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Food, Culture & Society

An International Journal of Multidisciplinary Research

ISSN: 1552-8014 (Print) 1751-7443 (Online) Journal homepage: www.tandfonline.com/journals/rffc20

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To cite this article: Justin Schupp (2019) Wish you were here? The prevalence of farmers markets in food deserts: an examination of the United States, Food, Culture & Society, 22:1, 111-130, DOI: 10.1080/15528014.2018.1549467

To link to this article: https://doi.org/10.1080/15528014.2018.1549467

FOOD, CULTURE & SOCIETY
2019, VOL. 22, NO. 1, 111–130
https://doi.org/10.1080/15528014.2018.1549467

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Wish you were here? The prevalence of farmers markets in food deserts: an examination of the United States

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ABSTRACT

Food deserts have received considerable attention in recent years. Research has shown that individuals living in these areas have less nutritional diets and experience worse health outcomes compared with those not living in food deserts. Though the ramifications of living in food deserts are well known, less is known about efforts to alleviate these effects. One proposal for increasing food access while improving nutrition is the farmers market. While the farmers market has been championed as a potential solution and celebrated when it succeeds, little work has explored how often farmers markets are in food deserts nationally. This article explores this by using data from the United States Department of Agriculture and the American Community Survey. Results suggest that though much praise is given toward the promise of farmers markets in food deserts they are infrequently found there. This research contributes to illuminating the present state of US food deserts and proposes several questions about the efficacy of farmers markets as a tool to alleviate the impacts within food deserts.

KEYWORDS

Farmers markets; food deserts; inequality; food systems

Introduction

Thelma Coleman's excitement leaps off the page as she discusses the farmers market she attended on the White Earth Reservation. Reflecting on the market's utility, Coleman states, "It's the best place for fresh stuff" (Olson 2013). Additionally, the seventy-seven-year-old great-great grandmother notes that the market provides a nostalgic reminder of her own garden as a child while facilitating purchases of items not typically available in her area (Olson 2013). Echoing the literature on the social and nutritional effects of food deserts (for example, Schafft, Jensen, and Hinrichs 2009; Cannuscio, Weiss, and Asch 2010; Whitley 2013), Coleman notes that the market, located in what the USDA considers a food desert, diversifies her food options while providing relief from the food she consumes on non-market days, which often includes preparation in a deep fryer (Olson 2013).

Coleman's remarks about a lack of access to healthy or well-priced food within a food desert reflect an increasingly common situation (for example, Jetter and Cassidy 2006; Hendrickson, Smith, and Eikenberry 2006; Weatherspoon et al. 2013). However, instead of seeking a fix to these issues within the conventional food system, the farmers

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market has increasingly been suggested as the solution. Like the White Earth Farmers Market, many other farmers markets across the United States have experienced success recently when being located in a food desert. Newspaper stories in Los Angeles, Birmingham, Chicago, New York City, and Baltimore have highlighted the inclusion of farmers markets as a tool to battle obesity, the lack of fresh food access, and, in some cases, the economic disparity seen in areas labeled food deserts (Blackmore 2013; Bornstein 2012; Chen 2013; Todd 2012; White 2012).

The desire to include a farmers market in a food desert is understandable given what research has shown to be the effect of each. Research has consistently found that those who shop at farmers markets shop there because of the perception of higher-quality food when compared with other food outlets (Kezis et al. 1998; Jekanowski, Williams, and Schiek 2000; Colasanti, Conner, and Smalley 2010). Wolf, Spittler, and Ahern (2005) found that a significant motivating factor for shopping at farmers markets is for perceived increase of access to healthier and more nutritional foods. Additionally, an extensive body of research on food deserts provides evidence that individuals living in food deserts have diets that are less nutritional and have much worse health outcomes compared with those who do not live in food deserts (Schafft, Jensen, and Hinrichs 2009; Cannuscio, Weiss, and Asch 2010; Whitley 2013).

While the promise of the farmers market in food deserts has been championed, many unanswered questions remain. Though farmers markets have been shown to bolster access to healthier foods, and individual success stories of farmers markets in food deserts have created optimism, we do not know how often this occurs across the United States. In particular, little attention has been given to the proportion of food deserts that have farmers markets or the proportion of farmers markets that are in food deserts nationally. This article examines these two questions.

To do this, the article first reviews the previous scholarship on farmers markets and food deserts, highlighting the research on the trajectory of both of these social phenomena in the United States. Second, the article analyzes data from the USDA and the American Community Survey (ACS) to examine contemporary crossover between farmers markets and food deserts. Results suggest that although much praise is given to the promise of farmers markets to alleviate the ills of food deserts, in practice there is little overlap between the two. Thus, several questions remain concerning food accessibility for those located in food deserts.

Farmers markets in the United States

According to the USDA's Agricultural Marketing Service (2017) farmers market directory, in 2016 there were 8,669 farmers markets—up from 4,385 in 2006 and 2,410 in 1996. Much of this growth has been attributed to the benefits that farmers markets are suggested to provide to consumers and sellers. Hinrichs (2000), and Lyson (2004) also contend that foods procured at farmers markets and overall participation at the markets themselves provide a more embedded, civically and democratically minded outcome for sellers and customers when compared with the conventional food system.

The role of the farmers market in the United States has dramatically shifted over time (Parsons 2006; Cole 2010; Neal 2013). Echoing longstanding European open-air markets, US farmers markets can be traced back to the frequent gathering of farmers

looking to trade and/or sell excess food in town squares. Emerging in Boston and Philadelphia in the seventeenth century, these markets were popular and well attended (Neal 2013). Cole (2010) and Parsons (2006) note that significant demand from consumers kept these markets quite popular until the end of World War II.

The farmers market quickly fell out of favor with the increasing industrialization (and urbanization) that followed World War II. Consumers slowly grew tired of the goods available at farmers markets, especially the meager wares available during the off-season, and began looking beyond their immediate geographic boundaries (Brown 2001). Fruit from California and Florida became a staple on the tables of families all over the United States, regardless of the time of year, thanks to the nascent and rapidly expanding supermarket (Hamilton 2003; Ruhlman 2017). These emerging national food distribution lines made it more difficult for local-only farmers to compete with the farmers joining the increasingly commercialized and nationalized farmscape. Scant official records were kept—perhaps reflecting the lack of interest in them—but a couple of accounts suggest there were as few as 100 to 600 farmers markets between the late 1940s and early 1970s in the United States (Brown 2001).

