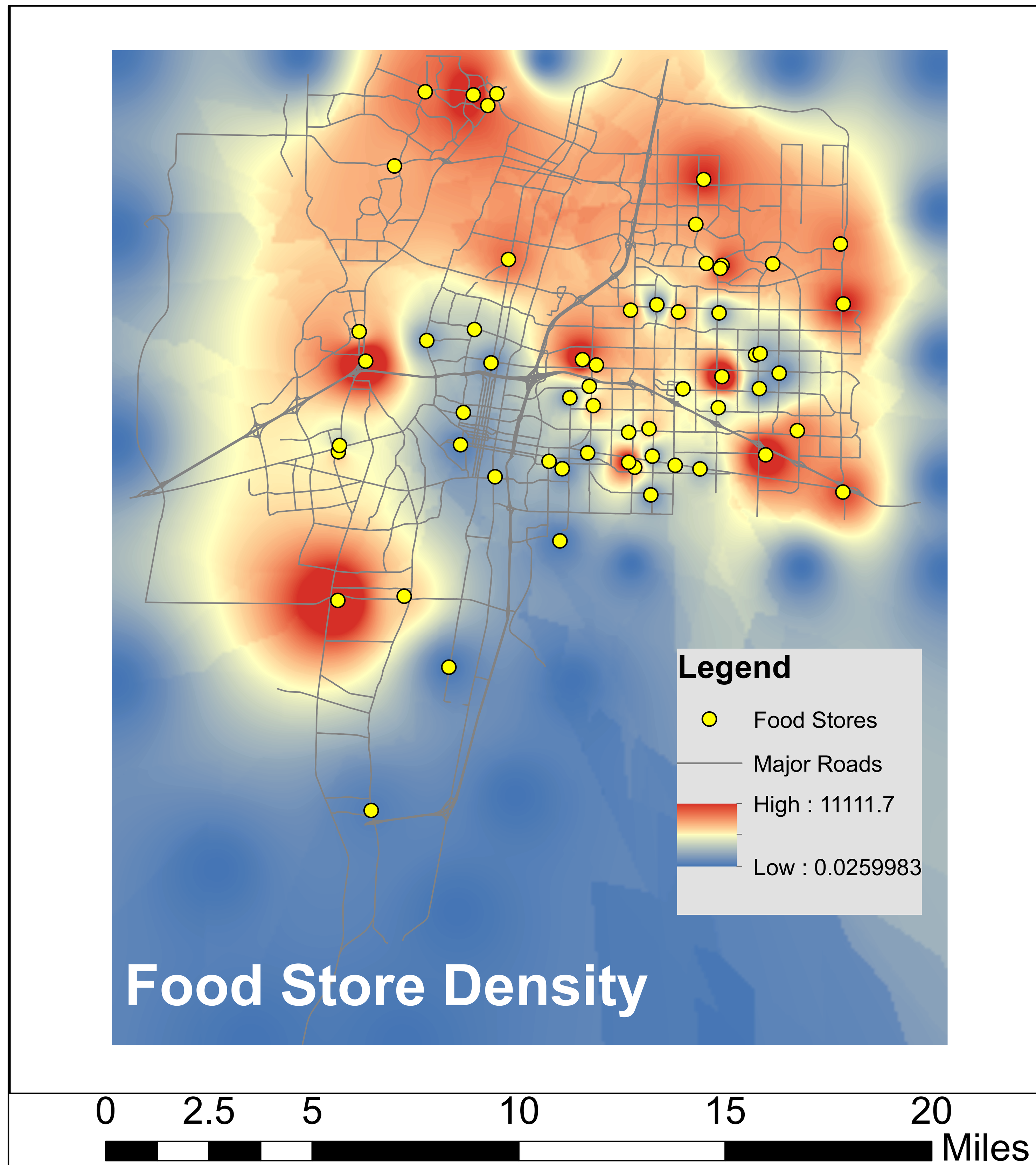
Albuquerque, New Mexico - Food Store Location Analysis, 2010



Albuquerque New Mexico – Food Store Location Analysis, 2010

Larry Spear M.A., GISP - Geography 586L - Spring 2014 - Department of Geography – UNM

