Heterogeneity in the Hinterland: A Typological Analysis of Ohio Exurban Areas

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Short Abstract: Located between suburban and rural regions, exurban areas are among the fastest growing regions in the U.S. To better understand exurban changes and their policy implications, we develop a typology of rural-urban places and use statistical methods to examine township patterns of rural-urban change in Ohio.

Introduction

Substantial population growth in relatively rural areas adjacent to larger, urbanized areas over the last 30 years has been documented by a variety of sources (Nelson, 1999; Johnson, 1999; Olson and Lyson, 1999; Daniels and Bowers, 1997). The result is a complex mosaic of settlement and land-use that cannot easily be characterized as "rural" or "urban" and is increasingly labeled as exurban (Audirac, 1999; Nelson, 1992). Nelson (1992; 1999), a leading exurban researcher, characterizes the exurbs as an area of relatively low population density that begins at the edge of an urbanized areas and extends fifty or more miles from that edge. The pattern of exurban residential development can be sprawl-like, with a scattering of homes and businesses across the landscape with no apparent focal point (Lamb, 1983). Despite the perception that exurbia is an unorganized and "sprawl"-like, we attempt to identify some of the patterns of exurban settlement, land-use and change. To do this, we analyze a variety of demographic, social, economic, land-use, and agricultural data to characterize Ohio townships according to similarities and differences that exist in their current condition and recent patterns of changes. A central goal of this research is to identify the extent to which these variations among exurban locales is explained by their stage of development along the exurbanization continuum of rural to suburban vs. is due to other processes that make the distinctions among exurban locales more complex. In doing so, we hope to begin to anticipate some of the development trajectories that are likely to exist for exurban locales.

Exurbs and Exurbanization

A variety of descriptions and definitions of "exurban" have been offered to describe once rural areas that are undergoing changes associated with urbanizing influences. Because urbanization pressures are distance-dependent, a defining characteristic of exurban places is their geographical proximity to existing urban areas. Other characteristics are those factors that are most likely to undergo changes as a result of urbanization influences. These include increasing population and population density; increasing conversion of land from agriculture and other non-urban uses to new residential, industrial and commercial uses; declining agricultural or other natural resource based industries; changes in the socioeconomic characteristics of residents, including increasing median household incomes, an increasing number of residents employed in service and professional occupations, and increasing commute times; increasing housing values and local economic growth in non-traditional sectors, e.g., service related, professional, or industrial jobs; and changes in traditional social ties, including increasing conflicts between "old" and "new" residents and less homogeneity in terms of shared values and beliefs.

Some hypothesize that the exurbs are a "step" in the evolution of a place from rural to urban (Audriac, 1999; Pond and Yeates, 1993). Research related to this hypothesis has focused on determining whether differences exist between exurban and suburban residents in terms of their localities, preferences, and sociodemographic characteristics. Daniels (1999), Nelson (1992), and others assert that the exurbs differ in perceptible ways from suburbs in that they are more distant from core urban areas; have lower population densities; traditional rural industries (e.g. farming) remain central within the local economy; and the pattern of land uses exhibits more of a mix of large undivided parcels in rural uses with some smaller, land parcels in low density residential or other urban uses. Nelson (1992), Davis, et al. (1994), and others also argue that exurban residents are different from their suburban counterparts, placing more emphasis on "rural" values, including a rural landscape ethic, and less emphasis on public services

associated with urban areas. Davis et. al. (1994) found that exurbanites prefer rural amenities, large lots and longer drives to work. In a study of Sonomo County, California, Crump (2003) found households moving into exurban locales were strongly motivated by a desire to live in a rural environment while households moving into surburban locales were more often attracted by the co-set of housing, ease of commute and proximity to shopping. Demographically, though, Nelson and Sanchez (1999) found some differences between exurban and suburban households (e.g. household size, occupation mix, and commuting time) but there were also many similarities, such as the mean age of the head of the household, household median income, and housing budgets.

While assessing the differences between exurbs and suburbs, particularly in terms of the locational preferences of newcomers to both types of locales is an interesting planning question, there are also a number of relatively unexplored questions related to the differences that can exist between exurban locales. It is recognized that exurbia is not a homogeneous place (Audirac, 1999), but few have systematically explored the differences among exurban places.[1] While enumerating all of the different ways that exurban locales can vary from one another is not possible, we anticipate differences will exist among exurban locales across three distinctive dimensions that are relevant to managing changes and anticipating future changes of concern. These three dimension include, 1) stage of exurbanization as measured by population densities, amount of urbanization, and population growth; 2) economic and land-use characteristics of the locale—rural and urban; and 3) demographic and socioeconomic characteristics of the residents.

