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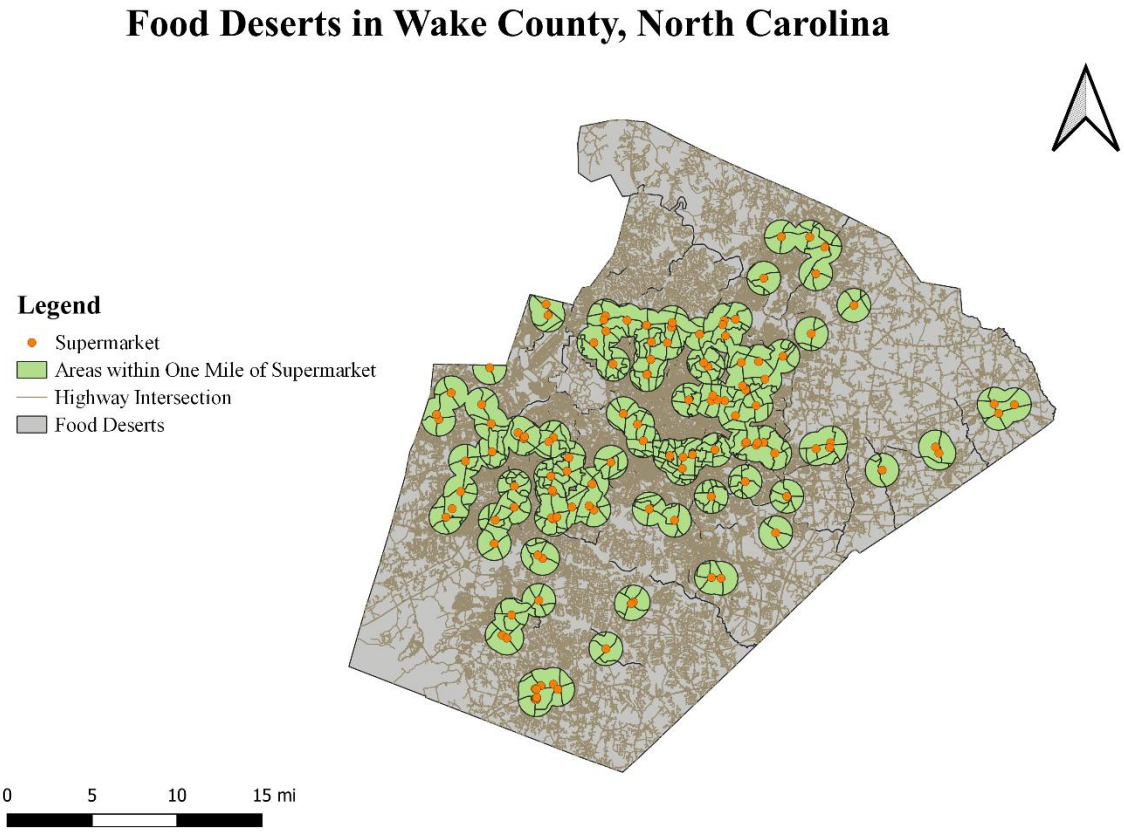
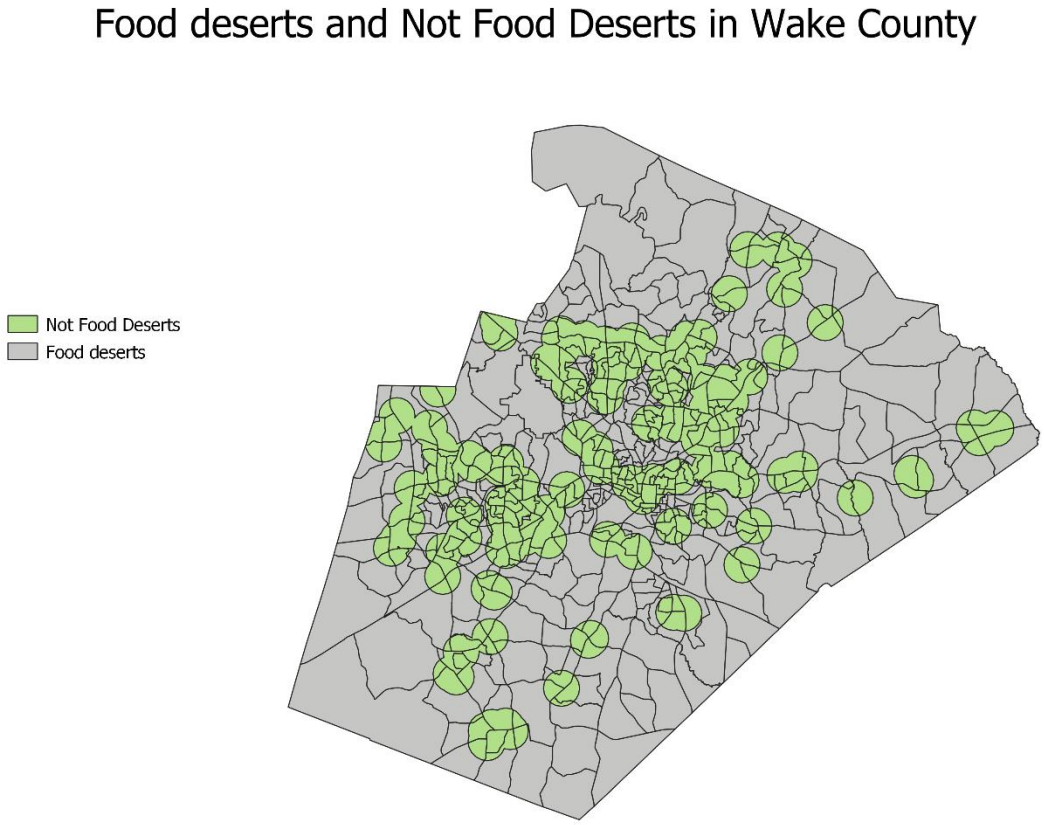
PLAN 390 Assignment 3

