems (GIS) that calculate the minimum distance and coverage methods in order to determine the supermarket accessibility within a city (Leete et al. 2011; Smoyer-Tomic et al. 2006). For example, the use of public transit (bus and rail) is examined with GIS, using census tracts as a good indicator of 'neighborhoods' and then a buffer or container is created for that particular area. However, these measures do not take into consideration how people actually commute or access the stores (Larsen and Gilliland, 2008). Many authors therefore use network-based approach and look at

footpaths, roads, and public transit routes, amongst others, in order to better examine the accessibility of food retailers (Cummins and Macintyre 2002; Drewnowski et al. 2012; Jetter 2006). This approach is useful for determining accessibility, but the studies will ignore (or are unable to include) the population who actually use those forms of transportation for their shopping trips to the grocery store.

When defining a food desert, the types of geographic boundaries vary greatly. The census tract is the most commonly used (Rose et al. 2009; Moore and Diez Roux 2006; Bader et al. 2010; Leete et al. 2011; USDA 2009). The United States Department of Agriculture (USDA 2009) defines a food desert by identifying a census tract that qualifies as a low income tract and a low access tract. A census tract is considered low income if at least 20 percent of the population have an income at or below the federal poverty level for a family of four, or the median income for the tract is at or below 80 percent of the surrounding area's median income for a family of four (for urban areas the surrounding area is considered the metropolitan area). A census tract is identified as a low access tract if at least 500 persons or 33 percent of their population live more than a mile from a large/national chain grocery retailer (USDA 2009). Based on the USDA criteria, in 2000, 10 percent of the census tracts in the U.S. are considered food deserts; with the majority (82 percent) of the census tracts are in urban areas (USDA 2009). This explains why most of the literature focuses on urban area food deserts. This definition is important to mention specifically because it is used for this study in order to facilitate the analysis of the impact of smaller format retailers (i.e. small mom and pop grocers, dollar stores, and drug stores).

In addition to these approaches, there are other ways of evaluating access. The next section deals more specifically with the supply side of accessing foods, and engages the literature that focuses on food retailing and marketing.

Food Retailing/Marketing

The food desert literature is starting to focus on the type of stores or food included in the study. For example, Moreland et al. (2001) state that a food desert refers to low income areas with limited food service availability, which includes all food services such as any type of restaurant, supermarkets, supercenters, drug stores, etc. This definition ignores major components of defining a food desert. It does not indicate the availability of healthful food, just that there is food period. Also it does not include the issue of affordability when defining a food desert. Therefore, just knowing there is access to food is not helpful for decision makers when identifying need. Another example is a study by Regan and Rice (2012) where alternative grocery distribution channels were included in the analysis of food deserts. This was a preliminary study to this thesis. It identified the difference these stores make in the geographic coverage of food deserts, though it did not evaluate the store contents, ignoring the healthful food aspect of the food desert definition. Only most recently are we starting to see studies that look at the actual contents of the stores. The studies that actually do, for example, Rose et al. (2009) and Hiller et al. (2011) look at the quality, variety, and affordability of the products in stores in New Orleans, LA and Philadelphia, PA respectively. Many studies choose to not take this approach because such an undertaking by someone other than the retailers, who have instant access to inventory, is an enormous task. This

is most likely the reason there is not much literature on the types of food or products offered in differing food retail environments (USDA 2009).

A growing body of research suggests that the suburbanization of food retailers in North America and the United Kingdom in recent decades has contributed to the emergence of urban food deserts (Alwitt and Donley 1997; Clarke 2004; Cummins and Macintyre 2002; Guy 1996; Powell et al. 2007; Leete et al. 2011). This is based on the idea that grocers locate near consumers with high disposable incomes. Thus, as more affluent populations moved to the suburbs, grocery stores followed, leaving populations remaining in the inner city under-served. More on this and how it relates to uneven development is discussed in the next section.

Research from this perspective is also based on insights provided by the spatial demand curve concept: people consume more from stores that are physically closer to them, and less from stores located further away. Also, Most of the literature looks at the food retail environment as a whole and concludes some areas and households have easier access to fast food restaurants and convenience stores but limited access to supermarkets (Clarke 2000).

For grocery retailers, having lower logistical operating costs is key for business success (Graff 2006). As a result, we see the larger national chain grocery retailers (e.g. Wal-Mart, Kroger, Target, Save-A-Lot, etc.) provide groceries at the most competitive prices, especially given the fragile nature of fresh produce. One reason there is typically little to no fresh foods in smaller format grocery retailers is related to this same concept, and therefore these smaller stores typically are not as price

competitive because they simply cannot achieve the same economies of scale² (USDA 2009).

Within the food retailing industry, there is an increasing diversity in the kinds of stores providing food. Along with grocery stores, convenience stores, drug stores, and dollar stores have also become important food providers in recent years (Whol 2011; Martinez and Kaufman 2008). For example, as a part of their new marketing strategy, Walgreens is increasing the amount of shelf space dedicated to fresh foods as well as opening stores in food deserts across the U.S. in order to assist in Michelle Obama's initiative to eliminate food deserts by 2016 as part of the "Let's Move" campaign (Marlowe 2011). Due to an increase of competition, traditional grocers may endure pressure to lower their prices. This increased pressure to lower prices combined with the perceived costs of locating in an area of low socioeconomic status (typically due to crime and lower demand) form an ideal combination of the obstacles that create food deserts (Berg and Murdoch 2008 and USDA 2009). The literature on food deserts seems to avoid the more recent trends in the grocery retailing industry (Campo and Gijbrecchts 2004 Delisle 2005; Martinez and Kaufman 2008). These changes could lead to definitions of food deserts that ignore potential sources of food for communities. This can result in a misallocation of efforts and resources when attempting to alleviate the impact to these food deserts. Knowing the access to a store is one thing, but knowing the consumer's access to specific products is a better indicator of the actual healthfulness of a neighborhood.

² This refers to the advantages obtained by increasing scale in order to spread out fixed costs over more units of output. Generally resulting in a lower cost per unit of production.

With an unstable economy and increasing gas prices, many food retailers are looking for alternative distribution channels in order to reach their consumer better (Campo et al. 2004; Geuens 2003). For example, Wal-Mart is expanding their mid-sized stores and Wal-Mart Neighborhood Market Store because its return on investment in those stores is comparable to that of its larger supercenters, also they are looking for ways to spur growth as surging gasoline prices curb some customers' shopping trips (Boyle 2011). Formats like fresh food trucks that deliver food like an ice cream truck should not be ignored and could be included in the analysis of food environments, though this may prove to be problematic to look at, given the data issues associated with the mobility of the trucks.

Some studies have looked at the effects of programs aimed at assisting stores in providing more healthful food options, with mixed results. Interventions in convenience stores primarily located in disadvantaged areas were found to have no effect on consumer behavior due to limited participation in marketing efforts by the store owners (Adams et al. 2012). However in another study, when intervention provided the stores with more healthful food items, almost half of the customers who participated in the survey switched their main source of groceries to the new location with the more healthful food options. In addition to that, the distance that these respondents traveled decreased by about 57 percent (Wrigley et al. 2003; Wrigley et al. 2004). Other studies have looked at the effects of promotional efforts on the purchases of fruits and vegetables. For example, Rickard et al. (2011) found that when exposed to broad-based advertisements, people would increase their purchase of fruits and vegetables. Thus,

there is some evidence to suggest that businesses can make changes that have a positive impact on the buying behavior of consumers.

The next section ties in some concepts already addressed in this literature review. However, it takes a look at a more macro-level approach to looking at urban processes, and then linking them to food deserts.

Uneven Development

The literature on uneven development is an important perspective on urban geography that needs to be addressed when discussing food deserts. The increasing world impacts of income inequality and how these inequalities impact quality of life are of great concern amongst researchers focused on uneven development (Harvey 1990; Smith 1982; Peck and Tickell 2002). Due to the fact that capitalism favors economic gain over social equality, we see areas that receive more investment than other areas, for various reasons (e.g. arising from lower costs of labor, land, etc.). In addition, the need for capital accumulation to maintain production under capitalism results in the flow of investments from one space to another. These situations create underdeveloped spaces and continue to facilitate the seesaw motion of capital (Harvey 1978; Smith 2010). Thus uneven development is an inherent characteristic of capitalism. Though, it is important to note that a neoclassical theoretical approach asserts the idea that unevenness is more of a stepping-stone to the eventual end-result of an evenly developed market place, given the diffusion of capital in an open market.

There are many issues that arise out of uneven development, and as the world becomes more globalized, this unevenness becomes more intense. The movement of capital at this scale (throughout the global market) is especially uneven due to

investments in some areas, and marginalizing others (Harvey 1978; Kiely 2012). This increased intensity in uneven development is most prominent in global cities, creating even larger gaps in the socioeconomic status of the people living in those cities (Smith 2002). These processes can be visualized on a map of Dallas showing the divide of classes with a north-south orientation, given the large number of global companies headquartered within the city and surrounding areas, and above average poverty levels (see Table A.1 in Appendix A).

One prominent concern related to uneven development is with the globalization of gentrification processes and the impact these processes have on communities (Smith 2002; Smith 2000; Butler and Lees 2006; Lees 2003). These studies look at how this continued investment/disinvestment of capital shapes the geographic landscape at various scales, and therefore drive gentrification. Several studies look at the economic and political forces that shape the physical environment and how it affects the food desert landscape (Freeman 2005; McKinnish et al. 2010; Bader et al. 2010). For example, a prominent subtheme of research on gentrification examines how gentrifying neighborhoods access food retailers, although this line of inquiry typically focuses on measuring access as opposed to the social exclusion that arises in the gentrification process.

Food deserts are thus a prominent theme of investigation related to uneven development. Food deserts are usually attributed to grocery stores following wealthier customers to the suburbs, or to the neoliberal restructuring of urban space in general (Cotterill and Franklin 1995; Chung and Meyers 1999; Weber 2002; Guthman 2008). Thus we see an increase of marginalized (with regards to food access) areas due

to this disinvestment in these poorer spaces. Food deserts are a result of this process, and tend to be more prominent in global cities such as Dallas (USDA 2009). In an investigation that is particularly relevant to the present study, Berg and Murdoch (2008) examined the underdevelopment of certain areas in Dallas and point to companies not wanting to open their grocery stores in areas due to the (perceived) crime rates or inability to make a profit creating food deserts. Their study goes on to make a case for why stores should open a location in these underserved areas, citing examples of companies (in other industries) who have had success in doing so. Overall, research from an uneven development perspective is important to acknowledge as part of this study's theoretical framework, and insights from this perspective will be helpful in discussing and interpreting the study results.

Summary

Although the USDA (2009) study looked at some grocery retailers' availability of non-canned fruits and non-canned vegetables (non-canned includes fresh and frozen products), it did not go beyond that. It is important to include store type and product selection as a major component of a study because it plays a major role in the definition of a food desert. For example, if an area is not served by a major supermarket, but has a few small "mom-and-pop" grocery stores that sell healthful foods, it is possible that from a functional perspective the area might not be a food desert. However if none of these smaller format retailers sell whole grains or fresh produce, then their customers are still as limited in their healthful options as consumers in areas not served by any grocery stores.

In addition, ignoring recent trends in the food retail industry could lead to misleading definitions of food deserts, and therefore to a misallocation of resources intended to alleviate the impact of food deserts. Take, for example, Walgreen's latest marketing efforts (in partnership with the Michelle Obama's "Let's Move" campaign) to offer healthful food options in order to position itself as a "health store" destination and potentially alleviate the impact of food deserts (Walker 2010). For such a store, knowing the food offerings of established, near-by competitors is vital. The drug store should not assume that other stores in the area do not provide healthful food items simply because the USDA identifies the area as a food desert. Determination of consumer access to major supermarkets is a helpful step, but analysis of consumer access to specific food types is a better indicator of the actual healthful food status of a neighborhood.

Lastly, there is no literature that actually looks at the demand for healthful food items; in fact most literature assumes that everyone demands healthful food items and would purchase them if they are available. Thus, there are many gaps in the food desert and related food retail literature that need to be addressed for the benefit of society. Having a more complete understanding of food deserts and related patterns and processes is a crucial step in addressing the health issues that impact low income communities across America.

It is also important to keep in mind the role of uneven development in the formation of these food deserts and how it might affect the areas of lower socioeconomic status (underdevelopment and/or gentrification). This should guide the interpretation of the results in this study.