Stage of exurbanization

Exurbanization refers to the process whereby rural residential development is largely, although not exclusively, an outward movement of suburban and urban households maintaining jobs in the urban/suburban setting and typically, undergoing gradual

urbanization (Davis, Nelson and Dueker, 1994; Lamb, 1983). Because exurbanization is a process, it is clear that different locales that have exurban characteristics can be experiencing different rates of exurbanization. For instance, there may be a modest amount of residential development in a relatively undeveloped locale some distance from the edge of large urbanized area while another locale closer to that urban edge might be experiencing substantial residential, commercial, and industrial development closer to that edge. Pond and Yeates (1993) suggest there are five stages in the evolution of exurbia to suburbia, based on the ratio of actual urban land use to the amount of land indirectly influenced by an urbanized area. The outcome of this ratio is that at the earliest stages, the ratio is low because there has been little urban development and the ratio increases at later stages the amount of urban land conversion increases, but the amount of nonurban land indirectly influenced by urbanization increases. At the last stages, the ratio is once again low as most land is urbanized and little land remains that can be indirectly influenced by urbanized area.

Whether all land that begins the process of exurbanization is destined to become suburban is debatable (Audirac, 1999), models such as Pond and Yeates (1993) do indicate that if planning is to occur to manage the lower density character of exurbia, then it must occur at an earlier stage of the exurbanization process. Thus, one important consideration for any typological analysis of exurbia is to be able to characterize where an exurban locale is on the exurbanization continuum. Thus, factors such as population density, amount of urbanized land area, and the relative and net population growth of a locale must be considered to characterize a locale as at the early stages of exurbanization versus nearly fully developed into a suburb.

Economic and land-use characteristics

Not only can exurban locales vary according to their level of exurbanization, there can exist substantial variation in the dominant economic and land-use characteristics

within the locale. For example, the local economies of exurban locales can consist of extensive agriculture amidst modest residential development or it might consist of small, urban-oriented farms and a variety of industrial and commercial firms. Nelson (1990; and Nelson et al., 1995) identifies a pattern of manufacturing firms locating in exurban locales across the United States due to the availability of large tracts of land and reduced transportation costs. The result is that the growth of manufacturing employment in exurban areas substantially exceeds the changes in manufacturing employment in other areas. Nelson's work (1990; Nelson et al., 1995) does not focus on differences between exurban locales, but it might be expected variation in exurban locales in the extent to which manufacturing development has occurred.

In the case of agricultural characteristics, there have been a number of empirical analyses and more conceptual work done to delineate the diverse mixture of agricultural enterprises which might exist in an exurban locale (Lapping and Pfeffer, 1997; Ilbery, 1985). Lapping and Pfeffer (1997) suggest three general types of agricultural areas based on their observations of the metropolitan northeast. These types include regions marked by stability (including dairy farming, extensive grain production, and small ranching, and poultry), stability and change (diversified crop and livestock farming, with a decline in the number of very large farms), and transitional areas (with specialty farms, small-scale fruite, medium-sized grain farms, but an overall decline in total production). Their typology is formulated based on a key influence being population change. The extent to which other facets of the community are changing or diversifying are not considered.

Tying together the work related to manufacturing and agriculture, it may be possible to identify a more diverse array of exurban economic areas by looking at changes in the economy more broadly and not just within one specific sector, such as agriculture. Thus, not only might agriculture evolve due to residential and associated urban land growth, but also will evolve due to growth in the industrial or commercial sector. This is particularly true as many of these industrial and commercial firms require

substantial areas of land. The interplay of nonagricultural economic development in relation to agricultural development has not been examined, but may have different impacts than traditional residential development, particularly as agriculture might not have to deal with some of the concerns associated with nonfarm neighbors that has been found to be related to agricultural decline in some cases (Berry, 1978).

Demographic and socioeconomic characteristics

A final feature of exurban locales that might substantially vary are the socioeconomic characteristics of the residents. One natural set of difference that can exist in locales undergoing exurbanization are those associated with newcomers having different socioeconomic characteristics from the longtime residents. For instance, newcomers might have higher incomes or occupy higher status employment positions compared to longterm residents. Studies of change in exurbia as well as other rapid growth areas have found newcomers to be younger than longtime residents (Smith and Krannich, 2000; Stockdale et. al., 2000), more educated, and to have higher incomes (Smith and Krannich, 2000; Graber, 1974). Other research, though, suggests that newcomers to traditionally rural areas are not easily classified as a homogenous group (Sokolow, 1981; Davis et. al., 1994; Nelson, 1992). For example, studies of recent homebuyers in exurbia identify two general types of households: affluent with a primary wage earner employed in a white-collar job; and less affluent, with the primary wage earner in a blue collar occupation (Dueker et. al., 1983; Davis et. al., 1994). Neither of these latter two studies compared the newcomers with the long-time residents.

The ultimate mixture of resident socioeconomic characteristics will likely vary. For some characteristics, there might be more homogeneity, particularly for those locales at the earlier stages of exurbanization vs. those at the later stages of exurbanization. Further, the dominant characteristics of the population, such as predominantly farmers, agricultural workers, or other extractive industry employee or blue color versus white

collar might vary depending on the costs of local housing, proximity to different types of employment opportunities, and the local communities amenities.

