

**Identifying Areas with Low Fresh Food Accessibility in Athens-Clarke County, GA**

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GEOG 6370e: Intro to GIS

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## **Identifying Areas with Low Fresh Food Accessibility in Athens-Clarke County, GA**

This study examines the challenges posed by food deserts for local governments, focusing specifically on Athens-Clarke County (ACC) in northeast Georgia. Using geographic information systems (GIS) vector analysis, areas are identified within the jurisdiction that lack proximity to a grocery store or public transportation route. The percentage of individuals without access to a vehicle for each census tract are overlaid to highlight areas of higher need of intervention. Specific locations are then identified as areas where residents would benefit from the placement of a new grocery store or expansion of bus routes.

### **Background**

#### **Problem**

A food desert is an area in which residents do not have sufficient access to a source of fresh food, like a grocery store or market. The exact specifications that qualify an area as a food desert vary based on the criteria selected. Food deserts can exist in both urban and rural areas. Residents who are most vulnerable in food deserts are those who lack a means of transportation out of the food desert to reach a grocery store. If someone lives too far from a grocery store and does not have access to their own vehicle or a public transportation network, they are more likely to rely on closer sources of food, like fast food restaurants, convenience stores or dollar stores. This will generally lead to less healthy outcomes for these individuals due to the lack of fresh produce and other foods that promote healthy eating habits. These alternatives also end up being more expensive. This creates a public health and equity problem, both of which public administrators should be concerned about. Research shows that low-income Americans are less likely to live near a grocery store (Krukowski, 2010) and that limited

food choices in food deserts lead to poor nutrition, increased risk for obesity and chronic diseases like diabetes and hypertension (Story, 2008; Zhao, 2011). Measurements defining a food desert can vary but the United States Department of Agriculture (USDA) estimates that 17.7 percent of the U.S. population, or 54.4 million people, live in census tracts that are both low-income and more than a half-mile from the nearest supermarket or more than 10 miles from the nearest supermarket for rural areas (USDA, 2019).

Local governments across the country are looking for ways to promote access to fresh food, especially in food deserts. ACC is not immune to this problem. ACC is the smallest county geographically in the state of Georgia. Despite its small size, there are areas of the county that lack proximity to a source of fresh food. ACC also has a poverty rate of 37.8 percent and a public transportation system that is limited, not reaching the outer regions of the county (ACC Unified Government, 2017). For low income residents and those who lack access to a vehicle in a food desert, these factors present a major problem.

### **Objective**

Based on the above problem, the research question is: are there opportunities to strategically recruit new grocery stores and/or expand the public transportation network in ACC to improve access to fresh food for residents who do not have a vehicle? The desired output is a map that shows food deserts in ACC and the prevalence of individuals without a vehicle in those food deserts.

### **Current State of Research and Practices**

According to the USDA, there are two criteria an area must meet to be classified as a food desert: low income and low access. To be considered low income, the tract must meet one

of three conditions: a poverty rate of 20 percent or higher, a median family income of less than or equal to 80 percent of the state average, or if the tract is in a metropolitan area, a median family income of less than or equal to 80 percent of the metropolitan area average. A low-income tract is also considered to be low access if it is a certain distance away from the nearest grocery store or supermarket. This distance varies, with the USDA including a half-mile and mile as the distance thresholds for urban areas and 10 miles and 20 miles for rural areas. A fourth condition can be used that includes vehicle access. A tract can be considered low access if at least 100 households are more than a half-mile from a supermarket and have no access to a vehicle. Using an estimate from USDA, 2.1 million American households are in low-income and low access tracts and do not have a vehicle (USDA, 2019).

Research has shown that food deserts correlate with urban sprawl. In one study, urban sprawl was measured using a compactness index. As a census tract increased one unit on the compactness index, the odds of that tract being a food desert decreased by 5.8 percent. The study concludes by promoting increased land use density and a mix of land use classifications in an area, along with walkability of neighborhoods, as solutions to drive investment from food retailers in more spread out areas (Hamidi, 2020). This study highlights some of the tools local governments have to address food deserts, mainly creating appealing environments to draw private investment. A local government cannot tell grocery stores where to locate but they can strongly influence company selections by offering advantageous situations and removing barriers to entry.

For example, a food retailer may be less likely to place a new grocery store in a location considered remote. If the location is more accessible to customers, the retailer would be more

likely to place a store in a location. ACC's objective to create "complete streets" that feature a robust transportation network of sidewalks and bicycle lanes would create a better business environment for that grocery store and for the residents trying to reach it without vehicles (ACC, 2012). Other local governments have attempted to remove up-front costs associated with building a grocery store by proactively running utility and water lines to an area strategically selected to draw a new commercial business like a grocery store. Other governments have actually subsidized the start-up costs for grocery stores (Reinvestment Fund).

At a federal level, the Healthy Food Financing Initiative is a collaborative effort between the USDA, Department of Treasury and the Department of Health and Human Services that started in 2010. The goal is to facilitate public-private partnerships to bring more stores to underserved communities (Administration for Children and Families). That project has funneled \$220 million in grants and another \$1 billion to finance projects, supporting nearly 1,000 stores across the country. A persistent challenge is how to ensure grocery stores not only open, but survive in food deserts. As grocery stores see a continued increase in the popularity of online ordering and pickup and delivery services, some public administration practitioners believe governments should think beyond recruiting new grocery stores and think about how to expand access to grocery delivery services to food deserts (Nussbaum, 2020).

## **Data Sources**

### **Grocery Stores**

A data set called "Athens Area Grocery Stores" was added from the ArcGIS Online. The data set was created by another user and it was last updated in November 2019. It was reviewed to ensure accuracy.

**Bus Routes**

The bus routes feature class was downloaded from the ACC Open Data portal on the ArcGIS Online website. The data was last updated in July 2019.

**Census Tracts**

Census tract data and boundaries for ACC were downloaded from CensusReporter.org. The data set downloaded was specifically for Table B08201 Household Size by Vehicles Available of the American Community Survey 2018, which provides data based on a sample of the population for a five-year period, 2014-18. The downloaded data set did not include population for each tract so that was manually collected from the same website and added to the attribute table of each tract.

**Streets**

A data set of ACC streets was already available from University of Georgia GEOG 6370e course materials.

**Research Design and Methodology****Research Design Overview**

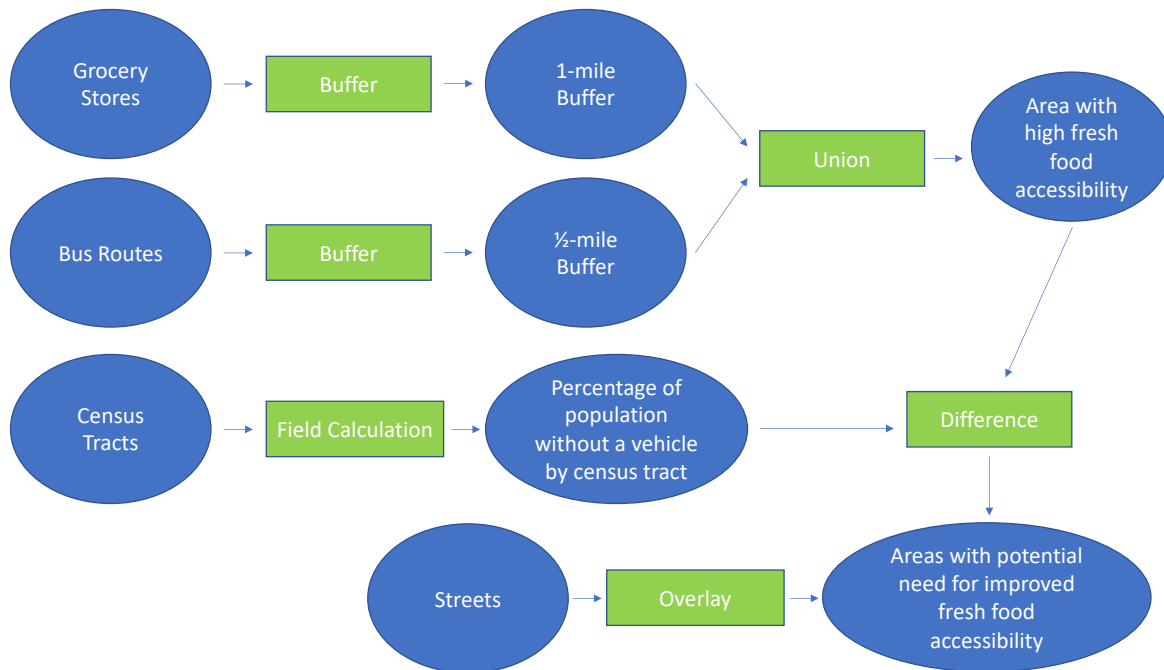
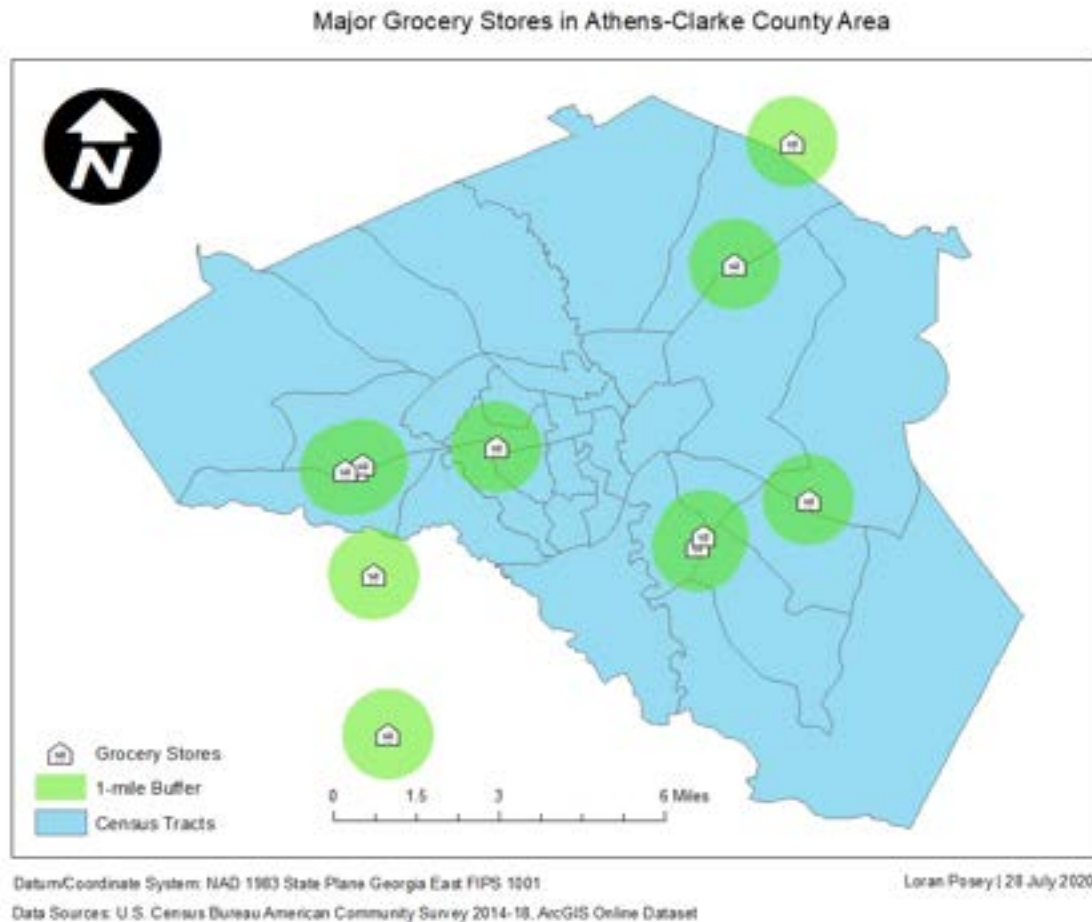


