RESEARCH ARTICLE

Food Availability and the Food Desert Frame in Detroit: An Overview of the City's Food System

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This article takes a new approach to studying food access. It combines environmental justice analysis with systems thinking in an examination of the food environment of Detroit. The article reviews food access literature and identifies how each body of scholarship's underlying assumptions help or distort our understanding of urban food environments. The article argues for more comprehensive approaches to studying food access and demonstrates how such approaches can be implemented. We collected data from multiple sources, including ReferenceUSA, Orbis, and the Michigan Department of Agriculture, between 2011 and 2013 to build a database of food outlets in the city. We used SPSS 22 and ArcGIS 10.1 to analyze and map the data. The article analyzes the location of 3,499 food outlets in Detroit, comprising 34 categories food retailers, growers, supply chain, and food assistance programs. The study identified 96 supermarkets or full-line grocery stores; 1,110 small groceries, convenience stores, mini marts, and liquor stores; 279 specialty food stores; 306 pharmacies, dollar, and variety stores; 1,245 full-service and fast food restaurants and other food service outlets; 157 supply chain operations; 206 farms, community and school gardens, farmers' markets, and produce markets; and 100 food assistance programs. The article finds that though Detroit has areas that lack food outlets, the portrayal of the entire city as a "food desert" is misleading. Moreover, the traditional approach of food desert research of using only or primarily the presence or absence of supermarkets and full-line grocery stores to study food access ignores many important venues from which people obtain food. It also ignores the strategies people use to cope with food insecurity and their responses to limited food access.

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Numerous studies have been conducted on inequitable access to food in poor urban areas. Many of these studies use the presence of supermarkets and full-line grocery stores as the sole indicator of access to healthy foods. Conversely, researchers identify corner stores, mini marts, gas stations, liquor stores, and fast food restaurants as reservoirs of unhealthy foods. Several food access studies have been conducted in Detroit, and these are often framed in terms of distance to healthy or unhealthy food outlets. Some studies have characterized the city as a "food desert," with racial inequities in access to food. This paper identifies important shortcomings of the food desert frame and demonstrates why a more systematic approach to studying the city's food environment is needed. We argue that Detroit has a complex food system, and this paper provides an overview of it. The paper focuses on three questions in this analysis of Detroit's food system: (a) What kinds of food outlets are available to residents inside the city? (b) What is the nature of the Detroit food environment and how does it vary by neighborhood? (c) How do citizen-driven initiatives shape the food landscape?

It is important to examine and understand Detroit's food system, because the city has been in the center of discussions about food access for more than a decade. It has been a part of the debate over whether "food desert" is the appropriate term to describe areas that have limited or

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no access to supermarkets and whether depopulated and deinstitutionalized inner-city areas can attract and retain full-line grocery stores. Detroit is also a city with vibrant food movements that coalesce around issues of healthy foods and social justice. The opening of a Whole Foods and a Meijer big box store in 2013 in the city intensified conversations about food security, social justice, food policy, urban redevelopment, gentrification, tax policies, the role of independent grocers in the city, and affordable food (Gallagher, 2013; Sadovi, 2013).

Theoretical Overview

The Food Desert and Food Swamp Frames

A variety of ecological terms have been used to describe low-income, urban food environments. One of the most common and controversial is the term "food desert." The term was popularized in the United Kingdom (UK) in the 1990s, when it was used to describe suburban housing developments devoid of shops, churches, community centers, etc. (Cummins and Macintyre, 2002; Smith et al., 2010). Over time, the conceptualization of the term narrowed to focus on food retailers; hence, the term "food desert" is now commonly used to describe neighborhoods in which residents lack access to fresh, healthy, and affordable foods.

In the United States (US), poor urban communities are often described as food deserts. Some argue that the prevalence of food deserts has resulted from many cities have losing 50% or more of their supermarkets and large grocery stores since the 1970s (Cameron et al, 2010; Turque, Rosenberg, and Barrett, 1992). Residents of such communities often live more than a mile from supermarkets or large grocery stores or lack transportation to get to distant food outlets (Beaulac, Kristjansson, and Cummins, 2009; Cummins and Macintyre, 2002; de Leeuw, 2009; Pearce, Witten, and Bartie, 2006; Pearce, Witten, Hiscock, and Blakely, 2007; Smith et al., 2010; USDA, 2013). Detroit has been described as an urban food desert for almost a decade (Gray, 2009; Grossman, 2009; Harrison, 2009).

The US Department of Agriculture (USDA) has been influential in defining food deserts. According to the agency, food deserts are:

> urban neighborhoods and rural towns without ready access to fresh, healthy, and affordable food. Instead of supermarkets and grocery stores, these communities may have no food access or are served only by fast food restaurants and convenience stores that offer few healthy, affordable food options. The lack of access contributes to a poor diet and can lead to higher levels of obesity and other diet-related diseases, such as diabetes and heart disease. (USDA, 2013)

It should be noted that this definition identifies the sources of healthy and unhealthy foods. It also makes an explicit connection between access to supermarkets and full-line grocery stores, poor diet, and health outcomes.

Moreover, the USDA uses the location of supermarkets and full-line grocery stores within census tracts and poverty levels to operationalize the concept. Hence, a census tract is designated as a food desert tract if it has a poverty rate of 20% or more or a median income that is at or below 80% of the median family income for the area. In addition, the tract must also have at least 500 residents living in it, and at least 33% of the tract's population must live more than a mile from a supermarket or large grocery store (10 miles, in non-metropolitan areas) for it to qualify as a food desert tract (USDA, 2013). The agency's definition is reflected in the approaches many scholars take when they study food access.

A related frame, "food swamp," has emerged in recent years to describe low-income, urban communities that have a plethora of fast food restaurants, convenience stores, mini marts, gas stations, and liquor stores that sell food. This notion is also implicit in the USDA's definition. According to Rose et al. (2009), "food swamp" is a more useful concept to describe "the excess of unhealthy food" found in low-income neighborhoods. They argue that the large amounts of energy-dense foods sold in venues in such neighborhoods "inundate, or swamp out" the "relatively few" healthy food choices residents have (Rose et al., 2009). The researchers suggest that the term "food swamp" be used in lieu of the food desert concept. Researchers at the USDA have also promoted the food swamp concept (USDA, 2009; Ver Ploeg, 2010a, 2010b).

Research on Detroit's food environment began appearing about a decade ago. A widely cited study of the Detroit metropolitan area found that when the poorest neighborhoods in the area were compared to one another, the ones that in which a high percentage of Blacks resided were, on average, 1.1 miles farther from supermarkets than poor neighborhoods in which a low percentage of Blacks resided. The researchers also found that poor neighborhoods were farther from supermarkets than wealthier ones. The researchers used access to

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chain supermarkets as a proxy for enhanced access to high-quality, lower-cost healthy foods in Detroit. This assessment was based on an analysis of 18 supermarkets, full-line grocery stores, and supercenters (Zenk et al., 2005). However, Zenk et al. (2006)included chain grocery stores, large independent groceries, "mom-and-pop" stores, and liquor stores in their analysis of food access in Detroit. In a recent publication, Zenk et al. (2013) continued to broaden their definition of Detroit's food environment to include fast food restaurants.

The food desert frame has emerged as a dominant narrative in food security studies. In this genre of research, identifying the spaces to be labeled deserts; the race/ethnicity and social class of the inhabitants of such spaces; the quantity and location of food sources; the quality of food available, the behavior of food desert inhabitants, and the health of inhabitants in the food deserts are the main preoccupations of researchers. Hence, common approaches to studying food environments that adopt this frame place emphasis on distance to supermarkets (Gallagher, 2007; Ghirardelli, Quinn, and Foerster, 2010; Moore and Diez Roux, 2006; Morland et al., 2002; Powell et al., 2007; Sharkey et al., 2009; Zenk et al., 2005; 2009), density of food stores (Block, Scribner, and DeSalvo, 2004; Hubley, 2010; Leslie, Frankenfeld, and Makara, 2012; Mason, Bentley, and Kavanagh, 2013; Morland et al., 2002), analysis of food content within stores (Andreyeva et al., 2008; Eckert and Shetty, 2011; Farley et al., 2009; Krukowski et al., 2010; Miller, Bodor, and Rose, 2012; Zenk et al., 2006), the pricing of food, efforts to bring more grocery stores to cities (Andreyeva et al., 2008; Antin and Hora, 2005; Hee-Jung et al., 2012; Pothukuchi, 2005; Sharkey et al., 2009), and attempts to sell healthier foods in corner and convenience stores (Dannefer et al., 2012; Hee-Jung et al. 2011, 2009; Martin et al., 2012; O'Malley et al., 2013; Pothukuchi, 2010). Recent studies have also examined food acquisition strategies (Rose, 2011; Zachary et al., 2013; Zenk et al., 2011) and changes in food access after new grocery stores are built in underserved areas (Sadler, Gilliland, and Arku, 2012; Wang et al., 2007).

While this line of research identifies community deficits and deficiencies, considerations of adaptive strategies or analyses that enhance our understanding of community agency, assets, and strengths are often missing from these studies. Hence, studies of where people obtain food outside of commonly examined food outlets are not often done. Even less common are studies that explore how food-insecure people obtain food and how they perceive and understand their consumption behavior. Moreover, subsistence activities – farming, gardening, fishing, hunting, and gathering, to name a few – are often ignored. Consequently, analyses of the roles of urban farming and gardening, food justice and food sovereignty movements, community organizing to increase access to food, and the role of community-based food assistance programs in providing food are barely studied or, in many instances, are completely overlooked.

Questioning the Food Desert Concept: The Food Oasis and Food Grassland Frames

Researchers who have recognized these gaps in the food desert literature are raising questions about the definition of food deserts and the depiction of communities described as such. Though the occurrence of food deserts has been widely reported in the media and extensively studied, the question remains – are poor inner city neighborhoods as devoid of healthy food outlets as some researchers and the media have portrayed? Raja, Ma, and Yadav (2008) question the idea of food deserts and argue that the notion of an urban food desert can be misleading. Not only does the concept conjure up images of environments bereft of places to purchase healthy foods, studies that focus on identifying only full-service supermarkets and grocery stores miss a variety of small food outlets that carry the healthy foods that urban consumers desire.

Other critics argue that the focus on supermarkets and full-line grocery stores as the sole or primary indicator of good food access distorts our understanding of local food environments (McKinnon et al., 2009; Hubley, 2011; Alkon et al., 2013) and might understate the availability of food (Alkon et al., 2013; Hale, 2004; Sharkey et al., 2009). The emphasis on supermarkets and full-line grocery stores often ignores the important roles that independent grocers and small ethnic grocery stores play in food systems. For instance, a study of three San Francisco Bay area neighborhoods found what researchers termed "food oases," with full-service food retailers offering affordable, culturally desired food in ethnic minority neighborhoods. The study found ethnic food stores – overlooked in most food environment studies – that provided foods neighborhood residents wanted (Short, Guthman, and Raskin, 2007). Studies have also found that these smaller stores have a positive influence on residents' consumption of fruits and vegetables (Bodor et al., 2007).

Though all agree that parts of Detroit are underserved by food retailers purveying healthy and affordable foods, the depiction of the whole city as a food desert does not hold up under scrutiny. Ergo, some community activists (Yakini, 2010) and

researchers are questioning the dominant food desert narrative as it pertains to the city (Devries and Linn, 2011; White, 2010, 2011a, 2011b). Researchers from Data Driven Detroit analyzed National Establishment Time Series data from 2010 and reported that they found 115 grocery stores in the city. Arguing that it is a myth to describe the entire city as a food desert, the researchers asserted that the city could best be described as a "food grassland," with small only pockets lacking easy access to grocery stores (Devries and Linn, 2011). The study found that only about 10% of the city could be considered a food desert, as per the USDA definition, and about 90,000 people live in such areas (Linn, 2011).

Linking Food Consumption with Health and Place

Scholars studying food access in Detroit have linked food availability and consumption patterns to health and place (Budzynska et al., 2013). For instance, researchers link the consumption of high-calorie, unhealthy food to obesity, diabetes, hypertension, and other illnesses (Rose, et al., 2009). Budzynska et al. (2013) found that obesity is prevalent in Detroit. However, once demographic factors were accounted for, there was no correlation between body mass index and the presence of supermarkets.

