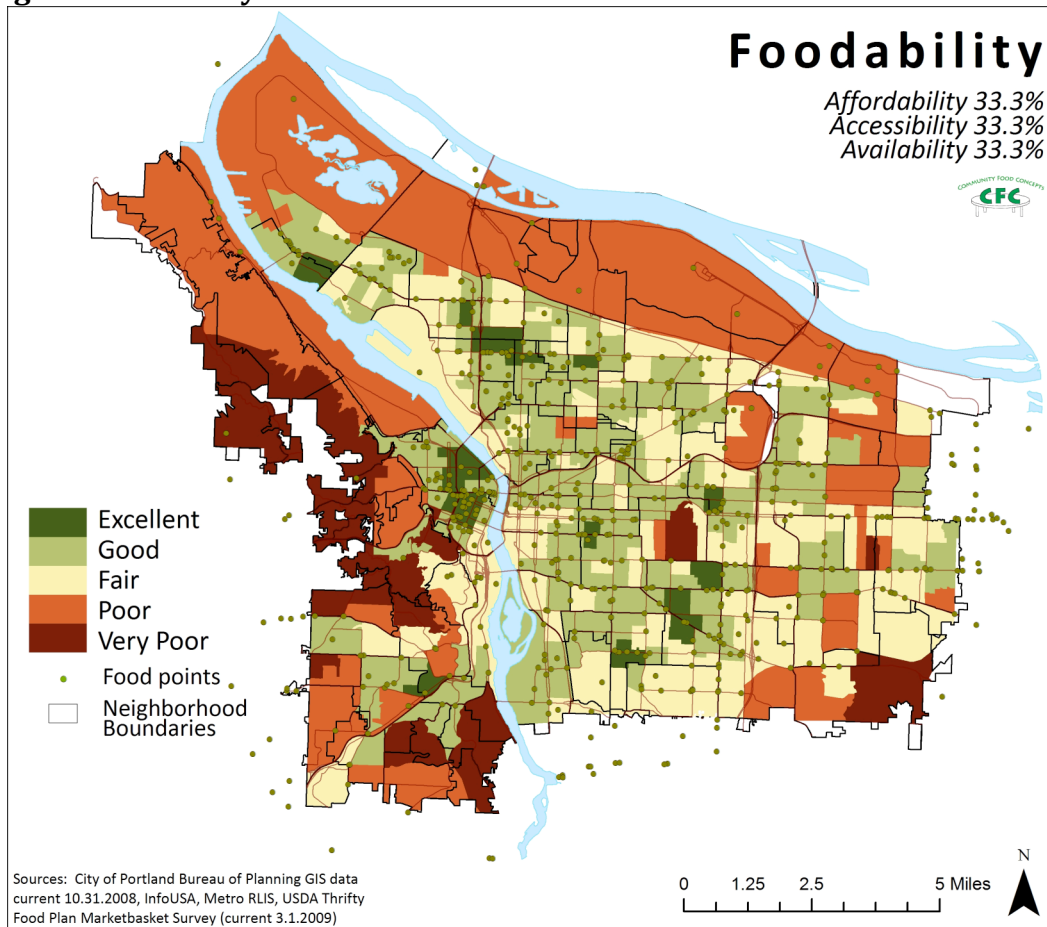


## Evaluating Grocery Store Siting: A Case Study at SE 122<sup>nd</sup> and SE Foster

### Introduction

Grocery store location is a challenging problem both from the business perspective (where could a profitable business locate?) and the equity perspective (where is food access limited or inequitably distributed?). This project examines industry assumptions about grocery store location combined with demographic and other geoanalytic processes. The Bureau of Planning and Sustainability (BPS) is conducting a study of the SE 122nd Avenue corridor from Division Street south to Foster Road. The southern portion of study area has limited grocery access, as determined by several recent studies of food access in Portland, including the MURP Foodability 2009 Planning Workshop study completed last year.<sup>1</sup> (See Image 1)