Figure 1 GIS Flowchart

To create the desired output, a flowchart was designed. By creating buffer zones around the grocery store points and bus routes lines and then performing a union operation of the two, a zone was created to represent areas that are close to grocery stores and/or able to access the public transportation system to reach a grocery store. Then, by using the field calculator to produce percentages for each census tract of individuals who do not have a vehicle, a map was produced to show where the food-accessible zones are relative to tracts and individuals without vehicles. By performing a difference operation between the food-accessible areas and the census tract layer, a map was produced to show areas with potential need for improved fresh food accessibility. Streets were then overlaid on the map. The final output can inform policy decisions related to grocery store permits, land use planning and bus route expansions in ACC. The process is presented in the GIS Flowchart in Figure 1.

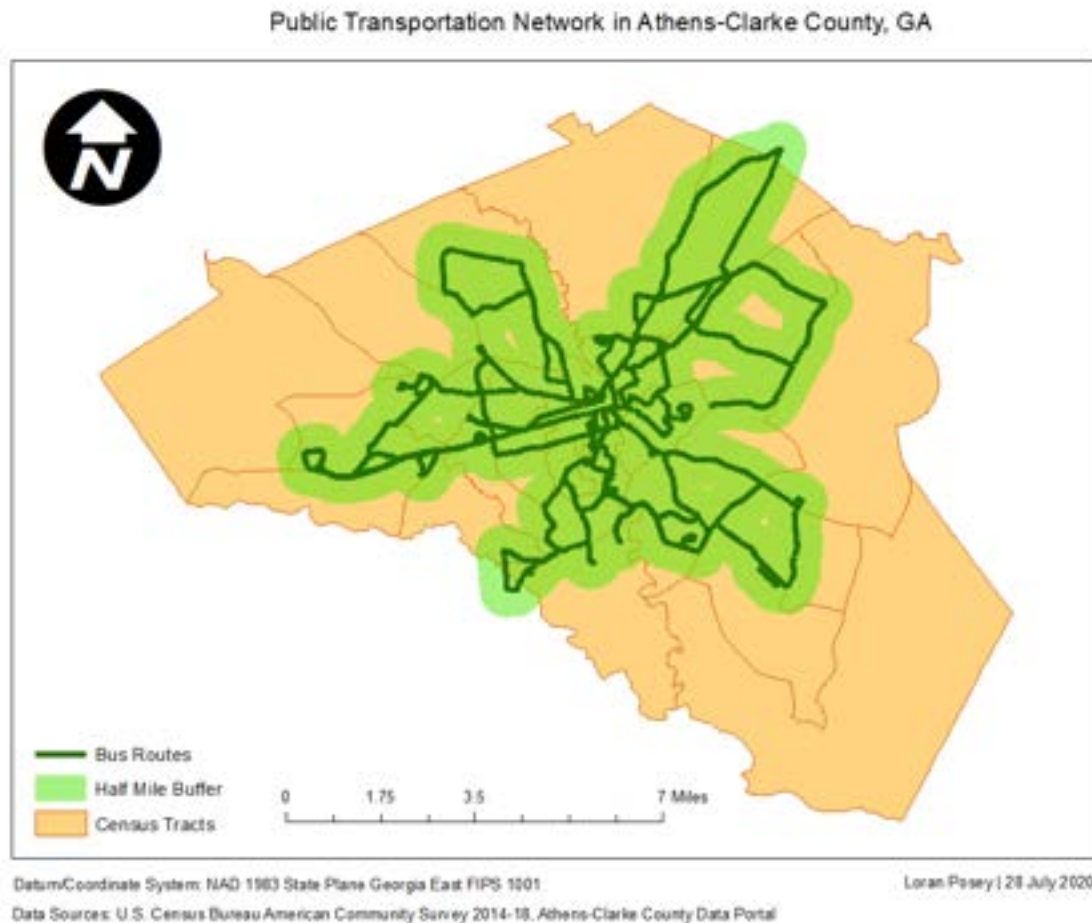
## Step-by-Step Methodology



*Figure 2 Grocery Stores Buffers*

After adding the census tract feature class, the first step was to add the grocery store data set from ArcGIS Online and establish a buffer zone around the major grocery stores in the ACC area. Eleven major grocery stores in the area were placed on the map. Some of the stores included were not within the boundaries of ACC. However, because of the convenience of the data set and the close proximity of some of the stores to ACC residents, those grocery stores were included. A one-mile buffer zone was created around each point feature that represented a grocery store. The one-mile buffer zone represents an area in which a resident without a vehicle could feasibly walk to and from the grocery store (see Figure 2).





*Figure 3 Bus Route Buffer*

Next, the grocery store and store buffer classes were unchecked, and the bus route feature class was added to the data layer. Even if a resident is not within walking distance of a source of fresh food, they could access the bus system to take a trip to a grocery store so that is an important factor to look at. A half-mile buffer was established around the bus routes to represent a realistic distance one could walk to get to a bus route. The buffer was kept to only a half-mile, considering the time and effort it would take not only to reach a bus route, but to find a bus stop, wait for a bus to arrive and travel to a store—all before returning home in a similar fashion. Figure 3 shows the resulting map.

