

Contextual Approaches in Food Access Measurement

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Abstract

This study presents a set of geospatial methods to assessing food access that is sensitive to varying contexts across urban environments. This new methodology employs 1) a variable distance threshold for physical access, 2) transportation accessibility measurement for resource-based access, and 3) segmented analysis of food destination types. It is applied to the City of Atlanta, showing that good food access is driven primarily by large grocery retailers, but small scale food destinations contribute to food security in the neighborhoods experiencing the lowest levels of food access. This new approach advances the means for planning practitioners to accurately assess complex food landscape characteristics to better target food systems planning.

Introduction

Supermarkets are heralded as the solution to the obesity epidemic plaguing America. On the face of it, it is the absence of supermarkets that creates food insecurity and drives grocery dollars to convenience stores and fast food outlets. Yet it is the market behavior of large-scale food retailers, driven by a host of factors involving costs, consumers, and competition, that creates gaps in the food landscape, yielding patterns of food disadvantage. Much of the earlier research on food access measurement assesses these dominant market players as the sole provider of healthy foods. The rise of the supermarket has undeniably altered the scale and competitiveness of smaller retailers. Market power of larger retailers has been shown to shape firm geography in surrounding areas, crowding out traditional retailers and creating geographic gaps in the food landscape. Evolving trends in food retailing attempt to capture some of this demand, such as the development of small format superstores and the surging popularity of alternative food sources such as urban agriculture, cooperative grocery stores and farm-direct purchasing. Likewise, current food access research has begun to assess the impact of small scale food destinations on healthy food access. However, there lacks as of yet a consistent methodology to evaluate the differential impact of various healthy food sources, recognizing the market forces at play. For the purposes of this study, we are interested in capturing these complex dynamics in the food environment and understanding how they inform food access across urban populations. We have developed a set of geospatial methods that measures the varying contributions to food access of various large and small scale food destinations. The methods presented are drawn from a thorough review of the literature on food access and food retailers and are sensitive to varying contexts across urban environments. The goal is to provide a useful tool for planning and health practitioners to measure complex food landscape characteristics and their relation to local residents.

We propose an analytical structure that is broadly inclusive and can be tailored to the particular characteristics of a given study area. A variable distance threshold takes into account the relationship between residential and supermarket locations across a given locality. We also consider how the built environment influences transportation access, a vital component of physical food access. We evaluate whether local modes of transport broadly enable residents to grocery shop at healthy food outlets. We then examine varied access to healthy foods by segmenting food destinations into large scale retailers who dominate the market and have some degree of market power, and small scale food destinations that respond to gaps in the food retail geography.

Background

There are several conceptualizations of food accessibility that have evolved since the origin of the “food desert” literature in the 1990s. New terms, such as “food swamps” and “food hinterlands” have emerged to assist in unraveling the complex issues of food accessibility and its relation to community health. The WHO definition of food access, subsumed within the concept of food security, presents it as “having sufficient resources to obtain

appropriate foods for a nutritious diet.” Definitions for food deserts are similarly broad – for example, Ver Ploeg (2010) describes food deserts as “areas with limited access to affordable and nutritious food.” This vagueness in food desert and food access terminology has allowed for flexible interpretation and redefinition as the body of literature evolves.

Numerous studies demonstrate the association between the built environment and health outcomes (such as Mobley et al., 2006). Current methods of evaluating food accessibility are underpinned by studies that tie food access to dietary behavior (such as Rose & Richard, 2004, Morland et al., 2002, Moore et al., 2008) and obesity (Morland et al., 2006). However there are some contradictions in the literature regarding the food desert concept. Some studies found no link between access to healthy food destinations and nutrition (e.g. Cummins et al., 2005; Flint et al., 2012) or nutritional morbidities such as obesity and coronary heart disease (eg. Flint et al., 2012, Mobley et al., 2006). However several of these studies considered only large-scale grocery stores or supermarkets, and did not consider smaller and alternative food retail outlets. Boone-Heinonen et al.’s (2011) longitudinal study also found supermarket and grocery availability generally unrelated to diet quality and fruit and vegetable intake, with the authors noting that the variability in their results for grocery store availability reflective of contradictions in the recent literature (p. 1167). Kyureghian et al. (2013) found income, rather than the availability of fresh produce, to significantly affect fruit and vegetable purchases. This finding echoes an economic perspective that purports lower socioeconomic groups invest less in their health (Cutler, & Lleras-Muney, 2010).

The research is as of yet inconclusive on the direct causation of food deserts for obesity. However there are several other benefits we see in increasing food access in needed areas: reducing the burden of higher grocery prices for those who are less likely to be able to afford it; meet local demand for healthy foods and increase demand externalities; and catalyze new development in underserved areas. Each of these three points is broadly relevant to urban areas and applicable to Atlanta. An analysis conducted by the Brookings Institution and The Reinvestment Fund (2011) looked at grocery demand and expenditures in low access communities in metropolitan Atlanta, finding substantial leakage, equivalent to 93% of demand. Moreover, the areas in Atlanta that we show to experience low food access are of lower socioeconomic status, with constrained incomes and suffering from disinvestment.

Defining Food Access

There are four components of food access that have been well-documented in the literature, although the specific variables used vary widely from study to study. These common components are (1) a spatial unit of analysis; (2) a determination of what constitutes healthy food destinations; (3) a specified distance barrier; and (4) a defined constraint on resources that limits access to distant food destinations (Leete, Bania, & Sparks-Ibanga, 2012). We first outline established definitions and methods of food access, then discuss recent trends in the literature.

Food Destinations. Supermarkets are the most commonly employed food destination type in food access studies. However the scope has expanded to include a wide variety of food sources. Short et al.'s (2007) study assessed the impact of small-scale retailing in three diverse, low income neighborhoods in the San Francisco bay area, demonstrating that smaller grocery stores can provide accessible, nutritionally adequate, affordable, quality foods. Larsen and Gilliland (2005) evaluated the addition of farmers markets as new food retail options and found that they reduced the prices of produce at nearby grocery stores while increasing the quantity and choice of healthy foods. Other studies have also found small grocery stores and other healthy food retailers such as ethnic food, natural, and specialty shops to increase food access (Raja et al., 2008; Moore & Diez Roux, 2006).