The Multidimensionality of Exurbia

Putting this all together, we expect that significantly different types of exurban locales may exist as defined across the three dimensions described above. Further, we expect that there are likely to be correlations among these three dimensions. For example, a common type of exurban local might be an early stage exurb, with primarily agricultural activity, and a relatively homogenous local population employed in local businesses and farming activities versus a later stage exurb with a high proportion of commuters and a fair amount of variation in socioeconomic status of residents due to the intermixing of long-time rural residents and newer migrants from the suburbs.

The existence of significant differences across exurban communities may be a result of their current stage of exurbanizaiton. In this case, these exurban communities are ultimately on their way to be coming suburban (which also might have a variety of types). But it may also be that the combination of economic and residential characteristics of the exurbs will lead some toward their own destiny that is neither suburban or rural, but a combination of the two. If this is the case, identifying some of the characteristics of these locales and the differences across exurban areas not only increases our understanding of the evolution of places along the rural-urban continuum, but also aid in guiding policy and planning of exurban communities and rural-urban regions.

Data, Empirical Analysis, and Results

To explore the potential commonalities and differences across exurban locales, we use township level data from Ohio. Townships are a subcounty level of government in Ohio that encompasses the unincorporated areas of the state. Because they exclude

areas that are heavily urbanized, they provide a convenient unit of analysis for this study. Most of the data, including data on population, income, race, housing, employment, and commuting, are generated from the U.S. Census Bureau's "place remainder" level of geography for the year 2000. We augment these data with township land cover data, generated based on remotely sense images from the LandSat Thematic Mapper satellite circa 1992-93. In addition, geocoded data and a Geographic Information System are used to generate proximity measures, including the distance between each township centroid and the nearest urbanized area boundary, and the population of the nearest urbanized area.

In the following analysis, an empirical definition of exurban is first developed and then applied to the townships data to select a subset of exurban townships for Ohio. This exurban subset is further analyzed by examining the variations in the data associated with each of the three dimensions discussed above. Clusters of similar townships are identified for each of these three dimensions and the resulting clusters are mapped for each set of township characteristics. The spatial patterns reveal a number of interesting aspects of these clusters. Next, a typology is developed by combining the clusters that were generated for each separate dimension into "super clusters" that describe an exurban locale across all three dimensions. We look at the frequency with which these super clusters occur across all of the townships and identify the most dominant types of exurban townships and their features. By structuring these super clusters according to common features that they share, a hierarchical representation of these clusters is generated that aids in the identification of dominant township types.

Identifying Exurban Townships

Following other definitions of exurbia in the literature (e.g., Nelson 1992, 1999; Ponds and Yeates 1993), we begin by identifying exurban townships based on two characteristics: proximity to an urbanized area and the amount of existing urban

development relative to their total area. The latter is measured by population density and the percent of township land that is categorized as urban. In order to obtain a scalar measure of the variation across these three variables, principal components analysis is used to calculate a standardized "exurban score" that allows us to rank townships according to these characteristics. This score corresponds to the standardized values of the first principal component, which explains 71% of the variation of these three variables in our sample and has an eigenvalue of 2.13. In order to determine a minimum threshold value that qualifies a place as being exurban, we map the exurban score values by standard deviations above and below the mean (Map 1). This map clearly illustrates the pattern of the suburban-rural continuum in Ohio relative to urban centers in and around Ohio. Because we are interested in classifying a wide range of townships, including those that may not yet be perceived as being exurban, we apply a liberal minimum cut-off value to select a subset of exurban townships. Specifically, any township with an exurban score that is a half standard deviation below the mean or higher is selected as an exurban township. Of the 1,309 townships total, this yields a subset of 1,034 townships (79%).

Identifying Exurban Clusters

Given this subset of townships deemed to be exurban, a primary task is to identify whether they can be classified according to key characteristics that are hypothesized to vary across exurban locales. To do so successfully, correlations in key characteristics of these townships must exist such that they generate subsets of townships with similar values. Whether this is true or not is an empirical question. Cluster analysis is an appropriate method by which to explore correlations in the data and to assess whether the data exhibits natural groupings without specifying these groupings *apriori*. Cluster analysis uses a distance or dissimilarity criterion to partition observations into clusters such that observations within a given cluster are more similar to each other than they are

to observations contained in different clusters. A wide variety of clustering methods are available. They differ in a number of ways, most notably in the procedures used to assess similarity among observations and assign observations to distinct clusters and the criteria that are used to assess the goodness-of-fit of the clustering scheme.