1. create a map showing food deserts and supermarkets. Please show the street network, and label major streets. It will likely be easier to highlight areas which are not food deserts on the map.

Food deserts – more than 1 mile from supermarket

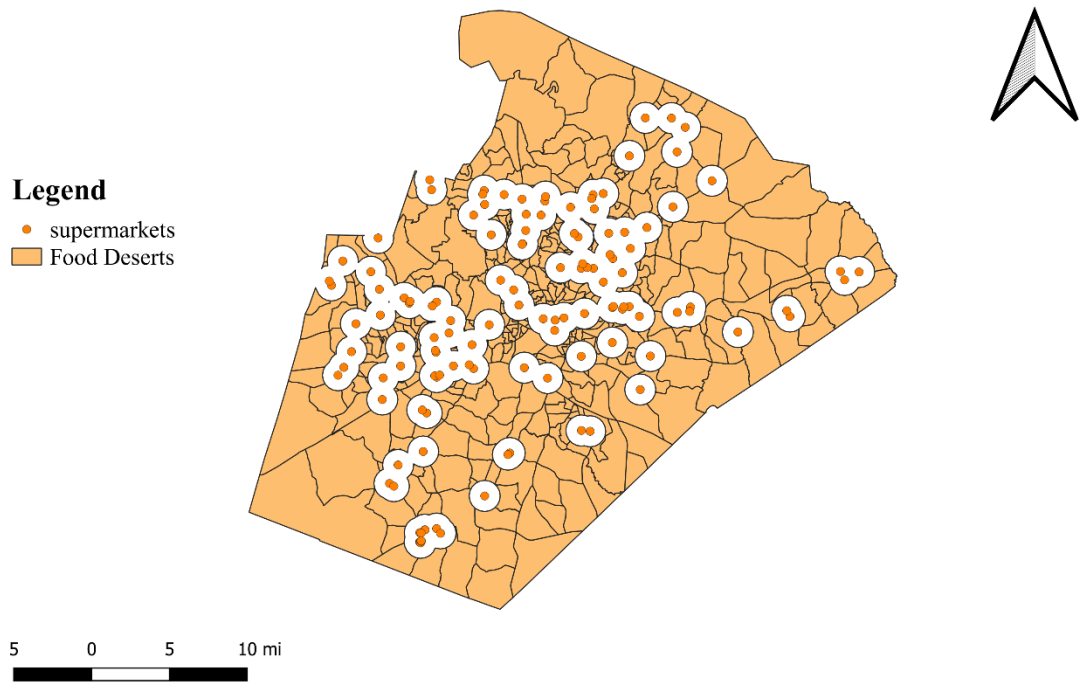
I selected wake county from the orange_durham_wake_block_groups shapefile by selecting where COUNTYFP = 183 and created a new shapefile called wake_county from the selection. I used the buffer tool (1 mile) to select the non-food deserts in wake county, then the intersection tool to remove areas that where outside of the wake county boundary. The places outside the buffer are food deserts. The streets names are too tiny to be seen on the map.





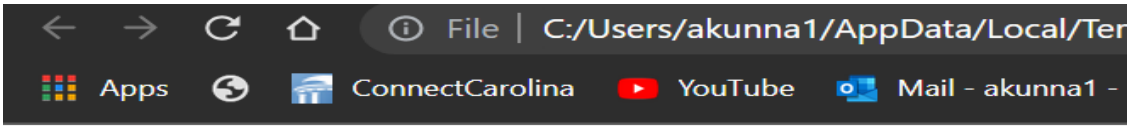
2. you need to perform some analysis of the demographics of food desert residents in Wake County. First, you need to determine for each Census tract whether it is in a food desert or not. Make a map showing which Census tracts you considered to be in food deserts. Note: many Census tracts will be partially in food deserts. You can choose to consider these Census tracts to be in food deserts or not in food deserts. Document and justify your decision.

   I joined census data (triangle_cenus) to the wake county shape file (wake_county_NC_83), and also to the buffer shape file (one_mile_buffer_intersection_NC_83), which shows only places that are not food deserts. Then, I had to create a new shape file that crops out the buffer region from the wake county shapefile, in order to have only the food desert areas using the symmetrical difference tool. I named this new shapefile, food_deserts_wake_county.