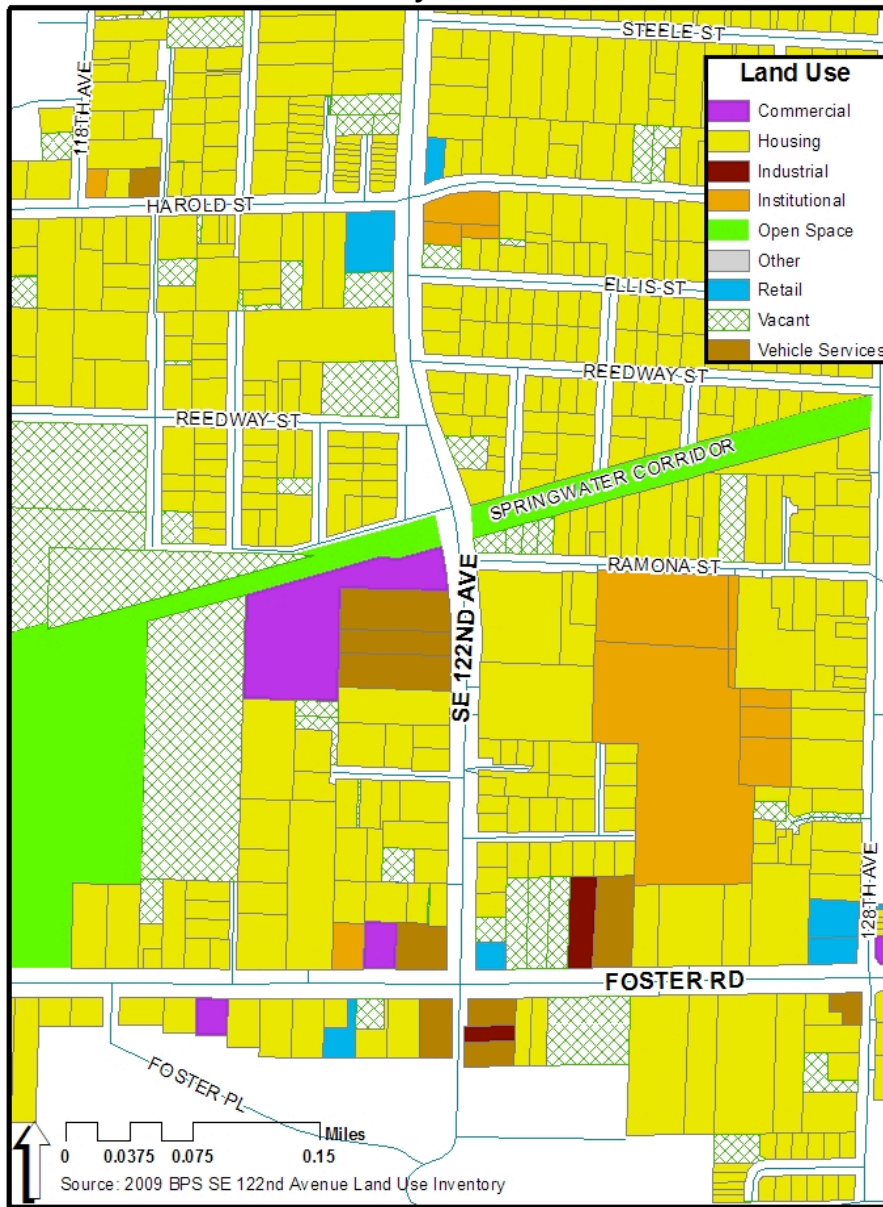
**Image 1: Foodability**



<sup>1</sup> Armstrong, Kim, Elizabeth Chapin, April Chastain, Julia Person, Stephanie VanRheen, and Steve White. "Foodability: Visioning for Healthful Food Access in Portland." Thesis. Portland State University, 2009. Print.

There are several contiguous vacant commercial lots in the southern portion of the area. Community members have suggested that these vacant parcels (hereafter referred to as the Foster site) should be explored as a potential grocery store location. (See Image 2) This analysis examines the suitability of the Foster site as a grocery store location based on a combination of traditional location factors and more recent consumer demographic research.

**Image 2: SE 122<sup>nd</sup> Avenue Land Use by Taxlot**



## Background and Existing Conditions

Standard grocery store location decisions take into account the size of the lot of the potential building and parking site, market leakage, variations in service area by store type, and population needed to support a store. More recent research also explores demographic trends in consumer store choice.

### Lot Size & Market Leakage

The Foster site has an area of roughly 63,605 square feet. There are several grocery stores in Portland on lots of a similar or smaller size, including dozens of specialty stores and three New Seasons Markets.<sup>2</sup> An ESRI Business Analyst report for the Foster site indicates that there is market leakage of \$8,159,848 for grocery stores within a five minute drive and of \$871,087 for specialty stores within a three minute drive.<sup>3</sup> Market leakage is calculated as retail potential minus retail supply and is often used in economic development research as one indicator of what types of new development an area can support.

### Store Types & Service Catchment Areas

There are dozens of different schemes used to categorize grocery stores according to stock, size, and ownership. For our purposes, we developed a simplified version of the scheme from a 2004 article from the *Journal of Planning Education and Research*, as detailed later.<sup>4</sup> The authors of the article noted that "few people would substitute walking for driving to the grocery store, even if access were excellent."<sup>5</sup>

This finding, coupled with our limited time frame and the traditional location decision parameters led us to focus on automobiles for the creation of the analysis network.

A supermarket generally has a consumer catchment area of three miles or a five minute drive-time. Specialty stores typically have a smaller catchment area of one mile or a three minute drive-time. Large discount stores often operate at a regional level, so a ten minute drive-time is a conservative estimate of their catchment area.<sup>6</sup>

### Demographic Trends

Dunkley also reviewed existing literature about consumer demographics and preferences, with findings relevant to this analysis. As income and education

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<sup>2</sup> Bureau of Planning and Sustainability, Alma L. *Select Grocery Store Size Types and Market for Portland*. Rep. Portland: BPS, 2007. Print.

<sup>3</sup> ESRI Business Analyst Online. *Retail Marketplace Profile*. Rep. 2009. Print.

<sup>4</sup> Dunkley, Bill, Amy Helling, and David Sawicki. "Accessibility versus Scale: Examining the Tradeoffs in Grocery Stores." *Journal of Planning Education and Research* 23.4 (2004): 387-401. *CSA Web Illumina*. Web. 20 Nov. 2009. <<http://csaweb105v.csa.com>>.

<sup>5</sup> 393

<sup>6</sup> Flores, Alma. Personal interview. 18 Nov. 2009.

decrease, or as household size increases, likelihood of shopping in discount stores increases. Size-constrained grocery stores are more successful in areas of high income or in areas where there is a large population without personal vehicles. A 2006 article from the *International Journal of Retail & Distribution Management* concluded that supermarket patronage (especially of "traditional neighborhood markets") increases with decreasing household size.<sup>7</sup>

## Methodology Overview

In order to examine the suitability of the Foster site, this analysis draws on Portland grocery store data from BPS, Portland streets data from Metro's Regional Land Information System, and demographic information from the 2000 Census.

### Grocery Store Data

The first step in this analysis was to geocode and map a list of Portland grocery stores to examine market coverage by store type and to assess the store service areas for demographic or geographic trends. A preliminary list was received from BPS, updated with recently opened stores, geocoded, and categorized to use in the analysis.

