Food Availability and Poverty: Tompkins County, New York

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# Table of Contents

## INTRODUCTION

- Background and Context.................................................................2
- Purpose.........................................................................................3
- Context Map................................................................................4

## DATA

- Data Collection ............................................................................5
- Data Table.....................................................................................6

## METHODOLOGY

- Suitability Analysis.................................................................7
- Geocoding..................................................................................8
- Nearest Facilities..........................................................................9
- Rural v. Urban...............................................................................10

## ANALYSIS

- Where is the Poverty?..........................................................11
- Where are the Stores?..........................................................12
- Where is food the cheapest? And most Expensive?............15
- Where are the emergency food services?........................18

## CONCLUSION

- Challenges and Further Research Opportunities................21
- Final Observations..................................................................22

## REFERENCES..............................................................................23

## APPENDIX..................................................................................24
Introduction

Background and Context

In the summer of 2010, Cornell Cooperative Extension of Tompkins County began the process of conducting a county wide Community Food Assessment (CFA). Funded by a USDA Community Food Projects Grant, the CFA is focused on measuring and evaluating food access within Tompkins County, with particular attention paid to the many vulnerable populations that find it especially difficult to access healthy food. In terms of data and information that could be used to evaluate food security, the CFA has relied on secondary data from the USDA, U.S. Census Bureau, and various Tompkins County agencies which collect annual data. Additionally, the CFA incorporates several forms of primary data, including interviews with key informants, surveys conducted with low-income residents, and a comprehensive list of emergency food services (food pantries and soup kitchens) and food stores (convenience and grocery stores) within Tompkins County.

This Geographic Information Systems report utilizes the food store and emergency food service data collected by Cornell Cooperative Extension (CCE), in conjunction with general population characteristics, in order to evaluate whether there are areas of the County which are underserved by these two types of food access points. Unlike traditional food desert mapping studies which focus on access to transportation, distance to store and household income, this report acknowledges that many low-income households rely on emergency food services as a regular part of their food consumption patterns.\(^1\) Additionally, instead of merely using income data or population below federal poverty levels as an indicator of poverty, this report utilizes several indicators of poverty together.

The report comes at a time when food insecurity is reported to be increasing dramatically since the economic recession.\(^2\) In Tompkins County this has been exacerbated by the fact that the average cost of rent has been increasing dramatically, which has caused many low-income households to move further away from the center of Ithaca in order to find cheaper housing. The graph titled Tompkins County Livable Wages: 2000-2010 (below) demonstrates this point clearly. Over the past ten years, the average cost of rent has increased from $500 to $800, which also means that people are spending a larger portion of their income on rent. As low-income households are being forced out of Ithaca, they have

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1 Economic Research Service (2010)
2 Coleman-Jensen, et al. (2011)
become disconnected from the myriad resources that exist within the City. Additionally, there has been discussion in recent months about the Tompkins Consolidated Area Transit service being reduced to some rural areas of the County. This will compound the physical isolation felt by many households outside of walking range from the City of Ithaca, and it will create more demand for supportive resources in rural areas.

**Purpose**

There are several aspects of food security and access that I will be attempting to address in this GIS analysis and report. One objective is to identify the census block groups within the County that are most vulnerable, in terms of poverty levels, car ownership, rental housing units, unemployment rates, and free lunch eligibility for children in school. The next aim is to identify census block groups that score poorly on these poverty indicators, and to measure whether these block groups are adequately served by various types of food resources. Within the context of these aims, there are several questions that I will be attempting to answer:

1. What areas are the most vulnerable in terms of various poverty indicators?
2. Where is rural poverty the most pronounced?
3. What is the relative proximity of these areas to convenience stores, grocery stores, and emergency food services?
4. Are the services in the City of Ithaca accessible to rural residents?
5. Do the prices of items at grocery and convenience stores correspond to the areas with high levels of poverty?

These questions are answered through geospatial analysis, as well as statistical analysis. The following page shows a context map of Tompkins County, with the Towns, Villages and City of Ithaca boundaries.

