

MASSACHUSETTS FOOD ACCESS INDEX

A Pilot Method for Assessing Food Access in the Commonwealth

OVERVIEW

DEFINING FOOD ACCESS In recent years, researchers and policymakers have taken considerable interest in food access. Despite this increased attention, the term “food access” lacks a universally accepted definition. Nonetheless, definitions tend to agree on three essential components of food access: availability, affordability, and accessibility. This method considers these food access components within the framework of three guiding questions:

Access to what? → Availability and affordability, described by food retail environment

By what mode? → Accessibility, described by modes of transit and travel network

For whom? → Demographic and community characteristics

ASSESSING STATEWIDE FOOD ACCESS Food access has been assessed at a variety of scales using both quantitative and qualitative methods. Increasingly, researchers use GIS to spatially analyze food access. However, spatial analysis of food access has not been previously undertaken on a statewide scale. Statewide analysis presents unique challenges, including that food retail datasets rarely exist for an entire state and no single mode of transit or network distance is relevant for all community types statewide.

NATURE OF THIS PROJECT We have created the first statewide food access study that incorporates spatial analysis of the food retail environment, network analysis, and analysis of demographic and community characteristics. This project was completed in partnership with Metropolitan Area Planning Council as part of the Field Projects course in the Department of Urban & Environmental Policy & Planning at Tufts University. A full report bearing the same title was written by Jamie Fanous, Noah Habeeb, Caitlin Matthews, and Lexie Raczka.

METHODS

FOOD RETAIL ENVIRONMENT We compiled data from ReferenceUSA for eight relevant NAICS codes, as well as MassDOT farmers markets, to create a dataset of all food retailers in Massachusetts. We cleaned this dataset, reducing it from more than 14,000 entries to approximately 9,500 food retailers. Then, we classified the food retailers by weight based on ability to procure healthy food options across the full diet:

- 5 Supermarkets and Other Grocery (except Convenience) [$>10,000$ ft²], Warehouse Clubs and Supercenters
- 4 Supermarkets and Other Grocery (except Convenience) [$<10,000$ ft²], Farmers Markets, and Fruit and Vegetable Markets
- 3 Specialty Food Stores, Meat Markets, and Fish and Seafood Markets
- 2 Convenience stores [>2500 ft²], Pharmacies and Drug Stores
- 1 Convenience stores [<2500 ft²]

FOOD ACCESS INDEX To create the Massachusetts Food Access Index, we calculated network polygons for each food retailer across the state. We calculated drivesheds for 5-mile and 1-mile distances along a driving network that included all roads in the state. We calculated walksheds for 1/2-mile and 1/4-mile network distances along a walking network that included Class 4 through 6 roads, therefore excluding routes unsafe for walking.

For each network distance, we converted the travelsheds to raster. For each food retailer weight category, we created a binary raster layer in which cells within a network polygon carried the value of the weight category (1-5) and cells outside the network polygons carried a value of 0. Next, we created a composite raster with a possible range of values from 0 to 15. Finally, we calculated a mean food access score for each census block group.

DEMOGRAPHIC AND COMMUNITY ANALYSIS Once we constructed the index, we joined it with demographic and community data, and ran statistical analyses in order to analyze patterns between food access and demographic and community characteristics.

For more information about the relevant NAICS codes and weight categories, and for a detailed description of the methods, see the full report.

FUTURE DEVELOPMENT

DATA ACCURACY AND COMPLETENESS The dataset describing the food retail environment is a critical starting point. However, given that our dataset describes food retail across the entire state, it was not feasible to verify that each retailer is still in business and is correctly categorized according to our criteria. As individual towns and cities employ this method to assess food access in their communities, verifying the food retailer dataset will be an essential first step.

AFFORDABILITY While the weight categories include some proxies for affordability, these weights do not capture the full picture of economic access to food. One option for improving the affordability component of the model would be to include a multiplier for food retailers that accept Supplemental Nutrition Assistance Program (SNAP) and Women, Infants, and Children (WIC) benefits.

PUBLIC TRANSIT At present, our model does not include public transit, a key mode of transit for food procurement. With a few additional steps using existing datasets, this model could assess which food retailers are accessible by the greatest number of public transit stops or routes.

