

# Boston's Food Access

## Considering Convenience Stores

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### Introduction & Background

Food deserts have been identified as critical areas for community development throughout the United States. Politicians, activists, community leaders and community members both in urban and rural areas have taken action. Boston is no exception. In 2013, the Boston Health Department recognized food access in its strategic planning. Since then, initiatives have swept through the city as farmer's market and grocery store openings improved access to food. But where do convenience stores fit in? Convenience stores historically offer more highly processed, high sugar, and sodium, and fat and low nutrient foods, therefore, some analyses of food access consider convenience stores to be a detriment to food access rather than a source of food.

To analyze how convenience stores are contributing to food sources in Boston, I evaluate residents' food access both with and without accounting for convenience stores.

Table 1. Definitions of important Terms

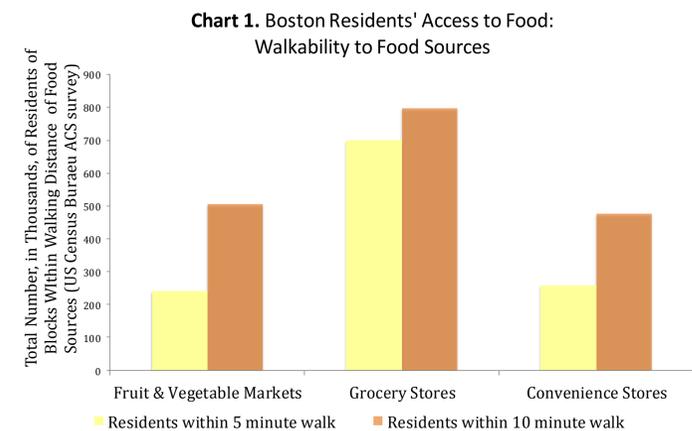
<b>Food Access</b>	Proximity to access food sources, specifically, an ability to access food within a walkable distance to one's residence.  <i>High food access</i> refers to populations residing in areas within a 10 minute walk to a grocery store or fruit and vegetable market; or, in some analyses, a 5 minute walk to a convenience store  <i>Low food access</i> would be beyond one and a half times the bounds of a high food access area.
<b>Grocery Store</b> <small>2016 NAICS Code 445110</small>	This industry comprises establishments generally known as supermarkets and grocery stores primarily engaged in retailing a general line of food, such as canned and frozen foods; fresh fruits and vegetables; and fresh and prepared meats, fish, and poultry. Included in this industry are delicatessen-type establishments primarily engaged in retailing a general line of food.
<b>Fruit &amp; Vegetable Markets</b> <small>2016 NAICS Code 445230</small>	This industry comprises establishments primarily engaged in retailing fresh fruits and vegetables.
<b>Convenience Stores</b> <small>2016 NAICS Code 445120</small>	This industry comprises establishments known as convenience stores or food marts (except those with fuel pumps) primarily engaged in retailing a limited line of goods that generally includes milk, bread, soda, and snacks.

### Methodology

The definitions which I accept for food sources and convenience store in this model are listed in Table 1 along with definitions from the United States Census Bureau's North American Industry Classification System (NAICS) of food sources. Food sources considered include grocery stores, farmers markets, and convenience stores. I chose to overlay this information on a base layer representing the prevalence of residents living below the poverty line because historically, wealthier communities have benefited from better food access than their poorer counterparts, according to the Center for Disease Control. Those data that are of greatest importance in this model are the entities representing locations for food access and the populations within a walk-able distance from them, entities which can be seen in Figure 1. I modeled areas of high food access by measuring the Euclidean distance from food sources, re-classifying these distances to attribute higher value to areas within closer proximity to food sources, and then calculated the overall food access value of each area based on walkability to grocery stores and fruit and vegetable markets. I included walkability to convenience stores in one scenario and compare that to the model without convenience stores. The model is detailed in Tables 2a. and 2b. Figures 1, 2, and 3 demonstrate the model spatially in the scenario without considering convenience stores.

### Analysis

Based on the data, food access does not seem to be a concern in Boston, whether or not convenience stores are included in the analysis. Residents within walking distance of Grocery Stores and of Fruit and Vegetable Markets each, separately, is higher than those residents within walking distance of Convenience Stores



of Convenience Stores (Chart 1). Though there are a significant amount of areas in Boston where residents live with Moderate Food Access or Poor Food Access, these analyses are very conservative and consider a walk greater than 10 minutes to equate to No Food Access (Table 2b; Figure 2).