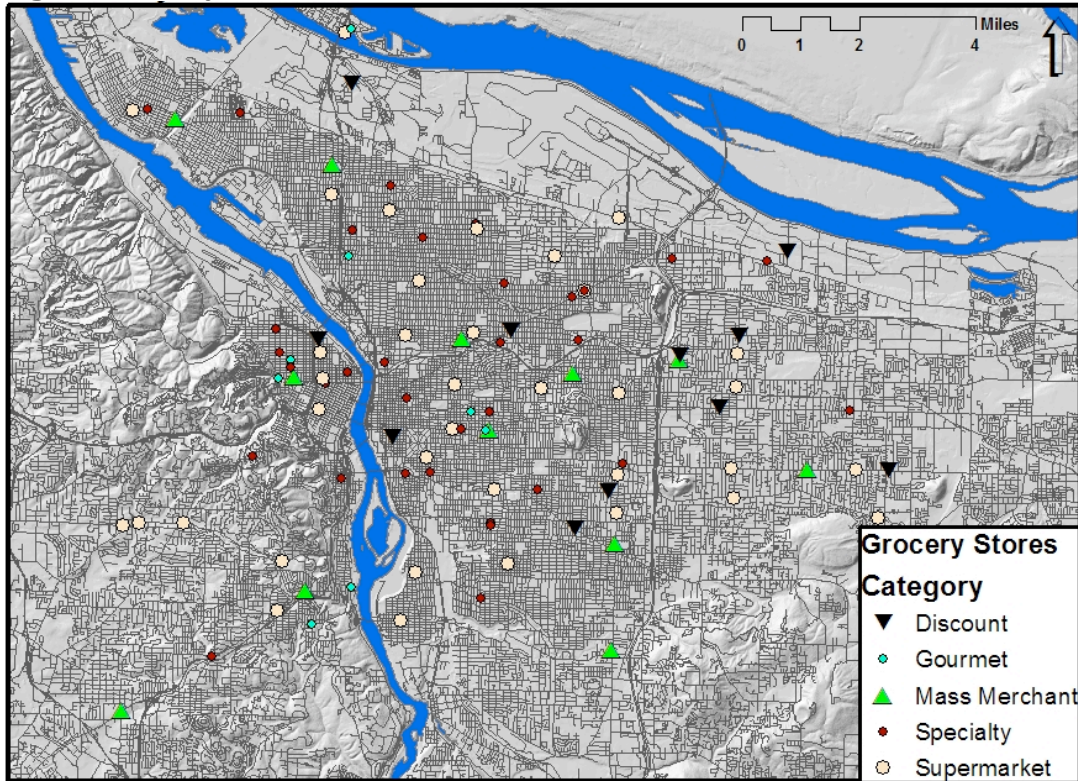
A. Steps to analyze the grocery store data were as follows: (See Image 3)

1. Obtained list of Grocery Stores from BPS.
2. Added known missing stores (Grocery Outlet, New Seasons, Pastaworks).
3. Geocoded to Portland Streets with a 98% match rate and matched the remaining stores manually.
4. Removed locations operating only as wholesalers.
5. Assigned a category to each location according to simplified scheme informed by the literature review:
  - Supermarket - full-service chain or independent grocery store (ex.: Albertsons)
  - Gourmet - limited selection; little to no nonfood items (ex. Zupan's Market)
  - Specialty - ethnic stores, greengrocers, bakeries, seafood markets, butchers, etc. (ex.: An Dong Market)
  - Discount - supercenters, warehouse/wholesale sellers (ex.: Winco)
  - Mass merchant - departmentalized store that sells food in addition to other household goods (ex.: Fred Meyer)

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<sup>7</sup> Carpenter, Jason, and Marguerite Moore. "Consumer demographics, store attributes, and retail format choice in the U.S. grocery market." *International Journal of Retail & Distribution Management* 34.6 (2006): 434-52. *Emerald*. Web. 20 Nov. 2009. <<http://www.emeraldinsight.com>>.

**Image 3: Grocery Stores in Portland**



### **Street Network**

Next a street network was created using the Metro RLIS streets file. Lengths were converted to miles and drive-times were assigned based on speed limit assumptions detailed below.

B. Steps to create a Portland street network were as follows:

1. Added a miles field to the attribute table for the street shapefile. The miles were calculated as  $\text{length}/5280$ .
2. Added a speed field to the attribute table for the street shapefile. Values for the speed field were populated as below, according to street type and in miles per hour:
  - Freeways = 55
  - Highways = 45
  - Primary arterials = 35
  - Secondary arterials = 30
  - Other arterials = 30
  - All others = 25
3. Added two fields, "TF\_Minutes" and "FT\_Minutes" and calculated both of their values to be  $\text{miles} \times 60 / \text{speed}$ .
4. These additions allowed for the creation of a network dataset that could evaluate a route based on time impedance.