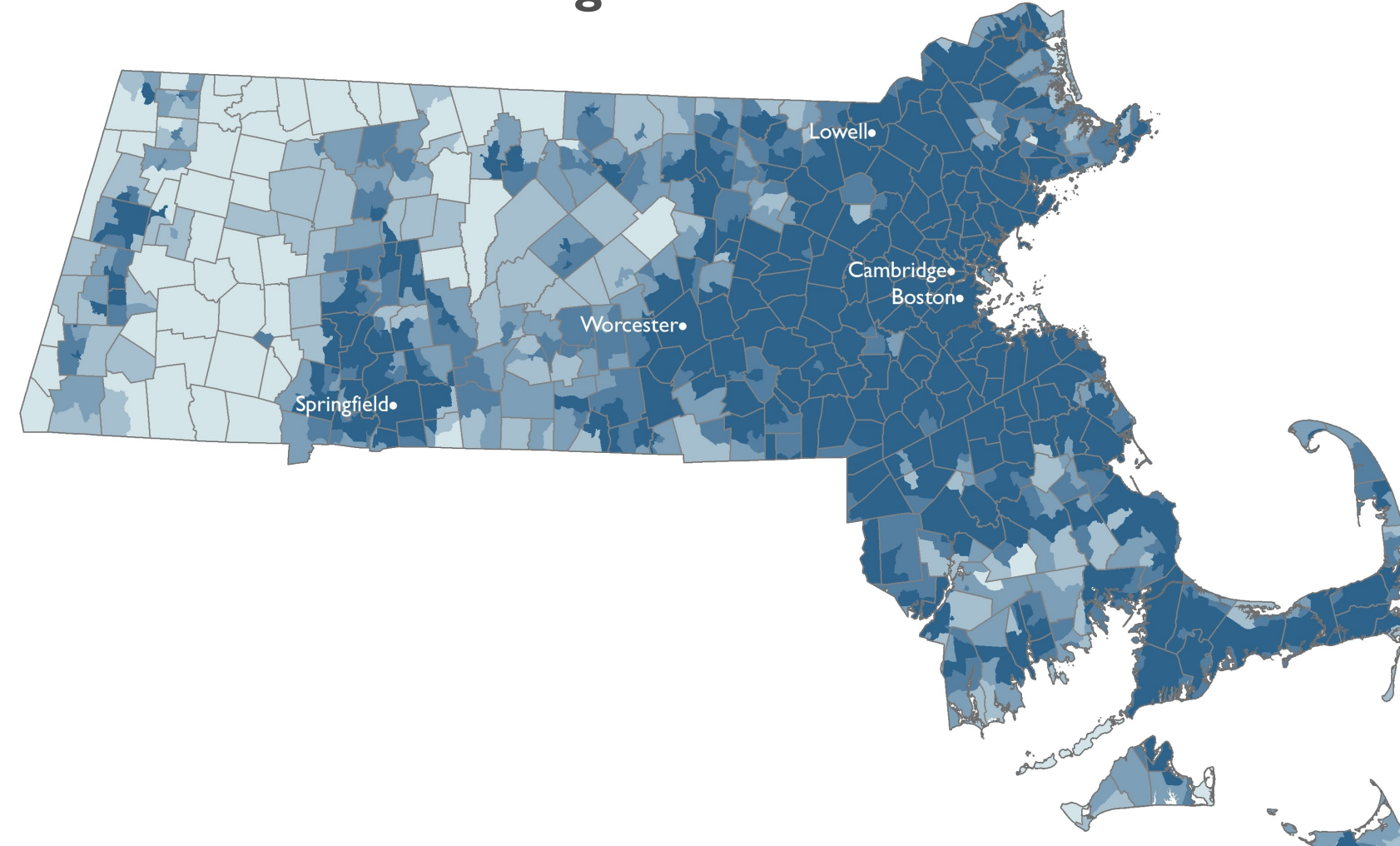
SERVICES TO INCREASE FOOD ACCESS This index could also be used to look at if and how services to increase access to healthy food overlap with areas of limited food access. Existing datasets for emergency food locations and SNAP redemption by individual food retailer could be used in this way.

COMPARISON ACROSS COMMUNITY TYPES The mean index score is influenced by the road network and the area of a block group—two factors of road density. Since road density varies greatly by community type, we recommend normalizing the mean block group food access index score by road density in order for better comparison between urban, suburban, and rural communities.

