



## Can community gardens and farmers' markets relieve food desert problems? A study of Edmonton, Canada



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### ABSTRACT

This article integrates community gardens and farmers' markets into a spatial analysis of food deserts in the City of Edmonton, Canada. Our results show that community gardens and farmers' markets can improve fresh food accessibility and help relieve food desert problems to some extent, especially for mature, inner-suburban neighborhoods. However, based on the minimum road network distance and high need indicators, four neighborhoods throughout the city can still be considered as food deserts even after farmers' markets and community gardens are taken into consideration. Regression results reveal that community gardens tend to cluster with supermarkets, so that neighborhoods that have poor access to supermarkets also tend to have limited access to community gardens.

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### Introduction

Several recent studies have shown that obesity and other chronic diseases are rising (Chen, Rennie, & Dosman, 2009; Ismailov & Leatherdale, 2010; Janssen, 2013) and that lack of access to fresh vegetables, fruits and meats can exacerbate disease risks (Bruner, Lawson, Pickett, Boyce, & Janssen, 2008; Liese, Weis, Pluito, Smith, & Lawson, 2007; McPhail, Chapman, & Beagan, 2013; Morland, Diez Roux, & Wing, 2006). The term “food desert” has frequently been used to describe situations in which consumers lack access to affordable nutritious food, typically a populated low-income area with limited access to full-service supermarkets. USDA (2009) defines a food desert or “low-access community” as a census tract in which at least 500 people and/or at least 33% of the population reside more than one mile from a supermarket or large grocery store. Food deserts have been identified in both urban and rural areas of North America (Hubley, 2011; McEntee & Agyeman, 2010; Smoyer-Tomic, Spence, & Amrhein, 2006).

In addition to supermarkets and other grocery outlets as sources of fresh food, there is growing interest in the role of community gardens and farmers' markets as solutions to food desert problems (e.g., Larson, Story, & Nelson, 2009; McCormack, Laska, Larson, & Stoty 2010; Tong, Ren & Mack, 2011). A community garden is a plot of land that is gardened collectively by a group of people. It can

provide group members and other local residents with fresh vegetables and fruits. At the same time, it can contribute to development of healthier dietary patterns and thus potentially reduce health risks (Alaimo, Packnett, Miles, & Kruger, 2008; Armstrong, 2000; Corrigan, 2011; Guitart, Pickering, & Byrne, 2013; Jerme and Wakefield, 2013). Given these potential benefits, particularly in low-income areas, research has also explored the transformation of vacant urban plots into community gardens (Drake & Lawson, 2014).

A farmers' market is a physical retail market featuring foods sold directly by farmers to consumers. Farmers' markets typically consist of booths, tables, and stands, outdoors or indoors, where farmers sell fruits, vegetables, meats, and prepared foods and beverages. Introducing farmers' markets into neighborhoods can improve access to nutritious foods, especially for low-income shoppers (Larson & Gilliland, 2009) as products available at some farmers' markets are, on average, less expensive than the equivalent items available in nearby supermarkets (Leone et al., 2012). Jilcott, Keyserling, Crawford, McGuirt, and Ammerman (2011) and Payne et al. (2013) found that more farmers' markets and grocery stores/supermarkets per capita are associated with a lower prevalence of obesity. Intuitively, these farmers' markets and community gardens might be considered as potential options to address or provide relief for the food desert problem (Campbell, 2012; Guitart et al., 2013; Schmit, & Gomez, 2010). Despite the prominence of farmers' markets and community gardens, little research has been conducted to incorporate both, together with supermarkets, into food desert assessment and association analysis.

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**Table 1**  
Demographic and socio-economic characteristics summary ( $n = 247$ ).

Variable	Median	Mean	Minimum	Maximum	S. D.
Population	3176	3300	346	18,580	2071
Population density (per km <sup>2</sup> )	2802.72	3266.65	8.93	99698.11	6298.93
Unemployment (%)	2.13	2.24	0	7.37	1.30
Teenager (%)	23.43	22.80	4.88	35.05	5.53
Senior (%)	10.91	12.36	1.10	43.27	7.09
Median income (CAD \$)	35,909	37,597	3228	65,219	9033
High education (%)	44.98	46.27	13.82	75.86	10.53
Car access (%)	42.00	41.71	9.32	68.86	7.81

This study uses advances in spatial data and analytical techniques and fills a gap in the quantitative research on identifying food deserts; it also explores the spatial relationships between community gardens, farmers' markets and access to supermarkets. For the specific case of Edmonton, Canada, we (1) illustrate the distribution of supermarkets, community gardens, and farmers' markets; (2) measure neighborhoods' access to these food outlets through road network analysis; (3) investigate the effects of community gardens and farmers' markets on improving food access through the coverage method; (4) identify food desert neighborhoods based on low accessibility and three indicators of high need; (5) explore the heterogeneity among different socio-economic groups in terms of access to community gardens and farmers' markets. By incorporating farmers' markets and community gardens with supermarkets into the analysis of healthy food accessibility, our empirical results provide a more nuanced understanding of the food desert phenomenon for both policy makers and other interest groups.

