# Direct Marketing VegShed of New Mexico:

## Exploring a geospatial methodology to optimize the distribution of locally-produced food.

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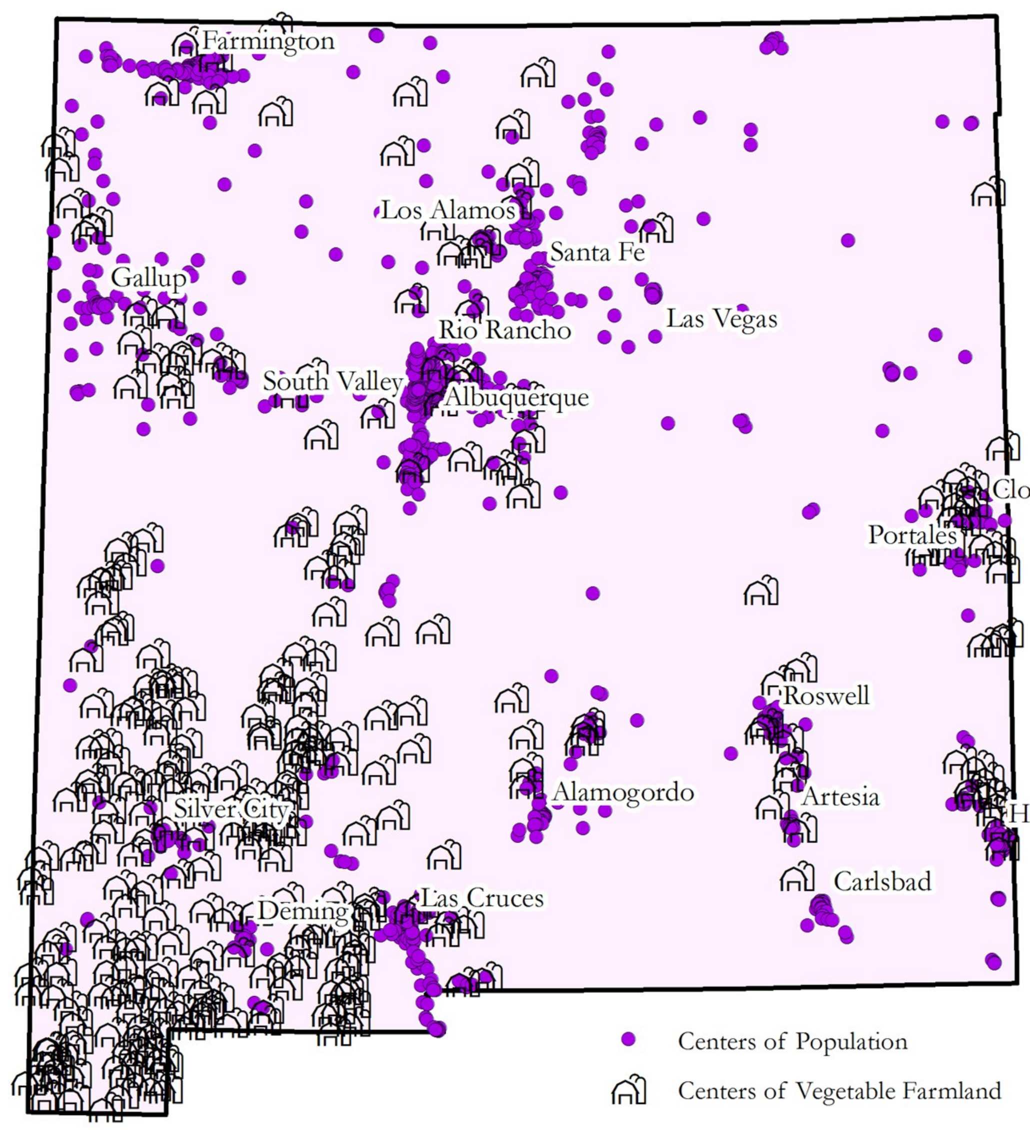
NEW MEXICO FARMERS' MARKETS

### Overview:

Consumer demand for locally-produced food has increased sharply in recent years (1). Consumers are looking for food that is fresh, high in nutritional content, grown locally or regionally on family-scaled farms (2). Furthermore, locally-produced food can help to reduce food insecurity, support farmers and rural economies, encourage more healthful eating habits, and reconnect consumers with farmers (1).

Rising consumer demand is coupled with continuous growth in local food markets, such as direct marketing using farmers markets and community-supported agricultural (CSA) enterprises. For these reasons, local and regional food system assessments are becoming a popular tool for examining and planning more sustainable food production, distribution and consumption. A *foodshed* analysis can be one tool to assess production and consumption. Analogous to the physical concept of a watershed, a foodshed is a bounded area of land that provides some portion of the food needs to a given population center (3).