Theory:

- Economic (Retail) Geography considers food stores to be a lower-order type of retail service and tend to be located close to the residential population they are intended to serve.
- Consumers (customers) are assumed to be rational and hence prefer to shop at the closest food store.
- Previous academic and applied research has focused on the delineation of market (trade) areas around existing stores primarily based on customer shopping patterns.
- Gravity models have been used to predict the probability of customers frequenting competing store locations.
- Much of this research is based on customer information (sales data, and geocoded customer addresses) collected by individual companies that is considered proprietary and is not shared.
- Recent research has focused on the identification of “food deserts” that are areas lacking access to full-service groceries, providing the essentials of a healthy diet.

Method:

- Can a method be devised to test the assumption (hypothesis) that full-service food stores tend to be located with respect to the distribution of residential population?
- This method should use readily available data such as store size instead of proprietary customer data and not attempt to delineate rigidly defined market (trade) areas around stores.
- This method should also be easy to apply with generally available GIS and statistical software packages and be useful to others than those employed by supermarket corporations such as city planners and small business owners.
- A gravity model can be developed that measures the overall opportunities (retail coverage) available to customers by the location and distribution of all stores and which considers that customers will also shop at more than just the closest food store.
- This gravity model or measure of retail coverage should also measure the availability of all stores (potential shopping choices) to a consumer at a particular location. It should model spatial interaction (distance decay) such that closer and larger stores will provide more service and are more likely to attract customers than further smaller stores.
- The measure of retail coverage can be statistically compared using regression with the distribution of population to determine areas of a city or community that are relatively over, under, or adequately serviced based on the overall average or trend line.
- The measure of retail coverage (gravity model) is defined as:

$$Cij = \sum_{j=1}^{k} \frac{Aj}{Dij} a$$

Cij – Retail coverage for each block group
Aj – Store Area Dij – Distance to Store a – Distance decay parameter (exponent)

Application (Analysis Results):

- ArcGIS ModelBuilder was used to perform the analysis and generate the maps. Additional data manipulation, visualization, and supporting statistical analyses were provided by Excel, Minitab, R, SAS, and SPSS.
- The Food Store Density map (upper left) shows the location and distribution of full-service food stores with density measured by the approximate size of each store area devoted to food sales (N = 59).
- The Population Density map (bottom left) shows the location and distribution of residential population density per square kilometer for 2010 Census block groups (N = 417).
- The Retail Coverage map (upper right) shows the results from the gravity model defined above.
- The Retail Servicing map (bottom right) is based on the application of a linear regression model where the standardized residuals are mapped and used to display areas that are relatively over, under, or adequately serviced.
- Additional Population (count by census block group) and Study Area map are shown for reference (bottom center)
- The following are some of the results from the regression model:
  *Note: The natural log of population (LNPOP100) and population density per square kilometer (LNPOPDENK) are the independent variables and sum of retail coverage (SUM_RetCov) from the gravity model is the dependent variable. The resulting regression equation can be written as:
  SUM_RetCov = 76284.323 -10844.309(LNPOP100) + 5365.073(LNPOPDENK)

Model Summary[b]