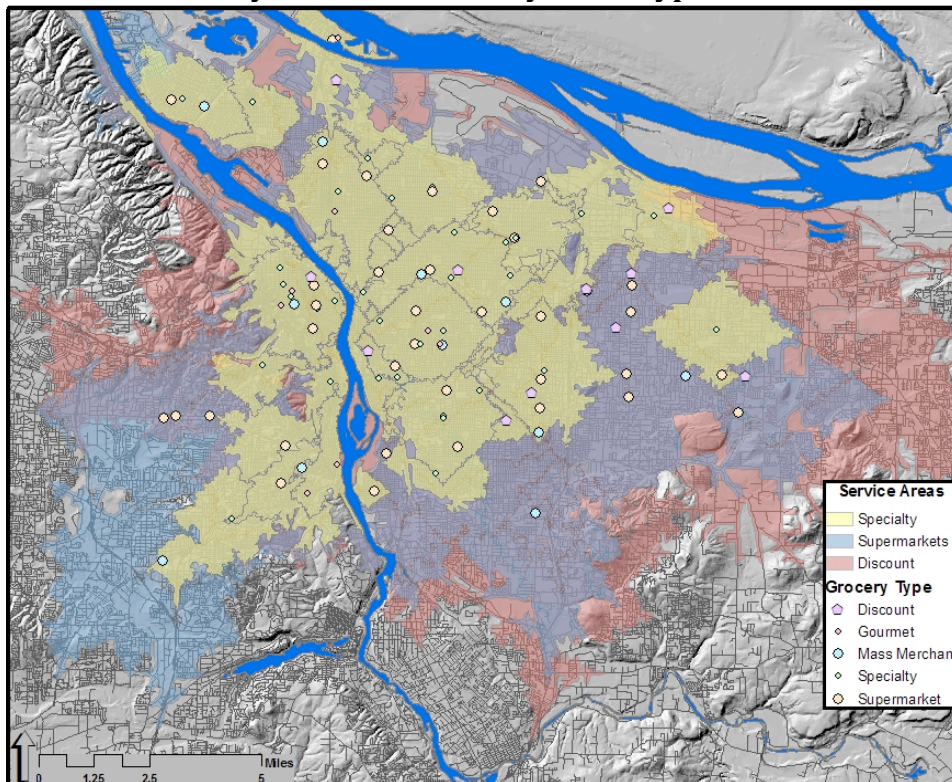
### Service Area Analysis

Drawing on the literature reviewed and categories of grocery stores (gourmet, specialty, supermarket, mass merchant and discount), standard business market catchment areas were assigned to each category. Network analyst was used to create service area polygons according to the assigned drive-time catchment for each store on our list, as well as for a site manually created at the Foster site.

C. Steps to complete a service area analysis were as follows: (see Model & Image 4)

1. Based on BPS information, divided grocery stores into three drive-time catchment groups and ran three separate service area analyses, changing only the impedance breaks.
  - Discount store service areas: 10 minute break
  - Mass merchant and supermarket: 5 minute break
  - Specialty and gourmet: 3 minute break
2. Each analysis generated overlapping polygons, and routes were calculated towards the facility.
3. Manually created a facility at the Foster site. Ran service area analysis with 3, 5, and 10 minute breaks, calculated towards the facility.
4. Individually selected Foster site and comparison store polygons (see step D.3), saved as layer, and then exported as shapefiles to use in clip process in step D.5.

**Image 4: Network Analyst Service Areas by Store Type**



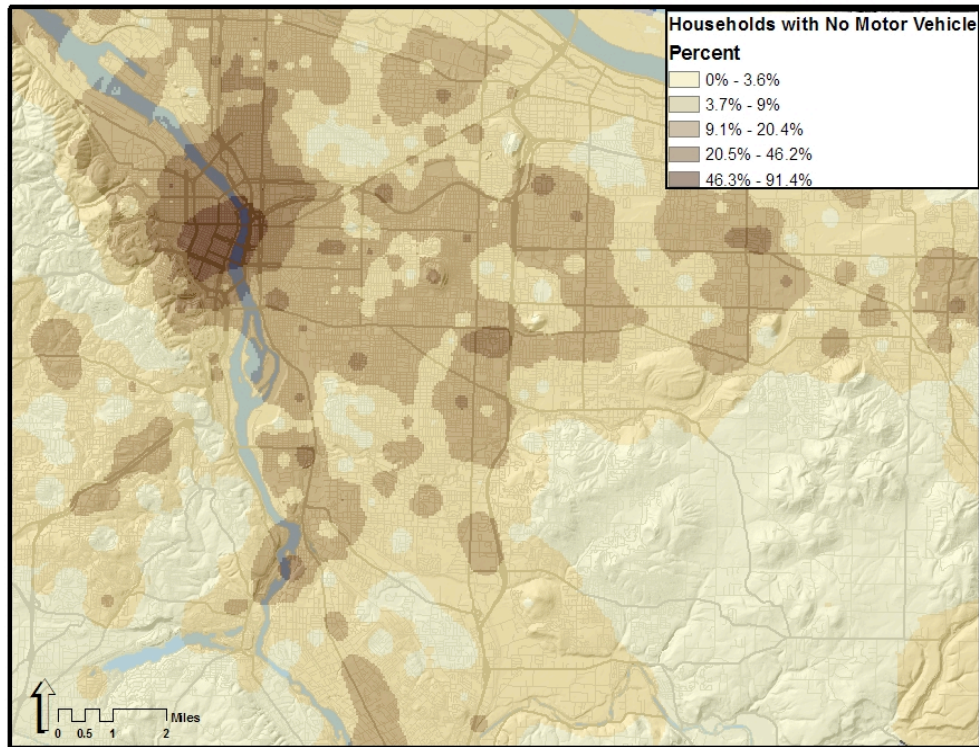
### **Demographic Rasters**

Demographic data were used to assess the market demographics of a potential new grocery store and of select existing grocery store locations. The literature review suggested that certain demographic groups (particularly in relations to household size, median household income and number of households without a motor vehicle) provided favorable market conditions for different types of stores. Rasters were created from Census block group data and clipped to store polygons in order to compare our potential site to existing stores.

- D. Rasters of Median Income, Household Size and Households with No Vehicle
1. Downloaded 2000 block group Census data for Multnomah and Clackamas Counties (Household size (P14); Income (P53); Car ownership (H44
  2. Downloaded 2000 block group shapefiles for Multnomah and Clackamas Counties and merged into one shapefile.
  3. Joined merged block group shapefile to data table from step 1, based on FIPS.
  4. Created raster surfaces for each of the three demographic variables for use in visual comparison to Foster site.
    1. Used feature to point conversion to extract block group centroids. These centroids provide point data for the following raster interpolation processes. IDW method chosen to avoid values below 0 for all factors and above 100% for percentage of households owning no vehicles.
    2. Interpolated a raster surface for each demographic factor using IDW.
      - No Vehicle - IDW 2.0 power, 8 points, 10560 feet max radius (See Image 5)
      - Household size - IDW 2 power, 8 points, 10560 feet max radius (See Image 6)
      - Median Income - IDW 2.0 power, 8 points, 10560 feet max radius (See Image 7)
    3. Chose other store catchment areas to analyze in step D.5.5. Visually examine rasters to choose areas likely to have similar character to Foster site (based on median income, household size, and no vehicle percentage).
  5. Create raster surfaces for demographic data for each of the relevant service area polygons: (see Model)
    1. For each of the three Foster site service polygons created in step C.4, clipped the merged block group shapefile from step D3 to the polygon.
    2. Converted new polygons to raster based on each of the three demographic factors: household size, median income, and % households with no vehicle.
    3. Examined raster statistics for each of the demographic factors.