Many attribute the re-emergence of the farmers market to the consumer, but evidence suggests that it was actually farmers who restarted the trend in the early 1970s (Brown 2001). Lobao and Meyer (2001) note that farmers increasingly began to find themselves on the losing end of the profits created from booming technological advances in agriculture during the late 1960s and early 1970s. These farmers began to utilize direct marketing as a tactic to recapture lost profits. Allaire and Sylvander (1997) note this marked a shift in production logic embedded in mass production to one that focused on quality to attract a niche consumer base. Farmers were met by an expanding consumer base, such as gourmet chefs, who had rekindled a curiosity in foods grown locally, and regionally further contributed to farmers markets becoming an emerging form of agriculture (Parsons 2006).

The US government, seeing the boom of farmers markets since the 1970s, charged the USDA's Agricultural Marketing Service (AMS) with looking into the phenomenon in 1994. The outcome was a new branch of the AMS, the Wholesale and Alternative Markets Program, which was tasked with searching out and quantifying the number of farmers markets in operation in the United States (USDA AMS 2017). Soon after academics followed suit and began to research farmers markets more noticeably. Arguably the most studied facet of the market is the individuals who visit the market and the motivations that cause them to attend (Kezis et al. 1998; Jekanowski, Williams, and Schiek 2000; Zepeda and Li 2006; Zepeda 2009; Colasanti, Conner, and Smalley 2010; Schupp 2016). Also receiving attention is research examining the space that the farmers markets occupy and the effect that they have on the surrounding community (Holloway and Kneafsey 2000; Gerbasi 2006; Gillespie et al. 2007). Consistently this research has found that farmers markets tend to cluster in neighborhoods populated by those with higher than average socioeconomic status and education levels, and predominantly white populations, when compared with the United States as a whole (Kezis et al. 1998; Schupp 2016).

Food deserts in the United States

White flight from inner-city metropolitan areas to the suburbs contributed greatly to the emergence of the food desert in the United States because grocery stores followed en masse shortly after (Pothukuchi 2005). While the suburbs enjoyed the enlarging presence of large-footprint grocery stores, The U.S. House Select Committee on Hunger (1987) found that from the 1960s to the mid-1980s there was a 90 percent reduction of supermarkets in low-income areas. As a result, fewer stores were located in urban areas, particularly low-income areas, areas with high proportions of racial and ethnic minorities, and areas with more overweight and/or obese individuals (Chung and Myers 1999; Blanchard et al. 2003; Guy, Clarke, and Eyre 2004; Gordon et al. 2011). Low-income areas were hit especially hard because grocery stores had pushed out many of the other food-purchasing options, including independent food markets, prior to departing (Leland 1987). Now known as food deserts, these food-poor areas were filled by fringe food retailers, such as "gas stations, liquor stores, party stores, dollar stores, bakeries, pharmacies, [and] convenience stores" (Gallagher 2007; quoted in Weatherspoon et al. 2013).

Using data from 2010, Ver Ploeg et al. (2012) estimates that upwards of 30 million (or 1 in 10) people in the United States live in food deserts. The literature considers food deserts as a form of spatial inequality in society that disproportionately affects low-income and racial and ethnic minority populations and that often acts as a form of redlining (Schafft, Jensen, and Hinrichs 2009; Gordon et al. 2011; Whitley 2013). Studies have also found that prices for food are often higher in food deserts and that availability of quality food is low in food deserts (Hendrickson, Smith, and Eikenberry 2006; Jetter and Cassady 2006; Weatherspoon et al. 2013). Dietz (1995) points out what is a seemingly paradoxical effect for those living in food deserts in the United States: inhabitants with limited access to grocery stores often also suffer from high rates of obesity.

Also important to recognize is the healthy debate in the literature regarding the term "food desert" itself. Some scholars contend that the creation of areas known as food deserts suffer from measurement issues, such as being created from county-level data that are too broad to effectively capture what is going on and may not accurately reflect one's access to food (Bodor et al. 2008; Shannon 2014). Other scholars critique the utilization of "food deserts" as a tool that outsiders, such as politicians and non-profit groups, can attempt to address without actually creating substantial change (Alkon et al. 2013). Further, some work has suggested that "food desert" as a term is demeaning because it does not reflect what is actually occurring in these areas and that the term "food swamp"—a deluge of highly processed, minimally nutritious packaged food available—would be more effective (Caspi et al. 2012).[1]

The promise of farmers markets in food deserts?

Given what the farmers market has been perceived to offer participants and the experience of individuals in food deserts, much has been made of the promise of the farmers market in food deserts (Manning 2010; Boos 2012; McCracken, Sage, and Sage 2012; Todd 2012; Blackmore 2013; Richner 2012; White 2012; Blackmore 2013; Chen 2013). This promise has hinged on the farmers market's suggested improvement of many social, economic, and cultural ills in the conventional food system. Previous literature highlights benefits: for customers, in terms of higher quality, fresher, and healthier food (Kezis et al. 1998; Jekanowski, Williams, and Schiek

2000; Colasanti, Conner, and Smalley 2010); for vendors, who can engage in more innovative marketing practices; and for the broader community as farmers markets become the keystones of their community for food procurement but also social and cultural engagement (Gillespie et al. 2007; Lyson 2004).

Whereas the farmers market has been shown to provide benefits, other works have suggested that this occurs unevenly across multiple variables. Scholars have found that farmers markets are more often located in areas with higher than average socioeconomic status and proportion of white residents (Kezis et al. 1998; Slocum 2007; Zepeda 2009), which is significantly different than those that have been found to live in food deserts (Chung and Myers 1999; Blanchard et al. 2003; Guy, Clarke, and Eyre 2004; Gordon et al. 2011). Work by Slocum (2007) and Alkon et al. (2013) furthers the critique of farmers markets by noting the potential of whiteness acting as normality, thus potentially excluding people, practices, and cultures that are not white.