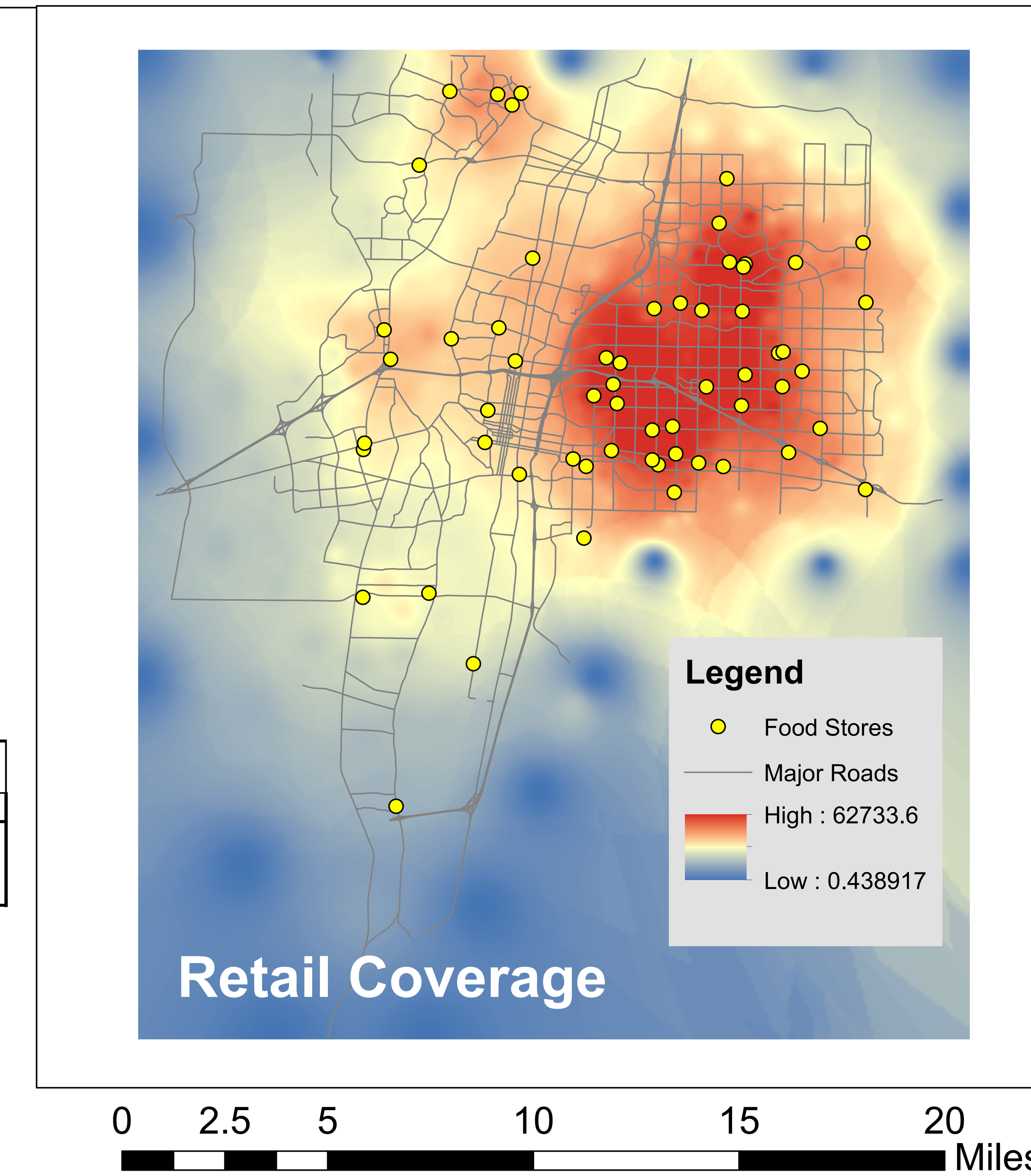
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.542[a]	.294	.291	10125.111655281304000	1.607

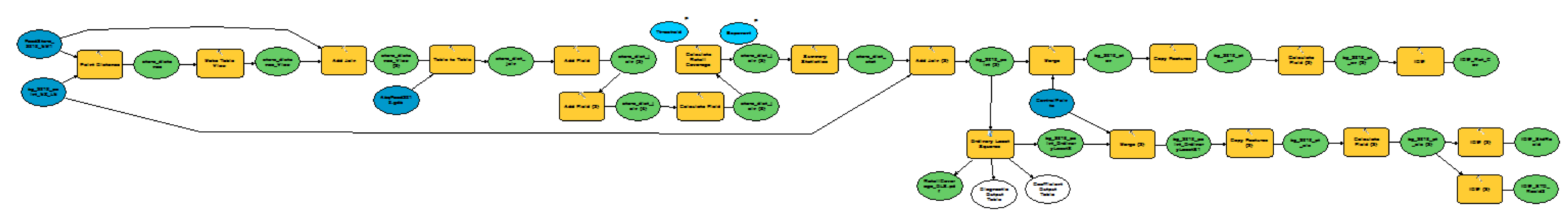
a. Predictors: (Constant), LNPOPDENK, LNPOP100
b. Dependent Variable: SUM_RetCov