Though many factors affect consumption patterns, scholars argue that food choices are affected by food availability (Morland, Diez Roux, and Wing, 2006). Studies have linked food availability in grocery stores to the diets of nearby residents. That is, the presence of stores selling fresh produce in a neighborhood is associated with neighborhood residents' increased consumption of fruits and vegetables (Zenk et al., 2009). Conversely, the presence of fast food outlets in an area is said to increase the consumption of such foods in area residents. A study of the city found that roughly 550,000 Detroiters travel twice as far to reach a "mainstream" grocery store than they do to reach a fringe food establishment (Gallagher, 2007).

However, some researchers question an important assumption in this line of research. They argue that the assertion that a person's neighborhood food environment has a direct effect on his or her dietary behavior and health rests on the supposition that people buy all or most of their food in their immediate neighborhood (Alkon et al., 2013; Kumar et al., 2011; LeDoux and Vojnovic, 2013). But, Wang et al. (2007b) found that the opening of a full-line grocery store did not change the consumption behavior of nearby residents. Other researchers have found that consumption patterns were unrelated to increased access to supermarkets (An and Sturm, 2012; Boone-Heinonen et al., 2011; Budzynska et al., 2013; Lee, 2012). Cummins and MacIntyre (2006) argue outright that researchers have not provided any data to demonstrate that there is a causal link between food access and health outcomes.

Thus, in characterizing the food environment of a city, one should not assume that people shop for food only at the stores closest to them or in their immediate neighborhood (Born and Purcell, 2006; Cummins, 2007; Mason, Bentley, and Kavanagh, 2013). Since people often shop for food outside of their immediate neighborhoods or cities, the types of stores in a particular neighborhood do not always completely define what kinds of foods people have access to and consume. With this in mind, food access researchers have been studying the leakage rate (residents purchasing food outside of their neighborhoods) of low-income communities in Detroit. LeDoux and Vojnovic (2013) found that residents of Detroit's lower eastside bypassed their neighborhood food stores to shop at independent, discount, and regional supermarkets in other parts of the city or in the nearby suburbs.

Rose (2011) also studied the food purchasing habits of low-income Detroit residents and found that they shopped for food outside their neighborhoods and also coordinated their trips, so they could share rides to get to distant grocery stores. Only 11% of the participants in Rose's study relied exclusively on the food outlets in their neighborhoods to obtain food. So, not only do low-income residents show agency in determining where they shopped, they found ways of maximizing their funds by shopping where the food was cheapest, where there were sales, and where they could get the most goods for their money.

Devries and Linn (2011) used State of Michigan Department of Human Services data regarding expenditures on Electronic Benefit Transfer (EBT) cards. They found that many Detroit EBT recipients eschewed neighborhood stores and purchased their food outside of the city. Thirty-one percent of the Detroit EBT household grocery bills were transacted outside of the city. The Social Compact (2010) study of Detroit found that, when the whole population was considered, there was a 30% leakage rate for money Detroiters spent on groceries outside the city.

Food Production and Subsistence Activities

Urban Farms, Community Gardens, Farmers' Markets, and Cooperatives

Participation in agricultural initiatives is another adaptive strategy that Detroiters use to procure food. Urban agriculture

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is not a new phenomenon in Detroit, and the city has been in the vanguard of the movement before. A depression swept the country from 1893 to 1897 that left many urbanites hungry and desperate for food. Hence, in 1894 Detroit's mayor, Hazen Pingree, unveiled a plan to allow residents to farm on 430 acres of the city's vacant land for free, as a means of alleviating the food shortage. Three thousand families applied for plots, but only 945 half-acre plots were assigned. The following year (1895), the program enrolled 1,546 families, and 1,701 families tended plots in 1896. The program, which lasted till 1901, was copied in New York, Boston, Chicago, Minneapolis, Seattle, Duluth, and Denver (Detroit Historical Society, 1980; Holli, 1969). Today, Detroit's urban agriculture movement is citizen-driven, and Detroiters now farm for health reasons (such as maintaining vegetarian and vegan lifestyles) as well as recreational, subsistence, and commercial purposes. They also farm to participate in food sharing and gifting, as these are important dimensions of the agricultural undertakings in the city.

Many of the researchers conducting traditional food desert studies ignore urban farms, community gardens, home gardens, school and other institutional gardens, food cooperatives, and community supported agriculture (CSA) in their analyses of food access. Yet, in cities such as Detroit, these are vital components of the food system. Despite the robust body of research on Detroit's food environment, relatively few studies recognize and discuss the city's vibrant farming, gardening, and food production sector (see Colasanti and Hamm, 2010; Colasanti, Litjens, and Hamm, 2010; Pothukuchi, 2004; and White, 2010, 2011a, 2011b, for food production studies). Hence, food desert research often ignores the agency and resiliency that community residents show in defining their own food environment, identifying challenges, articulating their needs, and devising strategies and responses to ameliorate problems.

Detroit, a 139-square-mile city, has approximately 40 square miles of vacant land (US Census Bureau, 2013). This presents enormous opportunities and challenges for those wanting to work within and understand the city's food system. The high land vacancy rate arises from many factors, but, foremost among them, Detroit has hemorrhaged population and businesses over the last six decades, and those fleeing have abandoned properties that are eventually demolished. The high land vacancy rate has provided opportunities for urban agriculture to thrive. However, Detroiters have to be careful about converting the land to agricultural purposes, as many vacant parcels are contaminated from the industries that are defunct or have moved their operations elsewhere (City of Detroit, 2009). Notwithstanding, in 2012, the Garden Resource Program Collaborative reported that 5,411 adults and 16,128 youths participated in urban farming and community gardening programs in the city as well as in Hamtramck and Highland Park (two small, independent municipalities encircled by Detroit). (Keep Detroit Growing, 2012). In 2013, the program administered 748 family gardens, 55 school gardens, 365 community gardens, and 76 market gardens. Fifty-eight market gardeners sold their produce at Eastern Market and Wayne State Farmers' market; they grossed more than $43,000 between May and October (Keep Detroit Growing, 2013).

Subsistence Fishing and Hunting

Fishing, hunting, and gathering are other subsistence activities that residents of low-income communities engage in that are not captured in most food access studies or in the metrics used to measure food insecurity. Detroiters have a rich tradition of fishing and hunting. They fish in the River Rouge, which runs through the city, and in the Detroit River, the 32-mile-long waterway connecting Lake St. Clair to Lake Erie (which also forms part of the international border with Canada). Data collected from anglers in the city in 1985 and 1986 found that White residents of Detroit were more likely to fish primarily for recreation, while Black and Hispanic anglers fished for both recreation and consumption of their catch. Low and moderate income Blacks and Hispanics were most likely to consume fish caught from the rivers. This raised concerns about toxic fish consumption, as fish in the rivers and parts of the Great Lakes can be contaminated with mercury, polychlorinated biphenyls (PCBs), dioxins, and other hazardous chemicals. Moreover, studies of anglers have found that female and ethnic minority anglers were less likely to know about fish consumption advisories (for the aforementioned chemicals) issued for the water sources from which they were fishing (Kalkirtz, Martinez, and Teague, 2008; West, 1992). A 1994 study of Black anglers fishing from the Detroit River found that they fished for high-risk (for toxic contamination) benthic fish, such as catfish and drum, as well as other sport fish (Hornbarger, MacFarlene, and Pompa, 1994). Since food gifting and sharing is a common cultural practice among anglers, the concern is not only for the families of the anglers, but also for the friends and neighbors with whom anglers share their catch.

Researchers studied subsistence fishing and consumption from the Detroit River again in 2007. They found that 59.5% of White and 78.9% of non-White anglers reported that fish was an important part of their diet. In probing how important

caught fish was in the anglers' diets, the investigators found that fish from the Detroit River played a bigger role in the diet of non-Whites than Whites. While only 46.7% of Whites took home the fish they caught, 65.6% of non-Whites did likewise (Kalkirtz, Martinez, and Teague, 2008).

Detroiters also hunt recreationally and to supplement their diet and income. An African American retired truck driver and former sharecropper made headlines and became a media sensation in 2009 when he revealed that he hunted, consumed, and sold raccoons, rabbits, and pheasants. The coverage played into the food desert narrative by conjuring up images of extreme scarcity and depravity in the city (LeDuff, 2009). Hunting is very popular in Michigan as a recreational, commercial, and subsistence activity for both rural residents as well as urbanites. Its popularity in the densely populated southeastern part of the state is made evident by the numerous hunting clubs present in the Detroit metropolitan area as well as the number of hunting preserves in and around the region. Recognizing the importance of these activities to local residents, the US Fish and Wildlife Service allows hunting and angling in the Detroit River International Refuge, which begins at the metro Detroit border and stretches almost to Toledo, OH.

The Food Justice and Food Sovereignty Frames

In Detroit, food justice is a narrative frame that occupies a critical space in the discourses about locally grown foods, organic farming, urban agriculture, and sustainability. While all these discourses articulate visions for sustainably growing and consuming healthy foods, the food justice discourse combines that interest with social justice concerns. Detroit's food justice movement is rooted in environmental justice principles (see Taylor 2000, 2010, 2011). Hence, it addresses inequalities in the food system by blending demands for human rights and sovereignty with the quest for social justice. Food sovereignty is an important element of this discourse that sees control of the means of food production, trade, and consumption as critical to the survival of Blacks and other disadvantaged groups (White 2010, 2011a, 2011b; Yakini, 2013, 2010).

This vision is clearly articulated in the founding documents of the Detroit Food Justice Taskforce. Founded in 2010, the taskforce – comprised of urban farming groups, environmental justice organizations, other community organizations, and civic leaders – outlined its "principles of food sovereignty" alongside environmental justice principles that were adopted by environmental justice activists in the 1990s. The consortium of People of Color led organizations and allies that comprise the taskforce state that food sovereignty is a "right of the people" (Detroit Food Justice, 2010, p. 8).

The Detroit Black Community Food Security Network (DBCFSN), a member of the Detroit Food Justice Taskforce, is one of many organizations in the city that embodies the vision of food justice and practices its principles. Founded in 2006, DBCFSN operates the 7-acre D-Town Farm in the 1,800-acre Rouge Park located on the city's west side. DBCFSN is organized and led by Black food activists who grow a wide array of produce on their farm, lead community education forums, sit on the Detroit Food Policy Council, and operate the Ujamaa Food Co-op Buying Club. D-Town farmers, like others in the city, participate in season-extending and value-added activities such as canning, pickling, and making jams and jellies from their produce. DBCFSN is in the process of raising funds to open a cooperative grocery store with a deli/café in the city that will source locally grown food (Detroit Food Justice, 2010; Wey, 2012; Yakini, 2013). D-Town's farmers come from various neighborhoods but gather at the farm to grow produce. Hence, these activists have access to food from a locale outside of the neighborhoods in which they live. Participation in the co-op also provides access to food that is not linked to the neighborhoods they live in or the food outlets those neighborhoods contain.

But the questions still remain – do the poorest people in the city have access to organic, healthy foods from urban farms and farmers markets, and can they afford to purchase them? Evidence from Detroit suggests that poor people do patronize farmers' markets. Urban farming groups in Detroit such as D-Town Farm, Food Warriors, Feedom Freedom, and Earthworks Urban Farm sell some of their products to low-income customers. Programs that allow customers on Supplemental Nutrition Assistance Program (SNAP) and other federal food assistance programs to use their EBT cards at farmers' markets have been established in Michigan. In 2009, a double-SNAP program, wherein customers received coupons allowing them to get up to 10 dollars of free produce for every dollar spent on Michigan-grown produce, was piloted at four Detroit farmers' markets (Eastern Market, Northwest Detroit Farmers' Market, SEED Wayne Farmers' Market, and East Warren Avenue Farmers' Market) and one mobile food truck (Peaches and Greens). Data show that SNAP customers increased their expenditures on fresh produce by 41%, and 93% of the coupons issued were redeemed. During the 7-week pilot program, Eastern Market served 1,082 EBT customers who purchased $21,554 worth of produce (Collier and Rabaut, 2011; Fogelman, 2009).

