

THE RIGHT FOODSTUFF

Using GIS to determine food accessibility in Hennepin and Ramsey Counties, MN



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Abstract

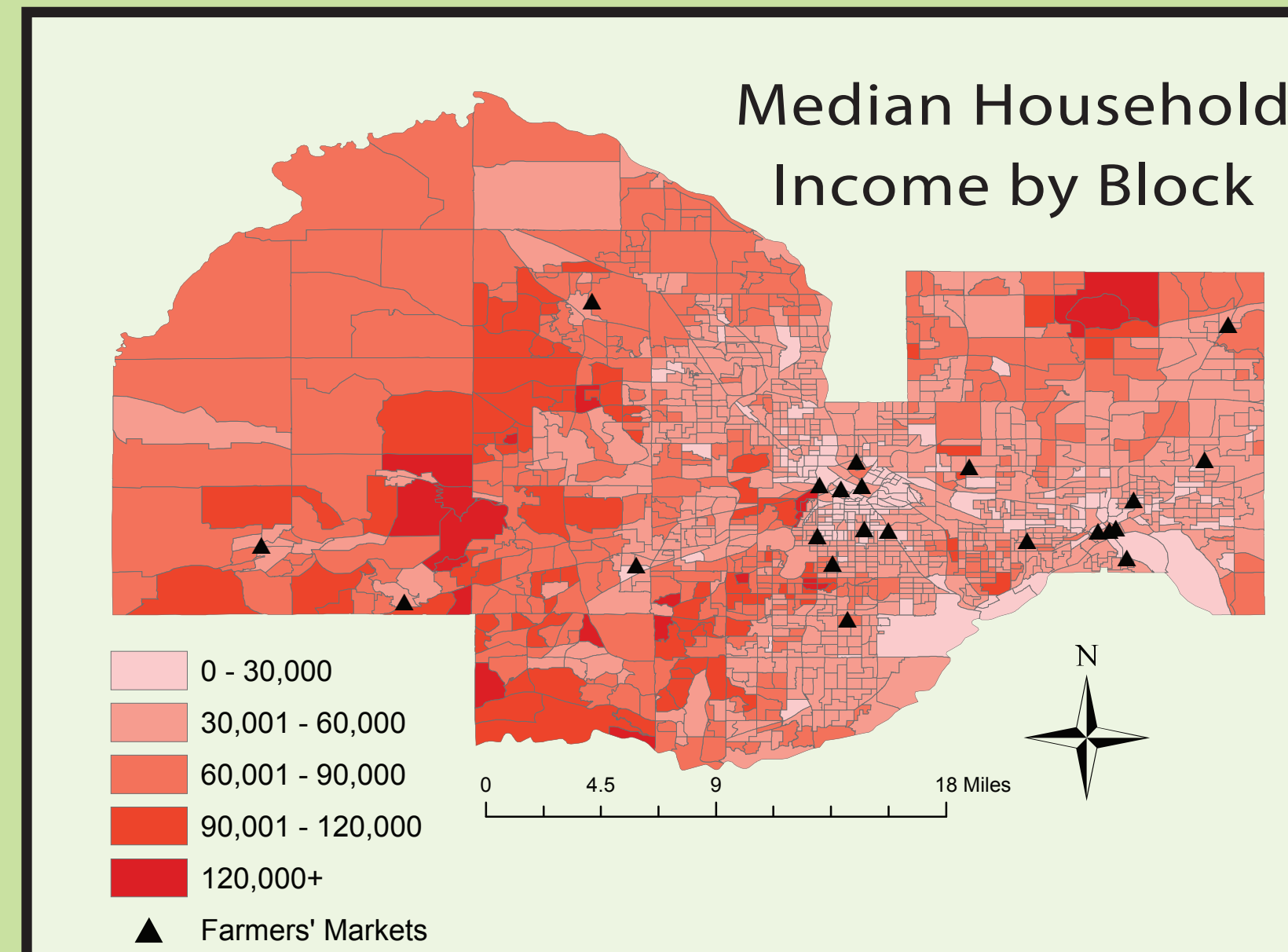
Farmers' markets provide fresh, local food to urban neighborhoods. However, low income and predominantly minority areas tend to have poorer access to these food sources. Geographic Information Systems (GIS) provides the analysis tools necessary to identify the spatial patterns of food outlets in relation to population centers. This project uses geocoding and network analysis to examine neighborhood food access in Hennepin and Ramsey Counties, Minnesota.