Proximity. Food access also considers a physical accessibility dimension, such as proximity to nearby food destinations using a threshold distance to delimit good access areas. The Economic Research Service (ERS), a research branch of the USDA, uses two absolute standards for urban areas, $\frac{1}{2}$ mile and 1 mile (2013). Another method is to create a threshold that represents an acceptable walking distance, such as the $\frac{1}{4}$ mile limit set by the Baltimore Food Policy Initiative (City of Baltimore, 2010) or $\frac{1}{2}$ km by Guy, Clarke and Eyre (2002). Other studies have utilized a relative threshold value rather than an absolute one, such as selecting the upper quantile of geographic units with the greatest distances (Smoyer-Tomic, Spence, & Amrhein, 2006). An additional relative threshold calculation has been documented in the literature that approximates a distance threshold suitable to each community (McEntee & Agyeman, 2010). Although relatively underused, it is a straightforward calculation that determines a community's average nearest distance to a food destination or set of food destinations. This is accomplished using Geographic Information Systems (GIS) by identifying the shortest routes from households to supermarkets and then averaging the lengths of the routes.

Density of food destinations is another measure that is used and is well suited to explaining how concentrations of fast food restaurants and convenience stores may negatively impact dietary behavior. This concept, known as "food swamps," has been linked to unhealthy food consumption and obesity (Li et al., 2009; Rose et al., 2009; Boone-Heinonen et al., 2011). In consideration of the competing presence of both healthy and unhealthy local food destinations, Baker et al. (2006) compared clusters of grocery stores and fast food restaurants, and Raja et al. (2008) developed the Neighborhood Healthful Foods Vulnerability Index (NHFVI) that evaluates the density of both healthy and unhealthy food locations.

Socioeconomic status (SES). SES is an often used variable that generally considers some measure of disadvantage such as poverty status, median family income, or recipient status of government assistance programs. The United States Department of Agriculture (USDA) employs the common method of setting a concentration threshold (at least 20% of local residents in poverty or median family income no more than 80% of greater area median family income) (USDA, 2013). Leete et al. (2012) also utilized SES to identify what they term "food hinterlands," which considers populations that do *not* live in areas of concentrated SES but still experience low food access.

New perspectives

Widener (2013) and others have argued for the necessity of looking beyond the home environment to include other destinations such as work and school, to account for trip-chaining behavior. Although initially given little consideration, the role of transportation in food access has gained much traction over the last decade. Clifton (2004) evaluated mobility strategies for low-income residents in Austin, Texas and found that they often travel outside of their neighborhood to access mainstream retail stores, facing limited transportation options, constrained schedules, and time and money costs to do so. Larsen and Gilliland (2008) explored food access and equity through a network analysis of walkability and transit accessibility to food destinations. Burnes and Inglis (2007) utilized similar techniques to measure access via bus, car, and foot to both major supermarkets and fast food outlets. Numerous studies have concluded that no vehicle access is the most important determinant for low food access (Ver Ploeg, 2010; Coveney & O'Dwyer, 2009; Burns & Inglis, 2007; White, Bunting, Raybould, Adamson, Williams, & Mathers, 2004). Most recently, Widener et al. (2013) found that when accounting for urban commuting patterns, proximity to healthy food destinations was improved. In particular, they showed that single-occupancy vehicle commuting greatly increases food access. This widening in perspectives to include transportation access is also demonstrated in the USDA's unveiling of their Food Access Research Atlas in March, 2013. This new online tool replaces their previous Food Desert Locator and provides several new indicators of food access, including one for vehicle availability.

To date we know that established food methodologies are limited because we have seen a rapid evolution in analytical methods that continue to fall short in accuracy for widespread application. Bitler & Haider (2011) have argued for a more economic view that grounds food access analysis in supermarket and consumer behavior, a view that is currently underrepresented in the literature. As they point out, although food deserts are extensively researched, the causes are relatively unexplored. However, research into the spatial distribution of grocery retailers yields insights into why food access is restricted for some populations. One aspect is the location of supermarkets. Several studies have found less grocery retail to be located in lower income and high minority neighborhoods than high socioeconomic neighborhoods (Gordon, Purciel-Hill, Ghai, Kaufman, Graham, & Van Wye, 2011; Powell et al., 2007; Morland et al., 2002; Larsen & Gilliland, 2005). Another phenomenon is spatial clustering of supermarkets, which has been investigated by research into firm behavior. The agglomeration-differentiation tradeoff or volume-sales tradeoff is a dilemma facing grocery retailers, choosing between co-locating to achieve higher sales volume from a larger customer base and spatially differentiating to reduce price competition. Datta, Sudhir and Talukdar (2007) found that consumers suffer high travel costs because grocery agglomerations are valued.

Methods

The concept of food deserts and food access are often used interchangeably but do not carry the same meaning. Food deserts involve a binary reading of local communities, often using threshold criteria to designate food deserts. Although attractive as a concept that is easy to grasp and clear to denote, the results end up masking natural gradations of food access across a chosen geography. Instead, we considered the complex food landscape and evaluate the levels of access it affords residents across Atlanta's neighborhoods. It was our primary concern to identify populations whose circumstances do not afford even a basic level of access to fresh foods. Such low access is most often driven by access to transportation. Therefore, we first determined if a household has a minimum level of access to a large scale food retailer via proximity or transportation access. A second consideration was then access to smaller and alternative food sources and how such provision interacts with supermarket-driven access. This hierarchy of food destinations structures a tiered analysis to provide a richer examination of food accessibility.

We utilized GIS as the primary means of analysis because it has benefits of being both spatial and statistical. There are often multiple calculation methods for a single objective – for instance, finding the nearest distance between two objects can be performed by a simple Euclidean straight line distance, a road network distance, or a cost-weighted distance. There are tradeoffs in each, with network methods more time-intensive though generally achieving much higher accuracy (although radial methods will not differ so drastically in the presence of a consistent street grid and will account for walking paths such as through parks and parking lots). For this exercise we opted for less computationally intensive approaches that are less costly and more available to planning practitioners and policymakers (Sparks et al., 2009).