4. The service area for discount stores has a higher income and smaller household size than the other service areas. These groups are not as likely to shop at discount stores. The demographic statistics, coupled with size constraints of site, led us to exclude discount stores from further analysis.
5. For each service polygon of selected comparison stores (step D.4.3), clipped the merged block group shapefile from step D3 to the polygon.
6. Converted new polygons to raster for each of the three demographic factors: household size, median income, and % households with no vehicle.

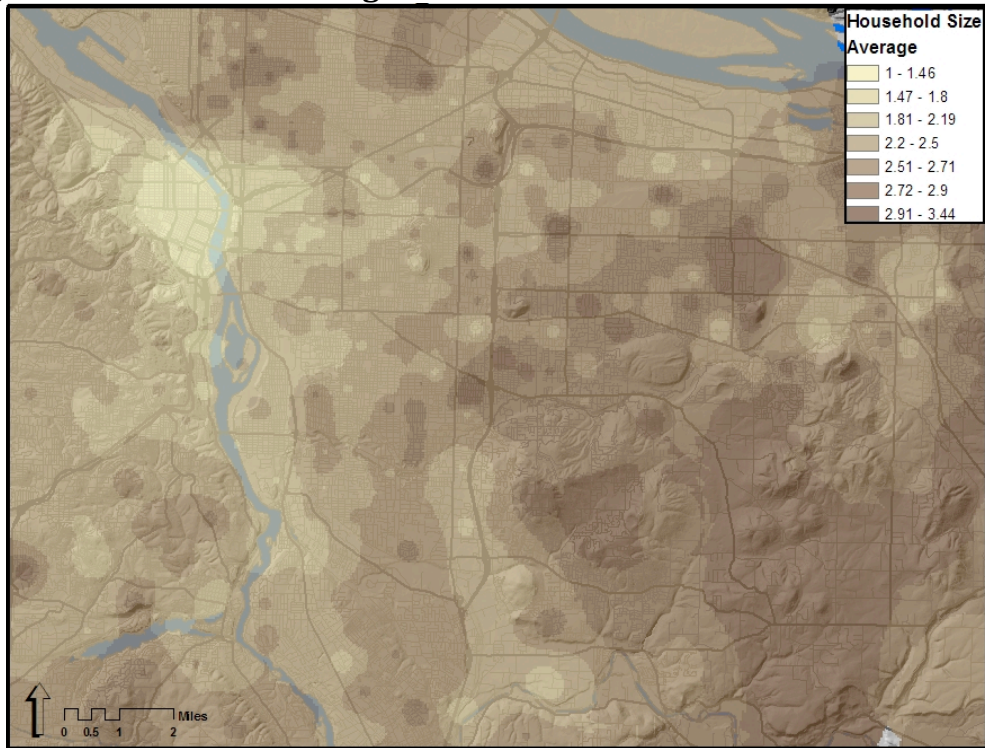
**Image 5: Portland Area Households with No Motor Vehicle**



