

# Evaluating Food Access in Boston Neighborhoods

## Introduction

Humans have struggled with food access for the entirety of their existence, and even with the development of modern food technology, people still struggle to access nutritionally beneficial foods. A food desert is an area where residents do not have adequate access to healthy and affordable food, meaning that grocery stores are difficult to access and fast food restaurants and convenience stores are the more plausible option for food. Food deserts pose major health risks as they lead to an increase in obesity and a lack of knowledge on proper dieting. Through spatial analysis using GIS, I evaluated the prevalence of food deserts in the Boston area, discovering several locations where residents are lacking proper access to grocery stores.

## Methods

**Step 1:** First, I gathered the economic data in the Boston neighborhoods to create a baseline map showing the median household income in each census block.

**Step 2:** For each census block, I measured the distance from the centroid of the census block to the nearest bus stop, the nearest grocery store, and the nearest fast food restaurant. For this data, I included the most common grocery stores (Shaw's Supermarket, Star Market, Stop & Shop, Trader Joe's, and Whole Foods Market) and the most common fast food restaurants (Wendy's, Burger King, Taco Bell, McDonald's, and KFC) in the Boston neighborhoods, taken from Reference USA. I also measured the distance from the centroid of each census block to the nearest MBTA bus stop. Figure 1 shows the economic data and locations of the grocery stores (with a half mile buffer radius), fast food restaurants (with a quarter mile buffer radius), and bus routes. Blank census blocks do not have economic data.