CHAPTER III

METHODOLOGY AND RESEARCH DESIGN

Study Area

The study area for this project is the city of Dallas³, Texas. This study area was selected based on two factors: 1) Dallas County, Texas has been noted as hosting one of the largest concentrations of food deserts in the U.S. (USDA 2009), and 2) the City of Dallas maintains an excellent store dataset that includes store coverage exclusively within Dallas city limits. This dataset provides a highly suitable foundation for food desert analysis.

Dallas makes for an interesting and appropriate venue for urban research of all kinds. The City of Dallas is the third most populous city in the State of Texas (ninth in the U.S.) and is the largest economic center within the Dallas- Fort Worth metropolitan statistical area (DFW MSA). The DFW MSA is the largest in the southern U.S. and reports a total of \$85.7 billion in retail sales (ranking them as the fourth largest amongst MSAs in the U.S.) However, despite the dynamic economy that characterizes the city, Dallas also includes within its boundaries a substantial area experiencing economic challenge. According to the 2010 census data, 23% of the Dallas population lives below the poverty level (compared to 17% in the state of Texas), most of which live in south Dallas (Economic Census 2013). Additional demographic data is detailed in Table A.1.

³ City of Dallas extends past the county borders. This part of the city is not included in this study.

Data Collection

Demographic and Socioeconomic Data

Income data from the 2006-2010 American Community Survey (ACS) are used to identify the income levels of census tracts in Dallas. The study uses block level population data from the 2010 census to perform basic population analyses (related to trade area definition) as further discussed later in this chapter. All of the datasets used in the study are the most recent available at the time of the study. The time frame of the 2006-2010 ACS encompasses much of the most recent recession, thus providing a very timely view of the economic status of the neighborhoods being analyzed.

This research obtains demographic, spending pattern, and supply and demand data from Synergos Technologies, Inc. (STI). STI is a leading provider of marketing research data who have provided services for companies in the food retailing industries such as Kroger Co., Walgreens Co., and Family Dollar. The STI data starts at the ZIP + 4 level, then moves up to the block group, tract, county, then state levels (STI 2010), thus providing precise data at the desired geography. The STI data are updated quarterly, providing very timely demographic data. The data used in this analysis were current as of November 2012.

This study uses the geodemographic market segments (LandScape classes) provided by STI. These segments classify all populations in the United States, clustering them into classes of highly similar groups based on demographic, economic, and social data from the US Census. Census tracts were chosen as the level of geography for this study because food deserts are based on the same level of

geography. Synergos classifies its LandScape system into 15 major neighborhood types, which can in turn then be broken into a total of 72 different detailed segments. As analysis based on the 72 detailed market segments would go beyond the resources available for this study, this research focuses on the 15 major neighborhood types as a suitable base to facilitate store sampling. These neighborhood types and their distributions are summarized in Table B.1. In addition, the description of each neighborhood is outlined in Appendix B.

The study uses spending pattern data to reflect current food purchase behaviors, and to demonstrate how much consumers are willing to pay for grocery items. This data is also at the tract level, and includes specialty data on spending habits based on consumers living in group quarters. This data is collected from the Bureau of Labor Statistics (BLS) using the Consumer Expenditure Survey, which consists of a quarterly interview survey, and a weekly diary survey, which records the purchasing habits of consumers.

Finally, the analysis uses Market Outlook supply and demand data from STI which is also based on the BLS Consumer Expenditure Survey, the U.S. Census Bureau's monthly Retail Trade reports, and the Economic Census. The study uses this data source to identify supply and demand for grocery items at the tract level.

Store Data

In addition to the neighborhood demographic and socioeconomic data summarized above, the study also relies on a variety of store-based data. Part of the store data includes a list of all food retail establishments and their addresses that operate within Dallas city limits. This dataset was obtained from the Department of

Code Compliance Services for the City of Dallas. The stores were geocoded using ArcMap. Only 6% of the stores did not geocode and Google Earth was used to identify the remaining coordinates. To ensure accuracy of the addresses, 30 stores were randomly selected to compare the geocoded location to the location of the stores in Google Earth. Only one was incorrectly geocoded due to a spelling mistake in the street name. The remaining stores in the data set were then double checked for any spelling errors (or other technical errors).

This dataset assigns a category, based on store type, to each retail establishment in the database. Store type is determined by square footage and the good or service that provides the store with the majority of its sales (not profits). The categories that were already assigned to each retail establishment have been modified into more useful categories for this particular study. The categories and their criteria used in this study are outlined in Table 1. However, the main purpose of reclassification stemmed from the need to differentiate between the small grocers, convenience stores, and gas stations. These stores were categorized similarly many times, however they all function differently and should be treated as such.

Table 1 Store type criteria and the number of stores in study area

Store Type	Description	Number of Stores
Supercenters & Large Supermarkets	Large national chain supercenters and supermarkets. These usually serve as primary grocery retailers for consumers living in its proximity.	108
Small Grocers	Smaller grocery retailers (i.e., local mom and pop grocery stores). Could serve as the main grocery retailer for certain people living in its proximity.	49
Convenience Stores	Offer any variety of convenience goods, including, but not limited to grocery, beauty, health, or tobacco. Typically located further away from the highways than gas stations; more neighborhood oriented.	189
Gas Stations	Convenience stores with gas pumps. Typically located near highways.	308
Drug Stores	Stores that sell convenience and food items but position the store as primarily a pharmacy.	63
Dollar Stores	Deep discount stores that sell predominately commodity items, including food items.	71
Total:		788

Caterers and food available for purchase located inside a school, hotel, or other non-food establishments (such as a gym or a corporate office) were removed from the dataset. Those food purchase options are removed from the analysis based on the idea that typical neighborhood residents may not have access or ability to purchase the items from such stores (e.g., they are not a member of the gym or work in the office with the food establishment). Also, stores that are currently under construction were not included in the analysis because the store type was undeterminable. The data for food retail establishments are current as of 2011, but store closures and openings were updated as discovered throughout an additional step of re-classification to clean and verify the data. Re-classification involved a broad range of references to online yellow pages, customer reviews, Google maps, and Google Earth to assign and verify each store within this classification system (for example, Google Maps and Google Earth were used to provide confirmation of the presence of gas pumps). Through this

composite process of data acquisition and verification, it can be stated with confidence that the analysis is based on the highest quality of data possible given the resources available.

Sampling

The intent of this study is to evaluate the store contents of the smaller grocery retailers (thus including all store types except supercenters and large supermarkets). Once the store database was acquired, classified, and verified as outlined above, each food retailer was mapped to identify the census tract each store serves, as well as the census tract's neighborhood type. Within Dallas city limits, 11 of the 15 major neighborhood types identified nationally by STI are present. This was done using a point-in-polygon approach in ArcMap. Each store was manually checked to ensure no duplications of stores in the different neighborhood types due to any possible geocoding errors.

The majority of the smaller format retailers fall into two neighborhood types that dominate the Dallas landscape (see Table B.2). To avoid a sample that over-represents certain neighborhood types (and thus reduce the chances of sampling errors influencing the research results), the study uses a stratified random sample. Given resource constraints, the analysis selects 5 stores from each of the 11 neighborhood types in Dallas for data collection, thus yielding information for 55 stores in total. Of the 11 neighborhood types, 3 had less than 4 stores present within their boundaries. Also, five stores declined to be surveyed with no alternatives being available, so the final store sampling database included 40 stores. The map of these store locations can be viewed in Figure C.3 in Appendix C.

To facilitate the timely collection of store data, I conducted the in-store survey with the help of an undergraduate assistant, whom I trained on the data collection procedures summarized here. Templates were made to prompt the surveyor for specific data to record: these are reproduced as Figure C.1 and Figure C.2. An initial round of in-store surveys aimed at measuring shelf space dedicated to specific food groups. This was based on the basic marketing concept that increased shelf space for a given product results in increased sales for that specific product (Wilkinson et al. 1982). However, in-store tests of this data collection procedure showed this process to be very time consuming. Therefore the data collection procedure as implemented in the full study focuses on measuring variety within broad food groups, and not shelf space devoted to specific brands and products. For example, the study is not concerned with whether a store offers canned green beans or frozen green beans: the study simply records whether green beans are offered. A food item was not considered to be a different variety if it was the same product, but different brand. The food groups that were surveyed, and examples of those foods, are provided in Table C.1.

In addition to cataloging food item variety, the study also recorded brand, weight, and price of specific, pre-determined products in order to evaluate the affordability of the products in the store. The products chosen for this type of data were included popular selections within each product category in order to maximize the likelihood of the exact, same product (same brand, same package size) being available at multiple stores. These data were collected throughout January; therefore aisles dedicated to Valentine's Day products (e.g. seasonal candy) were excluded from this study to avoid a misrepresentation of ongoing store contents.

The categories used in this data collection process were based on nutritional guidelines given by the USDA for the “Thrifty Food Plan” (a food plan created for people with limited budgets). The Thrifty Food Plan was created by the USDA recognizing that people in lower-income areas have a limited food budget, but still require a balanced diet (Carlson et al. 2007). This is important when identifying the variety of healthful foods, which is key to understanding the overall healthfulness of the product selection in a store. With each category further broken down into more specific categories, it is easier to indicate healthfulness of the products within the category (i.e. whole grains versus non-whole grains). Examples of these foods and their categories can be found in Table C.1.

Product Price Data

To facilitate in-store pricing comparisons, the national average price of 4,635 food types in the U.S. was obtained from the USDA’s Center for Nutrition Policy and Promotion (CNPP) website (given as a price per 100 grams). On the website the data is available to download in excel, for each month of every year going back to 1994. The CNPP uses the June costs to represent the annual average. The June 2012 costs were used in this study (USDA 2012)

In addition to the national average food prices, STI provided “average price potential” data for certain food categories. The average price potential is the average price paid per transaction. These prices are not associated with a specific quantity or time frame of purchases within a given category, but provide a reasonably local estimate of product prices. To calculate this value, STI takes total expenditures in a

given food category and divides it by the number of transactions. Again, this dataset comes from the BLS and the U.S. Census Bureau.

Research Questions

The literature on food deserts suggests that smaller stores cannot provide a product selection comparable to major supermarkets. The problem with this assertion is that there is little literature that actually surveys smaller format store contents, with an especially important gap being recent data. This gap is important because the food retailing industry has seen important shifts in store formats, offerings, and competition in recent years. Thus, evidence is needed to specify the degree to which smaller stores compare to larger stores in terms of food product selection. Sampling from stores in different types of neighborhoods will give insight as to how these stores function within the context of their geography, as well as identify what kind of products people have access to. It would be reasonable to hypothesize that there will be a significant difference in the types of products that are offered in the different types of neighborhoods, especially in the race/ethnic neighborhoods. This leads to the first research question in this study:

1. Do smaller format grocery retailers (as defined in the above discussion of Table 1) provide a product selection that can fulfill the dietary needs of an affordable and balanced diet (based on the Thrifty Food Plan)?

Including smaller format retailers in the analysis of food deserts is typically ignored in the literature because of cost. Cost shows up in two ways: 1) the cost of collecting the data on smaller format stores is high because of their great numbers, and

2) actual product costs are assumed to be higher overall in these smaller format retailers because these stores are thought to be unable to achieve the same economies of scale that characterize larger stores (USDA 2009). Thus, the lack of store-based evidence and the importance of cost supposition in the literature provide an opportunity to fill an important research gap. The Dallas-based analysis pursued here allows for a micro-level analysis to see if smaller format retailers ought to be taken into consideration in food desert analyses in food desert research more broadly. Preliminary analysis of the dataset (Regan and Rice 2012) makes it reasonable to hypothesize that the smaller format retailers do indeed make a statistically significant difference in the geographic extent of the food deserts in Dallas, Texas. From these ideas with the accessible data already discussed, the following question arises:

2. Do smaller format retailers make a statistically significant difference in the geographic coverage of food deserts in Dallas when compared to the coverage of current USDA food deserts?

The gap in supply and demand has not been addressed in the food desert literature. It is arguable that consumers should have adequate access to healthful food items; however, if the products are available, but not consumed, businesses suffer from high inventory costs. If there are areas where there is a demand for healthful items, but no suppliers (from smaller grocery retailers), then these are areas that can be identified as possible locations for new stores, or a new effort by an existing store to be the supplier. In contrast, if supply for groceries in a food desert does meet demand, can we still call it a food desert? These issues raise the last research question in this study:

3. Is the retail food supply meeting the neighborhood grocery demand in the USDA-defined food deserts of Dallas? If so, do certain types of smaller format retailers play a key role in meeting food demands in these census tracts?

Data Analysis

This section outlines the various analyses used to answer each of the research questions detailed in the previous section. Table 2 summarizes these data analyses and their respective data used to answer each research question.

