PROPOSED SUPERMARKET LOCATIONS

Comparing and contrasting locations to serve a higher number of low income households

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CONCEPTUAL DECISION-MAKING MODEL

Food retail locations that are located within ¼ mile **(400 meters)** [1] along walkable roads[2] of **low income households**, are able to provide healthy food options across the full diet[1] that may help alleviate food insecurity in this vulnerable population. By identifying areas where food retail locations are not within ¼ miles (400 meters) [1] of vulnerable low income households, construction of a supermarket may be proposed.

SPATIAL MECHANISM

The walkable roads described in the conceptual decision making model includes major roads and minor streets and roads, which are used as proxies for sidewalks assuming that all roads and streets have sidewalks.

The 400 meters definition of walkability was obtained and adapted from "Walking the Network: A Novel Methodology for Measuring Walkability Using Distance to Destinations Along a Network. Although the distances were derived from the author's own assumptions and may be deemed arbitrary, they were useful in his analysis, and has even been useful and adapted in the "Massachusetts Food Access Index"[2] pilot to create a composite food access index score for distance of travel.

KEY DATASETS

Dataset	*Description of Use in Model*	*Original Methodology + Purpose*	*Key Attributes*
Massachusetts Food Retailers (Reference USA)[3]	NAICS to download to model food retailers*	Keep up-to-date business data. Information from public sources, then research staff analyzes and verifies every record.	Latitude, Longitude, Primary NAICS, Primary NAICS Description
MassDot Roads (MassGIS)[4]	To model walkability using 400 meter buffers	Represent public and a good part of the private roadways in Massachusetts. Continually adding linework from municipal sources among others; uses orthophoto imagery as basemap.	Class 4-6; MGIS_TOWN
2013 American Community Survey 1-Year Estimates (U.S. Census Bureau)[5]	Household income in the past 12 months (in 2013 inflation-adjusted dollars) to model low income**	12 months of collected data (Jan 1, 2013-Dec 31, 2013). Uses series of monthly samples to create estimates for small areas that were initially surveyed using the decennial census.	Estimate and Margin of Error

*Includes *Supermarkets and Other Grocery = 445110, Convenience Stores = 445120, Meat Markets = 445210, Fish and Seafood Markets = 445220 , Fruit and Vegetable Markets = 445230.* ***Original search=666 to clean dataset= 535 food retailers****. Data demonstrates both verified and unverified businesses.* ** Includes income data: B19001e1, B19001m1, B19001e2, B19001m2, B19001e3,

OBJECTIVES

The objectives of this project are: to evaluate the existing food retail locations in Boston, MA; identify areas that do not have food retail locations within 400 meters of low income households and propose locations for supermarket construction to compare and contrast which location will serve or benefit a higher number of low income households.

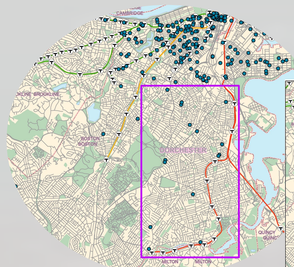

Figure 1 *demonstrates all existing food retails in Boston, MA from Reference USA after data cleaning and purple box represents study of interest with lower concentration and clustering of existing food retails.*

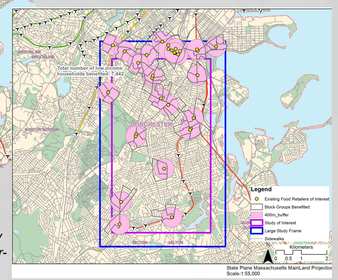

Figure 2 *shows all existing food retails with their respective 400 meter buffers, currently benefitting 7,442 low income households*

GIS PROCEDURES

Existing Food Retailers and Buffers

Existing Boston food retailers from Reference USA were imported using the tool ***display X and Y data*** on map, then points were ***exported into a shape file***. Existing Boston food retailers of interest were ***selected by location*** using the large study frame layer and made into a ***feature layer***. ***Buffers*** were created that were ***400 meters of distance*** of these existing food retailers of interest *using* ***a full, round planar method.***

Population Density+ Low Income Households Benefitted

Population density is displayed as total households per hectare. ***A new field was created*** to calculate hectares by dividing area of land from 2013 ACS block groups by 10,000. ***Joined*** 2013 ACS household income data to 2013 ACS block group. Reduced the spatial extent by ***creating a layer*** with only block groups within a ***distance of 1000 meters*** of large study frame by ***selecting by location.*** This layer was used to select block groups that ***had their centroid*** in the 400 m buffer layer and calculate the ***summary statistics*** for low income households including those households with less than $10,000, $10,000 to $14,999, and $15,000 to $19,999. Total number of low income households benefitted is a ***sum*** of all the households in these three categories.

Proposed locations for supermarkets

Points were created using the ***draw tool*** and converted into three separate ***shape files*** and ***appended*** the point to a copy of the existing Boston food retailers layers. The same analysis was ran but now including the new location to explore the new total number of low income households benefitted.

GRANULARITY OF DATASETS

- ***Existing food retailers*** represent supermarkets, convenience stores, meat, fish, seafood, fruit and vegetables markets; when grouped together this way, factors important for food security such as quality or variety of these food sources are lost. It is plausible that there is an overestimation or underestimation of the number of food retailers as dataset includes unverified businesses as well.
- Only ***major roads, minor roads and streets*** are displayed to represent these sidewalks, which may be an acceptable use of data for the purpose of this analysis. Roads and streets are used as a proxy for sidewalks, and it assumes that all roads and streets have sidewalks. The level of detail of sidewalks is not necessary and roads and streets are enough to model walkability in this study.
- Using ***block groups for household income*** may not be able to identify where these specific households live in this area near the buffer, but this detail is not necessary because the interest is to get a rough estimate of households that will be benefited in this large study frame when a new location is added.