The scope of study is constrained in our methods to the evaluation of geographic food access, based on the established concept that food access is but one component of the larger complex issue of food security. We recognize some implicit parameters regarding affordability and availability without seeking to quantify them. For instance, our analysis is structured based on findings in the literature that attribute certain characteristics to food destination types: food destinations as having a diverse, good quality and affordable selection of healthy foods; community gardens and farmers markets as having high quality, nutritious foods but restricted availability; and smaller grocery stores less consistent in price and quality.

Spatial scale

This study evaluates food access in the city of Atlanta at neighborhood level. The initial analysis is conducted at the census tract level as it is dependent on the U.S. Census Bureau's American Community Survey data on household vehicles. We then aggregated the results up to the Neighborhood Planning Unit (NPU). This is a commonly used administrative and planning unit in the city of Atlanta that groups geographic clusters of neighborhoods into 25 areas. The NPU was used in this case because the results feed into a larger Quality Of

Life and Health Indicators Project that makes data and findings publicly available. Given that the NPU system is familiar in Atlanta, rendering places more identifiable for residents, planners and public officials, it was the chosen unit to display final results.

Data

Where possible we selected data sources that are widely available to the public and collected for jurisdictions around the country. This supports our intention to provide a replicable model for assessing food access. The U.S. Census Bureau's (2010a) American Community Survey data was used to identify no-vehicle households. Although this dataset approximates a key determinant of food access, we recognize its limits to fully characterizing actual vehicle access. For example, it does not account for informal car sharing arrangements that may increase supermarket access. For non-traditional food sources such as farmers markets and community gardens, we geo-coded lists published online by various public and non-profit agencies. For retail destinations, we used Reference USA's (2012) business database and selected food-related locations by NAICS code.

Analytical framework

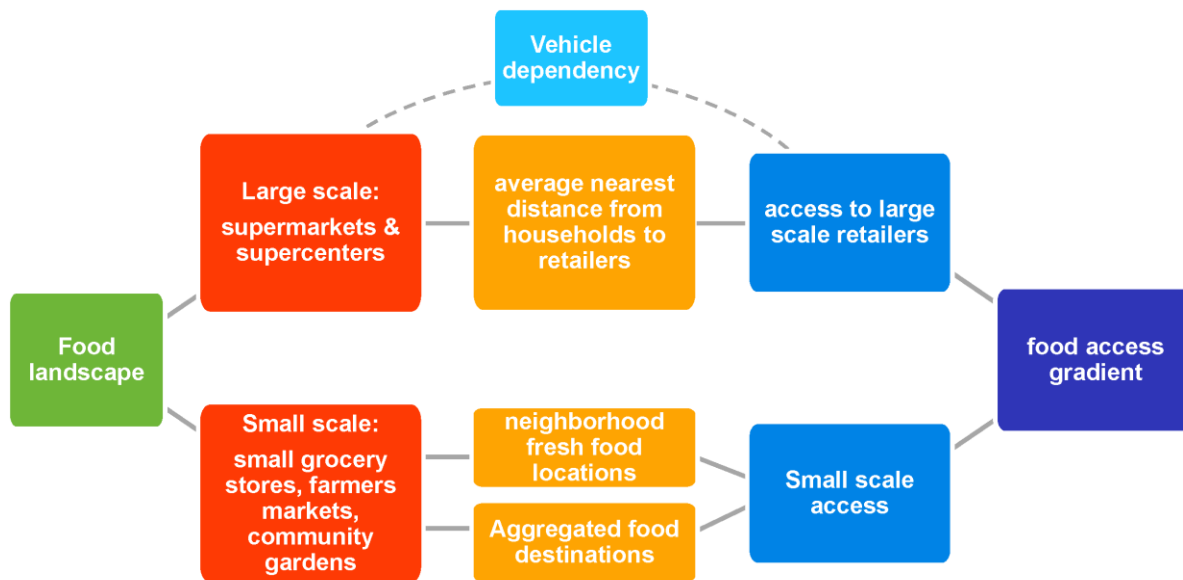
Our proposed method (Figure 1) takes a two-pronged approach, assessing both large scale and small scale food destinations. We make this distinction with the understanding that large scale retailers function differently than the neighborhood market or corner store. Supermarkets are regionally oligopolistic, with a small number of retailers capturing a large market share. The economic literature has well established that supermarkets do not significantly compete with smaller grocery stores and should be therefore analyzed differently (Smith, 2004).

Large scale food retailers in this case include supermarkets and superstores that have a sizeable fresh food section. These food destinations are most widely considered because large format grocers can provide a wide range of competitively priced fresh foods. To assess food access at the large scale, we first calculated a distance threshold based on the average nearest distance function identified in the literature review. We then identified populations beyond the distance threshold with low transportation access as having low food access. For Atlanta and for most localities, low transportation access is defined by vehicle availability. This determination was made for Atlanta by assessing whether the study area is car dependent, as outlined in the following section.

Small scale food destinations are market and non-market (such as the case with a subsidized fresh food retailer or a nonprofit community garden) responses to gaps in the food landscape. Examples of such include smaller grocery stores, specialized and ethnic food stores, community gardens, produce stands, and farmers markets. The small-scale analysis is segmented because each type of small scale food source functions differently, with varying coverage and impact. We first identified small scale destinations that definitively provide healthy fresh foods and calculated their impact at a neighborhood level. We also looked at how clusters of small scale food destinations can effectively serve

as a larger grocery retailer. We combined these two sets of results to see how food access is increased by these smaller food destinations. The final food access gradient is the aggregated result of large scale and small scale access, thereby providing a cohesive representation of food access across Atlanta's NPUs.

Figure 1. Methodological Framework



Source: authors.

Evaluating Transportation and the built environment

Incorporated into the methods is a common sense notion borne out in the literature that transportation mobility and daily travel outside the neighborhood contribute greatly to good food access. We understand that in dense, highly walkable places, the need for a car to access basic amenities is greatly diminished. However, most places we plan for do not realistically function as car-free environments. Therefore we employed several indicators that represent human travel behaviors and land use factors shaping transportation access (Table 2). The literature on this subject supports the notion that the built environment is influential on travel behavior. For example, the findings of Krizek's 2003 study show that households change travel behavior in response to differing urban forms. In this case, a longitudinal study of households in Seattle showed that vehicle miles traveled decrease when neighborhood accessibility is increased. This relationship appears to hold true even when accounting for self-selection bias. Cao et al. (2009) reviewed 38 studies that investigate the role of self-selection bias, finding that even when it is controlled for, the built environment overwhelmingly has a causal relationship with travel behavior.

