MASSACHUSETTS FOOD ACCESS INDEX
A Pilot Method for Assessing Food Access in the Commonwealth

DEFINING FOOD ACCESS
In recent years, researchers and policymakers have taken considerable interest in food access. Despite this increased attention, the term “food security” remains 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 a contextual framework by asking the following questions:

- Access to what? — Availability and affordability, described by food retail environment.
- For whom? — Demographic and community characteristics.
- What to access? — Spatial availability of food retailers.

ASSESSING STATEWIDE FOOD ACCESS
Food access has been assessed at a variety of scales using both qualitative and quantitative 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.

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 Racala.

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:

- Supermarkets and Other Grocery (except Convenience) >10,000 ft.
- Warehouse Clubs and Supercenters >10,000 ft.
- Specialty Food Stores, Meat Markets, and Fish and Seafood Markets 1-10,000 ft.
- Convenience stores >1000 ft.
- Convenience stores <2500 ft.

FOOD ACCESS INDEX
To create the Massachusetts Food Access Index, we calculated network polygons for each food retailer across the state. We calculated driveweights 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 roads unsuitable 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 comprised the value of the weight category (1-5) and cells outside the network polygons comprised a value of 0. Next, we created a composite raster with a possible range of values from 0 to 1.5. Finally, we calculated a mean food access index 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.

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 every 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 model’s output does not count food retailers of the same weight category allowing the index scores to reflect the diversity of options rather than allowing a high density of low-weight food retailers, such as convenience stores, to overrepresent access to healthy options across the full diet.

Very low (0-3) index scores indicate guaranteed lack of access to a grocery store of any scale. Low (4-6) 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 supermarket.

FOOD ACCESS BY COMMUNITY TYPE

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 ground truthing process could enhance the assessment of food access in a green 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.