

**Retail Concentration, Food Deserts, and Food Disadvantaged Communities
in Rural America**

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INTRODUCTION

For many residents of the United States, purchasing groceries is a minor inconvenience rather than a major obstacle. In 1995, a standard shopping trip for the average U.S. family involved a six-mile drive lasting no more than 12.5 minutes (U.S. Department of Transportation Federal Highway Administration 2001). For other Americans, especially those in rural areas, the time and distance traveled to purchase groceries is significantly longer. A report by the Economic Research Service of the U.S. Department of Agriculture indicates that residents of rural communities in the Lower Mississippi Delta endure a far different journey to the shopping center (Kaufman 1998). For example, rural counties in the Delta average one supermarket per 190.5 square mile. Additionally, over 70% of the low-income population in the Delta traveled 30 or more miles to purchase groceries at supermarkets in an effort to avoid high priced smaller grocers and inadequate quality food sold at convenience stores and gas stations.

Researchers studying similar conditions in the United Kingdom have described areas with limited access to food as “food deserts” (Furey et. al. 2001). In the case of the U.K., declining neighborhoods in large cities lost all grocery stores and markets, leaving the population without access to any type of food retailer. In contrast, the notion of food deserts in the U.S. has eluded both policy makers and researchers alike. One possible explanation for this omission is the important distinction between quantity and quality of food retailers. For the U.K., the *absence* of food retailers was the central issue driving the recognition of food desert populations. In the U.S., the proliferation of convenience stores and gas stations ensure that some type of food is accessible to almost all residents. However, the *quality and pricing* of food products available in U.S. convenience stores and supermarkets varies dramatically. Consumers purchasing food at a convenience store pay a premium for access to food products. Additionally, consumers choose

from a smaller variety of food products that may not be suitable for the maintenance of a healthy diet. Thus, the application of the food desert concept in the U.S. elucidates a great divide between those with and without access to low cost, high quality foods.

In this study we apply the concept of food deserts to U.S. non-metropolitan areas, in an effort to understand inequalities in food access for non-metropolitan residents. We develop a measure of food access for U.S. non-metropolitan counties to examine how the restructuring of non-metropolitan retailing has created food deserts. We also explore the characteristics of food desert populations to better understand the consequences of this process for non-metropolitan populations. Finally, we conclude our analysis with a contextual analysis case study of the impact of food deserts on the intake of fruit and vegetables for nonmetropolitan residents of the state of Mississippi.

THE EMERGENCE OF FOOD DESERTS IN THE U.S.

The retail distribution of food is a central concern for U.S. non-metropolitan areas. Simply put, if U.S. non-metropolitan retail food sales activity among supermarkets and supercenter stores (hybrid stores offering groceries and discount merchandise) becomes concentrated within limited geographic areas, such as one or two cities or towns within a county, persons outside of these retail centers become isolated from convenient access to low cost, quality food. The remaining choices for these residents, such as small convenience stores, gas stations, and restaurants, offer few prospects for the maintenance of a quality diet. Populations facing these conditions reside in food deserts and engage in lengthy commutes to access supermarkets and supercenters.

The creation of food deserts in the U.S. has occurred gradually during the past 30 years. The impetus for the shift from a large number of widely dispersed small scale local grocers to a

concentration of supermarkets and supercenters into a limited geographic area has been fueled by the globalization of food production and distribution resulting in a handful of corporations controlling the majority of sales (Lyson and Raymer 2000). Globalization allows supermarket and supercenter chains to purchase large quantities of food from suppliers in order to sell at lower prices. The buying power possessed by large retail chains, such as Wal-Mart, Target, Sam's Club, Albertson's, and others, provides these corporations a distinct advantage over smaller chains and "mom and pop" grocers. For U.S. nonmetropolitan areas, the effect of larger retail chains has been most pronounced in the South and Midwest. Blanchard et al. (2003) find that the entrance of a large retailer into southern and midwestern nonmetropolitan markets, generates declines in the number of small retail establishments and retail employees.

Studies of globalization in the retailing industry have focused on discount merchandise superstores and the concentration of food sales into large chain supermarkets. Combined, these two types of retail outlets account for 89.8% of all grocery and "food for off premise consumption" sales in the U.S. (U.S. Bureau of the Census 2001). Studies of both types of retailers follow a common theme: the buying power of large chains reduces the viability of smaller establishments. While discount merchandisers accounted for only 12.1% of all grocery sales in 1997, their share of grocery sales grew by 9.3% from 1992 to 1997 and they represent the fastest growing segment of firms selling groceries. In 1999, the most dominant firm in this category, Wal-Mart supercenters, ranked fifth in total grocery sales in the U.S. (Kaufman et al. 2000). Additionally, studies of discount merchandisers focus exclusively on Wal-Mart because of its unique effect on competing small establishments.

Studies of the impact of Wal-Mart indicate that the entrance of a Wal-Mart store restructures local retail markets. In a study of the effects of the presence of Wal-Mart in 14

Missouri counties, Keon et al. (1989) found that the number of retail stores in counties with a Wal-Mart declined during the 1980's. Stone (1995) also documented the concentration of retail activity within 34 Iowa towns. Towns without a Wal-Mart experienced declines in sales, number of retail establishments, and sales tax, while those with a Wal-Mart experienced substantial growth in sales revenue and employment. Prior studies also suggest that local retailers in rural communities report an "environment of hostility" when large retailers enter local markets (Shils 1997). Research contrasting the location of Wal-Mart stores to other large retailers attribute the success of Wal-Mart to its strategy that targeted small southern towns, where competition was negligible (Barnes and Connell 1996; Shils 1997; Graff 1998).

The food stores industry (supermarkets, grocery stores, and convenience stores) has also followed a similar trend over the past 50 years. Until the mid-1980s, the consumer market for food stores serving metropolitan populations could be characterized as a single metropolitan area or for rural communities a town with as few as 1,000 residents (Kaufman et al. 1993; Stone 1995). During this era, the viability of small "mom and pop" grocers varied. In 1982, the percentage of sales accounted for by the four largest food store firms operating in a metropolitan area ranged from 90.6% in Iowa City, IA to 27% in the Appleton-Oshkosh, WI SMSA. Changes in the technology of food distribution and corporate mergers led to a major restructuring in food retailing beginning in the mid 1980's. For rural areas in Iowa, Stone (1995) suggests that many small towns (1,000 or fewer residents) lost local grocery stores, forcing residents to travel to larger towns for groceries. In the 1990s, supermarkets in rural and urban markets also competed with discount chains for sales. From 1992 to 1997, the percentage of total grocery sales in the U.S. accounted for by food stores declined by 8.9%, while the discount merchandisers gained 9.3% of grocery sales (U.S. Bureau of the Census 2001). Additionally, the number of

supermarket and grocery stores in the U.S. declined from 73,357 in 1992 to 69,461 in 1997 representing a 5% decline in the number of stores. This follows the general pattern of decline in the number of food stores over the past 40 years (Kaufman 1993).