This study aims to establish a vegetable foodshed for New Mexico by first determining the service areas for fresh unprocessed vegetables, and second to optimize the food's allocation to meet consumer dietary need and minimizing the distance traveled.




Map A: Farmland and Population

### Farmland Representation:

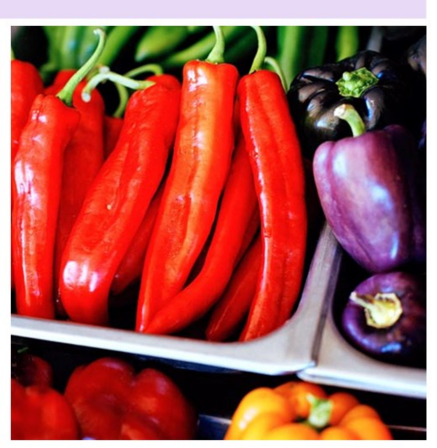
Although the USDA National Agricultural Statistics Service (NASS) collects farm-level data, production information at this scale is not made available to the public to protect the privacy of farmers. Therefore, this project established a methodology (refer to **Figure 1**) for using NASS CropScape with a pixel size of 0.22 acres as a proxy for farm-level data. Raster data from 2010 through 2012 were reclassified to extract areas with annual vegetable and melon production. This land base was converted to vector point format and aggregated to polygons. Points with acreage attribute data were spatially joined to the closest polygon. Finally, the polygons were converted to points that represent the central location of vegetable production (refer to **Map A**) .

**Abbreviated Citations:**

(1) King, R. et al. (2010). Comparing the Structure, Size, and Performance of Local and Mainstream Food Supply Chains.
(2) Stevenson, G. and Pirog, R. (2008). Chapter 7: Values-Based Supply Chains: Strategies for Agrifood Enterprises of the Middle.
(3) Peters, P. (2008). Mapping potential foodsheds in New York State: A spatial model for evaluating the capacity to localize food production.
(4) Peters, C. et al. (2013). Forthcoming Foodprint article.
(5) Picardy, J. (2001). Closing the Distance Gap Through Community Supported Agriculture.

**Image Sources:**

(1) New Mexico Farmers' Markets. http://www.farmersmarketsnm.org/



(2) Santa Fe Peppers. http://img4.sunset.com/i/2011/07/farmers-market-santa-fe-nm-0711.jpg?500:500