Table 1. Combining food justice and food systems approaches – The case of Detroit

1. **Neighborhood Food Access Index (NFAI) - Terrestrial and aquatic:**
   a. Spatial analysis of food locations, clustering, density, barriers, etc.
   b. Community demographic, social, and physical characteristics
   c. Multiple methods of distributing and accessing food
   d. Road networks
   e. Transportation
   f. Crime
2. **Food producers:**
   a. Farms – Urban farms and community gardens; rural and peri-urban farms; family gardens; school/other institutional gardens
   b. Farmers' markets
   c. U-pick farms, farm markets
   d. Community supported agriculture
   e. Farm cooperatives
   f. Farm stands
3. **Food retailers:**
   a. Different types of food outlets
   b. Ethnic food outlets
   c. SNAP, WIC retailers, etc.
   d. The food environment inside and outside the store
   e. Shopping "climate" – treatment of customers, surveillance and raids by immigration officials, etc.
4. **Supply chain (commercial, nonprofits, and home-based):**
   a. Food processors
   b. Food distributors
   c. Food manufacturers
5. **Restaurants:**
   a. Fast food
   b. Full service
   c. Ethnic – ownership and cuisine type
6. **Other locations of food acquisition:**
   a. Schools
   b. Hospitals
   c. Community centers, etc.
   d. Lakes, ponds, rivers, streams, ocean
7. **Food providers or services:**
   a. Food assistance programs
   b. Faith-based programs
   c. Community departments of health
8. **Food-related laws and policies:**
   a. Food assistance programs
   b. Barriers to food production
   c. Barriers to the distribution of food
   d. Tax credits and incentives
   e. City and state food policies
   f. Zoning
9. **Public engagement and behavior change:**
   a. Nutrition and public health
   b. Training and education
   c. Monitoring pre- and post-intervention activities
   d. Community organizing and stakeholder processes
   e. Cultural and inter-generational transmission of knowledge
   f. Consumer needs
   g. Consumer behavior
   h. Food movements
10. **Other factors:**
   a. Urban environmental hazards, relict hazardous land uses and wastes
   b. Land tenure
   c. Organizational capacity
   d. Funding and resources
   e. Infrastructure
   f. Race and ethnic relations (segregation, conflicts, etc.)
   g. The social, historical, and political contexts
   h. Food environment of neighboring municipalities

The Fair Food Network operates the Double Up Food Bucks (formerly known as Double-SNAP). In 2013, about 80% of Double Up Food Bucks customers report that they have increased their consumption of fruits and vegetables since participating in the program. In addition, 80% of the farmers' market vendors who accept Double Up Food Bucks tokens report selling more produce. Fair Food Network is also coordinating the Detroit Grocery Store Pilot program, wherein three stores (Metro Foodland, Mikes' Fresh Market, and Honeybee Market) will also participate in the Double Up Food Bucks program (DeWitt, 2013; Fair Food Network, 2013).

Combining Food Justice and Food Systems Approaches

We take a new approach to studying food accessibility in Detroit that combines the food justice approach with systems thinking. That is, we see the city's food environment as a system that is influenced by forces from within and outside of the city. The system has interconnected human, ecological, economic, social, policy, and political dimensions (see Table 1). Thus, the availability of food in a particular neighborhood or city cannot be distilled down to only which full-line stores are present. As Table 1 indicates, food availability is affected by a number of factors, including the desire and ability of food producers to sell and distribute products in a given community, the ability and willingness of consumers to purchase foods, the barriers and incentives for retailers and distributors to service an area, the involvement of citizens in food policy decision making (as well as in food production), and subsistence activities. Food access is also affected by the strategies people use to obtain food – this includes shopping outside their neighborhoods and city, buying where products are on sale, food sharing, carpooling to go food shopping, and subsistence activities.

We take this approach because it adds a needed corrective to traditional food desert and food access narratives. Though scholars have critiqued the food desert approach and offered alternative approaches, both the food oases and food grassland approaches still rely primarily on studies identifying the presence or absence of supermarkets and grocery stores, as do studies that seek to link food access with health outcomes.

The food justice approach goes further, challenging researchers to add environmental justice, human rights, and structural racism and discrimination analyses to the examination of food access than other approaches discussed above. Our contribution will be to embed the food justice discourse more fully in the frameworks of environmental justice and systems thinking. We hope this will spur scholars to think about and analyze food access in ways that will provide more comprehensive understanding of the people and the communities being studied.

As Table 1 shows, understanding Detroit's food system requires a multi-method, interdisciplinary approach. The approach outlined in the table calls for analysis of consumers; food retailers, food producers, processors, manufacturers, and distributors; policy makers; food and other community activists; and socio-environmental factors.

The primary objective of this study is to examine food access in Detroit. We will examine the following questions: (a) Where can Detroiters obtain food in the city? and (b) How do the types of food venues available to residents vary by neighborhood? We will also continue to identify and discuss citizen-driven food initiatives that shape the city's food landscape. Though we study the factors listed in Table 1 in a larger project on food access, it is beyond the scope of a research article of this nature to analyze all the inter-connections and relationships implied in Table 1. Consequently, we will use the remainder of this article to provide an overview of the variety of places where Detroiters can obtain food within the city. Though several food access studies have been conducted in Detroit, none have provided us with a comprehensive overview of the city's food system.

Methods

Determining the Food Environment

We study a wide array of food outlets, because these are the places from which we observed people obtaining food (see Table 2). As more people pay attention to food availability in the city, increasing numbers of retailers engage in channel blurring, a practice that impacts the food environment. Channel blurring occurs when retailers expand their product lines to include the sale of food items. Hence, one finds a growing assortment of fresh, packaged, processed, and refrigerated foods in convenience stores, pharmacies, dollar stores, and supercenters (Sharkey et al., 2009). We adopt the approach of other food access studies that have identified several types of food outlets (Andreyeva et al., 2008; Lisabeth et al., 2010; Raja, Ma, and Yadav, 2008; Sharkey et al., 2009). However, our study is unique, as it examines a much broader range of food sources than comparable projects. Applying systems thinking, we assess

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Table 2. Defining Detroit's food sources

Food outlet type	Definition	Definition source	Example
Traditional supermarket	• Offers full line of groceries, meat, produce • At least $2 million in annual sales • Chain supermarkets or grocery stores	FMI	Kroger, A&P, Spartan
Fresh format supermarket	• Emphasis on perishables • Natural and organic foods	FMI	Whole Foods
Superstore	• At least 30,000 square feet • Annual sales of $12 million or more • Extensive selection of non-food items	FMI	Metro Foods
Super warehouse	• High-volume hybrid of traditional supermarket and warehouse store • No frills, limited service • Reduced prices • Bulk food items and perishables • Full range of service departments	FMI	Cub Foods, Food 4 Less
Supercenter	• Hybrid of traditional supermarket and mass merchandiser • Wide range of food and non-food items • Average 170,000 square feet	FMI	Meijer, Walmart Supercenters
Mass merchandiser	• Large store selling primarily clothing, electronics, and sporting goods • Sells groceries too	FMI	Kmart, Target
Limited- assortment store	• Limited assortment of center-store and perishable items • Reduced price point	FMI	Aldi's Trader Joes
Small groceries, convenience or corner stores	• Small and medium-sized grocery stores and convenience stores • Limited selection of staples and other goods • Under $2 million in annual sales	FMI/Authors	Motown Market
Dollar stores and variety stores	• Small stores selling staples and knickknacks • Foods and consumable items • Low prices	FMI	Dollar General, Dollar Tree
Pharmacy or drug store	• Prescription-based drug store • General merchandise and seasonal items • Limited selection of food items	FMI	Walgreens, CVS
Gas stations	• Gas stations with attached mini marts or convenience stores that sell food	Authors	Mobil Mini Mart
Liquor and party store	• Stores selling alcohol • Limited selection of food items	Authors	Liquor Castle
Full-service restaurant	• Have wait staff and sit-down service • Payment collected after meals are served and tips expected	Block, Scribner & DeSalvo (2004)	Olive Garden, Red Lobster
Fast food restaurant	• No wait staff and sit-down service • Payment collected before meals are served and no tips expected • Drive-through service		Burger King, McDonalds
Health foods	• Health foods and nutrition supplements	Authors	Nature's Remedy
Bakery	• Sells baked goods	Authors	National Bakery
Caterer	• Prepares food by order	Authors	Golden Spice Catering
Coffee, tea, and juice shops	• Serves primarily coffee, tea, or beverages • Limited amount of baked goods or cooked food	Authors	Starbucks
Confectionaries	• Stores selling primarily candy and other sweets	Authors	The Candy Shop
Bars & clubs	• Bars or clubs serving meals also	Authors	Varsity Lounge
Banquet halls/hotels	• Banquet halls that serve meals and hotel restaurants	Authors	St. Regis Hotel
Community supported agriculture	• Cooperative – customers pay for produce • Has a weekly basket of produce prepared for delivery or pick up	Authors	Plantscapers Choice

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Table 2. (*Continued*)

Food outlet type	Definition	Definition source	Example
Food cooperative	• Group of people buying food and/or produce collectively • Purchasing can be done at a store or through a club	Authors	Detroit Black Community Food Security Network Food Buying Club
Farmers' markets and produce markets	• Local farmers sell fresh produce • Other consumables sold	Authors	Eastern Market
Urban farms and community gardens	• Food-producing urban farms • Produce sold at farm/garden or other venues • Produce may also be donated • Includes mobile food vans	Authors	Earthworks Urban Farm
School garden	• Food-producing school farm or garden • Produce sold at farm/garden or other venues • Produce consumed by students and staff at school	Authors	Drew Transition Center
Dairy	• Storage, processing, and distribution of milk and milk products	Authors	Star Dairy
Ice cream parlor	• Sells primarily ice cream and dairy products • Limited food items on menu	Authors	Dairy Queen
Meat markets and deli	• Fresh meat and seafood • Delicatessen	Authors	Prime Gourmet Meats
Wholesaler	• Sells bulk items • Sells at wholesale prices	Authors	Atlas Wholesale Food Company
Manufacturer, processor	• Commercial food manufacturer or processor	Authors	Michigan Packing Co.
Distributor	• Commercial distribution hub for food items	Authors	Hispanic Food Distributor
Food pantries or soup kitchens	• Food pantries, soup kitchens, faith-based programs, etc. serving or distributing food to individuals	Authors	Loaves and Fishes
Food banks	• Large warehouses storing millions of pounds of food for distribution to smaller organizations serving those needing food • Does not give out food directly to individuals	Authors	Gleaners
Food hub	• Centrally located, permanent facility • Has a business management structure • Aggregates, stores, processes, and distributes food • Focus on locally or regionally grown and produced food • May provide wholesale or retail vending space • May offer social services	USDA Agricultural Marketing Service	Eastern Market (being organized)

not only food stores, but also food producers, processors, and distributors in the city. We also study venues that other researchers ignore in the food procurement process; hence, we analyze food sources such as clubs, caterers, food cooperatives, urban farms, community-based food assistance programs, etc.

Data Collection and Sources

Between 2011 and 2013, we collected data from multiple sources and merged them, so that we could identify as many food sources as possible. We take this approach because researchers studying food outlets found great disparity in the number of outlets identified by various data sources; hence relying on only one source can lead to undercounting and other errors (Liese et al., 2010; Lisabeth et al, 2010; Wang et al., 2006). In addition, because we study such a broad range of food sources, no one source has information on all of them.

Hence, we collected food source information from two international databases: ReferenceUSA and Orbis. Other food access studies using ReferenceUSA as a data source include Lisabeth et al. (2010), Liese et al. (2010), and Raja, Ma, and Yadav (2008). In searching these databases, we used the Standard Industrial Classification (SIC) division codes to help

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us identify the relevant businesses to include in our database. SIC codes are commonly used in research to identify businesses of interest (see for example, Lisabeth et al., 2010; Moore and Diez Roux, 2006; Raja, Ma, and Yadav, 2008). We are aware that relying only on division codes would result in the identification of only a subset of the food retailers in the city. For instance, supercenters that sell a wide variety of merchandise besides food would not be captured by using division codes alone, as such businesses are not categorized by their food department at the division level.

Ergo, in addition to the division codes, we used the major group, industry group, and industry codes to identify additional food-related businesses. These combinations allowed us to identify businesses like mass merchandisers, supercenters, and variety stores where food is not the primary business and would not be included in the data being collected if only the SIC division codes were used.

We turned to additional data sources as we found that ReferenceUSA and Orbis were missing many of the food outlets in the city. Moreover, these two databases contain only a few of the alternative food sources we studied. Consequently we used three statewide databases to identify and obtain additional information on vendors. The Michigan databases also helped us to identify EBT and Women, Infant, and Children (WIC) vendors and farmers' markets. Therefore, we also obtained data on food venders from the Michigan Department of Agriculture (see also Zenk et al., 2005, 2006, for studies using this data source), the Michigan Department of Human Services, and the Michigan Farmers' Markets Association.

We used two national nonprofit databases, Local Harvest and FoodPantries.org, to help us collect information on emergency food assistance programs in the city. We also used several local sources, including the Detroit Public Schools listing of school gardens, the Detroit Yellow Pages business directory, Eastern Market's vendor directory, and local nonprofits' listings of community gardens, to build our database. We supplemented this with local knowledge gleaned from Detroit residents, who provided information on food outlets that did not appear in other data sources.