Table 2 Summary of data analyses and data used to answer research questions

Research Question	Data Analysis	Data Used
1	Evaluating Stores: Extrapolating in-store survey data to non-surveyed stores Identifying stores that met the criteria for <i>Variety, Affordability, Combination, and Healthy</i>	STI neighborhood type data Store data In-store survey data CNPP price data STI spending pattern data ⁴
2	Identifying Food Deserts: USDA food deserts Food Deserts when stores meeting the criteria for <i>Variety, Affordability, Combination, and Healthy</i> were added Statistical Analysis: Chi-squared	ACS data 2010 U.S. Census data Store data
3	Identifying Gaps in Supply and Demand	STI supply and demand data

Evaluating Stores

Using the 40-store sample established above, this study applied the product offerings as found in surveyed stores to the same store type of non-surveyed stores in the same neighborhood type. By applying the sample to the remaining non-surveyed

⁴ This was removed from the study because it gave the same results as *Variety*.

stores, this provided a complete list of smaller format retailers in Dallas with associated contents without surveying all 680 stores. Applying the sampled data to stores of the same type is the best approach to obtaining a complete data set because it is reasonable to assume that similar store types have similar store contents (Rose et al. 2009). The sampled stores were only applied to the same store type in their respective neighborhood type to preserve any differences in neighborhood type that may arise. If there is a non-surveyed store in a neighborhood type without a sample to apply to it, the contents of the most similar store in the same neighborhood type was applied to it. For example, if there was a convenience store in a neighborhood type that did not have a convenience store sampled, the contents of the gas station was applied to it. If there is no other sample in the neighborhood type to apply to the store, the sample of the same store from the most similar neighborhood type is applied. For example, in the *Married in the Suburbs* neighborhood there are only two gas stations, and no other smaller format retailer. Therefore, the gas station that was surveyed from the *Single in the Suburbs* was applied to the gas stations in *Married in the Suburbs*. Table 3 outlines this extrapolation approach using the *Crème de la Crème* neighborhood type for further clarification. The complete list of how every sampled store was applied to the non-sampled stores see Table C.2 in Appendix C. Once all stores have an associated store contents, they were then evaluated to identify the extent of their food offerings.

Table 3 Example of applying sampled store contents to non-sampled stores

Store Type	Number of Stores Sampled	Number of Stores in Neighborhood Type	Sample Store Type Applied
Small Grocers	0	0	-
Convenience Stores	1	9	Convenience Stores
Gas Stations	1	20	Gas Stations
Drug Stores	2	11	Drug Stores
Dollar Stores	0	5	Drug Stores

The reason most studies, and therefore the USDA do not include these smaller format retailers in their definition of a food desert (as mentioned before) is because it is not guaranteed that these stores even carry healthful food items. If these stores do carry healthful foods they are typically much more expensive than in the larger grocery retailers. In order to make an argument for these stores to be considered, the presence and affordability of healthful food items must be evaluated. This evaluation included determining if the stores met certain ‘thresholds’ within specific categories. The categories are defined as follows:

- *Variety*: Number of food category types offered.
- *Affordability*: Actual price of goods compared to the average national price, or the price potential, of the products surveyed.
- *Combination*: Store meets both criteria above (variety and affordability).

To be considered a store that has *variety*, there must be at least three or more products offered in each major category. Again, these specific products and the major categories they fall in can be found in Table C.1. In order to be considered an *affordable* store, at least half the products in a given product category must be at or below the

upper threshold of the national average price (obtained from the CNPP), or must be less than or equal to the price potential for that product (obtained from STI). The upper threshold is defined as the range of the national average prices of similar products plus the national average price. This amount varies depending on the product. For example, when determining the upper threshold for mozzarella cheese, the range of the national average prices for similar cheese were calculated (so using other common cheeses like reduced-fat mozzarella, American, cheddar, etc.), and then added to the national average. This was done in order to avoid categorizing a food as unaffordable even though it may have only been a few cents more than the national average price per 100 grams. The potential price per product is given as an average per tract. When comparing the product price to the potential price, the price of the sampled product was first averaged per tract, and then compared to the average price potential. The price is considered affordable if it is less than or equal to the price potential. Both ways for measuring affordability are compared and discussed in the results chapter. For a store to meet the criteria for *combination*, it must qualify as *variety* and *affordable*.

Another way of evaluating the smaller format retailers involves looking at the ratio of healthful foods to unhealthful foods. Doing this will give a better idea as to the overall healthfulness of the store. The ratio of healthful to unhealthful foods in each store can fall into one of four categories outlined in Table 4.

Table 4 Range for each health ratio category

Category Number	Ratio Range
1	.75 and above
2	.50 to .74
3	.25 to .49
4	.24 and below

The analysis classifies stores that lie within categories 1, 2, and 3 as adequately providing healthful food options, while stores in category 4 will be classified as not providing healthful food options. This approach is based on parallel studies that focused on shelf space measurements and comparisons of healthy food items to unhealthy food items. Supermarkets, though they may have a larger amount of shelf space dedicated to fresh fruits and vegetables, also have an even larger amount of shelf space dedicated to unhealthy food items (candy, soda, etc.). In Farley et al. (2009), these ratios varied from 0.18 to 0.72 in small and large grocery retailers. Thus, the healthfulness ratio is a useful means of assessing whether smaller format retailers are comparable to larger national chain grocery retailers. This measure will also provide a helpful indication as to the overall healthfulness of the grocery retail environment in a neighborhood based on its smaller format retailers.

Identifying Food Deserts

To locate the food deserts, the analysis identifies low-income census tracts based on the USDA's criteria cited earlier (in chapter II), specifically focusing on the 2006-2010 income data from the ACS and the national poverty level for a family of four in 2010⁵

⁵ National poverty level for a family of four in 2010 was \$22,314 (U.S. Bureau of the Census, 2010).

(both at the census tract level). It also uses the mean income⁶ data for Dallas County for 2006-2010 from the ACS in order to obtain the surrounding area's mean income required for part of the definition of a food desert.

The study then uses a GIS analysis in ArcMap to select the census blocks that are completely within low-income census tracts, and to specify which of those blocks fall outside of a one mile radius of a food retailer. This is done in two steps: first, including only the larger national chain grocery retailers, with the goal of reproducing the USDA's definition of a food desert based on the 2010 census data. Second, the same analysis is implemented again with the smaller format retailers, in order to identify the difference these stores make in the geographic coverage of food deserts.

Identifying Gaps in Supply and Demand

Using the supply and demand data from STI the analysis calculates the difference between supply and demand in each Dallas census tract. Differences (deficits and surpluses) were mapped (see Figure 7) in order to identify the census tracts that can also be considered to be food deserts.

Statistical Analyses

A Chi-square statistical test is used to determine if there is a significant difference between food deserts that only include the large national chain grocery retailers versus the food deserts that include smaller format retailers at their various stages of variety, affordability, and healthfulness as identified earlier in this chapter. Using the chi-square test of independence is an appropriate test given the categorical nature of the store data

⁶ The mean income for Dallas County in 2010 was \$47,974 (U.S. Bureau of the Census, 2010).

and the need to assess the difference between the USDA food deserts and the food deserts that remain once the different categories of smaller format retailers are added. This test shows if the difference between the coverage of these measures is likely (or unlikely) to have occurred by chance.

CHAPTER IV

RESULTS

Sources of Affordable and Balanced Diets

When including the smaller format grocery retailers in the analysis of the food deserts, the availability and affordability of healthful food items should be evaluated in order to determine whether consumers can obtain groceries that provide them with an affordable and balanced diet. Analysis of variety, affordability, and healthfulness provides a good basis for answering the first research question, which asks: do smaller format grocery retailers provide a product selection that can fulfill the dietary needs of an affordable and balanced diet (based on the Thrifty Food Plan)?

The number of products in each food category was counted in order to evaluate the variety of the product offering in each store. Variety is an important measure because humans need a palatable diet. A store meets the criteria for *variety* if all product categories have a variety of three or more products offered in each food category⁷. Most stores carried a variety of all food categories. Of the smaller format retailers, 82% carried a variety of whole grains and 88% carried a variety of vegetables. Most (95%+) of the smaller retailers carried a variety of all other product categories. However, it is important to note that these products were usually canned, dried, cereal, or a snack bar of some kind. 90% of convenience stores and gas stations did not meet the criteria for *variety* in two product categories. Only 54% of convenience stores carried a variety of whole grains and 77% of gas stations carried a variety of vegetables.

⁷ Regular fat potatoes were not included in the measure of variety as to obtain a better picture of the variety of more healthful vegetable options.

One means of determining product affordability is comparison of store-sampled product prices to national average pricing. Based on this measure, whole grains were the least affordable product category among the smaller format stores in this study. Only 5.8% of the smaller format stores offered affordable whole grains (zero small grocers, gas stations, and drug stores offered affordable whole grains); 39.4% of dollar stores offered affordable whole grains. Fruit is another category where affordability is scarce. Only 11% of all smaller format retailers offered affordable fruits. No drug stores offered affordable fruits, and few dollar stores and gas stations offered affordable fruit (4.2% and 5.8% respectively). However, 59.2% of small grocers offered affordable fruits. Milk and other products were the most affordable across store type. All dollar stores offered affordable milk and other products, unfortunately the milk product category is dominated by milk drinks and desserts, and the other category is made up of salts, fats, and oils. The majority of drug stores and small grocers offered affordable milk products (96.8% and 89.7% respectively). Most dollar stores (94.3%) provided affordable protein products and only 1.6% of gas stations provided affordable proteins. Other stores fell somewhere in between. A summary of the variety and affordability of the smaller format retailers is provided in Table 5.

Table 5 Summary table of the percent of stores (by type) that meet the criteria for *variety* and *affordability*

Store Category	Percent of Stores												Total Count of Stores
	Variety of Whole Grains	Affordable Whole Grains	Variety of Veg	Affordable Veg	Variety of Fruits	Affordable Fruits	Variety of Milk Products	Affordable Milk Products	Variety of Proteins	Affordable Proteins	Variety of Other Products	Affordable Other Products	
Small Grocers	96%	0%	96%	86%	96%	59%	92%	90%	96%	61%	96%	57%	49
Convenience Stores	54%	6%	96%	35%	96%	6%	96%	53%	97%	33%	97%	10%	189
Gas Stations	90%	0%	77%	12%	94%	12%	99%	92%	99%	2%	99%	3%	308
Drug Stores	97%	0%	97%	97%	97%	0%	97%	97%	97%	75%	97%	97%	63
Dollar Stores	100%	39%	100%	99%	100%	4%	100%	100%	100%	94%	100%	100%	71
Total	82%	6%	88%	41%	96%	12%	98%	83%	98%	31%	98%	27%	680

When looking at product category affordability, the study found no situation where a product met the affordability criteria but there was no variety provided in the product's category; put another way, if a product is affordable, then it is also available in variety. Therefore when using this measure of affordability, the stores that qualify as having all product categories affordable, also meet the requirements of *combination*. Only 2 smaller format retailers in the study area met these requirements, both of which are dollar stores⁸.

A store may offer some affordable healthful food options, but does that qualify it as an adequate source for healthful food? Looking at the ratio of healthy food items to unhealthy food items is a better indicator of the overall healthfulness of the store. It is well documented that the more shelf space dedicated to a product; the more likely that particular product will sell--if there are more unhealthy foods, this could lead to more frequent purchases of them. It is also a basic marketing principle that product positioning, in addition to the sheer quantities, also affects the consumer purchase behavior, so even if there are healthy foods, if they are surrounded by unhealthy food, or in an area not easily seen by the consumer, they are likely to not purchase them (Bodor et al. 2008; Curhan 1972; Farley et al. 2009; Frank and Massy 1970). Figure 1 shows examples of this situation. These are two separate stores' produce sections surrounded by calorie-dense food and beverage options.

⁸Another way of determining the affordability of the products was to compare the average price of the sampled product to the average price per transaction for that product. This gave the same results as the stores that met the same criteria for variety, and thus was thrown out.