We hypothesize that exurban townships will differ most significantly across three distinct dimensions: 1) the township's stage of exurbanization as measured by population densities, amount of urbanization, and population growth; 2) the rural and urban economic characteristics of a township; and 3) demographic and socioeconomic characteristics of the residents. Cluster analysis is used here to examine whether natural groupings of townships emerge for each of these three dimensions. In order to reduce the dimensionality of the data, we first use principal components analysis to reduce the number of variables used in the cluster analyses. Then, because of the size of our sample, two cluster routines are performed on the data. The first performs a preliminary grouping of observations into one hundred non-hierarchical clusters. The second performs a hierarchical clustering routine using the preliminary clusters identified by the first round. Ward's minimum variance method is used for this final clustering stage. This method calculates the distance between two clusters as the ANOVA sum of squares between the two clusters summed over all the variables. This method uses a hierarchical approach to join clusters such that larger clusters are comprised of smaller clusters and overlapping clusters are not possible. In each iteration, a larger cluster is formed from two smaller clusters by minimizing the within-cluster sum of squares over all possible partitions that result from merging two clusters together. In order to determine the final number of clusters that is appropriate, we use the cubic clustering criterion (CCC) and look for the smallest number of clusters that is associated with a CCC value of 2.0 or greater.

The first dimension that we explore is the township's stage of exurbanization, as defined by the township's existing level of urbanization and its rate of growth. We use the following variables at the township level to represent this dimension: population

density in 2000, distance from the township centroid to the nearest urbanized area boundary, proportion of urban land cover in the early 1990's, the proportion of houses built between 1990 and 2000, and the proportion of residents in 2000 that lived in county in 1995. The cluster analysis identified six clusters that vary in terms of their degree of urban and rate of urban growth. These six clusters, which are labeled stages 1-6 of exurban development, and the number of townships within each group are reported in Table 1. Map 2 displays the spatial arrangement of these clusters.

Exurban Development Cluster	**Count of Townships (% of Total)**	**Total Population (% of Total)**
Stage 1: Low urban, slow growth	354 (34.2%)	943,831
Stage 2: Low urban, above average growth	200 (19.3%)	502,407
Stage 3: Low urban, fast growth	131 (12.7%)	399,312
Stage 4: Medium urban, above average growth	101 (9.8%)	877,335
Stage 5: Medium urban, below average growth	203 (19.6%)	522,866
Stage 6: High urban, average growth	45 (4.3%)	301,504

Table 1: Exurban Development Clusters

The clustering analysis identified natural groupings of townships that correspond to stages of urban development along a continuum anchored by rural at one end and suburban at the other. As a township passes through these stages, it increases steadily in the amount of urban land use and population density (stages 1-6), while the rate of urban change increases initially (stages 1-3) and then decreases with increasing levels of urbanization (stages 4-5). Stage 6 corresponds to townships that have completed the exurbanization process and are most likely fully integrated into an existing urban area. Of the total 1,034 townships deemed to be exurban, approximately one-third are characterized as being in the first stage of exurbanization (low urban, slow growth). Townships at the beginning and ending stages of the exurbanization process—those at stages 2 and 5—comprise about one-fifth of the sample each. Townships in the middle of the exurbanization process (stages 3 and 4) make up just over one-fourth of the sample.

The spatial distribution of these townships correlates roughly with distance from an urban area (Map 2). Townships with higher amounts of urban (stages 5 and 6) are concentrated around existing urban areas. Faster growing townships with average or above average levels of urban (stages 3-4) are somewhat clustered around larger urban areas while faster growing townships with lower amount of urban (stage 2) are more widely distributed. However, this pattern is much more complex than approximate concentric rings around urban areas. Patterns of exurbanization are far from symmetric around urban centers, e.g. there are clear patterns of growth to the north of Columbus and east of Cincinnati. Of the three major metro areas (Cincinnati in the southwest, Columbus in the center, and Cleveland in the northeast), the Cleveland region has a much higher concentration of townships at the latter stages of exurbanization. Regions around smaller urban areas have a concentration of townships that are in the latter stage of exurbanization (stage 5), but do not appear to have concentrations of townships at earlier stages. These observations suggests that growth processes around smaller urban areas are different than those associated with larger urban areas and that the growth processes around large urban areas can influence surrounding regions in different ways. Lastly, we observe that some townships that are in the early or middle stages of exurbanization are located far from urban areas and do not appear to be associated with a urban distance gradient. This suggests that the process of exurbanization is not homogeneous and that there may be different mechanisms that spur exurban growth in areas located relatively far from urban areas vs. those that are adjacent to urban areas.

The second dimension for which cluster analysis was performed relates to the local economy and the mix of rural and urban economic characteristics that a township exhibits. The variables used to represent this dimension were divided into rural vs. urban characteristics and separate cluster analyses were run for each. The variables that describe the local urban economy include the proportion of residents employed in blue collar, wholesale, professional, and public sector jobs, all for the year 2000. The rural

economy is measured by the proportion of residents employed in agriculture in 2000, the proportion of township land cover in agriculture as of the early 1990's, and the proportion of residents who work in their county of residence in 2000. The cluster analysis identified four clusters for the urban economic characteristics and five clusters for the rural economic characteristics. Table 2 identifies these clusters and the total number of townships assigned to each group. Maps 3 and 4 displays the spatial arrangement of these clusters.[2]