The popular press has frequently spotlighted and highlighted the proposed benefits of farmers markets to alleviate the negative effects felt by those in food deserts. These reports contend that farmers markets will increase access to healthy foods in food deserts. Richner (2012) writes that farmers markets, as an alternative to absent conventional grocery stores, "directly [inject fresh] and healthy foods into areas saturated with fast food restaurants" (p. 2). Todd (2012) reported on Chicago Mayor Rahm Emanuel's commitment to multiplying the number of farmers markets in food deserts to expand and develop food-purchasing options while increasing nutrition. Blackmore (2013), writing in Los Angeles, documented the use of grants by several food advocacy groups to start farmers markets in areas long known as food deserts, such as Inglewood and Compton. Similarly, White (2012) detailed the incipient use of mobile farmers markets in Baltimore as a way to alleviate the lack of healthy food options for those in food deserts. Chen (2013) outlined the efforts of REV Birmingham to bring farmers markets to the roughly 40 percent of residents who live in food deserts in Alabama.

A few academic studies have examined the presence of farmers markets in food deserts and resulting outcomes. Manning (2010) found that "the size of food deserts shrinks during the months when farmers markets are active and produce is available" (p. 1). Boos (2012) found that food desert inhabitants increased their purchases of healthy food when a farmers market was in session. McCracken, Sage, and Sage (2012) found that access to healthy foods did increase with farmers markets—though there were unique barriers within rural areas when compared with urban areas.

While the optimism of these stories and findings in a few academic studies contribute to a popular opinion that farmers markets can alleviate the effects of food deserts, there are still gaps in our knowledge about this. These accounts and studies have focused on one farmers market and/or the promise of what farmers markets could do for food deserts. In sum, the literature review suggests that there is a persistent belief that farmers markets can alleviate the ills felt in food deserts; however, a systematic understanding of how often this occurs has thus far been elusive. This is important to look into because other studies on farmers markets and food deserts suggests that we should not expect significant overlap between the two, even though the former is suggested to alleviate the latter. Examining the prevalence of farmers markets in food deserts will help to fill in these gaps.

Data and methods

The goal of the analysis was to explore the proportion of food deserts that have farmers markets and the proportion of farmers markets that are in food deserts nationally. Several different data sources were amalgamated for analysis. The primary source for the independent variables was the American Community Survey (ACS). The data used were from the 2006–2010 five-year estimates at the census tract level (n = 73,057). The second data source was the USDA AMS 2012 list of farmers markets in the US (n = 6,249). These data were limited because the list was self-reported by farmers market managers, thus numerous issues appeared, such as duplicate entries, those that could not be located on the map, and inactive markets. Thus, the list was inspected for accuracy and any problematic markets were removed from the list and inaccurate addresses were corrected. In total, this resulted in 5,260 famers' markets across the United States. Lastly, the 2015 Food Desert Locator dataset, from the USDA Economic Research Service (ERS), was used to identify census tracts that are food deserts (n = 8,959).

ArcGIS, a mapping and spatial analysis software (Esri, Redlands, CA, USA), was used to amalgamate these data sources and root each of the variables into their correct census tract. Finally, the data were exported into STATA 14.2 (StataCorp, College Station, TX, USA) for statistical analysis.

Measurement

A dichotomous dependent variable was constructed to denote food desert tracts in the United States. The variable was created using the same criteria implemented by the USDA ERS, specifically that the tract was considered low income and low access to large food outlets. As noted in the literature review, there is a critique toward the effectiveness and usage of food deserts in research; however, this study utilizes this conceptualization, regarding it as one viable aspect with which to examine access to healthy food. To be able to create these tracts the first step was to categorize tracts by their rural and urban status, where tracts with less than 2,500 inhabitants were coded as rural, and all tracts with 2,500 or more inhabitants were coded as urban. Second, the socioeconomic status of a tract was taken into consideration; a census tract was considered to be low income if the "poverty rate [of inhabitants was] 20 percent or more, or a median family income [was] less than 80 percent of the statewide median family income; or a tract in a metropolitan area [had] a median family income less than 80 percent of the surrounding metropolitan area median family income" (USDA ERS 2013). Lastly, each tract was distinguished by how far inhabitants had to travel to reach a supermarket, supercenter, or grocery store: A tract was considered low access if more than 500 people in a tract or at least 33 percent of the total tract had to travel more than one mile (ten miles for rural tracts) to access a supermarket. A tract was considered to be a food desert if it was coded both low income and low access. In total, 8,959 (12.3%) census tracts in the United States were coded as food deserts.

A dichotomous independent variable was created to capture a tract's farmers market status. An area was considered a farmersmarket tract if there was a market within one mile of its boundaries. One mile was selected because this has been shown in previous studies to be an upper boundary of the distance that individuals are willing to travel to

access a particular food outlet, and as a way to conceptualize neighborhood dynamics that do not easily begin and end at census tract boundaries. Overall, 22,665 census tracts (31.31%) were found to be within one mile of a farmers market.

In addition to the primary variables of interest, four categories of independent variables were created.

Individual–level demographics

A variable that measures race and ethnicity was included since the literature on farmers markets and food deserts both note its importance (Slocum 2007; Walker, Keane, and Burke 2010). Originating from the ACS, an interval variable that reflects the proportion of white individuals living in a tract, ranging from 0.00 to 1.00, was constructed. To create the proportion, the number of respondents who identified as "white only" was divided by the total number of inhabitants living in a census tract.

Geography

There was an interest in examining where both farmers markets and food deserts are located geographically in the United States. Three topographic measurements were included. First, farmers markets and food deserts were coded by which US state they inhabit. Second, both were categorized by which US census regional division they inhabit to measure farmers markets by regions of the United States. Lastly, the ERS rural–urban commuting area (RUCA) codes were used to measure farmers markets and food deserts in relation to their population density, level of urbanization, and daily commuting.