Finally, we also used Google Street View, Bing, and telephone calls to businesses to identify additional food outlets, get correct addresses, obtain the latitude and longitude of food outlets that were not in the ReferenceUSA and Orbis databases, and to verify the information in all the aforementioned data sources. We used this fact checking technique to identify duplicates, incorrect addresses,

Table 3. Food venues studied in Detroit

Category of food outlet	Frequency	Percent
All food venues:	**3,499**	**100**
Supermarkets and large grocery stores:	**96**	**2.7**
Traditional full-line supermarkets	63	1.8
Limited-assortment stores	26	0.7
Superstores	3	0.1
Supercenter	1	
Mass merchandiser	1	
Super warehouse	1	
Fresh format supermarket	1	
Small groceries and convenience stores:	**1,110**	**31.7**
Liquor stores and party stores with mini-marts	460	13.1
Gas stations with food stores	371	10.6
Small groceries, convenience, and corner stores	279	8.0
Specialty food stores:	**279**	**8.0**
Meat, delicatessen	116	3.3
Bakeries	76	2.2
Health food and nutrition supplements	31	0.9
Confectionaries	31	0.9
Ice cream parlors	23	0.7
Food cooperatives	2	0.1
Pharmacies, dollar, and variety stores:	**306**	**8.7**
Pharmacies and drug stores	183	5.2
Dollar stores and variety stores	123	3.5
Restaurants and other food service:	**1,245**	**35.6**
Full service restaurants	618	17.7
Fast food restaurants	338	9.7
Bars and clubs	185	5.3
Caterers	64	1.8
Coffee, tea, and juice shops	40	1.1
Supply Chain:	**157**	**4.5**
Wholesalers	97	2.8
Food manufacturers and processors	31	0.9
Food distributors	29	0.8
Farms, gardens, farmers' markets, and produce:	**206**	**5.9**
Urban farms	23	0.7
Community gardens	69	2.0
School gardens	42	1.2
Farmers' markets and produce markets	61	1.7
Dairy	7	0.2
Community supported agriculture	4	0.1
Food assistance:	**100**	**2.9**
Food pantries and/or soup kitchens	98	2.8
Food banks	2	0.1

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defunct businesses, inaccurately classified businesses, and non-food-related businesses. Duplicated entries or businesses that were closed or were not food related were removed from the database.

The exact coordinates of the food outlets were plotted on maps using ArcGIS 10.1. The ReferenceUSA and Orbis databases contain latitude and longitude coordinates. We used Google and Bing to verify the ReferenceUSA and Orbis coordinates and also to find coordinates for venues obtained from the remaining data sources. ArcGIS 10.1 allowed us to merge neighborhood information and 2010 census data to the block group level. Researchers conducting food access studies have used census tracts (Andreyeva et al., 2008; LeDoux and Vojnovic, 2013; Rose, 2011; Zenk et al, 2005) and census block groups (Galvez et al., 2007; Sadler, Gilliland, and Arku, 2012; Zenk et al., 2005) in their analyses. We also used SPSS 22 to perform statistical analyses on the data.

Categorizing Food Outlets

We examine 34 categories of food venues in this paper. We used the Food Marketing Institute's (FMI) typology to identify and classify 10 categories of grocery stores found in the city (FMI, 2013). We identified several additional types of venues that are discussed herein. Table 2 contains the types of food outlets studied, the defining characteristics of each, the source from which the definition comes, and examples of each category of outlets. This list is by no means exhaustive. For instance, we do not include roadside food stands, family gardens, or school and hospital cafeterias. The inclusion of these would add hundreds of food sources to our database. Moreover, because of concerns for privacy and the growing incidences of unauthorized harvesting of produce and vandalism of private gardens, we are not analyzing these. For these reasons, we are analyzing only the farms, community gardens, and school gardens that have been publicly identified.

Results

The City's Food Environment

We identified and studied 3,499 food outlets in Detroit (see Table 3 and Figures 1 and 2). Our study shows that supermarkets and full-line grocery stores constitute only a

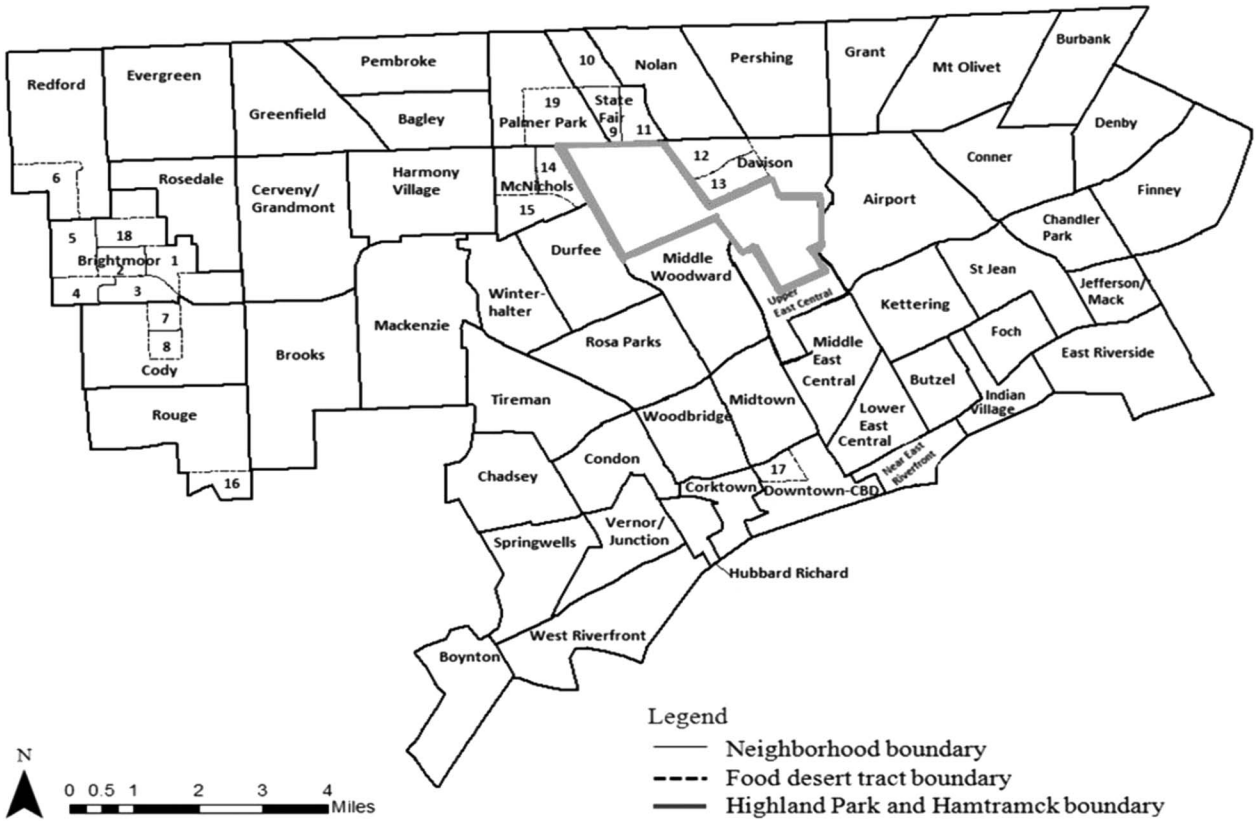

Figure 1. Map of Detroit showing neighborhood boundaries and USDA-designated food desert census tracts.

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Figure 2. Map of Detroit showing all food outlets studied.

small segment of the city's food system. The 96 supermarkets and full-line grocery stores we identified accounted for only 2.7% of the food outlets in the city. This group comprised 63 supermarkets and grocery stores, 26 limited-assortment grocery stores, 1 fresh format store, and 6 super-sized food retailers (see Figure 3). This finding underscores two important points: (a) Detroit has more supermarkets and full-line grocery stores than has been identified in some earlier studies, and (b) focusing solely or primarily on supermarkets and full-line grocery stores misses the vast majority of sources from which people can obtain food in the city.

Small groceries, convenience stores, corner stores, and mini marts dominate the grocery sector in the city (Figure 4). The 1,110 small groceries, convenience stores, corner stores, and mini marts we identified constituted 31.7% of the food outlets in the city. Of these, 460 (13.1%) were liquor and party stores with mini marts, 371 (10.6%) were gas station convenience stores, and 279 (8%) were small groceries, convenience stores, or corner stores. Though there is a tendency to categorize all of the small groceries and corner stores as fringe or unhealthy food outlets, there is a need for greater analysis of these types of retailers to find out which actually sell healthy foods. In addition, Detroit has 183 (5.2%) pharmacies or drug stores and 123 (3.5%) dollar or variety stores that sell food. The city also has 279 (8%) specialty stores. This includes 116 (3.3%) meat markets or delicatessens and 76 (2.2%) bakeries.

Restaurants are the most numerous type of food outlet in the city (Figure 5). The 1,245 retailers categorized under the heading of restaurants and other food service outlets account for 35.6% of the food outlets studied. Though researchers tend to study fast food restaurants, there are far more full service restaurants than fast food restaurants in Detroit. There were 618 (17.7%) full service restaurants and 338 (9.7%) fast food restaurants. Though food access studies tend to ignore bars and clubs as venues where people obtain food, the 185 bars and clubs we identified in the city constitute 5.3% of the food outlets in the city.

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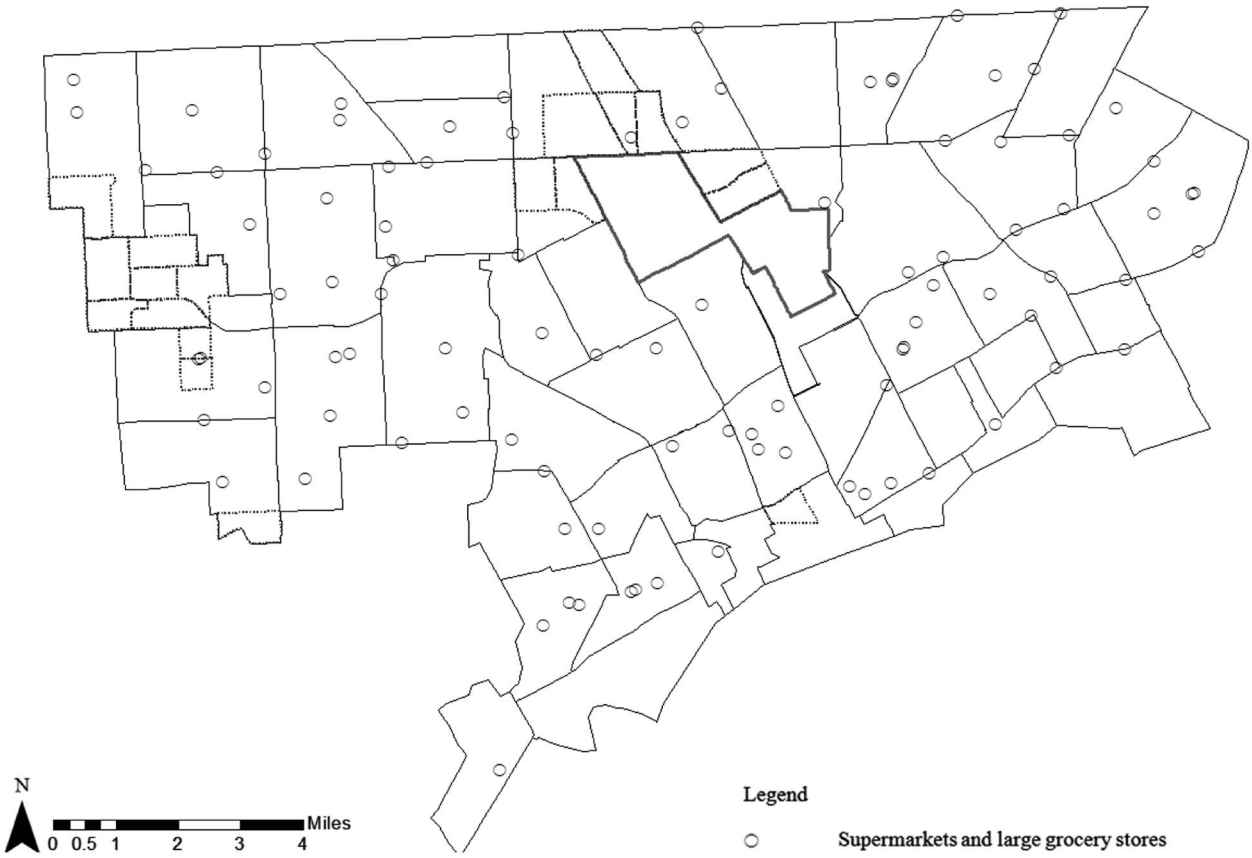

Figure 3. Map of Detroit showing supermarkets and large grocery stores.