Urban Economy Cluster	**Count of Townships**
Type 1. High percent of professional, public sector, and wholesale employees	202 (19.5%)
Type 2. High percent of professional and public sector employees only	292 (28.2%)
Type 3. High percent of wholesale employees only	265 (25.6%)
Type 4. High percent of blue collar employees	275 (26.6%)
Rural Economy Cluster	
Type 1. High level of agriculture, high percent of residents working in county	223 (21.6%)
Type 2. High level of agriculture, low percent of residents working in county	256 (24.6%)
Type 3. Low-med level of agriculture, high percent of residents working in county	119 (11.5%)
Type 4. Low level of agriculture, med-high percent of residents working in county	243 (23.5%)
Type 5. Low level of agriculture, low percent of residents working in county	193 (18.7%)

Table 2: Urban and Rural Economic Clusters

The number of urban (non-agricultural) economic clusters is roughly equal across the sample, with townships with a high percent of employees in professional and public sector jobs making up the single largest component (28%). The two largest clusters along the rural economic dimension are strong agricultural townships with a more dependent economic base (Type 2) and weak agricultural townships that are more

economically independent (Type 4). Weaker agricultural townships that are economically more independent (Type 3) make up the smallest rural economic component.

The spatial distribution of these two types of clusters reveals some interesting patterns. Townships that are more economically dependent (Types 2 and 5 of the rural economic clusters) are concentrated around the larger urban areas (Map 4), suggesting that these townships are to some extent part of larger regional economies centered around these larger urban areas. Dependent townships with strong agriculture are particularly prevalent in central Ohio around the Columbus metro area, whereas non-agricultural, dependent townships dominate the northeast area around Cleveland and a mix of agricultural and non-agricultural dependent townships surround Cincinnati. Dependent townships with strong agriculture are a particularly interesting case that raises the question of how rural vs. urban economic forces are playing out in these areas. To what extent are these forces in competition, and thus leading to farmland conversion and conflicts between farmers and non-farmers, vs. complementary, e.g. due to adaptation undertaken by farmers in these areas to capitalize on proximate urban areas? Unfortunately our data is not detailed enough to distinguish these various underlying processes. Economically dependent townships are also scattered in regions that are not adjacent to urban areas, suggesting that these townships may be in rural economic decline. Townships with independent economies are located in areas further from urban centers and, in some cases, in areas that are directly adjacent to urban centers. Economically independent townships that are directly adjacent to urban areas have most likely been fully integrated into these urban economies and are most likely no longer exurban in nature.

The spatial distribution of the urban employment characteristics (Map 3) reveals broad regional differences in the economic base of places, e.g., there are concentrations of townships with high proportions of either blue collar or wholesale employees in the

northeast and northwest. Townships with high proportions of professional and public sector jobs, as well as those with additional high concentrations of wholesale employees, are clustered around urban areas. In addition, there are substantial clusters of townships with high proportions of public sector employees located in the south and southeast regions.

The third dimension for which cluster analysis was performed describes the demographic and socioeconomic characteristics of the township populations. Variables that were used to represent this dimension include average household income (which is collinear with the proportion of households in poverty) in 2000, the proportion of the population with a post-high school degree in 2000, and the proportion of the population that was nonwhite in 2000. The cluster analysis identified six clusters that describe varying combinations of education and income (which vary together) and nonwhite population. Table 3 reports these clusters along with the total number of townships assigned to each group and Map 5 displays the spatial arrangement of these clusters.[3]

Socioeconomic Cluster	**Count of Townships**
1. Med-high education & income, high proportion non-white	50 (4.5%)
2. High education & income, ave. proportion non-white	111 (10.7%)
3. Low education & income, ave. proportion non-white	85 (8.2%)
4. Low-med education & income, med-high proportion non-white	152 (14.7%)
5. Low education & income, low proportion non-white	390 (37.7%)
6. Med-high education & income, low proportion non-white	246 (23.8%)

Table 3: Socioeconomic Clusters

The socioeconomic cluster with the largest number of townships is characterized by low average income and education levels and a low proportion of nonwhite population

(Type 5). Townships with higher levels of income and education, but a low percentage of nonwhite population comprise the second largest cluster (Type 6). Townships with higher levels of income, education, and percent of nonwhite population make up the smallest cluster (Type 1). Turning to the spatial distribution of these clusters (Map 5), we find that townships with higher levels of income and education are largely clustered around urban areas and, to some extent, distributed throughout the western portion of the state. This pattern seems to follow interstate corridors to some extent. Higher proportions of nonwhite populations are concentrated around urban areas and are also found in some rural regions, with a noticeable concentration in the southeast.