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3 TCAT (2011)
Tompkins County Municipalities
Towns, Villages and City

Context Map

Created by: Rebecca Gershon
Date: 12/7/2011
Projection: NY State Plane Central
Data source: CUGIR, US Census Bureau
Data

Data Collection

In order to make this study possible, various types of data were collected from many sources (see Tompkins County Data Sources table on next page). Boundary files were easily obtained from the Cornell University Geospatial Information Repository. Although they are from different years, this did not pose any problems in terms of overlaying boundary files or joining attribute information. Boundaries for unified school districts were also collected, even though they do not follow the same boundary lines as counties or census block groups. Transportation data was collected for both roads and public transportation routes. The roads data was accessed through the GIS specialist at Cornell, because the roads data through CUGIR did not have the necessary information in order to use it for geocoding purposes. The TCAT bus route data was obtained through a former intern for the Ithaca-Tompkins County Transportation Council, because it is not available publically.

Population characteristics for Tompkins County were obtained through the U.S. Census Bureau. In an effort to use data at the smallest possible geographic scale, data from 2000 was collected. This is a significant challenge, as this data is now eleven years out of date, and it does not reflect the economic downturn which started in 2007. Population characteristics were chosen based on their predictability of poverty, which have been documented as being appropriate poverty indicators by various authors.4 Additionally, data for free lunch eligibility within the unified school districts of Tompkins County were collected from the NY State Report Cards, for the 2009-2010 academic year.

The most important and original data which is used in this study comes from Cornell Cooperative Extension of Tompkins County. Over the past two years, interns and staff have collected information about all the stores that sell food in Tompkins County. They recorded whether stores accepted SNAP or WIC, how much certain items were being sold at, and whether they sold local produce. I also collected data about all the food pantries and soup kitchens that operate within Tompkins County, including their hours of operation, how many days per month they are open, and how many hours per month they are open.

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4 Davis (2003)
## Data Table

### Tompkins County Data Sources

<table>
<thead>
<tr>
<th>Data</th>
<th>Year</th>
<th>Source</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tompkins County Boundaries</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tompkins County Municipal Boundaries</td>
<td>2010</td>
<td>Cornell University Geospatial Information Repository</td>
<td>This shapefile contains basic Tompkins County municipal boundary lines</td>
</tr>
<tr>
<td>Tompkins County Census Block Groups</td>
<td>2000</td>
<td><a href="http://cugir.mannlib.cornell.edu/index.jsp">http://cugir.mannlib.cornell.edu/index.jsp</a></td>
<td>This shapefile contains block group boundaries from 2000 TIGER, as well as some population characteristics</td>
</tr>
<tr>
<td>Tompkins County Unified School Districts</td>
<td>2001</td>
<td>SP</td>
<td>This shapefile contains TIGER line files, without significant attribute information</td>
</tr>
<tr>
<td><strong>Transportation Networks</strong></td>
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<td></td>
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</tr>
<tr>
<td>Tompkins County Roads</td>
<td>2010</td>
<td>NYSGIS Clearing House <a href="https://www.nysgis.state.ny.us/gisd">https://www.nysgis.state.ny.us/gisd</a></td>
<td>This roads shapefile allows for geocoding</td>
</tr>
<tr>
<td></td>
<td></td>
<td>data/inventories/details.cfm?dsid=932</td>
<td></td>
</tr>
<tr>
<td>TCAT Bus Routes</td>
<td>2010</td>
<td>Tompkins Consolidated Area Transit obtained from Karim Beers, former</td>
<td>This shapefile contains information about bus routes within Tompkins County</td>
</tr>
<tr>
<td></td>
<td></td>
<td>intern at Ithaca-Tompkins County Transportation Council</td>
<td></td>
</tr>
<tr>
<td><strong>Population Characteristics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income to Poverty Ratio</td>
<td>2000</td>
<td>U.S. Census Bureau <a href="http://factfinder2.census.gov/main.htm">http://factfinder2.census.gov/main.htm</a></td>
<td>The income-to-poverty ratio represents the ratio of family income to their appropriate poverty threshold</td>
</tr>
<tr>
<td>Car Ownership</td>
<td></td>
<td>American Community Survey</td>
<td>Car ownership rates for households in Tompkins County</td>
</tr>
<tr>
<td></td>
<td></td>
<td><a href="http://factfinder2.census.gov/main.htm">http://factfinder2.census.gov/main.htm</a></td>
<td></td>
</tr>
<tr>
<td>Employment Status</td>
<td></td>
<td></td>
<td>Basic counts on populations that are employed and unemployed</td>
</tr>
<tr>
<td>Renter/Owner Occupied Housing Units</td>
<td></td>
<td></td>
<td>Basic counts on renter and owner occupied housing units, but family type</td>
</tr>
<tr>
<td>Free Lunch Eligibility</td>
<td>2009-'10</td>
<td>New York State Report Cards <a href="https://reportcards.nysed.gov/">https://reportcards.nysed.gov/</a></td>
<td>Comprehensive data on educational statistics – but only free lunch eligibility included in this study</td>
</tr>
<tr>
<td><strong>Food Availability</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food Stores</td>
<td>2010</td>
<td>Cornell Cooperative Extension</td>
<td>Data contains addresses of all grocery and convenience stores selling food in Tompkins County, as well as price data for selected food products</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Data collected by staff and interns during the summer of 2010 and 2011</td>
<td></td>
</tr>
<tr>
<td>Emergency Food</td>
<td>2011</td>
<td></td>
<td>Data contains addresses of all food pantries and soup kitchens in Tompkins County, as well as hours and days of operation</td>
</tr>
</tbody>
</table>
Methodology

