

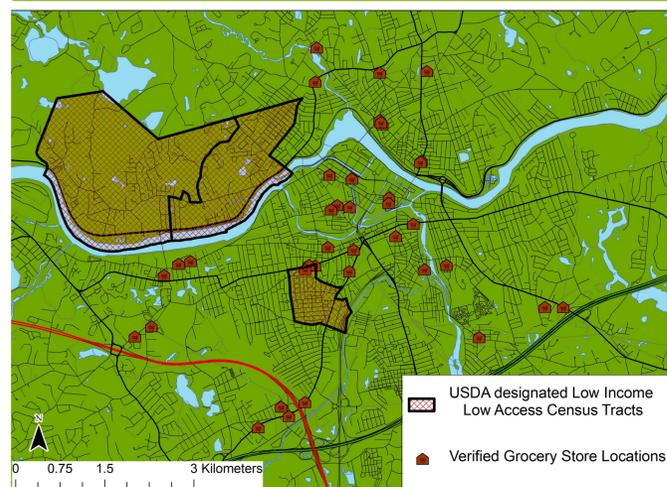
An Alternative Method for Determining Geographies With Low Access to Healthy Food: Case Study Lowell MA

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Food Deserts and the USDA "Food Access Research Atlas"

The term "food desert" was first brought into common use in 2002 (Whelan et al. 2002) to describe areas where residents have poor access to healthy food options. Since that time it has become a bit of a fascination for urban planners and community health experts. There is good reason for this considering the large role that diet plays in obesity, diabetes, heart disease, cancer, and other serious health conditions that affect our communities. To better understand where these food deserts are and who lives in them the USDA has created a report for congress on the issue (VanderPloeg et al. 2012) which was accompanied by the "Food Access Research Atlas" which is a project that maps areas of poor access to healthy foods across the US. In this atlas all census tracts in the US are evaluated on several factors to determine the relative access of its residents to the nearest supermarket and the poverty rate in that census tract. Each tract is then labeled by its various access characteristics. One of the stated goals of this atlas is to provide geographic information on healthy food access to planners and organizations. But since the evaluation is based on census tracts and tracts tend to be large and heterogeneous this information is of marginal use to planners. In this project I will create an alternative model that will seek to improve upon the USDA designations using Lowell MA as my study area.

Current USDA Methodology

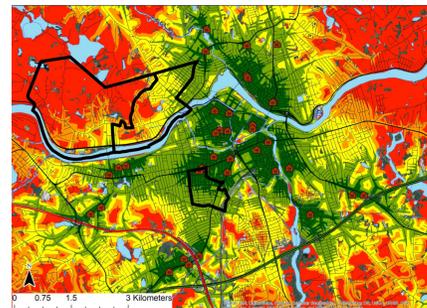


The above map shows the area of Lowell MA in 2010. The USDA List of supermarkets with the three Low Income Low Access (LILA) tracts highlighted in red cross hatch. The definition used to designate these census tracts was that the poverty rate was above 20% of the population and that a significant portion of the population lived more than a mile from the nearest supermarket. The USDA relied on the 2010 decennial census for population counts, the 2006-2010 American Community Survey income estimates, and a list of supermarkets compiled

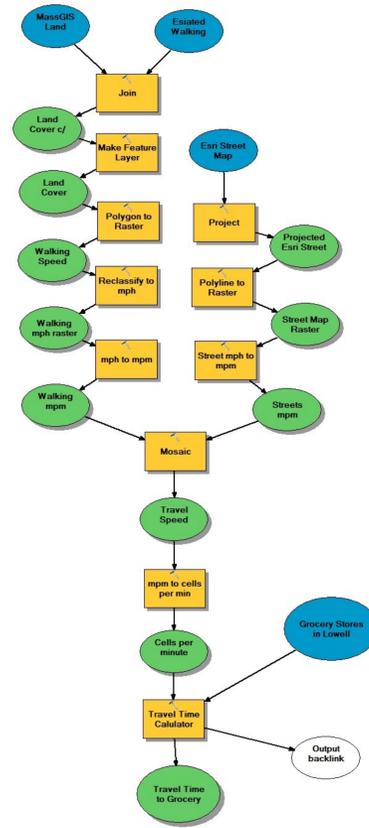
in 2010. The USDA List of supermarkets was compiled using a list of stores that accepted SNAP benefits and / or were listed in the database Trade Dimensions TDLinx®. To be classified as a supermarket the store also needed to carry a wide variety of food options and have annual sales above \$2 million. Because this list of stores included information from a proprietary database it is not publically available, the stores shown on the map above are from the Reference USA database.

