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Authors

Fulfrost, Brian
Howard, Phil

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Mapping the Markets: The Relative Density of Retail Food Stores in Densely Populated Census Blocks in the Central Coast Region of California

Report to the Second Harvest Food Bank of Santa Cruz and San Benito Counties and the
Agriculture and Land-Based Training Association

Report prepared by

Brian Fulfrost
Environmental Studies Department

and

Phil Howard
Center for Agroecology and Sustainable Food Systems

University of California, Santa Cruz
1156 High ST
Santa Cruz, CA 95064

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Executive Summary

Research in the United Kingdom and more recently in the United States has found geographic differences in access to affordable, nutritious food. In some cases more limited access has been associated with a higher proportion of residents in ethnic minority groups. Using Geographic Information Systems (GIS), we explored the potential existence of “food deserts” and their relationship with ethnicity in Santa Cruz, Monterey and San Benito Counties. Relative to the region as a whole, there were few clusters of census blocks with less access to retail food outlets with fresh produce (grocery stores, supermarkets and fruiterias) after adjusting for population density. In addition, access to these retail food outlets was not associated with the percentage of the population that was Latino. However, we identified some areas that would benefit from further investigation, and that may be suitable locations for locating new fruit and vegetable markets. Such markets may benefit local residents, as well as new, limited-resource, and minority farmers who often have inadequate access to distribution networks for their produce.

Introduction

The vast majority of people in industrial nations acquire food from retail sources, not by growing it themselves. For example, just 11 pounds of fruits and vegetables per person were home-grown in 1998, and more than 97% of fruit and vegetable production in the

United States is for commercial sale.¹ However, some populations have more limited access to retail food sources than others. In the last decade, researchers have expressed increasing interest in the geographic distribution of food retailers in densely populated areas. Studies conducted in the United Kingdom and the United States have suggested that both the quantity of retail outlets and the quality of food available from retailers varies from place to place. In the United States these differences are typically associated with demographic characteristics of regions, such as fewer retail food outlets in areas with a high proportion of residents belonging to minority ethnic groups, at lower income levels.

Are there areas in the Central Coast of California with more limited access to affordable, nutritious food? Answering this question is important for several reasons. One is that identifying such areas could help target interventions to improve access to these foods. Lack of access to nutritious foods, such as fresh fruits and vegetables, is hypothesized to be a contributor to overweight, obesity and related health conditions such as diabetes.² Overweight and obesity rates are increasing among children, and nearly one-third of seventh graders in the Central Coast region fall into these categories. Approximately 54% of adults surveyed in the Central Coast reported they were overweight or obese, with the number rising to 64% for Latino respondents.³

Another reason to identify areas that lack affordable, nutritious food is that these locations may be suitable for creating new markets for local fruit and vegetable growers. For example, the Agriculture and Land-Based Training Association (ALBA) teaches Spanish language courses in organic farming. One major challenge for graduates of this program is finding outlets to sell their produce. Selling produce in areas with few retail markets could benefit not only the residents of these areas, but new and limited-resource farmers as well.⁴

Study objectives.

The objectives of this study were to:

- 1) Investigate the relationship between retail density and population density
- 2) Explore the role of ethnicity as it relates to retail density per population density
- 3) Using the results from #1 and #2 above, identify potential promising locations for new fruit and vegetable markets

Background

“Food deserts” and research in the United Kingdom. Researchers in Scotland used the

¹ Putnam, J. 2000. Major Trends in U.S. Food Supply, 1909 – 99. Food Review, Volume 23, Issue 1, US Department of Agriculture.

² He, K. *et al.* 2004. Changes in fruit and vegetables in relation to risk of obesity and weight gain among middle-aged women. *International Journal of Obesity and Related Metabolic Disorders* 28: 1569-74.

³ Diringer, J. & Gilman, A. 2006. *Paradox in Paradise: Hidden Health Inequities on California’s Central Coast.* Diringer & Associates: San Luis Obispo, CA.

⁴ Boyer, J., *et al.* 2006. *The Face of Food on the Central Coast: A Community Food Assessment.* Agricultural & Land-Based Training Association: Salinas, CA.

term “food desert” (suggested by a resident of a public housing project) to describe areas without access to affordable, healthy food, and it usually refers to densely populated, or urban, areas.⁵ Investigations of areas that potentially lack access to affordable, nutritious food has rapidly expanded in the United Kingdom since this term was coined in early 1990s. Early studies suggested that poorer areas were likely to have more limited access to food, and paid higher prices for food that was available when compared to more affluent areas. Since the late 1990s, however, many studies in the UK have failed to find socioeconomic differences in access to food.⁶ The existence of “food deserts” (a term which may be defined differently, depending upon the analyst) remains a matter of debate in this region.⁷ However, one study found that the opening of a new supermarket in a low-income section of Leeds, England resulted in slightly increased fruit and vegetable consumption among those living nearby.⁸

Research in the United States. Fewer studies of food access have been conducted in the United States, but most have found ethnic and socioeconomic differences in the geographic distribution of affordable, nutritious food.⁹ Since the latter half of the 20th Century, public health research has focused primarily on individual-level contributors to disease. More recently, the field has recognized the importance of social context and environmental factors as determinants of health.¹⁰ As a result, there is increasing interest in exploring differences in “local food environments” as a potential pathway of explaining ethnic and socioeconomic disparities in obesity, diabetes, heart disease and other public health issues.¹¹ In other words, there has been a shift from a tendency to simply blame individuals for their health problems, to a more serious consideration of the ways that disease is shaped by forces beyond individual control, including the availability, affordability and quality of food in neighborhoods.