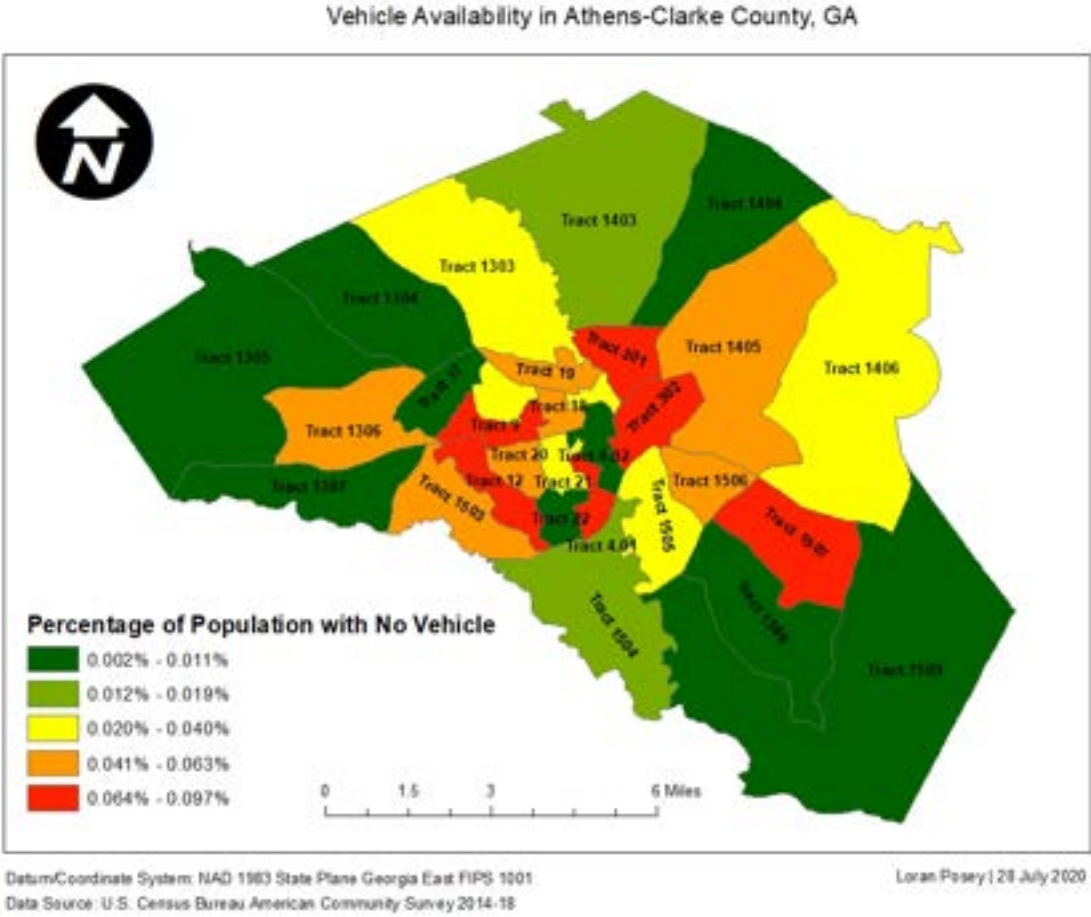


Figure 4 Vehicle Availability

The bus routes and buffer layers were unchecked to focus on the census tract data. The attribute table contained the number of individuals in each ACC census tract who had no vehicle for transportation. The table was edited to add a field for total population of each census tract. Then, another field was added, and the field calculator produced the percentage of the population in each census tract who did not have a vehicle. The symbology of the feature class was modified to reflect this percentage, producing the map shown in Figure 4.

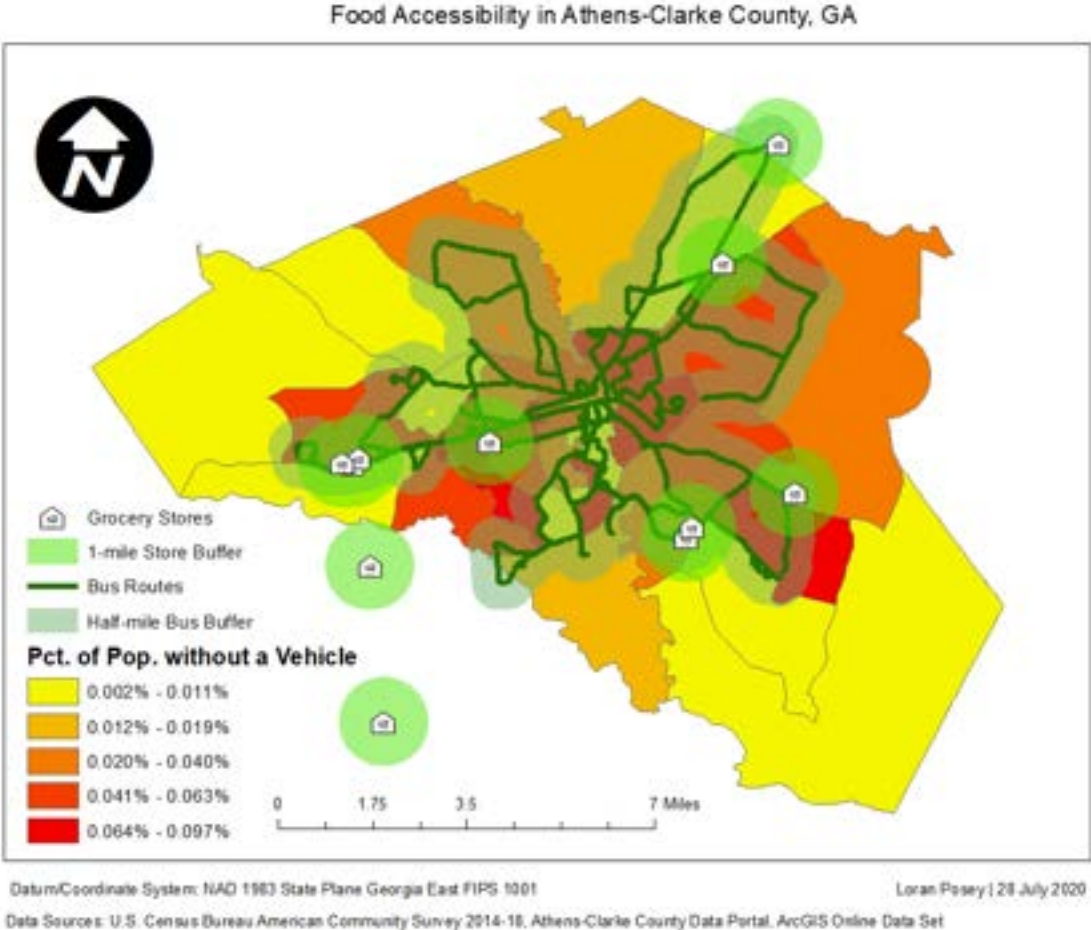


Figure 5 Stores, Bus Routes, Buffers and Vehicle Availability

All three feature classes were overlaid on the same map to show the relationship between the location of grocery stores, bus routes, their buffers and the census tract data of individuals without a vehicle. Figure 5 shows a very busy map that makes it difficult to analyze. To solve this problem, the union feature was utilized to create a new feature class combining the grocery store buffer zones with the bus route buffer zones. This new class represents a zone of high fresh food accessibility because the areas in the zone are within one mile of a grocery store and/or within a half-mile of a bus route.

To identify which areas of ACC would have poor fresh food accessibility for individuals without a vehicle, the difference tool was used to remove the areas in which the high accessibility area intersected with the census tract feature class. This produces a map of ACC showing only the areas that are not within walking distance to a grocer or bus route. One issue encountered here was the fact that the buffer zones included some areas outside of the jurisdiction of ACC and, therefore, were not removed by the difference operation.

To fix this issue, the clip operation was used to isolate the areas outside of the county. Then, the difference operation was used to remove them. This produced a map that shows only areas within ACC that are not within sufficient walking distance to a grocery store and/or bus route along with the prevalence of individuals without a vehicle of the census tract in which the remaining areas are located (see Figure 6).