In summary, the cluster analyses of townships along these three dimensions reveal interesting patterns. Many of the characteristics associated with urbanizing areas are spatially distributed in an expected pattern around the urban areas. For example, we find concentrations of fast-growing, economically dependent townships that have a higher proportion of residents employed in professional, public sector, or wholesale jobs located in the regions surrounding large urban areas. Noticeable patterns in areas located further from urban centers and unexpected patterns around urban areas also emerged. For example, townships with a strong agricultural base were found not only in the outlying areas of the state, but also concentrated in central Ohio around the Columbus metropolitan area. Concentrations of higher urban, slower growth townships were found around smaller urban areas, but concentrations of lower urban, faster-growth townships were not. Patterns of higher income townships were not limited to areas proximate to urban centers, but were also distributed throughout more rural areas, particularly in the northwest of the state, which also has higher concentrations of strong agricultural townships.

While this analysis reveals some interesting trends within each of the dimensions that are used to characterize townships, it does not reveal the extent to which variations within one dimension correspond to variations in another dimension. We are also

interested in examining the extent to which clusters defined along these three separate dimensions correlate with each other. Just based on visual inspection of the maps, the economic and demographic/socioeconomic cluster patterns appear to be somewhat correlated with the pattern exhibited by the stage of exurbanization clusters. In the next section, we examine these correlations more closely and use the results from this exercise to determine whether particularly combinations of clusters across these three dimensions are most dominant.

Dominant Exurban Types

The cluster analysis performed for each of the three dimensions can also be used to identify particular combinations of features across these three dimensions that are the most common among townships. In theory, combining the clusters defined along the different dimensions that are shown in Maps 2-5 implies a total of 6x4x4x4 (384) possible "super clusters" of townships that capture the combined variations across all of these dimensions. Of course some of the combinations that are possible in theory will not be observed and many will just be observed for one or a few townships. To investigate which combinations of clusters are more prevalent, we identify the most common "super clusters" by calculating the frequency of each super cluster among the 1,034 exurban townships and select the top 50 as ranked by their frequency of occurrence. Then, to determine whether dominant types exist at higher levels of typology (i.e., as defined along only one or two dimensions rather than all three), we group these super clusters according to their common elements. The result is a table (Table 6) that represents a hierarchical tree-structure exhibited by the super clusters, which reveals the frequency of particular combinations of attributes at multiple levels (i.e., across one, two, and multiple dimensions).

Combining the cluster analyses for the urban growth, rural economic, urban economic, and demographic/socioeconomic dimensions yielded 250 unique combinations

or super clusters. Of these super clusters, 67% occurred in five or fewer townships, 22% occurred in 5-10 townships, 10% occurred in 10-20 townships and less than 1% occurred in 20 or more townships. A total of 348 townships are classified by the top 50 super clusters—therefore approximately one-third of the townships in our sample exhibit a particular combination of urban, economic, and demographic/socioeconomic characteristics that is a relatively common grouping. Of these top 50, the top ranked super cluster occurred in 29 townships and the lowest ranked in seven townships. Because there are very few super clusters that contain a substantial number of townships, it would appear that there are no dominant townships. To better identify possible dominant types, we restructure the super clusters based on characteristics that are common across more than one super cluster. The result is a hierarchical tree representation of the super clusters that more clearly illustrates the dominant characteristics and their frequency (Table 6).

Table 6 reveals a number of notable characteristics of the most common township types, as represented by these super clusters. First and foremost, it illustrates the multitude of relationships across the urban growth, economic, and demographic/socioeconomic dimensions. Each stage of exurbanization is associated with a range of economic and demographic characteristics and each combination of higher level variables (e.g., exurbanization stage and household income) is associated with multiple combinations of lower level variables (e.g., weak and strong agriculture, low and high percentages of residents that work in the county, and various concentrations of urban employment). This complex structure suggests that the heterogeneity exhibited by these exurban locales extends far beyond what can be accurately represented by a unidimensional categorization corresponding to the six stages of exurbanization.

Level 1	Level 2	Level 3	Level 4	Level 5	Township Count
Low urban; slow growth; low % of nonwhite population	Below average income levels	Higher %of residents work in county	Strong agriculture	Higher %blue collar employees	24
				Higher %wholesale employees	29
				Higher %prof & public employees	7
			Weak agriculture	Higher %blue collar employees	11
				Higher %prof & public employees	15
				Higher %prof, public, & wholesale employees	7
		Lower %of residents work in county	Strong agriculture	Higher %blue collar employees	17
				Higher %wholesale employees	13
				Higher %prof & public employees	7
	Above average income levels	Higher %of residents work in county	Strong agriculture	Higher %blue collar employees	9
				Higher %prof & public employees	16
			Weak agriculture	Higher %wholesale employees	8
				Higher %prof & public employees	7
Lower urban; faster growth	Below average income levels; low % of nonwhite population	Strong agriculture	Higher %of residents work in county	Higher %wholesale employees	8
			Lower %of residents work in county	Higher %blue collar employees	21
				Higher %wholesale employees	32
				Higher %prof, public, & wholesale employees	10
	Above average income levels	Lower %of residents work in county	Strong agriculture	Higher %prof & public employees; low % nonwhite population	9
				Higher %prof, public, & wholesale employees; higher % nonwhite population	7
			Weak agriculture	Higher %prof, public, & wholesale employees; higher % nonwhite population	8
Higher urban; slower growth	Weak agriculture	Higher %of residents work in county	Above average income levels	Higher %prof, public, & wholesale employees	27
				Higher %prof, public, & wholesale employees	10
				Higher %blue collar employees	8
			Below average income levels	Higher %blue collar employees	8
				Higher %wholesale employees	11
				Higher %prof, public, & wholesale employees	19