Kimberly Morland and her colleagues have reported that in study sites Mississippi, North Carolina, Maryland and Minnesota, there were 4 times more supermarkets in predominantly white census tracts when compared with predominantly African-American census tracts.¹² In addition, they found that the presence of supermarkets in census tracts was associated with increased fruit and vegetable intake for white survey respondents,

⁵ Cummins, S. & Macintyre, S. 2002. “Food deserts” – evidence and assumption in health policy making. *British Medical Journal* 325: 436-8.

⁶ Cummins, S. & Macintyre, S. 2006. Food environments and obesity – neighbourhood or nation? *International Journal of Epidemiology* 35: 100-4.

⁷ Wrigley, N. 2002. ‘Food deserts’ in British cities: policy context and research priorities. *Urban Studies* 39: 2029-40.

⁸ Wrigley N, Warm D, Margetts B. 2003. Deprivation, diet and food retail access: findings from the Leeds ‘Food Deserts’ study. *Environment and Planning A* 35: 151–88

⁹ Cummins, S. & Macintyre, S. 2006. Food environments and obesity – neighbourhood or nation? *International Journal of Epidemiology* 35: 100-4.

¹⁰ Kawachi, I. 2000. Social cohesion and health. In Tarlov, A. & Peter, R.S. (eds.) *The Society and Population Health Reader. Volume II: A State and Community Perspective*. New York: New Press.

¹¹ Moore, L.V. & Diez Roux, A.V. 2006. Associations of neighborhood characteristics with the location and type of food stores. *American Journal of Public Health* 96: 325-331.

¹² Morland, K., Wing, S., Diez Roux, A. & Poole, C. 2002. Neighborhood characteristics associated with the location of food stores and food service places. *American Journal of Preventive Medicine* 22: 23-29.

and even more strongly for African-American survey respondents.¹³ The presence of supermarkets in a census tract was also linked to a lower prevalence of obesity and overweight for individuals in the study, while the presence of convenience stores was slightly associated with a higher prevalence of obesity and overweight.¹⁴ A later study conducted in North Carolina, Maryland and New York found that predominantly African-American census tracts had half as many supermarkets and less than one-third as many natural food stores as predominantly white census tracts. African-American census tracts also had 2.7 times as many grocery stores, and 20% more convenience stores when compared with white census tracts. Similar differences were found when comparing low-income to high-income tracts in the study areas.¹⁵

This same pattern was also reported in Detroit and Los Angeles. In Detroit predominantly African-American and low-income census tracts were found to be located further from supermarkets than census tracts with lower proportions of African-American and low-income residents.¹⁶ The research conducted in three zip codes in Los Angeles utilized a community-based participatory methodology and involved local residents in the design and collection of store inventory data. In the predominantly African-American zip codes there were more convenience stores and local markets than the wealthier zip code, which had fewer African-American residents. The wealthier zip code also had a higher proportion of supermarkets, and greater availability of fruits, vegetables, non-fat milk and low-fat snacks.¹⁷

While most research has focused on urban areas, one study used Geographic Information Systems (GIS) to analyze the locations of large supermarkets, supercenters and wholesale clubs in rural counties the Southeastern US. These retail outlets were chosen based on several studies suggesting that supermarket food tends to be higher in quality and lower in price when compared to smaller grocery stores. The authors suggest that counties with more than 50% of the population residing more than 10 miles from a large food retailer could be considered ‘food deserts’ and that these counties are clustered in areas with high poverty rates.¹⁸ Large supermarkets and warehouse clubs may not always be superior to other types of retail food outlets, at least in some contexts. For example, a Consumers Union study in California found that the price of milk was generally higher at supermarket chains than at smaller grocery stores.¹⁹

¹³ Morland, K., Wing, S. & Diez Roux, A. 2002. The contextual effect of the local food environment on residents’ diets: the atherosclerosis risk in communities study. *American Journal of Public Health* 92: 1761-8.

¹⁴ Morland, K., Diez Roux, A.V. & Wing, S. 2006. Supermarkets, other food stores, and obesity: the atherosclerosis risk in communities study. *American Journal of Preventive Medicine* 30: 333-9.

¹⁵ Moore, L.V. & Diez Roux, A.V. 2006. Associations of neighborhood characteristics with the location and type of food stores. *American Journal of Public Health* 96: 325-331.

¹⁶ Zenk, S.N. et al. 2005. Neighborhood racial composition, neighborhood poverty, and the spatial accessibility of supermarkets in metropolitan Detroit. *American Journal of Public Health* 95: 660-7.

¹⁷ Sloane, D.C. et al. 2003. Improving the nutritional resource environment for healthy living through community-based participatory research. *The Journal of General Internal Medicine* 18: 568-75.

¹⁸ Blanchard, T. & Lyson, T. 2006. *Food availability and food deserts in the nonmetropolitan South*. Southern Rural Development Center. Mississippi State, MS.