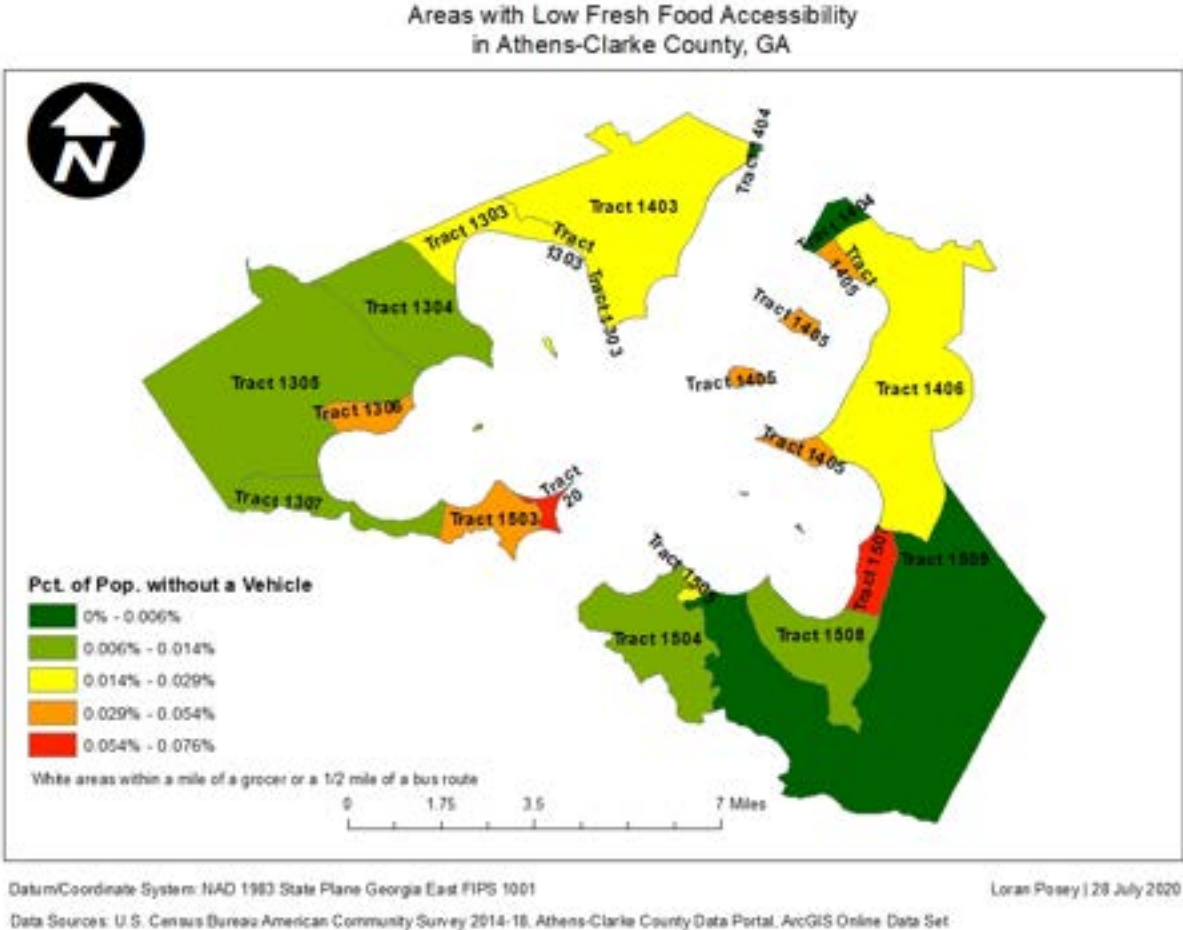


Figure 6 Low Access Areas

Using this final map, one can identify areas of ACC with low accessibility to fresh food for individuals without a vehicle, as well as which areas have a higher percentage of individuals with no vehicle. This information can inform policy decisions for the ACC. One final feature class was added to improve the utility of the final map. ACC streets were overlaid to better understand what areas the output map represented and how the existing transportation network interacted with those areas. This helped to avoid an area being reported as high need when, in reality, the area is actually undeveloped forest or some other type of land that would not be appropriate to label as in need to a store or bus route. Figure 7 shows the final output.

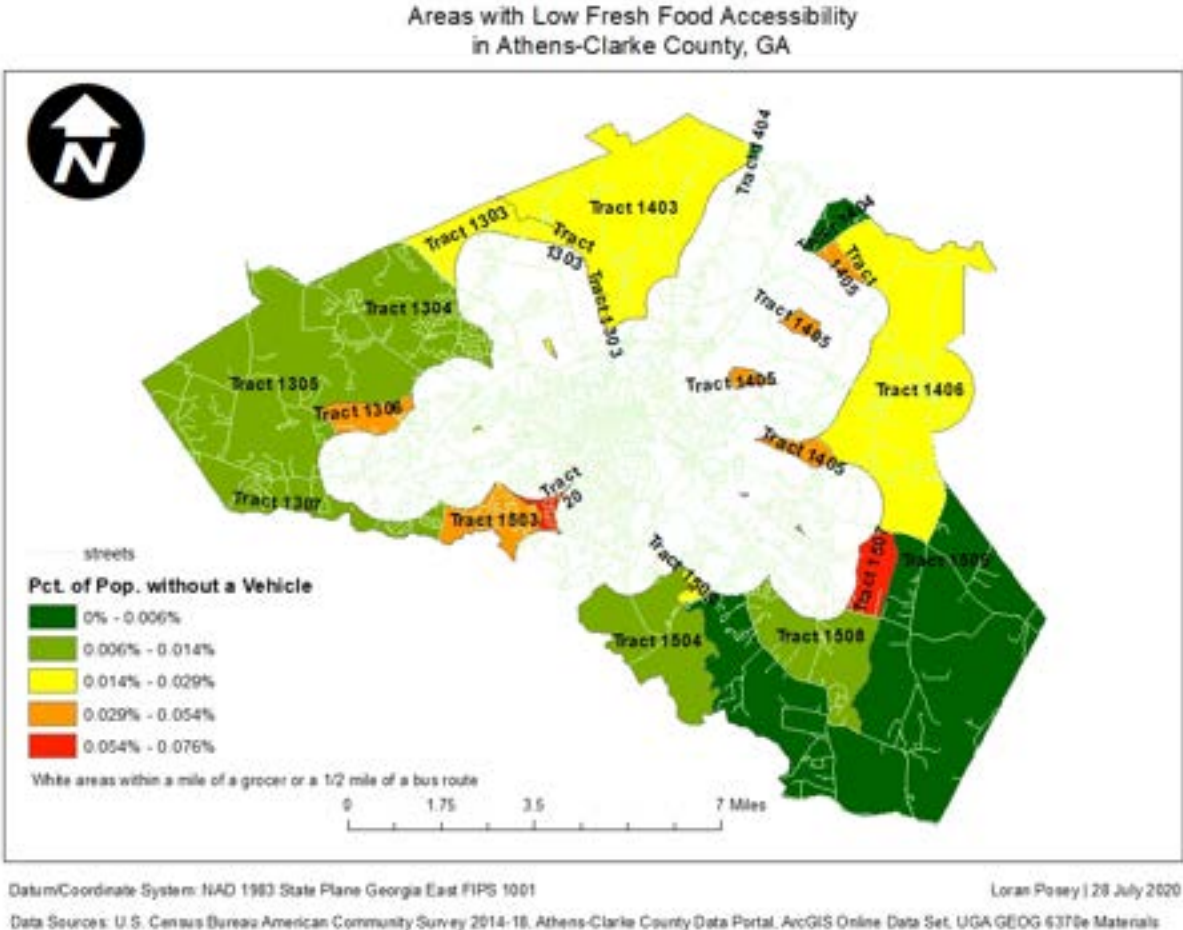


Figure 7 Final Output Map

### Analysis of Results

The results show minor bus route expansions and the strategic recruitment of new grocers would improve access to fresh food for residents with low mobility in ACC. In West Athens, parts of census tracts 12, 1503 and 1306 are in low-access areas with relatively higher percentages of residents without a vehicle. These slivers are all positioned not far from existing bus routes. These routes could be expanded to reach these areas of higher need without major disruption to then route. In East Athens near Winterville, nearly all of tract 1406 is outside of the reach of the ACC public transportation system and is far from surrounding grocery stores.

With the addition of a more central grocery store for this area, this issue could be alleviated. However, the absence of bus routes is a problem that persists.

Also in East Athens, there are three slivers of tract 1405 which could be reached by minor bus route modifications. These areas have higher rates of residents without a vehicle and are important to reach. In the northern reaches of the county, nearly all of tract 1403 is located outside of the high-accessibility area. While the area only has a relatively moderate proportion of residents without a vehicle, it could benefit from the strategic recruitment of a grocer. Also, like tract 1406, tract 1403 is largely untouched by public transportation routes. Tract 1507 is located near the Wal-Mart on Lexington Road but has one of the higher rates of residents without a vehicle and has a significant area outside of the buffer distance to a grocer or the bus routes. With the addition of a bus route into this area, this problem could be resolved. It is also contiguous with tract 1509, which has a low percentage of residents without a vehicle, but also is completely untouched by the bus routes and has no grocery stores nearby. It is potentially an area of concern to keep an eye on in the future.

### *Limitations*

When producing census tract data to communicate vehicle availability, the only calculation made was the number of individuals without a vehicle divided by the total population of the census tract to produce the percentage of residents without a vehicle. While this is an important calculation, it potentially misses other individuals who have low mobility and are not accounted for in this study. For example, the ACS survey data included household size for each individual and the number of vehicles available in the household. If there are two adults in a household and only one car available, it is possible that one of the adults will need to

operate without a vehicle. This individual would also rely on bus routes or close proximity to a store. A limitation of this study is that this sort of individual is not accounted for in the methodology. Future research could focus on how to include household size and number of vehicles.

Another limitation to this study was the reliance on an already existing data set for grocery stores. While the data set was updated recently and included all major grocery stores, it is possible that some smaller stores were not accounted for. Future research could include manual gathering of grocery store data in ACC to ensure all sources of fresh food were included. Another consideration in future data collection would be inclusion of ethnic or specialty grocery stores. These stores are often not included in counts related to food deserts but play an important role in offsetting scarcity in food deserts (Bukanya, 2018).

### **Conclusion**

Even in a small geographic area, food deserts persist. Because of the limitations of public transportation, effects of poverty and the absence of fresh food retailers in certain neighborhoods, ACC residents can face major obstacles to accessing fresh food, which is key for positive health outcomes. Local governments have many tools to influence where new grocery stores are placed and how public transportation networks can be expanded. There are also new outside-of-the-box innovations to improving access to fresh food, brought on by grocery delivery services. GIS technology can play a central role in helping local government practitioners identify food deserts and opportunities for improving fresh food access. ACC has several areas within its jurisdiction in which residents who do not have access to a vehicle are too far away from grocery stores or bus routes. Specific action can be taken to expand bus



routes and approach land use planning and economic development in a strategic way to improve access to public transit and recruit well-placed grocers.