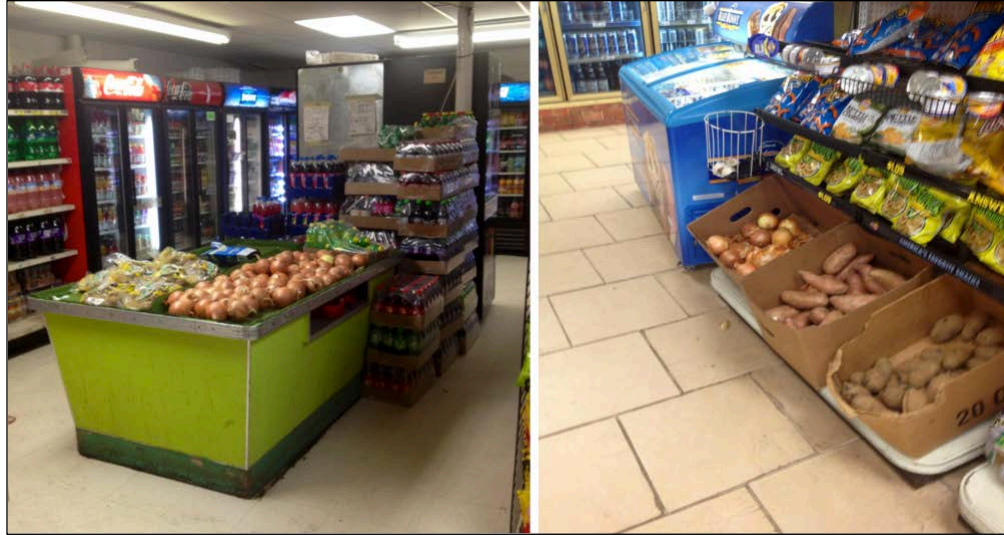


Figure 1 Examples of produce displays surrounded by calorie dense food and beverage options

Table 6 displays the distribution of the stores that fall into each health ratio category amongst the neighborhood types. Only two stores fell into category 1 (having a health ratio of 0.75 or above). One of these stores is the Dallas Farmer's Market; both are in the same neighborhood type (*Specialties*). There are clearly more unhealthy stores (category 4) than there any other combined, most of which lie within the *Española* and *Harlem Gateway* neighborhood types (at 246 and 108 respectively). However these neighborhood types make up a combined 64.1% of the tracts in Dallas. *Española* represents 43% of the tracts and has 53.9% of the stores in category 4. *Harlem Gateway* represents 21.2% of the tracts and has 23.6% of the stores in category 4. Segment *Thriving Alone* makes up 11.47% of the tracts in Dallas and has 12.7% of the stores in category 4. *Crème de la Crème* is the only segment that does not have a store in category 4, however doesn't have stores in categories 1 or 2 either.

Table 6 Distribution of health ratio store categories in the major neighborhood types in Dallas

Major Neighborhood type	Category 1	Category 2	Category 3	Category 4	Total
<i>Crème de la Crème</i>			45		45
<i>Urban Cliff Climbers</i>			3	4	7
<i>Urban Cliff Dwellers</i>			1	2	3
<i>Thriving Alone</i>			13	58	71
<i>Going It Alone</i>			5	8	13
<i>Single in the Suburbs</i>			6	12	18
<i>Married in the Suburbs</i>				2	2
<i>Retired in the Suburbs</i>			1	1	2
<i>Harlem Gateway</i>			37	108	145
<i>Española</i>		14	88	246	348
<i>Specialties</i>	2		9	15	26
Total	2	14	208	456	680

Figure 2 shows tracts with particularly high concentrations of unhealthy stores in addition to which of those are identified as USDA food deserts. The analysis classifies a census tract as having a high concentration of unhealthy stores if there are five or more category 4 stores in the tract (five stores was selected as the threshold here because four stores is the median number of stores per census tract). There are 12 census tracts that the analysis reveals as having a particularly unhealthy food environment. The most extreme cases include one tract that has 21 unhealthy food stores (and only one other small store that falls into category 2) and another has 11 (and no other type of smaller grocery retailer). Of these tracts, four are USDA food deserts, and are thus areas that are particularly distressed. It is important to note that the tract with 21 unhealthy food stores stretches approximately nine miles along a highway used for the north/south commute to work and therefore has a high concentration of gas stations.

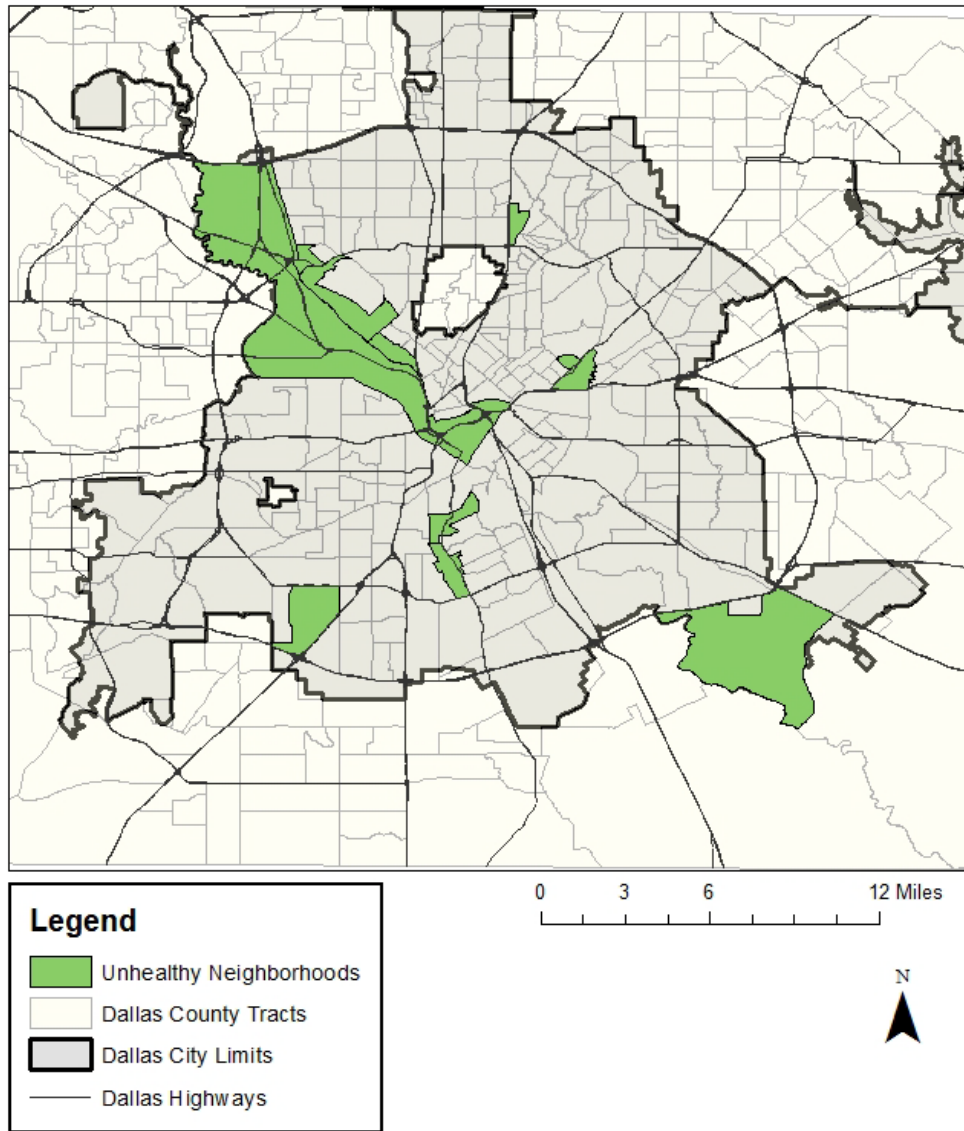


Figure 2 'Unhealthy' census tracts

Geographic Coverage of Food Deserts

The USDA food deserts are identified using the 2010 census data not only reproduce their methods to insure accuracy, but to update which tracts are considered food deserts based on the most recent census (at the time of this paper, the USDA food desert website still uses 2000 census data). The smaller format retailers are then compared to the USDA food deserts to identify the difference in geographic coverage.

Based on the USDA's criteria for identifying food deserts, there are 63 census tracts (22.5%) in the Dallas city limits that qualify as a food desert. This means 276,304 persons (or 22.6% of the city's population) in Dallas live in a food desert. Of these food deserts, 9 census tracts have 100% of the population (23,992 persons) living outside a one mile radius of a large national chain grocery retailer, and an additional 3 more tracts (or 11,161 of persons) had more than 80% of the population living more than one mile from a large grocery retailer. The distribution of these food deserts is mapped out in Figure 3.

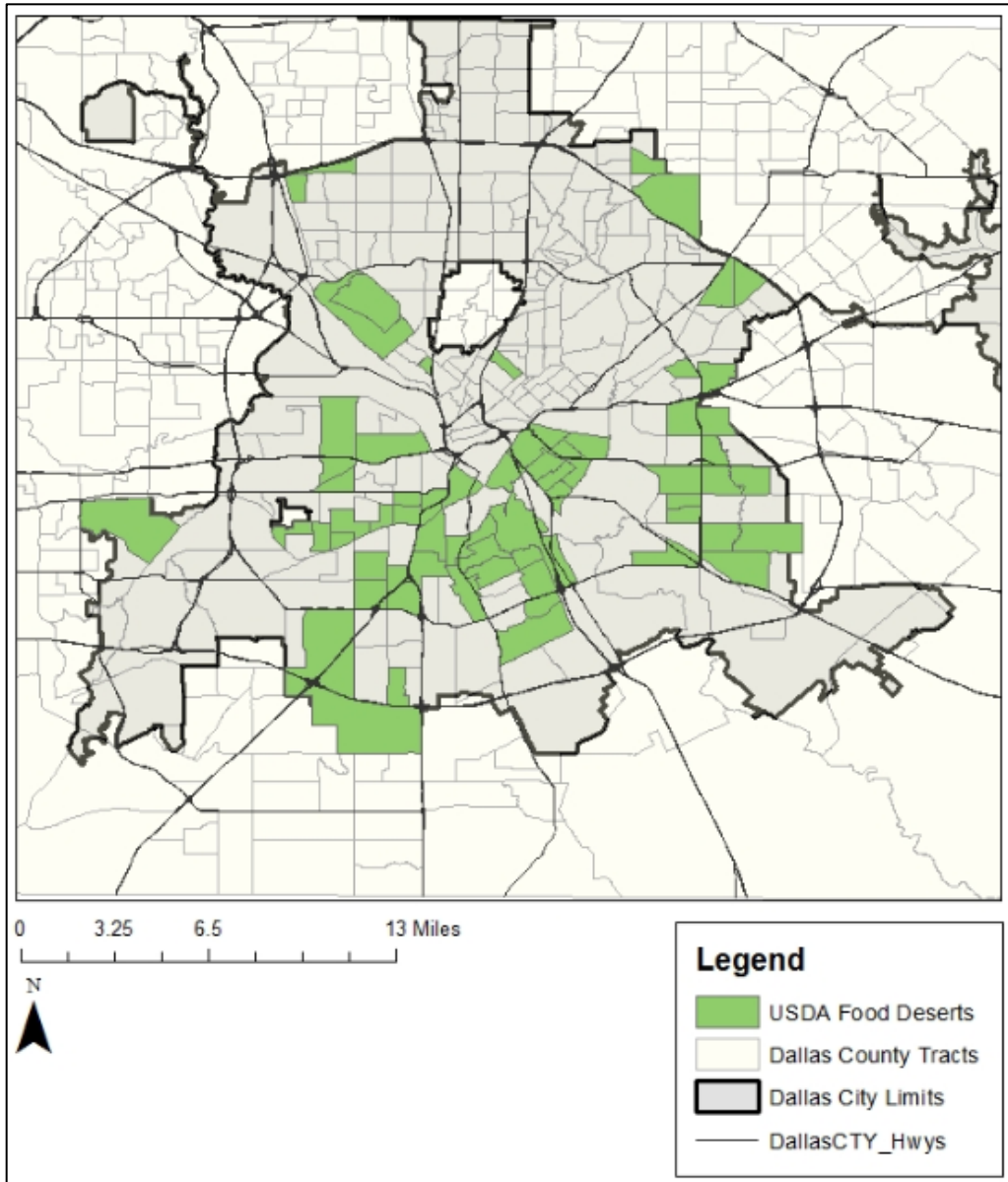


Figure 3 USDA food deserts

If variety was the only criteria qualifying the smaller format retailers as stores that can adequately provide healthful food items, then there is a tremendous decrease in the number of census tracts that qualify as a food desert. When smaller format retailers that have variety across all food categories are included in the analysis, only three census tracts in Dallas remain food deserts. The distribution of these tracts is mapped out in

Figure 4. Compared with food deserts identified with the USDA definition, inclusion of smaller format retailers thus lead to a 95.2% decrease in the number of food desert tracts and a decrease of 96.2% of the population living in food desert tracts (from 276,304 to 10,463 persons). Based on the chi-square test, these stores make a statistically significant difference in the geographic coverage of the food deserts (see Table D.1 for details on results from test). Whether or not there are a variety of products offered at these smaller format retailers still does not fully answer the first research question. The issue of affordability still stands.