3. What percentage of the Wake County population resides in food deserts? Make sure you only include Wake County residents (there are 1,069,079 residents of Wake County)

   I had to add the census data (triangle_cenus) to the food deserts in wake county shape file (food_desert_wake_county). Then, I took the sum of all the total population for each region in the attribute table of the food_deserts_wake_county shape file i.e., the sum of the triangle_cenus_total_population column by going to Vector → Analysis tools →Basic Statistics for fields. I chose food_deserts_wake_county as my input layer and triangle_census_total_population as the field to calculate statistics on. An html file was created showing the statistic values, which is shown below.



Analyzed field: triangle_census_total_population

Count: 360

Unique values: 343

NULL (missing) values: 1

Minimum value: 0.0

Maximum value: 11124.0

Range: 11124.0

Sum: 906882.0

Mean value: 2519.116666666667

Median value: 2038.5

Standard deviation: 1772.8788555309934

Coefficient of Variation: 0.703770047251084

Minority (rarest occurring value): 407.0

Majority (most frequently occurring value): 0.0

First quartile: 1354.5

Third quartile: 3069.0

Interquartile Range (IQR): 1714.5

To calculate the percentage of the wake county population that resides in food deserts, I did:

$$\frac{\text{sum of total population of food deserts in wake county}}{\text{total population of residents in wake county}} * 100$$

$$\frac{906{,}882.0}{1{,}069{,}079} * 100 = 84.83\%$$

4. Evaluate the demographic makeup of the food deserts—are residents of food deserts more likely to be poor or not own cars than the residents of Wake County as a whole (again, make sure you only include Wake County residents)?

Columns from triangle census file:

- zero_vehicle_households- shows number of households with zero vehicles
- households_income_less_than_35k – household income less than 35K
- total_households- shows total households

I took the sum of all the zero_vehicle_households, households_income_less_than_35k and total_household from in the attribute tables of the non-buffer (food deserts) and wake county shapefiles by going to Vector → Analysis tools →Basic Statistics for fields and calculate the percentages using the values.

Basic Statistics on field:

For non-buffer region (food deserts):-

Total households in non-buffer region (food desserts): 331,763

Sum of households with zero vehicles in non-buffer region: 11,267

Sum of household with income less than 35k in non-buffer region: 58,519

$$\frac{\text{household with zero vehicles in non} - \text{buffer region (food deserts)}}{\text{total households in non} - \text{buffer region (food deserts)}} * 100$$

$$\frac{\text{household with income less than 35k in non} - \text{buffer region (food deserts)}}{\text{total households in non} - \text{buffer region (food deserts)}} * 100$$

$\frac{11,267}{331,763} * 100$ = 3.40% with zero vehicles in non-buffer region

$\frac{58,519}{331,763} * 100$ = 17.64% with income less than 35k in non-buffer region

For wake county:

Total households in wake county: 400,172

Sum of households with zero vehicles in wake county: 15,878

Sum of household with income less than 35k in wake county: 75,233

$$\frac{\text{household with zero vehicles in wake county}}{\text{total households in wake county}} * 100$$

$$\frac{\text{household with income less than 35k in wake county}}{\text{total households in wake county}} * 100$$

$\frac{15,878}{400,172} * 100$ = 3.97% with zero vehicles in wake county

$\frac{75,233}{400,172} * 100$ = 18.80% with income less than 35k in wake county

Residents of the food deserts are not more likely to be poor or not own cars than the residents of Wake County as a whole because the percentage of households with zero vehicles and an income of less than 35k in Wake County is higher than those in food deserts (non-buffer regions). Wake county is 3.97% for households with zero vehicles, while the food deserts are 3.40 %. Wake county is 18.80%, for households with income less than 35k, while the food deserts are 17.64%

5. Wake County has received a grant from the United States Department of Agriculture to improve food access in Wake County by subsidizing the construction and opening of one new supermarket. Based on your analysis, where should this supermarket be placed? There is no one right answer, and your answer will depend on which demographic characteristics you think are most important. Explain and justify your answer with a discussion of at least three paragraphs. Include at least one map showing the spatial distribution of a demographic characteristic that you used in your decision making process. Make sure the map represents a percent (e.g. percent of households in poverty), rather than an absolute number (e.g. total households in poverty), to avoid simply highlighting the most populous Census tracts in the county

   I created and added new fields to the attribute table of the food deserts in wake county shapefile (food_deserts_wake_county).