Implications for Food Desert Populations

The increasing concentration of food retailing activity has clear implications for food access among non-metropolitan residents. Studies documenting price differentials in food costs between urban and rural areas find that rural residents, especially the rural poor, pay more for groceries because of lack of access to large supermarkets that offer more competitive prices than smaller grocers (Kaufman et al. 1997). Thus, non-metropolitan residents experiencing physical or economic resource limitations are at a distinct disadvantage. For example, persons experiencing physical disabilities may be less able to travel long distances to secure low priced, high quality food. This problem is compounded by the lack of public transit systems available to non-metropolitan residents.

The poor in food deserts also experience a severe disadvantage. Studies of food pantry clients indicate that the vast majority of persons using food pantries to meet food needs do not own vehicles (Daponte et al. 1998; Molnar et al. 2001). Additionally, the Food Stamp program limits total assets held by program participants to no more than \$6550 in total assets, limiting the ability of a family to own reliable transportation and receive food stamp benefits (Molnar et al. 2001). If the family owns an unreliable vehicle, low income families on a tight budget must redirect money away from food expenditures into car maintenance.

Thus, the changes in the food retailing industry have “distanced out” many disadvantaged non-metropolitan populations from supermarkets and superstores. These residents may be forced to rely on convenience stores or small grocery establishments that may not offer foods essential

to a healthy diet. For the poorest of the poor, a food pantry may be the only option (Daponte et al. 1998).

MEASURING FOOD DESERTS

To our knowledge, prior research of food access has not attempted to measure the concept of food deserts in the U.S. In the U.K., researchers have measured food deserts through site visits and direct observation of neighborhoods to determine the absence or presence of food retailers. Although direct observation of a given neighborhood or community is an ideal methodological approach, the objective of this study is to measure the level of food access in the 2,275 non-metropolitan counties in the continental U.S. Because of the scope of our study, we rely on secondary data on food retailers and the distribution of the U.S. non-metropolitan population.

To identify populations in counties that have limited access to large supermarkets or supercenters, we use ARCVIEW Geographic Information System (GIS) mapping software, which provides a means to assess spatial relationships. For the purposes of this analysis, GIS is employed to identify populations that reside within a given distance from supermarkets and supercenters. We selected those zip codes that contained at least one supermarket with 50 or more employees or supercenter/wholesale club in 1999. To assign a spatial location for these business establishments, we matched zip code data from ZBP to the 1999 U.S. Bureau of the Census Zip Code File that contains longitude and latitude coordinates for U.S. Zip Codes. Longitude and Latitude coordinates of each zip code represent the spatial center of a zip code area. The center of each zip code area is used to calculate distances. Figure 1 and Figure 2 provides an example of the use of zip code centroids for the state of Mississippi and the relation

between the location of interstate highway, places of 10,000 or more persons, and the location of supermarket and supercenters.

All census block groups whose boundaries intersect a ten mile radius of the zip code centroid are classified as high retail access areas, while those blockgroups falling outside of the ten mile radius are considered low retail access areas. We chose a ten mile radius based on the National Transportation Survey. NTS survey data suggest that in 1995 the average U.S. resident traveled approximately 8 miles during grocery shopping trips. We selected ten miles rather than the national average because travel times vary between urban and rural locales. Our ten mile radius also assumes a point to point drive time of approximately 20 minutes, traveling at an average rate of speed of 30 miles per hour. We also adjusted our measurements based on proximity to an interstate highway. In the event that an interstate intersected the ten mile radius boundary, we extended the boundary to include an additional five miles of space that extended one mile around the highway. We included this additional boundary area to account for higher road speed on interstate highways. Figure 3 provides an example of the ten mile boundaries calculated for each zip code centroid containing a large supermarket or supercenter for the state of Mississippi. Figure 4 displays the remaining block groups that fall outside of the boundary areas. These county remainders are classified as low access areas for retail food distribution and can be operationalized as a food desert. For the state of Mississippi, 443,079 persons reside in areas classified as low access. After identifying food deserts within each county in the U.S., we calculate the proportion of the total county population in these low access areas.

We classify non-metropolitan counties as food deserts if the proportion of the county's population in a food desert is greater than the median proportion for the region of the U.S. in which the county is located. For example, in the western region of the U.S., the median

proportion of the population residing in a food desert is .63. Thus, all counties in western states with a proportion of the population in food deserts greater than .63 are classified as food desert counties. We define region using the Bureau of the Census designation. We classify counties based on the regional median for two reasons. First, the distribution of the proportion of the population in a food desert among counties is highly skewed. Second, we chose regional medians, rather than the national median, because the size of a county (square miles) varies across regions. Thus, a large county may have a higher proportion of the population in a food desert because of our use of a ten-mile radius to capture food desert populations. Classifying food desert counties regionally, rather than nationally, avoids overclassification of western counties as food deserts and underclassification of southern and northeastern counties.

Analytical Strategy

In our descriptive analysis we employ both maps and tables to describe food desert counties. We present a national map of all food desert counties, and a map of “severe” food desert counties using GIS software. Severe food desert counties are defined as counties in which the total county population resides in a food desert. Our tabular data addresses two issues. First, we provide information on other types of food retailers present in food desert counties, such as small grocers, convenience stores, gas stations, fruit and vegetable markets, fast food restaurants, and full service restaurants. This information will identify the alternatives available to consumers without convenient access to a supermarket, supercenter, or wholesale club. Our information on other types of food retailers comes from the 1999 County Businesses Patterns data from the Bureau of the Census. These data report the number of businesses by type of business for all U.S. counties. Our second table provides socio-demographic characteristics of food desert residents. The data reported in this table comes from the 2000 Census of Population

and Housing Summary File 3. The socio-demographic characteristics of food desert populations provide information on the type of persons in food deserts and point to the specific policy needs of food deserts.