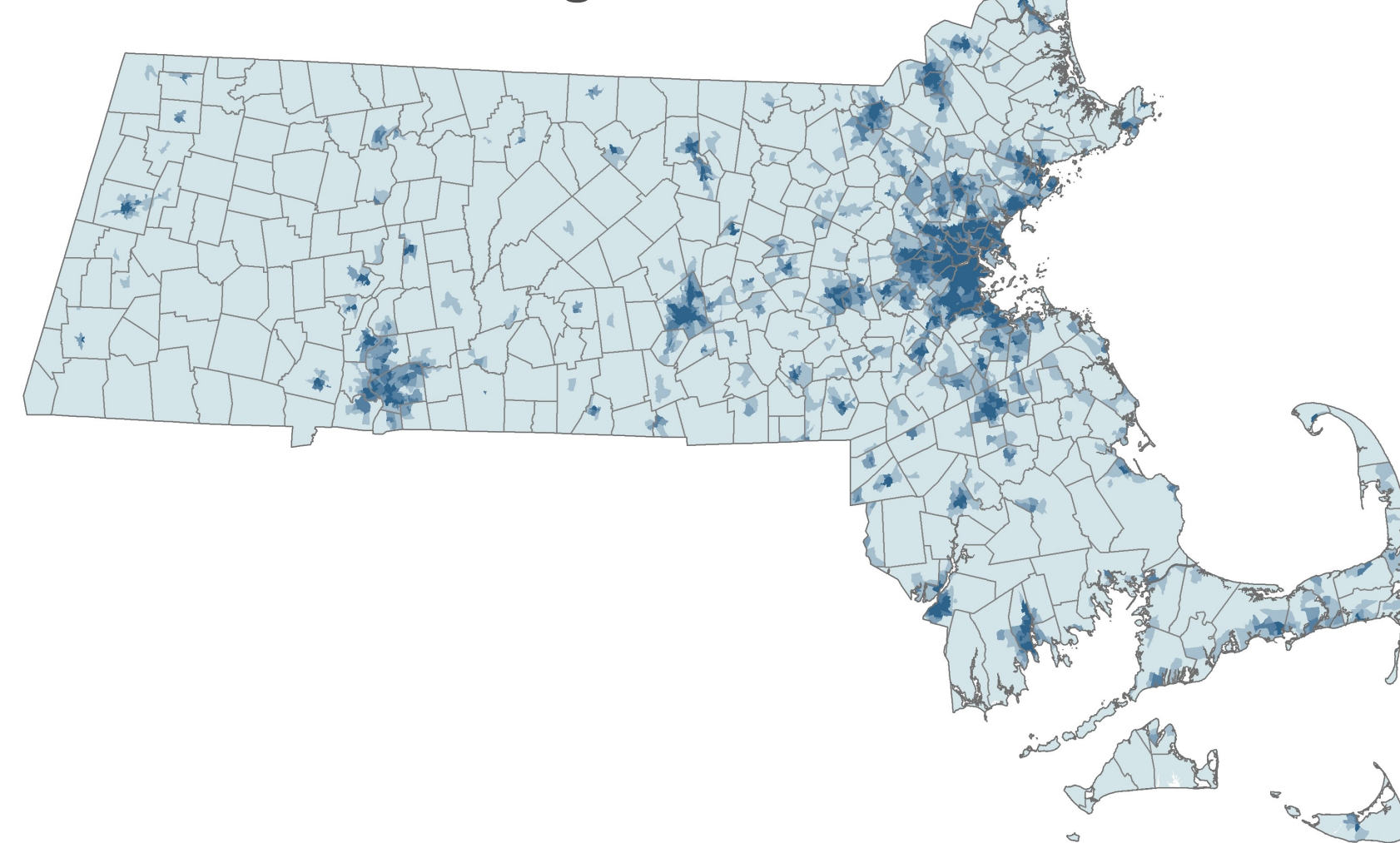
FOOD ACCESS BY BLOCK GROUP

INTERPRETING FOOD ACCESS INDEX SCORES A score of 0 represents lack of access to a food retailer of any weight category at the specified network distance. A score of 15 represents access to at least one food retailer of each weight category at the specified network distance. The model is constructed in such a way that food retailers of the same weight category cannot be double counted in one index score. The decision not to double count food retailers of the same weight category allows the index score to reflect the diversity of options rather than allowing a high density of low-weight food retailers, such as convenience stores, to misrepresent access to healthy options across the full diet. Very high (12-15) index scores indicate guaranteed access to at least one large-scale grocery store or supercenter within the specified network distance. Very low (0-3) index scores indicate guaranteed lack of access to a grocery store of any scale. Low (3-6) index scores indicate likely access to a smaller-scale grocery store, farmers market, or fruit and vegetable market. Moderate (6-9) and high (9-12) index scores indicate increasing likelihood of access to a large scale grocery store or super center.