Table 6: Hierarchical Structure of Top 50, Most Common "Super Clusters"

Even though a substantial amount of heterogeneity is exhibited among these top ranked types, some stand out as being more dominant than others. There is a large cluster of townships that are characterized by low urban levels and growth and a low proportion of nonwhite population. Of the exurban townships that are characterized by low urban/slow growth, 170 townships have these features. Within this cluster, a substantial proportion (93 townships) are characterized by lower income levels and a high percent of residents that work in the county. These combined features describe a group of townships that are the most rural of the exurban townships under consideration. Within this group, there is variation in the types of jobs that residents have and in the extent to which agriculture is a defining characteristic of the township. A smaller proportion of townships that are characterized by low urban levels and growth and a low proportion of nonwhite population also have a low proportion of residents that work within the county (37 townships). Interestingly, all of these townships also have a strong agricultural base. Given the dominant rural features of these townships, these townships are not likely to be part of a neighboring urban economic base, but rather are more isolated townships that risk being in rural decline. Not all low urban/slow growth townships are low income communities however. Of the low urban/slow growth townships considered here, 40 are typed as higher income. Of these, the largest clustering is of townships with a strong agricultural base and a high percentage of professional and public employees. Therefore, even though the general trend is that it is the more urban and faster growth places that have high proportions of their residents in professional and public sector jobs, there is a subset of more rural places that also have these features. It is likely that some of these more rural places contain sizeable towns that may be the seat of a county or local government or that may be the home of state or federal institutions (e.g., prisons).

Another dominant type of township are the low urban, fast-growing, lower income townships with a strong agricultural base and a low proportion of residents that work within the county. Of the townships identified as low urban/fast growth places, 63

have these particular features. Of these 63 townships, over half have a high proportion of employees in wholesale jobs. The rural features, fast pace of growth, and the degree of economic dependence of these places suggest that these are places that are at the threshold of a strong exurbanization phase and are likely to experience substantial changes over an extended period of time. A smaller proportion of these low urban/fast-growing, economic dependent townships have higher income levels. Of these, all have a high proportion of employees in professional and public sector jobs; some also have a strong agricultural base and/or a higher proportion of employees in wholesale jobs. In comparison to the other low urban/fast growth/economic dependent cluster, the presence of more higher income residents with a higher percent employed in professional and public sector jobs suggests that there are at least two different types of economic growth processes in these exurban areas: growth with lower paying, lower skilled jobs and growth with better paying, higher skilled jobs. Given that both types occur in areas characterized by the same levels of urbanization, growth, economic dependence, and agricultural base it is not clear based on this analysis what factors determine the type of growth that occurs in an exurban locale.

A dominant type of township for those townships at the latter stage of exurbanization (higher urban/slower growth) are non-agricultural townships with a high percentage of residents that work in the county and that are employed in professional, public sector, or wholesale jobs. Of the townships that are characterized as being in this stage of exurbanization, 67 exhibit these features and of these, slightly more than half are typed as higher income. The clustering of both higher and lower income townships in this broader group is consistent with our earlier observations on the differing types of growth that appeared to be associated with exurban townships. In this case, while there appears to be some convergence in townships at the latter stage of the exurbanization process in terms of jobs in which a high proportion of residents are employed, there does not appear to be a convergence in terms of income levels. In this analysis of the top 50

types of townships, the number of higher urban/slower growth townships split across low vs. high income groups is roughly equal.

In summary, the analysis of these top ranked super clusters reveals at least seven dominant types of exurban locales:

1. Largely rural, slow growth, economically independent townships with lower incomes and racially homogeneous populations that vary in terms of their agricultural base and mix of non-agricultural employment.
2. Largely rural, slow growth, economically dependent townships with lower incomes and racially homogeneous populations that have a strong agricultural base, but appear to be in risk of rural decline.
3. Largely rural, slow growth, economically independent townships that have a racially homogeneous populations and a higher percentage of residents employed in professional or public sector jobs.
4. Low urban, fast-growing, economically dependent townships that have a lower income levels, a strong agricultural base, and a higher percentage of residents employed in blue collar and wholesale jobs.
5. Low urban, fast-growing, economically dependent townships that have a higher income levels with a higher percentage of residents employed in professional, public sector, and wholesale jobs.
6. Higher urban, slow growth, non-agricultural, economically independent townships with lower incomes and a higher percentage of residents employed in professional, public sector, or wholesale jobs.
7. Higher urban, slow growth, non-agricultural, economically independent townships with higher incomes and a higher percentage of residents employed in professional, public sector, or wholesale jobs.