We also evaluate the validity of the food desert thesis by performing a case study of nonmetropolitan residents of Mississippi residing in counties isolated from metropolitan area. Drawing on data from the 1998, 2000, and 2002 Behavioral Risk Factor Surveillance System (BRFSS), we estimate contextual effects logistic regression models predicting the likelihood of consuming five or more servings of fruits and vegetables per day. Our models include a measure of the local availability of supermarkets, supercenters, and warehouse club stores. We also control for demographic and socioeconomic characteristics of BRFSS respondents. According to our review of the literature, we hypothesize that nonmetropolitan residents without convenient access to a supermarket, supercenter, or warehouse club will be less likely to consume five or more servings of fruits and vegetables per day.

DESCRIPTIVE RESULTS

Figure 5 shows non-metropolitan counties in the United States we classify as food desert counties. Only Massachusetts, Rhode Island, Connecticut, and New Jersey have no food desert counties. Several states, primarily but not exclusively in the Midwest and Mountain West, have a majority of their land area composed of food desert counties, including Maine, Texas, Kansas, Nebraska, North Dakota, South Dakota, and Montana.

<FIGURE 5 ABOUT HERE>

Three key trends emerge from an analysis of Figure 1. First, food desert counties tend to cluster around each other, with several bordering each other, both within and between state boundaries. Second, there is a high concentration of food desert counties stretching from the

Rocky Mountains east into the western part of the Great Plains, from the Canadian border to the Mexican border. Virtually all of the non-metropolitan counties in Montana, eastern Wyoming, eastern Colorado, northeastern New Mexico, North Dakota, South Dakota, Nebraska, western Kansas, western Oklahoma, Texas, and western Minnesota qualify as food desert counties. Finally, in addition to the Great Plains, there are concentrated areas of food desert counties within the southeastern United States. These areas are those traditionally linked to conditions of hardship and deprivation, including the Mississippi Delta and Black Belt counties, the Appalachian Mountain region of Kentucky, West Virginia, and northwestern Virginia, and eastern sections of North Carolina and South Carolina.

In Figure 6, the non-metropolitan counties in the United States we classify as “severe” food desert counties are shown. Compared to Figure 1, far fewer counties qualify for this status, though again, some interesting observations can be drawn from the spatial dynamics of this situation. Clustering of “severe” food desert counties is still apparent in the western portion of the Great Plains states, including Montana, eastern Wyoming, eastern Colorado, northeastern New Mexico, North Dakota, South Dakota, central Nebraska, western Kansas and western Texas. There are still counties in Oklahoma and Minnesota that qualify as “severe” food desert counties, however the clustering of these counties is quite sporadic compared to the designation of food desert counties. Even within the states listed above, there are certain counties that are food desert counties, but not “severe” food desert counties. Regarding the southeastern United States, the only clusters of “severe” food desert counties that remain are very small clusters in the Mississippi Delta region and the West Virginia-northwestern Virginia Appalachian border country.

<FIGURE 6 ABOUT HERE>

Table 1 reports the number of food retailers per 10,000 persons by region for food desert and non-food desert counties in non-metropolitan areas. In each region, there are more supercenters and supermarkets in non-food desert counties. These differences are particularly pronounced in the South, Midwest, and West. It is interesting to note that in the non-metropolitan food desert counties of the West there are virtually no supercenters such as Wal-Mart or Target.

<TABLE 1 ABOUT HERE>

In terms of small grocers, there are more small grocery stores in food desert counties across the country. This gap is most extreme in the Midwest and Western states. It should also be noted that across regions and county type, there are far more small grocery stores than supermarkets or superstores in non-metropolitan areas. There are also few differences in the number of convenience stores; however in the Northeast and the West, there are more gas station convenience stores in food desert counties. Again, there are more gas station convenience stores in non-metropolitan areas than general convenience stores. Also noteworthy is that in each region, there are more fruit and vegetable markets in non-food desert counties. Fast food restaurants are somewhat more likely to be found in non-food desert counties than food-desert counties, particularly in the Northeast and the South. Full service restaurants are more likely to be located in food desert counties in the Midwest and the West. With the exception of the South, where gas station convenience stores are found as frequently as full service restaurants, this category of food retailer appears most commonly in non-metropolitan food desert and non-food desert counties.

In Table 2, regional differences in demographic and socioeconomic characteristics between food desert and non-food desert counties are compared. Across regions, food desert counties are more likely to be rural than non-food desert counties. This particularly holds in the

Midwest, where 85.72% of food desert counties are rural, as opposed to 59.22% of non-food desert counties. Racial-ethnic disparities are slight, except for the percentage of Hispanics in food desert counties in the South (10.3%) versus non-food desert counties (5.34%), and the percentage of Native Americans in food desert counties in the Midwest (3.5%) versus non-food desert counties (1.1%).

<TABLE 2 ABOUT HERE>

In each region of the country, the percentage of those in poverty is higher in food desert counties as opposed to non-food desert counties. In the South, the absolute percentages of people in poverty are higher than the other regions in food desert and non-food desert counties.

Correspondingly, within each region of the country, there is a gap of several thousand dollars in median family income between non-food desert counties and food desert counties. Again in the South median family income is lower for both food desert and non-food desert counties than in any other region of the country. In fact, residents of food-desert counties in the other regions have a higher median family income than residents of non-food desert counties in the South.

Educational differences are found between food desert and non-food desert counties nationwide, with residents of food desert counties being more likely to have received less than a high school education, and less likely to have received a Bachelors degree or better. Again, residents of the South are much more likely to have less than a high school education than residents of other regions, regardless of whether or not they live in a food desert county. This pattern also holds for the percentage of households with no vehicle, and the number of disabilities per 1,000 persons, both of which are higher in the South than other regions, regardless of food desert status.