## References

- Administration for Children & Families: Office of Community Services. CED Healthy Food Financing Initiative FY 2016. <https://www.acf.hhs.gov/ocs/programs/community-economic-development/healthy-food-financing>
- Athens-Clarke County Unified Government (2012). Athens-Clarke County Complete Streets Policy. <https://www.athensclarkecounty.com/DocumentCenter/View/11362/CompleteStreets-Policy?bidId=>
- Athens-Clarke County Unified Government (2017). Athens-Clarke County By the Numbers. <https://www.accgov.com/DocumentCenter/View/535/Athens-ClarkeCounty-By-the-Numbers?bidId=>.
- Bukenya, J. O. (2018). The Importance of Ethnic Food Stores in Identifying Food Deserts: A Case Study of Huntsville, Alabama. *Journal of Food Distribution Research*, 49(1), 56–62.
- Hamidi, S. (2020). Urban sprawl and the emergence of food deserts in the USA. *Urban Studies (Sage Publications, Ltd.)*, 57(8), 1660–1675.  
<https://doi.org/10.1177/0042098019841540>
- Krukowski, R. A. et al (2010). Neighborhood Impact on Healthy Food Availability and Pricing in Food Stores. *Journal of Community Health*, 35, no. 3: 315–20.
- Nussbaum, S. (2020). Revitalizing America’s Food Deserts. *Harvard Kennedy School Review*, 20, 108–112.
- Reinvestment Fund. Limited Supermarket Access. Retrieved July 31, 2020, from <https://www.reinvestment.com/policy-solutions/limited-supermarket-access/>.

Story, M. et al (2008). Creating Healthy Food and Eating Environments: Policy and Environmental Approaches. *Annual Review of Public Health*. 29, no. 1: 253–72.

United States Department of Agriculture. (2019, October 31). Documentation. Retrieved July 31, 2020, from <https://www.ers.usda.gov/data-products/food-access-research-atlas/documentation/>

Zhao, D. et al (2011). *Dietary factors associated with hypertension*. *Nature Reviews Cardiology* 8, no. 8: 456–65.

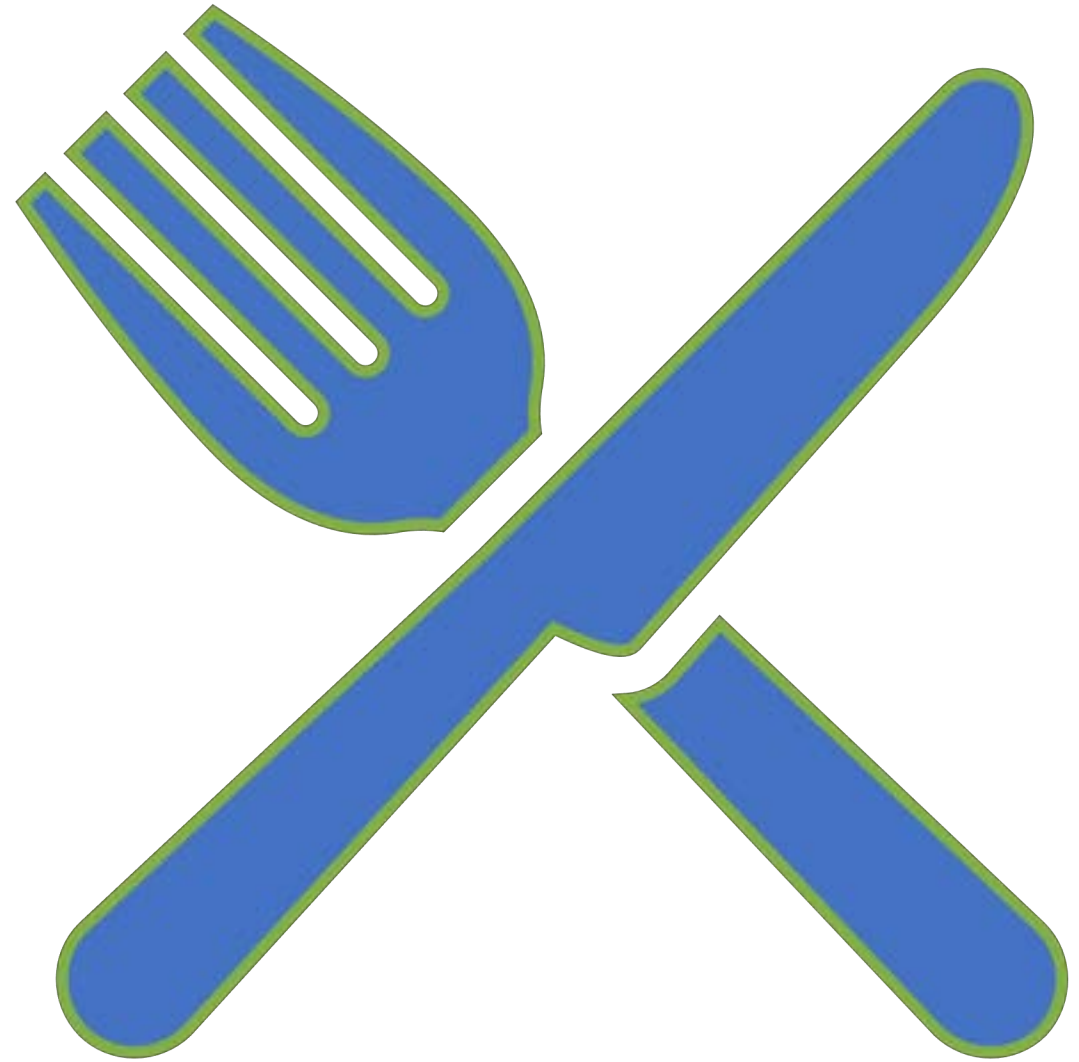


# Identifying Areas with Low Fresh Food Accessibility in Athens-Clarke County, GA

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LORAN POSEY

# Food Deserts



# Criteria

- Low-income: poverty rate of 20% or higher or AMI lower than state/metro average
- Low access: distance to nearest grocery stores (urban vs rural)

# Vulnerable Populations

- Low income Americans are less likely to live near a grocery store
- Individuals without access to transportation will rely more heavily on closer options
  - Health outcomes
  - Cost

# 54.4 million

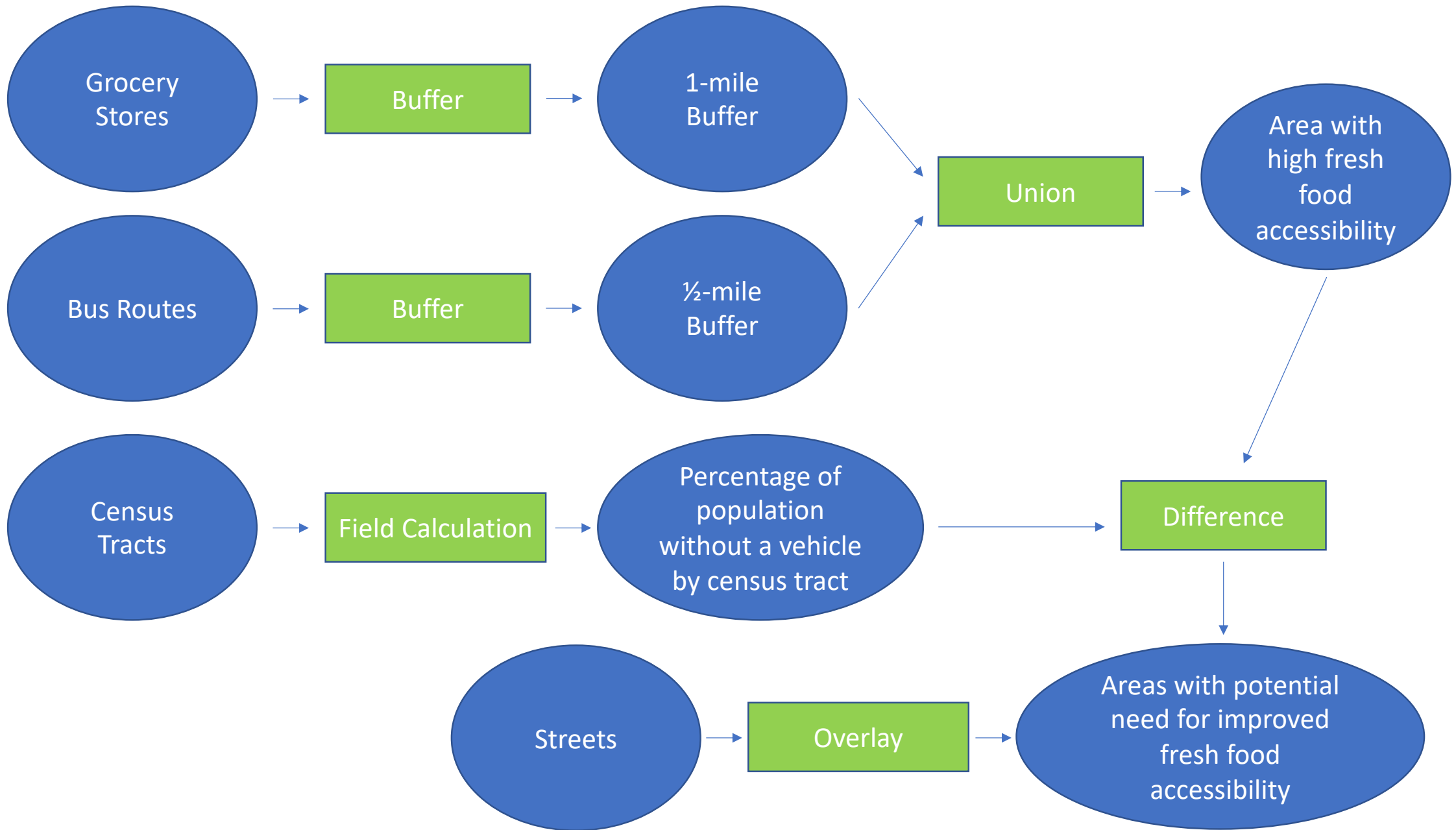
Live in low-income census tracts and are more than a ½ mile from a grocery store (or 10 miles for rural areas)