Socioeconomic status

Since the literature has devoted extensive attention to the relationship between socio-economic status and both farmers markets and food deserts (Ver Ploeg et al. 2012; Walker, Keane, and Burke 2010; Zepeda and Li 2006), multiple variables that measure this phenomenon were included in this analysis, such as median household income, average education level, median home value, and median rent. Median household income was an interval variable that measured a census tract's median household income over the past twelve months. Education level was an ordinal scale variable that measured educational attainment for those twenty-five years or older in a tract where individuals with less than a high school diploma were coded 1, high school graduates were coded 2, those with some college were coded 3, and college graduates and beyond were coded 4. The average education level was created by summing all of the individual scores and dividing by the population in a given tract. Median home value was an interval variable, top coded at $1,000,001. Lastly, an interval variable of median rent of a tract, top coded at $2001, was included.

Neighborhood-level demographics

Five variables that reflected several prominent characteristics of the census tracts were included. First, an interval variable that measured participation in social support

programs was created from participation rates in supplemental security income and public assistance provided by the government.[2] Cronbach alpha reliability tests (alpha = 0.65) and principal component factor analysis (eigenvalue = 1.48) confirmed the suitability to combine the two into a single latent variable. Collectively these variables constitute a measurement of participation rates programs, such as Temporary Assistance for Needy Families (TANF), that provide income assistance to those in need. Second, three poverty-status variables were included based on responses to several income-related questions in the ACS. Reflecting the same scheme as the ACS, these interval-level variables used in the analysis have three distinct summary categories (doing okay, struggling, doing poorly) that reflect the proportion of families in a tract that belong to each respective category.[3] Lastly, an interval variable of the number of empty houses in a neighborhood was included by dividing the number of empty homes by the total number of homes in a tract. A residence was considered to be empty if it was abandoned and not for sale or rent.

Results

Two forms of analysis were performed to explore the relationship between farmers markets and food deserts. First, descriptive statistics were calculated to examine the characteristics of each. Results of these are located in Tables 1–3 and Figures 1–4. Second, a logistic regression model predicting the likelihood of a neighborhood being a food desert was created to predict the effect of multiple independent variables, including farmers markets. This type of analysis was completed because while the effects of living in a food desert are fairly well known, much less is known about how individual- and neighborhood-level characteristics contribute to the likelihood of an area being a food desert. Results from this analysis are located in Table 4.

Descriptive statistics

Table 1 summarizes the descriptive statistics for each of the neighborhood types included in the analysis.[4] In addition, the United States as a whole was included. The results allow one to compare and contrast these neighborhoods based on several demographics. Multiple trends emerge. First, food desert neighborhoods are more diverse in terms of racial and ethnic composition when compared with both farmers market neighborhoods and the United States as a whole. Within food deserts, neighborhoods that do not have farmers markets are more racially and ethnically diverse when compared with those that do have farmers markets. Across US census regional divisions, farmers markets are more prominent in the New England and Mid-Atlantic divisions, while they are less prominent in the South Atlantic, East South Central, and West South Central divisions. In comparison with the national average, food deserts are more pronounced in the East South Central and West South Central divisions, and there are far fewer in the Mid-Atlantic, New England, and Pacific divisions.

Results from the socioeconomic status variables also show several differences between neighborhoods that are solely farmers markets or food deserts and across food deserts based on if they have or do not have a farmers market. Table 1 shows that farmers markets neighborhoods are mostly higher than the US average on the

Table 1. Descriptive statistics of farmers market and food desert neighborhoods.

Independent variable	US median/# of tracts	Farmers market tract[#]	Non-farmers market tract	Food desert tract	Non-food desert tract	Farmers market in food desert	No farmers market in food desert
United States	72,378	22,665	49,713	9,238	63,140	2,528	6,710
Individual demographic level							
Proportion white (%)	0.648	0.630	0.656	0.551	0.662	0.612	0.529
Proportion black (%)	0.133	0.139	0.131	0.221	0.121	0.197	0.230
Proportion minority (%)	0.352	0.370	0.344	0.449	0.338	0.388	0.471
Geography:							
United States	72,378	0.313	0.687	0.127	0.873	0.274	0.726
Pacific	10,755	0.392	0.608	0.082	0.918	0.274	0.726
Mountain	5,220	0.270	0.730	0.150	0.850	0.136	0.864
South Atlantic	13,525	0.206	0.794	0.154	0.846	0.214	0.786
East South Central	4,424	0.239	0.761	0.192	0.808	0.276	0.724
West South Central	8,079	0.147	0.853	0.200	0.800	0.166	0.834
East North Central	11,705	0.354	0.646	0.120	0.880	0.371	0.629
West North Central	5,263	0.351	0.649	0.143	0.857	0.360	0.640
New England	3,359	0.544	0.456	0.077	0.923	0.565	0.435
Mid-Atlantic	10,048	0.417	0.583	0.051	0.949	0.368	0.632
Socioeconomic status							
Median household income	54,864	53,846	56,078	37,132	57,607	35,691	37,714
Median house value	234,202	277,840	217,506	125,608	250,693	133,182	122,886
Average education rate	2.66	2.72	2.64	2.39	2.70	2.45	2.37
Median rent	882.29	907.02	883.06	710.88	909.87	692.12	718.68
Neighborhood-level demographics							
Public assistance rate (%)	0.043	0.049	0.041	0.060	0.041	0.063	0.059
SSI rate (%)	0.027	0.032	0.024	0.036	0.026	0.039	0.035
Doing okay (%)	0.666	0.645	0.676	0.522	0.687	0.512	0.525
Struggling (%)	0.186	0.186	0.186	0.250	0.176	0.242	0.242
Doing poorly (%)	0.148	0.169	0.138	0.228	0.136	0.245	0.222
Empty houses	0.079	0.073	0.081	0.102	0.075	0.089	0.107

Table 2. Crosstab of farmers markets within a mile and food deserts at census tract level.