RESULTS

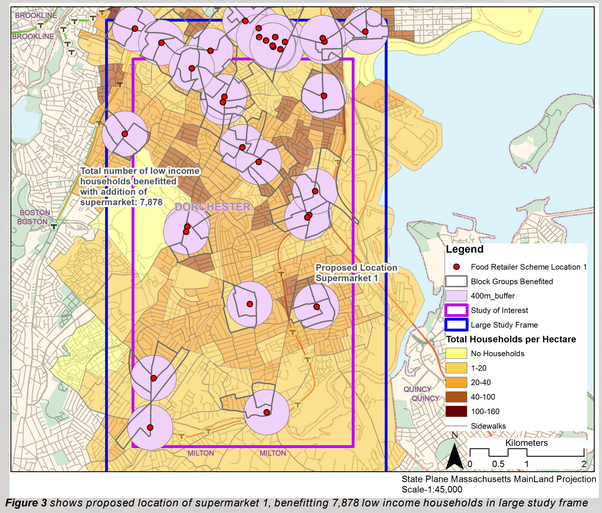

Figure 3 *shows proposed location of supermarket 1, benefitting 7,878 low income households in large study frame*

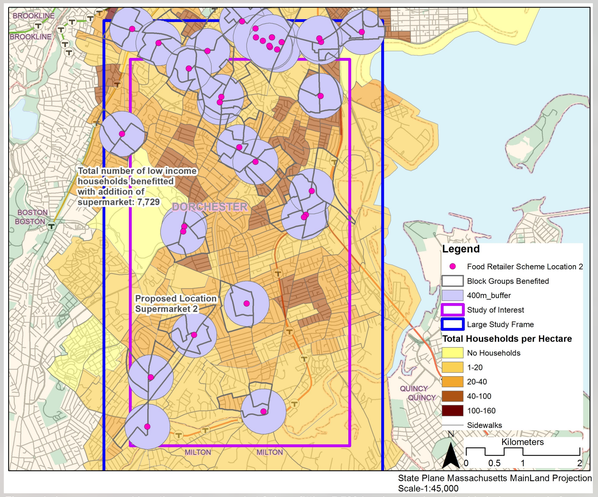

Figure 4 *shows proposed location of supermarket 2, benefitting 7,729 low income households in large study frame*

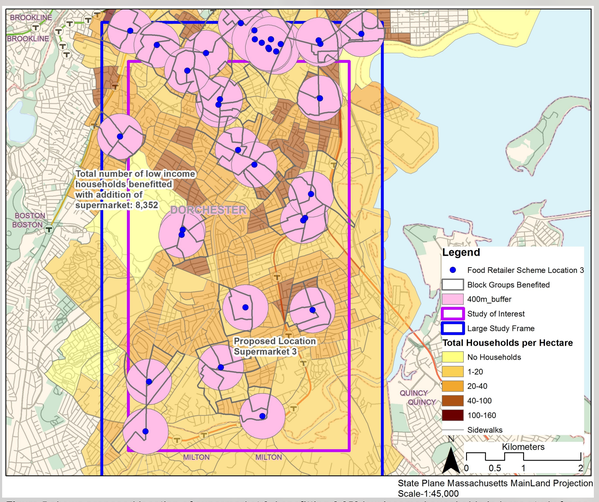

Figure 5 *shows proposed location of supermarket 3, benefitting 8,352 low income households in large study frame*

DISCUSSION

Location of supermarkets

From visual examination of Figure 2 along with mapping population density (map not shown), potential locations for supermarkets were proposed. Supermarket 1 was placed where 2013 ACS block group data showed a high population density of approximately 40-100 households per hectare without an existing food retailer nearby. Supermarket 2 and 3 were placed near a moderate population density of approximately 20-40 households per hectare.

Best location in terms of number of low income households served

Figure 5 shows proposed location of supermarket 3, which 2013 ACS block group data estimates to benefit a total of 8,352 low income households compared to the estimated 7,442 households with only the current existing food retailers. Using these datasets, the supermarket location would have benefited an additional 910 low income households. Figure 3 and 4 show proposed location of supermarket 1 and supermarket 2, which benefit approximately 7,878 and 7,729 households, respectively. Supermarket 1 would benefit an additional 436 low income households, while supermarket would benefit only 287. Therefore, by using these methods and model, I am able to pinpoint where supermarkets may be needed and the number of low income households benefited to decide which location will be best for supermarket construction.

Granularity and Improvements

The model itself is not perfect but may be useful in exploring and proposing supermarket locations using existing and available data about food retailers and income. There is overestimation in the number of households benefitted by using block groups as some of the block groups that are within the 400 meter buffers also capture households outside the buffer because they are part of that block group. Additionally, although the area of interest is the purple frame, the large study frame in included to be able to capture the reality that even if the food retailer is outside the study of interest, people in households within the study of interest would go to that retailer as well. Because the model tries to get a rough estimate on the number of households benefitted by the placement of a supermarket before and after, detailed data at the block level was not deemed necessary, but for further work, block level data may be able to give a more accurate number of households benefitted as blocks will be confined more precisely within the buffers. Low income households in this model were defined as a household having an income less than $19,999, which is the poverty line in Massachusetts for a household of 3. Therefore this model is not taking in consideration number of people living in these households, as the main interest is in number of households and not residents in the households served.

Future work

1) Assign weights to food retailers as not all retailers are created equally, convenience stores do not provide same level of quality of foods as a large supermarket could in terms of fruits and vegetables. 2)Use poverty status instead of household income to evaluate low income households. 3)Look more in depth in these areas proposed if it is feasible to build a super market

REFERENCES

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