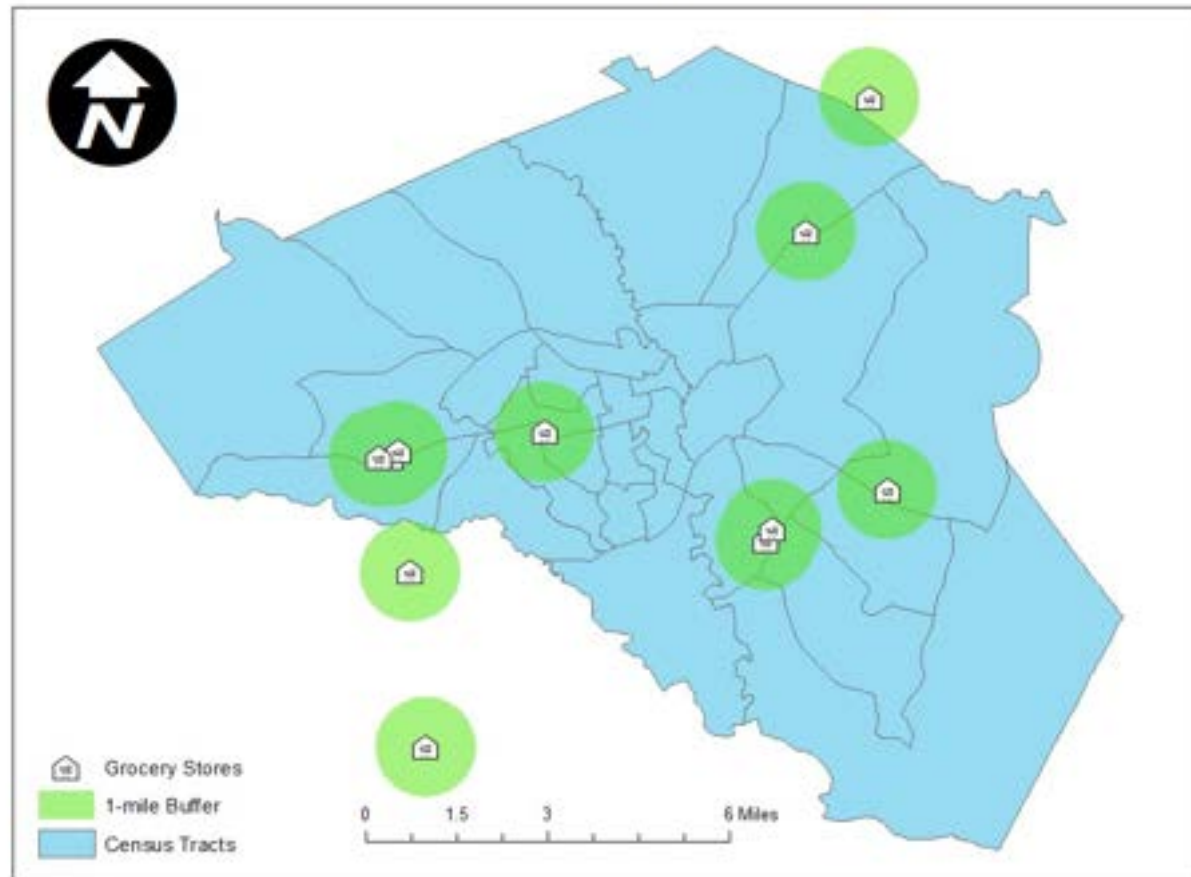
# Athens- Clarke County

- Public health and equity concern for public administrators
- 37.8 percent poverty rate in ACC
- Small geographically but limited public transportation network, walkability

Are there opportunities to strategically recruit new grocery stores and/or expand the public transportation network in ACC to improve access to fresh food for residents who do not have a vehicle?



### Major Grocery Stores in Athens-Clarke County Area

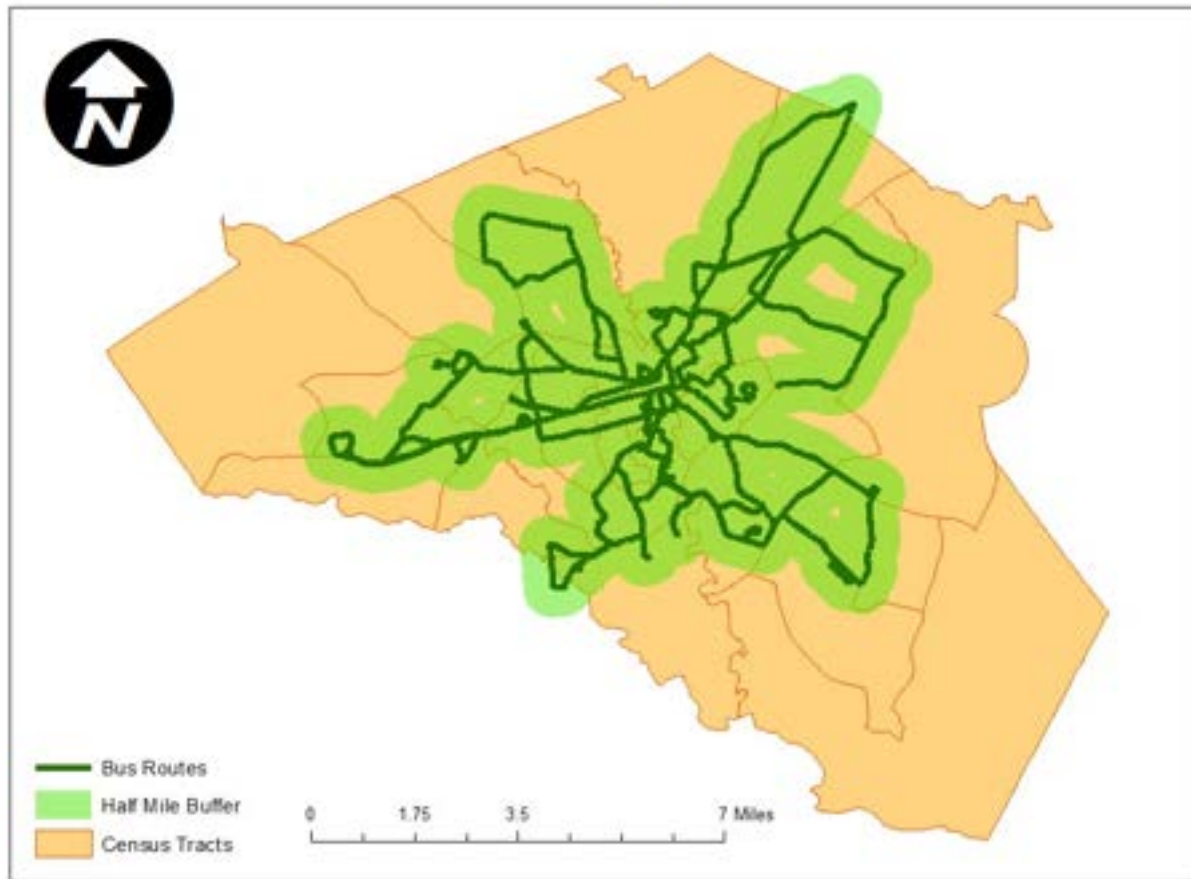


Datum/Coordinate System: NAD 1983 State Plane Georgia East FIPS 1001

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Data Sources: U.S. Census Bureau American Community Survey 2014-18, ArcGIS Online Dataset