Farmers market within a mile of census tract?	Food desert at census tract level? No	Food desert at census tract level? Yes	Total
No	43,003 (86.5%/68.1%)	6,710 (13.5%/72.6%)	49,713 (100%/68.69%)
Yes	22,137 (88.9%/31.9%)	2,528 (11.15%/27.4%)	22,665 (100%/31.3%)
Total	63,140 (87.2%/100%)	9,238 (12.8%/100%)	72,378 (100%/100%)

Note: Percentages are row/column.

Table 3. Number and percentage of farmers markets within a mile of a food desert, by state.

State	Total # of food deserts	Farmers market in the food desert? Yes	% of total	State	Total # of food deserts	Farmers market in the food desert? Yes	% of total
Alabama	246	72	29.3	Montana	41	10	24.4
Alaska	34	7	20.6	Nebraska	51	17	33.3
Arizona	257	46	17.9	Nevada	58	7	12.1
Arkansas	177	64	36.2	New Hampshire	44	25	56.8
California	541	144	26.6	New Jersey	106	32	30.2
Colorado	180	48	26.7	New Mexico	135	38	28.1
Connecticut	70	39	55.7	New York	181	89	49.2
DC	6	3	50.0	North Carolina	368	112	30.4
Delaware	27	5	18.5	North Dakota	17	4	23.5
Florida	582	76	13.1	Ohio	447	130	29.1
Georgia	444	59	13.3	Oklahoma	197	46	23.4
Hawaii	34	15	44.1	Oregon	103	40	38.8
Idaho	42	23	54.8	Pennsylvania	224	67	29.9
Illinois	268	100	37.3	Rhode Island	11	9	81.8
Indiana	220	79	35.9	South Carolina	221	74	33.5
Iowa	96	65	67.7	South Dakota	35	5	14.3
Kansas	138	58	42.0	Tennessee	269	64	23.8
Kentucky	130	55	42.3	Texas	1041	132	12.7
Louisiana	249	34	13.7	Utah	58	13	22.4
Maine	31	14	45.2	Vermont	9	6	66.7
Maryland	112	13	11.6	Virginia	281	85	30.2
Massachusetts	97	55	56.7	Washington	179	38	21.2
Michigan	333	138	41.4	West Virginia	63	23	36.5
Minnesota	172	55	32.0	Wisconsin	142	76	53.5
Mississippi	207	44	21.3	Wyoming	17	7	41.2
Missouri	247	68	27.5	Total	9,238	2,528	33.8

socioeconomic status measurements, whereas food desert neighborhoods are lower.[5] Figure 1 combines all the socioeconomic status variables into one latent variable (mean = 0, standard deviation = 1) based on results from Cronbach alpha reliability tests (alpha = 0.88) and principal component factor analysis (eigenvalue = 3.41). This latent variable shows that farmers markets are more likely to be found in areas with positive scores, meaning higher levels of socioeconomic status, whereas food deserts are predominantly located in areas with negative scores.

In looking at neighborhood-level demographics, Table 1 shows that areas with farmers markets neighborhoods closely mirror the US rates in relation to all of the measurements. Contrastingly, food desert neighborhoods are shown to have notably higher rates of public assistance and SSI usage, and also higher rates of those struggling and doing poorly.

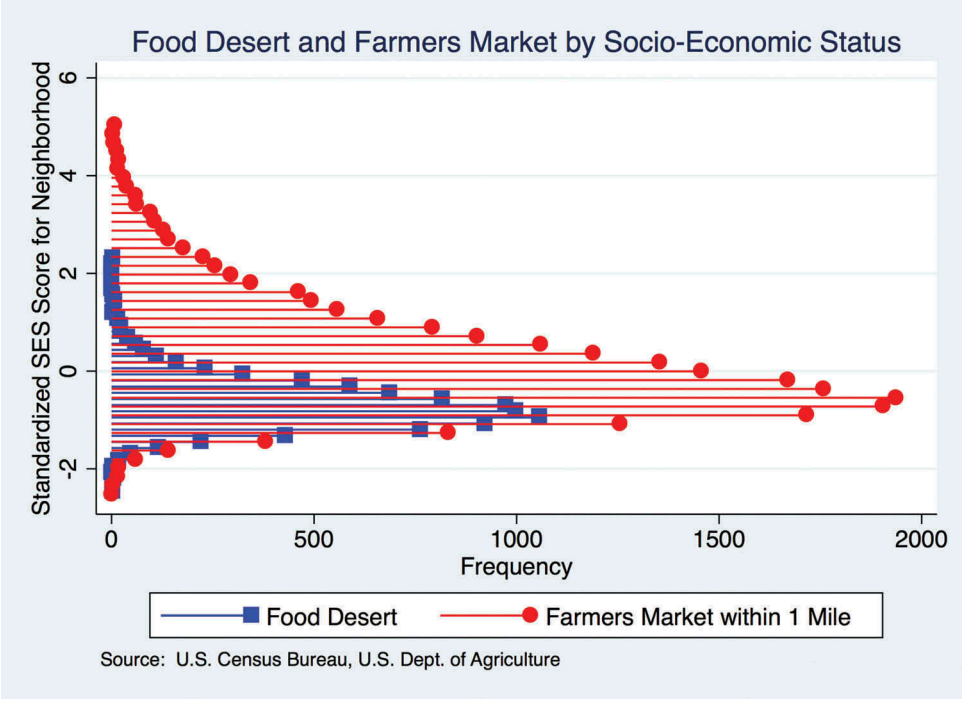

Figure 1. Location of US food deserts and farmers markets by socioeconomic status.