CONTEXTUAL MODEL OF FOOD DESERTS IN MISSISSIPPI: A CASE STUDY

To examine the effect of food deserts on individual-level nutrition outcomes, we perform an exploratory analysis of the effect of food deserts on fruit and vegetable intake. The findings from our case study are reported in Table 3. Our data come from the 1998, 2000, and 2002 Mississippi BRFSS surveys contain information on 3,322 Mississippi nonmetropolitan residents who reside in a county not adjacent to a metropolitan area. Under a special agreement with the Mississippi Department of Health, we obtained an unedited version of the Mississippi BRFSS survey data that contains detailed geographic identifiers for all respondents. The BRFSS program is an annual household telephone survey of persons age 18 and over designed to collect information on health behaviors for U.S. residents. In 1998, 2000, and 2002 Mississippi respondents were asked about their daily dietary intake of fruits and vegetables.

The dependent variable in our analysis is a binary measure of fruit and vegetable intake coded 1 if the respondent consumes five or more servings of fruit and vegetables a day and 0 if the respondent consumes fewer than five servings. We chose five or more servings as our dependent variable based on recommended daily intakes of fruits and vegetables (Hyson 2002). The key independent variable in our analysis is a binary variable that identifies respondents who do not have a supermarket, supercenter, or wholesale club in their place of residence. We include a measure of age (in years), binary indicators for race and ethnicity (nonhispanic white, nonhispanic black, and other), a binary indicator for sex (1=female, 0=male), and binary indicators of education (less than a high school diploma, high school diploma or equivalent, post-high school education). Descriptive statistics for all variables included in our models are reported in Table 3.

<TABLE 3 ABOUT HERE>

We report odds ratios for the probability of consuming 5 or more servings of fruit and vegetables per day in Table 4. In Model 1 we report results from our full model that contains all nonmetropolitan residents in our study. The findings indicate that food desert residents are 23.4% less likely to consume five or more servings of fruits and vegetables per day than non-food desert residents. In Models 2 and 3, we disaggregate our data by food desert (Model 2) and non-desert residents (Model 3). These models highlight the detrimental effect of food deserts on the relationship between educational attainment and food intake. For food desert residents, persons with post-high school education are 34.9% more likely to consume 5 or more servings of fruits and vegetables per day. In contrast, persons with greater than a high school education in non-food desert areas are 79.8% more likely to consume five or more servings of fruits and vegetables per day. Thus, food deserts may attenuate the protective effects of education on health and health behaviors. These findings suggest that food deserts may have important direct and indirect effects on nutrition for nonmetropolitan residents.

<TABLE 4 ABOUT HERE>

CONCLUSIONS

Our study points to a central finding regarding the prevalence and severity of food deserts in U.S. non-metropolitan areas. Primarily, individuals living in food desert areas will pay higher prices for groceries or incur a greater travel cost to access the large food retailer that may offset the savings available at these stores. Our findings suggest that small grocers and gas and convenience stores are the likely alternatives in the absence of access to supermarkets and supercenters. More importantly, healthy alternatives, such as fruit and vegetable markets, are less prevalent in food deserts. This is especially troubling for vulnerable segments of the

population such as poor, low-income individuals and the disabled, who comprise a greater share of the population in food deserts. For these persons it may not be feasible to shop at a large food retailer because of travel cost and time considerations. This issue is especially problematic in the South where the percentage of households without a vehicle is greatest. Without access to the large food retailer, these individuals are left with few alternatives.

The key implication of the food desert dynamic is that populations already experiencing high risk of poor dietary intake and nutrition related illness, such as the poor and those without a high school diploma, experience an even greater risk of poor dietary intake when living in a food desert. Food deserts may compound severe nutritional problems and further exacerbate the socioeconomic gradient in health status. More specifically, food deserts may limit the capacity of populations to meet recommended servings of fruit and vegetables, because fresh produce is rarely available in convenience and gas station food retailers. A recent report summarizing the link between fruit and vegetable consumption and major health problems, such as heart disease, stroke, some forms of cancer, and pregnancy complications, underscores the health risk of poor nutrition (Hyson 2002). Our findings indicate that food deserts do indeed impact nutritional intake. Residents of food deserts are less likely to consume five or more servings of fruit and vegetables per day. This finding is important because the social and economic costs of food deserts generated through increased health care expenditures through Medicaid and poor health among the labor force may hamper economic development and limit the viability of non-metropolitan communities.

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Figure 1. Mississippi Counties and Places