### Public Transportation Network in Athens-Clarke County, GA

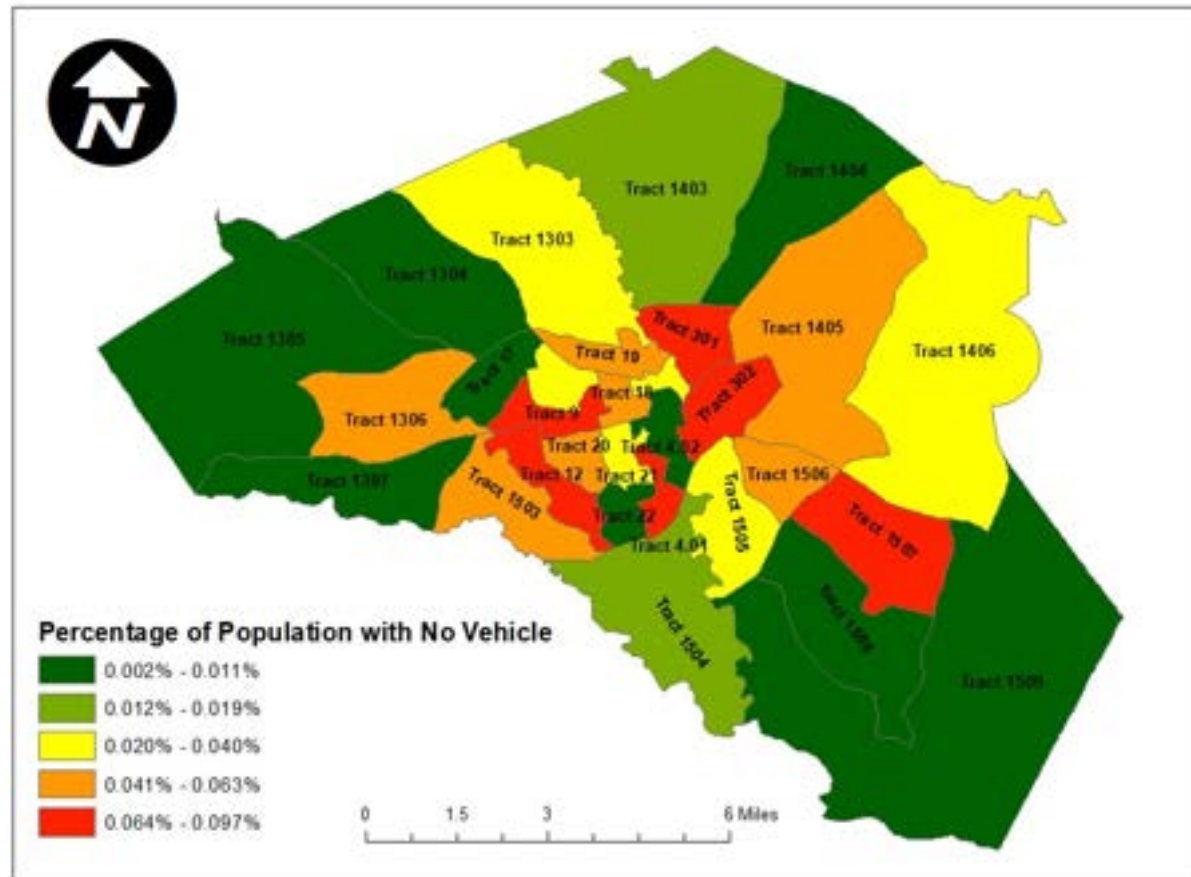


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Data Sources: U.S. Census Bureau American Community Survey 2014-18, Athens-Clarke County Data Portal

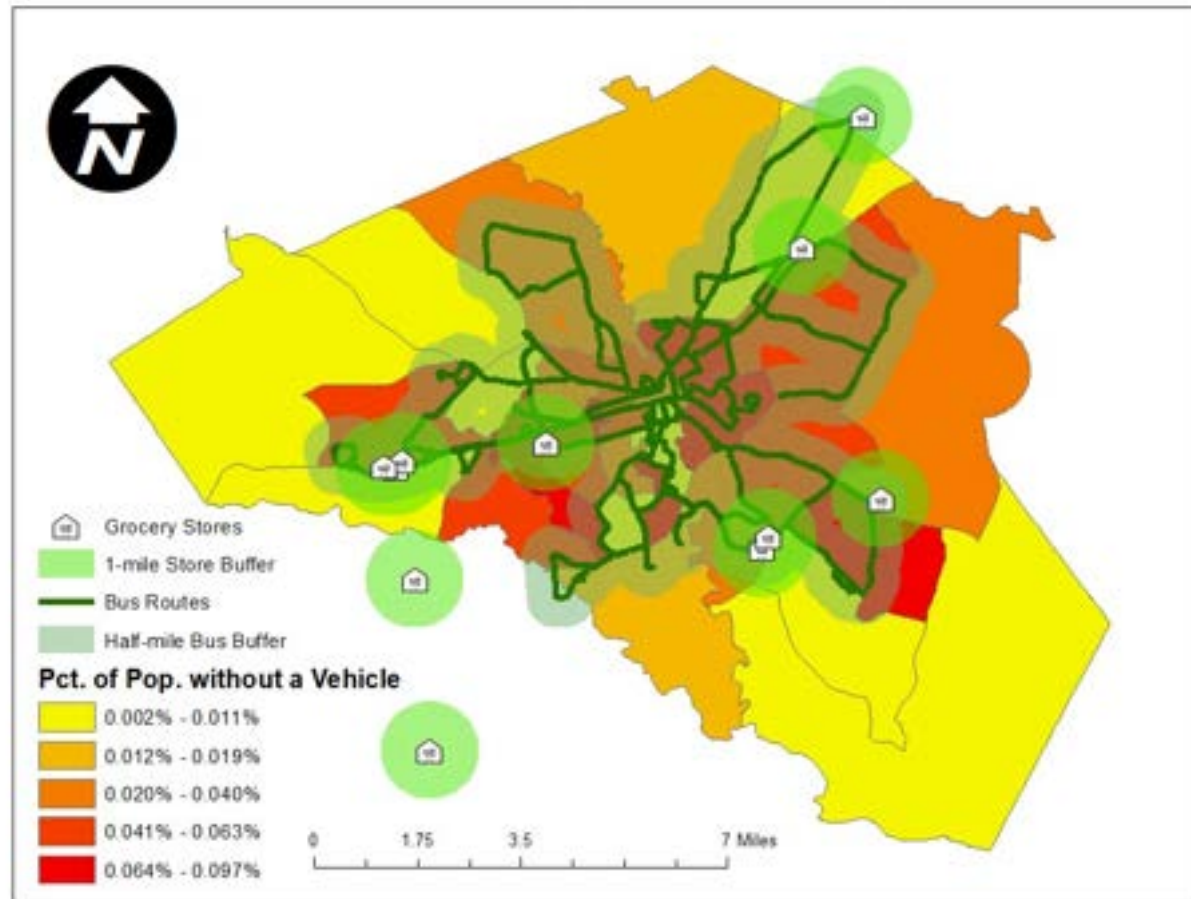
### Vehicle Availability in Athens-Clarke County, GA



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Data Source: U.S. Census Bureau American Community Survey 2014-18

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### Food Accessibility in Athens-Clarke County, GA

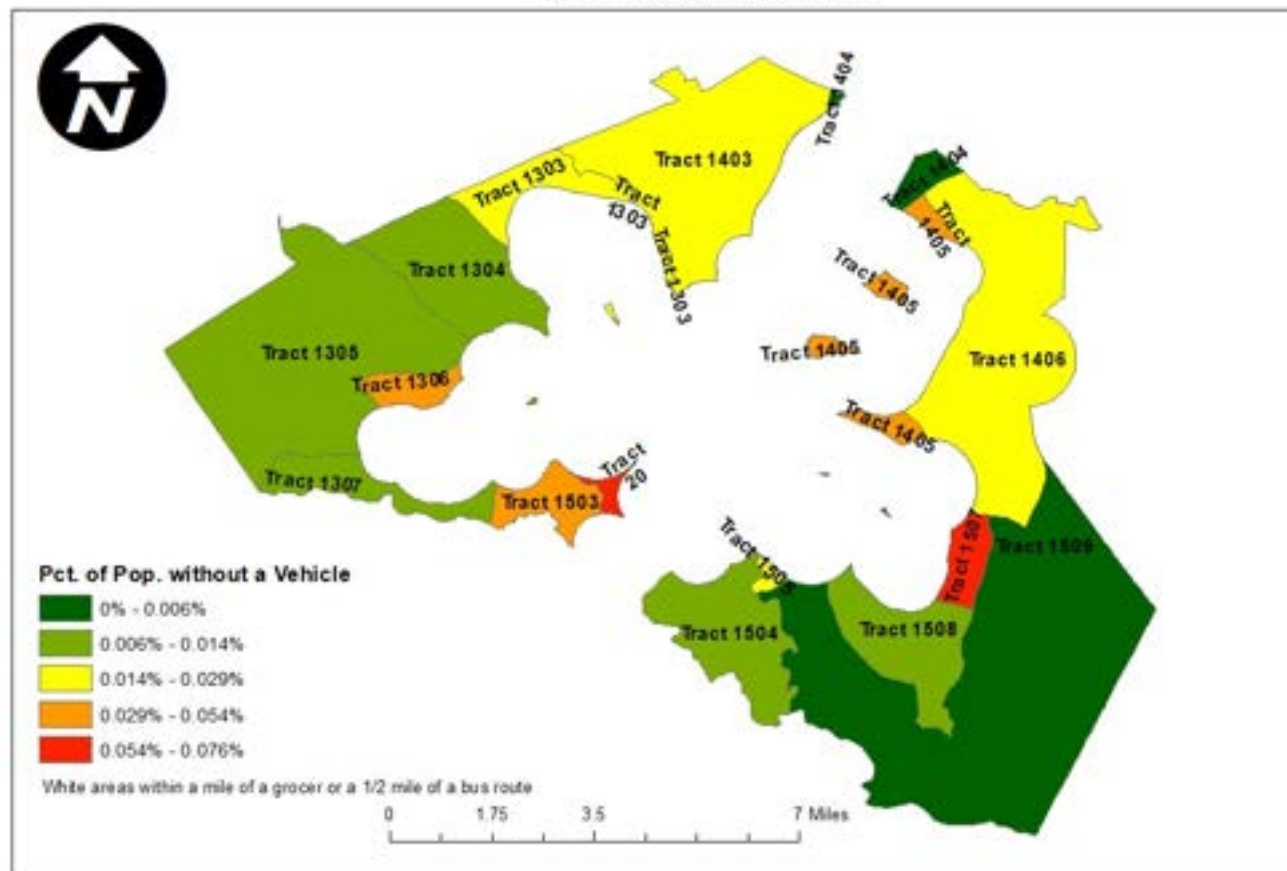


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Data Sources: U.S. Census Bureau American Community Survey 2014-18, Athens-Clarke County Data Portal, ArcGIS Online Data Set