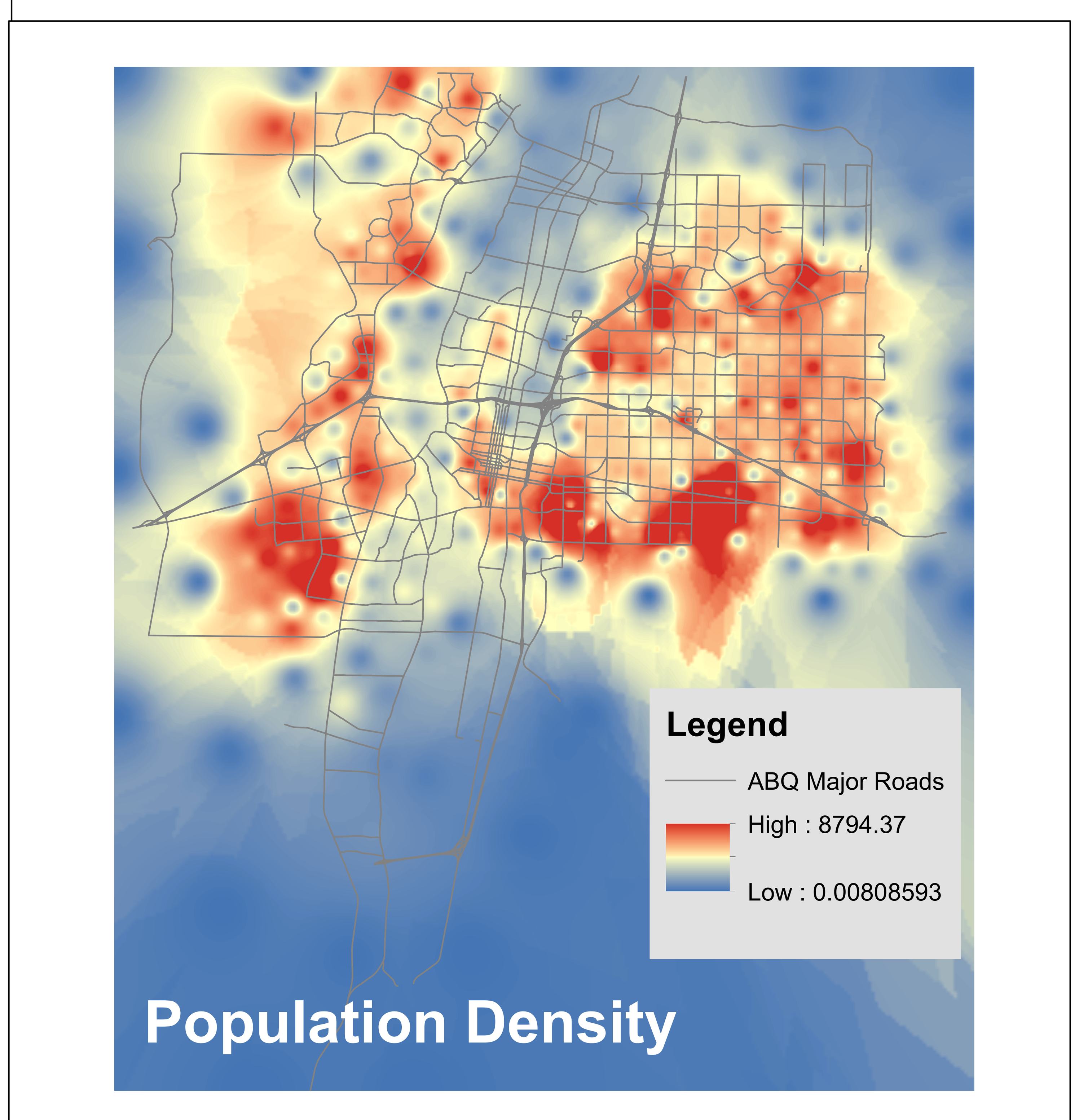
Coefficients[a]