The urban farming, community and school gardening, and farmers' market sector has more venues in the city than the supermarket sector. These food outlets provide residents with alternative places to purchase fresh, locally-grown produce. We identified 206 (5.9%) urban farms, community gardens, farmers' and produce markets. We studied 23 urban farms – this does not include the newly-operational mega Christmas tree farm or the agricultural campus, which will be discussed later. We included 69 community gardens and 42 school gardens in our study (we believe this is a conservative estimate, as some gardens do not publicize their name or location). The city's thriving urban farming and gardening sector helps to support 61 farmers' and produce markets as well as seven dairies (see Figure 6).

Detroit is also an important industrial center, a waterfront city and the site of two of the busiest international crossing points (and a third is planned) between the US and Canada. Hence, in addition to food retailers, food service providers, and producers discussed above, the city has a robust supply chain network for food products. There were 157 such businesses in the city; this accounts for 4.5% of the city's food outlets (Figure 7). We found 97 wholesalers as well as 31 food manufacturers or processors and 29 food distributors in the city. These businesses play an important role in supplying the city and the region with food. They can also play a role in hunger alleviation, by supplying community-based food assistance programs with excess food.

The nonprofit sector has played a critical role in helping reduce food insecurity in the city. Consequently, scores of religious institutions and other community-based organizations have established 98 food pantries and/or soup kitchens. There are also two food banks in the city (Figure 8).

Neighborhood Food Environments

As mentioned before, Detroit's population has declined rapidly over the past six decades, and that has contributed to the inequitable distribution of food in the city. Detroit's population peaked at 1,849,568 in 1950; at the time Whites constituted almost 83.6% of the population and African Americans, 16.3%. By 2010, the population had declined to 713,777, and Whites not of Hispanic ancestry constituted only 7.8% of the population. African Americans made up

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Figure 4. Map of Detroit showing small groceries and convenience stores, pharmacies, and dollar and variety stores.

82.7%, Hispanics 6.8%, and Asians 1.1% of the city's population (see Table 4). Detroit lost 25% of its population between 2000 and 2010. By 2012, the city's population had declined another 1.7%, down to 701,475 residents. In that year, the median household income was $26,955, 37.7% of the population received SNAP benefits, and 38.1% of the population was living below the poverty level. The unemployment rate is currently 14.8% (Gibson and Jung, 2005; US Census Bureau, 2013). All our analyses will use the 2010 population count of 713,766 (we exclude Belle Isle, an island park in the Detroit River with 11 people living on it, from the analysis).

Detroit is a city of neighborhoods, but it is sometimes hard to reach consensus on what particular sections of the city are called and where the boundaries are. This has been confounded by the steady and significant decline in population, which has left once-intact neighborhoods with large swaths of vacant land and a patchwork of housing. Nonetheless, the Detroit Planning and Development Department has identified 54 master plan neighborhoods. These neighborhood designations have been used in the Social Compact (2010, p. 7), by the city, and by Data Driven Detroit in neighborhood analyses for the past several years. We also use these neighborhood boundaries in our analysis (see Figure 1).

Table 4 contains the demographic characteristics of each of these neighborhoods. Though the residents of Detroit are predominantly Black, the percentage of Blacks in the neighborhoods vary from 5.2% (in Springwells) to 97% (in Bagley). Similarly, the percentage of White residents varied from 0.5% (in Bagley) to 37.5% (in Corktown). Though Hispanics constitute less than 7% of the city's population, they make up between 36% and 72% of the population in six neighborhoods (Condon, West Riverfront, Hubbard Richard, Chadsey, Vernor/Junction, and Springwells).

Eight of Detroit's neighborhoods (Downtown-CBD, Middle East Central, Midtown, Brooks, Cerveny/Grandmont, Mackenzie, Middle Woodward, and Harmony Village)

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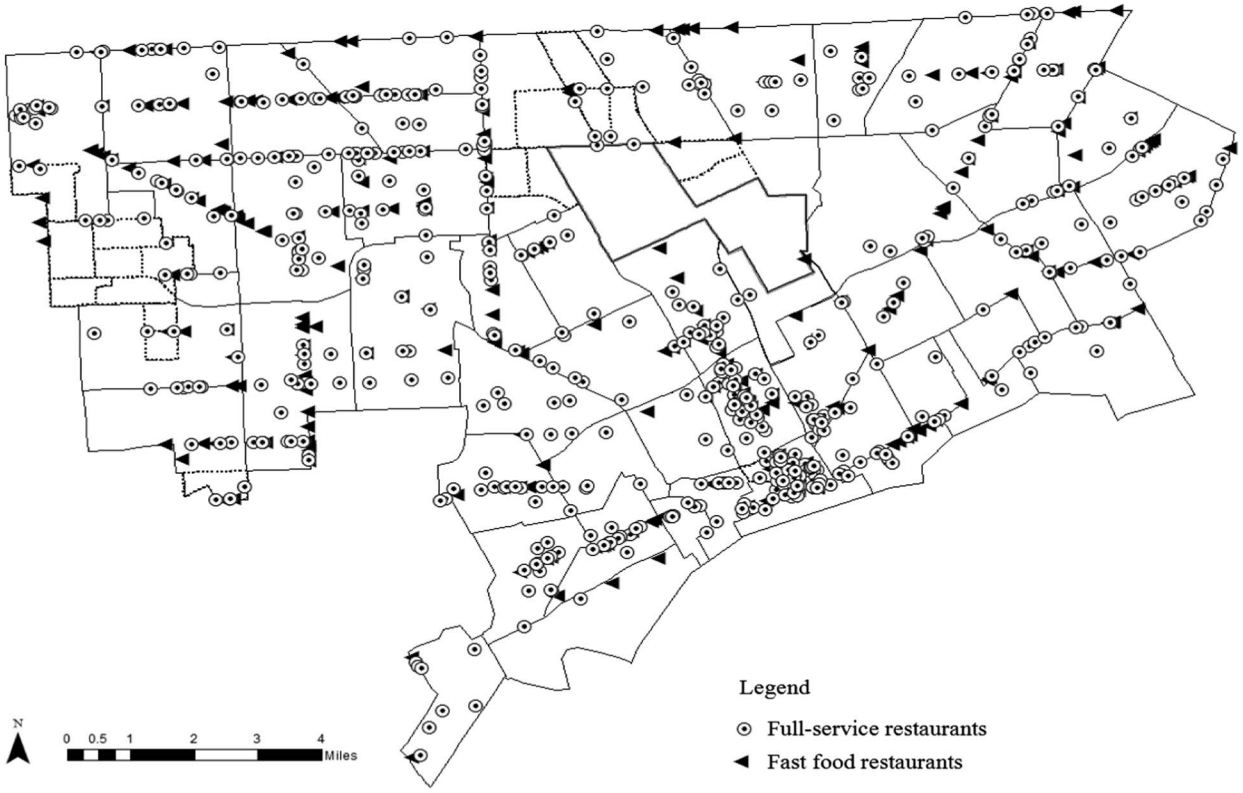

Figure 5. Map of Detroit showing full-service and fast food restaurants.

each have 100 or more food outlets in them (see Table 5). One of these neighborhoods – Downtown-CBD – does not have a supermarket or full-line grocery store in it.

The neighborhood with the largest number of food outlets is Downtown-CBD; it has 258 food retailers in it. The central business district (CBD) is the main restaurant district of the city. This part of the city hosts government offices, corporate headquarters, professional sports venues, and several tourist attractions. It has 105 full service restaurants and 26 fast food ones, as well as 11 delicatessens. It also has six community gardens, three produce or farmers markets, an urban farm, and a dairy. Downtown corporations have taken an interest in sponsoring urban gardens. For instance, the .75-acre Lafayette Greens urban garden is located outside of and is sponsored by Compuware, which is headquartered in Detroit. Vegetables are grown and sold at the garden site or donated to Gleaners Food Bank; educational demonstrations are also held at the garden. Lafayette Greens is operated by Compuware employees and community residents (Lafayette Greens, 2013). Downtown-CBD has a small population – only 5,292 people. The neighborhood's residents are 63.2% Black, 26.4% White, and 3.2% Hispanic. The median household income is $26,549. Almost 85% of the residents are employed in white-collar occupations, and 80% are college educated (Point2homes, 2013; US Census Bureau, 2010).

Middle East Central, an adjoining neighborhood east of Downtown-CBD, also has a large number of food outlets. This neighborhood also has a small population, of just 5,286 residents. However, the neighborhood, which is home to the 43-acre Eastern Market, has 165 food outlets. Eastern Market is the largest historic public market district in the country. Constructed in 1891, approximately 70,000 tons of food pass through the market and the numerous warehouses in and around the complex annually. Roughly 45,000 people – many from the suburbs and Canada – attend the Saturday markets (Deeb, 2013; Detroit Historical Society, 2013; US Census Bureau, 2010). About 39% of the supply chain food outlets in the city are located in this warehouse district. In addition, Middle East Central has 25 meat markets or delicatessens, 22 full service restaurants, and 6 fast food ones. Despite the large number of food outlets in this neighborhood, prices are out of reach for some residents. In response,

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Figure 6. Map of Detroit showing urban farms, community and school gardens, farmers' markets and produce markets, dairies, and community supported agriculture.

vendors at the market participate in the Double Up Food Bucks program. Notwithstanding, three soup kitchens or food pantries operate in the neighborhood; this indicates that there are unmet food needs in the community.

Finney is the Detroit neighborhood with the largest number of supermarkets and full-line grocery stores – five in all. It is one of the most stable residential areas in the city. Finney, which lies on the eastern edge of the city, abuts the affluent, predominantly White waterfront suburbs (or the "Pointes"). With a population of 26,031, Finney's residents are 10.9% White, 85.2% Black, and 1.1% Hispanic (City of Detroit, 2009; US Census Bureau, 2010). Six neighborhoods (Midtown, Brooks, Mackenzie, Mt. Olivet, Kettering, and Conner) each have four large supermarkets and full-line grocery stores in them.

Cerveny/Grandmont, a community of quaint homes and neighborhood associations located in the northwestern portion of the city, is Detroit's most populous neighborhood. It has 32,769 residents, 96% of whom are Black, 1.4% are White, and 0.7% are Hispanic. The median income is $34,262, 77.6% of the residents are college educated, and 81.2% of them are employed in white-collar occupations (Point2homes, 2013; US Census 2010). This neighborhood has 124 food retailers. Among them are three supermarkets or full-line grocery stores. The neighborhood also has three school gardens, one community garden, two produce markets, and two dairies.

Detroit's waterfront is heavily industrialized, so all the neighborhoods abutting the river have populations of less than 7,500. With the exception of the Downtown-CBD, the riverfront neighborhoods (East Riverside, Indian Village, Near East Riverfront, Corktown, Hubbard Richard, and West Riverfront) each have fewer than 50 food outlets within their confines.

East Riverside has an industrial district, marina, and numerous canals. Many of the commercial buildings in the area are underutilized, and there are large parcels of

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Figure 7. Map of Detroit showing supply chain outlets.

contaminated vacant land that were formerly industrial sites. East Riverside has a population of 7,399 residents (City of Detroit, 2009; US Census Bureau, 2010). It has two supermarkets or full-line grocery stores, two community gardens and one school garden. Two soup kitchens or food pantries operate in the neighborhood.

Indian Village is a stable, middle-class residential area of historic homes, guided house tours, and garden clubs. Almost a third of the residents are 65 or older. However, the neighborhood of 4,639 residents is home to the municipal water treatment plant (City of Detroit, 2009; US Census Bureau, 2010). The neighborhood has the fewest food outlets of any of the city neighborhoods. Indian Village has only nine food outlets, but these include one supermarket or full-line grocery store, two school gardens, and one soup kitchen or food pantry.

Near East Riverfront adjoins the Downtown–CBD neighborhood to the east. A neighborhood of 1,404 people, East Riverfront has several vacant industrial and commercial sites. The Uniroyal site is in this neighborhood (City of Detroit, 2009; US Census Bureau, 2010). Corktown, located just west of the Downtown–CBD, has 1,200 resident. The neighborhood's residents are 37.5% White, 41% Black, and 17.2% Hispanic. Corktown contains many vacant properties, including a former rail yard and the old Tiger baseball stadium. Abandoned industrial buildings abound, and several light industrial facilities currently operate in the neighborhood (City of Detroit, 2009; US Census Bureau, 2010). Most of the food outlets in Corktown are bars and restaurants. It has two community gardens, one urban farm, and a soup kitchen or food pantry.