Literature Review

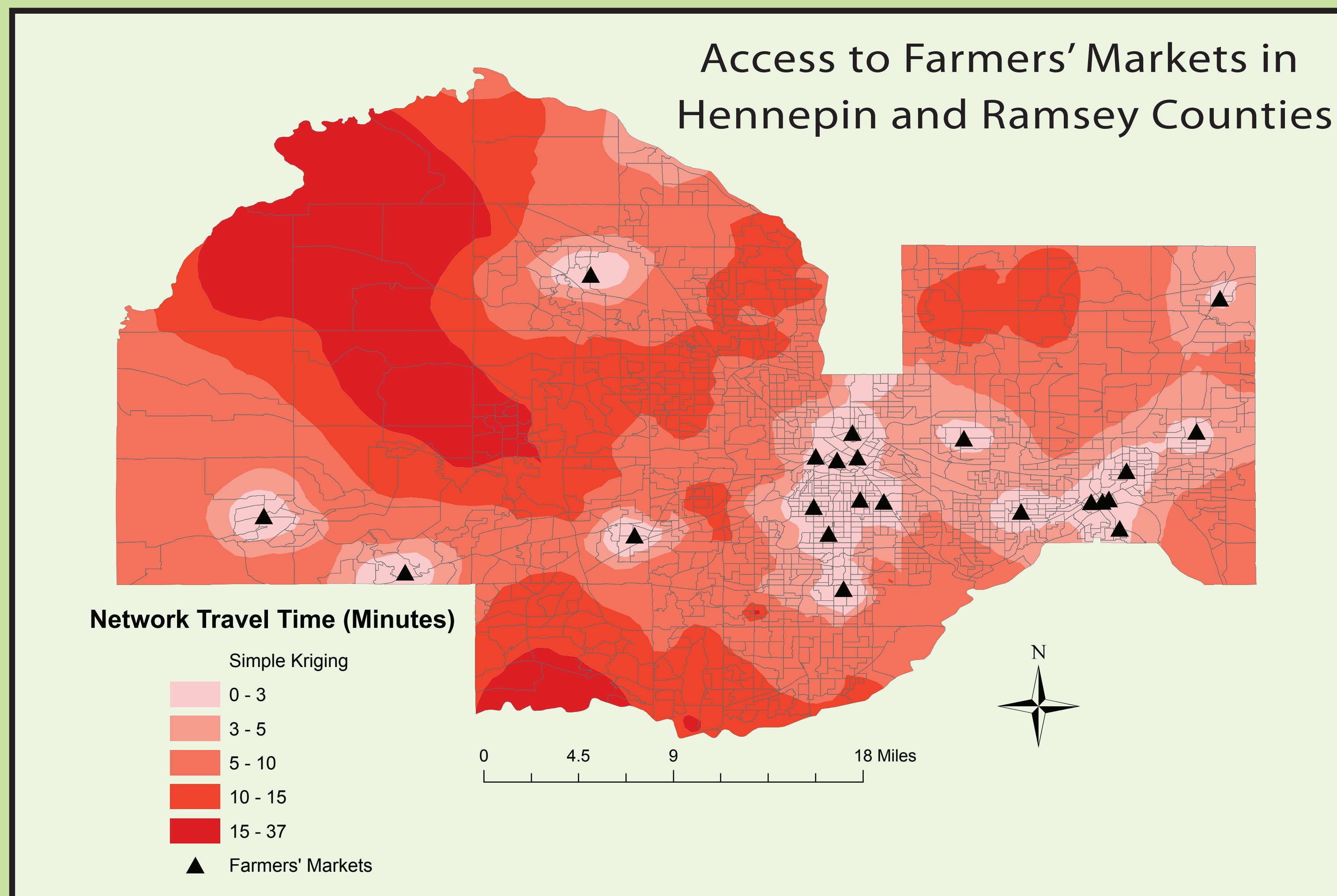
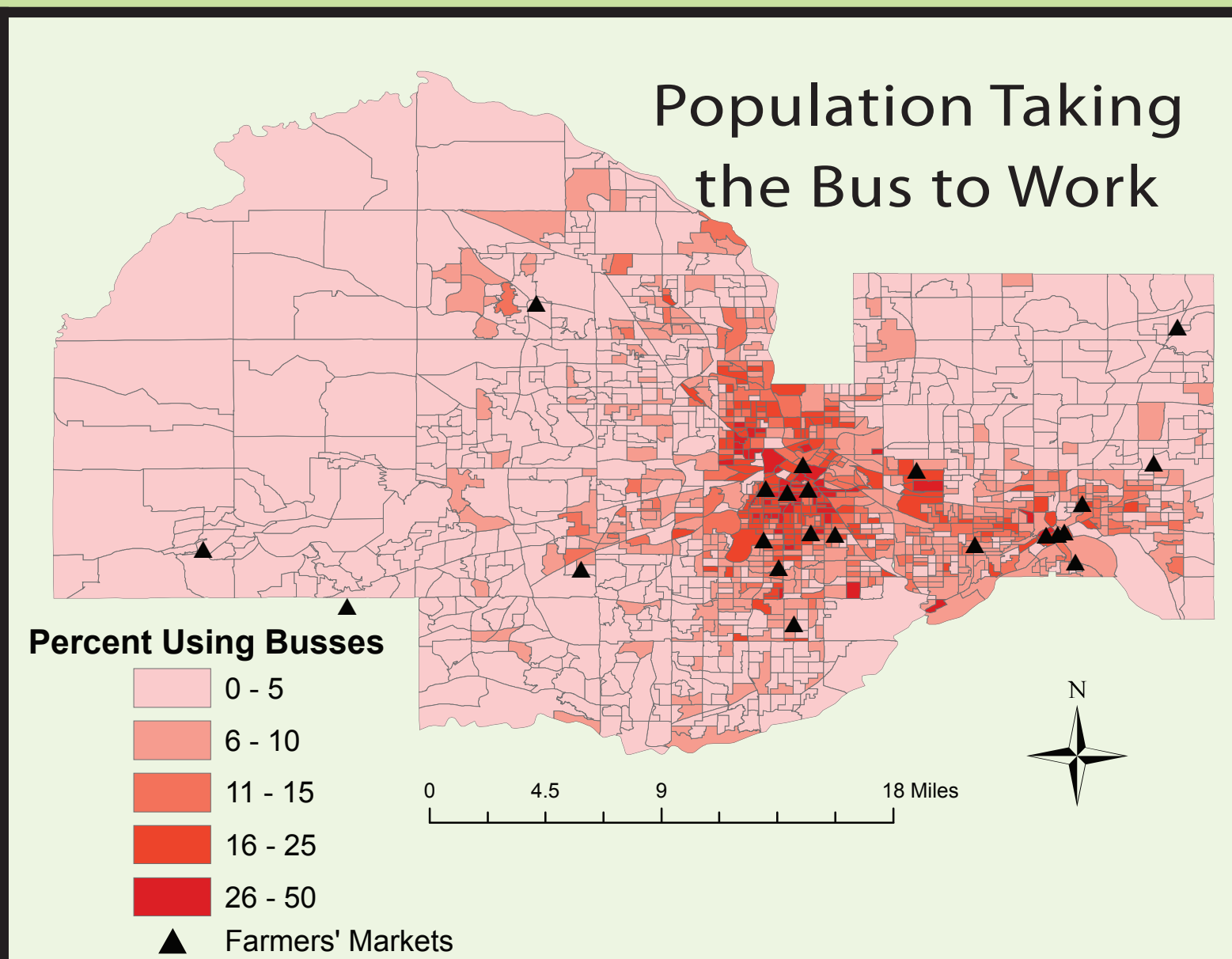
Geocoding is a common method for spatial analysis of food sources in respect to population centers. In my study, the geocoded addresses of farmers' markets were validated using Web searches and devices such as Google Maps Street View; methods similar to those used in the study of food deserts in London, Ontario (Larson and Gilliland 2008).