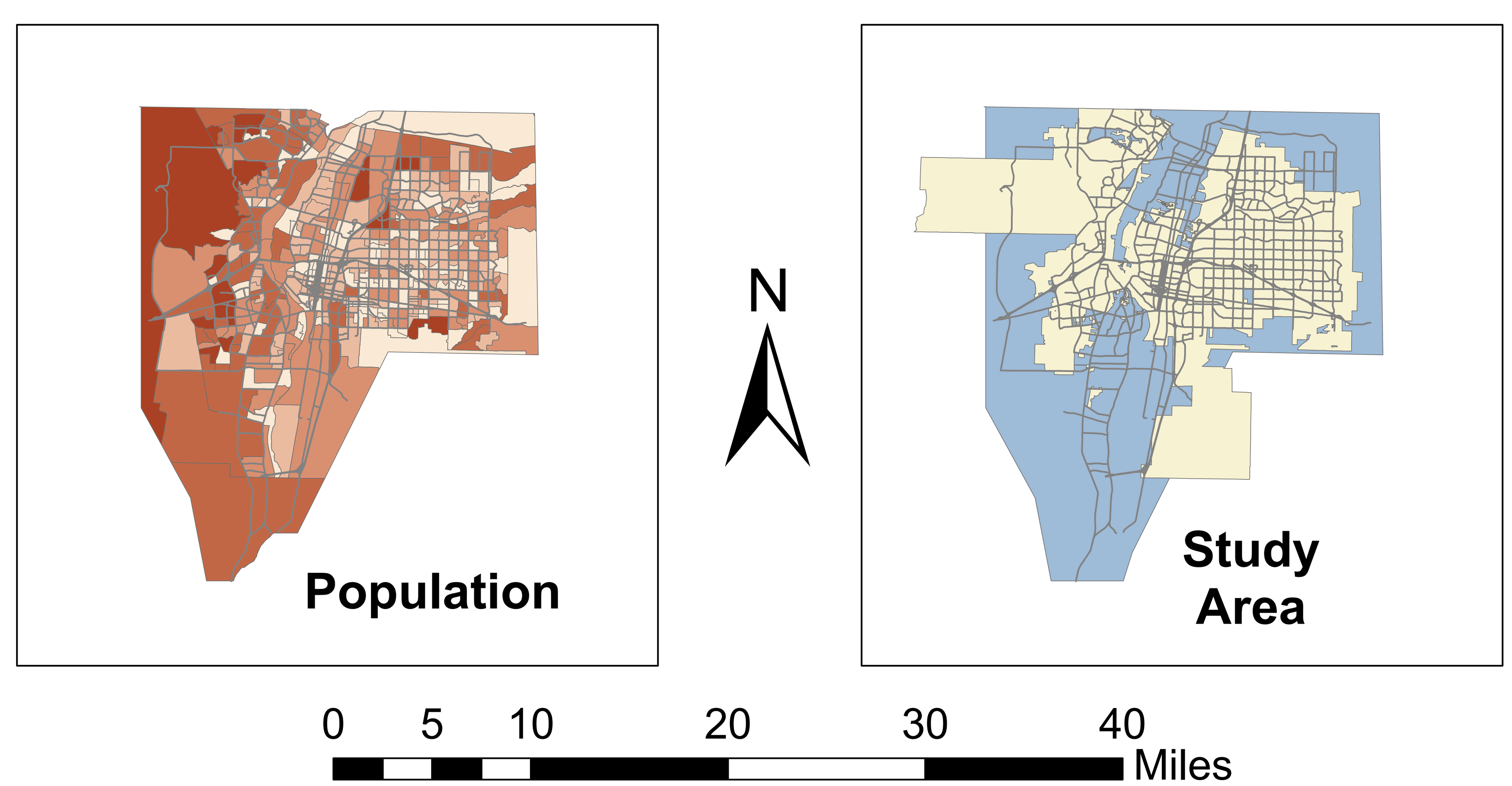
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	76284.323	8827.474		8.642	.000	58932.063	93636.583
	LNPOP100	-10844.309	1106.883	-.405	-9.797	.000	-13020.120	-8668.498
	LNPOPDENK	5365.073	576.482	.385	9.307	.000	4231.877	6498.269