¹⁹ Odabashian, E. 1999. *White Liquid Gold*. Consumers Union, West Coast Regional Office: San Francisco,

Research in California. In addition to the study in Los Angeles noted above, there have been several reports that have included mapping food access in California. A statewide study conducted by the organization Ecotrust examined the road distance of populations in census block groups to the nearest full-service grocery store (selling meat, dairy and fresh produce), using a raster GIS. They found that 22.5% of the population lives more than one mile from these grocery stores. Access was limited in both rural and urban areas, with 18% of urban residents living at least one mile, and 59% of rural residents living more than 3 miles from a full-service grocery store.²⁰ As part of a community food assessment in Oakland, CA, maps were created with points for grocery stores larger than 10,000 square feet. The authors observed that some neighborhoods, such as West Oakland, Central East Oakland and Far East Oakland were less likely to have access to these stores.²¹

Methodology

Data

Two datasets were utilized for the analysis detailed in this report: (1) 2000 US Census Bureau block demographics, and (2) the locations of retail stores and farmers' markets selling food and fresh produce. Population and ethnic group data was acquired from the US Census Bureau²². Data from the 2000 Census was utilized at the finest spatial scale available, census blocks. Scale plays a crucial role in characterizing local food environments, and most studies in the United States have been conducted at the census tract level, or even coarser scales such as zip codes or counties. Although income statistics were of interest, they were only available at the group block level (a coarser scale), and therefore were excluded from the present analysis. Retail store and farmers' market data was acquired from the California Nutrition Network²³ in March, 2005, and was based on Dunn & Bradstreet business registries.

Maps were created using ArcInfo 9.1 Geographic Information Systems to help identify areas with the highest likelihood of having (a) high population density and (b) low retail density. These areas are labeled here as "food deserts," that is, they are areas where there is a relative paucity of retail food outlets in relation to the number of people that live there. GIS was also used to extract data from various map layers for statistical analysis, such as correlations and scatterplots. The use of GIS allowed spatially explicit mapping of "local food environments" and holds great promise for other types of community food assessment as well.

Since the focus of this report was on areas of relatively high population density, we first

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²⁰ Hatfield, D. & Gunnell, A. *Food Access in California Today*. Ecotrust: Portland, OR.

²¹ Unger, S. & Wooten, H. 2006. *Oakland Food System Assessment: Toward a Sustainable Food Plan*. Mayor's Office of Sustainability: Oakland, CA. <http://oaklandfoodsystem.pbwiki.com/>

²² US Census Bureau. 2000. Census Block Demographics, Summary File 1 (SF1).

²³ Any analyses, interpretations, or conclusions reached are those of the authors and not the California Department of Health Services or California Nutrition Network.

selected those blocks that met these criteria. A number of measure of “high population density” were considered, including US Census “urbanized areas” as well as the US Census definition of “urban.”²⁴ The former tended to restrict areas to be included in the study, because of its reliance on areas with relative high population (50,000 people or more), which became a problem in the predominantly agricultural communities of Santa Cruz, San Benito and Monterey counties. The latter measure tended to also be somewhat too restrictive (areas with 1,000 or more people per square mile) for the same reason. In addition, experiential review of the areas under study demonstrated exclusion of potentially important locations using these two measures. An alternative measure, blocks with a population density of 500 or more people per square mile, was chosen because of its inclusive nature and relative spatial similarity with the two other accepted measures discussed above.

The locations of retail stores were acquired from California Nutrition Network as a point shape file. The data were filtered by excluding delicatessens and convenience stores, where fresh produce is rarely sold. These datasets include primarily supermarkets and grocery stores. Interestingly, this datasets also include localized neighborhood produce resources like fruiterias, which are more frequently found in Latino communities. In areas with lower percentages of Latino residents it is likely that these alternative forms of retail produce are not common. Once filtered, a kernel density grid of retail stores selling fresh produce per square mile was created using ArcView 9.1 Spatial Analyst extension.

Because retail density is associated with population density (Pearson's correlation = .376, $p < .001$), retail density was divided by the population density in each block. This variable was then binned into 10 quantiles across the 3 county study area. The primary “food desert” maps produced for this study, utilized this variable (food density/population density) and these 10 quantiles. The proportion of the population that was Latino was created by dividing the number of Latino residents by the total population in each Census block. This variable was also classified into even intervals for display on the maps.

The maps display the location of farmers' markets, although this data was not included in the analysis. Farmers' markets have much more limited hours than other retail outlets, typically just a few hours a week. However, they are an important source of fresh produce, and noting their location in relation to potential food deserts may aid in identifying sites for new markets.

Results

Associations between ethnicity and retail density, controlling for population density

Associations between retail density and the ethnic composition of census blocks for the three counties were examined, focusing on Latinos, the largest minority ethnic group. Other minority ethnic groups, such as Asian-Americans and African-Americans do not make up a large enough proportion of the population in this region to obtain statistically significant results. Both scatterplots and Pearson's correlations indicated no association

²⁴ US Census Bureau. 2002. *Census 2000 Urban and Rural Classification*. http://www.census.gov/geo/www/ua/ua_2k.html

between retail density (adjusted for population density) and percent Latino. In other words, the number of retail food markets, controlling for population density, does not increase or decrease as the proportion of Latino residents increases in census blocks. This finding contrasts with previous studies that have found ethnic differences in food access. However, previous studies have focused on areas where African-Americans are the largest ethnic minority, rather than the Latino populations found in the Central Coast. In addition, previous studies have found the largest ethnic differences with respect to access to supermarkets and warehouse clubs, and this analysis did not examine these outlets separately from smaller grocery stores. If the hypothesis that supermarkets and warehouse clubs provide higher quality food at lower prices than smaller grocery stores receives further support, it may be worthwhile to examine ethnic differences by type of retail outlet in this region.