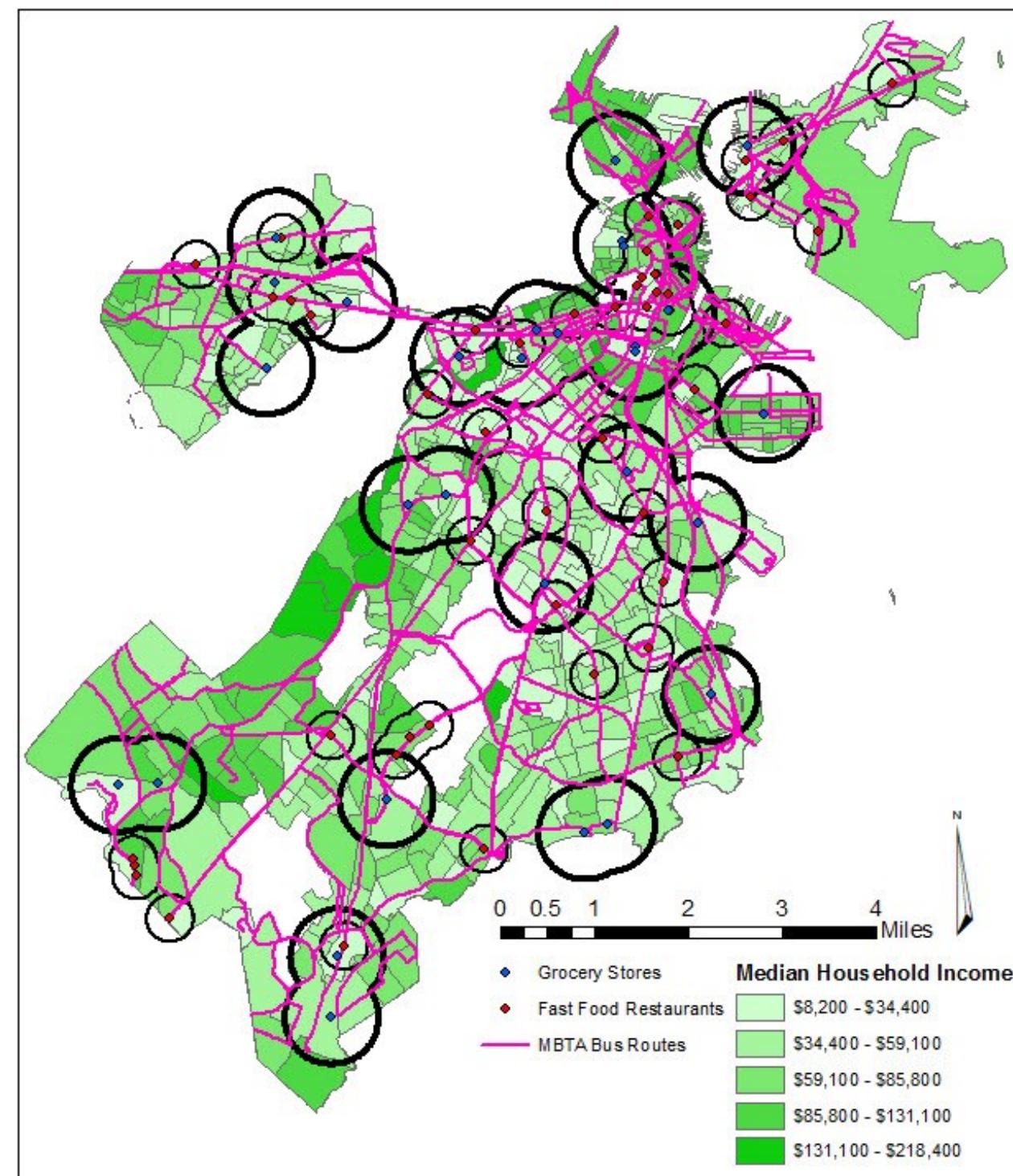


Figure 1

common grocery stores (Shaw's Supermarket, Star Market, Stop & Shop, Trader Joe's, and Whole Foods Market) and the most common fast food restaurants (Wendy's, Burger King, Taco Bell, McDonald's, and KFC) in the Boston neighborhoods, taken from Reference USA. I also measured the distance from the centroid of each census block to the nearest MBTA bus stop. Figure 1 shows the economic data and locations of the grocery stores (with a half mile buffer radius), fast food restaurants (with a quarter mile buffer radius), and bus routes. Blank census blocks do not have economic data.

**Step 3:** I subtracted the distance to the grocery store or fast food restaurant from the distance to the bus stop to find the distance one would ride on the bus to get to the grocery store or fast food restaurant, assuming the bus stop is on the way to the grocery store or fast food restaurant and that the grocery store or fast food restaurant is on the bus route, which are both fair assumptions given Figure 1. Using an average walk speed of 3.1 mph and an average bus speed of 13.5 mph, I calculated the time it would take for someone to walk to the nearest bus stop and ride to the nearest grocery store and fast food restaurant.

**Step 4:** Assuming 40 hour work weeks and 50 week work years, I calculated the median hourly wage for each census block. If a given census

block did not have median household income data, I used the average hourly wage in Boston (\$30.77). I then calculated the opportunity cost of going to the grocery store or fast food restaurant by adding the time walking and the time on the bus, multiplying that number by the median hourly wage, adding \$1.60 to account for the bus fare, and doubling that number to account for the trip back home. If the walk to the food source is less than 5 minutes, or if the food source is closer than the nearest bus stop, I assumed people would walk to the food source and the opportunity cost was calculated by just multiplying the walking time by the hourly wage and doubling that number.

**Step 5:** The final food desert calculator adds the opportunity cost of traveling to the nearest grocery store to the difference of the opportunity costs of traveling to the nearest grocery store and to the nearest fast food restaurant. This food desert calculator evaluates how costly it is for someone to get groceries versus getting fast food.

