Analyzing Colorado Springs Food Deserts within Low Income Census Tracts

Defining a “Food Desert:”

The term food desert describes neighborhoods and communities that have limited access to affordable and nutritious foods (Paula Tarnopol Whitacore et al., 2009). Three key elements of a food desert include: fruit, vegetable prices, socio-economic deprivation, and a lack of locally available supermarkets (Tim Pearson, et al., 2005). Grocery stores are in surrounding areas, but due to high prices and lack of public transportation this can create many problems for low-income families. Food deserts can be found throughout the United States in both rural and urban areas. These food deserts are denying low-income households the ability to choose nutritious foods such as fresh fruits and vegetables.

Every city has a plethora of restaurants available in all areas, which can be very affordable to low-income households. These restaurants are not necessarily the healthiest choice, but might be their best and most affordable option. Obesity is a rapidly growing problem occurring in the United States, and child obesity is a huge concern. “Human beings are price sensitive when they buy food or any other item. The lower the cost of the item, the more likely they are to buy it and the more of it they are likely to buy (H. Dele Davies, 2008, 37).”

Purpose of the Study:

The purpose of the study was to provide information to local groups such as community gardens and food assistance programs that would allow them to best target their resources. We wanted to identify parcels within Colorado Springs that were more than 1 mile from a grocery store and see if these parcels are clustered or randomly distributed. This could then be compared to census data with income information to identify what areas of the city have a lack of adequate, nutritious food sources for their income levels. We defined a grocery store as any place that one could purchase fresh produce and fruits year round. We looked at all major grocery stores which included: King Soopers, Wal-Mart, Safeway, and Albertsons along with looking at small local grocery stores.

Data and Methods:

In order to determine the locations of food deserts in Colorado Springs, we used several data sources: 1) The City of Colorado Springs provided a shapefile of parcel data as well as street centerlines and aerial imagery. 2) The U.S. Census Bureau TIGER Line file was used for identification of census tracts. This was joined with a table of economic data. 3) Grocery store locations were extracted from internet searches and then verified by ground-truth or visual inspection of aerial imagery.

The grocery store addresses were geo-coded onto the street centerline file, providing us with the locations of all year-round producer retail outlets within Colorado Springs (Figure 1.) A one mile proximity buffer was drawn around each grocery store location to determine their service area. From this shapefile, we extracted the parcels that were zoned for residential use. Due to the temporal variability of residential housing data, we felt that it was adequate for this study to utilize parcels that were zoned as residential, even if they did not currently sit on a residential building on them. Using clipping analysis, we extracted the residential parcels whose centroids fell outside of the one-mile proximity buffer from a grocery store. This is shown in Figure 3 as a point density surface map in order to help visualize the results. Proximity to a grocery store is not the only determining factor for a food desert; income also plays a role. We created a choropleth map of Colorado Springs census tracts showing the percentage of households within the tract with an annual household income of less than $25,000 (Figure 5.) This was overlaid on top of the density surface to determine if the clustered parcels were geographically concurrent with areas of low income.

Results and Recommendations:

After overlaying the results of the point density analysis on top of the choropleth of the low-income census tracts, three areas of the city are found to be of interest. These areas both fall within a census tract that contains greater than 20% of their households with an annual income of $25,000 or less AND the parcels are greater than one mile distance from a grocery store. Figure 5 shows these areas of focus. The first area of note is immediately to the east of the downtown area of Colorado Springs. The second area is in the far southeast of the city, not far from the airport. The third and final area is of the most interest to the researchers. It is the area immediately surrounding the University of Colorado Colorado Springs.

College students are some of the most vulnerable residents of the city. Many college students live on shoe string budgets, surviving on of caffeinated soda, ramen noodles, and peanut butter and jelly. In addition, many of these students live on campus and lack transportation to reach distant grocery stores in order to afford fruits or vegetables to their diets.

As a limitation of our study, we were only able to utilize a Euclidian distance analysis to identify food deserts. As a suggestion for further study, it is recommended that these initial results be validated with a Manhattan distance model in order to calculate a more natural understanding of food desert locations. Incorporating public transportation routes would also add to this analysis.

We offer this information to the City of Colorado Springs and UCSC as support for increasing food assistance programs, community gardens, and food education to these three areas. This information could also be used to help grocery store chains to determine areas that would benefit both their business and the populace of the city by targeting for expansion. Just three additional stores with the availability of low cost, high quality produce could add food security to some of the most vulnerable areas of the City of Colorado Springs.

Works Cited:


Figure 4

The Moran’s Index evaluates whether there is a clustered pattern; the closer the index number is to +1.0, the greater the evidence that the data is patterned rather than randomly distributed. An index of 0.71286 indicates that these clusters do follow a pattern. The statistical significance of this data is expressed in the z-score. Figure 4 above shows a normal distribution curve and related z-scores. With a z-score of over 1,000, it is highly likely that the results of this analysis are statistically significant.

We would like to thank and acknowledge the City of Colorado Springs for providing us the data with which to conduct this research and in particular the Office of Innovation and Sustainability for their feedback and support throughout this process.

Created by Josh Hendrickson, Sherissa Buck, and Brandon Zimmerman

Grocery Store Locations

Figure 1

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Moran’s Index: 0.71286
Expected Index: 0.0000063
Z-score: 1191.699021
P-value: 0.0000000

Figure 5

Low Income Areas and Food Deserts Locations

Areas of Focus

Statistical Analysis

Figure 4

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