Low retail density areas and potential market sites

If we define food deserts simply as we have above, then we have identified some clusters of census blocks that could be labeled as “food deserts” in the study area, however they seem uncommon and by no means has our study indicated that Santa Cruz, Monterey and San Benito counties contain a significant proportion of “food deserts”. However, some “hot spots” did appear visually once we plotted the datasets in the GIS. It is important to remember, that only census blocks with population densities of 500 people per square mile or more were included in the maps. The size of blocks may be misleading as to their importance visually, i.e. given the roughly equivalent population in blocks, blocks that are smaller in size are more heavily populated than larger blocks. It is also important to note that the food deserts described below are relative to the study area and are not being measured in relation to some absolute standard. The maps produced from this process are described below.

Santa Cruz County

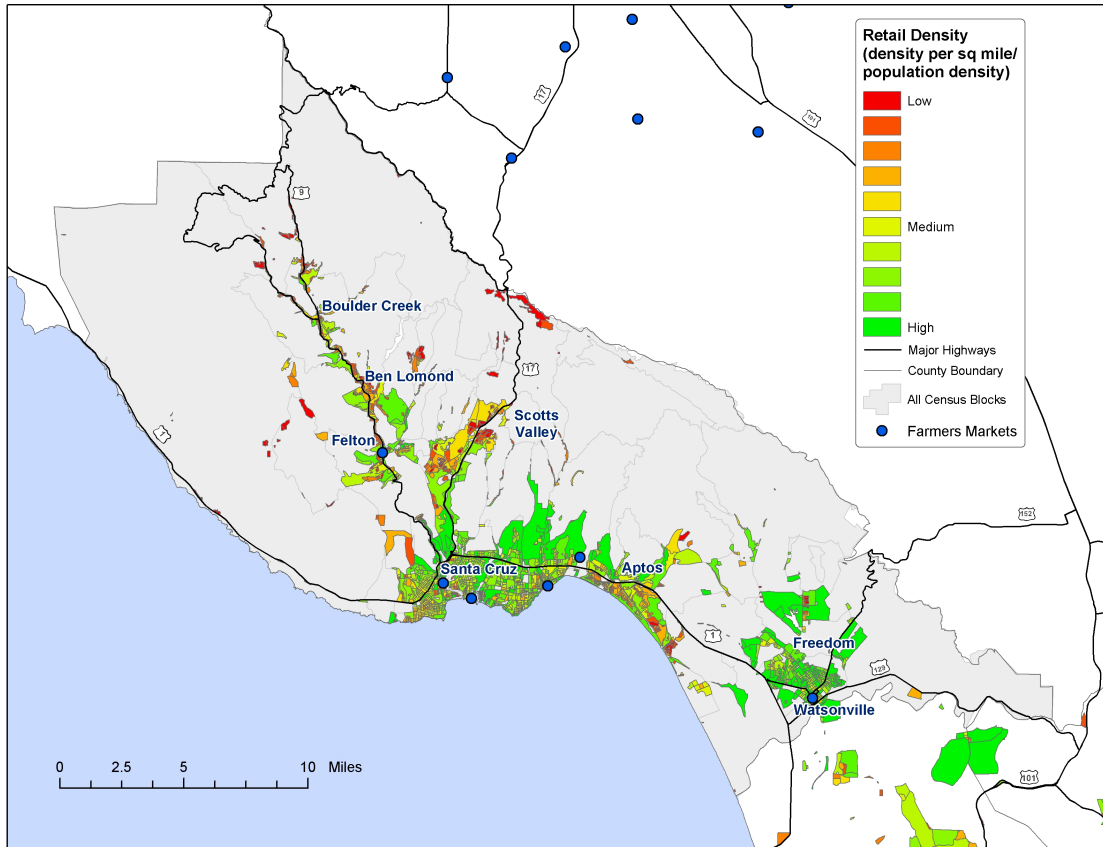
After thorough visual inspection of our results (see map 1), four areas in Santa Cruz county were identified as having potential “food deserts” in the following locations:

- (1) Ben Lomond and Bonny Doon areas off of Highway 9;
- (2) the Scotts Valley area off of highway 17;
- (3) the Aptos/La Selva area off of Highway 1;
- (4) UC Santa Cruz.