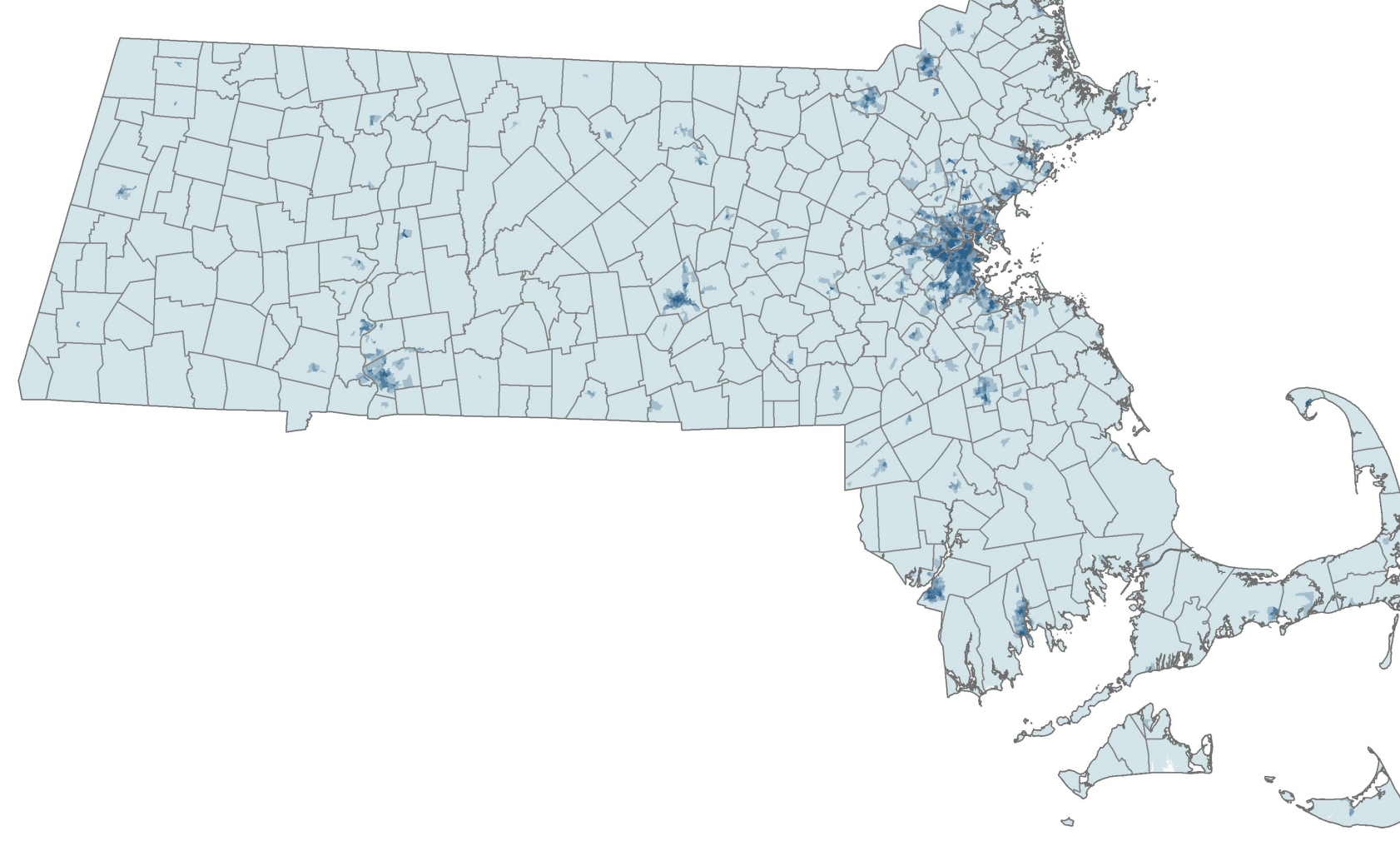
5-mile Driving Network



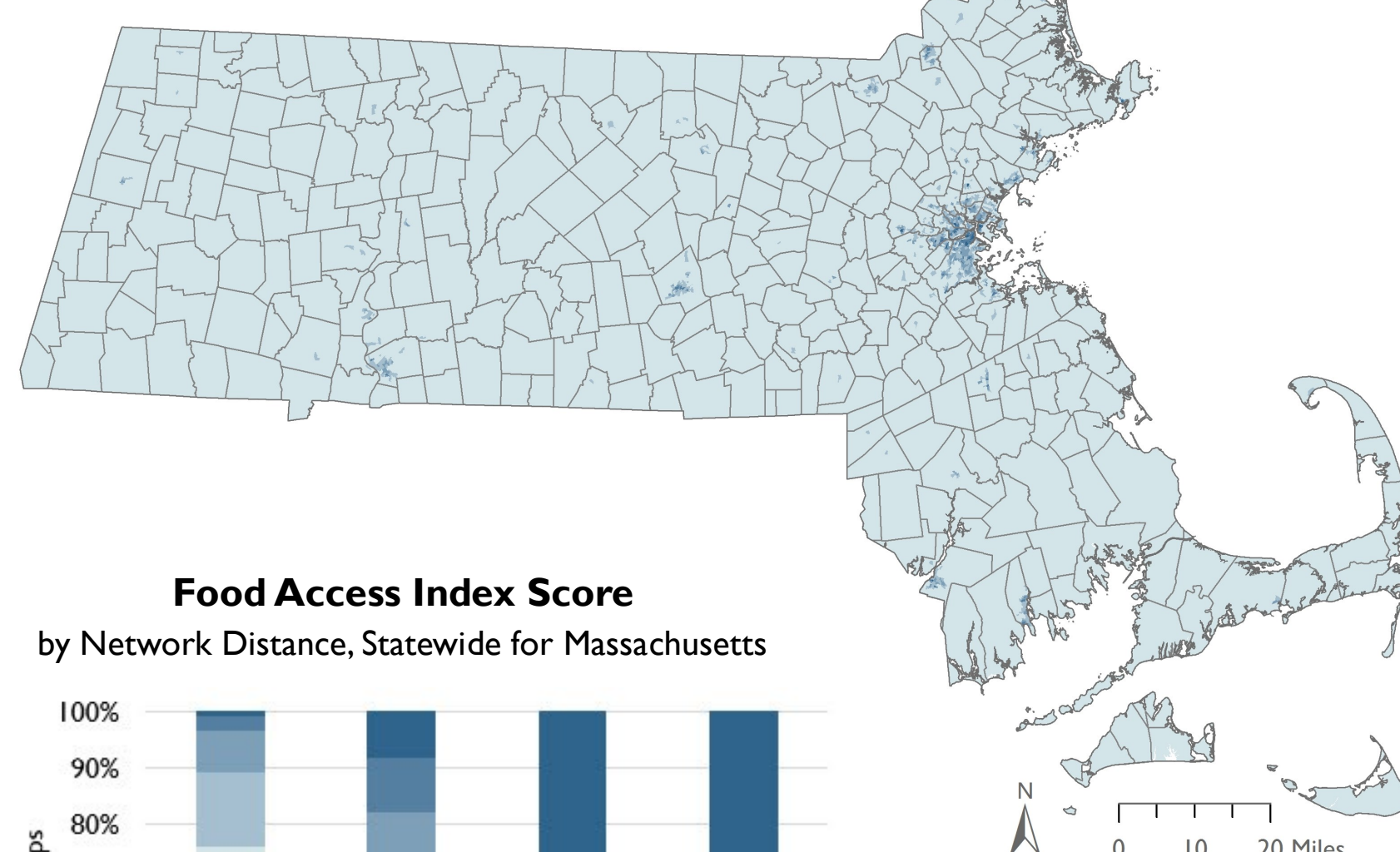