Table 2a. Relative Importance of Distance to Respective Food Sources

Food Sources	Walkable Distance	Reasoning for Value
<b>Grocery Stores</b>	10-minute walking distance: ≤ 800 meters	Grocery stores are open year-round and have the main function of providing food to customers.
<b>Fruit &amp; Vegetable Markets</b>	10-minute walking distance: ≤ 800 meters	Fruit and Vegetable markets are often available seasonally and close in the colder months. The purpose is to provide food to customers.
<b>Convenience Stores</b>	5-minute walking distance: ≤ 400 meters	Convenience stores are engaged in providing a limited amount of food.

Table 2b. Valuing Euclidean Distance for Walking Time

Euclidean Distance from Food Source	Time to Walk	Value
0-200 meters	< 5 minutes	3 points
200-500 meters	Up to 5 minutes	2 points
500-800 meters	5-10 minutes	1 point
800-10,000 meters	>10 minutes	0 points
>10,000 meters	>>10 minutes	No Value

Walkable distance is based on walkability research by ArcUser, Valued according to relative availability of food throughout each season in the year, healthy options historically available at respective type of food source, and average size of location.

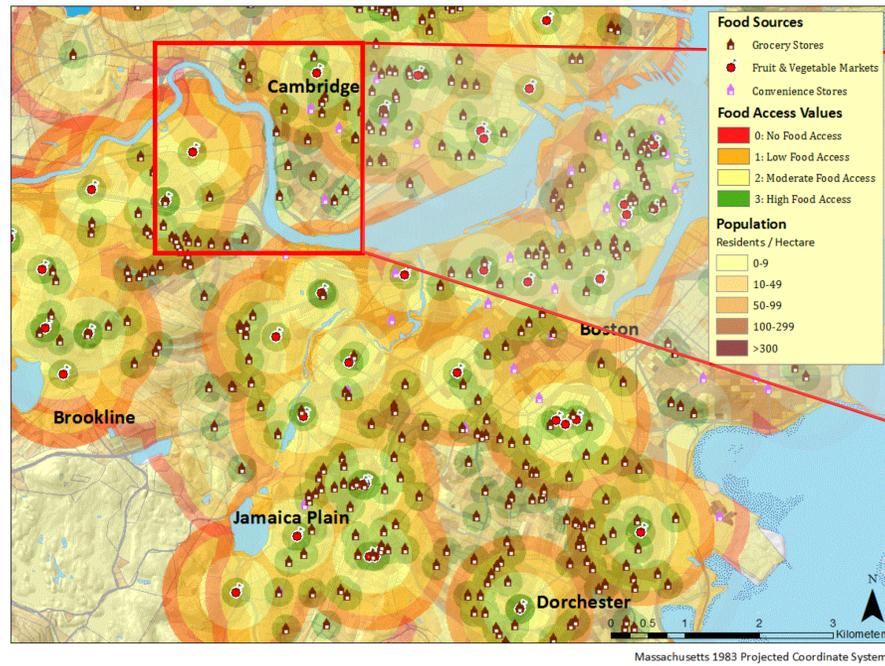


Figure 1. Food Access in Boston, showing Food Source locations, when not including Convenience Stores as Food Sources in Calculation.

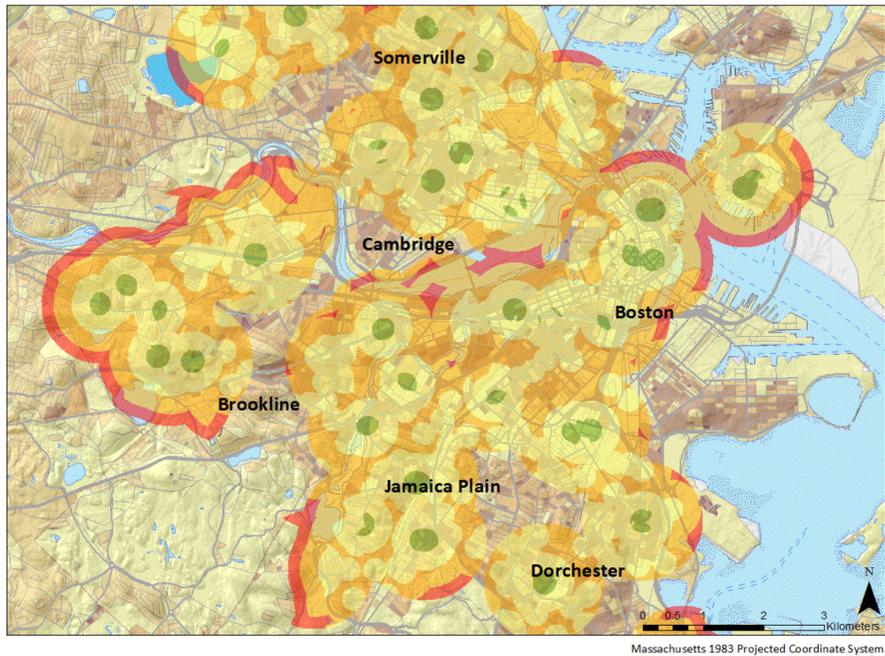


Figure 2. Food Access Values in Boston when not including Convenience Stores as Food Sources in Calculation.