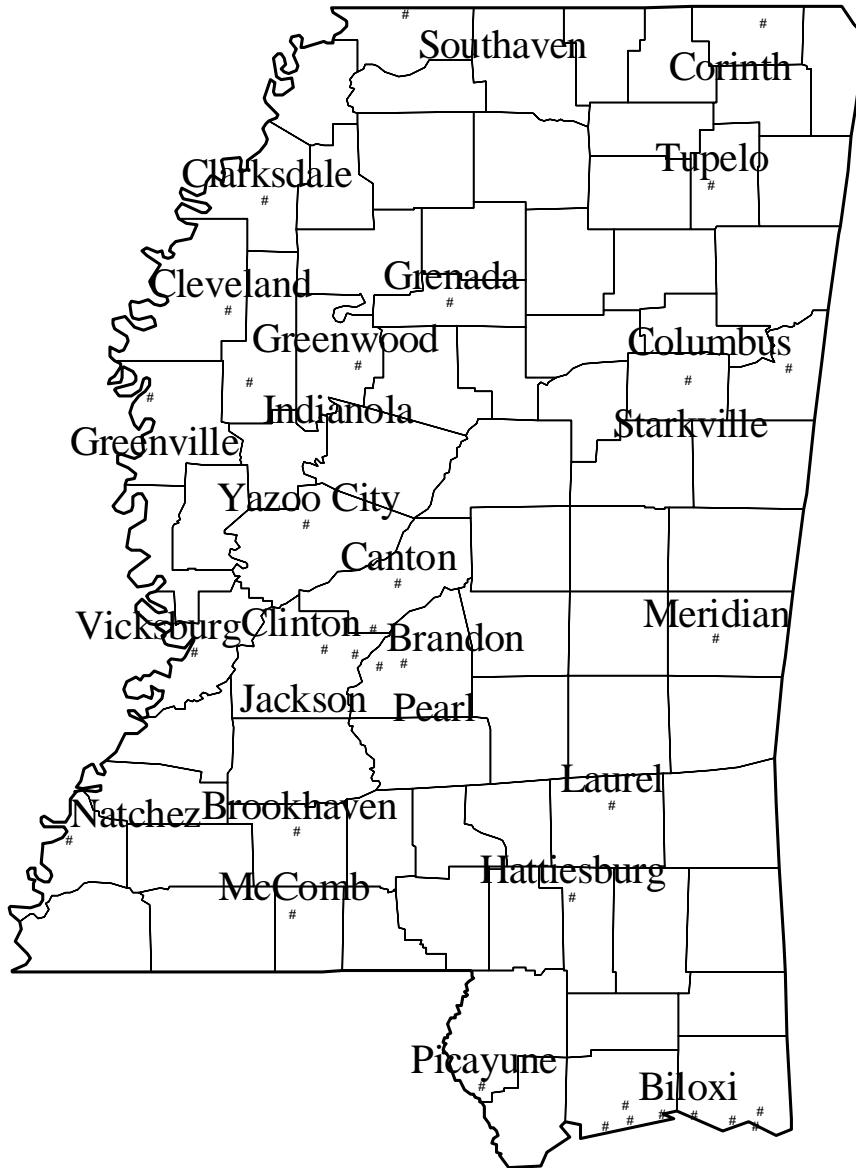


Figure 2. Zip Codes Centroids Containing Supermarket-Supercenter Establishments, 1999