1-mile Driving Network



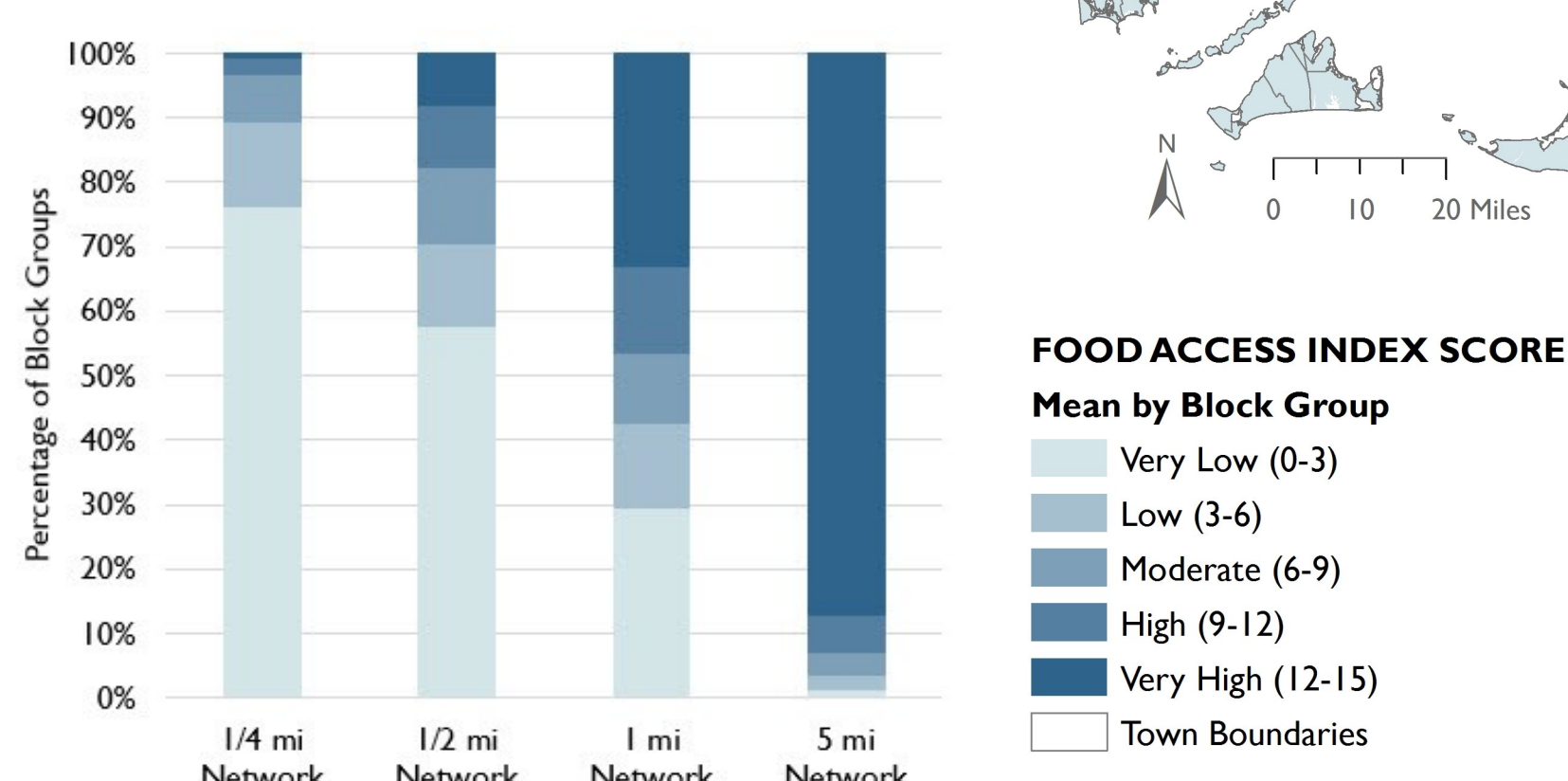
1/2-mile Walking Network



1/4-mile Walking Network