Hubbard Richard and West Riverfront hug the waterfront in the southwestern portion of the city. Hubbard Richard is a predominantly Hispanic neighborhood and one of only three neighborhoods in the city where the population increased between 2000 and 2010. It is the site of one of the two international border crossings between the US and

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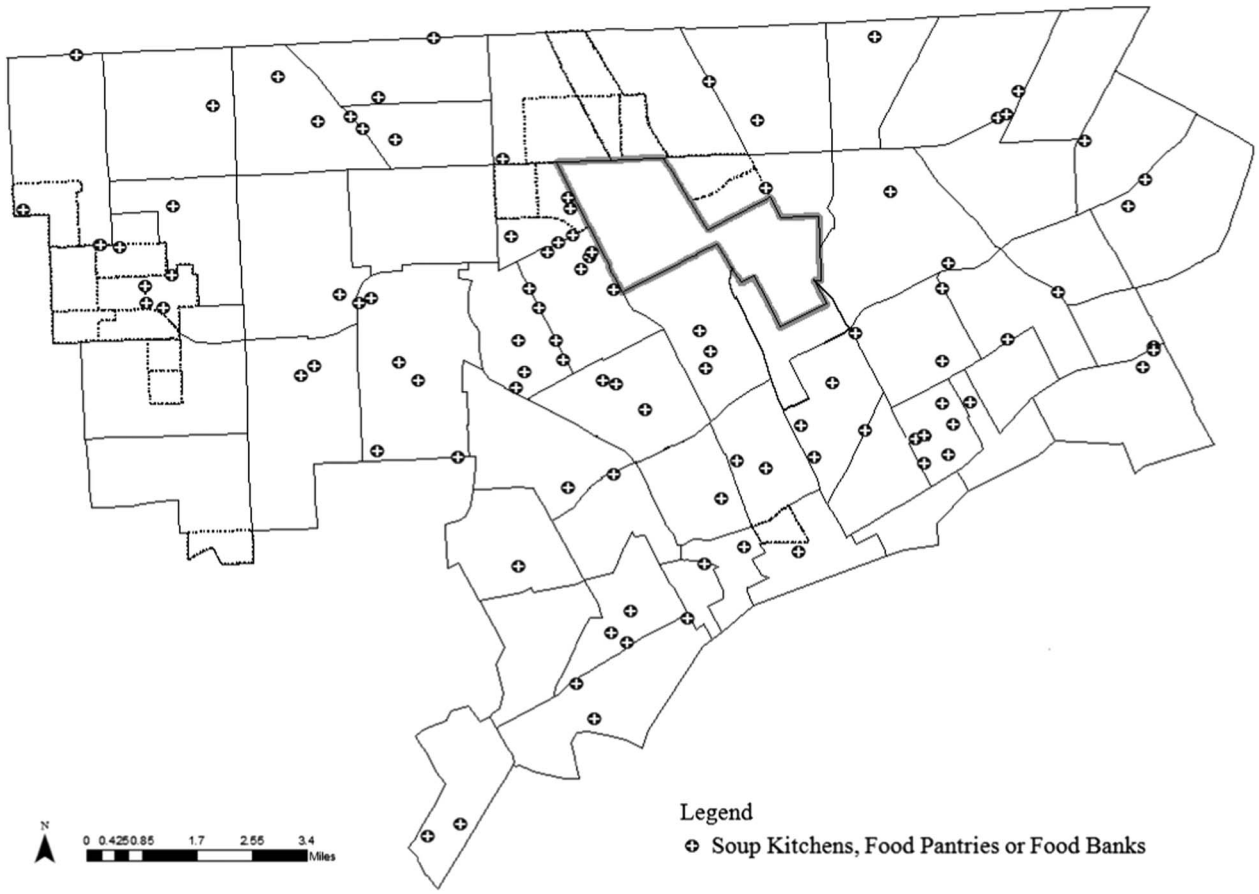

Figure 8. Map of Detroit showing soup kitchens food pantries, and food banks.

Canada; hence, heavy traffic flows through an already heavily industrial community. The neighborhood has 2,080 residents, 16.1% of whom are White, 28.9% are Black, and 51.3% are Hispanic (City of Detroit, 2009; US Census Bureau, 2010). Hubbard Richard has only 24 food outlets. However, it contains nine full service restaurants. The neighborhood is home to Mexicantown, and ethnic (Mexican) cuisine is one of its specialties. Hubbard Richard has one supermarket or full-line grocery store, one pantry or soup kitchen, and two produce or farmers' markets.

West Riverfront has rail, port, and other industrial facilities that has contaminated the neighborhood. The neighborhood also has a large Hispanic population. There are 2,783 residents, 25.9% of whom are White, 24.6% are Black, and 46.9% are Hispanic (City of Detroit, 2009; US Census Bureau, 2010). We identified 43 food outlets in West Riverfront, but several were supply chain outlets. That is, 12 were wholesalers, 3 were distributors, and 1 was a manufacturer or processor. There were six produce or farmers' markets, but there were also five pantries or soup kitchens in the neighborhood. There were no supermarkets or full-line grocery stores in the neighborhood.

New Supermarkets

So, where do the new supermarkets go in Detroit? Midtown, home of the new Whole Foods, is another restaurant district well-endowed with food outlets. The neighborhood has 38 full service restaurants, 18 fast food ones, and 12 coffee/tea/juice shops. The neighborhood, that had three existing full-service supermarkets before the Whole Foods opened, also has nine farmers markets, produce markets, or community gardens. Anchored by Wayne State University, the Detroit Institute of Art, Orchestra Hall, the Detroit Public Library, and several other important cultural institutions, Midtown is a gentrifying area that attracts tourists. The neighborhood has 14,550 residents, 24% of whom are White, 62.7% are Black, and 2.1% are Hispanic. About a fourth of the residents are college students (City of Detroit, 2009; US Census Bureau, 2010). Whole Foods has announced plans to build a second store in Detroit (Pinho, 2014).

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Table 4. Neighborhood demographic characteristics

		White - Not Hispanic		Black - Not Hispanic		Hispanic of any race		
Neighborhood	**Total population**	**Number**	**Percent (%)**	**Number**	**Percent (%)**	**Number**	**Percent (%)**	**Percent Other (%)**
Detroit total	**713,766**	**55,604**	**7.8**	**586,573**	**82.2**	**48,679**	**6.8**	**3.2**
Corktown	1,200	450	37.5	492	41.0	206	17.2	4.3
Chadsey	21,121	5,850	27.7	2,172	10.3	12,335	58.4	3.6
Downtown-CBD	5,292	1,399	26.4	3,342	63.2	167	3.2	7.3
West Riverfront	2,783	721	25.9	684	24.6	1,304	46.9	2.7
Midtown	14,550	3,488	24.0	9,117	62.7	310	2.1	11.2
Rouge	21,841	4,789	21.9	15,005	68.7	1,411	6.5	2.9
Upper East Central	123	26	21.1	94	76.4	1	0.8	1.6
Springwells	14,703	3,058	20.8	761	5.2	10,584	72.0	2.0
Davison	14,510	2,838	19.6	7,307	50.4	252	1.7	28.3
Vernor/Junction	16,126	2,854	17.7	1,760	10.9	11,150	69.1	2.2
Indian Village	4,639	806	17.4	3,591	77.4	55	1.2	4.0
Near East Riverfront	1,404	243	17.3	1,061	75.6	30	2.1	5.0
Airport	8,221	1,376	16.7	6,416	78.0	74	0.9	4.3
Hubbard Richard	2,080	335	16.1	602	28.9	1,067	51.3	3.7
Brooks	24,195	3,741	15.5	19,173	79.2	642	2.7	2.6
Woodbridge	7,905	1,166	14.8	6,226	78.8	259	3.3	3.2
Redford	18,182	2,615	14.4	14,779	81.3	236	1.3	3.0
State Fair	4,315	586	13.6	3,481	80.7	89	2.1	3.7
Finney	26,031	2,847	10.9	22,166	85.2	275	1.1	2.9
Condon	7,140	688	9.6	3,715	52.0	2,598	36.4	1.9
Brightmoor	12,836	1,175	9.2	11,046	86.1	205	1.6	3.2
Palmer Park	9,463	811	8.6	8,272	87.4	112	1.2	2.8
Lower East Central	11,484	840	7.3	10,133	88.2	117	1.0	3.4
Middle East Central	5,286	369	7.0	4,698	88.9	67	1.3	2.9
East Riverside	7,399	507	6.9	6,640	89.7	48	0.6	2.8
Butzel	7,134	448	6.3	6,469	90.7	63	0.9	2.2
McNichols	9,107	551	6.1	8,112	89.1	121	1.3	3.5
Burbank	17,959	1,035	5.8	16,306	90.8	143	0.8	2.6
Boynton	8,210	467	5.7	6,569	80.0	1,019	12.4	1.9
Grant	10,334	512	5.0	9,499	91.9	85	0.8	2.3
Rosedale	16,121	785	4.9	14,849	92.1	127	0.8	2.2
Middle Woodward	12,476	596	4.8	11,342	90.9	128	1.0	3.3
Denby	20,135	950	4.7	18,631	92.5	158	0.8	2.0
Cody	15,008	647	4.3	13,864	92.4	162	1.1	2.2
Jefferson/Mack	3,592	151	4.2	3,323	92.5	39	1.1	2.2
Mt. Olivet	23,390	929	4.0	21,338	91.2	159	0.7	4.1
Pershing	17,356	486	2.8	16,313	94.0	189	1.1	2.1
Nolan	14,724	401	2.7	13,932	94.6	128	0.9	1.8
Foch	5,090	121	2.4	4,837	95.0	30	0.6	2.0
Evergreen	25,277	588	2.3	24,029	95.1	164	0.6	2.0

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Table 4. (*Continued*)

		White - Not Hispanic		Black - Not Hispanic		Hispanic of any race		
Neighborhood	**Total population**	**Number**	**Percent (%)**	**Number**	**Percent (%)**	**Number**	**Percent (%)**	**Percent Other (%)**
Rosa Parks	15,984	353	2.2	15,003	93.9	225	1.4	2.5
Conner	18,950	389	2.1	18,045	95.2	105	0.6	2.2
Durfee	18,207	373	2.0	17,303	95.0	160	0.9	2.0
St. Jean	6,561	115	1.8	6,295	95.9	46	0.7	1.6
Chandler Park	8,011	125	1.6	7,638	95.3	60	0.7	2.3
Kettering	10,345	164	1.6	9,956	96.2	54	0.5	1.7
Cerveny/Grandmont	32,769	452	1.4	31,474	96.0	243	0.7	1.8
Mackenzie	26,660	370	1.4	25,613	96.1	235	0.9	1.7
Greenfield	21,627	245	1.1	20,809	96.2	147	0.7	2.0
Harmony Village	24,209	265	1.1	23,236	96.0	195	0.8	2.1
Tireman	13,538	139	1.0	12,557	92.8	519	3.8	2.4
Pembroke	18,017	157	0.9	17,375	96.4	135	0.7	1.9
Winterhalter	13,234	122	0.9	12,718	96.1	121	0.9	2.1
Bagley	16,912	85	0.5	16,400	97.0	125	0.7	1.8

Source: US Census Bureau. 2010. Census of Population and Housing. Dept. of Commerce., Washington, D.C.

In contrast, the Meijer store is located in the newly-developed Gateway Center on the northern edge of the city, in the State Fair neighborhood (adjacent to the abandoned State Fair Grounds). Meijer stores have full-line grocery sections that carry organic and locally grown foods at affordable prices. It should be noted that Meijer's location – a few blocks from the northern suburbs of Ferndale and Hazel Park – ensures that it has a large customer base. State Fair is a low-income neighborhood that has lost about 51% of its population since 2000. In 2010, it had 4,315 residents, 13.6% of whom were White, 80.7% were Black, and 2.1% were Hispanic. About a quarter of the residents of the neighborhood are foreign-born and more than 80% of the foreign-born come from the Middle East (City of Detroit, 2009; US Census Bureau, 2010). State Fair has only 36 food outlets. It had no large supermarket or grocery store before the Meijer opened, neither does it have any produce or farmers' markets. However, the neighborhood has community garden as well as two CSAs. Despite being low on food outlets, no food pantries or soup kitchens operate in the neighborhood.