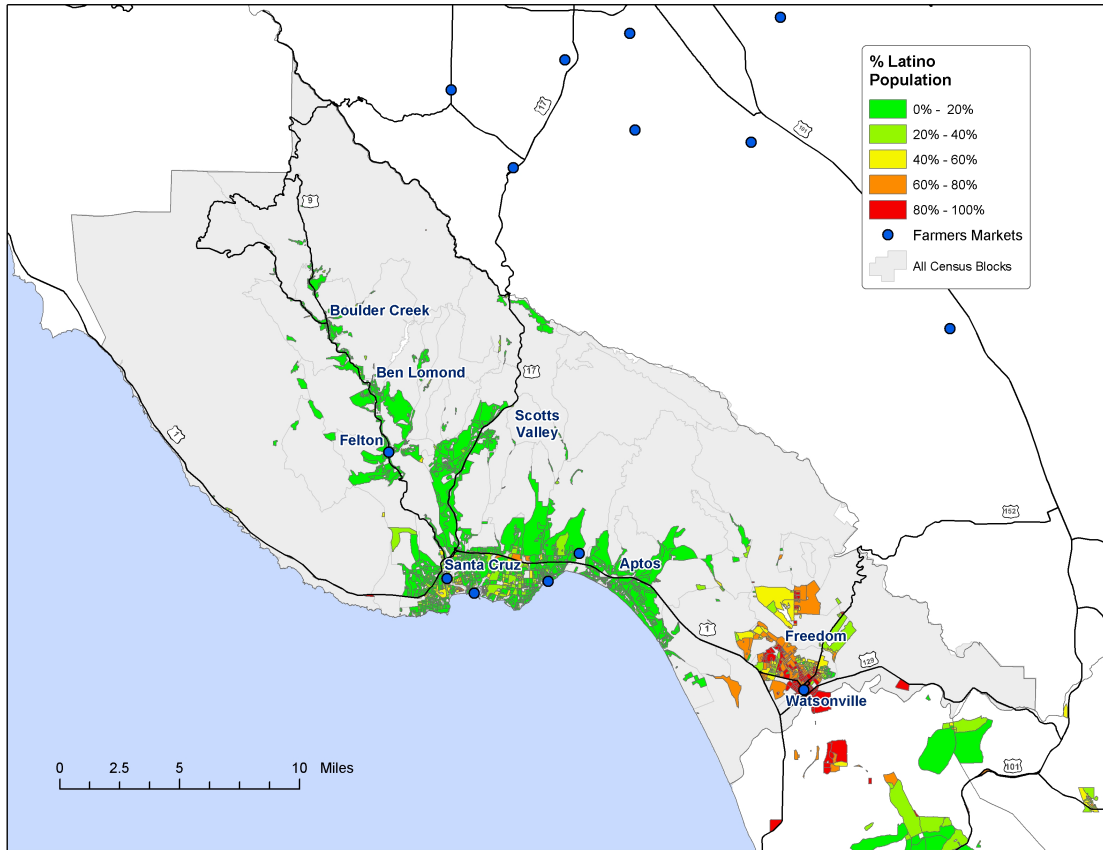
Although these areas contain relatively low Latino population densities (0%-20% Latino), the **Scott’s Valley and Ben Lomond/Bonny Doon** areas in particular, contain significant clusters of census blocks with low retail densities (bottom 4-5 quantiles). It is likely that as the population densities of the Highway 17 and Highway 9 corridors increases (potentially due to cost of living in the Santa Cruz metro area), the need for retail food access will also grow in these areas. In addition, as the student population of UCSC increases, the relative lack of access to fresh food on campus might also increase.

However, among the more densely populated areas of Santa Cruz county, the Latino population makes up a higher percentage of the population only in the Watsonville area (see map 2). However, as seen in the “food desert” map for Santa Cruz county (see map 1), the Watsonville area has a very high density of retail stores, and an almost complete lack of census block containing “food deserts”. There is just one area that appears “red” above the town of Freedom that has both a high density of Latinos and a very low retail density.

Map 1. ‘Food deserts’ in Santa Cruz County



Map 2. Percentage of the population that is Latino in Santa Cruz County



Monterey County

After thorough visual inspection of our results (see map 3), three areas in Monterey county were identified as having potential “food deserts” in the following locations:

- (1) Highway 128 corridor between Salinas and Seaside;
- (2) parts of Marina (including former Fort Ord) and Seaside
- (3) Highway 101 corridor through the Salinas Valley;

The area bounded by - highways 128, highway 1 and highway 183 – contain a significant clustering of census blocks with relatively low retail densities (in bottom 5 quantiles). This includes Marina, Seaside and the 128 corridor (see map 3 – inset).

The **128 corridor** is an area of increasing urban growth from the surrounding Monterey and Salinas area. A significant cluster of census blocks with low retail densities is found adjacent to the highway, including census blocks in the bottom 3 quantiles (bottom 30%). In addition, various small clusters of census blocks within a couple of miles off the highway, including a number of census clusters in the lowest quantile (bottom 10%). However, this area also contains a relatively low percentage of Latino population density

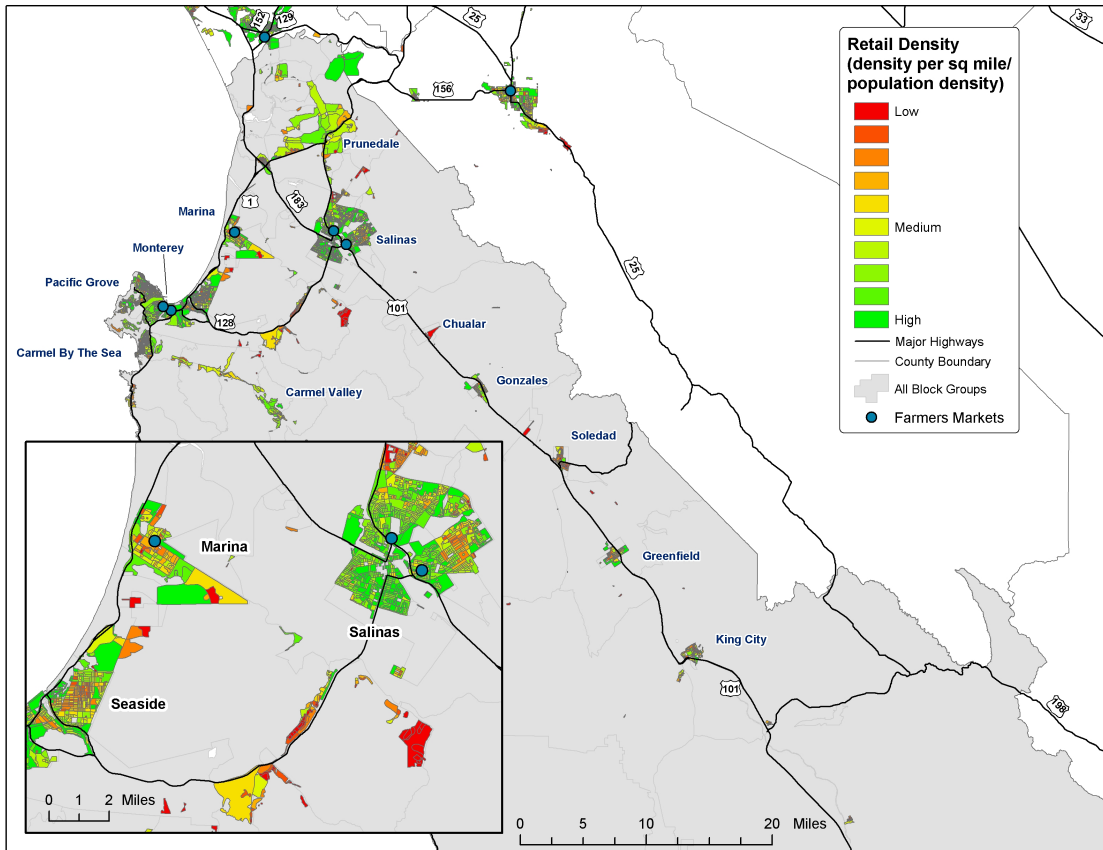
(0%-20%, see map 4).