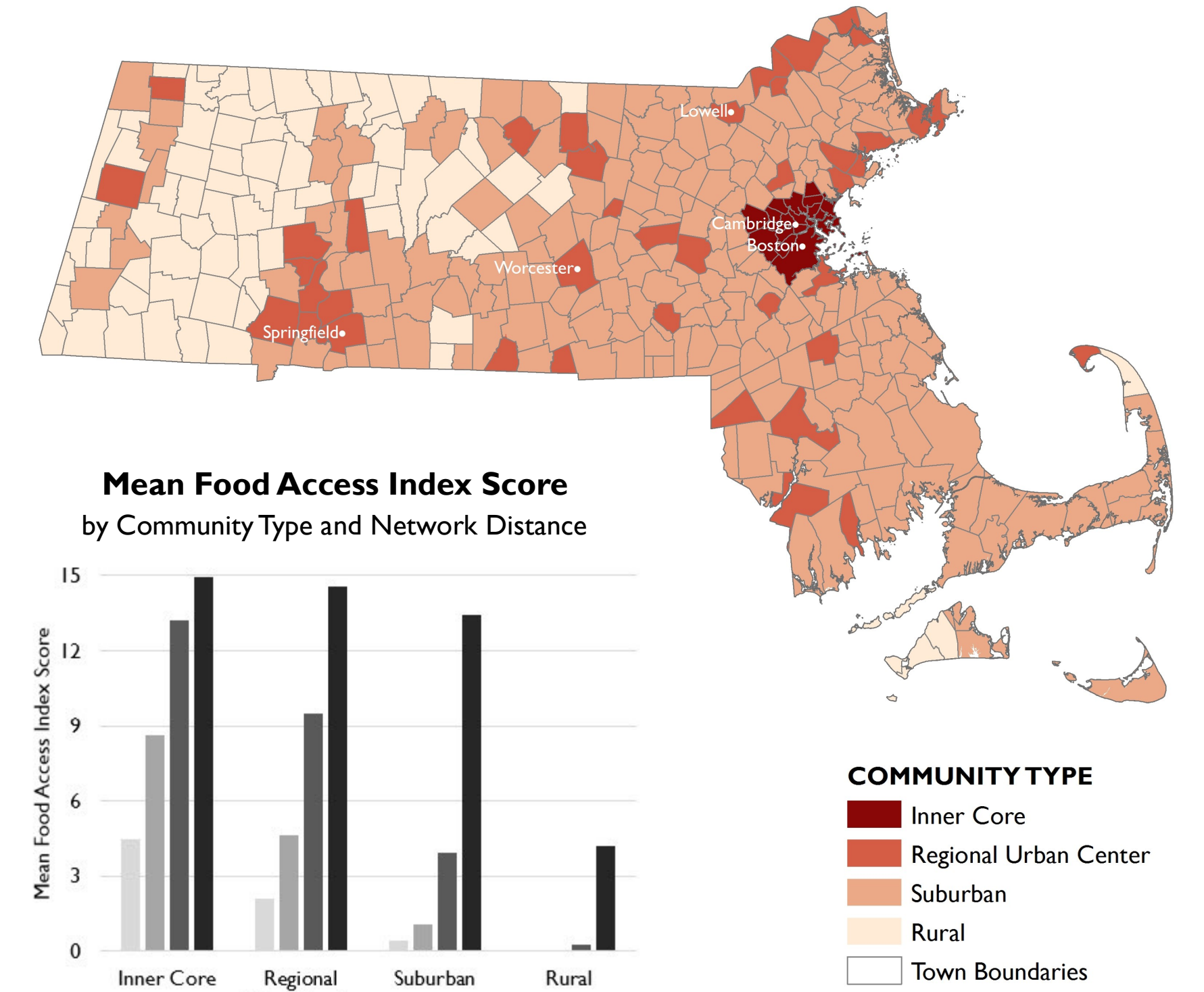


Food Access Index Score
by Network Distance, Statewide for Massachusetts