Race, Population Size, and the Prevalence of Food Outlets

A common finding in the food desert literature is that predominantly Black neighborhoods are less likely to be served by supermarkets and full-line grocery stores than predominantly White ones (see for example Morland et al., 2002; Zenk et al., 2005, 2006). In the context of this analysis, this raises the question of whether there is a relationship between the racial composition of neighborhoods and the prevalence of different types of food outlets in Detroit.

In keeping with this overview, we calculated the per capita ratios of the different food outlets and present the results of those calculations in Table 6. As the table shows, there is one food outlet per every 204 individuals in Detroit. However, there is great variation depending on the type of food outlet being considered. While there is one supermarket or full-line grocery store for every 7,435 residents, there is one small grocery, convenience store, or mini mart per 643 residents. There is even greater access to restaurants and food service – there is one such food outlet per 573 residents.

Our analysis found that the racial composition of the neighborhoods mattered. Table 6 shows the racial composition of the neighborhoods that were examined. Though the relationship between racial composition of neighborhood and the presence of supermarkets or full-line grocery stores was not linear, the table shows that neighborhoods with the lowest percentage of Black residents had a better ratio of people to supermarkets than other neighborhoods. Hence,

Table 5. Neighborhood food venues studied in Detroit

Neighborhood	Total population	Supermarkets, large groceries	Small groceries	Specialty food stores	Pharmacies, variety stores	Restaurants, food service	Supply chain	Farms, farmer's markets, gardens	Food assistance	Total food outlets
Detroit total:	**713,766**	**96**	**1,110**	**279**	**306**	**1,245**	**157**	**206**	**100**	**3,499**
Corktown	1,200	0	4	1	2	22	2	3	1	35
Chadsey	21,121	2	31	6	10	32	6	7	1	95
Downtown-CBD	5,292	0	39	21	4	181	1	11	1	258
West Riverfront	2,783	0	10	1	0	7	16	5	4	43
Midtown	14,550	4	20	9	11	79	3	13	2	141
Rouge	21,841	2	28	6	7	30	1	4	0	78
Upper East Central	123	0	3	1	0	2	4	3	0	13
Springwells	14,703	3	28	6	7	21	1	3	0	69
Davison	14,510	1	26	5	6	3	0	1	1	43
Vernor/Junction	16,126	3	29	6	8	29	6	9	3	93
Indian Village	4,639	1	1	1	0	3	0	2	1	9
Near East Riverfront	1,404	1	6	2	3	18	2	0	0	32
Airport	8,221	2	22	4	6	12	2	7	2	57
Hubbard Richard	2,080	1	3	2	0	12	3	2	1	24
Brooks	24,195	4	45	18	11	45	7	5	2	137
Woodbridge	7,905	2	13	1	3	9	1	8	1	38
Redford	18,182	2	27	5	6	35	0	1	2	78
State Fair	4,315	1	10	5	2	12	2	4	0	36
Finney	26,031	5	26	7	13	41	1	3	2	98
Condon	7,140	1	16	2	2	8	2	1	1	33
Brightmoor	12,836	0	19	6	2	11	0	7	7	52
Palmer Park	9,463	1	9	2	3	18	0	2	1	36
Lower East Central	11,484	3	12	1	4	7	4	11	1	43
Middle East Central	5,286	1	18	31	3	32	61	16	3	165
East Riverside	7,399	2	7	1	2	13	1	3	2	31
Butzel	7,134	0	12	1	6	10	0	4	6	39
McNichols	9,107	1	16	7	0	8	3	2	3	40
Burbank	17,959	1	23	7	6	24	0	0	0	61
Boynton	8,210	1	12	2	0	10	2	1	2	30
Grant	10,334	2	17	5	8	18	3	2	1	56
Rosedale	16,121	2	12	5	6	22	0	0	1	48
Middle Woodward	12,476	1	30	5	10	40	0	12	3	101

Table 5. (*Continued*)

Neighborhood	Total population	Supermarkets, large groceries	Small groceries	Specialty food stores	Pharmacies, variety stores	Restaurants, food service	Supply chain	Farms, farmer's markets, gardens	Food assistance	Total food outlets
Denby	20,135	1	18	2	2	15	1	1	1	41
Cody	15,008	3	21	1	6	17	3	6	0	57
Jefferson/Mack	3,592	1	8	0	6	6	0	2	1	24
Mt. Olivet	23,390	4	25	5	13	24	1	3	2	77
Pershing	17,356	2	20	5	7	25	2	1	2	64
Nolan	14,724	2	23	2	4	14	0	2	0	47
Foch	5,090	0	11	1	1	5	1	5	0	24
Evergreen	25,277	2	42	9	9	34	0	2	1	99
Rosa Parks	15,984	1	22	0	13	19	0	1	3	59
Conner	18,950	4	39	2	6	17	1	1	1	71
Durfee	18,207	1	30	4	7	16	1	2	8	69
St. Jean	6,561	3	9	2	5	10	1	2	2	34
Chandler Park	8,011	0	18	2	1	10	0	2	1	34
Kettering	10,345	4	18	3	4	9	1	0	2	41
Cerveny/Grandmont	32,769	3	41	16	13	39	3	8	1	124
Mackenzie	26,660	4	44	7	12	26	2	1	6	102
Greenfield	21,627	3	32	10	13	29	0	5	2	94
Harmony Village	24,209	3	34	7	10	40	3	3	0	100
Tireman	13,538	1	22	3	4	9	1	3	1	44
Pembroke	18,017	1	18	5	5	24	0	2	2	57
Winterhalter	13,234	1	24	1	9	22	0	1	6	64
Bagley	16,912	2	17	10	5	21	2	1	3	61

Table 6. Neighborhood food venues per capita

Neighborhood Characteristics	Total population	Number of residents per food outlet								
		Supermarkets, full-line groceries	Small groceries, mini marts	Specialty food stores	Pharmacies, variety stores	Restaurants, food service	Supply chain	Farms, farmers' markets, gardens	Food assistance	Total food outlets
Detroit total:	**713,766**	**7,435**	**643**	**2,558**	**2,333**	**573**	**4,546**	**3,465**	**7,138**	**204**
Racial composition:										
1%–40% Black	56,813	6,313	563	2,705	2,273	563	1,775	2,185	6,313	175
41%–70% Black	64,533	8,067	485	1,467	2,017	200	7,170	1,956	10,756	110
71%–90% Black	196,369	6,771	631	1,835	2,455	561	2,182	2,158	5,168	179
91% or more Black	396,051	7,921	701	3,701	2,343	841	15,233	7,072	8,427	266
Population size:										
1–5,999	35,804	5,967	317	542	1,705	119	389	676	2,984	54
6,000–10,999	99,830	5,254	591	3,120	2,496	739	6,239	2,936	4,160	213
11,000–20,999	331,012	8,487	690	3,678	2,470	704	13,240	4,244	7,043	243
21,000 or more	247,120	7,723	710	2,716	2,226	727	10,297	6,027	14,536	246

neighborhoods that were 1%–40% Black had one supermarket or full-line grocery store per 6,313 residents. These same neighborhoods had one farm, farmers' market, produce stand, or garden for every 2,185 residents. In contrast, neighborhoods that were 91% or more Black had one supermarket or full-line grocery store for per 7,921 residents and a farm, farmers' market, produce stand, or garden for every 7,072 residents.

We found that the population size of the neighborhood also mattered (Table 6). Neighborhoods that had less than 11,000 residents had much better ratios of supermarkets and full-line stores to residents than larger neighborhoods. As neighborhood size increases, the prevalence of urban agricultural food outlets decreases. The same is true for emergency food assistance outlets.

USDA and Detroit's Census Tract Food Desert Designation

How prevalent are food deserts in Detroit? Despite the general perception that the whole city is a food desert, the USDA has labeled only 19 of the 297 census tracts in Detroit as food deserts (USDA, 2013). A 20thtract was included in the list, but it has been merged with another tract and renumbered since its designation; therefore, it is not included in this analysis. The USDA's food desert census tracts are in three parts of the city – one cluster in on the western edge of the city in the Redford/Brightmoor/Cody/Rouge neighborhoods. Combined these four neighborhoods have seven supermarkets or full-line grocery stores. The four neighborhoods also have a total of 18 urban agricultural food outlets. However, eight urban agricultural outlets and two supermarkets or full-line grocery stores are located in the 10 designated food desert census tracts in these neighborhoods. The two supermarkets occur in one tract (#8). Eight of the eleven soup kitchens or food pantries in the four neighborhoods are located in 10 food desert tracts.

The second cluster of designated food desert tracts is on the northern edge of the city in the Palmer Park/McNichols/State Fair/Davison neighborhoods. These four neighborhoods have a total of four supermarkets or full-line grocery stores, nine urban agricultural outlets, and five soup kitchens or food pantries. There are eight USDA-designated food desert tracts in these neighborhoods. These tracts contain four urban agriculture outlets, three soup kitchens or food pantries, and one super center.

Of the 19 tracts that the USDA labeled as food deserts, one of them has 50 food outlets in it (#17 on the map). This is one of

the three census tracts that comprise the Downtown-CBD neighborhood. Though the CBD census tract designated as a food desert does not have a large supermarket or large grocery store, it has a farmers' or produce market, four community gardens, and an urban farm.

There were four census tracts with no food outlets in them (one is in Tireman, another in the Rosa Parks neighborhood, and two are in Brightmoor). Yet, none of these tracts were identified as food desert tracts by the USDA. All of these tracts had more than 500 residents (at least 500 residents must inhabit a tract for it to be considered a food desert). The combined population of the three tracts is 3,412 people.

This discussion of which of the city's census tracts are labeled as food deserts shows some of the inconsistencies that arise when relying too heavily on the location of supermarkets and full-line grocery stores as the primary criteria for defining access to healthy foods. For instance, one of the Brightmoor food desert census tracts (#5) is mostly occupied by a park – the Eliza Howell Park, which occupies about a third of food desert tract #6 also. A group of neighborhood residents, Neighbors Building Brightmoor, have helped to create a 14-block farmway, built an edible playscape (the Treedome Park), managed the youth market garden, beautified the park, and created vegetable gardens on vacant lots in Brightmoor. The food production activities are coordinated with St. Christine's Soup Kitchen (Neighbors Building Brightmoor, 2014).

Similarly, most of the Palmer Park food desert tract (#19) is occupied by the Palmer Park Golf Course. Dotted with historic and architecturally distinctive homes, the Palmer Park neighborhood is one of the most affluent in Detroit. It contains the Sherwood Forest subdivision, public parks, miles of hiking and biking trails, and a historic log house. More than a third of Palmer Park residents earn $75,000 annually and about 90% of the homes in the neighborhood are worth $100,000 or more (City of Detroit, 2009). The University of Detroit, Mercy campus occupies part of the McNichols food desert tract (#15).

Discussion

Key Findings

Food access studies that focus only on supermarkets and full-line grocery stores in Detroit are examining less than three percent of the food outlets in the city. Even when studies include fast food stores, gas stations, liquor stores, and convenience stores, they are still examining less than half of the city's food outlets.

There is great variation in neighborhood food access. The study found that the location of supermarkets and full line grocery stores is related to the racial composition of the neighborhoods. Neighborhoods where the percentage of Black residents is 40% or lower have greater access to supermarkets and full-line grocery stores than neighborhoods where the percentage of Black residents exceed 40%. Neighborhoods with population under 11,000 also have greater access to supermarkets and full-line grocery stores than more populous neighborhoods.

Urban agricultural initiatives are important in Detroit. Hence, farms, farmers' markets, produce stores, community and school gardens, and dairies constitute almost six percent of the food outlets in the city. Other alternative food sources such as emergency food assistance make up about three percent of the city's food outlets. Despite Detroit's robust alternative food networks, the study did identify neighborhoods that had a paucity of supermarkets and full-line grocery stores as well as urban agricultural food outlets and food assistance programs.

Policy Implications

Despite having neighborhoods with large numbers of food outlets, food insecurity is a way of life for some Detroiters. As a result, food production has become an important part of the zeitgeist of the city. Recognizing this, in 2013, the Detroit City Council amended Chapter 61 of the Detroit Zoning Code to identify and define several types of agriculture (aquaculture, aquaponics, hydroponics, composting, farmers' markets, farm stand, garden center, greenhouse, hoop house, orchard, tree farm, urban farm, and urban garden) as legitimate land uses in the city and set standards for them. This will make it easier for residents to undertake agricultural initiatives for commercial and non-commercial purposes. For example, the lifting of the ban on hoop houses will allow farms to extend the growing season, harvest rainwater from such structures for use in irrigation, and grow crops in areas that do not have a city water hook-up. The new ordinance could also help to curb the spread of "guerilla" farms, where residents farm plots land without the appropriate permits and run the risk of being prosecuted for doing so. The agriculture ordinance will help residents and the city come to an understanding of what is permissible and what is not. This could also facilitate

the conversion of more vacant land to food production purposes.