   - Field 1- zero_vehicles_percentage. It was calculated using:

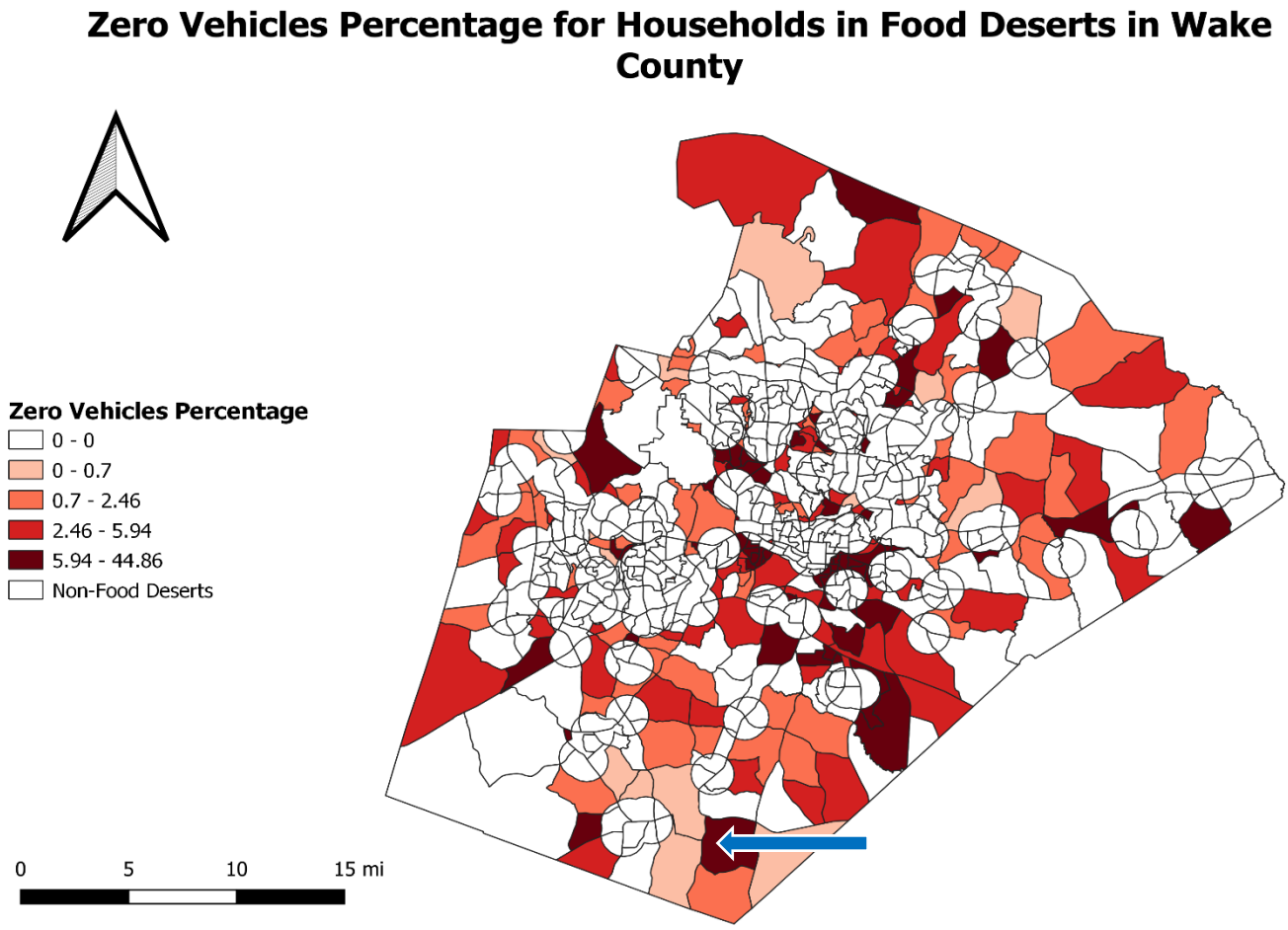
$$\frac{\text{triangle\_census \_zero\_vehicle\_households}}{\text{triangle\_census\_total\_households}} * 100$$

- Field 2 – less_than_35k_percentage. It was calculated using:

