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 farmers’ 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 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 access in Boston, I evaluate residents’ food access both with and without accounting for convenience stores.

Table 1. Definitions of important Terms

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<th>Food Access</th>
<th>Proximity to access food sources, specifically, an ability to access food within a walkable distance from one’s residence.</th>
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<td>Grocery Store</td>
<td>This industry comprises establishments generally known as supermarkets and grocery stores primarily engaged in retailing a general line of food.</td>
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<tr>
<td>Fruit &amp; Vegetable Market</td>
<td>This industry comprises establishments primarily engaged in retailing fresh fruits and vegetables.</td>
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<tr>
<td>Convenience Store</td>
<td>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, snacks, and sodas.</td>
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Methodology
The definitions which 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 are of greatest importance in this model are the entities representing locations of food access and the populations within a walkable distance from them, 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 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.

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 Community Survey 5-Year estimates which have been normalized by hectare. Basemap data includes roads, highways, 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 NAICS and SIC codes. Polite, quality checked and verified (not yet fully verified, may not be fully accurate) businesses. My choice to include unverified businesses might have resulted in an over-estimate of food access. However, if I had 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 question 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 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 many 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.

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.