The five indicators employed capture transportation mode usage, vehicle availability, and land use variables. Each of the data items comes from the U.S. Census Bureau (2011) except

for the Walk Score (2013) data, which proxies for amenities mix and density because of its methodology. The indicators were developed with reference to the Victoria Transport Policy Institute's (2012) guidelines on automobile dependency attributes. Atlanta, as can be seen in Table 1, is highly car dependent, receiving high scores across four measures and barely crossing the Walk Score threshold for the fifth. Because of these results, we employed vehicle access as a key determinant of healthy food access in our calculations for Atlanta.

Table 1. Vehicle Dependency Indicators

Indicator	Atlanta, GA	Low Dependency: Car Free	Medium Dependency: Car Beneficial	High Dependency: Car Necessary	Car Dependency Score
<i>Commute Share</i> Drive alone/carpool commute	75.10%	< 35%	35% - 65%	> 65%	High
<i>Vehicle Availability</i> Households with one or more vehicles	82.20%	< 45%	45% - 85%	> 85%	High
<i>Land Use</i> Residents per sq. mi.	3,154.30	> 10,000	4,000 – 10,000	< 4,000	High
Jobs per sq. mi.	2,860.98	> 10,000	4,000 – 10,000	< 4,000	High
Walk Score (out of 100 pts)	52.9	70 - 100	50 - 70	0 - 50	Medium

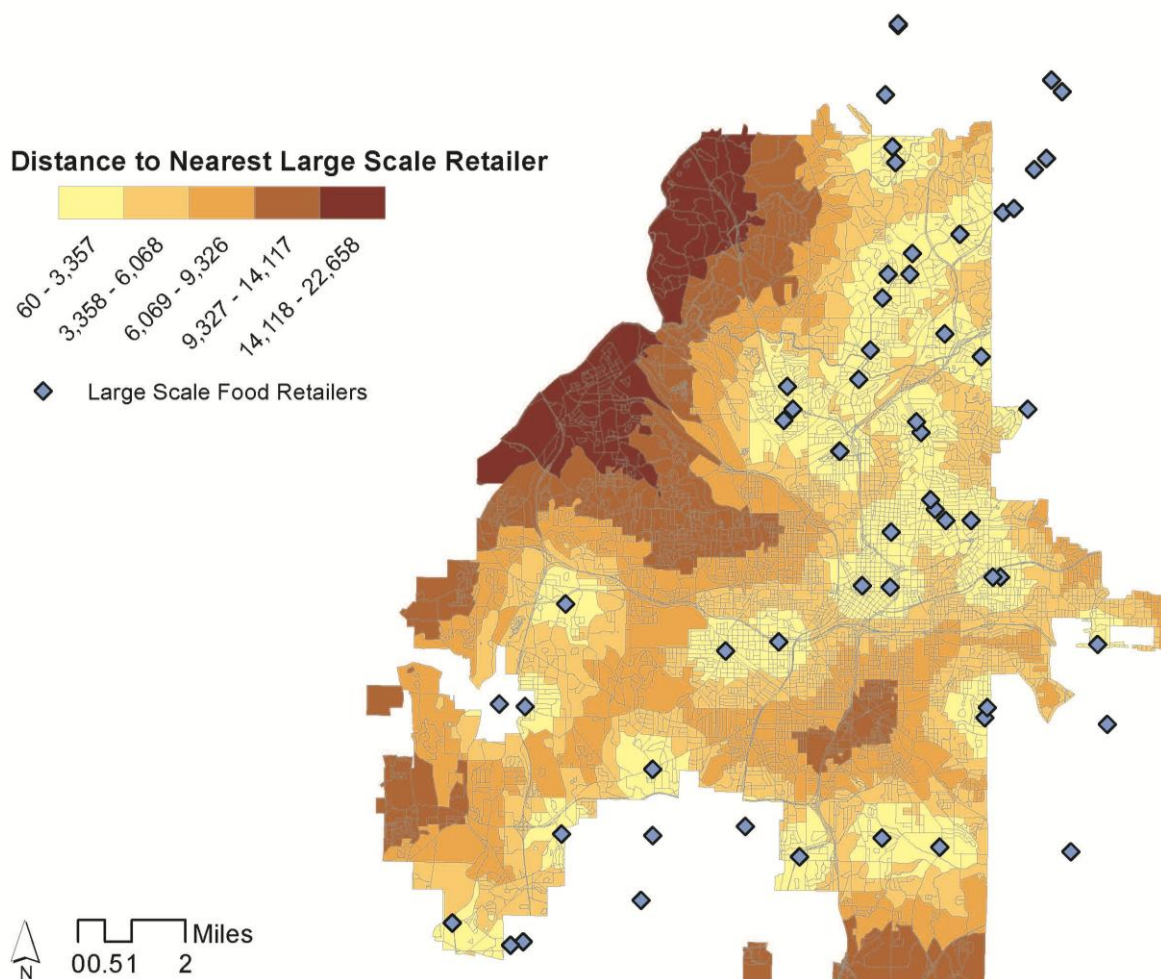
Source: U.S. Census Bureau, 2011; Walk Score, 2013; U.S. Census Bureau, 2010b.

Results

Large Scale

We first evaluated whether residents have an acceptable level of access to a supermarket, whether it is located within the neighborhood or beyond. The initial step was to identify a threshold distance from homes to grocery stores. Although 0.25 mile is often used as an ideal distance for walkability, we were interested in a minimum acceptable proximity that can reasonably be expected in Atlanta. A simple GIS calculation method was employed to find the average nearest distance from households to large grocery destinations. With census blocks centroids proxying as residential locations, the near tool was used to find the closest large scale retailer, recording its location and distance from centroids. These results were then combined, taking an average weighted by the number of households in each census block. Figure 2 shows the range of nearest distances, from 60 feet to over four miles. The weighted average comes out to 4748 feet, or 0.9 mile.