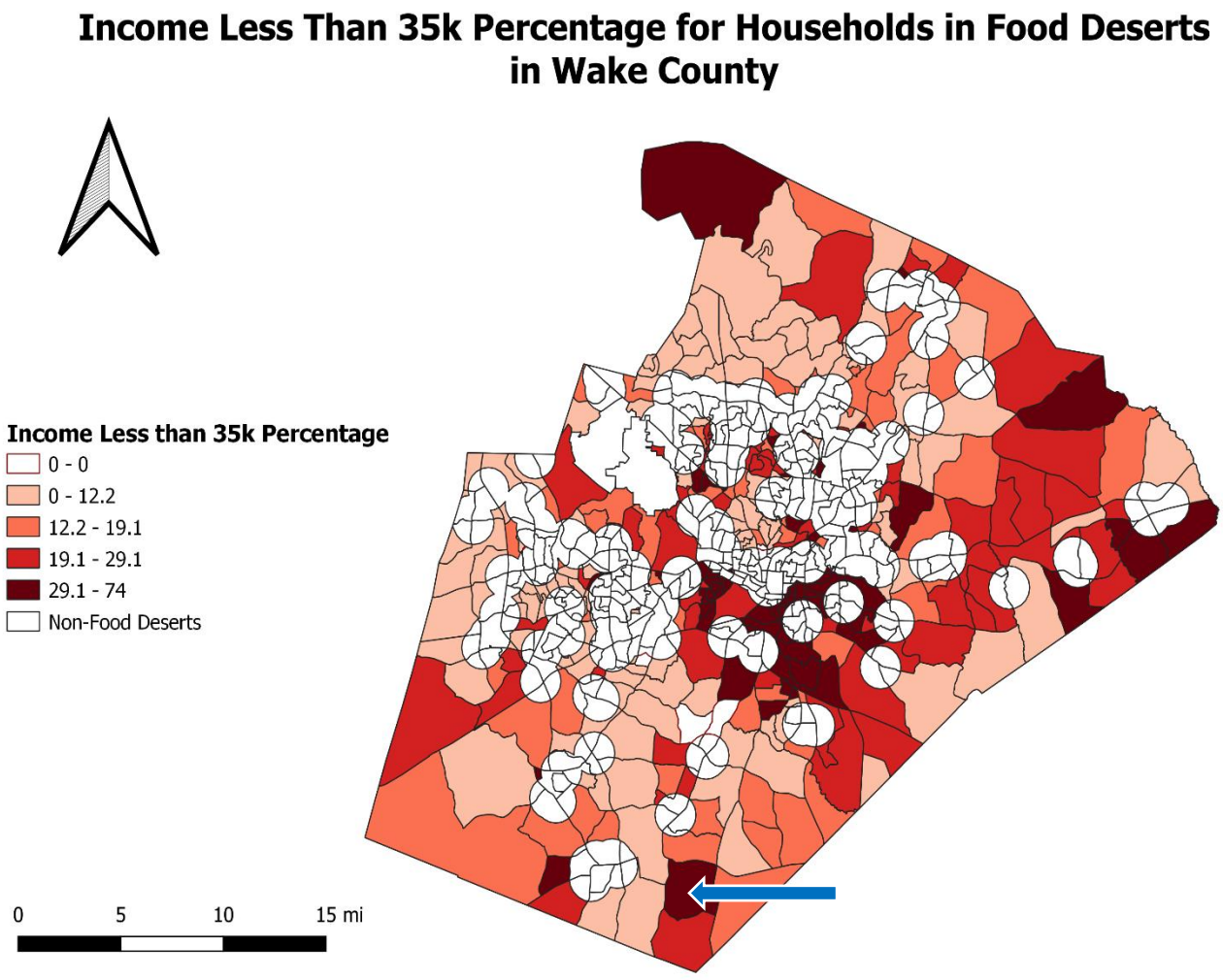
$$\frac{\text{triangle\_census \_households\_income\_less\_than\_35k}}{\text{triangle\_census\_total\_households}} * 100$$

Then I created choropleth maps of the two new fields created. I used Equal Count (quantile) as the mode.

Choropleth map for Zero Vehicles Percentage:



Choropleth map for Less than 35k Percentage:



The white areas in the choropleth map above are places, where the percentages were zero, nulls and the non-food desert areas.

Selecting a location for the new supermarket:

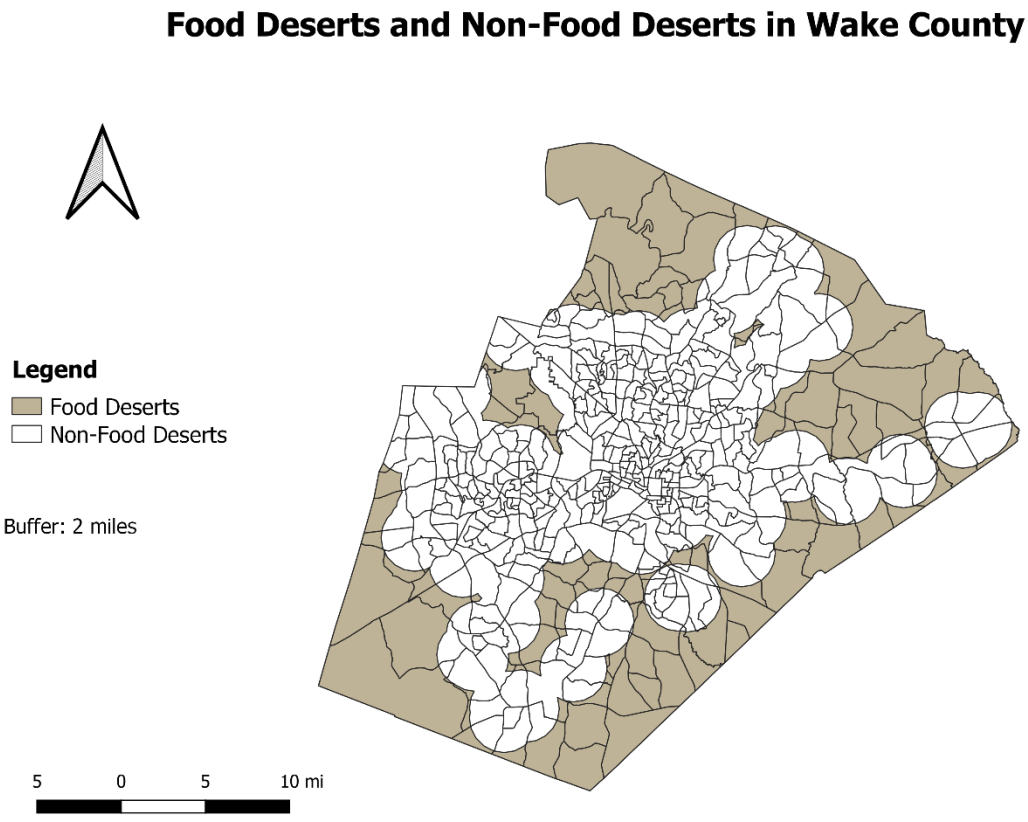
The blue arrow shows the location I chose. I chose that location because it has a high percentage for both the households with zero vehicles and incomes less than 35k.