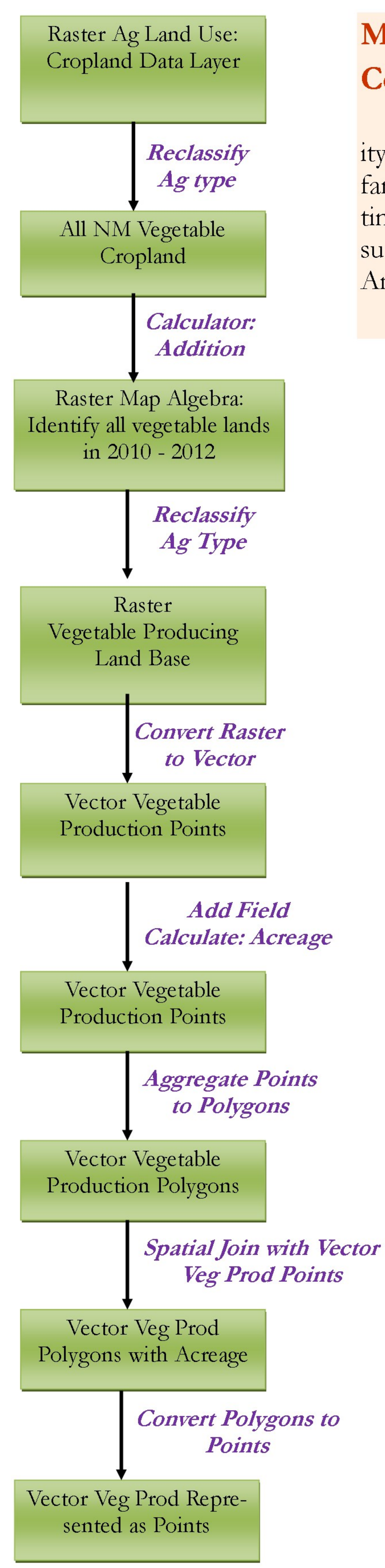
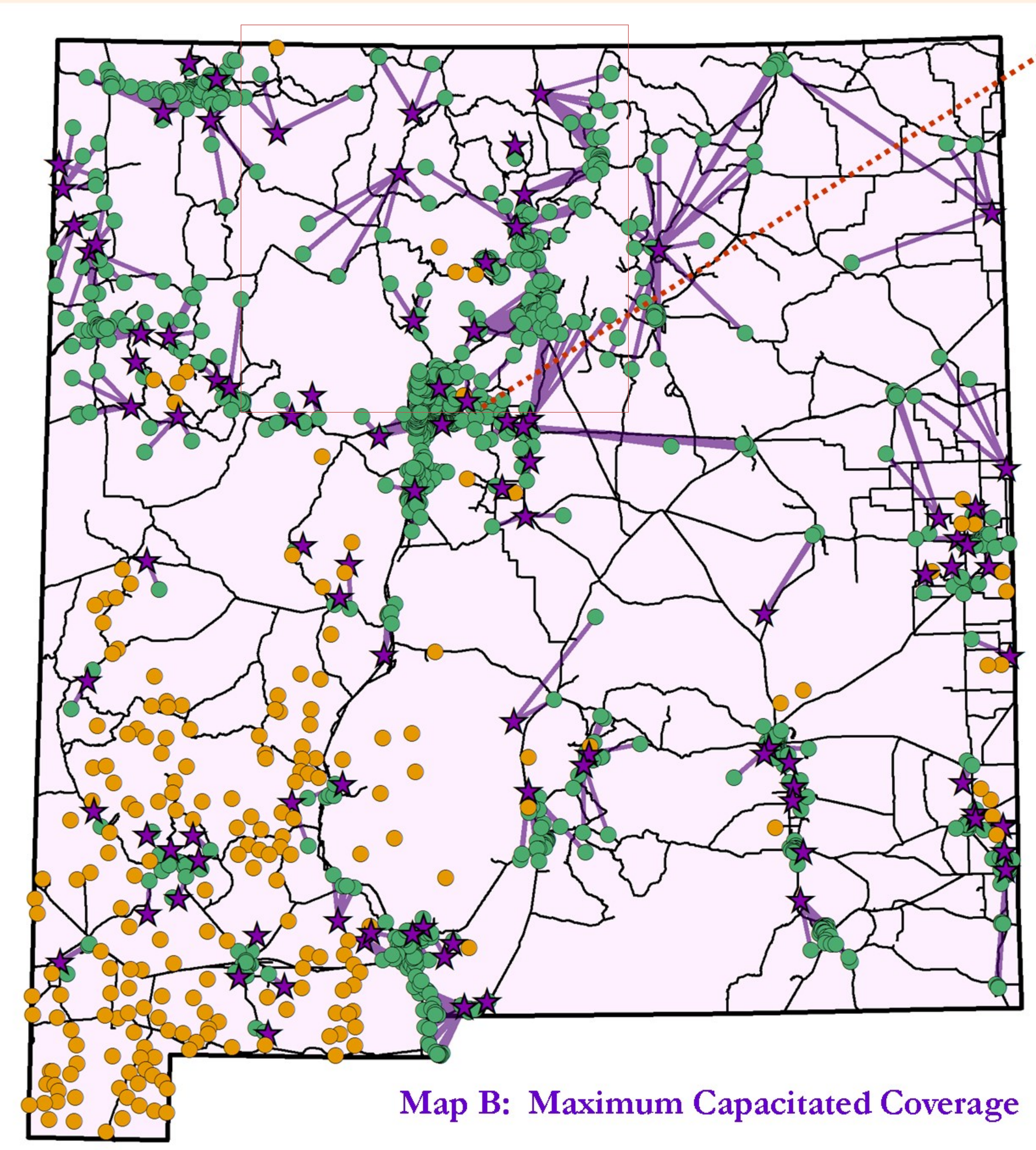