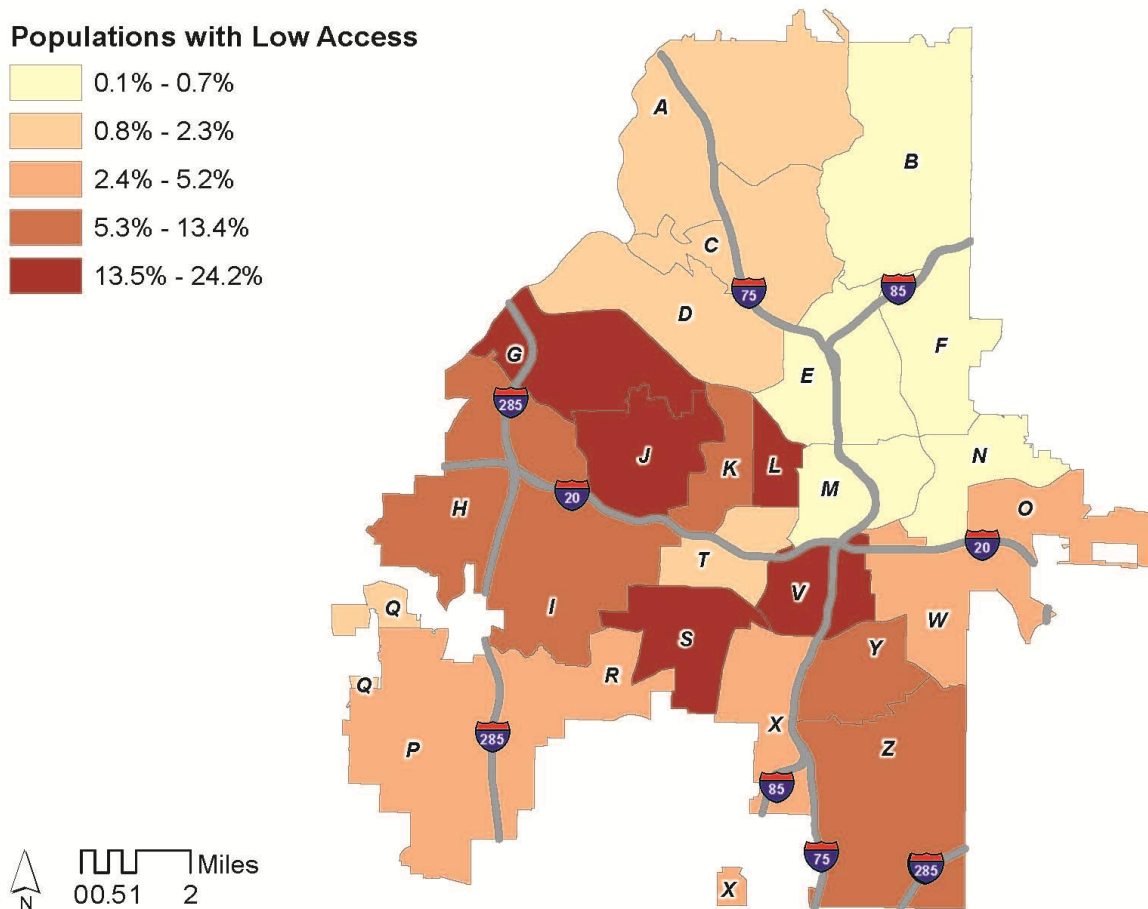
Figure 2. Average nearest distance from households to large grocery destinations



Source: ReferenceUSA, 2012; authors.

This 0.9 mile distance was used to delimit good proximity to large scale food retailers. In Atlanta, supermarkets and superstores appear to be prevalent in the more developed eastern and northern parts of the city, while the west and south neighborhoods have relatively few stores. Populations that live beyond the distance threshold may still have good food access if they have consistent vehicle access. We calculated the number of no vehicle households per census tract living beyond 0.9 mile from a supermarket or superstore. We then calculated these numbers as a percentage of all households by NPU, shown in Figure 3. There is a clear geographic demarcation between the northern NPUs with good food access, and the southern NPUs (S, V) and western NPUs (J, L, G) that experience rates of low access from 15% - nearly 25%.

Figure 3. Low Access to Large Scale Retailers



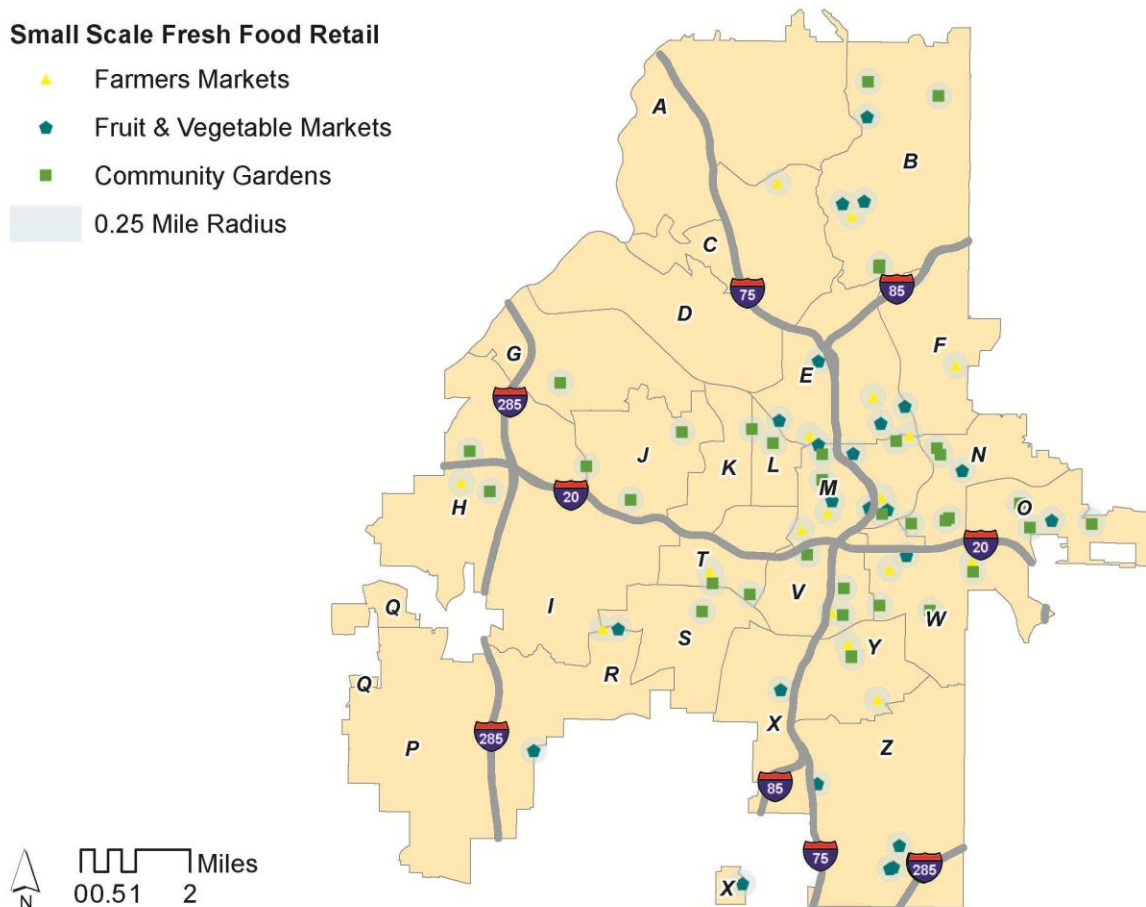
Source: authors.