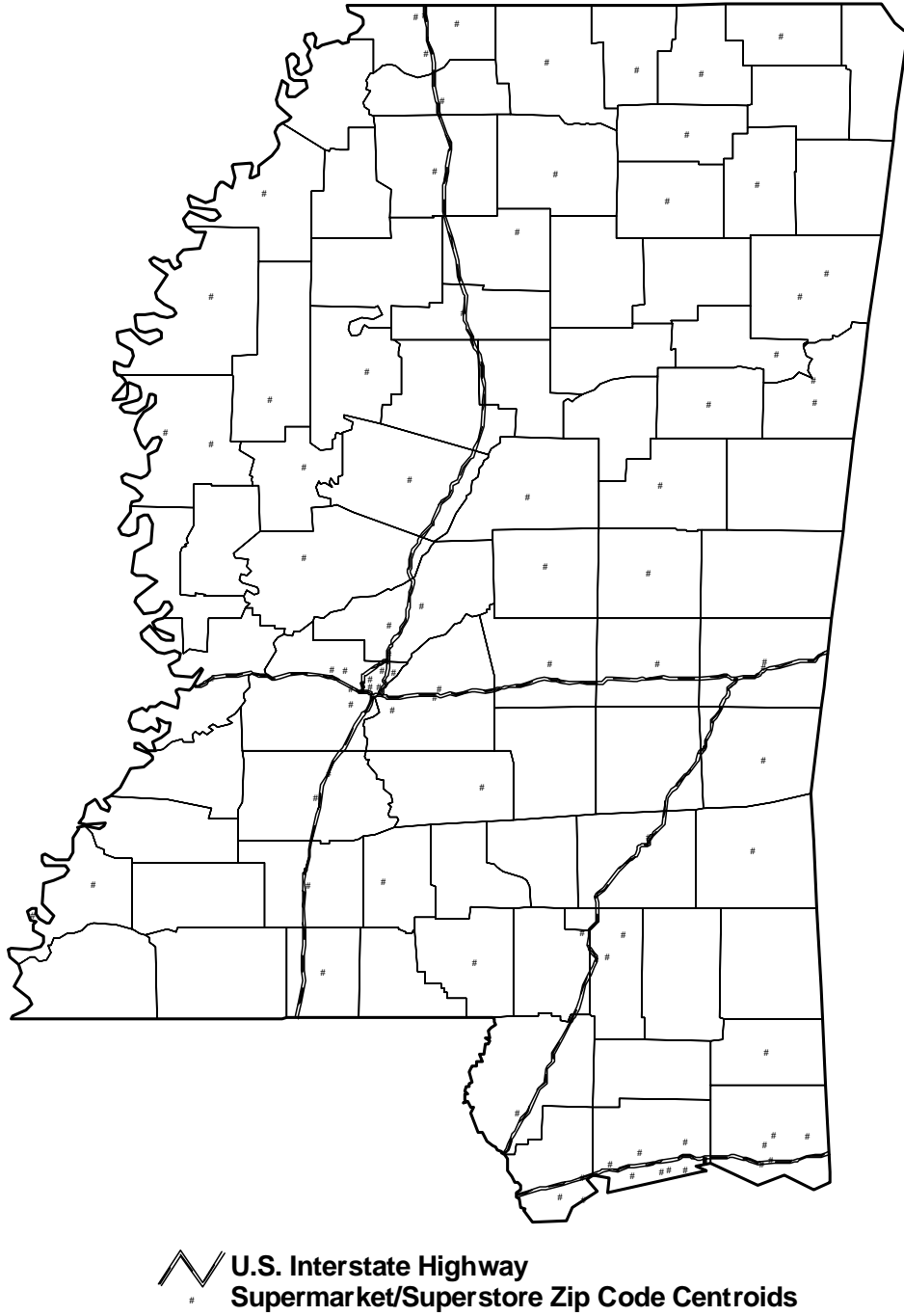


Figure 3. Supermarket-Supercenter Accessibility for Mississippi Counties, 1999

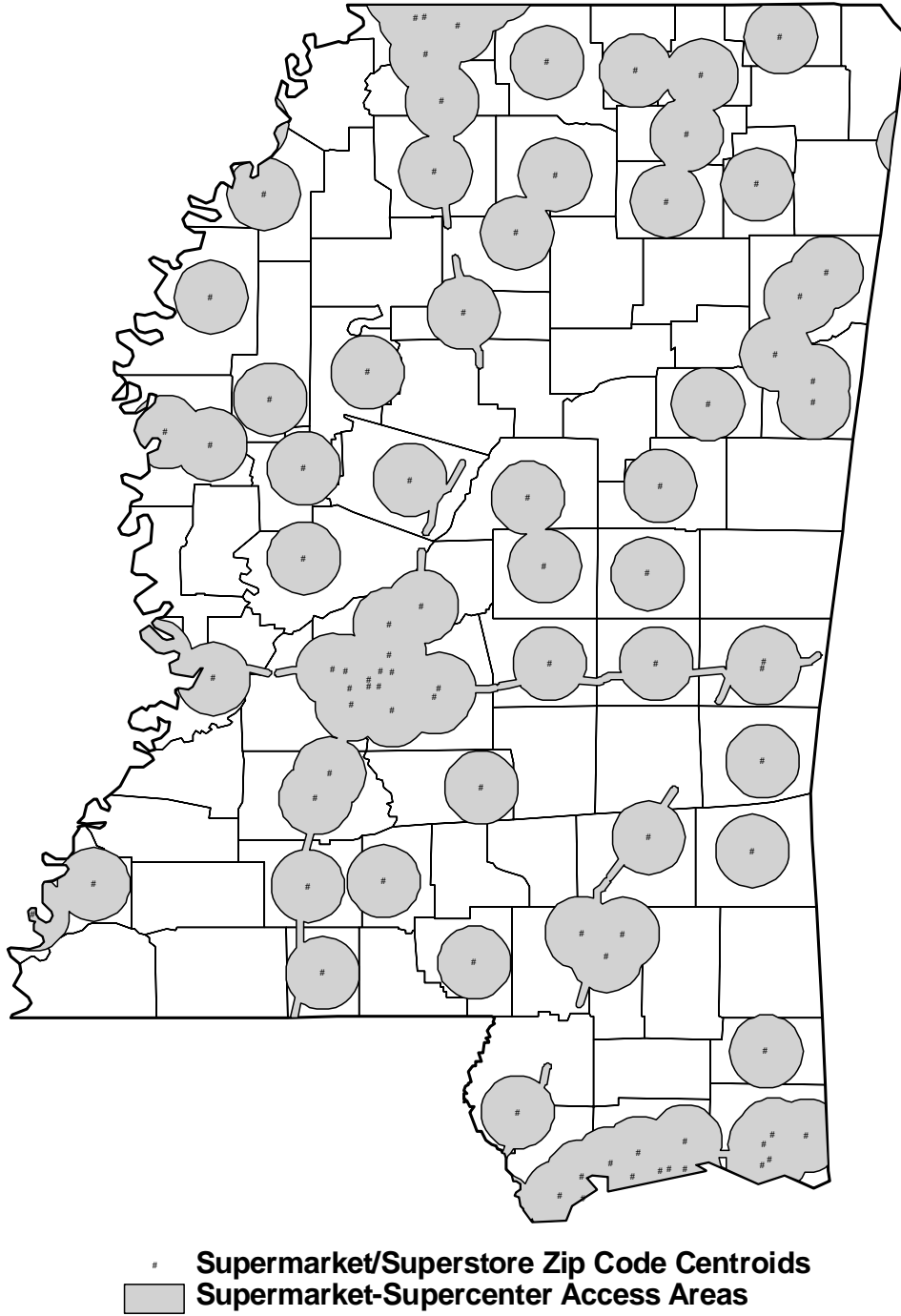
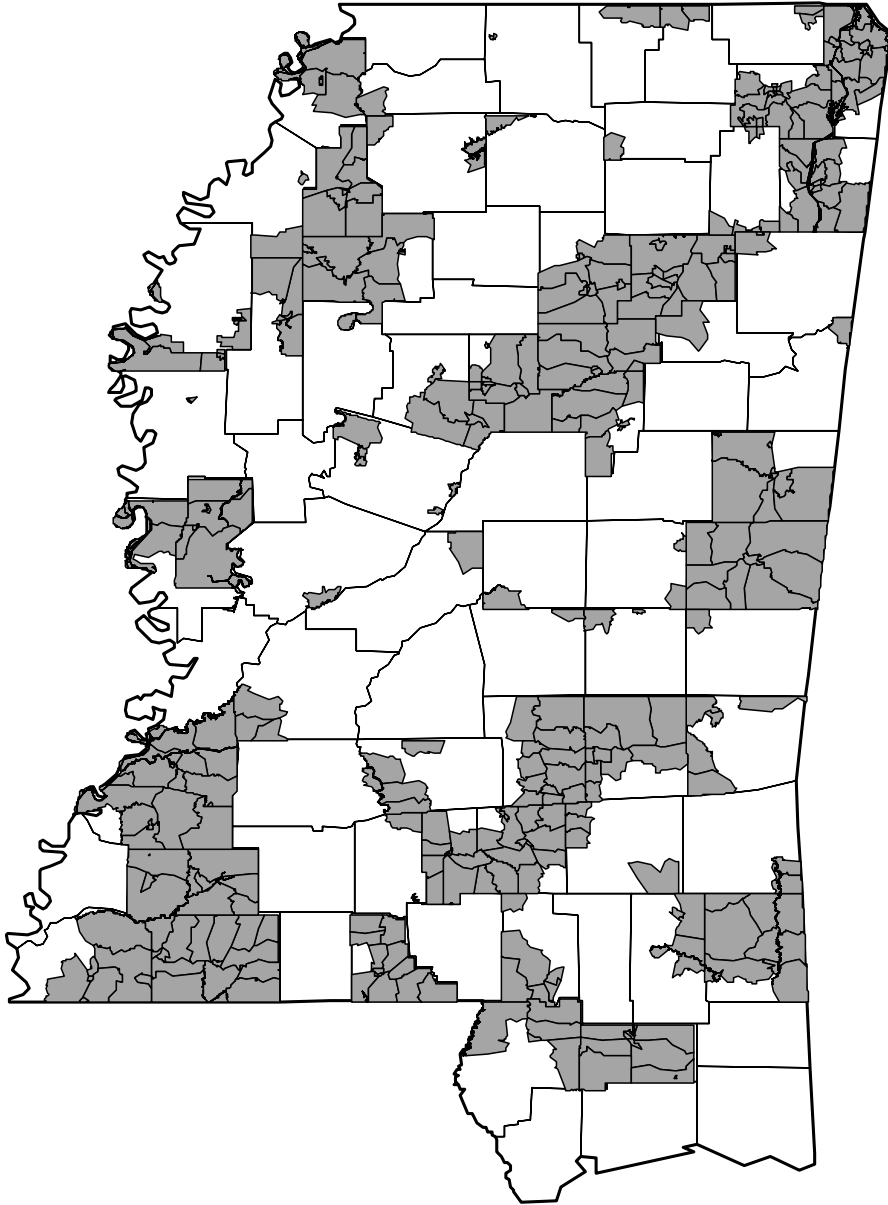