Suitability Analysis

The first step in this study was to conduct a suitability analysis based on the four poverty indicators (from the Census) that have already been discussed. These four were chosen because they are often correlated with food insecurity. This involved creating graduated color maps for each of the indicators, which were all normalized to the appropriate data (Appendix, Maps 1-4). Then this was converted to a raster format, in order to facilitate a reclassification of these categories from best (1) to worst (10). All four of these raster datasets were then combined in a weighted overlay, which produced a map that showed the least vulnerable census block groups (1) to the most vulnerable block groups (10).

This process was repeated, but this time including the school district data which was reclassified in a raster format. This produced a second weighted overlay map, but this map did not conform to the census block group boundaries because the school district boundaries did not follow the same boundaries as the other population characteristics (Appendix, Map 5). Although the second weighted overlay may be more informative because it includes more poverty indicators, it was not used in further analysis because census boundaries were needed for the nearest facilities analysis.
**Geocoding**

The next step was to geocode the location of grocery stores, convenience stores, food pantries and soup kitchens within Tompkins County. After creating an address locator in Arc Toolbox, the addresses were matched with relative ease based on the roads shapefile from the NYSGIS Clearinghouse.
Nearest Facilities

In order to determine which census block groups have the best and worst access to various food resources, centroids were calculated for each census block group. Then using the ‘Near Features’ tool, the nearest store and emergency food outlet was found for each of these centroids. Distance was calculated in miles, and then the various attribute information for the stores and emergency food services was joined back to the centroids. However, one piece of important information that was still missing from this attribute table for the centroids was the ranking of each census block group based on the suitability analysis. Since the suitability analysis produced a raster file, there was no way to assign the 1-10 categories to the centroid's attributes. Therefore I manually took note of all the rankings as they related to the census block groups, and joined it back to the centroids.
*Rural v. Urban*

One of the aims of this study was to determine whether there are differences in food resource availability between rural and urban areas of the county. Since the Census data and municipal boundary data did not include a classification that differentiated between urban and rural census block groups, I manually chose the rural census block groups that received a poverty indicator of 6 or greater, based on the suitability analysis. Though this is not a scientific method of isolating geographies, it highlighted some important differences between the nature of urban and rural food accessibility which will be discussed further in the analysis section. Additionally, the ‘city’ census block groups with poverty indicators of 6 or greater were extracted from within the City of Ithaca boundaries.
Analysis

Where is the poverty?