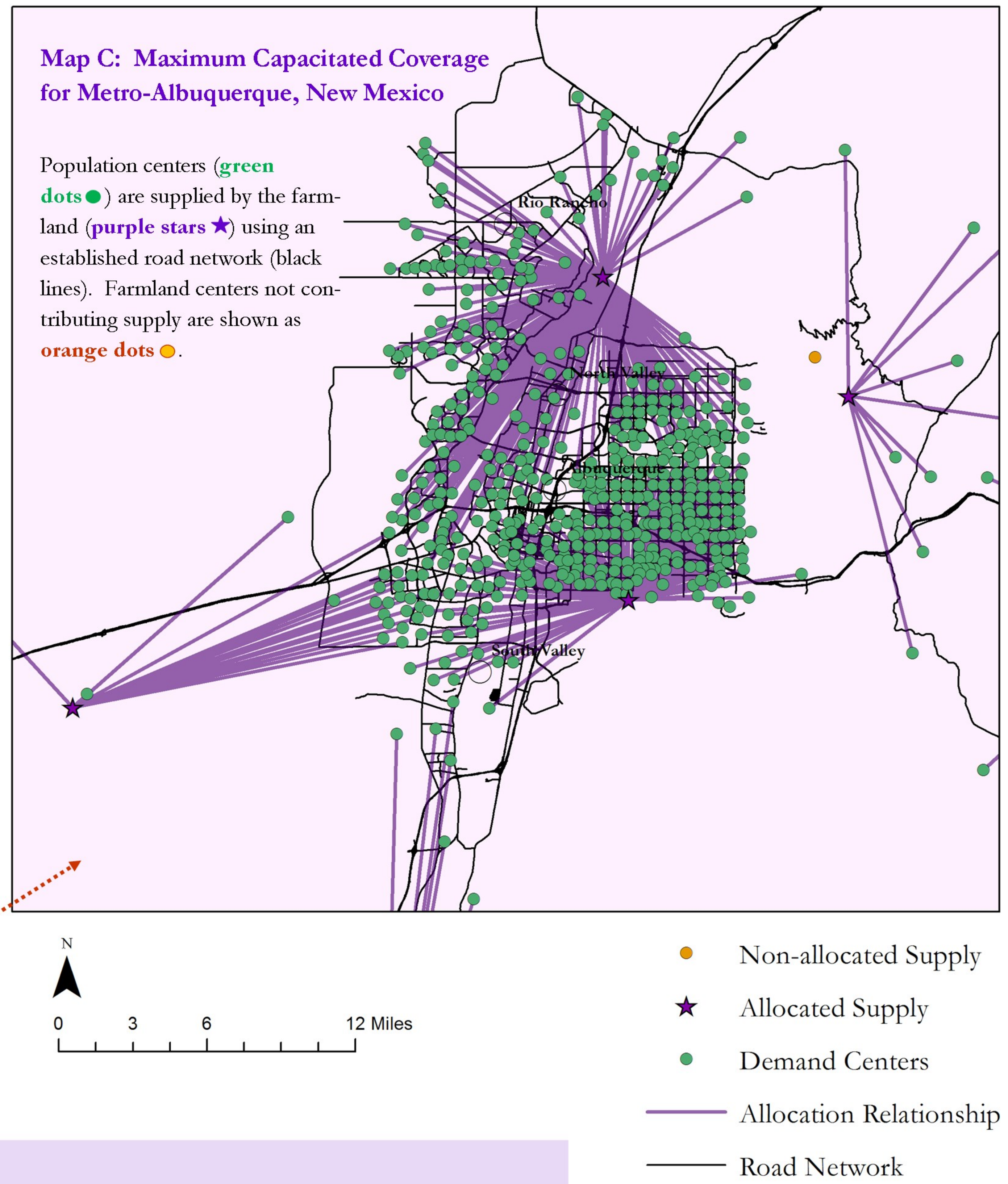

Figure 1: Farmland Representation

### Maximum Capacitated Coverage:

Using an **Excel sub-model**, productivity (yield) was calculated for each of the farm points and nutritional demand was estimated for all population within U.S. Census Block Groups (4). ArcGIS Network Analyst was employed to allocate vegetables across New Mexico. Maximize Capacitated Coverage optimized the food distribution by minimizing impedance (distance from farm to population), while meeting the nutritional demand. Please refer to **Map B** and **C**. This geospatial analysis led to 99.2% of the state's vegetable demand being met at a total distance of 18,835 food miles.



Map B: Maximum Capacitated Coverage




### Service Areas:

Using the same input of available supply (land productivity as yield) and demand (population nutrition needs of vegetables), Network Analyst was utilized to identify two service areas: 25-mile network, shown in green in **Map D**, and 100-mile network, shown in purple. The smaller service area represents the maximum distance consumers would travel to the farm for purchasing food (5); while the larger area represents the local VegShed for direct marketing via farmers' markets, CSA distribution, or retail outlets. The 25-mile area services 73.8% of New Mexico's population while 85.3% of residents are within the 100 mile network.

### Limitations:

This analysis is constrained by the input parameters, such as road network accuracy or validity of yield assumptions. Further, this optimization does not apportion demand across >1 facility. Results would be refined if partial demand could be met by >1 facility.