## Study area, data, and methods

Our research area targets Edmonton, the capital city of the Canadian province of Alberta and the center of the Edmonton Capital Region, with a population of 817,498 in 2014 ([The City of Edmonton, 2014](#)). The city has 392 defined neighborhoods. We excluded 145 non-residential neighborhoods (mainly industrial areas) that have no data for demographic and socio-economic characteristics and thus conducted our analysis of 247 neighborhoods. [Table 1](#) presents a summary of the demographic and socio-economic characteristics at the neighborhood level.

Previous studies of food deserts have usually only considered proximity to supermarkets located within the city boundary ([McEntee & Agyeman, 2010](#); [Smoyer-Tomic et al., 2006](#)). However, residents in fringe neighborhoods can always cross the municipal boundary to purchase food, indicating that food access might thus be under-estimated for peripheral neighborhoods. Therefore, this study included all supermarkets, community gardens, and farmers' markets within the city and a 10-kilometer buffering area along the city boundary ([Yeager, & Gatrell, 2014](#)). The supermarket data for Edmonton and the buffering area were obtained from DMTI Spatial Inc. (2013). DMTI Spatial Inc. is a Canadian company that provides various location-based data including detailed street maps, census data and boundary information, and geographic features for Canadian urban areas.<sup>1</sup> We defined supermarkets as the outlets of chain stores (e.g., Sobeys, Safeway, Superstore) that typically sell meat, fresh produce, dairy, baked goods, as well as canned and packaged goods.<sup>2</sup> For each supermarket identified in the DMTI

database, we cross-validated the store information by checking the official store websites. Convenience stores, drugstores, liquor stores, and gas stations that were mis-categorized as supermarkets in the DMTI database were excluded from the analysis. This left us with 96 supermarkets for the study area. We extracted information for the 61 registered community gardens from the Sustainable Food Edmonton database<sup>3</sup> and information for 17 approved farmers' markets from both Alberta Agriculture and Rural Development<sup>4</sup> and the Alberta Farmers' Market Association.<sup>5</sup> Road network data was obtained from CanMap RouteLogistics (V2012.3)<sup>6</sup> and neighborhood demographic information from Statistics Canada, National Household Survey (2011). [Fig. 1](#) displays the locations of supermarkets, community gardens and farmers' markets in Edmonton and the 10 km buffering area.

## Minimum distance and coverage methods

Geographic access to food providers (e.g., supermarkets) has been popularly accepted as an approach for measuring residents' access to healthy affordable food ([Hubley, 2011](#); [Smoyer-Tomic et al., 2006](#)). In our research, we used the minimum distance and coverage methods that were earlier applied by [Smoyer-Tomic et al. \(2006\)](#) to the case of Edmonton. In addition, we used network analysis (shortest route) instead of Euclidean distance to better represent actual travel/walking distances. Based on the neighborhood centroids, we calculated the nearest distances to supermarkets, community gardens, and farmers' markets. With respect to the coverage method, the number of supermarkets, community gardens, and farmers' markets for each neighborhood were calculated within 1-kilometer buffer. By overlaying neighborhood demographic and socio-economic characteristics with neighborhoods' nearest distances to supermarkets, community gardens, and farmers' markets, we identified neighborhoods with low food access, and obtained an assessment of how the inclusion of community gardens and farmers' markets relieves the difficulty. *ArcGIS 10.2.1* was used for the network and coverage analyses.

## Low accessibility and high needs

Low food access is often the only criteria used to identify food deserts ([Larson & Gilliland, 2009](#); [McEntee & Agyeman, 2010](#)). Following [Smoyer-Tomic et al. \(2006\)](#) we used 1 km as the threshold between good and poor access and used network analysis to identified poor-access neighborhoods. We also considered high needs as defined by the demographic and socio-economic characteristics of the neighborhood. Similar to other studies ([Hubley, 2011](#); [Smoyer-Tomic et al., 2006](#)), we considered low income and high population density as indicators of high need. In addition, we introduced low car access as an indicator of the challenge of getting access to healthy food.

## Regression model

To better understand the possible roles of community gardens and farmers' markets in improving access to healthy foods, especially for neighborhoods with economic disadvantages, we

<sup>1</sup> DMTI Spatial. <http://guides.library.ualberta.ca/content.php?pid=128666&sid=1104150> (accessed 2014/04/09).

<sup>2</sup> For further information, we verified with each supermarket from their websites that they have a minimum of five employees.

<sup>3</sup> Sustainable Food Edmonton. <http://sustainablefoodedmonton.org/find-a-community-garden/> (accessed 2014/04/09).

<sup>4</sup> Alberta Agricultural and Rural Development. [http://www.agric.gov.ab.ca/app21/rtw/markets/markets\\_map.jsp](http://www.agric.gov.ab.ca/app21/rtw/markets/markets_map.jsp) (accessed 2014/04/09).

<sup>5</sup> Alberta Farmers' Market Association. <http://www.albertamarkets.com/markets/north-central/> (accessed 2014/04/09).

<sup>6</sup> CanMap RouteLogistics. <http://abacus.library.ubc.ca/handle/10573/42752/> (accessed 2014/04/09).

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