6. It turns out much of Wake County is considered a food desert by the one-mile criterion. Evaluate how a shift to a two-mile criterion would change the analysis. Do you feel that

using a two-mile criterion would lead to better outcomes than the current one-mile criterion? Include a map comparing the one and two-mile food desert areas. [2 points]

Food deserts – more than 2 miles from supermarket

I created a two-mile buffer shapefile and did an intersection on it using the wake county shape file as the overlay layer, in order to remove the buffer regions that were out of the wake county boundaries. Then, I joined the triangle census data to the attribute table of the 2-mile buffer shapefile (2_mile_buffer_intersection). This shapefile shows the areas that are not food deserts. To show the areas that are food deserts, I created a new shape file that crops out the two-mile buffer region from the wake county shapefile by using the symmetrical difference tool. I named the new shape file new_food_deserts and joined the triangle census data to it.



The residents of wake county was already given to be 1,069,079.

I performed 'Basic Statistics for fields' on the triangle_census_total population field of the attribute table of the new_food_deserts shapefile, to calculate the percentage of the wake county population that resides in food deserts, I did:

$$\frac{\text{sum of total population of food deserts in wake county}}{\text{total population of residents in wake county}} * 100$$

$$\frac{400,285}{1,069,079} * 100 = 37.44\%$$

Are residents of food deserts more likely to be poor or not own cars than the residents of Wake County as a whole?

For non-buffer region (food deserts):-

Total households in non-buffer region (food desserts): 139,333

Sum of households with zero vehicles in non-buffer region: 3,186

Sum of household with income less than 35k in non-buffer region: 22,228

$$\frac{\text{household with zero vehicles in non} - \text{buffer region (food deserts)}}{\text{total households in non} - \text{buffer region (food deserts)}} * 100$$

$$\frac{\text{household with income less than 35k in non} - \text{buffer region (food deserts)}}{\text{total households in non} - \text{buffer region (food deserts)}} * 100$$

$\frac{3,186}{139,333} * 100 = 2.29\%$ with zero vehicles in non-buffer region

$\frac{22,228}{139,333} * 100 = 15.95\%$ with income less than 35k in non-buffer region

For wake county:-

Total households in wake county: 400,172

Sum of households with zero vehicles in wake county: 15,878

Sum of household with income less than 35k in wake county: 75,233

$$\frac{\text{household with zero vehicles in wake county}}{\text{total households in wake county}} * 100$$

$$\frac{\text{household with income less than 35k in wake county}}{\text{total households in wake county}} * 100$$

$\frac{15,878}{400,172} * 100$ = 3.97% with zero vehicles in wake county

$\frac{75,233}{400,172} * 100$ = 18.80% with income less than 35k in wake county

Residents of the new food deserts are not more likely to be poor and not own cars than the residents of Wake County as a whole because the percentage of households with zero vehicles and an income of less than 35k in Wake County is higher than those in food deserts (non-buffer regions). Wake county is 3.97% for households with zero vehicles, while the new food deserts are 2.29%. Wake county is 18.80%, for households with income less than 35k, while the news food deserts are 15.95%.

Does using a two-mile criterion lead to better outcomes than the current one-mile criterion?

Using a two-mile buffer instead of a one-mile buffer means that less area is considered food deserts. The percentage of the population living in food deserts is 37.44% with the two-miles buffer analysis, and with the one-mile buffer analysis, it is 84.83%. Residents of the previous food deserts (one mile criterion) are more likely to be poor and not own cars than the residents of the new food deserts, since the percentage of households with zero vehicles for the previous food deserts is 3.40%, and the new food deserts are 2.29%, and the percentage of households with income less than 35k for the previous food deserts is 17.64%, while the new food deserts are 15.95%. Therefore, using the one-mile criterion leads to better outcomes because it has a higher percentage of people living in food deserts and of poor households and of households without vehicles.

Selecting a location for the new supermarket:

I created and added new fields to the attribute table of the food deserts in wake county shapefile (new_food_deserts).