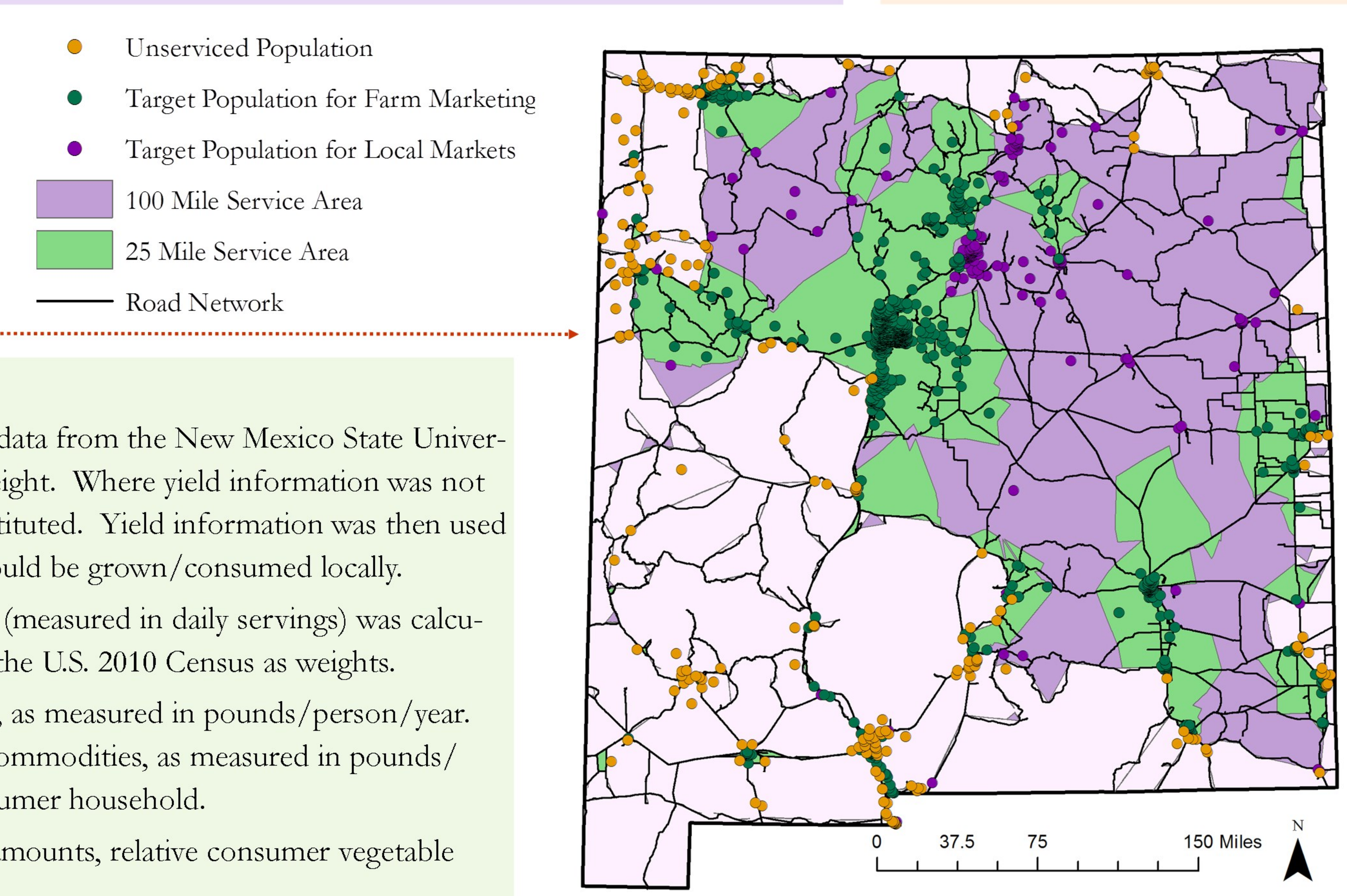
### Basic steps of the Excel sub-model:

(1) Weighted-average yield was calculated from agricultural yield data from the New Mexico State University OASIS organic farm, using mean annual harvest as the weight. Where yield information was not available, commodity yields from NASS Ag Census were substituted. Yield information was then used to calculate SUPPLY as well as determine which vegetables could be grown/consumed locally.

(2) Weighted-average USDA MyPyramid nutritional requirement (measured in daily servings) was calculated, using age and gender New Mexico demographics from the U.S. 2010 Census as weights.

(3) Vegetable requirements were converted to food commodities, as measured in pounds/person/year. Food commodities were then were converted to agricultural commodities, as measured in pounds/person/year., taking into account food loss from field to consumer household.

(4) Using the local list of vegetable and agricultural commodity amounts, relative consumer vegetable DEMAND was calculated.




Map D: Direct Marketing Service Areas