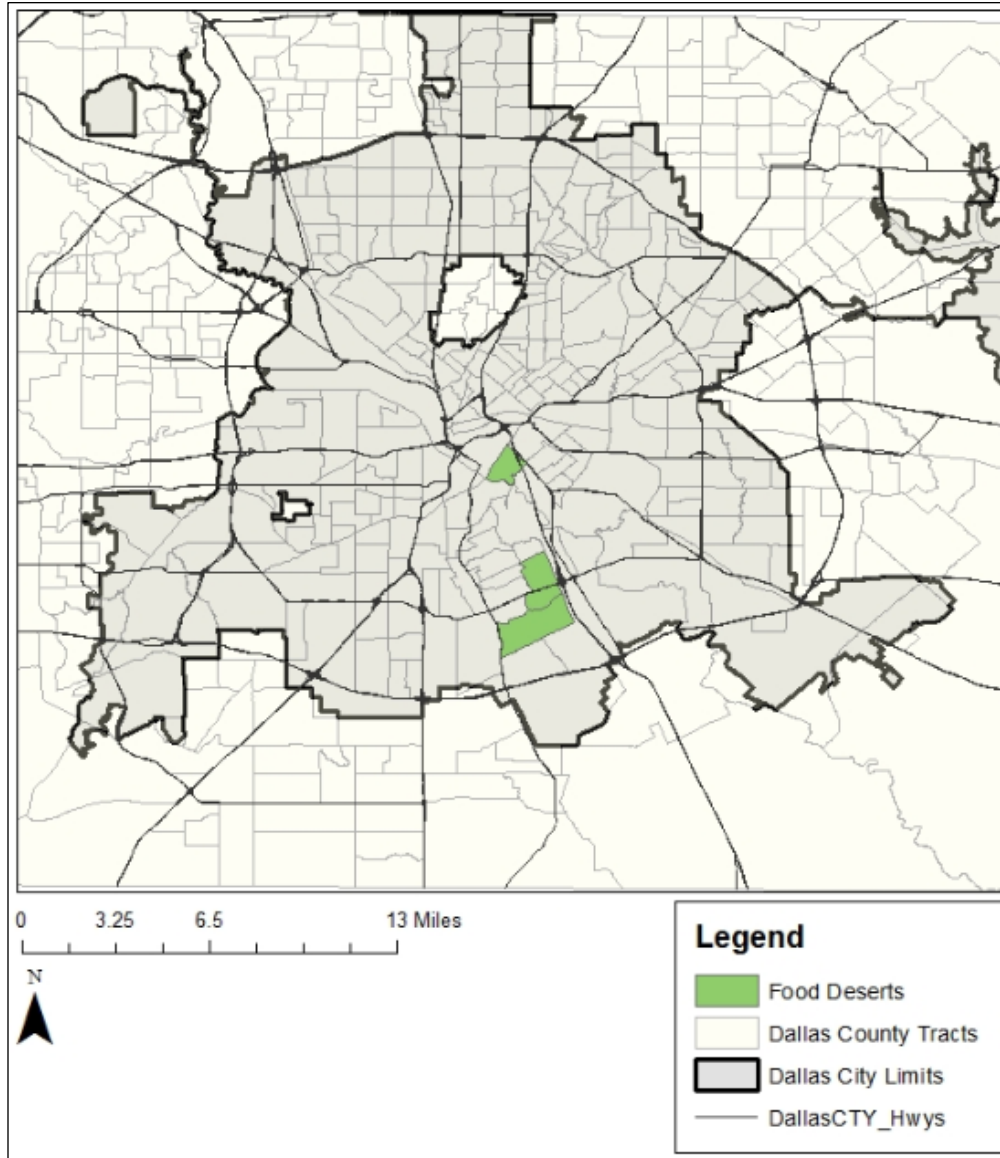


Figure 4 Census tracts that remain USDA food deserts when considering stores that meet the criteria for variety

After the two stores that qualified as affordable (and therefore met the criteria for *combination*) were included in the analysis of food deserts, three census tracts were no longer considered food deserts. This brings the food desert count down from 63 to 60 (so a 4.7% decrease), and the population that lives in a food desert down by 12,174 (so a 4.4% decrease). Again, there is a statistically significant difference in the geographic

coverage of the food deserts (see Table D.1). Figure 5 shows the geographic distribution of these tracts.

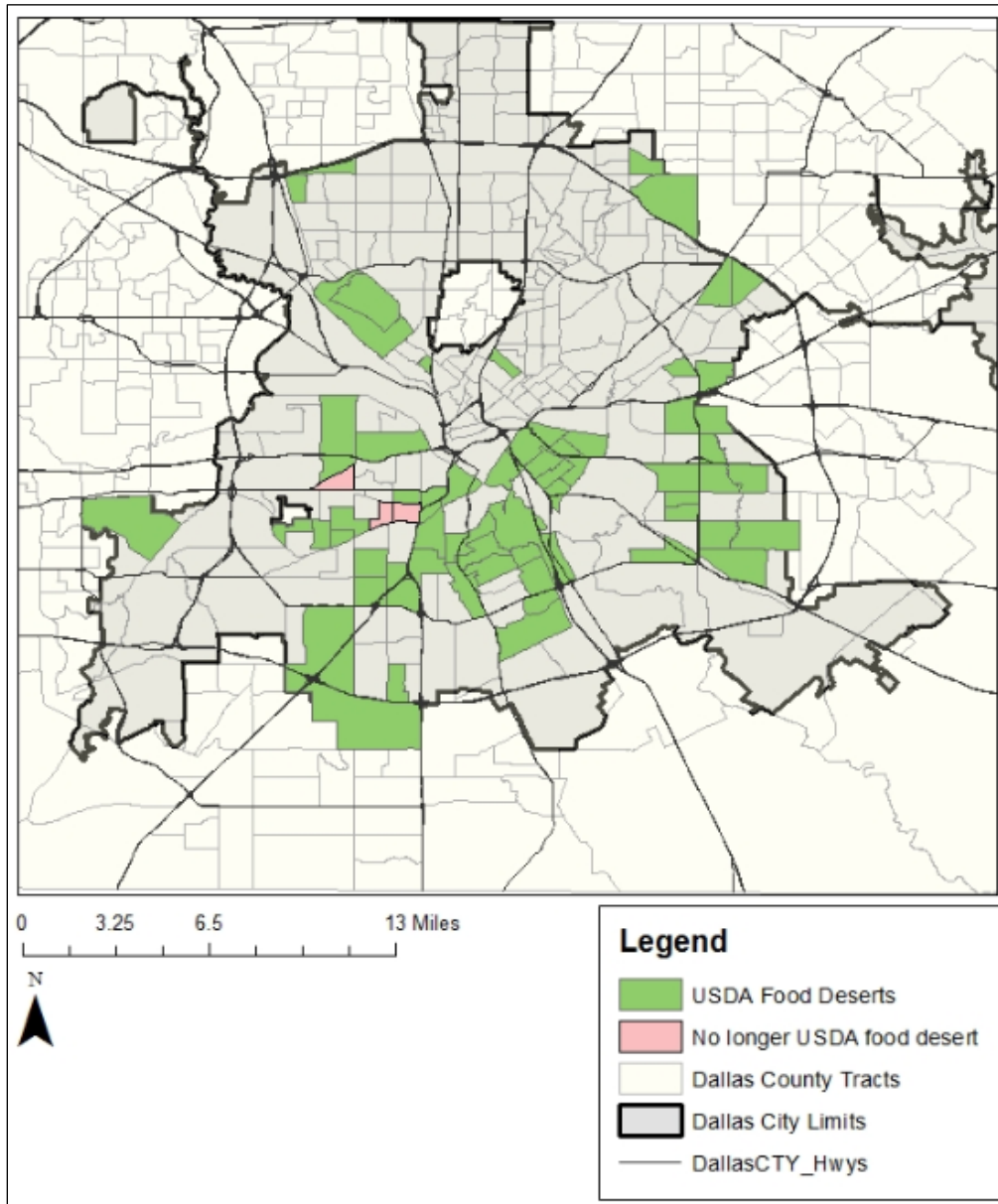


Figure 5 USDA food deserts and USDA food deserts that lose their status when considering stores that meet the criteria for *affordability* and *variety*

According to the decision rule specified earlier, stores qualify as adequate sources of healthful food items, or 'healthy stores' if they fall into categories 1, 2, or 3.

This way of analyzing product selection identifies a store as an adequate source of healthful food options based on the ratio of healthy foods to non-healthy foods. When the 'healthy stores' are added to the analysis of food deserts (similarly to stores that meet the criteria for *affordability* or *variety*) there are only eight census tracts that are still considered food deserts (29,724 persons). This is an 87.3% decrease in the number of tracts considered food deserts, and a decrease of 89.2% of the population that lives in a food desert. The distribution of these tracts is mapped out in Figure 6. This also results in a statistically significant difference of geographic coverage of food deserts (see Table D.1).

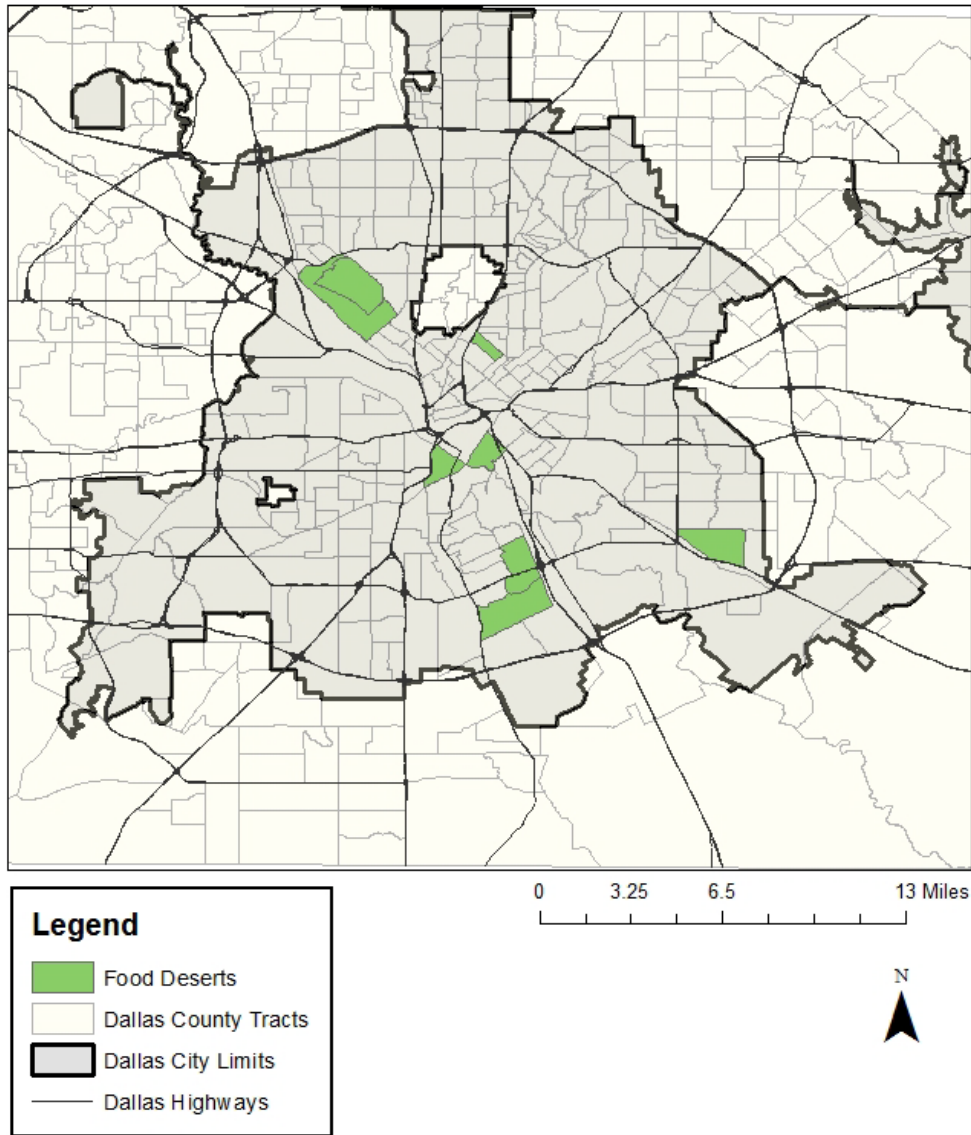


Figure 6 Census tracts that remain USDA food deserts when considering stores that meet the criteria for ‘healthy’

Regardless of the food desert analysis employed in this study, almost all (with the exception of one) of the tracts that are identified as food deserts are part of either the *Española* or the *Harlem Gateway* neighborhood types. Table 7 shows the distribution of the different measures of food deserts and their corresponding neighborhood type.