Based on the four maps depicting poverty indicators (income to poverty, car ownership, unemployment, housing occupancy), it is clear that the area with the most concentrated poverty lies within the City of Ithaca, in the Downtown area. However, there are several areas outside of Ithaca that also show signs of vulnerability. The Income to Poverty Ratio map (Appendix, Map 1) shows that the Town of Enfield, the Town of Newfield, and areas around the Village of Groton have relatively high rates of households with an income to poverty ratio below 1.5, at around 25%. The Car Ownership Rates map Appendix, (Map 2) seems to follow the same geographic patterns, with areas of Newfield and Enfield showing low car ownership rates, as well as areas around the three villages of Trumansburg, Groton, and Dryden. Although the geographic boundaries are not the same, the Tompkins County School Districts map (Appendix, Map 5) reinforces the general areas which seem to show the highest rates of vulnerabilities. The Newfield Central School District and the Dryden Central School District have 35% and 37% free lunch eligibility.

When the four indicators (excluding school districts) are weighted equally and ranked one through ten, the trends discussed above are highlighted further. The areas scoring the worst – with the highest rates of poverty indicators – are concentrated within the City of Ithaca. However there are several areas in Newfield, Enfield, Ulysses, Dryden and Groton that scored 6, 7 or 8, and these seem to be the same census block groups that were showing high rates of poverty indicators in the single variable maps.

Once the rural census block groups with a score of 6 or higher were isolated, some of
these patterns became more pronounced. The table below titled Ranking Distribution shows a breakdown of how the rankings were distributed among all of the census block groups within the County. The block groups with a score of 9 or 10 were all located within the City of Ithaca boundaries, as well as most of the block groups with a score of 8. However, the block groups with a score of 6 or 7 were all located within the rural areas outside of the City of Ithaca boundaries.

There are three Towns – Caroline, Lansing and Danby – that do not have any census block groups with rankings above 4, therefore these can be interpreted as experiencing the lowest rates of poverty or food access vulnerabilities.

Where are the stores?

As can be seen from the map at right, convenience and grocery stores appear to be scattered relatively evenly across the whole county. However, closer inspection highlights the fact that there is a cluster of stores within the central City of Ithaca region. There are also several rural areas that seem to only have one or two convenience stores in their vicinity.

In order to examine the relationship between proximity to store to census block group, centroids for each block group were found, and then a ‘near’ analysis was conducted. Some of the results from this analysis are included in the table below.

The table – Closest Stores to CBG Centroids – clearly demonstrates that there is a relationship between poverty ranking and the distance to closest store from each centroid. Generally speaking, the higher the poverty ranking, the closer they are to their closest stores. This trend is no doubt exacerbated by the fact that many of the highest ranking census block groups are located within the City of Ithaca, where many stores are centrally located.
located and short distance away from the Downtown area. The General QQ Plot below – Poverty Ranking v. Distance to Closest Store – also shows this relationship.

A further trend that can be seen from this table is that when the census block groups are separated into three groups, there is a relationship between ranking and whether or not their closest store is a grocery store or convenience store. The census block groups with the most poverty (ranks 8, 9, 10) have 88% of their centroids closest to a convenience store. On the other hand, block groups with a ranking of 1, 2, or 3 have only 65% of their centroids closest to a convenience store.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Distance (mi)</th>
<th>% CBGs Closest to Convenience Store</th>
<th>% CBGs Closest to Convenience Store</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.012</td>
<td>56%</td>
<td>65%</td>
</tr>
<tr>
<td>2</td>
<td>3.049</td>
<td>85%</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1.935</td>
<td>60%</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>3.200</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1.122</td>
<td>100%</td>
<td>69%</td>
</tr>
<tr>
<td>6</td>
<td>1.572</td>
<td>56%</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>1.134</td>
<td>80%</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>1.255</td>
<td>86%</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>0.521</td>
<td>100%</td>
<td>88%</td>
</tr>
<tr>
<td>10</td>
<td>0.501</td>
<td>80%</td>
<td></td>
</tr>
</tbody>
</table>

General QQ Plot: Poverty Ranking v. Distance to Closest Store

The same type of analysis was conducted for emergency food services in Tompkins County. In general, it was found that census block groups with a higher poverty ranking tended to be closer to the emergency food services, while block groups without significant poverty were further away. This can be seen in the General QQ plot on the next page, titled Poverty Ranking v. Distance to Emergency Food Service. Again, this trend is exacerbated by the fact that the census block groups with the most pronounced poverty is in the City of Ithaca, where many of the emergency food services are clustered.
General QQ Plot: Poverty Ranking v. Distance to Emergency Food Service

Note: Data Source #1 = Poverty Ranking
Data Source #2 = Distance to Closest Emergency Food Service

One other aspect of accessibility to food that was looked at was whether these facilities were located on or close to TCAT bus routes. As can be seen from the map at left, almost all of the stores and emergency food services are located on TCAT bus routes. The exceptions are in the north east corner of Tompkins County, on the border of Dryden and Groton where there is a convenience store and emergency food outlet located close together.