Source: US Census, 2000

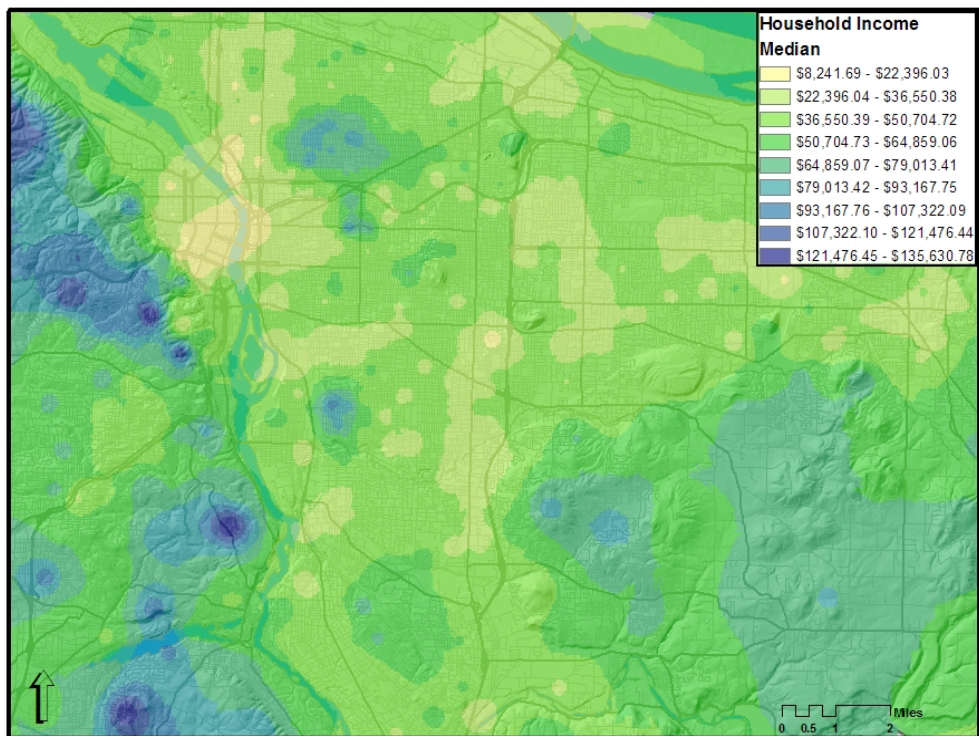


**Image 6: Portland Area Average Household Size**

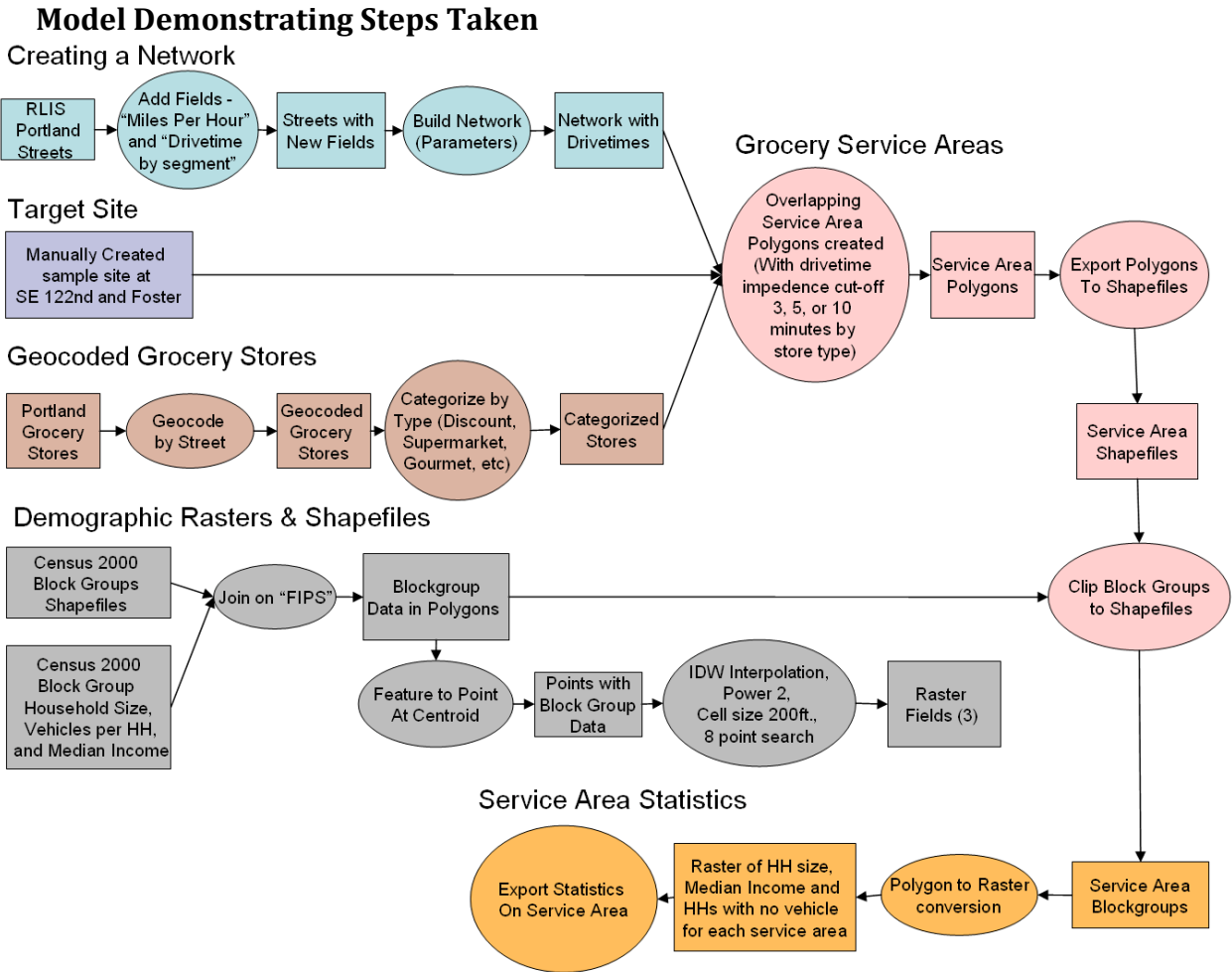


Source: US Census, 2000

**Image 7: Portland Area Median Household Income**



Source: US Census, 2000

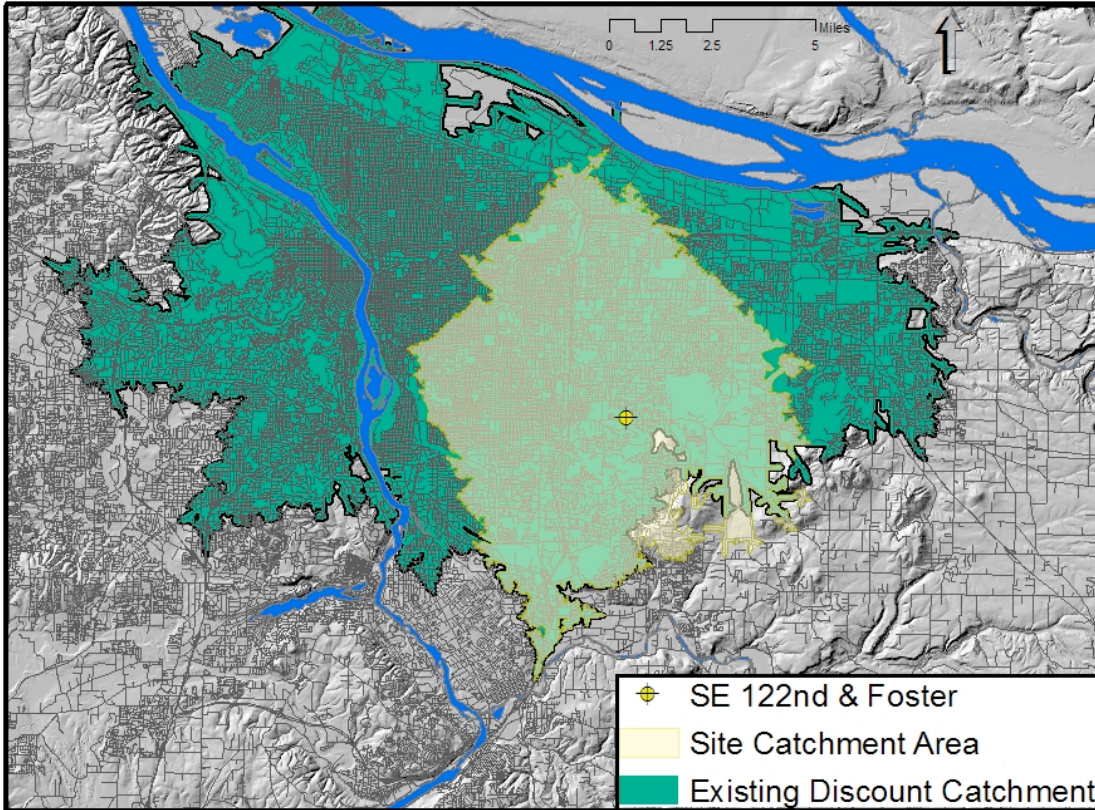


## Findings

### Discount Store

The first store type that we examined was the large discount grocery retailer with a ten minute drive-time service area. A review of the service area in comparison to the existing aggregate service area for discount grocery stores in Portland revealed that relatively little unique service area would be included for the SE Foster Road site. (See Image 8)

**Image 8: Potential Discount Store Catchment Area**



**10 Minute Drivetime  
 122nd Ave Site**

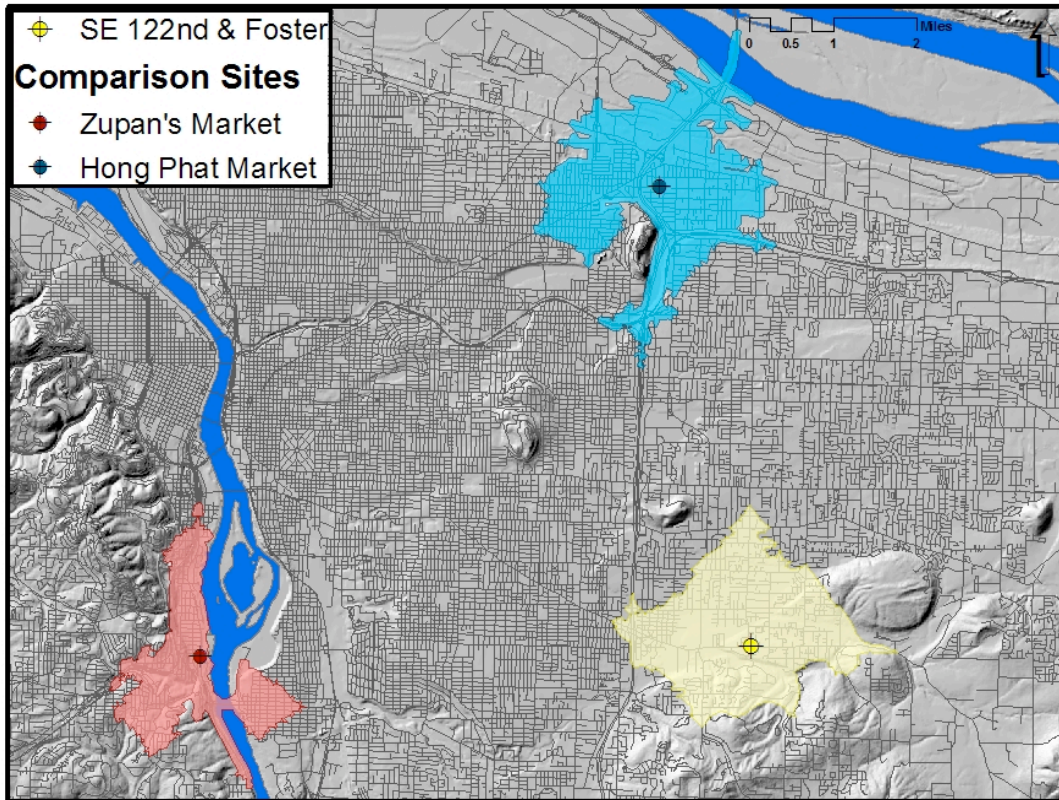
	Income	Household Size	% Households with no vehicle
<b>Discount</b>	Mean \$48,290	2.65	6.96%
	Range \$15,787 - \$100,514	1.61 - 3.45	0 - 39.6%

A review of the Foster site shows that the service area for discount stores has a relatively high income and small household size. Prior studies have shown that these groups are likely to shop at discount stores. This basic demographic data, coupled with size constraints of the site and the lack of new service area that would be created, led us to exclude discount stores from further analysis.

**Gourmet & Specialty Stores**

To examine the possibility of siting a gourmet or grocery store at our site, we looked at the three minute drive-time polygons created in our network analysis. By examining our rasters for median income and then for households without a motor vehicle, we identified two stores with service areas similar to that in the three minute catchment area of the Foster site - one gourmet store (Zupan’s) and one specialty store (Hong Phat). The three minute catchment area of the Foster site, along with that of two selected stores are shown below. (See Image 9)

**Image 9 – Gourmet and Specialty Store Catchment Areas**



**3 Minute Drivetime  
 122nd Ave Site**

Specialty	Income	Household Size	% Households with no vehicle
Mean	\$46,361	2.78	4.96%
Range	\$32,083 - \$65,655	2.42 - 3.10	0 - 20.4%