Table 7 Number of food deserts in each neighborhood type based on type of store included in analysis

Major Neighborhood Type	USDA Food Deserts	Food Deserts, Variety Added	Food Deserts, Affordability Added	Food Deserts, Healthy Stores Added
<i>Crème de la Crème</i>	0	0	0	0
<i>Urban Cliff Climbers</i>	0	0	0	0
<i>Urban Cliff Dwellers</i>	0	0	0	0
<i>Thriving Alone</i>	0	0	0	0
<i>Going It Alone</i>	0	0	0	0
<i>Single in the Suburbs</i>	1	0	1	0
<i>Married in the Suburbs</i>	0	0	0	0
<i>Retired in the Suburbs</i>	0	0	0	0
<i>Harlem Gateway</i>	27	3	27	5
<i>Española</i>	35	0	32	3
<i>Specialties</i>	0	0	0	0
Total	63	3	60	8

Supply and Demand in Food Deserts

The third research question analyzes food supply and demand conditions in USDA-defined food deserts. If a tract is truly a food desert, it would be reasonable to conclude that the demand for grocery items is not being met by food retailers in the tract. However, this is not the case for 22 of the 63 tracts identified as food deserts. Figure 7 below illustrates the distribution of these tracts.

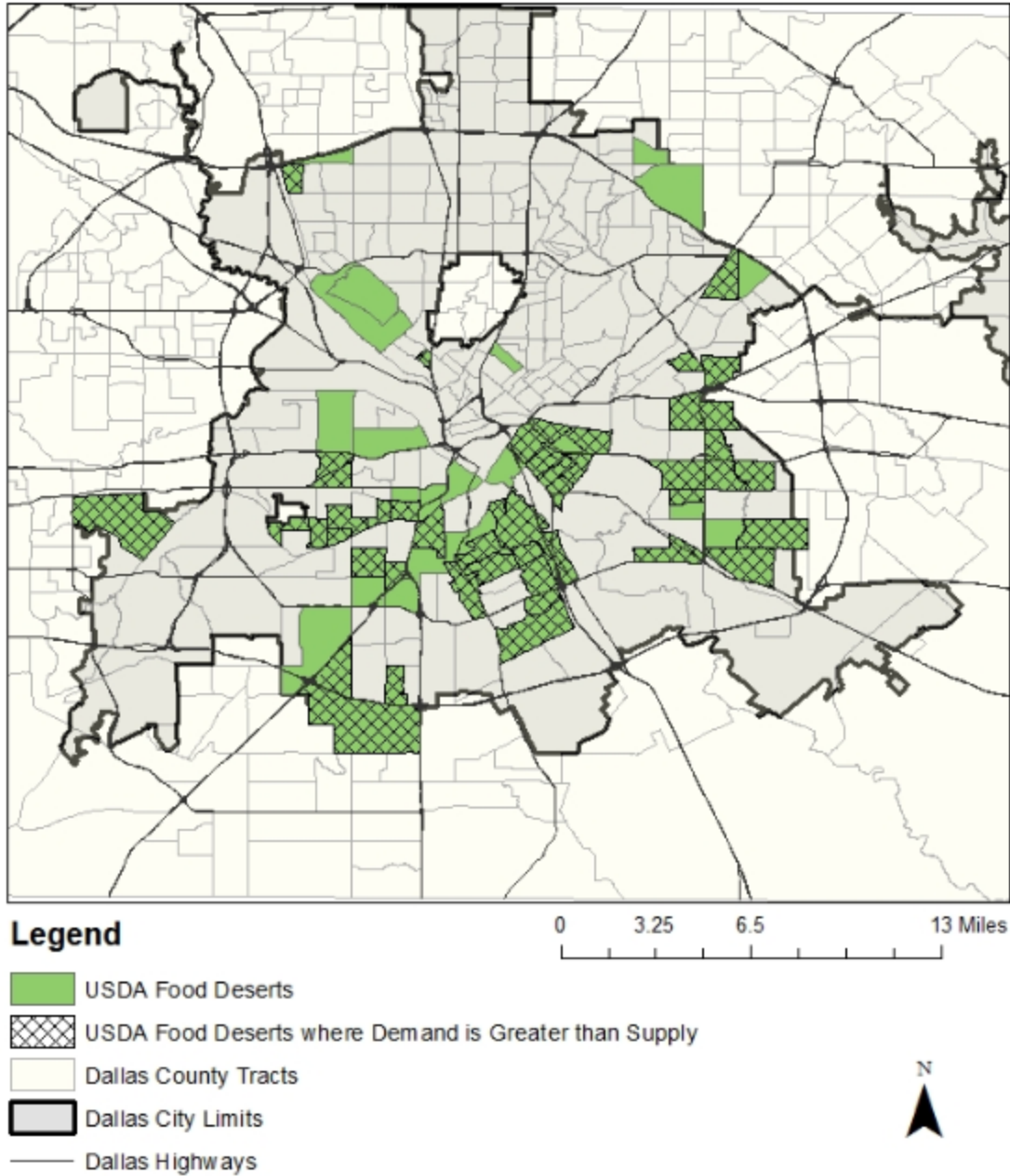


Figure 7 Food deserts where demand is not met

The populations per number of stores (of each store type) in the food deserts are displayed in Table 8. In the food desert tracts where demand is greater than supply, there are overall more people per smaller format retailers than in the food deserts where demand is met (which makes sense). More specifically, there is a larger population per

convenience store, gas station, and dollar store. In contrast, there are less people per gas station and dollar store in food deserts where the demand is met by the supply. These could potentially point to the types of stores that make a difference in the supply side of the food retail environment. Though the third question focuses on the supply and demand in the USDA food deserts, when looking at all Dallas tracts, 72.4% have a demand that is greater than the supply.

Table 8 Comparing the number of people per store in USDA food deserts based on supply and demand

Store Type	Food Deserts where Demand is Met		Food Deserts where Demand is Greater than Supply		
	Number of Stores in Category	People Per Store in Food Deserts	Number of Stores in Category	People Per Store in Food Deserts	Percent Population Difference
Gas Station	42	2047.81	41	4641.37	-55.88%
Dollar Store	11	7818.91	16	11893.5	-34.26%
Convenience Store	20	4300.4	39	4879.38	-11.87%
Small Grocer	3	28669.33	7	27185.14	5.46%
Drug Store	4	21502	11	17299.64	24.29%
Total	80	1075.1	114	1669.26	-35.59%

CHAPTER V

DISCUSSION AND CONCLUSION

In many developed countries, food deserts have been a growing topic for research and discussion in recent decades. This is mostly due to the rate at which obesity and other diet related diseases are affecting these populations, and the search for understanding what drives them. This large body of literature comes from various fields, backgrounds, and perspectives (i.e. public health, consumer behavior, geography, urban planning, etc.), and therefore has a fairly fragmented definition of a food desert. What does seem to be consistent is the fact that, in general, food deserts are areas of low socioeconomic status and have limited access to affordable healthful foods. Specific issues related to measurements, degree of food security, and what to do about these concerns, remain the focus of intense debate.

This study looked at the role of the smaller format grocery retailers in measuring food deserts with the intent to potentially identify any possible differences these stores may make within the context of Dallas, Texas. Store surveying has become a more widely-employed approach in recent years, specifically after the USDA 2009 study (and others) called for future research of this type. This study has attempted to contribute to the literature on food deserts, not only by contextualizing the food desert landscape within one of the nation's largest cities, but by contributing discussions of the role store type (and their contents) play in food desert research. Also, this study uses empirical findings to improve the understanding of food deserts within geographical literature. This chapter summarizes and interprets the study results, concluding with public policy, business operation, and future research recommendations.

Summary

Smaller format grocery retailers are starting to play a larger role in the grocery retailing industry as we see consumer behavior changing in response to the most recent economic recession (Donald 2013; Campo and Gijbrecchts 2004; Delisle, 2005; Martinez and Kaufman, 2008). In this study, the amount of variety in these alternative distribution channels confirms this idea; however, the affordability of most products in these stores still (to an extent) supports the original ideas behind leaving them out of the analysis of food deserts in the first place. In Dallas, larger format grocery retailers are still the most affordable option for a consumer to purchase items for a balanced diet, and populations of lower socioeconomic status do not have adequate access to them. From an uneven development perspective, this is an example of how the market does not meet the needs of all populations.

Overall, the least affordable and scarce foods are whole grains and fruits. Also, there are more stores that qualified as unhealthy (having the lowest healthy to unhealthy food ratio) than any of the other three categories of 'healthier' stores combined. To rub salt in the wound, most of these unhealthy stores are within the two neighborhood types, *Española* and *Harlem Gateway*, that host all, but one, of the food deserts in Dallas. On the other hand, the *Crème de la Crème* neighborhood type didn't have any unhealthy food stores. This fits in with existing literature that addresses the relationships between minorities and food deserts.

The majority of literature on food deserts (reasonably) assumes there is a demand for fresh and healthy grocery items, and by definition, people living in food deserts have limited (or no) access to these products. However, as seen in the previous

chapter, about one-third of the USDA food deserts had a demand for grocery items met by the supply.

Implications

The only 2 stores to meet the requirements for *combination* (both *affordability* and *variety*) were both dollar stores. Though only 2 in number, inclusion of these stores in the analysis of food deserts has an important impact: a total of 3 census tracts that are food deserts under the usual USDA criteria transition to non-food desert status. There are fewer people per gas station and dollar store in USDA food deserts where the demand is met by the supply. This could suggest the potential benefits of using these stores as a way to alleviate some of the impact of food deserts, or give better insight to how customers are accessing grocery items in these areas. For example, one way to look at the role of the gas stations could be that there may be more people with vehicles in those food deserts, and therefore they are able to access grocery stores further away, and thus have their demand for groceries met.

It is important to note this particular dollar store chain (99 Cents Only Store) that met the requirements for *combination* is unique in its product offering, in that of the dollar store concepts in Dallas, it is the only one to offer fresh produce (and at dollar store prices). In the past few years dollar stores and other deep discounters (think Wal-Mart, Dollar General, etc.) have opened smaller format grocery stores, though none are near these food deserts. Opening these deep discounters that are similar in product selection to the 99 Cents Only Store in food deserts can help alleviate their impact.

Despite the fact many smaller format retailers offer a variety of foods in all food groups, most of these foods were canned, dried, or frozen. According to the Thrifty

Food Plan, although not the most ideal, consumers can still obtain the nutrients for a balanced diet from these foods. Many consumers seek convenience and other time saving options above health (Fitch 2004). A household with a single mother (a variable that usually associated to food deserts) working to support her family, may not have the time (or the energy) to prepare fresh, healthful meals for her family. It is important to understand what consumers in a given market actually want. This could also hint as to why there may be some food deserts where the demand was met by the supply.

If the demand for groceries in a given food desert is met by the local supply, can we still call it a food desert? Yes, and the reason why has to do with access. People of lower socioeconomic status spend a greater proportion of the income on grocery items, and also incur a much higher cost of obtaining them, whether it be in time, or gas driving to the store. As a result it still fits in with the general definition of a food desert in that these are still areas where there is limited access to *affordable* foods. This study identifies where these areas are.

The high number of unhealthy stores relative to healthy stores in these neighborhood types helps put a perspective on the choices these consumers are actually faced with. Minority groups seem to suffer the most from this. Not only do we see a higher concentration of unhealthy stores in these neighborhood types in this particular study (as well as many others), but there are several studies that gives evidence showing these same groups of people have better access to fast food restaurants, and also see about twice as many ads for unhealthy foods such as fast food, soda, or candy (Haas et al. 2003; Harris et al. 2010; Henderson and Kelly, 2005;

Marsden, 2004; Powell, 2007) This potentially points to the greater underlying issues with the food industry in America today, that go beyond evaluating store type.

Recommendations

Based on the findings in this study, there are many recommendations that can be made for policy or business practices. This study identifies areas that are not only food deserts, but the unhealthiest areas in the city of Dallas. One way to alleviate the impact of food deserts at the policy level would be to assist the smaller format retailers in lowering their prices on healthful foods. For most food categories, many smaller format retailers offered a variety of healthful food options, just none that were affordable. Lowering food prices will make affordable healthful food items more accessible for people living in food deserts.