Although most outlets are located on bus routes, it is also important to consider whether the bus service is adequate for people that actually want to use them. This point will be explored in more depth within the analysis of emergency food services.
Where is food the cheapest? And most expensive?

It is not enough to look at the distance of census block groups to their closest stores. If the closest store to a high poverty area is a very expensive store, then the needs of that area will not be met, and the residents will not be able to afford the food that is closest to them. Therefore the price data from Cornell Cooperative Extension was utilized to explore this aspect of food accessibility, using the price of a gallon of milk, a loaf of white bread, and a pound of apples. These three maps show the result of mapping the prices for each item.

At a quick glance, it appears that apples are cheapest in rural areas, milk is cheapest in central Ithaca, and there is no clear relationship with bread. This relationship will be further explored in the table on the next page, titled Price of Milk, Bread and Apples.
This table shows the average prices for items in each census block group ranking. The most pronounced relationships can be seen within the prices for milk and bread when the ranking groups are combined into three categories. In both cases, the census block groups with higher levels of poverty show a higher average price for the item. The price for apples shows the same trend, however because many stores did not carry apples at the time of data collection, the sample may not be an accurate representation of how fruit is priced across the county.

### Price of Milk, Bread and Apples ($)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Milk</th>
<th>Milk (grouped)</th>
<th>Bread</th>
<th>Bread (grouped)</th>
<th>Apples</th>
<th>Apples (grouped)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.80</td>
<td>2.91</td>
<td>2.00</td>
<td>2.00</td>
<td>3.06</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2.96</td>
<td>2.06</td>
<td>2.00</td>
<td>0.99</td>
<td>2.45</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>2.99</td>
<td>1.96</td>
<td>2.00</td>
<td>2.82</td>
<td>0.99</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>3.04</td>
<td>2.29</td>
<td>2.68</td>
<td>0.99</td>
<td>3.06</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>3.39</td>
<td>2.92</td>
<td>1.94</td>
<td>0.00</td>
<td>3.99</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>2.77</td>
<td>2.68</td>
<td>1.94</td>
<td>3.74</td>
<td>2.29</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>2.97</td>
<td>2.72</td>
<td>1.94</td>
<td>3.74</td>
<td>2.29</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>3.27</td>
<td>2.72</td>
<td>1.94</td>
<td>3.74</td>
<td>2.29</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>2.49</td>
<td>2.72</td>
<td>2.78</td>
<td>3.74</td>
<td>2.29</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>3.29</td>
<td>2.72</td>
<td>2.78</td>
<td>2.29</td>
<td>2.29</td>
<td></td>
</tr>
</tbody>
</table>

This table below – *Price of Milk, Bread and Apples in CBG’s with Ranking Above 5 (Rural v. City)* – also shows trends in pricing of goods. Surprisingly, it is clear from the table that for both bread and milk, they are more expensive in the city. However, one important point to consider is that many of the City of Ithaca census block groups with poverty are located within short distances from many different stores; therefore they generally have more choice.

### Price of Milk, Bread and Apples in CBG’s with Ranking Above 5 (Rural v. City)

<table>
<thead>
<tr>
<th></th>
<th>Apples</th>
<th>Bread</th>
<th>Milk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td>4.86</td>
<td>1.79</td>
<td>2.90</td>
</tr>
<tr>
<td>City</td>
<td>2.97</td>
<td>2.94</td>
<td>3.35</td>
</tr>
</tbody>
</table>

The following page shows the QQ plots for all three of these items in relation to the ranking of the census block group. All three show varying degrees of positive relationships.
General QQ Plot: Poverty Ranking v. Price of Milk

Data Source #1 = Poverty Ranking
Data Source #2 = Price of Milk

General QQ Plot: Poverty Ranking v. Price of Bread

Data Source #1 = Poverty Ranking
Data Source #2 = Price of Bread

General QQ Plot: Poverty Ranking v. Price of Apples

Data Source #1 = Poverty Ranking
Data Source #2 = Price of Apples
Where are the emergency food services?