### Areas with Low Fresh Food Accessibility in Athens-Clarke County, GA



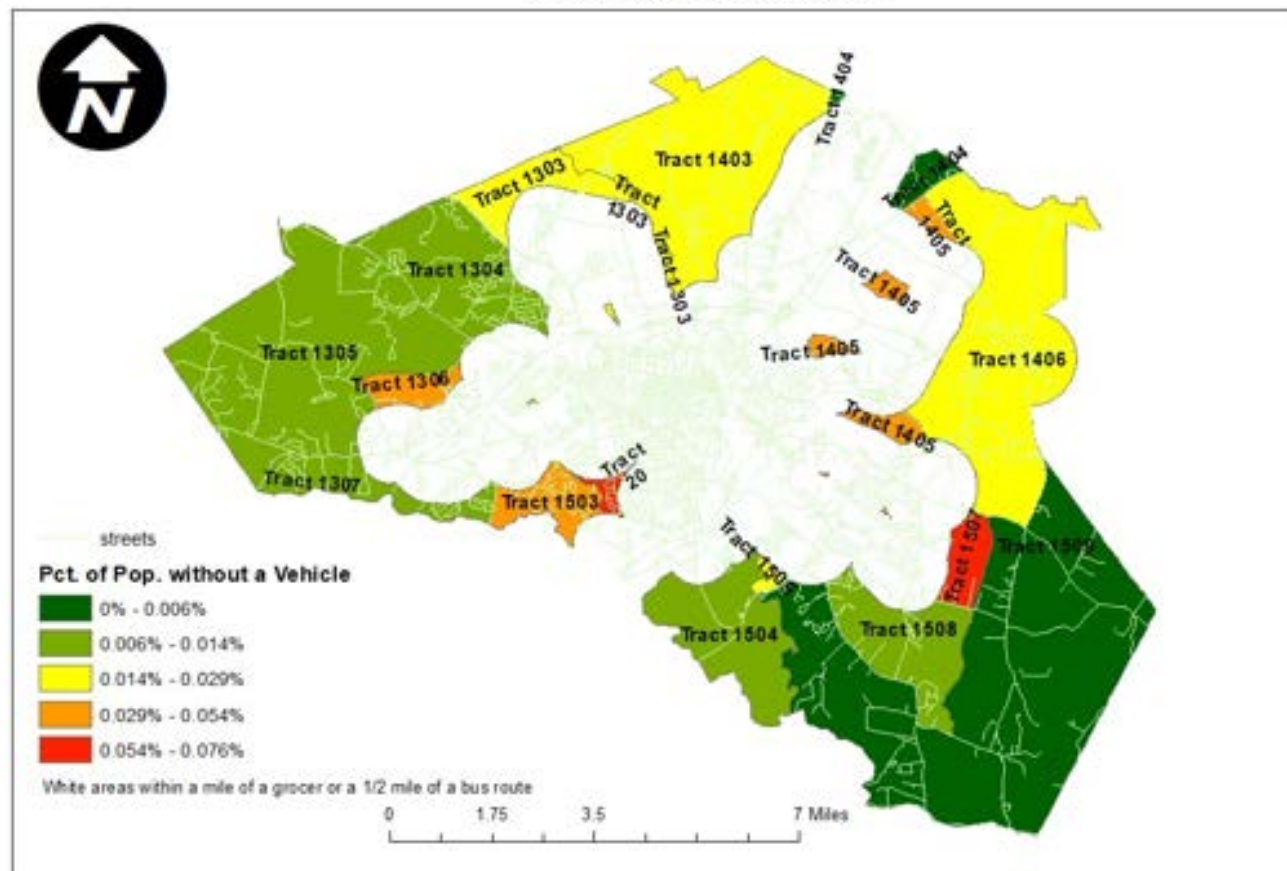
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Data Sources: U.S. Census Bureau American Community Survey 2014-18, Athens-Clarke County Data Portal, ArcGIS Online Data Set



### Areas with Low Fresh Food Accessibility in Athens-Clarke County, GA



Datum/Coordinate System: NAD 1983 State Plane Georgia East FIPS 1001

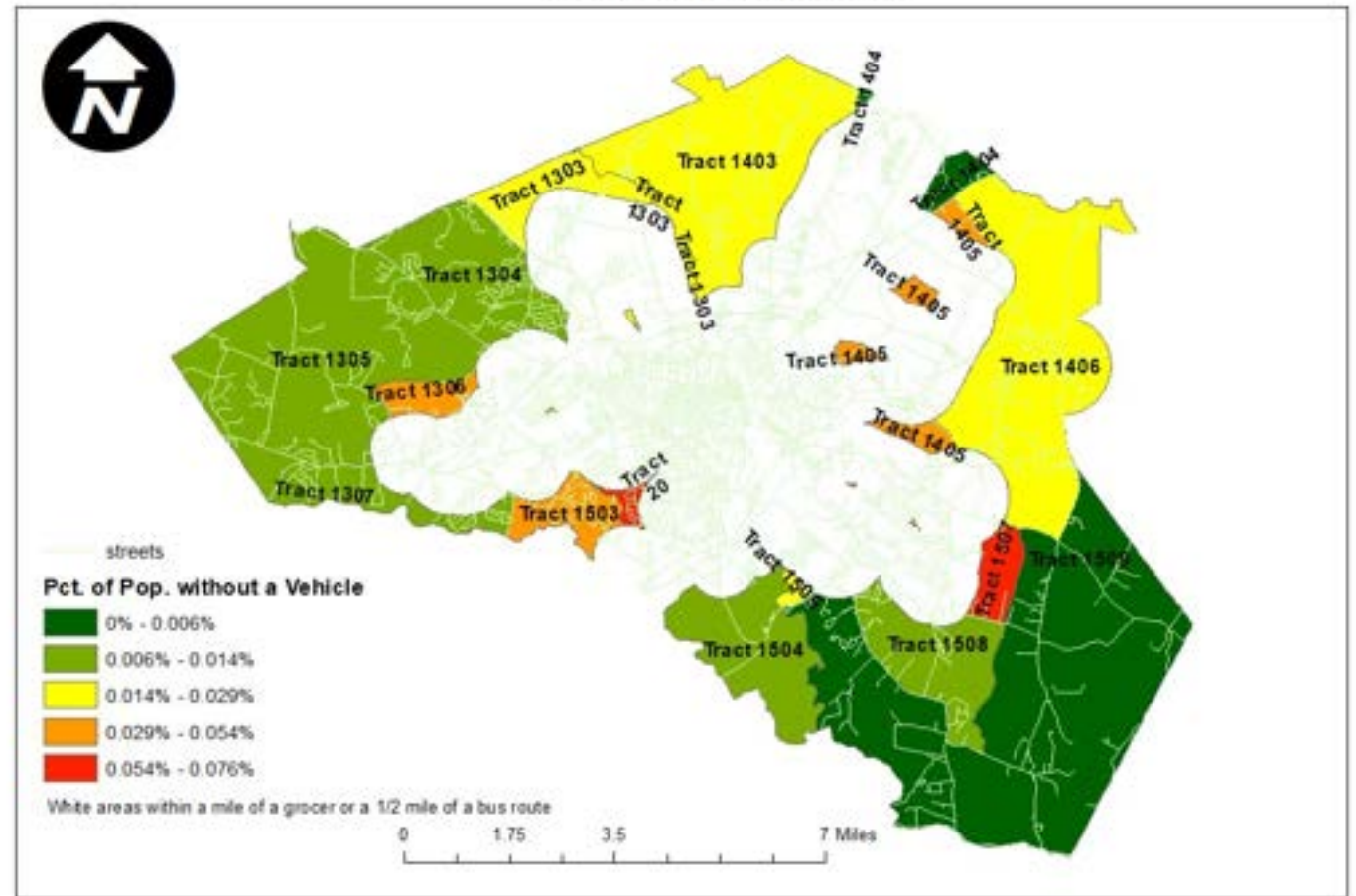
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Data Sources: U.S. Census Bureau American Community Survey 2014-18, Athens-Clarke County Data Portal, ArcGIS Online Data Set, UGA GEOG 6370e Materials

# Opportunities

- Bus Route Expansion
  - 1405
  - 1507
  - 20
  - 1503
  - 1306
- New Grocery Store
  - 1406
  - 1403/1303

Areas with Low Fresh Food Accessibility  
in Athens-Clarke County, GA



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Questions?

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