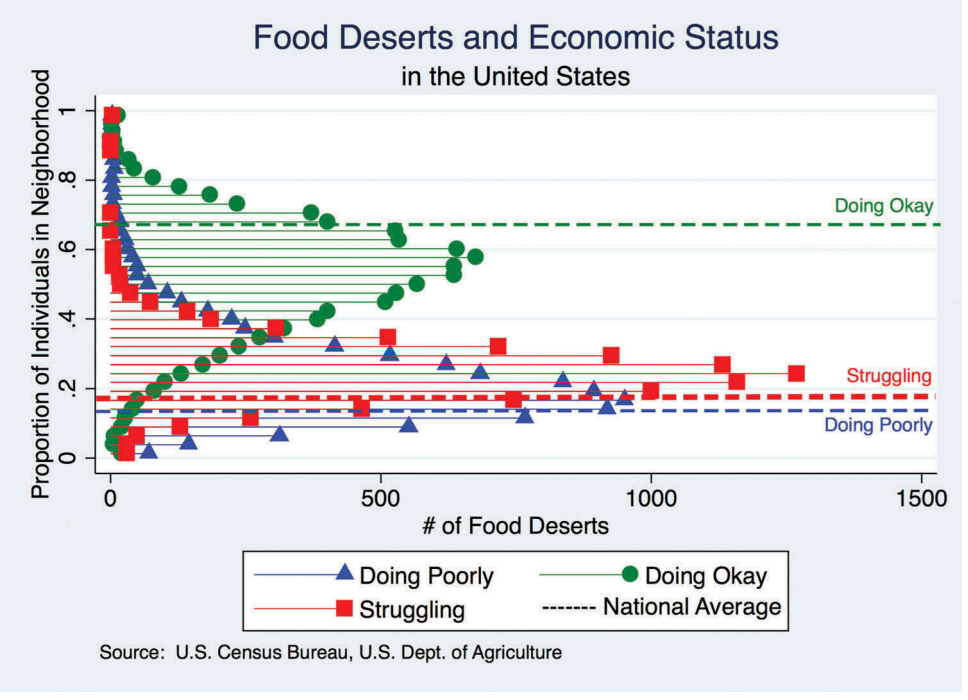

Figure 2. Location of US food deserts by economic status.

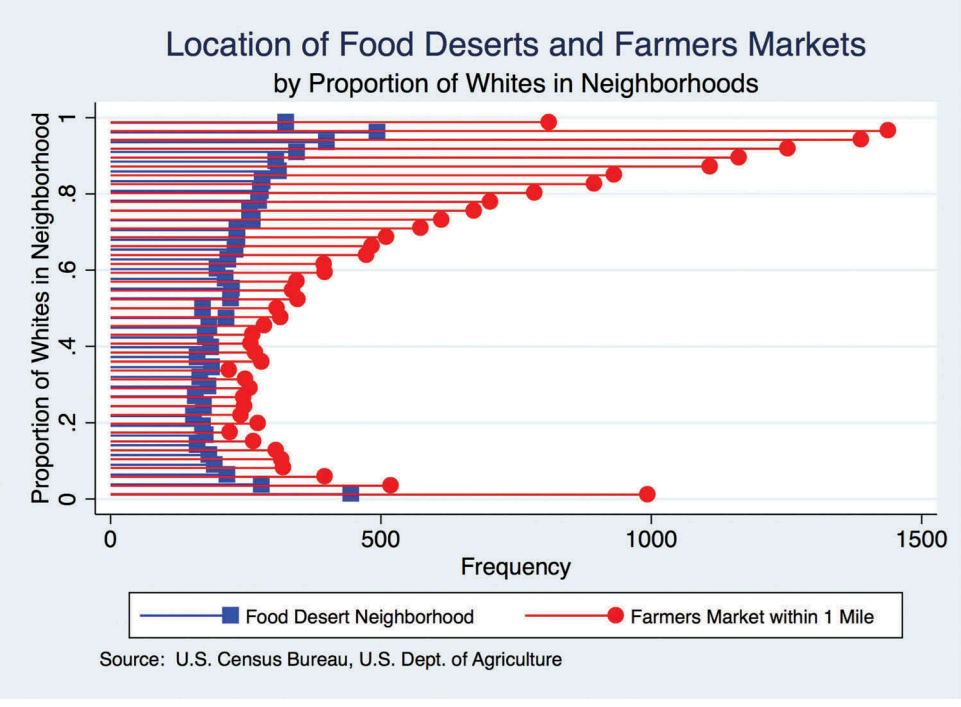

Figure 3. Location of US food deserts and farmers markets by proportion white.

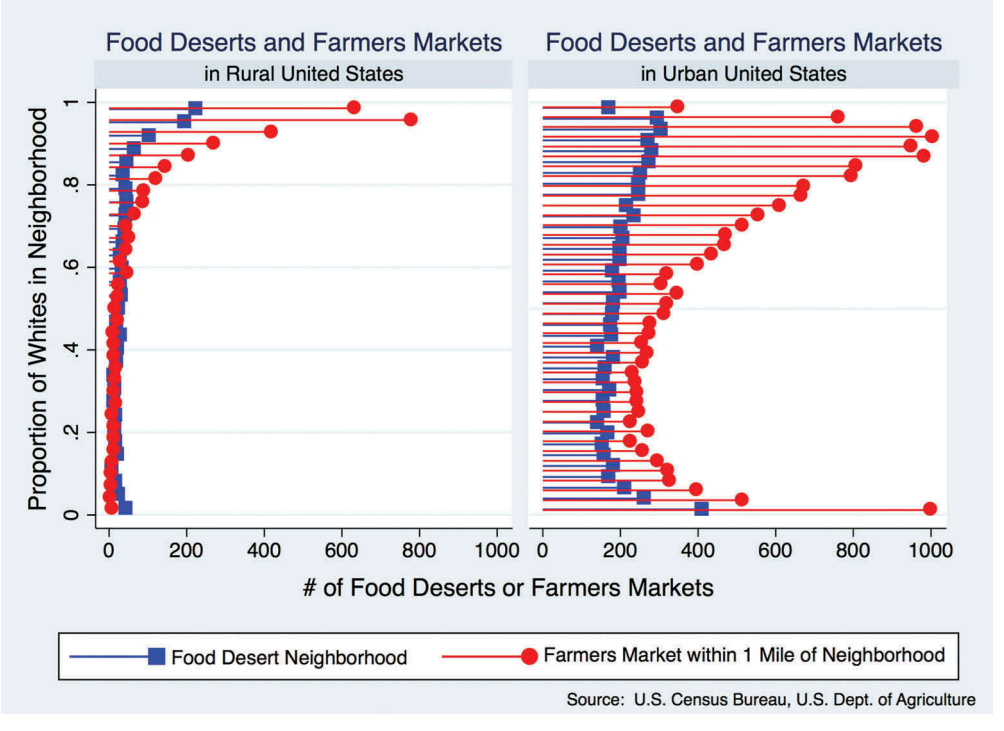

Figure 4. Food deserts and farmers markets in urban and rural location by proportion of whites in neighborhood.