**Comparisons**

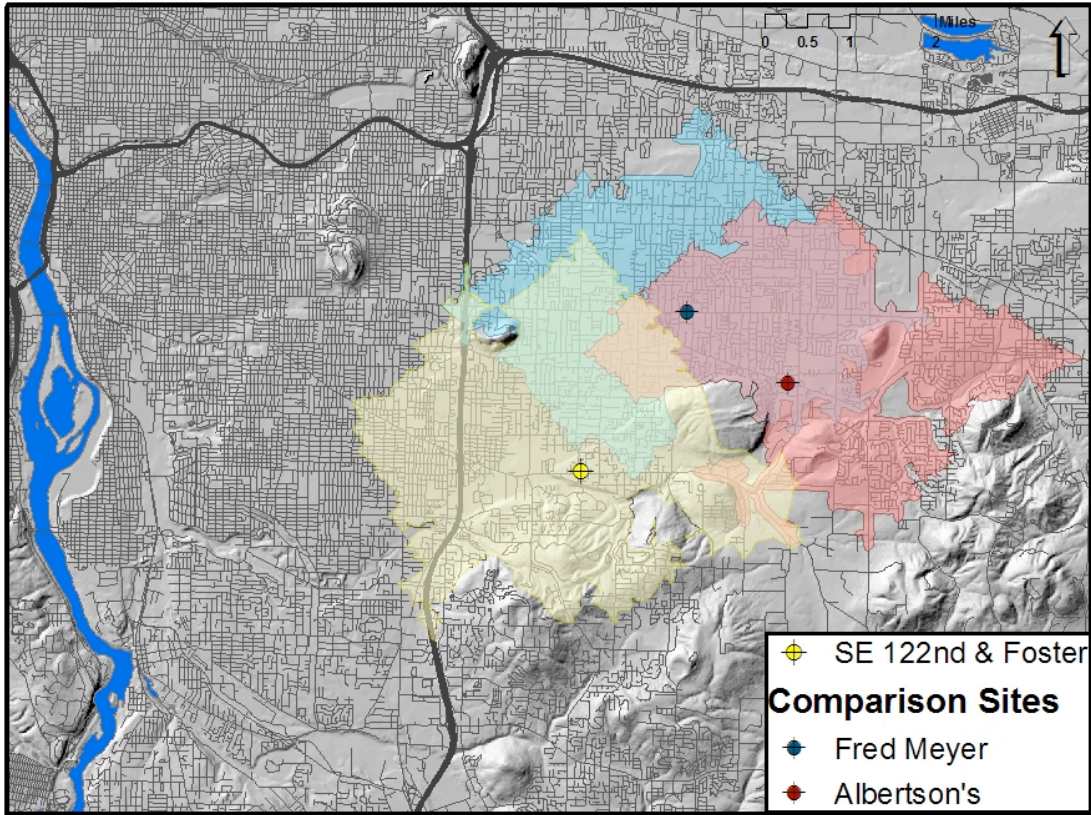
	Income	Household Size	% Households with no vehicle
<b>Specialty</b>	Mean \$40,820	2.57	6.30%
	Range \$26,889 - \$62,411	2.03 - 3.18	0 - 31%
<b>Gourmet</b>	Mean \$58,249	2.05	5.24%
	Range \$25,333 - \$85,000	1.57 - 2.50	0 - 34.2%

Looking to the grocery siting literature, which pointed to higher average household incomes as being a key factor in the success of a gourmet store, we determined that such a store might struggle at the Foster site; its household income was substantially below the median income of the comparison store - \$46,361 compared to \$58,249. Based on the literature and on the comparison of these two areas, the Foster site is likely to be better served by a specialty store than by a gourmet store.

**Supermarkets & Mass Merchants**

The third comparison was between a five minute drive-time service area from the Foster site and the catchment areas of two other grocery stores - a traditional supermarket (Albertson's) and a mass merchant (Fred Meyer). The service area polygons created from these three sites in network analyst can be seen below. (See Image 10)

**Image 10 – Supermarket and Mass Merchant Catchment Areas**



**5 Minute Drivetime  
 122nd Ave Site**

		Income	Household Size	% Households with no vehicle
<b>Supermarket</b>	Mean	\$46,682	2.78	7.25%
	Range	\$15,787 - \$84,278	2.05 - 3.45	0 - 39.6%

**Comparisons**

		Income	Household Size	% Households with no vehicle
<b>Supermarket</b>	Mean	\$48,318	2.79	6.77%
	Range	\$21,146 - \$78,262	1.94 - 3.26	0 - 28.4%
<b>MassMerchant</b>	Mean	\$38,997	2.74	8.86%
	Range	\$21,146 - \$78,262	1.92 - 3.39	0 - 28.4%

Literature showed that household size is negatively and median income is positively correlated to these kinds of stores, so we looked to our demographic rasters in these areas. The Foster site is similar to both of the comparison sites and looks as though it might be able to support either kind of store. Looking back to our available site size, it appeared as though the mass merchant store was not a good fit; however, a small supermarket might be a possibility.

### Conclusions

The size of the site would deter most supermarket developers, although as mentioned previously, there are at least three New Seasons Markets in Portland on lots smaller than the Foster site. Specialty stores often require much less land than supermarkets, though. Given the demographics of the area, we believe a specialty ethnic market would serve the area well. Next steps for this analysis could include working with small supermarket developers or with the local business district

members to attract an appropriate specialty store.

However, there were several limitations to our analysis. There are undoubtedly several grocery stores missing from the list, and supplemental food acquisition locations (such as minimarts) were not taken into account. In addition, building square footage plays an important role in store siting and in the volume of sales needed to support a store. This analysis originally included square footage from taxlot parcels, but here again, the data was incomplete and often incorrect. This was particularly true for mixed-use sites, where the building size often included all units on the site, or at least all commercial units.

Most shoppers frequent more than one store, and store choice often depends on the nature of the trip. In order to fully understand the grocery needs in the area, resident surveys and market-basket surveys would need to be completed. Interviews with grocery developers and with the owners of existing specialty stores could provide valuable insight into the decision-making constraints that they face. ESRI GIS tools can provide a powerful and flexible way to analyze data, but for this project, the data itself was too limited to generate a robust examination.