### Data: Usage & Limitations

Using data from the NAICS, these maps present the spatial arrangement of grocery stores, farmers markets, and convenience stores throughout Boston. These points are situated over a population layer derived from the US Census Bureau 2010-2014 American Census Survey 5-Year estimate data which have been normalized by hectare. Basemap data including roads, hydrography, and towns are from MassGIS. World basemap imagery is from Esri GIS. The hillshade layer has been created from the 2015 US Geological Survey's National Elevation database at the north latitude 43 and west longitude 72. The North American Industry Classification System includes both verified (phone verified, quality checked) and unverified (not yet fully verified, may not be accurate) businesses. My choice to include unverified businesses might have resulted in an overestimate of food access. However, had I failed to include unverified businesses, I would have risked underestimation of food access. Additionally, based on NAICS definition, some stores were classified as both convenience stores in some locations and as grocery stores in others; an example is the store 7/11. This causes questions about reliability of the data. Points are represented by latitude and longitude coordinates. Each year, the United States Census Bureau conducts the American Community Survey, but only surveys about 1.7% of the total population. This small sample size from limits the ability to accurately represent true population parameters. To compensate, ACS data is presented by the US Census Bureau as an aggregate of 5-years of survey results—the set used here being from 2010-2014. The data is aggregated by block which I normalized by hectare.

### Model: Tools & Limitations

Euclidean distance uses straight -lines and does not offer a realistic model of walkability because it fails to take into consideration physical barriers such as buildings, bodies of water, railways, and other obstructions. These barriers change and increase the true distance to food locations, thus by excluding them from my calculation, I underestimate the total with populations with poor food access. Statistics were summarized using the Select by Location tool, selecting the blocks whose centroid was within certain Euclidean distances from the respective food source. This calculation likely does not capture the true parameters for number of residents living within certain distances of food sources. A Raster Calculator was used to calculate the appropriate food access value for each location. These values assumed that each food source of the same category was equivalent in its ability to provide food to a resident, which likely is not the case in reality.

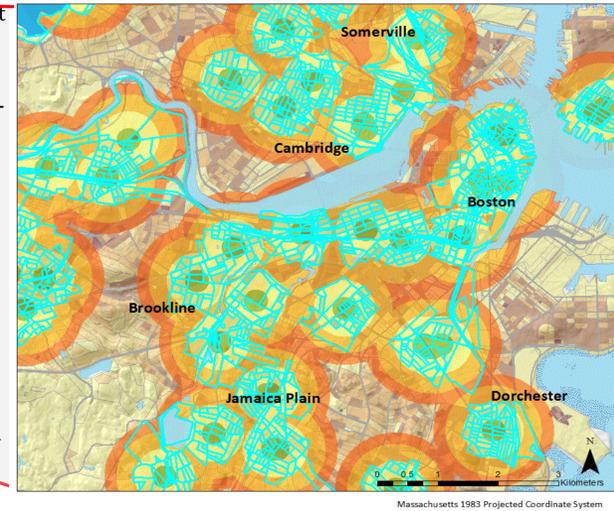


Figure 3. Blocks are highlighted where centroid is located within 400 meters of Fruit and Vegetable Markets using the Select By Location Tool. Image demonstrates the lack of precision in using this tool to model populations within a certain distance of locations.

### Future Direction

Future analysis of food access might be improved by creating buffers that take physical obstructions into consideration when calculating walkable distances from food sources. Massachusetts transit stops, community supported agriculture pick-up locations, and food trucks might be considered to better understand potential transportation and resulting food access changes. Maps of food access could be compared across seasons to analyze how food accessibility changes between months when many fruit and vegetable markets are closed and opened. Analysis might also include demographic information to consider how poverty rates might correlate with food insecurity, or health related chronic illness prevalence, prevalence of elderly within the population, and single mothers might be considered to analyze other potential correlations. Lastly, other definitions of food access, food security, food desert, and food oasis could be used and the conclusions compared to this analysis.

#### Sources:

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