- Field 1- zero_vehicles_percentage. It was calculated using:

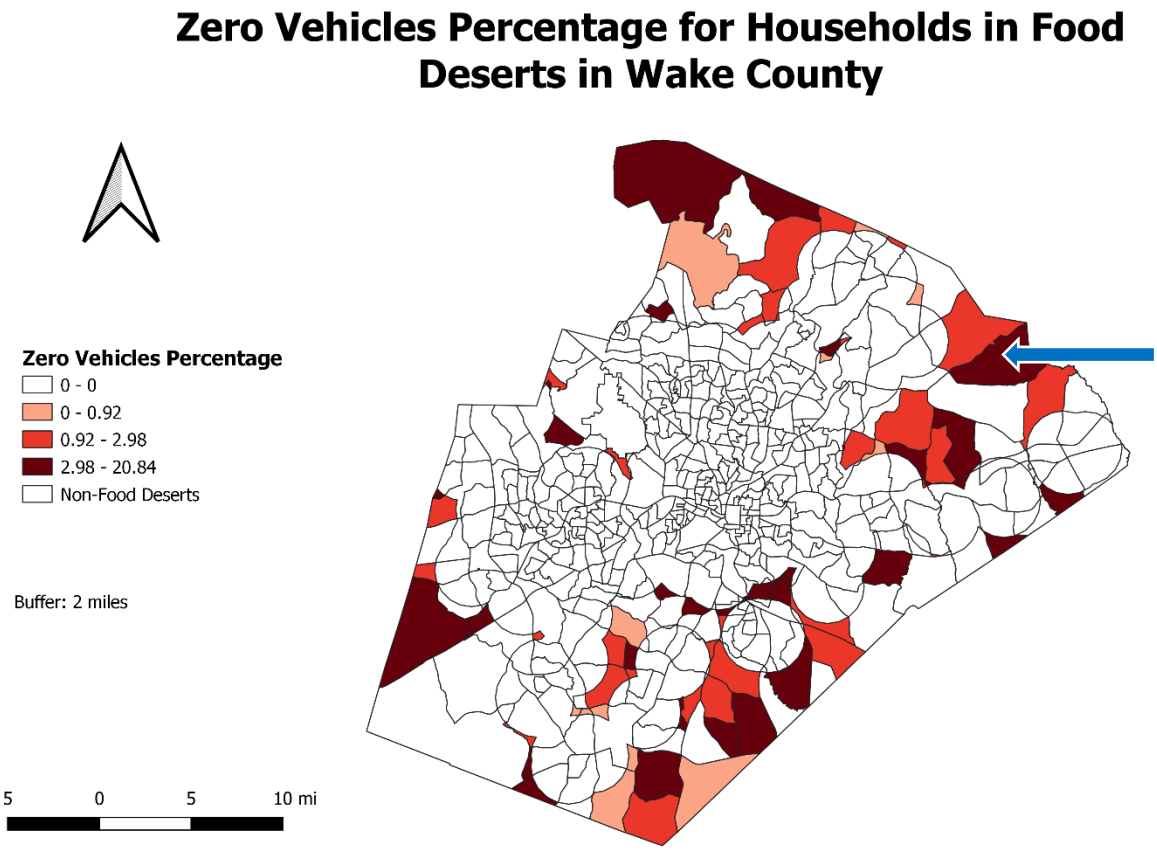
$$\frac{\text{triangle\_census \_zero\_vehicle\_households}}{\text{triangle\_census\_total\_households}} * 100$$

- Field 2 – less_than_35k_percentage. It was calculated using:

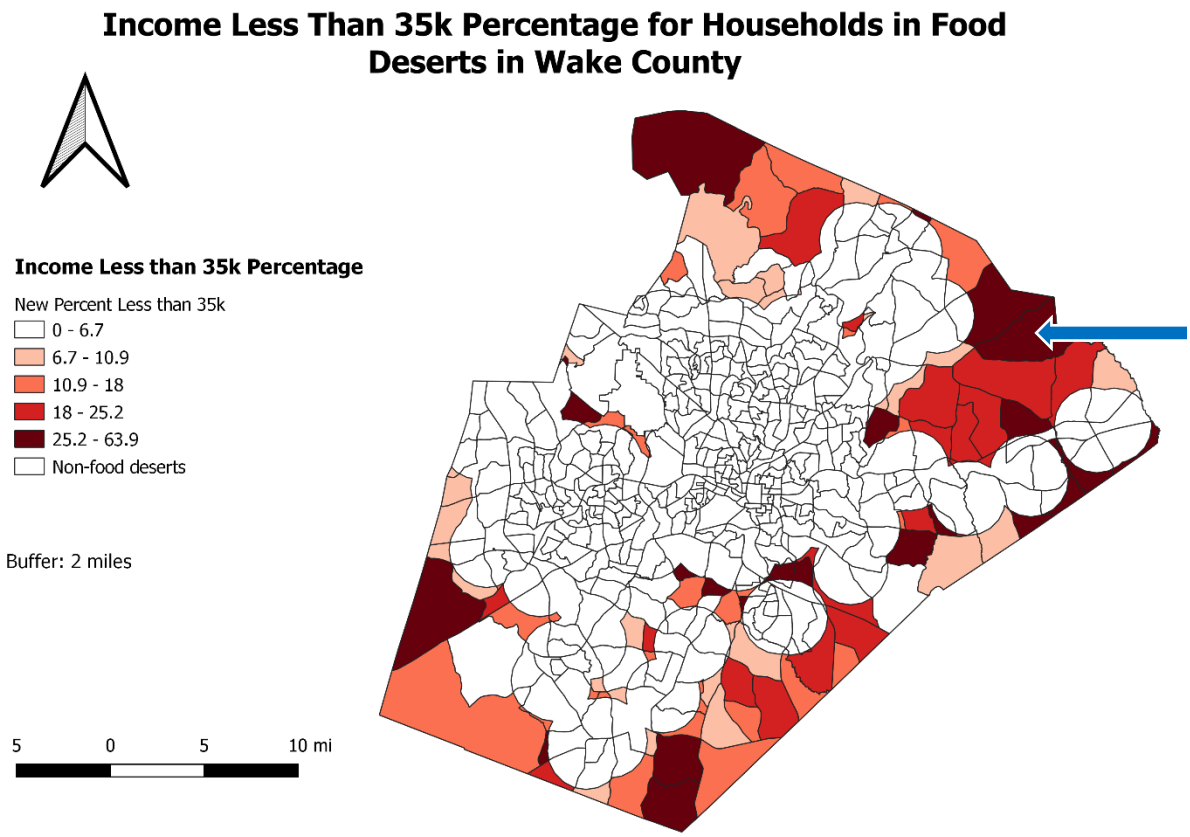
$$\frac{\text{triangle\_census \_households\_income\_less\_than\_35k}}{\text{triangle\_census\_total\_households}} * 100$$