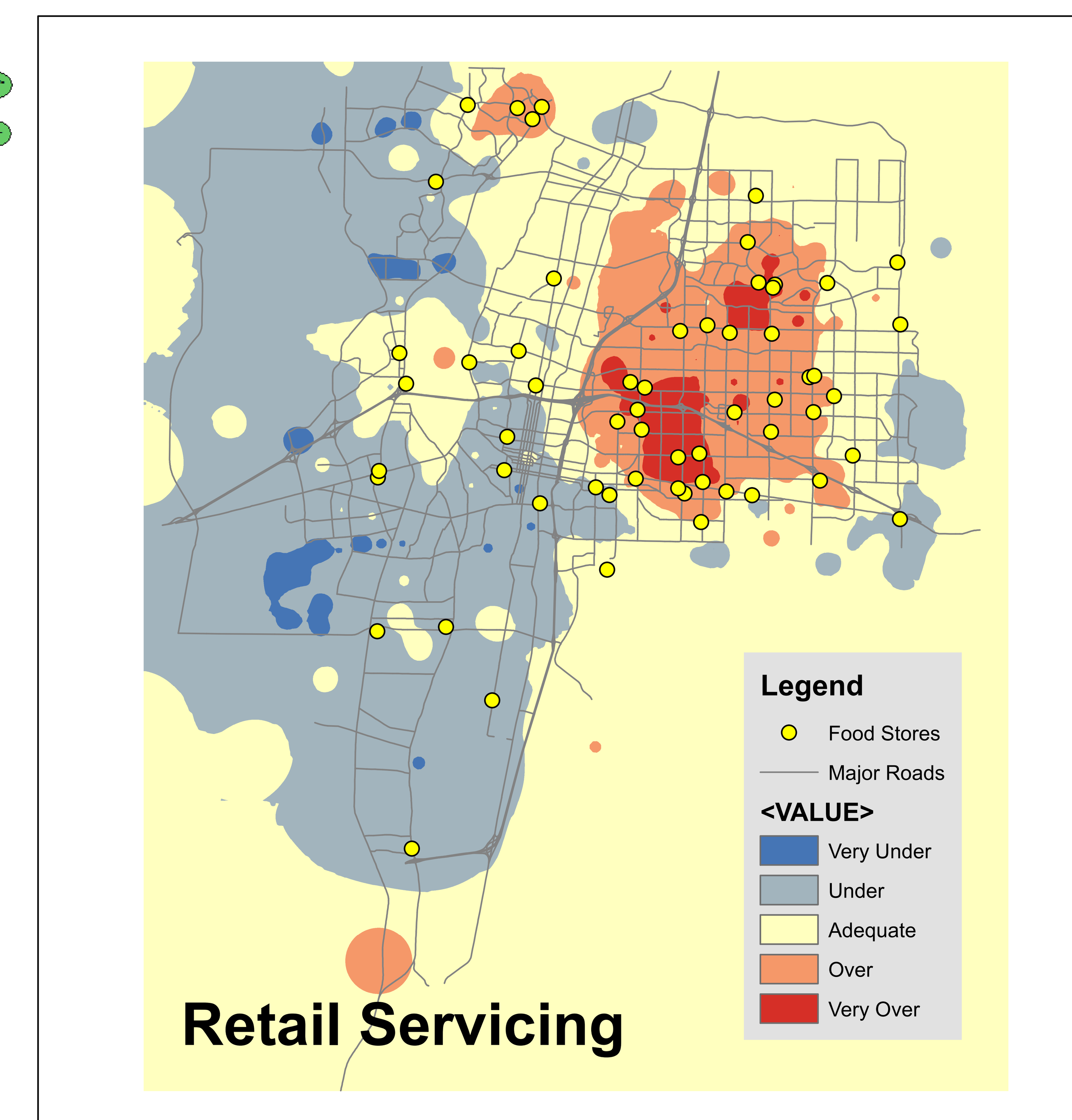
a. Dependent Variable: SUM_RetCov











Note: Preliminary Results (March, 2014)