The **Marina** area also contains relatively low Latino population densities (0%-20% Latino). However, it also contains a significant grouping of census blocks with low retail densities, including areas of California State University Monterey Bay (CSUMB) and the former Fort Ord area.

Just south of Marina, in **Seaside**, there is a cluster of census blocks with relatively low retail densities (again bottom 40-50%). Most interestingly, this is one of the only clusters of census blocks with low retail densities in Monterey county that has also a relatively high Latino population density (averages from 50%-90% Latino). These census blocks are surrounded by census blocks with significantly lower Latino population densities. The closest farmers' markets are in Monterey, and therefore this area might hold some potential for marketing produce for ALBA farmers.

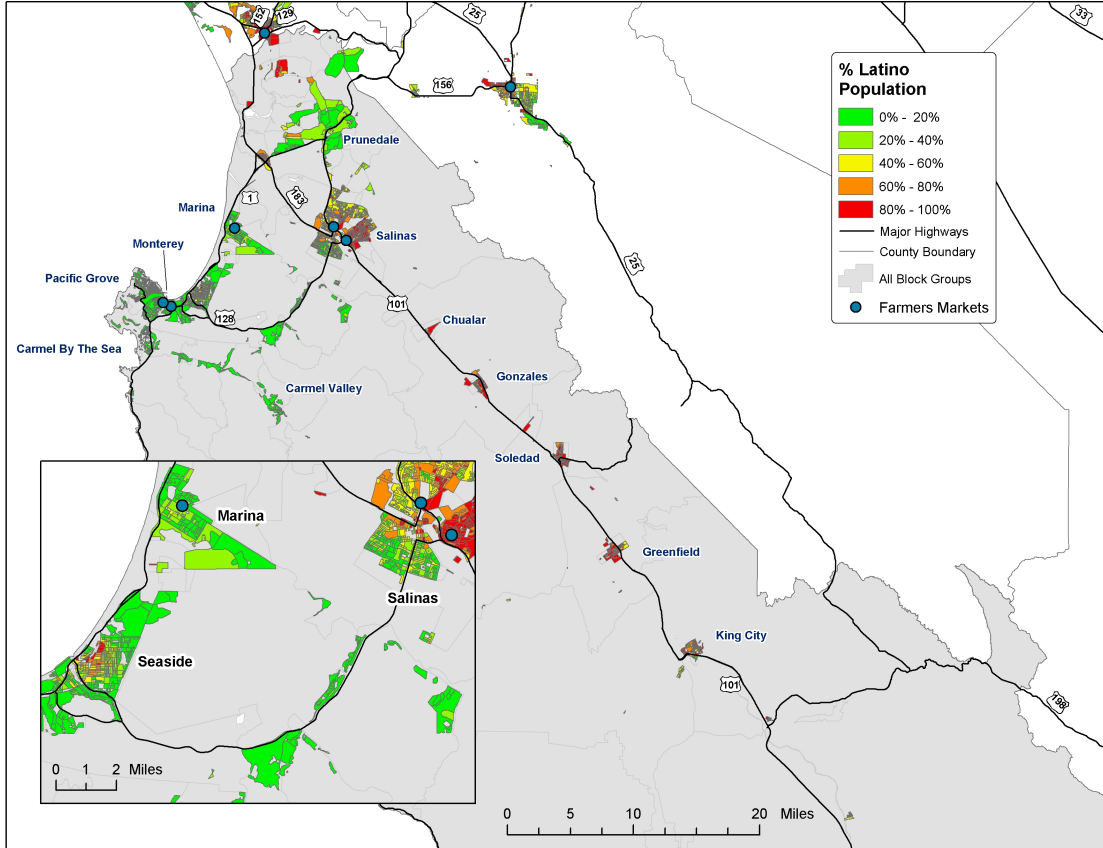
Another area of interest is the **Highway 101 corridor** that runs through the Salinas valley. There are various census blocks in Chualar, Gonzales, Soledad and King City, that have low retail densities, including quite a few in the lowest quantile (bottom 10%).