In addition to lowering prices on healthful food items, assistance in providing more healthful food options (to reduce the ratio of healthy to unhealthy foods) to the consumer would increase the likelihood people will choose healthier foods. Many of the smaller format retailers had very little to no shelf space dedicated to healthful food options. As early marketing literature shows, the more shelf space dedicated to a certain product, the more it sells. Another way to approach this would be to provide the store owner with incentives to increase the ratio of healthy to unhealthy foods. This could be in the form of penalization if the ratio falls below a specific threshold (maybe below a category 3) or awarding tax breaks if the ratio is kept at category 3 and above.

Another way this study can assist policy level intervention is by showing areas of most distress in order to prioritize efforts to assist these neighborhoods. Figure 8

displays the map of showing these distressed areas (areas that are food deserts and/or have high concentrations of unhealthy food stores). The most extreme case is the neighborhood that is not only is a food desert, but it is a particularly unhealthy area with more than 5 unhealthy food stores and the demand is not met (see Figure 8).

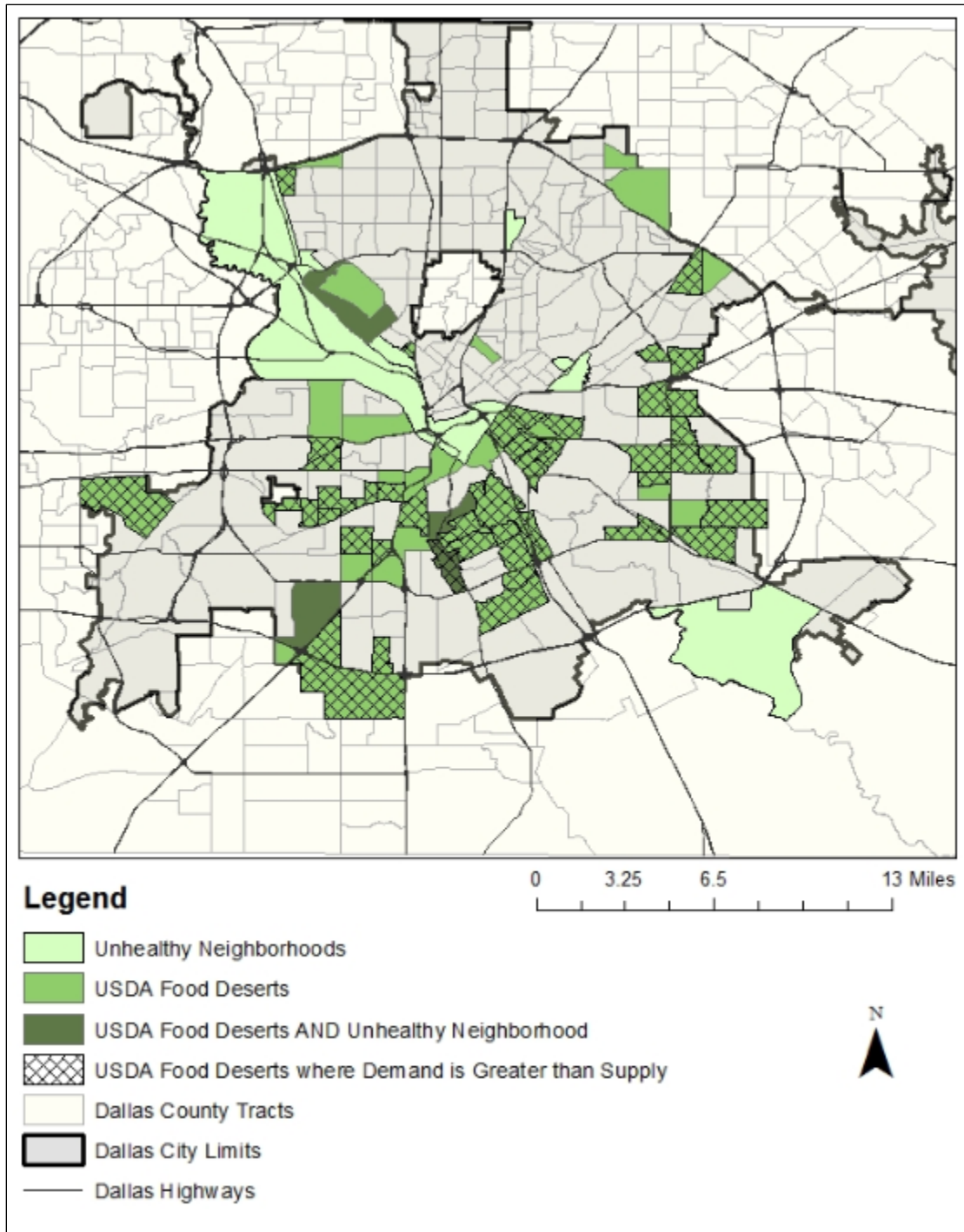


Figure 8 Most distressed areas in Dallas

Businesses, especially dollar stores, have an opportunity to tap these underserved markets. Smaller grocery formats or deep discounters like the Dollar

General Market or Aldi, could perform very well in these areas due to limited competition, existing brand recognition, and/or familiarity with the distribution channel, not to mention, lower costs in land/rent. It should be easier for a consumer to think of grocery shopping at a grocery store, than to learn to shop at a new format (i.e. a gas station). Because of this idea, I do not think it wise to pursue gas stations as a format that can be a destination for a consumer to do all of their grocery shopping. Though, it would be beneficial to lower the prices of basic grocery necessities (i.e. milk, eggs, bread, etc.) in these stores in order to provide better access, and therefore lowering the impact of food deserts in these areas.

Limitations of Study

Most of the limitations to this study are related to data and time. The data collected were the most recent at the time of this study; however that time frame expands from the earliest point of the ACS (2006) to the in-store survey data (2013). Some stores may not have been included in the study due to reconstruction, or may have been included, but were closed down over the course of the study. The pricing data used from the USDAs CNPP provided a national average. Having a local average of prices would be more useful for facilitating in-store comparisons to obtain a measure of affordability relative to the price of goods in Dallas.

Ideally additional smaller format retailers would have been surveyed, however with limited resources, the largest possible sample size was obtained. Having a larger sample size would have increased the accuracy of the results.

Future Research

Future research should include a comparison of the prices at the major national chain grocers in the study area to the smaller format grocers. The price data used in this study came from a national database, with national averages. Knowing how the prices compare to the grocery stores in the study area may be a better testament to the actual affordability of the products at these smaller format retailers.

This study only looks at some supply-side issues related to food deserts. However, as mentioned earlier, just because healthful food options may be offered, does not guarantee people will buy them. There is not an easy solution for dealing with the demand-side of healthful food items. Future research should take a more in-depth look at the demand before and after recommended policy interventions. This should be similar to the works published by Wrigley et al. (2003) and Clarke et al. (2012). Doing this ought to provide a better understanding as to the quantity and type of healthful food items people demand.

Future research should also include the socio-political aspects associated with food deserts. Understanding these processes within the context of their geography may better explain why we see food deserts in particular areas. In relation to the food industry and access to affordable foods, Donald (2013) says it best:

...getting people to eat better is not an easy task. Any policy solutions will be hard to implement without addressing either the sources of affordability or the particular dynamics of the U.S.-inspired agro-industrial food system that limits what personal responsibility can do.

There are many facets to the food retailing industry (beyond just grocery stores) that impact what people eat. Engaging consumer behavior literature and conducting future research with the intent of better understanding why and how people consume certain foods should help provide solutions for alleviating the impact of food deserts. Identifying the multiple influences on consumer choice can possibly get at the crux of the issues associated with obesity and eating healthy.

APPENDIX A
CENSUS DATA

Table A.1 Dallas QuickFacts⁹

People QuickFacts	Dallas	Texas
Population, 2011 estimate	1,223,229	25,631,778
White persons, percent, 2010	50.7%	70.4%
Black persons, percent, 2010	25.0%	11.8%
American Indian and Alaska Native persons, percent, 2010	0.7%	0.7%
Asian persons, percent, 2010	2.9%	3.8%
Native Hawaiian and Other Pacific Islander, percent, 2010	Z	0.1%
Persons reporting two or more races, percent, 2010	2.6%	2.7%
Persons of Hispanic or Latino origin, percent, 2010	42.4%	37.6%
White persons not Hispanic, percent, 2010	28.8%	45.3%
High school graduate or higher, percent of persons age 25+, 2007-2011	73.3%	80.4%
Bachelor's degree or higher, percent of persons age 25+, 2007-2011	28.8%	26.1%
Households, 2007-2011	452,487	8,667,807
Persons per household, 2007-2011	2.6	2.79
Per capita money income in the past 12 months (2011 dollars), 2007-2011	\$27,251	\$25,548
Median household income, 2007-2011	\$42,259	\$50,920
Persons below poverty level, percent, 2007-2011	23.0%	17.0%
Business QuickFacts	Dallas	Texas
Total number of firms, 2007	121,288	2,164,852
Manufacturers' shipments, 2007 (\$1000)	21,239,920	593,541,502
Merchant wholesaler sales, 2007 (\$1000)	19,169,362	424,238,194
Retail sales, 2007 (\$1000)	16,256,495	311,334,781
Retail sales per capita, 2007	\$12,837	\$13,061
Accommodation and food services sales, 2007 (\$1000)	3,378,598	42,054,592

⁹ (U.S. Census Bureau, 2012)

APPENDIX B
STI NEIGHBORHOOD TYPES

Below is an overview of the 15 STI LandScape neighborhood types taken from the data provided by the company.

1. **Crème de la Crème.** Urban neighborhoods with residents that measure far above average in all traditional classifications, including income, education, and family status.
2. **Urban Cliff Climbers.** Urban neighborhoods with residents that represent the definitive “working class,” and are young and in pursuit of their individual American dreams.
3. **Urban Cliff Dwellers.** Urban neighborhoods with 30-somethings pursuing a comfortable, classically American, working-class lifestyle.
4. **Seasoned Urban Dwellers.** Urban neighborhoods predominately home to working class, mid-to-late-40-somethings, plus a high percent of residents who are 65-plus.
5. **Thriving Alone.** Neighborhoods distinguished by a large number of residents who are flourishing in solitary, highly urban, high-income lifestyles.
6. **Going It Alone.** Urban neighborhoods that are a testament to the opportunities available to Americans who, even without higher educations, can live comfortable lives alone.
7. **Struggling Alone.** Urban neighborhoods where the single residents with minimal education and many children are struggling alone financially.
8. **Single in the Suburbs.** Residents of these suburban neighborhoods are among the lower income levels of modern suburbia, but are neither rich, nor poor.
9. **Married in the Suburbs.** These suburban neighborhoods are home to upper-middleclass residents with high incomes, married-couple households, and white-collar jobs.
10. **Retired in the Suburbs.** Suburban neighborhoods with 40-plus demographic, high incomes, few children, and a comfortable standard of living.
11. **Living With Nature.** Rural areas inhabited by a patchwork of people who have both chosen the rural lifestyle and whose vocations chose it for them.
12. **Working With Nature.** Rural areas home predominately to 40-plus-year-olds working the land for a living.
13. **Harlem Gateway.** Urban neighborhoods comprised predominantly of African Americans.
14. **Españiola.** Urban neighborhoods that are home mainly to Hispanic Americans.

15. Specialties. Neighborhoods across the U.S. that are so unique they do not fit into easily definable groups, for example: rich and poor senior citizens, Asians, apartment dwellers, trailer park residents, military personnel, and college students.