Small Scale

The small scale analysis measures to what extent these neighborhood level food sources increase food access. Although we would like to consider the full range of neighborhood food destinations, we do not know if fresh foods are present at all stores. Given research showing the heterogeneity in quality and availability of fresh foods across food types in business databases, we restricted this portion of the analysis to only those destinations that guarantee provision of fresh foods: farmers markets, community gardens, and produce markets. At the small scale we catalogued and mapped all community gardens and farmers markets using the Georgia Organics guide (2010), Park Pride's community gardens list (n.d.), and national and state farmers market listings (USDA, 2011; Georgia Department of Agriculture, 2011). We also identified produce stores based on the ReferenceUSA business database (2012). For each of these food destinations (shown in Figure 4), we attributed a benefit in increased food access that is incomplete because of limited food range, and restricted availability in the case of farmers markets and community gardens. These limitations are reflected in a shortened distance buffer of 0.25 mile, understanding that residents are less likely to travel as far as they would for a supermarket or a superstore.

In Atlanta, community gardens are the most common small scale fresh food source, although there are several produce markets across southern Atlanta in NPUs P, X and Z where few food destinations are located. Much of the neighborhood level access is concentrated in central Atlanta, where there is already good food access.

Figure 4. Neighborhood Fresh Food Sources



Sources: Georgia Department of Agriculture. (2011). Georgia Organics, 2010; Park Pride, n.d.; ReferenceUSA, 2012; USDA, 2011

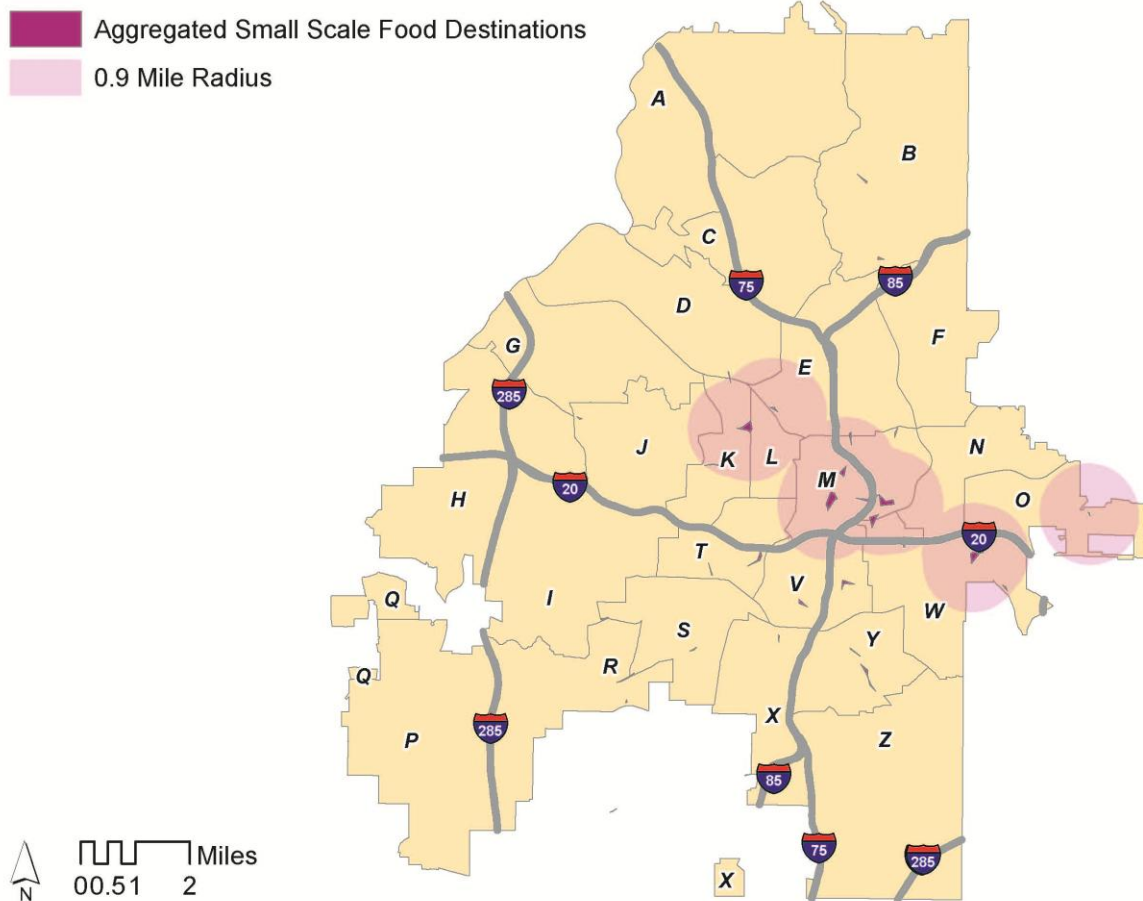
Table 2. Food destinations in Atlanta

Food Destination Type	Count	Identification method
farmers markets	20	online listings
small grocery	308	NAICS code 445299 & < 10,000 SF
meat & fish	29	NAICS code 445210, 445220
dairy	1	NAICS code 445299 & SIC Code
produce	28	NAICS code 454390, 445230
healthy/specialty stores	6	NAICS code 445299, 446191
community gardens	35	online listings
Total:	427	