Figure 4. Low Supermarket-Supercenter Access Areas in Mississippi Counties, 1999

Total Population in Low Access Areas in 2000: 443,079



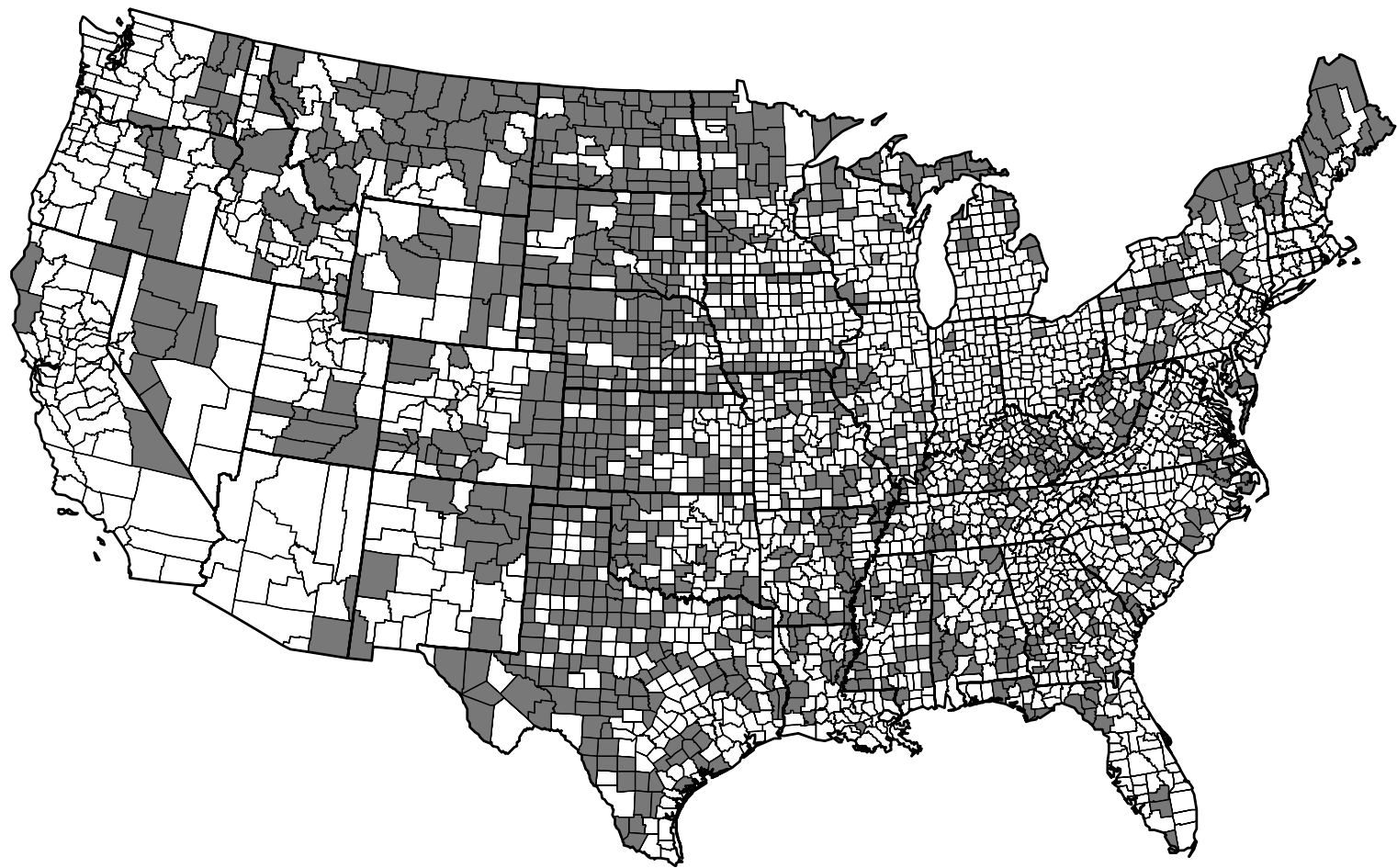


Figure 5. U.S. Nonmetropolitan Food Desert Counties, 2000

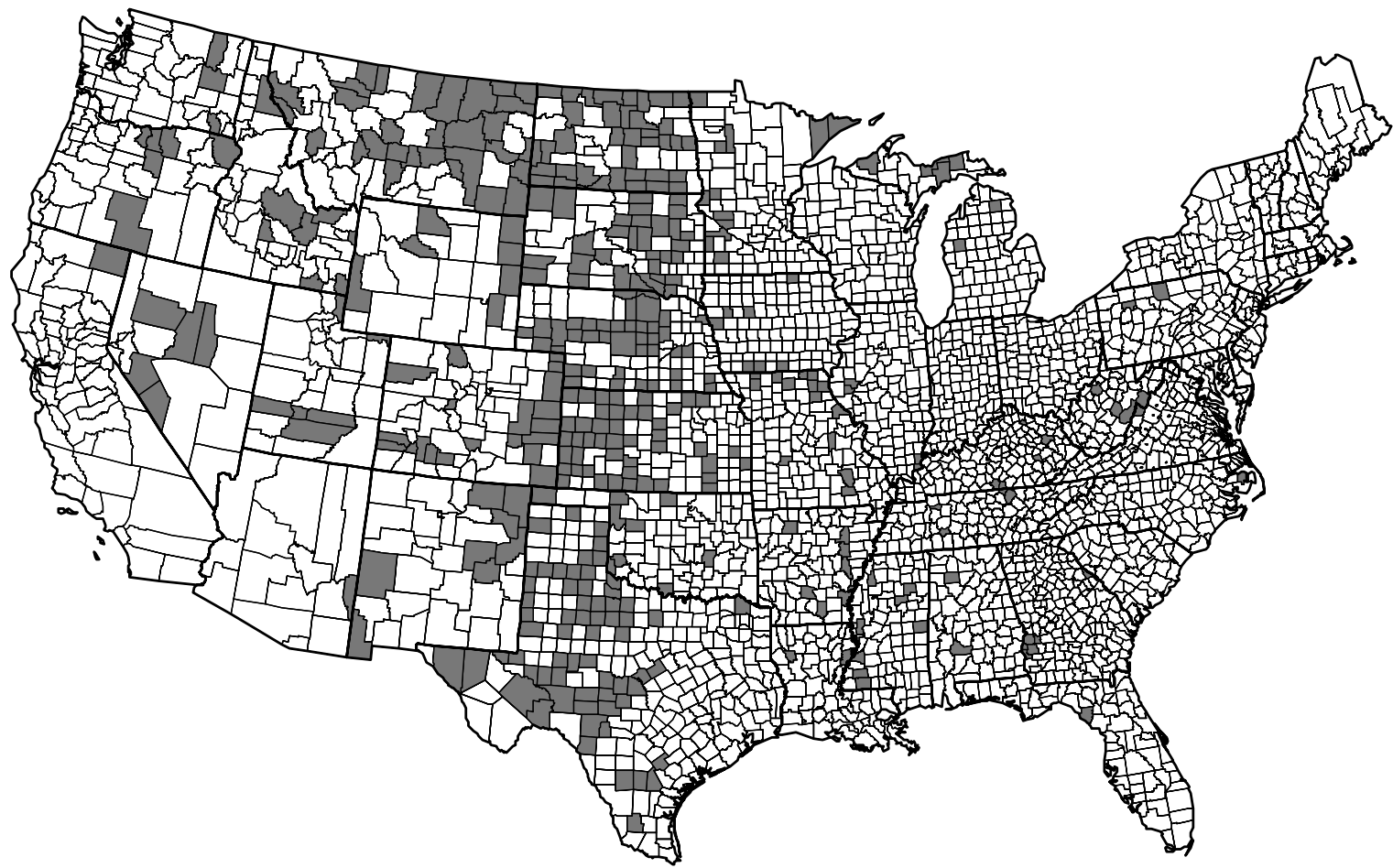


Figure 6. U.S. Nonmetropolitan "Severe" Food Desert Counties, 2000

Table 1. Number of Food Retailers per 10,000 by Region for Nonmetropolitan Food Desert and Non-Food Desert Counties by Region

	Supercenters	Supermarkets	Small Grocers	Convenience Stores	Gas Station Convenience Stores	Fruit and Vegetable Markets	Fast Food Restaurants	Full Service Restaurants
Northeast								
Food Desert	.02	.44	3.63	1.58	5.02	.12	6.33	10.42
Non-Food Desert	.05	.76	2.50	1.53	3.87	.19	7.79	10.29
South								
Food Desert	.03	.19	4.12	1.36	6.08	.04	4.94	5.76
Non-Food Desert	.08	.78	2.55	1.25	5.87	.10	6.48	5.97
Midwest								
Food Desert	.01	.19	5.45	.80	5.46	.02	5.91	10.26
Non-Food Desert	.04	.86	2.25	.79	5.03	.07	6.95	8.16
West								
Food Desert	.00	.18	5.84	1.04	5.45	.01	7.32	14.47
Non-Food Desert	.05	.84	2.50	1.13	4.30	.06	8.13	11.94

Table 2. Socio-Demographic Characteristics of Nonmetropolitan Food Desert and Non-Food Desert Counties by Region

	Northeast		South		Midwest		West	
	Food Desert	Non-Food Desert	Food Desert	Non-Food Desert	Food Desert	Non-Food Desert	Food Desert	Non-Food Desert
Demographic Characteristics								
Population	48013	63730	17090	31825	11098	29247	10786	32062
% Rural	74.84	61.89	77.79	62.52	85.72	59.22	78.00	52.15
% Hispanic	1.30	1.51	10.30	5.34	1.94	2.41	11.68	12.66
% Non-Hispanic White	95.50	94.97	71.10	74.75	92.44	93.81	82.58	79.32
% Non-Hispanic Black	1.33	1.58	16.56	17.03	.88	1.25	.45	.65
% Non-Hispanic Native Americans	.53	.30	.85	1.33	3.50	1.10	3.35	4.79
% Foreign Born	.81	.77	.40	.44	.36	.41	.57	.77
Socioeconomic Characteristics								