As can be seen from the map below, there is at least one emergency food service provider for each town in Tompkins County. There are many services within the City of Ithaca, however all of the services seem to be connected to TCAT bus routes with the exception of the Groton Food Providers in the north east corner of the map. This map also shows the number of hours per month that each facility is open. Clearly some of the largest symbols are within the City of Ithaca, while some of the facilities only have very small symbols, showing that they are open for just a few hours per month. Given that some rural residents may want to access City of Ithaca emergency food services instead, it is also important to look at the bus time schedule in relation to when the services are open in the City. This relationship is depicted on the following map.
Refering back to the map showing where the most vulnerable census block groups are located, it can be inferred that the most vital bus routes serving areas in poverty are Route 20, 67, 43 and 21. Each of these bus routes operates its last bus from the center of Ithaca at 6:00, 5:50, 5:10 and 6:15 respectively. Two of the emergency food providers that serve meals every day in Ithaca are Loaves and Fishes (5:00-6:00) and 50-Served (6:00-7:00). American Red Cross also has a food pantry that operates between 5:00-9:00 during the week. Therefore, many people living in rural areas that have to take a bus home cannot access these services, because they would not be able to catch their bus home in time after visiting the services.
As can be seen from the table below, there is a relationship between the number of hours and days the emergency food service is open, and the poverty ranking for the corresponding census block group. The block groups with a poverty ranking of 8, 9 and 10 are closest to the emergency food services that are open the most often.

There is also a distinction between rural and city census block groups with a poverty ranking of 6 or greater. In the rural census block groups, their closest emergency food services are only open for an average of 8.8 hours per month and 6.3 days per month, as opposed to 24.4 hours and 15.8 days in the City. This trend adds to the previous discussion about the lack of accessibility for rural households to the central Ithaca resources for lack of decent public transportation schedules.
Conclusion

Challenges and Future Research Opportunities

There are many challenges with conducting GIS analysis, and these challenges are compounded when trying to analyze something as difficult to define as food security. Below is a list of some of the challenges that are particular to this study.

Old Data: Much of the data that was used for this study was obtained through the U.S. Census Bureau. Unfortunately, much of the data is only available for the 2000 Census year, as most of the 2010 data has not been released. This makes the study somewhat outdated, and makes it difficult to understand the levels of poverty today. No doubt, conducting this same study with 2010 data would be very insightful.

Geographies: In order to obtain data at the smallest possible geographic scale, I obtained census block level data. Although this is smaller than census tracts, it still makes it difficult to analyze food security within smaller neighborhoods. If data were available at the census block level, it would make this study all the more accurate and useful.

Data Choice: Some data that is available through the census is not available at the block group level. For example, one poverty indicator that would have been appropriate to use within this study is the percentage of the population that receives Food Stamps or WIC benefits. However, this is only available for the county level.

Poverty: When choosing which variables to include in the weighted overlay analysis, there may have been other ways to think about indicators of poverty. Choosing different variables would have no doubt changed the weighted overlay output.

Students: There is a very large student population in the City of Ithaca, and many of these students appear to be living ‘in poverty’ on paper. This is because they are often not working, or making minimum wage, at best. Additionally, they do not have many assets. Therefore the level of student ‘poverty’ in the City of Ithaca skews the total poverty rates for long term residents.

Centroids: It was necessary to find a way to connect census block groups with their closest facilities, in order to determine which census block groups were the most underserved by food resources. Although centroids were used in this case, there are flaws to this method, as census block groups vary so much in size. For the larger block groups, the centroids held less meaning for a larger proportion of the people living within that block group.
Final Observations

Despite the challenges in mapping indicators of poverty and extracting observations about food security from Tompkins County, several important trends have been highlighted through this study. For one, there is a significant relationship between the levels of poverty (based on the four indicators) and the types and quality of resources that these areas have access to. For example, in terms of emergency food resources, rural areas are grossly underserved. While City census block groups have access to emergency food services that are open 24 hours per month on average, rural residents have nearby resources that are only in operation for a third of this time. To compound this lack of emergency food resources in rural areas, the bus schedules prohibit many residents from being able to visit the soup kitchens in Ithaca.