Previous studies have concluded that impoverished neighborhoods have higher travel times to food sources than wealthy neighborhoods (Zenk *et al* 2005, Larson and Gilliland 2008). However, as the study of food deserts in Scotland, UK concluded, the assumption of a universal deprivation of food access for impoverished neighborhoods may be misguided as each environmental setting has varying unique characteristics (Smith *et al* 2009).

This project measures access to farmers' markets based on network travel time and road-based distance from each neighborhood center to the closest market, similar to the application of GIS in food desert studies in Scotland, UK (Smith *et al* 2009).



Median Household Income and Percent of Population Bussing to Work were used in this study to explain farmers' market accessibility for several reasons. Wealthy neighborhoods have been proven in certain locales to have better access to food than impoverished ones. Moreover, wealthier neighborhoods have higher percentages of automobile ownership, increasing their ability to access farmers' markets. Conversely, impoverished neighborhoods rely more heavily on public transportation, inhibiting their ability to access farmers' markets.



Discussion

The network analysis of the study area shows that the urban centers of Minneapolis and St. Paul have the best access to farmers' markets. Travel times in these urban neighborhoods range from three to ten minutes. The highest neighborhood travel times, between fifteen to thirty minutes, exist in the suburban areas on the Twin Cities' periphery. This pattern suggests that the lowest income neighborhoods actually have the best farmers' market accessibility.

However, means of transportation differs between high and low income neighborhoods. Most households in suburban neighborhoods own automobiles and have the freedom to traverse greater distances to reach a farmers' market. On the other hand, low income neighborhoods have high percentages of people who bus, bike, or walk as a means of transportation. These neighborhoods have constricted spheres of mobility. A five or ten minute drive time in a car would actually take several times longer using other transportation means.

And, markets are not distributed evenly according to population. While there are more markets in the urban centers of the study area, they don't have the capacity to provide for all the neighborhoods in their service area. Markets such as Maple Grove and Excelsior, however, cater to less populated, more affluent neighborhoods. The placement of these markets further increases the ability of these neighborhoods to access fresh food.

Further studies could include regression analysis of network travel time and other weighted neighborhood demographic characteristics. Also, this study could be adapted to other locales to assess other types of potential food deserts.

Research Design

Purpose / Significance

- Analyze neighborhood access to food in the Twin Cities
- Relate findings to demographic characteristics of neighborhoods
- Enhance the application of GIS in the study of food deserts

Conceptual Context

- Theory of Scale and Connection
- Food systems
- Foodsheds
- Food deserts

Research Questions

- Which neighborhoods have the poorest access to food in the Twin Cities?
- What are the contributing factors to poor food access specifically in the study area?

Methods

- Geocode addresses of farmers' markets in study area
- Network analysis of distance from each neighborhood to food sources
- Examine the demographic information of neighborhoods with the poorest access to food markets