Table 4. Logistic regression model for the likelihood of a neighborhood being a food desert.

Factor	Model 1	Model 2
Farmers market		
Farmers market within 1 mile	0.88***	0.86***
Individual demographic level		
Proportion white	0.97	0.71***
Proportion white squared		0.70***
Geography—US region		
South	1.40***	1.20***
West	1.52***	1.30***
Socioeconomic status		
Socioeconomic status	0.33***	0.32***
Neighborhood-level demographics		
Social support	0.85***	1.13***
Social support squared		0.90***
Struggling[#]	1.26***	1.21***
Doing poorly[#]	1.26***	1.23***
Empty houses	1.92***	2.69***
Hosmer and Lemeshow/Pearson chi-squared score	415.24	421.90
n	72,226	72,221

Note: p-value: *< 0.05, **< 0.01, ***< 0.001; [#] reference group doing okay; all models present odds ratio.

Several graphs were created to depict several trends seen in Table 1 (see Figures 2–4). Figure 2 shows the location of food deserts across the three measurements of economic standing, with the dashed lines representing the national average for each type of standing. The graph confirms what previous literature has noted about the individuals located in food deserts. Individuals residing in food deserts were found to be more likely to be doing poorly (22.8%) or struggling (25.0%) and less likely to be doing okay (52.2%) when compared with US rates. Thus, the analysis suggests that food deserts are more likely to have residents experiencing tough economic circumstances when compared with average farmers market neighborhoods that mirror US rates.

The difference between farmers markets and food deserts continues when considering race and ethnicity. Figure 3 shows dispersion of both food deserts and farmers markets across the proportion of whites located in a given tract, where farmers markets are much more likely to emerge as the proportion of whites increases. In comparison, a U-shape distribution emerges when looking at food deserts, where a large proportion of food deserts are located in areas with very large or very small white populations. Given this result, the graph in Figure 4 was created to look at the racial/ethnic dispersion while also considering location on the rural-to-urban continuum. The graph shows a continued prominence of farmers markets in highly white areas. An interesting difference emerges when looking at the presence of farmers markets in neighborhoods with no white people. In rural areas there are very few markets, but in urban areas there are over 1,000.

Tables 2 and 3 reveal how often farmers markets and food deserts overlap. Table 2 shows that of the 9,238 census tracts that are food deserts, 6,710 tracts (72.6%) do not have a farmers market within a mile and 2,528 (27.4%) do, which is lower than the national average (31.3%). Table 3 looks at the crossover of farmers markets and food deserts within each US state. Maryland (11.6%), Nevada (12.1%), Texas (12.7%), Florida (13.1%), and Georgia (13.3%) all have appreciably lower proportions of farmers markets within a mile of food deserts when compared with the mean (33.9%). States such as

Rhode Island (81.8%), Iowa (67.7%), Vermont (67.7%), New Hampshire (56.8%), and Massachusetts (56.7%) all have high proportions of farmers markets within a mile of a food desert.

Given the results of the bivariate analysis, two logistic regression models were created to see how these variables interact with one another concurrently. To assuage issues of high correlation, three variables were standardized (mean = 0, standard deviation = 1): families doing poorly, families struggling, and proportion of whites in a census tract. The results of the logistic regression analysis are found in Table 4 and are presented in odds ratios to aid interpretation.[6]

Model 1 predicts that several variables significantly increase or decrease the likelihood of a neighborhood being a food desert. Consistent with the literature, increasing proportions of families struggling financially, doing poorly financially, and the number of empty houses significantly increase the likelihood of a neighborhood being a food desert. In terms of geography, being located in the West or South was found to significantly increase the likelihood of a neighborhood being a food desert, when the New England division was used as a reference category. Of particular interest to this study, both increasing socioeconomic status levels, measured by a latent variable that comprised income levels, home values, levels of education, and rent prices, and being located within a mile of a farmers market was found to significantly decrease the likelihood of a neighborhood being a food desert.

There were two surprising findings in model 1, which led to a second model being constructed. Given the results of the bivariate analysis and the literature's extensive discussion of white flight as contributing to the creation of food deserts, it was surprising that increasing levels of whites in a neighborhood were not found to significantly decrease the likelihood of a neighborhood being a food desert. Second, increasing levels of participation in social support programs were found to significantly decrease the likelihood of a neighborhood being a food desert. Given the presumed positive relationship between food deserts and social support utilization, it was not expected that the results would significantly decrease the likelihood.

Since the literature and the earlier bivariate analysis suggested an opposite relationship for the proportion white and social support participation, a quadratic term for both variables was included in the logistic regression (see model 2).[7,8] Both of the quadratic terms were found to be significant, suggesting a curvilinear relationship for each. In line with the previous literature and findings from the bivariate analysis, model 2 predicts that as the proportion of whites increases the likelihood of a neighborhood being a food desert decreases at a statistically significant rate and the quadratic term predicts that the likelihood of this decrease gets larger as the proportion of whites increases.[9] On the other hand, the results for the proportion of participation in social support suggest that initially increasing rates of social support participation increasing the likelihood of an area being a food desert, but as the social support increases the likelihood of an area being a food desert decreases. Predictions for the rest of the variables included in model 2 remained consistent when compared with model 1, including that the presence of a farmers market significantly decreased the likelihood of a tract being a food desert.

Discussion/conclusion

Interest in understanding and alleviating the effects of food deserts has increased in recent years. The literature has significantly expanded its understanding of how food deserts were created, and the negative effects felt by those within these areas. Additionally, an academic discourse, bolstered by numerous media accounts, suggests that farmers markets could be one of the best contemporary tactics to decrease the ills of food deserts. However, there has been a dearth of research that explores the efficacy of the farmers market to enter food desert neighborhoods. This study attempts to begin research in this area by examining how often farmers markets and food deserts overlap nationally. While this discourse remains prevalent in society, this study starts by examining the historical roots of farmers markets and food deserts, and then analyzes a cross-sectional dataset that shows the contemporary crossover between farmers markets and food deserts. Little evidence exists in the literature to suggest that farmers markets have been a prominent avenue for alleviating the negative effects of food deserts historically. Additionally, the data analyses presented here suggest that the two phenomena infrequently overlap today.