Table B.1 Distribution of neighborhood types in Dallas

Neighborhood type Category	# of Tracts	% of Tracts
<i>Crème de la Crème</i>	34	12.19%
<i>Urban Cliff Climbers</i>	5	1.79%
<i>Urban Cliff Dwellers</i>	1	0.36%
<i>Thriving Alone</i>	32	11.47%
<i>Going It Alone</i>	7	2.51%
<i>Single in the Suburbs</i>	9	3.23%
<i>Married in the Suburbs</i>	3	1.08%
<i>Retired in the Suburbs</i>	1	0.36%
<i>Harlem Gateway</i>	59	21.15%
<i>Española</i>	120	43.01%
<i>Specialties</i>	8	2.87%
Total	279	100.00%

Table B.2 Number of stores that lie within each major neighborhood type

Neighborhood type Category	Number of Stores
<i>Crème de la Crème</i>	45
<i>Urban Cliff Climbers</i>	7
<i>Urban Cliff Dwellers</i>	3
<i>Thriving Alone</i>	71
<i>Going It Alone</i>	13
<i>Single in the Suburbs</i>	18
<i>Married in the Suburbs</i>	2
<i>Retired in the Suburbs</i>	2
<i>Harlem Gateway</i>	145
<i>Española</i>	348
<i>Specialties</i>	26
TOTAL	680

APPENDIX C
IN STORE SURVEYS

Store Name		Store Cat	Seg Cat		
Address		City	State Zip		
	Variety Count	Product	Brand	Pkg Size	Price
Grains	Whole grain breads, rice, pasta, and pastries	Wholegrain bread	Mrs. Bairds	Loaf (Indicate oz)	
	Whole grain cereals (cold and hot)	Cold Cereal	Cheerios	14oz	
	popcorn and other whole grain snacks	Popcorn	Act II	3bags	
	Non-whole grain breads, cereal, rice, pasta, pastries, snacks, etc.	White bread	Mrs. Bairds	Loaf (Indicate oz)	
Veg	Potato products (reg fat)	Potato chips	Lays	1.88oz	
	Potato products (low fat)	Instant mash	Hungry Jack	reg box?	
	Dark-green vegetables	Broc/spin			
	Orange vegetables	Carrots			
	Other vegetables	Can green beans	Green Giant	1.5oz	
Fruits	Whole fruits (canned and dried)	Bananas			
	Fruit juices	100% Apple juice	Simply	59oz	

* = use cheapest price available

Figure C.1 Page 1 of store survey template

	Variety Count	Product	Brand	Pkg Size	Price	
Milk Products		Whole milk, yogurt, and cream	Whole Milk	Oak Farms	Gallon	
		Lower fat and skim milk, and low fat yogurt	2% Milk	Oak Farms	Gallon	
		All cheese	Mozz	Kraft	8oz	
		Milk drinks and milk desserts	Vanilla Ice Cream	Bluebell	1 pt.	
Meat and Beans		Beef, pork, veal, lamb, and game	Ground Beef		16oz	
		Chicken, turkey, and game birds	Canned Chicken	Starkist	5oz	
		Fish and fish products	Canned Tuna	Chicken of the Sea	5oz	
		Bacon, sausage, and luncheon meats (incl spreads)	Ham Lunch Meat	Oscar Meyer	16oz	
Other foods		Nuts, nut butters, and seeds	Peanut Butter	Jif	18oz	
		Egg and egg mixtures	Eggs		Dozen	
		Canned and dry beans, lentils, and peas (legumes)	Canned Peas	Green Giant	15oz	
		Table fats, oils, and salad dressings	Margarine	Country Crock	15oz	
		Gravies, sauces, condiments, and spices	Ketchup	Heinz	32oz	
		Coffee and tea	Ground Coffee	Folgers	10.3oz/11.3oz	
		Soft drinks, sodas, fruit drinks and ades	Dark Soda	Coke/Pepsi	2L	
		Sugars, sweets, and candies	M&M	Mars	1.69oz	

* = use cheapest price available

Figure C.2 Page 2 of store survey template

Table C.1 Examples of products in each major product category

Food Type	Examples
Grains	
Whole grain breads, rice, pasta, and pastries	Loaf of whole grain bread
Whole grain cereals (cold and hot)	Cheerios, whole grain oatmeal
Popcorn and other whole grain snacks	Popcorn, granola bars
Non-whole grain breads, cereal, rice, pasta, pastries, snacks, etc.	White bread, white rice, pre-packaged baked goods
Vegetables	
Potato products (regular fat)	Potato chips, russet potatoes
Potato products (low fat)	Instant mashed potatoes
Dark-green vegetables	Spinach, greens
Orange vegetables	Carrots, sweet potatoes
Other vegetables	Green beans, corn, tomatoes
Fruits	
Whole fruits (canned and dried)	Bananas, apples, oranges
Fruit juices	Apple juice, orange juice
Milk Products	
Whole milk, yogurt, and cream	Whole milk, yogurt
Lower fat and skim milk, and low fat yogurt	2% milk, low-fat yogurt
All cheese	Cheddar, American, Mozzarella
Milk drinks and milk desserts	Chocolate milk, ice cream
Meat and Beans	
Beef, pork, veal, lamb, and game	Ground beef, roast, tenderloin
Chicken, turkey, and game birds	Chicken breast, turkey breast
Fish and fish products	Tuna, tilapia, salmon
Bacon, sausage, and luncheon meats (including spreads)	Ham lunch meat, bacon
Nuts, nut butters, and seeds	Peanuts, cashews, almonds
Egg and egg mixtures	Eggs, egg whites, egg beaters
Canned and dry beans, lentils, and peas (legumes)	Green peas, black beans, pinto beans
Other Foods	
Table fats, oils, and salad dressings	Margarine, butter, ranch dressing
Gravies, sauces, condiments, and spices	Ketchup, mayonnaise, salt/pepper
Coffee and tea	Ground coffee, green tea
Soft drinks, sodas, fruit drinks and ades	Coke, fruit punch, Gatorade
Sugars, sweets, and candies	M&M's, jelly, honey

Table C.2 Applying Surveyed Stores to Non-Surveyed Stores

Neighborhood Type	Store Type	Number of Stores Sampled	Number of Stores in Neighborhood Type	Sample Store Type Applied
<i>Crème de la Crème</i>	Small Grocers	0	0	-
	Convenience Stores	1	9	Convenience Stores
	Gas Stations	1	20	Gas Stations
	Drug Stores	2	11	Drug Stores
	Dollar Stores	0	5	Drug Stores
<i>Urban Cliff Climbers</i>	Small Grocers	0	0	-
	Convenience Stores	0	1	Gas Stations
	Gas Stations	1	5	Gas Stations
	Drug Stores	1	1	Drug Stores
<i>Urban Cliff Dwellers</i>	Dollar Stores	0	0	-
	Small Grocers	0	0	-
	Convenience Stores	1	1	Convenience Stores
	Gas Stations	0	0	Convenience Stores
<i>Thriving Alone</i>	Drug Stores	1	1	Drug Stores
	Dollar Stores	1	1	Dollar Stores
	Small Grocers	0	0	-
	Convenience Stores	1	24	Convenience Stores
	Gas Stations	2	34	Gas Stations
<i>Going It Alone</i>	Drug Stores	1	11	Drug Stores
	Dollar Stores	0	2	Drug Stores
	Small Grocers	0	0	-
	Convenience Stores	2	5	Convenience Stores
	Gas Stations	1	5	Gas Stations
<i>Single in the Suburbs</i>	Drug Stores	1	1	Drug Stores
	Dollar Stores	1	2	Dollar Stores
	Small Grocers	1	4	Small Grocers
	Convenience Stores	1	6	Convenience Stores
	Gas Stations	1	6	Gas Stations
<i>Married in the Suburbs</i>	Drug Stores	2	2	Drug Stores
	Dollar Stores	0	0	-
	Small Grocers	0	0	-
	Convenience Stores	0	0	-

(table continues)

				<i>(continued)</i>
	Gas Stations	0	2	Gas Stations ¹⁰
	Drug Stores	0	0	-
	Dollar Stores	0	0	-
<i>Retired in the Suburbs</i>	Small Grocers	0	0	-
	Convenience Stores	0	0	-
	Gas Stations	1	1	Gas Stations
	Drug Stores	1	1	Drug Stores
	Dollar Stores	0	0	-
<i>Harlem Gateway</i>	Small Grocers	1	5	Small Grocers
	Convenience Stores	1	55	Convenience Stores
	Gas Stations	2	53	Gas Stations
	Drug Stores	1	7	Drug Stores
	Dollar Stores	1	25	Dollar Stores
<i>Española</i>	Small Grocers	3	38	Small Grocers
	Convenience Stores	1	82	Convenience Stores
	Gas Stations	0	167	Convenience Stores
	Drug Stores	1	26	Drug Stores
	Dollar Stores	0	35	Drug Stores
<i>Specialties</i>	Small Grocers	1	2	Small Grocers
	Convenience Stores	1	6	Convenience Stores
	Gas Stations	1	15	Gas Stations
	Drug Stores	1	2	Drug Stores
	Dollar Stores	0	1	Drug Stores
TOTAL:		40	680	

¹⁰Used Gas Station Data from Single in the Suburbs

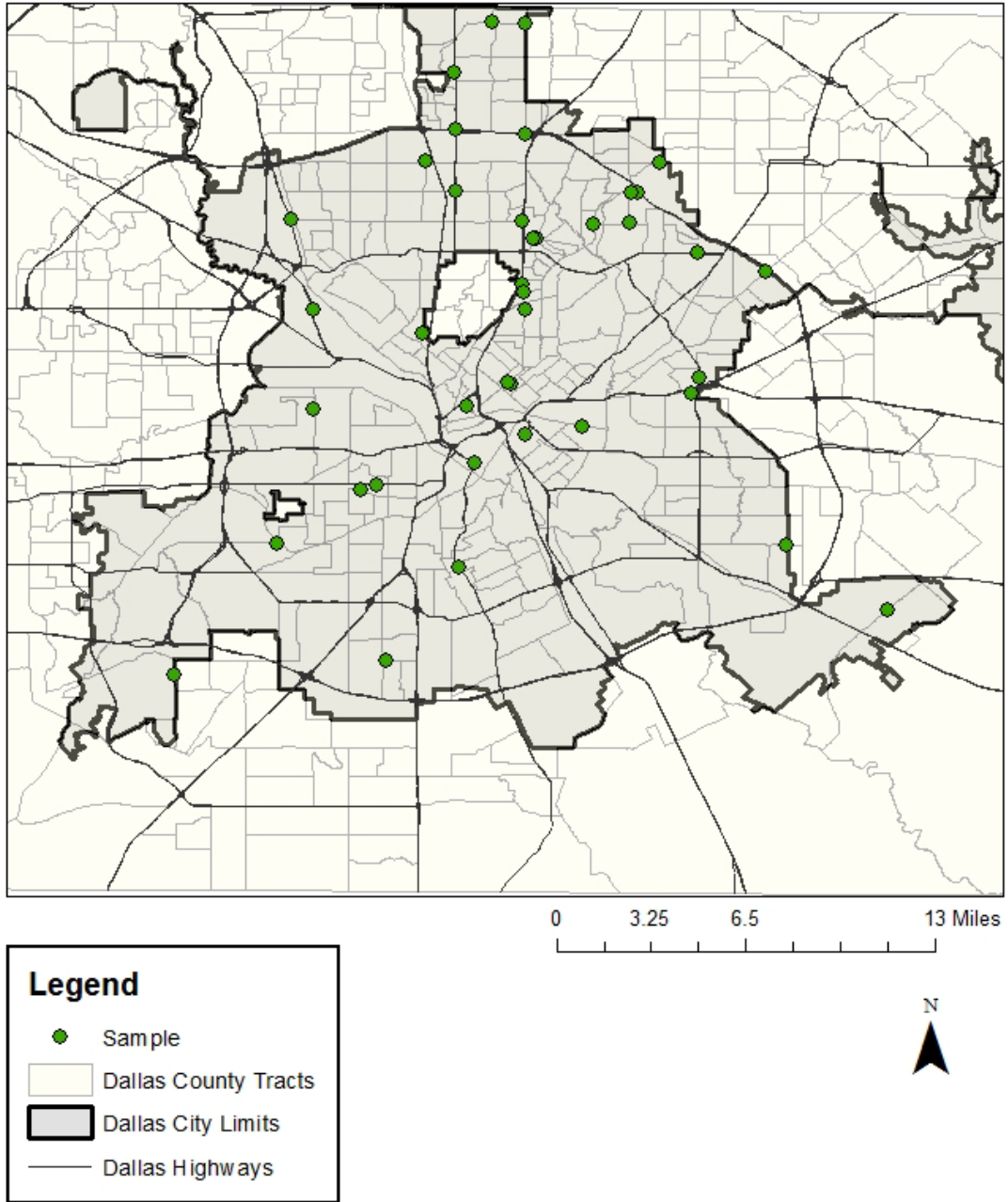


Figure C.3 Location of surveyed stores

APPENDIX D
STATISTICAL TESTS

Table D.1 Results from chi-square test¹¹

Pearson Chi-Square	Value	Asymp. Sig. (2-sided)
USDA Food Desert & <i>Variety</i>	10.398	0.001
USDA Food Desert & <i>Affordability</i>	262.074	0.000
USDA Food Desert & 'Healthy' Stores	28.238	0.000

¹¹n=279; 0% missing

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