Sources: Georgia Department of Agriculture. (2011). Georgia Organics, 2010; Park Pride, n.d.; ReferenceUSA, 2012; USDA, 2011

We then looked at how these fresh food sources, in addition to other small grocery retail, are clustered throughout the city. The food access literature shows that smaller and more specialized food destinations contribute to increased food access. The research is less clear as to what extent they improve access. We could not impose an assumption because of limited information on food shelf characteristics for these small grocery stores. However, we considered that there may be areas where multiple, diverse food destinations are clustered together to yield a broader food selection, effectively serving as a supermarket. Thus we aggregated small scale food destinations located within 0.25 mile, with a minimum of three destinations in each cluster. For each of the destination clusters, we calculated a richness diversity measure through a GIS plug-in (Miller Mountain, 2012) that attributed a value based on the number of component food destination types (outlined in Table 2). Food destination clusters with at least three different destination types proxy as a large scale retailer. We calculated the percentage of households with good access to these aggregated full service destinations, employing the same 0.9 mile buffer used for the large scale retail calculation. The results (Figure 5) show the food destination clusters to be concentrated in central and east Atlanta, spreading from NPU K to NPU O.

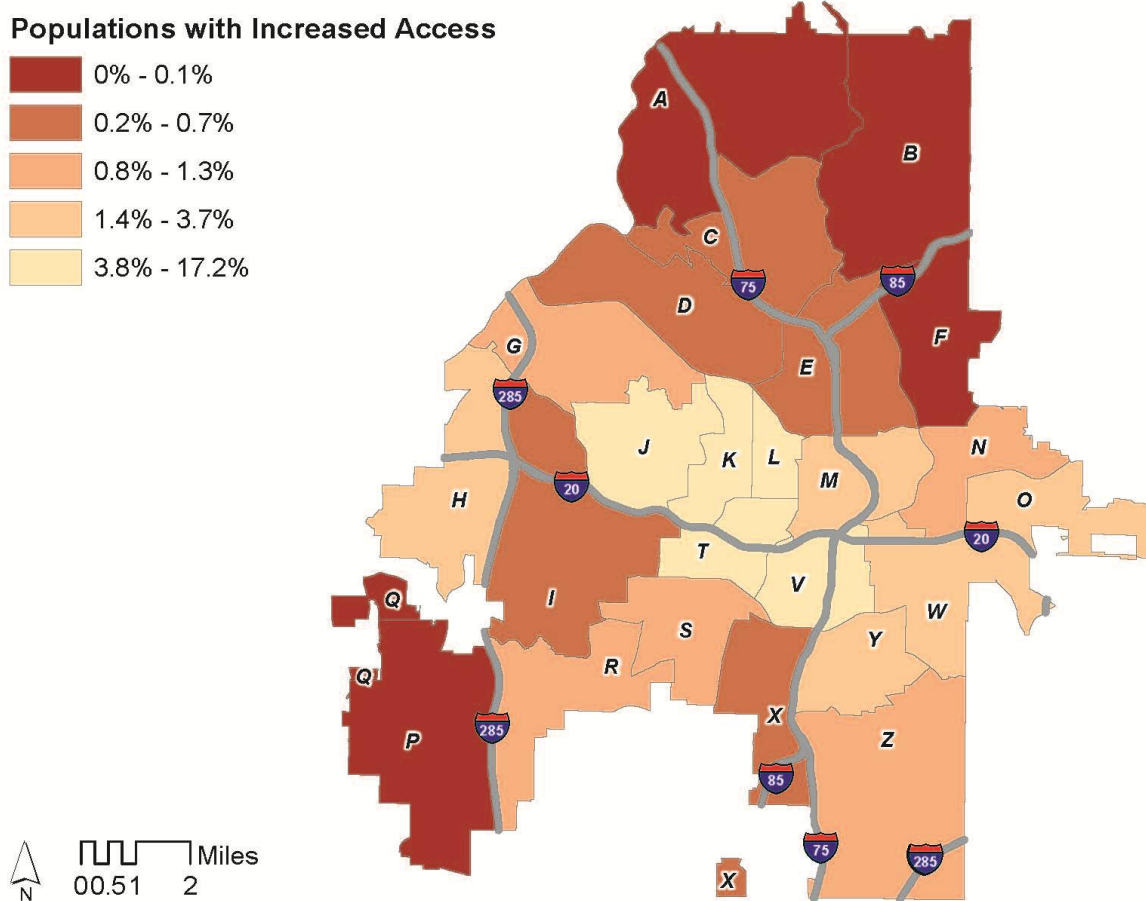
Figure 5. Aggregated Small Scale Food Destinations



Source: authors.

We considered how the presence of these smaller scale destinations could increase access by calculating the percentage of low access households that benefit from small scale retail. The results in Figure 6 show this increased access aggregated to the NPU level. The results for outer NPUs to the north and the southwest did not yield tangible increases in food access because they already have very good coverage from large scale retail. Increases in much of Atlanta were negligible, except for several NPUs in central Atlanta just west and south of the downtown area in NPU M.