Travel Time Modeling

To provide a more realistic measure of access to healthy food I modeled the travel time across the landscape of Lowell to reach grocery stores. In this model the grocery stores were identified from the Reference USA business database which is maintained by Reference USA for research applications. Travel speeds were determined using posted speed limits on public roads encoded in Esri Street Maps and by estimating the walking speed across the landscape represented by the Mass GIS Land Use Data layer. The data processing tool is represented to the right and the resultant Travel Time Raster below.



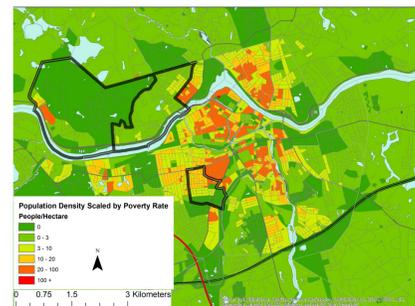
In this model shortest travel times are displayed in dark green and longest travel times in dark red, each color category represents a 10 minute time range.



Population Modeling

To represent the people who need access to food we used block level population counts from the 2010 decennial census conducted by the US Census Bureau. This was the smallest areal unit available for population counts.

Since low-income status is one of the most significant exacerbating factors that limits a person's capacity to access healthy food (Clifton, 2004) we used American Community Survey block group level poverty data to calculate block group level poverty rates that were then used to scale the block level population density data. This then generated a raster of the population density of people living below the poverty line which could be used to locate low income areas.