Then I created choropleth maps of the two new fields created. I used Equal Count (quantile) as the mode.

Choropleth map for New Zero Vehicles Percentage:



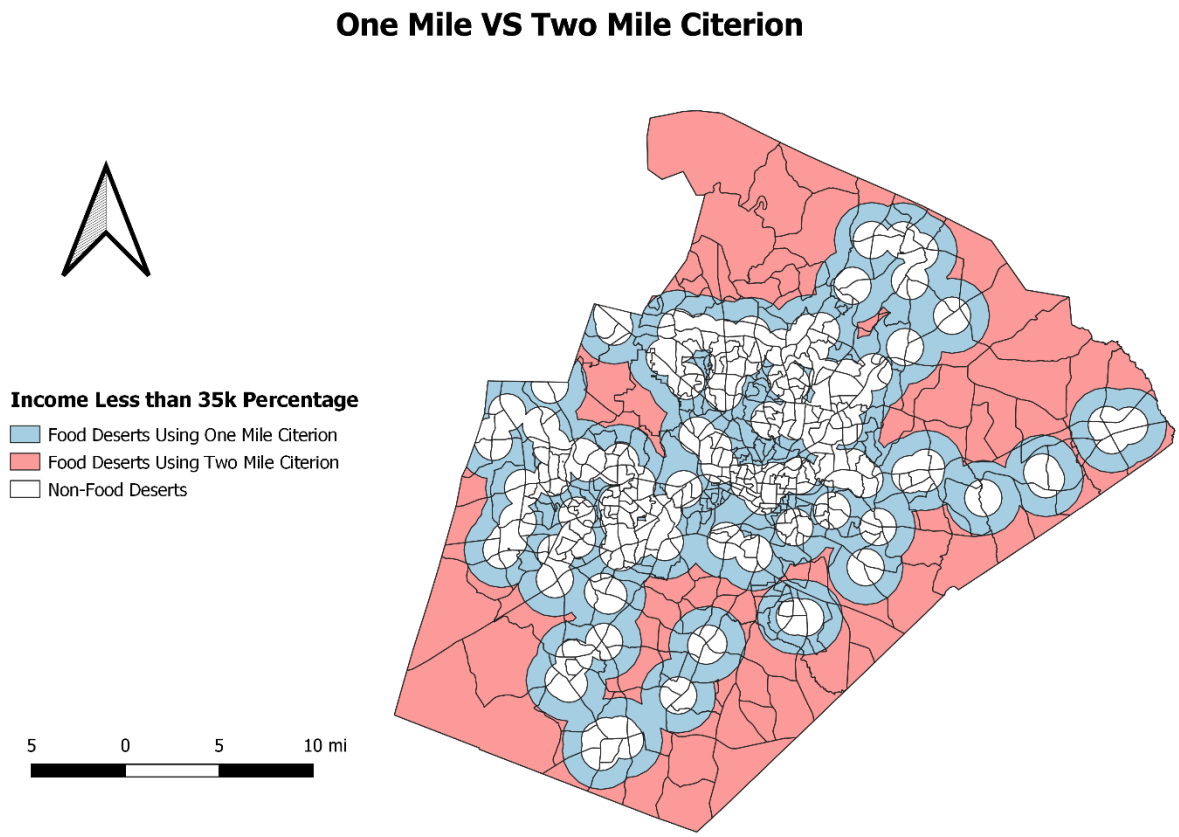
Choropleth map for New Less than 35k Percentage:



The white areas in the choropleth map above are places, where the percentages were zero, nulls and the non-food desert areas.

The blue arrow shows the location I chose. I chose that location because it has a high percentage for both the households with zero vehicles and incomes less than 35k. I can also choose the same location I chose in the previous analysis because it also has a high percentage for both the households with zero vehicles and incomes less than 35k.

Include a map comparing the one and two-mile food desert areas.


One Mile VS Two Mile Citerion
Income Less than 35k Percentage
Food Deserts Using One Mile Citerion
Food Deserts Using Two Mile Citerion
Non-Food Deserts
5
0
5
10 mi