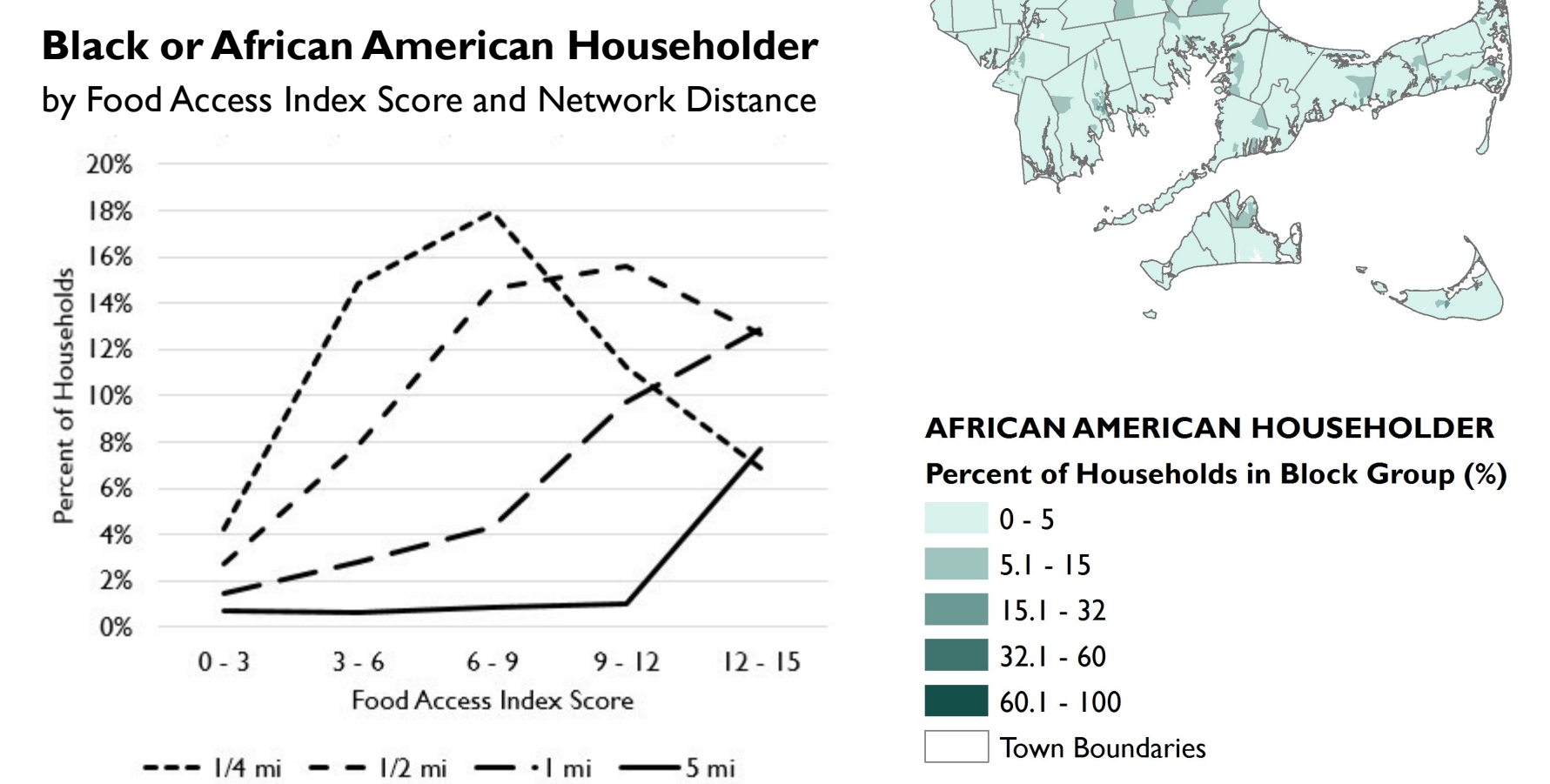
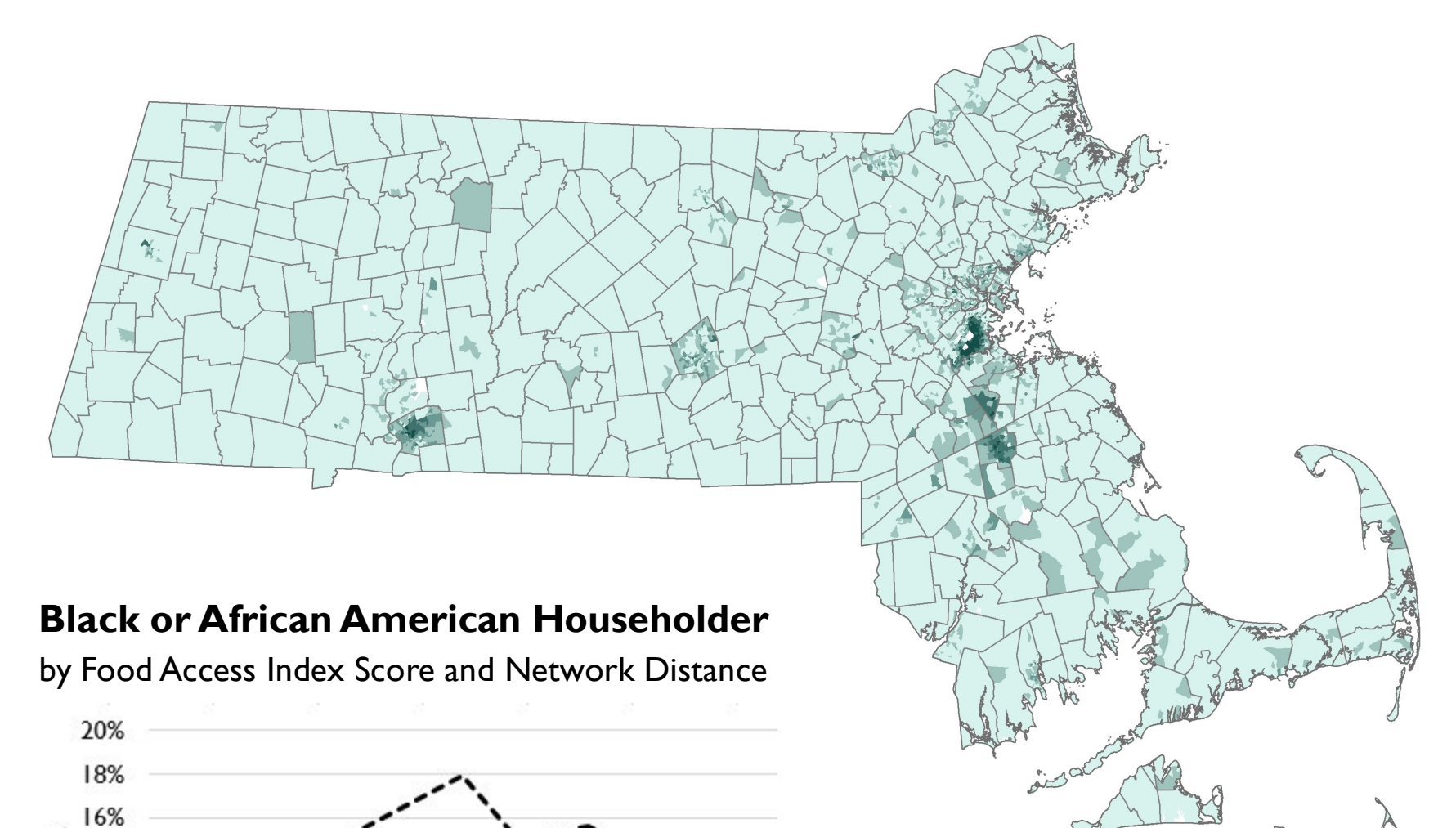
FOOD ACCESS BY COMMUNITY TYPE