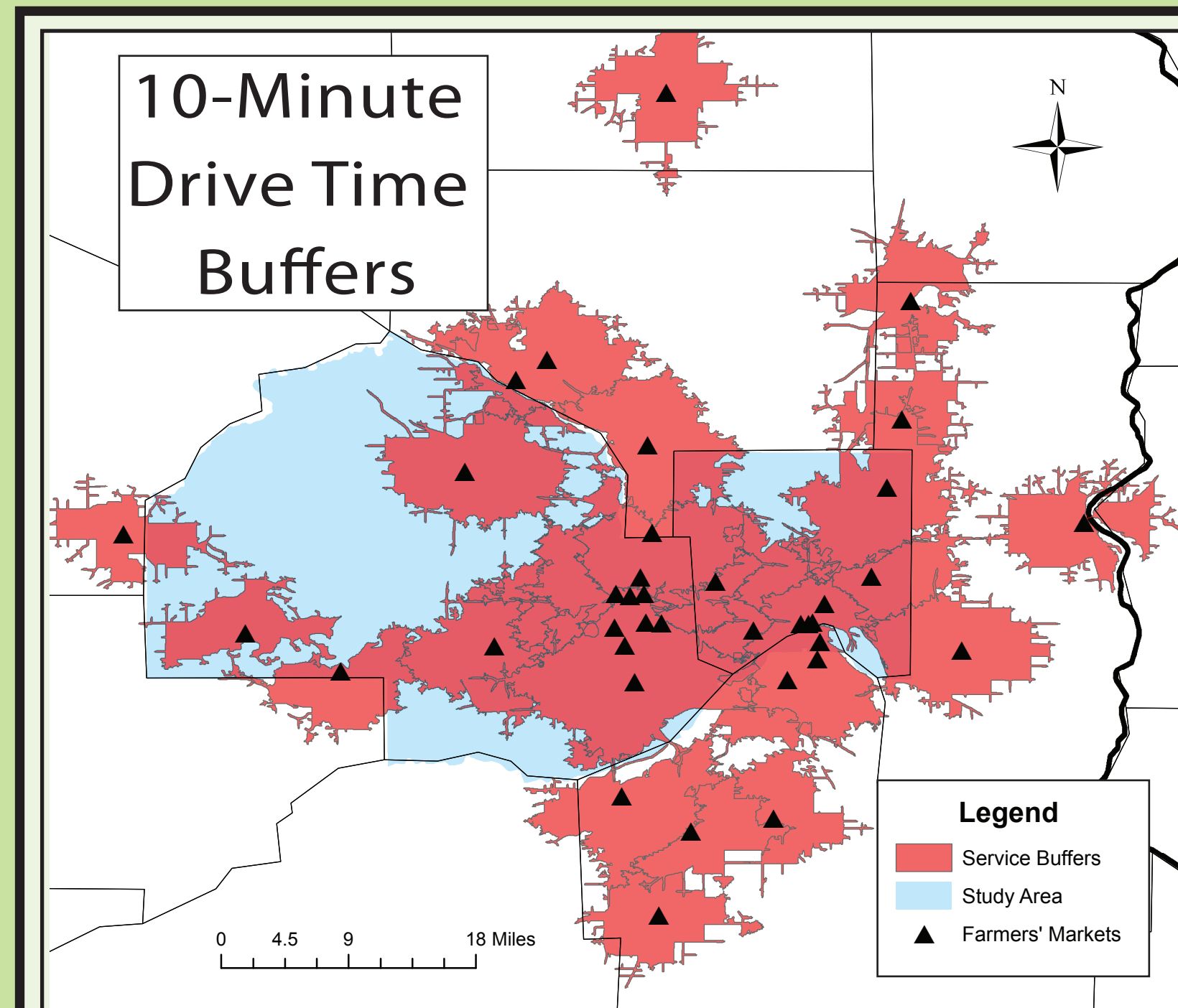
Validity

- Quantitative data collected from 2000 US Census
- Supporting qualitative data from related academic articles

Methods

Data obtained from the Land Stewardship Project website were used to establish the number and location of farmers' markets in the study area. The collected addresses were validated using web searches before they were parsed and standardized in preparation for geocoding. An ESRI United States address locator and street layer were used for geocoding in ArcMap.

The geocoded addresses were used to conduct network analysis of travel times from neighborhoods to farmers' markets. Neighborhoods were formed using census block groups, whose spatial data was obtained from ESRI and whose demographic characteristics were obtained from the 2000 US Census.