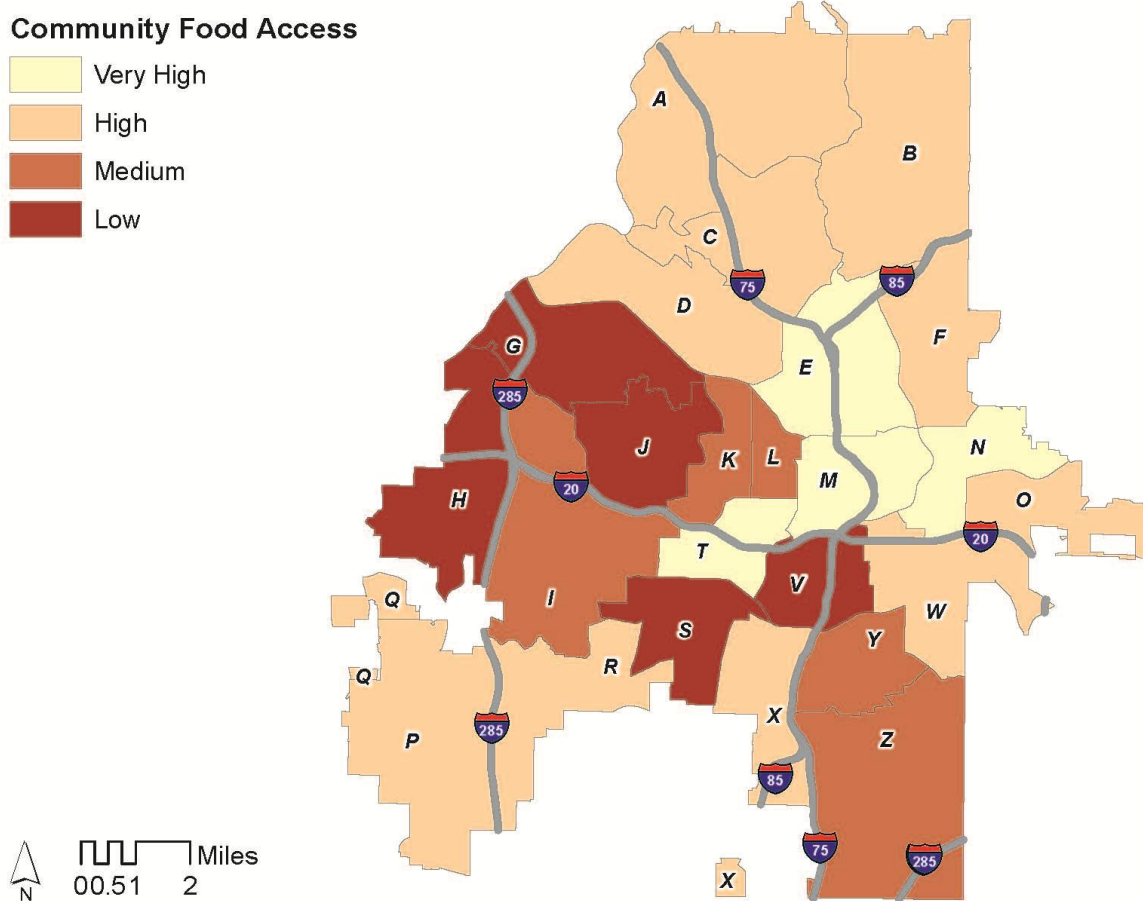
Figure 6. Improved Food Access From Small Scale Destinations



Source: authors.

To derive an understanding of overall community food access, we combined large scale and small scale results, subtracting increased access from the initial low access results. The results are broken down geographically in Figure 7, ranging from low to very high food access. Low community access includes NPDs that have between 10% and 16% of populations without direct access to food. Medium access ranges from 5% and to 10%, and high access under 5%. Very high access counts those NPDs that have good access across households and are enriched by neighborhood scale food destinations. Although small scale food destinations mitigate some of the low food access seen in the south and west NPDs, the overall food access gradient still resembles the initial geographic patterns of the large scale food access map.

Figure 7. Geographic Food Access Gradient



Source: authors.

Discussion

While NPUs L and V have the lowest access to supermarkets and superstores, they also see the biggest contributions from small scale food sources. They are lower income, high minority areas that have suffered decades of chronic disinvestment. A focal issue identified by both communities has been the acute need for a supermarket. Health outcomes are lower in these neighborhoods as opposed to higher socioeconomic NPUs in Atlanta (Source: Botchwey, Lee, Leous, & Guhathakurta, forthcoming). The increasing presence of community gardens and urban farms, and farmers markets are helping to ameliorate longstanding food security issues. These neighborhoods are part of a “Fertile Crescent” initiative aiming to develop local food systems that link communities in south and west Atlanta. Although small scale food destinations are alleviating some of the food access issues, there is still a large gap that could be filled by larger food retailers.

NPUs J, S, and G also have very poor access to large scale retail. For NPUs J and S, they do not benefit much from neighborhood retail or urban agriculture, resulting in over 15% of

households lacking food access. Conversely, food secure communities in the core of Atlanta have strong supermarket access but also benefit from local food destinations.

We see that while smaller food destinations contribute to increased food access, their impact is not substantial enough to eradicate low food access. They have an impact in the most needed areas as well as in the developed core of central and eastern Atlanta in NPUs E, M, T, and N, adding quality to good food access through a good mix of large scale and small scale food destinations.

We recognize some limitations in the methods presented. The greatest concern is the tradeoff in using secondary data to identify and characterize food destinations. We recognize that there is heterogeneity in food range, quality, and affordability within food destination categories that is not captured in the business databases (Kersten et al., 2012). Moreover, database undercounting and other errors potentially bias food access results (Liese et al., 2013). In this exercise, we came across several coding and classification errors that required entry by entry correction via web search verification. A potential remedy for such error that we did not explore in this study would be to ground-truth secondary data. Although considerably time intensive, in-store visits would also provide researchers the opportunity to conduct a food basket study, shedding further light on food quality, availability and affordability.

Conclusions

We developed this food access method as a preliminary analytical tool to inform community food assessments and health planning. Although results must be couched within a broader examination of community needs and characteristics, they provide a detailed reading of the food landscape, identifying food secure neighborhoods and geographic gaps in food access. By understanding how various food destination types contribute to food access we can help inform spatial policies for urban agriculture and farmers markets, neighborhood grocery stores and supermarkets.

Our findings show that there are clear, geographic patterns of food disadvantage, with lower income and high minority neighborhoods experiencing the lowest levels of food access. Large grocery retailers drive the geography of food access in Atlanta. Although there is some food retail and urban agriculture activity at the finer scale, it is not in its current form a panacea. However, these neighborhood food destinations are contributing considerably in several neighborhoods that would otherwise experience even higher food insecurity. They also yield benefits to already high food access populations by increasing the quality of food access with a diversity of options. Further research is needed to understand *why* certain neighborhoods have more small scale food development. Channeling growth of these smaller scale destinations will be valuable to improving food systems planning.

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