Inner core communities have the highest mean food access index score at all network distances, but on average do not have high (9-12) or very high (12-15) food access at distances less than one mile. In suburban communities, food access dramatically increases from the 1-mile network to the 5-mile network. This suggests suburban dependency on car travel for distances greater than one mile to procure food. At the 5-mile network distance, inner core, regional urban center, and suburban communities have comparably very high (12-15) food access. Rural communities have very low (0-3) to low (3-6) food access at all network distances. This suggests that rural residents must travel five miles or more to purchase food at all types of food retailers.



FOOD ACCESS BY DEMOGRAPHICS

Our full report includes analysis of seven variables from the US Census and the American Community Survey: single parent households, African American householders, Latino householders, median household income, households receiving public assistance, children under five years, and household access to a vehicle. National food access studies have identified these selected variables as influential factors with respect to food access. For many of these variables, such as African American householder, there is spatial autocorrelation between food access, demographic characteristics, and population density.



APPLICATIONS AND NEXT STEPS

SCALING AND ADAPTING THE MODEL The method we developed could be applied to assess food access at the local, regional, and state levels in Massachusetts and beyond. The method should be adapted to the urban, rural, or suburban community in question. When doing so, the following considerations should be made. If time and resources allow, the food retailer dataset should be verified. Network analysis should be conducted for the most relevant modes of transit and most relevant network distances, and the scale of analysis (raster cell size and geographic unit for calculating means) should be adjusted as appropriate to the community. However, one caution is that margins of error for the American Community Survey (ACS) 5-year estimates are greater for smaller geographic scales, and ACS data are not available below the block group level.

PAIRING QUANTITATIVE AND QUALITATIVE METHODS When applied on a smaller scale, the methods developed in this project should be paired with qualitative methods to validate the spatial analysis in relation to the lived experience in the community. This groundtruthing process could enhance the assessment of food access in a given community by increasing understanding of social and cultural barriers to food access. Community-level assessments can investigate the cultural appropriateness of food retail options, food preparation skills, access to kitchen facilities, and alternative food procurement strategies such as community gardens, farm stands, and community supported agriculture.