Depending on the poverty indicator level of the census block group, we are also able to predict whether their closest store is a convenience store or grocery store. While 88% of census block groups with a poverty indicator score of 8, 9 or 10 had convenience stores as their closest stores, only 65% of census block groups with a score between 1 and 3 had convenience stores as their closest stores. Given the mark-up in some convenience stores and the lack of healthy food options, this poses a serious problem for people living in high poverty areas. However, in terms of distance to their closest stores, high poverty census block groups tended to be closer to their stores than the more affluent census block groups.

In terms of price of goods, it was found that census block groups with high poverty rates were more likely to be close to stores with higher prices for milk and bread. This is extremely problematic because this means low-income residents would have to travel farther away to other stores if they want to find cheaper food. This trend is likely tied to the fact that many low income census block groups are closest to convenience stores, where items tend to be more expensive.

Though this study has highlighted some important trends, it is far from complete. As was mentioned through the discussion of challenges in conducting this research, many more poverty indicators could be utilized to predict where food insecurity is likely to be the highest. However, the level of rural poverty and lack of food access in some rural areas of Tompkins County should be taken seriously, especially as Ithaca rents continue to rise, and as TCAT services are cut back year by year. While it may be more convenient as a service provider to be located in downtown Ithaca, Tompkins County must continue to find innovative and effective ways in protecting rural residents from the realities of food insecurity.
References


Map 2

Car Ownership Rates
Households Without a Car

Legend
- Municipal Boundaries
- Census Block Groups

Households Without Car
- 0% - 2.83%
- 2.84% - 5.84%
- 5.85% - 8.81%
- 8.82% - 19.48%
- 19.49% - 22.81%

Created by: Rebecca Gershon
Date: 12/6/2011
Projection: NY State Plane Central
Data source: CUGIR, US Census Bureau
Map 3

Renter Occupied Housing Units
Tompkins County 2000

Legend
- Municipal Boundaries
- Census Block Groups
- Renter Occupied
  - 13.7% - 17.72%
  - 17.73% - 31.58%
  - 31.59% - 50%
  - 50.01% - 72.70%
  - 72.71% - 100%

Created by: Rebecca Gershon
Date: 12/6/2011
Projection: NY State Plane Central
Data source: CUGIR, US Census Bureau
Map 4

Unemployment Rates
Tompkins County 2000

Legend
- Municipal Boundaries
- Census Block Groups

Unemployment
- 0% - 0.81%
- 0.82% - 2.26%
- 2.27% - 3.76%
- 3.77% - 5.64%
- 5.65% - 13.49%

Created by: Rebecca Gershon
Date: 12/6/2011
Projection: NY State Plane Central
Data source: CUGIR, US Census Bureau
Map 5

Tompkins County School Districts
Free Lunch Eligibility (2009-2010)

Legend
- Municipal Boundaries
- School Districts
- Free Lunch Eligibility
  - 1%
  - 1.01% - 23%
  - 23.01% - 26%
  - 26.01% - 32%
  - 32.01% - 35%
  - 35.01% - 38%

Created by: Rebecca Gershon
Date: 11/28/2011
Projection: NY State Plane Central
Data source: CUGIR, NYSED, NYS Report Cards
Map 6

Weighted Overlay of Census Block Groups and School Districts
Poverty, Cars, Renters, Unemployment, Free Lunch

Legend:
- Census Block Group
- Block Groups:
  - 1: Best
  - 2
  - 3
  - 4
  - 5
  - 6
  - 7: Worst

This map shows the weighted values for each block group, based on unemployment, car ownership, income to poverty ratio, renters and free lunch eligibility. All five variables are weighted equally.

Created by: Rebecca Gershon
Date: 12/8/2011
Projection: NY State Plane Central
Data source: CUGIR, US Census Bureau