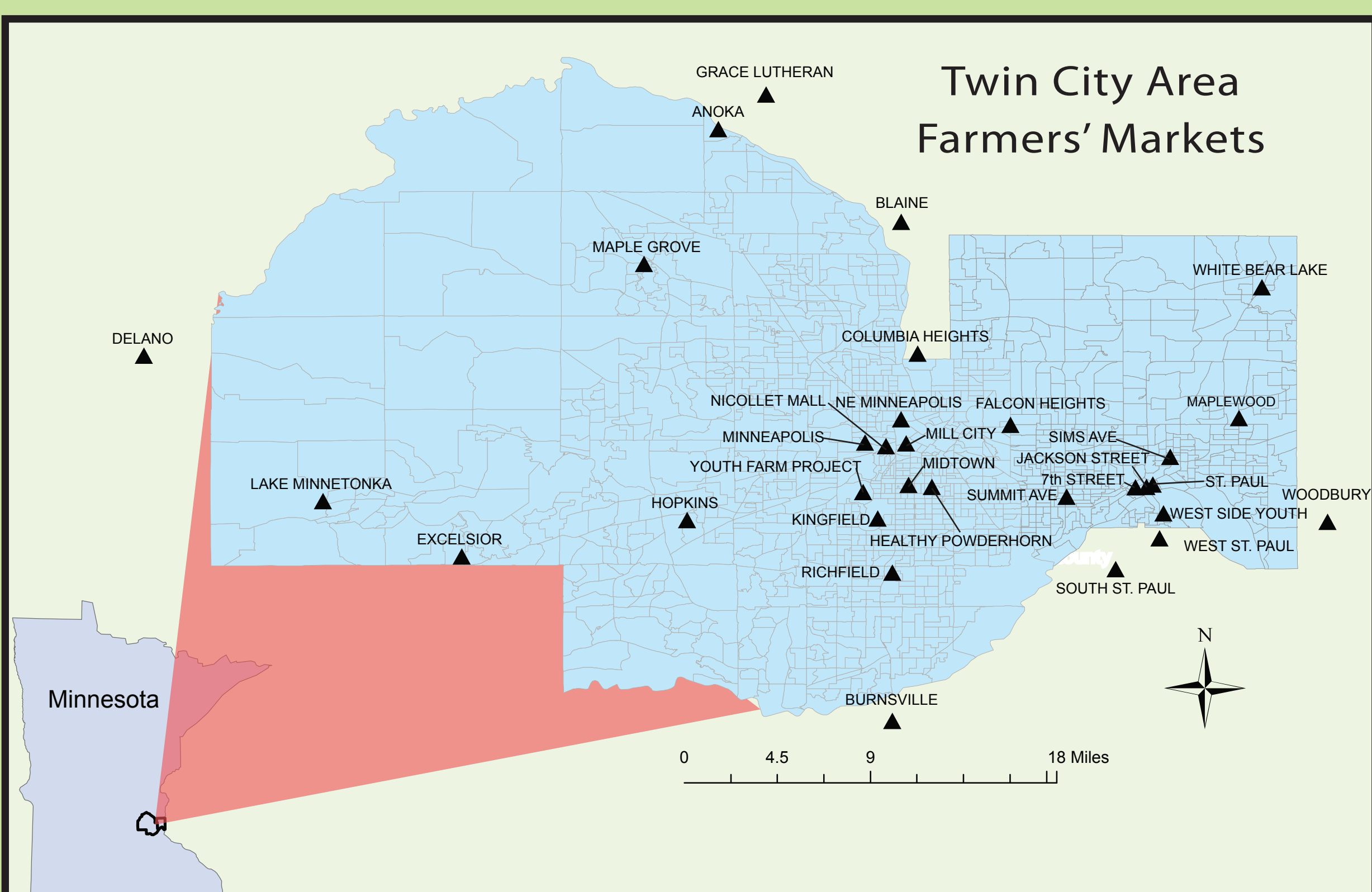