% in Poverty	12.66	10.39	20.31	18.10	13.28	10.92	15.47	14.84
Median Family Income (\$)	40210	45422	33830	36412	38533	42941	38125	41641
% Unemployed	6.37	5.54	6.83	6.59	4.70	5.15	6.15	7.48
% Less than HS Diploma	19.39	17.93	32.49	30.25	19.19	18.73	18.05	17.48
% HS Diploma	41.73	39.56	34.70	34.42	37.70	39.43	33.09	29.55
% Some College	22.69	22.88	21.13	22.18	28.65	27.07	31.43	32.86
% BA or Better	16.19	19.62	11.67	13.15	14.45	14.71	17.43	19.62
% Households with No Vehicle	7.52	7.56	9.30	9.19	5.83	6.47	5.67	5.92
Number of Disabilities per 1,000 persons	343.93	313.46	442.13	431.22	312.59	312.90	320.03	319.54

Table 3. Descriptive Statistics for Variables in Model

	All persons	Food desert only	Non-food desert only
<i>Fruit and Vegetable Consumption*</i>			
Five or more	.166	.155	.198
Less than 5	.834	.845	.802
<i>Food Desert Resident</i>			
Yes	.752	-----	-----
No	.248	-----	-----
<i>Demographics</i>			
Age (mean)	45.57	45.26	46.515
Sex			
Female	.540	.534	.561
Male	.460	.466	.439
Race*			
Nonhispanic black	.345	.341	.355
Other	.042	.036	.061
Nonhispanic white	.613	.623	.584
<i>Education*</i>			
Less than HS	.212	.222	.184
HS or equivalent	.348	.348	.344
Greater than HS	.440	.430	.472
Number of cases	3348	2482	866

* indicates significant difference between food desert and non-food desert respondents

Table 4. Odds Ratios of Consuming Five or More Servings of Fruits and Vegetables Per Day

	Model 1 (All persons)	Model 2 (Food desert only)	Model 3 (Non-food desert only)
<i>Food Desert Resident</i>			
Yes	.766*	-----	-----
No	ref	-----	-----
<i>Demographics</i>			
Age	1.010*	1.009*	1.012*
Sex			
Female	1.576*	1.623*	1.516*
Male	ref	ref	ref
Race			
Nonhispanic black	.937	.831	1.251
Other	1.257	1.649	.781
Nonhispanic white	ref	ref	ref
<i>Education</i>			
Less than HS	.852	.825	.885
HS or equivalent	ref	ref	ref
Greater than HS	1.469*	1.349*	1.798*
-2 Log Likelihood	3056.472	2209.764	838.415