Map 3. 'Food deserts' in Monterey County



These census blocks contain predominantly Latino populations (80 – 100%), making them of potential interest to ALBA farmers for marketing their produce.

Map 4. Percentage of the population that is Latino in Monterey County

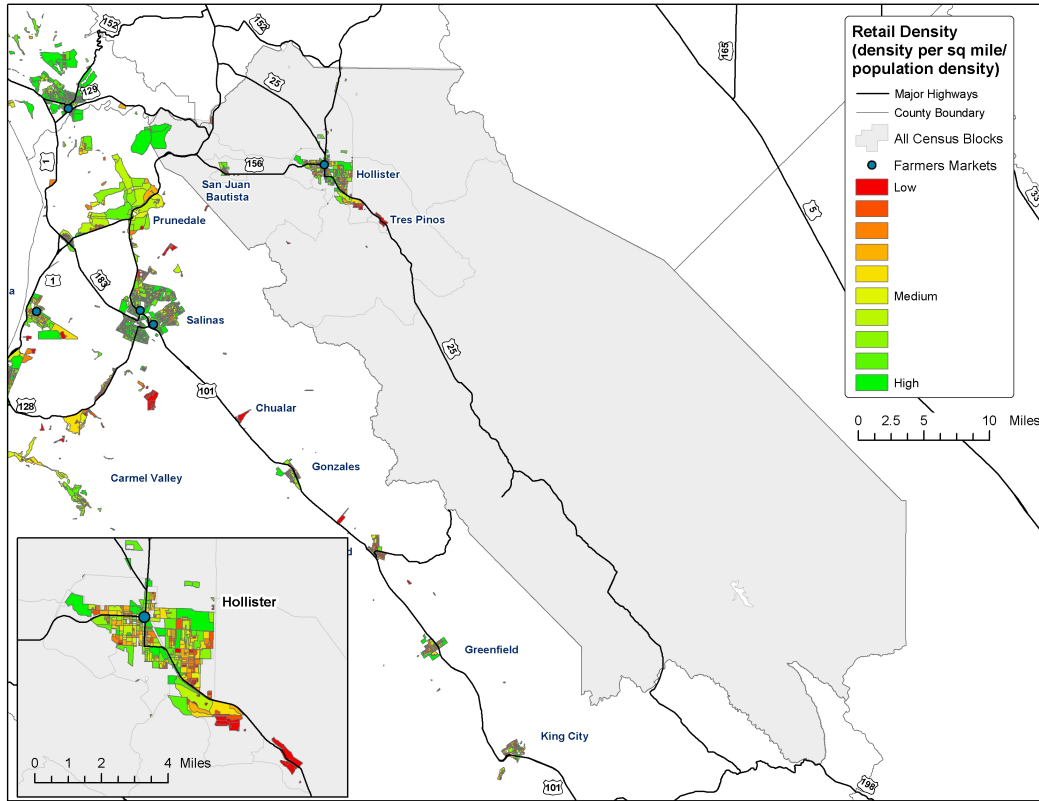


San Benito County

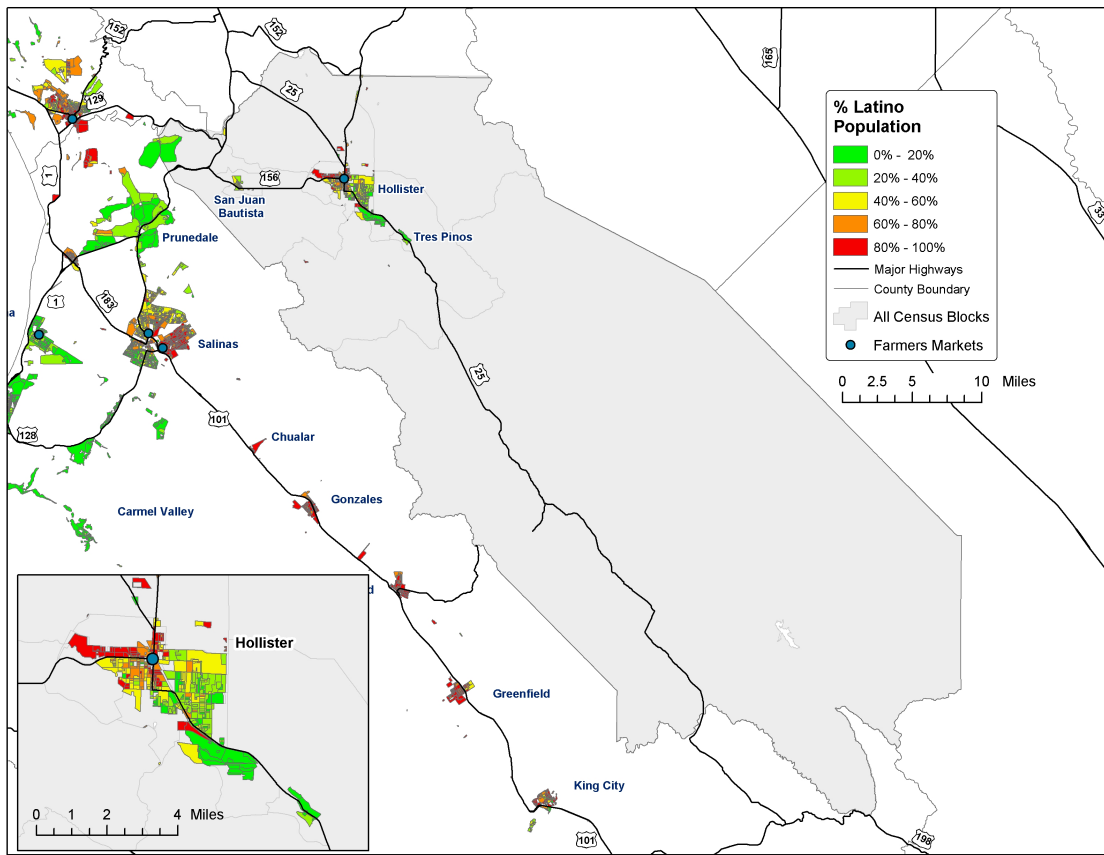
San Benito County is a dominantly rural county. Consequently, there is only one large cluster of densely populated census blocks within the county, centered on Hollister that was included in the study (see map 5).