The bivariate analysis shows several interesting themes regarding the characteristics of food deserts and the prevalence of farmers markets within them. Consistent with previous literature, the analysis found that food desert areas have considerably higher minority populations, more households struggling economically, higher participation rates in social support programs, and lower socioeconomic standing when compared with farmers market areas (see Table 1). Multivariate analysis also suggests that farmers markets are unlikely to be in food deserts, even after controlling for multiple other factors. Perhaps the most troubling information pertaining to the efficacy of farmers markets in food deserts is found in examining demographics of food deserts themselves (see Table 1). Table 1 shows that when a farmers market *is* located in a food desert, they often follow the same path seen in the United States generally: though still a food desert, the area has an increased likelihood of being a tract with higher than average socio-economic status and a higher than average proportion of whites.

Can farmers markets help alleviate the negative effects of food deserts? What makes this question interesting is that there seems to be a disconnect between the literature and media accounts that promote farmers markets as an effective tool to increase food access in food deserts', and the findings presented here that suggest a limited prevalence of farmers markets in food deserts. Although there is promise in farmers markets, the empirical analysis here does not offer much evidence that the goals of the movement are being met prominently.

There is one finding in the analysis that may provide a possible silver lining. Given that the effect of social support usage decreases as proportions increase (see the quadratic term in model 2 of Table 4) and the presence of farmers markets also decreases, one is left wondering if we are watching the onset of farmers markets moving into neighborhoods that they have not traditionally occupied. One possible reason for seeing these relationships in this way may be because farmers markets' have only recently begun targeting food desert neighborhoods.[10] Instead of ignoring these areas, the limited presence of farmers markets in food deserts could be a conscious attempt by farmers market actors to slowly, but effectively, move into food desert neighborhoods.

The results of the social support variables could point out that farmers market actors may be in the process of developing effective frames of resonance (Benford and Snow 2000) within food deserts while building, or taking advantage of, political/cultural opportunities in society (McAdam 1982) to lead to improved movement success. Giugni (1998) notes that the social movement literature has seen this occurring in a diversity of movements that enjoyed successes, such as the civil rights movement, the women's suffrage movement, the pro-environmental movement, and the anti-nuclear movement. This literature has noted that these successes in part have been emerging from movement actors purposely and strategically picking sites of activity to maximize the impact of the movement, which in the case analyzed here would be areas with the highest level of social support. Future research looking into if and how these frames are being built could be a fruitful area of research.

The inability to examine data longitudinally points out a limitation of the study. While the cross-sectional data do begin to explore the overlap between farmers markets and food deserts, they are limited because they cannot see what has occurred over time. One is left interested to know what the results would be if this were measured over time. In particular, as noted above, it could be that farmers markets are slowly and effectively moving into food deserts over time. Future research would do well to investigate this important question. Second, as noted by Shannon (2014) and Alkon et al. (2013), operationalizing areas that are food deserts and/or host farmers markets and the creation of GIS boundaries to analyze them is difficult to encapsulate given the complexity of these phenomena in relation to both their creation and analysis. This study should not be seen as the sole analysis on the intersection of farmers markets and food deserts but as adding to this body of work.

In conclusion, this study examined some demographic and neighborhood characteristics of food deserts while exploring the prevalence of farmers markets within their boundaries. The results suggest that farmers markets are not likely to be in food deserts, and when they are they tend to echo some of the same patterns that farmers markets have been found to demonstrate nationally when it comes to race and ethnicity and other forms of food distribution (Colasanti, Conner, and Smalley 2010; Sage and McCracken 2017). However, while farmers markets in food deserts do not appear to be occurring significantly at this time, this study does illuminate an important question to be answered in the future: has farmers market participation in food deserts been consistently low, or is the local food movement beginning to gain steam while it carefully selects sites for activity?

Notes

1. Despite the controversies and being mindful of these critiques, I believe that the term food desert still has analytical value toward examining access to healthy food.
2. Supplemental security income is also a form of public assistance; however, the ACS separates it into its own distinct variable.
3. Meaning that within a tract the sum of doing okay, struggling, and doing poorly totals 1.00.
4. The six types were farmers market neighborhood, non-farmers market neighborhood, food desert neighborhood, non-food desert neighborhood, food desert and farmers market neighborhood, and food desert without a farmers market neighborhood.

5. There is an exception to this where median income is lower in farmers market neighborhoods when compared with the US average.
6. An odds ratio lower than 1 suggests a decreasing likelihood of a neighborhood being a food desert, whereas an odds ratio greater than 1 predicts an increasing likelihood of a neighborhood being a food desert. The size of the odds ratio matters, where increasing odds ratios above 1 reflect a stronger likelihood of a neighborhood being a food desert (or vice versa for ratios less than 1).
7. Five tracts were dropped in the second model because their social support scores were significant outliers (more than five standard deviations from the mean of social support).
8. Quadratic terms are created by squaring a variable. They are included in regression to test linearity, specifically non-linearity, between an independent and dependent variable. The variable used to create quadratic terms predicts the general direction of the relationship between itself and the dependent variable, whereas the quadratic variable predicts any non-linearity to the relationship.
9. Odds in quadratic terms follow the same logic as singular variables, meaning that those with predictions of more than one have an increasing effect; whereas those with predictions of less than one have a decreasing effect. Since the singular proportion white effect predicts a decreasing effect, the quadratic term (somewhat counterintuitively) predicts the likelihood to continue to decrease, but at an increasing rate.
10. The model does not provide direct evidence of this. Equally as possible is that other forms of food distribution may be causing these predictions to occur.

Disclosure statement

No potential conflict of interest was reported by the author.

Notes on contributor

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