Detroiters still face barriers to farming, as the industrial legacy of the city has left many of the vacant lots and abandoned facilities with relict wastes and toxic contamination. Residents wanting to farm face costs associated with soil testing and remediation. While some turn to raised-bed farming and gardening, there are added costs associated with these techniques that present financial barriers that deter agricultural hopefuls from participating.

Because of the availability of ample vacant land, commercial agricultural interests are eyeing the city. A local millionaire has already purchased 140 acres of city property for the modest price of $350 per acre to establish Hantz Farm – the country's largest urban farm. The 100-block lower east side super-parcel comprises 1,500 lots, on which 15,000 hardwood trees (Christmas trees) will be planted. To do this, between 50 and 100 structures will be demolished (Associated Press, 2013; Sands, 2012a). Hantz Farm is located in Foch, a neighborhood of 5,090 residents, 95% of whom are Black (US Census Bureau, 2010). Foch, located just blocks from the waterfront, has only 24 food outlets in it. It does not have a supermarket or full-line grocery store. Yet, despite the controversy over the purchase of such a large block of city-owned land at a low price, there has not been much discussion of how the development of the tree farm or "reforestation project," as it has been called, will affect food access in Foch and surrounding neighborhoods. More analysis of the impact of this and future non-food producing farms on the city's food system should be undertaken as plans for the farm unfolds.

The Detroit Public Schools and food advocates are countering with a plan to convert the shuttered Kettering High School into a 27-acre farm. Backers of the Kettering Urban Agriculture Campus, as the complex will be called, plan to grow enough food on the site to feed the entire district (Swan, 2014). The neighborhood has four supermarkets and full-line grocery stores but no urban agriculture food outlets. Kettering is a neighborhood adjacent to Foch. The neighborhood has 10,345 residents and is 96.2% Black (US Census Bureau, 2010). Detroit obtained a grant from the Healthy Hunger-Free Kids Act in 2010 to establish farms at 45 of the city's public schools (Sands, 2012b). Hence, the Kettering project is an expansion of the agricultural projects already underway in the city's public schools.

The sale of land for agricultural purposes and tax incentives for food-related businesses are important dimensions of the city's food policies. Before Whole Foods and Meijer opened their stores in Detroit, they were provided with generous tax incentives. Whole Foods received about $5.8 million in state and local grants and tax credits as well as 1.9 acres of land from a real estate investor worth $1 million to build the store on (Whole Foods leases the property). Detroit's 21,000-square-foot Whole Foods store has a price tag of $12.9 million (Duggan and Skid, 2011; Sadovi, 2013). The 190,000-square-foot Meijer, which cost $20 million to construct, also received millions of dollars of tax credits and incentives (Gallagher, 2013).

The tax incentives have prompted entrepreneurs who have operated grocery stores in the city to ask why the incentives and funding were going to attract new national chains – which have had limited success operating in the city – and why independent grocery stores already operating in the city were being ignored (Duggan and Skid, 2011; Hurst, 2010; Sadovi, 2013). For instance, John Louissa, chair of the Detroit Independent Grocers, argues that, since 2002, independent grocers, most of whom are Chaldeans (Iraqi Catholics), have invested about $41 million towards constructing and renovating 23 grocery stores in the city that are 10,000 square feet or more in size, and that these stores sell fresh meat, dairy, and produce at affordable prices (Louissa, 2012).

The Detroit Economic Growth Council has responded to critics by providing $1 million to more than 80 grocery stores participating in the Green Grocer Project. The program provides technical assistance grants to help with renovations and with launching healthy eating campaigns (Aguillar, 2010; Stella, 2011).

This is in line with suggestions made by the Michigan Food Policy Council (2013) that more investment in local food systems infrastructure was desirable, as this would build capacity and create jobs. Drawing from the previous experience of building two new supermarkets in Detroit, more effort should be made to see that new supermarkets are placed in the most underserved neighborhoods. The council identified improved access to healthy foods as a high priority and saw farmers' markets as key drivers of economic growth in the food sector. The farmers' markets that do not accept SNAP usually do not have the capacity to process EBT transactions. Moreover, funding is needed to train farmers and provide the technical assistance needed to enable them to participate in the program.

Not only are farmers' markets an important part of the city's food environment, Detroit's farmers' markets are

unusual in the sense that ethnic minorities are not seen as mere consumers being provided opportunities to purchase healthy, fresh produce; ethnic minorities participate in the markets as growers and vendors too. While the vendors at farmers' markets in many cities are primarily White, Detroit provides opportunities for ethnic minorities, low-income people, and youths to sell their produce at farm stands and in farmers' markets. Hence, youngsters from the Brightmoor Youth Garden harvested and sold about 1,300 pounds of produce in 2010 and earned $2,700 doing so. Students at Catherine Ferguson Academy sold more than $4,200 worth of produce from the school's farm in 2009 (Keenan, 2010). This approach provides ethnic minority youths with opportunities to experience several aspects of the food system and to explore careers in agriculture at an early age.

Detroit's food producers cannot grow enough food to meet all of the city's food needs. Though there are many farms on Detroit's ex-urban fringe, it is difficult to get that produce into the city. One of the biggest challenges to surmount is a supply chain conundrum – how can small-scale local and regional farmers get their produce to markets in Detroit and other cities quickly and efficiently? The need for transportation to markets, warehouses, processing space, and storage facilities is a barrier that small farmers have difficulty overcoming. Value-added production presents another challenge. That is, it is cost prohibitive for many small farmers to convert their produce to new products for market. Consequently, activists are turning to food hubs to help solve the problem. A food hub is a centrally located facility professionally managed to facilitate the aggregation, storage, processing, distribution, and marketing of locally or regionally produced food. As earlier discussions show, Detroit has a robust supply chain and value-added infrastructure that could be utilized as a food hub within the city. Eastern Market has such a built-in infrastructure and a long history of connecting food producers and consumers. It is transitioning into becoming a regional food hub (Archambault, 2012; Barham, 2010).

Some of the same challenges that arise when trying to get food products to markets efficiently occur with getting surplus food (that would normally go to waste) from farms and other production points to food banks, pantries, soup kitchens, shelters, and other places where people in need of food can access it easily. Farmers report that they would like to donate unsold food to food assistance programs but lack the transportation, fuel, staff, or time to glean the produce and deliver it to the appropriate collection points. Though Detroit's food assistance programs do get food from farmers markets, farms, restaurants, and other businesses, the potential to collect surplus food in and around the city and deliver it to those in need is not yet fully realized.

Delivering fresh and healthy foods to clients at emergency food outlets should also be a priority. Detroit's Earthworks Urban Farm is an example of an organization trying to do so. Earthworks is a project of the Capuchin Soup Kitchen. The organization operates the Meldrum Fresh Market and youth farm stands. It also distributes farm produce to WIC participants at the health clinics and to youths participating in the youth programs. Farm products are also used to make the meals served at the soup kitchen (Earthworks Urban Farm, 2013). Community-based food assistance programs are usually overlooked in the scholarly literature on food access, but in Detroit, such programs play a vital role in alleviating food insecurity.

Detroit also has to overcome the challenge of getting more healthy foods into retailers such as small groceries, corner stores, mini marts, convenience stores, liquor and party stores, dollar and variety stores, pharmacies, and gas stations. Wayne State University researcher, Kami Pothukuchi, has developed a program – Detroit Fresh: The Healthy Corner Stores Project – to facilitate this process in 22 neighborhood stores (Pothukuchi, 2010). This is an area of the food system where more work is needed in order to be able to match customer needs with business projections. This is particularly true in areas where a large portion of the customer base relies on federal food assistance funds to purchase foods. Funds are disbursed at particular times of the month, which creates boom and bust demand cycles, rather than smoother demand curves. This is very difficult for small retailers to respond to, as it makes it challenging to stock fresh produce and other perishable items.

Toxic food consumption is another aspect of food insecurity that needs more attention. The Michigan Department of Natural Resources has to take further steps to heighten awareness amongst the city's residents (many of whom it sells hunting and fishing licenses to) of potential contamination of aquatic species. Urban gardeners need more resources (such as soil testing and monitoring) to ensure that they are not growing food in contaminated soil or in areas where air pollution presents hazards. Subsistence fishing and hunting (especially for waterfowl from contaminated waterways) can also pose health risks if anglers and hunters consume contaminated fish and wildlife.

Researchers examining food deserts have linked health outcomes with food consumption, without accounting for

the confounding factors (besides food consumption) that can contribute to health outcomes. This is important in Detroit because of the numerous active industrial and commercial facilities, abandoned buildings, and hazardous sites that pose health risks to residents. In the southwestern portion of the city, for instance, residents are inundated with toxins emanating from sources such as the Marathon Oil Refinery, piles of petroleum coke waiting to be refined, DTE's aging coal plant, and about a dozen other noxious facilities. African American environmental justice activists such as Rhonda Anderson of the Sierra Club and Donele Wilkins, founder of Detroiters Working for Environmental Justice, have been calling attention to the poor air quality and environmental hazards in the neighborhood for decades (DWEJ, 2013; Sierra Club, 2013).

Though investigators have produced a large body of scholarship on health impacts arising from exposure to toxins, researchers have yet to examine how factors such as exposure to environmental hazards, food consumption, food access, and health are related. Yet, the United States Environmental Protection Agency (US EPA, 2007, 2006) warns that exposure to air pollution, pesticides and other toxins, and environmental hazards are related to the incidence of diabetes and hypertension. Researchers find that living in close proximity to hazardous waste sites can contribute to diabetes (Kouznetsova et al., 2007) and exposure to pesticides can also contribute to diabetes and obesity (Slotkin, 2010). One research team has studied the relationship between cardiovascular disease, air pollution, and food consumption in three Detroit neighborhoods (Schulz et al. 2005). We urge researchers to undertake more studies to help account for which factors (diet, exposure to environmental hazards, or both) are related to the health outcomes being observed when both factors are present and could be implicated. We also argue that there should be greater convergence of the environmental justice and food access literature, as environmental justice scholars have not investigated how exposure to environmental hazards in cities such as Detroit is related to food insecurity as extensively as they should.

Conclusions

This article presents a picture of Detroit's food system as a complex one. It demonstrates why it is necessary to examine many more facets of the food environment than only the supermarkets and full-line grocery stores that have traditionally been looked at. This analysis can help food activists and policy makers identify neighborhoods with low food access and target them more effectively with efforts to improve food access. The paper also urges researchers to reframe the food desert discourse and introduce new approaches to analyze food insecurity. We suggest one such approach – combining environmental justice analysis and systems thinking.

We also suggest that the USDA refine its definition of food access when identifying "food desert" census tracts, to bear in mind the pathways through which people obtain food. Hence, small grocers in Detroit that have been participating in the Detroit Fresh, Green Grocers', and Fair Food Network's projects to sell healthy foods should be included in the healthy stores database. This database should not be limited only to supermarkets and full-line grocery stores. Other indicators of access to healthy foods should include access to urban farms, community gardens, farmers' markets, produce markets, meat markets, food cooperatives, community supported agriculture, and dairies. The food access database should be updated more frequently, so that users can get an accurate indicator of food availability in their surroundings.

We recognize the limitations of this paper – it covers only one city and does not explore all the interconnections implied in the systems analysis this paper proposes. We are in the process of addressing those concerns. Forthcoming publications by these authors and other colleagues in our research collaborative will examine clustering phenomena in food outlets, food access and pollution exposure, and race and class disparities in food access in Detroit. We are aware that census tracts and neighborhoods are aspatial units; consequently, further analyses will be conducted using statistical and mapping techniques that are more sensitive to spatial relations that occur across boundaries. This is pertinent, because our maps show that many of the food outlets are located on the boundaries of census tracts, neighborhoods, and the city and suburbs.

We will also conduct a metropolitan analysis, as we are aware that Detroiters go beyond the city boundaries to shop for food. Analyzing the metropolis will correct for the edge effect, as we will analyze the food outlets that Detroiters are likely to utilize inside and outside of the city. It will also allow for center city and suburban comparisons. We plan to replicate all these analyses in several other metropolitan areas in order to provide a comparative frame for our Detroit analysis.

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