Perhaps due to this small sample size (or just low population densities across the county), there is no large cluster of census blocks with low retail densities. However, in south Hollister and Tres Pinos, there appears to be a group of census blocks with very low retail densities (bottom 20% of all census blocks). The vast majority of the population in these census blocks is Latino (80 – 100%, see map 6), making them of potential interest to ALBA farmers for marketing their produce.

Map 5. 'Food deserts' in San Benito County



Map 6. Percentage of the population that is Latino in San Benito County



Limitations

This study has a number of limitations. It does not address the quality of produce or other foods available in the retail outlets, or the prices charged for these foods. This may be a much more important factor than simple availability. The methodology also does not control for the size of retail outlets, and other studies have suggested that larger retail outlets not only have a wider selection of foods, but their quality may be higher and prices may be lower than smaller stores. The data do not reflect recent store closings or openings, and several large, chain supermarkets in the region have been closed in the last few years, due to consolidation in the industry. For example, two Ralphs stores (owned by Kroger) in Capitola and Freedom, and an Albertsons in Santa Cruz were closed in 2006.^{25,26} Finally, this study does not examine walkability/transportation issues. Although it was conducted at finer scale than most other studies, it did not control for barriers to transportation, such as lack of bike paths or buses, nor did it control for high crime rates or traffic densities that could discourage walking.

²⁵ Gutierrez, S. 2006. Ralphs in Capitola, Watsonville shut doors. *Santa Cruz Sentinel*, March 27.

²⁶ Gumz, J. 2006. Albertsons to close. *Santa Cruz Sentinel*, June 7.

The fact that the three counties of this study are not dominantly urban makes doing a “food desert” analysis challenging, because of the inherently lower population densities. In addition, these counties have strong agricultural economies supported by large immigrant populations, therefore not all households will be documented by the US Census. It is important to consider these issues when interpreting the results.

Suggestions for future research

We suggest that future studies in this region could involve more qualitative investigations of the price and quality of food. Smaller areas could be selected based on the finding of this report and stratified by red/yellow/green areas to determine how other variables relate to retail density per population density. ALBA has recently conducted such a study in Salinas and surrounding areas, using a participatory methodology that explored the availability of organic produce.²⁷

The present study could also be extended in a number of ways. GIS could be used to geocode residential addresses of foodbank clients in order to identify 'hotspots' where large numbers of clients have low access to fresh produce.²⁸ Transportation patterns could be modeled to look at food access for those with automobiles compared to those who rely on alternatives. Comparisons could also be made to other regions, particularly areas with large Latino populations, to determine if the lack of association between food access and ethnicity is consistent. The densities of different types of retail food markets, such as large supermarkets, warehouse clubs, grocery stores, fruiterias, natural food stores, etc, could be examined. In addition, fast food and convenience store locations could be mapped and their relationships with population density and demographic variables could be investigated. In this region, easy access to cheap, but low quality foods, may be more of a public health issue than inadequate access to nutritious foods.

Finally, research on food environments should be conducted at multiple scales, from fine (census block or smaller) to coarse (county level) in order to determine what level of analysis is most appropriate for a given context. Theories about how variables such as ethnicity and income may interact with local food environments are just beginning to be developed. Studies comparing several levels of aggregation may therefore shed light on how neighborhood and community-level factors are related to individual food access, as well as how they affect health.

Summary and Conclusions

Monterey, San Benito and Santa Cruz Counties have few clusters of census blocks with less access to retail food outlets relative to the region as a whole. However, some clusters were identified as potential “food deserts” that would benefit from further investigation. If additional research indicates that residents of these areas do lack access to affordable, nutritious food, one potential intervention would be to establish markets for new, limited-resource and minority farmers, such as graduates of ALBA's training program.

²⁷ Boyer, J., et al. 2006. *The Face of Food on the Central Coast: A Community Food Assessment*. Agricultural & Land-Based Training Association: Salinas, CA.

²⁸ Algert, S.J., Agrawal, A. & Lewis, D.S. 2006. Disparities in access to fresh produce in low-income neighborhoods in Los Angeles. *American Journal of Preventive Medicine* 30: 365-70.

Retail density per population density was not associated with the percentage of Latino residents of a census block. Since this study was conducted at the block level, and socioeconomic information is only available at the block group level, we could not examine the relationship between income and food access. However, the authors plan to pursue such a study in the near future.

Pursuing this scale of analysis using the tools discussed here could prove to be beneficial for understanding not only “food deserts” but other issues related to local food environments, such as the prevalence of fast food restaurants relative to the ethnic and socioeconomic characteristics of neighborhoods. Using GIS in this manner assists decision-making but does not alone provide a definitive result. It is in the interpretation of the map within its own local socioeconomic and cultural context that these maps prove to be most useful.