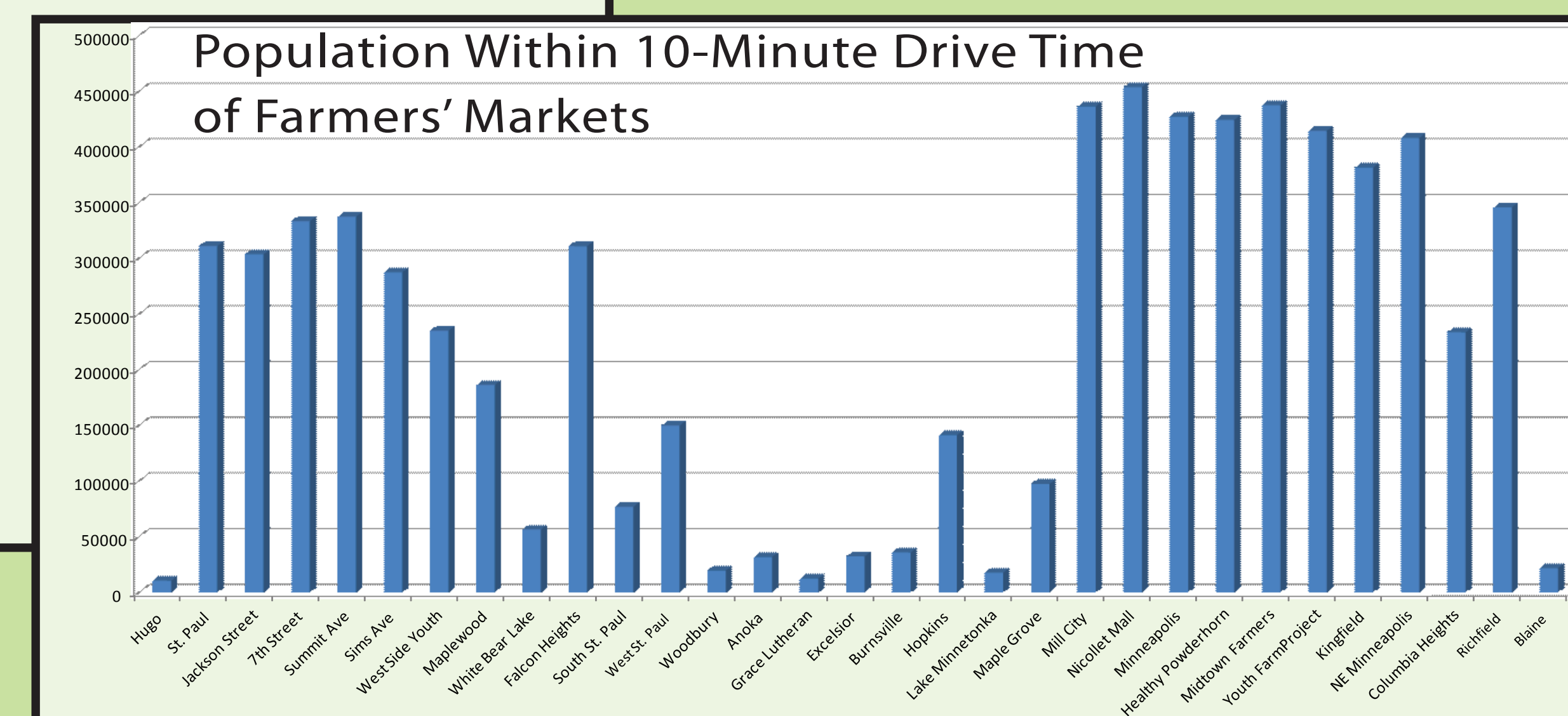