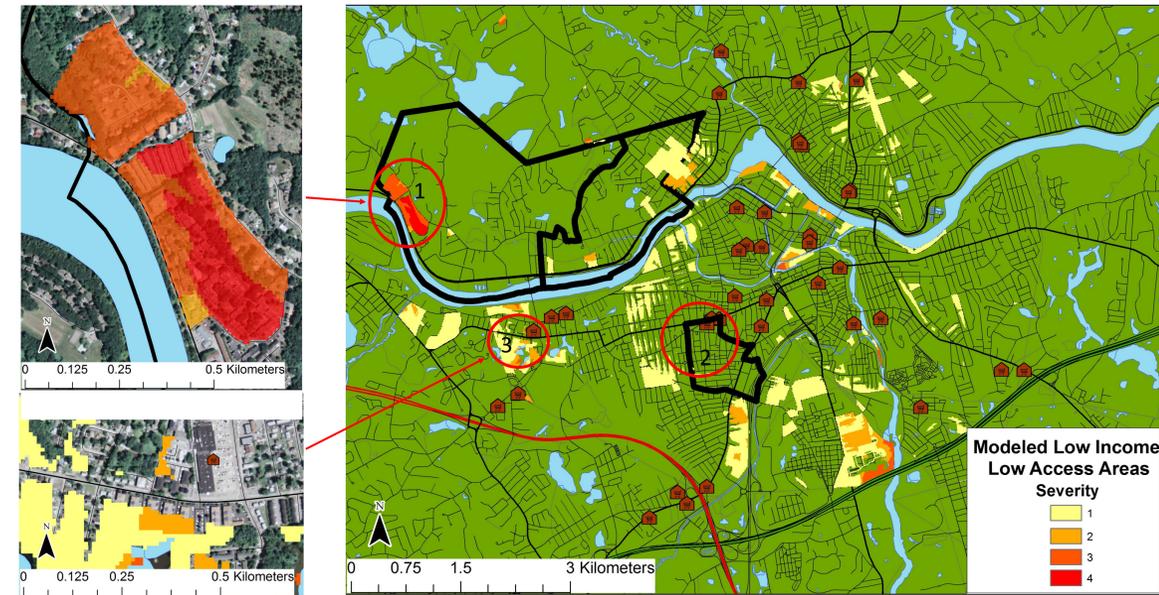


References

- Clifton, K. (2004). Mobility Strategies and Food Shopping for Low-Income Families: A Case Study. *Journal of Planning Education and Research*, 23(402).
- Raja, S., Ma, C., & Yadav, P. (2008). Beyond Food Deserts: Measuring and Mapping Racial Disparities in Neighborhood Food Environments. *Journal of Planning Education and Research*, 27(469).
- Ver Ploeg, M., Breneman, V., Dutko, P., Williams, R., Snyder, S., Dicken, C., & Kaufman, P. (2012). Access to Affordable and Nutritious Food Updated Estimates of Distance to Economic Supermarkets Using 2010 Data.
- Whelan, A., Wrigley, N., Warm, D., & Cannings, E. (2002). Life in a 'Food Desert' *Urban Studies*, 39(11), 2083-2100.

Final Modeled Low Income Low Access Areas

To generate comparable data the Travel Time Model was reclassified to indicate the severity of the disadvantage that the increased travel time causes. Since the national average travel time to a grocery store is 15min (VanderPloeg et al. 2012), all travel times less than that were considered unimportant, travel times of 15-25 min were deemed of level one importance, with importance increasing one level for every 10 min increase in travel time. The Population Model was reclassified so that a population density of fewer than 3 people per hectare with income below the poverty line was not considered and increments above that were considered with higher population densities of people living below the poverty line receiving higher scores. The resultant importance scores were then averaged to determine areas of Lowell that had both high travel time to grocery stores and high population densities of low income people. These areas are the modeled Low Income Low Access (LILA) areas.



The main advantage of my model is that it is more spatially discriminating than the USDA tract based model. Since census tracts are large and non uniform my model serves as an effective way to highlight which parts of the tract are causing it to be designated LILA. This can be seen in call out 1 where the large north western census tract has a section that is LILA but that section is much smaller than the tract as a whole. In fact my model identified a total of 376 hectares in Lowell as LILA compared to 805 hectares identified as LILA by the USDA tract based model. Having this additional information allows planners and organizers interested in food access to focus on smaller and more important geographic areas.

Additionally my model uses grocery store data compiled in 2015 and there have been new stores added since 2010 when the USDA compiled their list. This can be seen in call out 2, where a tract that was formerly LILA no longer is.

Yet there is a disadvantage to my model. In areas where the model relied on walking speeds, areas that are very close to a grocery store are considered Low Access (see call out 3).

As a result my method for identifying LILA areas of Lowell has highest utility for local planning and programming where people with additional knowledge of the situation can evaluate its results, while the USDA model is better suited to demographic studies of food access on the scale of a state or the entire country where some of the difficul-

GeoData Sources:

- ESRI Streetmap USA, 2015, Environmental Systems Research Institute, Available on Tufts M Drive, Accessed Nov 18, 2015
- Land Use (2005), June 2009, Sandborn, Published by MassGIS available [on-line](#), Accessed Nov 18, 2015
- Reference USA Business Database Grocery Stores in Lowell MA, Reference USA, Subscription service online [here](#), Accessed Nov 18, 2015
- Block Level Population Counts from 2010 Decennial Census, April 2012, US Census Bureau, Published by Mass GIS [On-line here](#), Accessed Nov 18, 2015
- Block Group Level Poverty Data from 2009-2013 American Community Survey, 2014, US Census Bureau, Published by US Census Bureau [on-line here](#), Accessed Nov 18, 2015
- Food Access Research Atlas, March 2015, United States Department of Agriculture: Economic Research Service, Published [on-line here](#), Accessed Nov 18, 2015