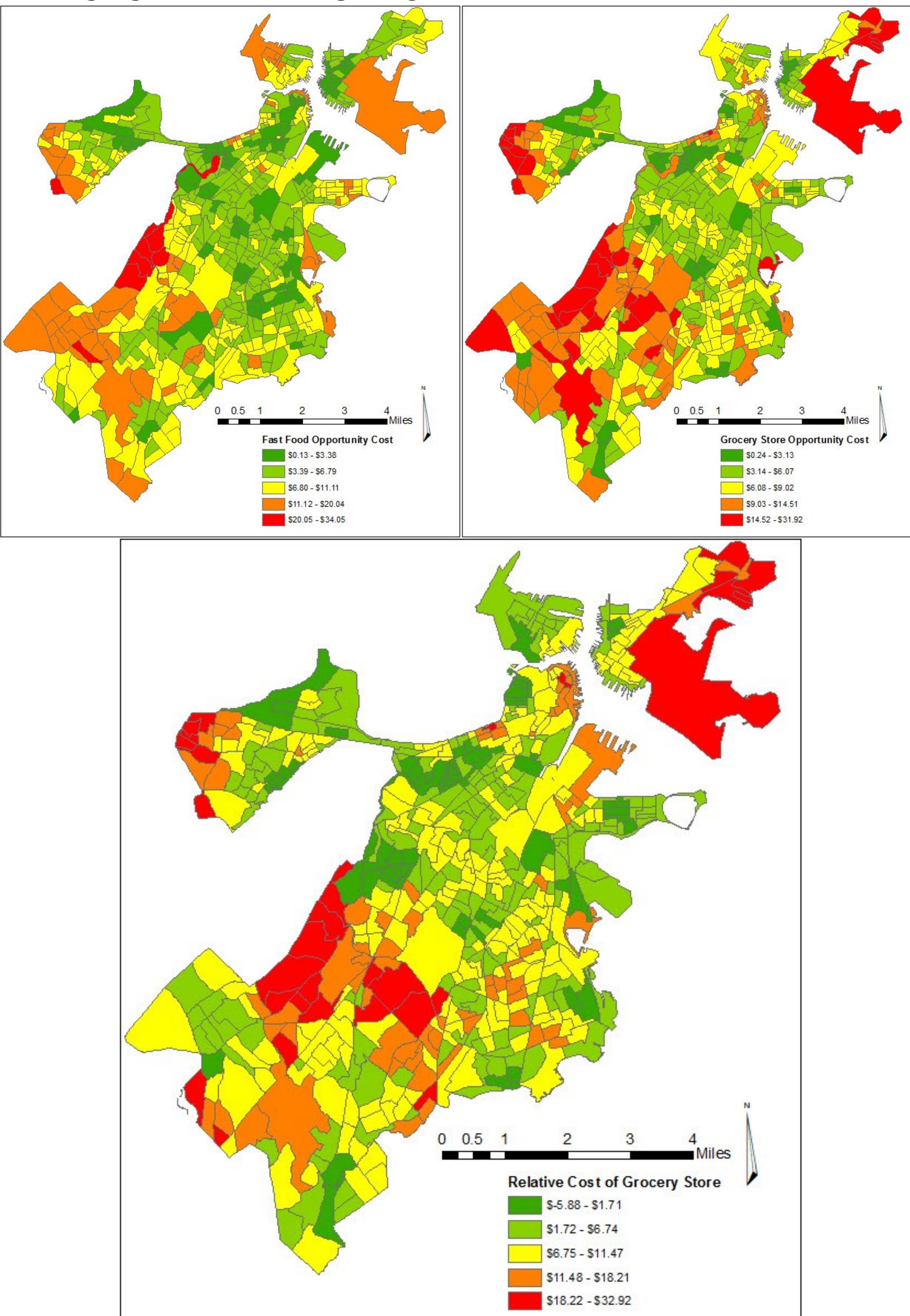


Figure 2

## Results

Figure 2 displays the outputs from steps 4 and 5. The relative cost of traveling to a grocery store is determined from the food desert calculator. Since the locations of bus stops are a crucial factor in how great the opportunity cost is to travel to a food source, the fast food restaurant and grocery store opportunity costs share some similarities. The areas with the worst access to healthy, affordable food tend to be away from the center of Boston, due to the grocery stores and bus stops being more spread out. In 20% of the Boston area, there is at least a \$15 opportunity cost—with up to a \$32 opportunity cost—to just travel to the grocery store, let alone buy groceries. Some areas have opportunity costs that high to travel to fast food restaurants as well, but other areas have only a 13 cent opportunity cost to go to a fast food chain. Although the opportunity costs for fast food restaurants are higher than I expected, the grocery store opportunity costs are also extremely high in some areas, leading to the existence of food deserts.

## Conclusions

Even though Boston is a wealthy and prosperous city, it has thousands of residents who are struggling to access healthy and affordable food. Because the opportunity cost to get groceries is so high in some areas, residents are more likely to settle for nutritionally unfulfilling foods, leading to major health concerns. These food access maps can serve as a prediction for where obesity levels in Boston are highest and where new grocery stores should be built and bus routes created to combat these health concerns.

## Limitations

The main limitation to this analysis is the amount of data present. I did not include convenience stores because there are so many of them that they would have cluttered the map and made the analysis much more cumbersome. Thus, the lack of convenience stores should be taken into account when looking at the fast food opportunity cost map, as the true opportunity costs of getting to low quality food are lower than the map suggests. Additionally, I did not include grocery stores or fast food restaurants that are right outside of the Boston neighborhoods, but for some of the outer census blocks, the closest food sources could be outside of the data I collected. Therefore, the opportunity costs for the outer census blocks to travel to a grocery store could be less than I calculated.

Cartographer: David Stack

Class: CEE 187—Geographical Information System

Data Sources: 2014 TIGER/Line Shapefiles (machinereadable data files) / prepared by the U.S. Census Bureau, Massachusetts, 2014; ReferenceUSA, Grocery Store and Fast Food Restaurant Locations, 2015

Projection: NAD 1983 (2011) State Plane Massachusetts FIPS 2001 (US Feet)

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