The feature-to-point tool was used to affix neighborhood centers for the purposes of network analysis. The closest facility application of ArcGIS network analysis calculated the road-based travel time from each neighborhood center to the closest farmers' market.

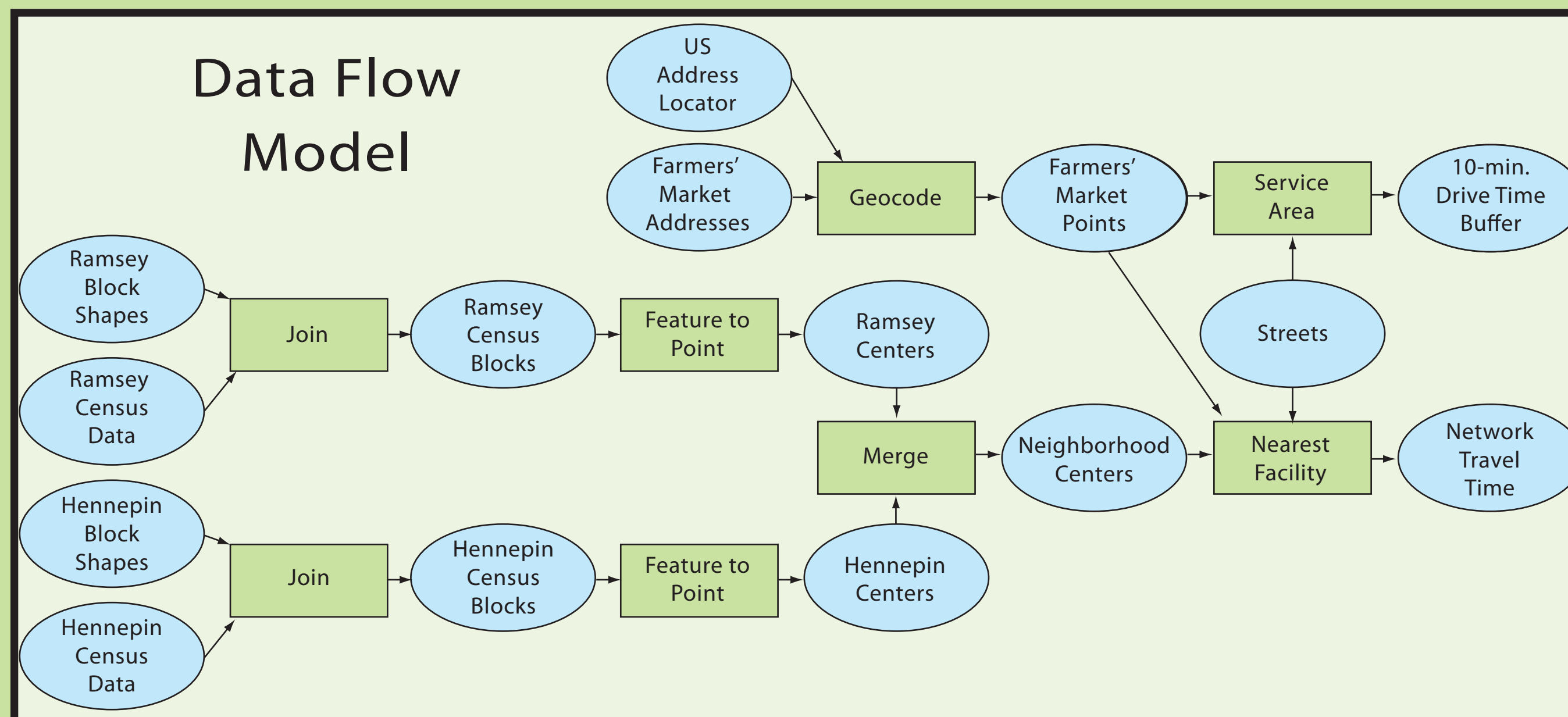
Markets outside of the study area were considered for the closest facility and service area applications of network analysis. Some markets, such as Columbia Heights and Delano, serve as the nearest market for neighborhoods in the study area.

Network Analysis

The service area application of ArcGIS network analysis built a 10 minute drive time buffer around each farmers' market. The neighborhoods within this buffer were spatially joined to the farmers' market layer. The neighborhood population within each buffer was aggregated, determining the potential population served by each market. The graph below shows the population served by each market. Markets in the urban centers of the study area have several times the population to serve than those in the suburban areas.



Data Flow Model



References

Larsen K and Gilliland J (2008) Mapping the evolution of 'food deserts' in a Canadian city: Supermarket accessibility in London, Ontario, 1961-2005. *International Journal of Health Geographics*. Vol. 7(16)

Smith DM, Cummins S, Taylor M, Dawson J, Marshall D, Sparks L and Anderson AS (2009) Neighbourhood food environment and area deprivation: spatial accessibility to grocery stores selling fresh fruit and vegetables in urban and rural settings. *International Journal of Epidemiology*. Vol. 39; p. 277-284

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