Conclusions

The analysis of exurban townships in Ohio reveals a number of trends across urban, economic, and socioeconomic/demographic dimensions that are consistent with the stages of exurbanization. Low urban, slow growth townships are found to have a predominance of typical rural characteristics, including homogeneous populations, lower incomes, and higher proportions of residents employed in agricultural, blue collar, and wholesale jobs. Townships at the beginning stages of high exurban growth are found to have predominantly dependent economies with a high percentage of residents that work outside of their county and are clustered around the major metropolitan areas. Townships at the latter stages of exurbanization that have higher population densities and amounts of urban land cover are predominantly non-agricultural with a high percentage of residents working in professional, public sector, or wholesale jobs. However, the analysis also reveals that the economic and demographic/socioeconomic characteristics can vary quite widely among townships that are in the same exurbanization development stage. For example, dominant types associated with low urban, fast growing townships were found to vary in terms of the job mix and strength of the township's agricultural base. We also found that townships in the latter stages of the exurbanization process may exhibit convergence in some features (e.g., job mix), but not in others (e.g., income levels). At a minimum, this suggests that there are multiple sub-types within each of these stages of exurbanization and that simply typing exurban locales by their stage in the urbanization process and location relative to urban areas is insufficient for capturing the distinctions that exist among them. Additionally, this complexity suggests that there may be different trajectories of exurban change that are distinguished by variations across dimensions other than the locale's stage of development, e.g., in terms of employment base, agricultural base, and socioeconomic features. In this case, exurban locales may evolve in different ways into communities that may exhibit similar levels of urbanization, but that are fundamentally different in other ways.

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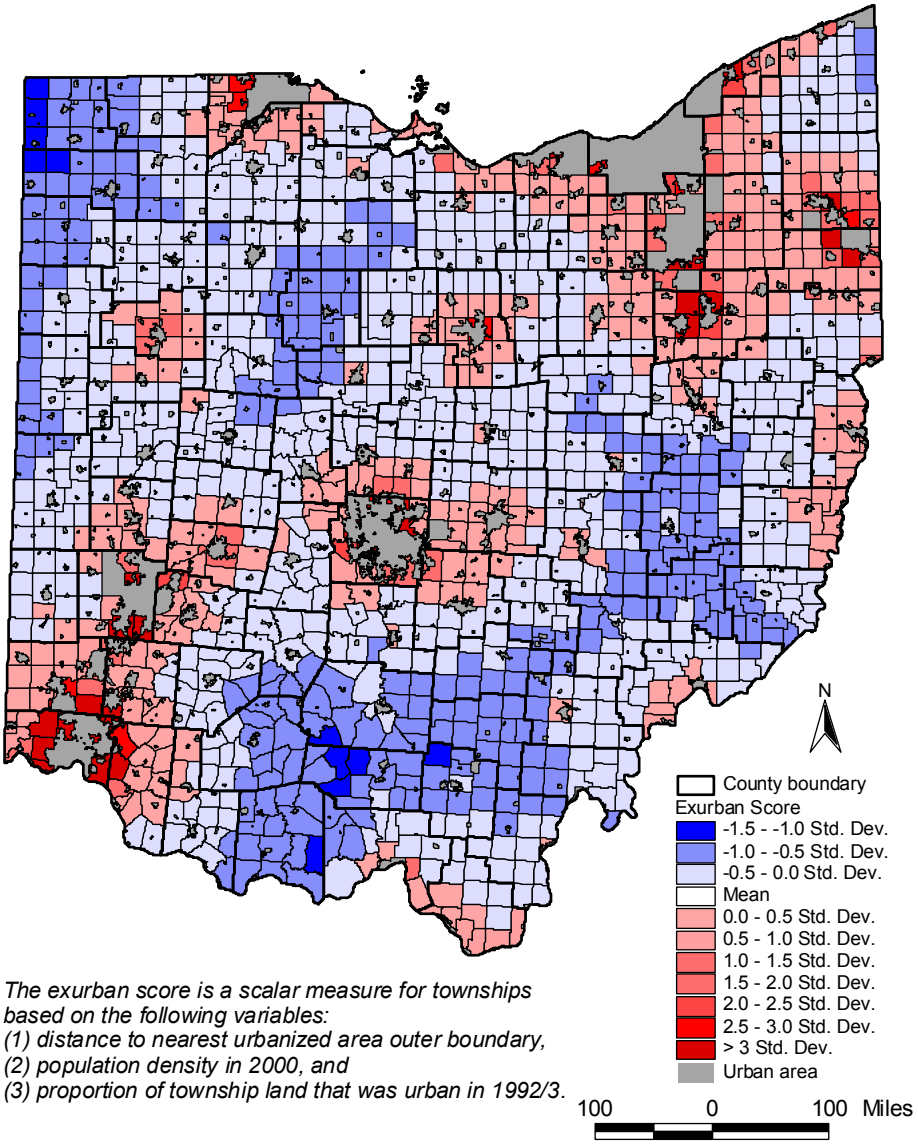
Map 1

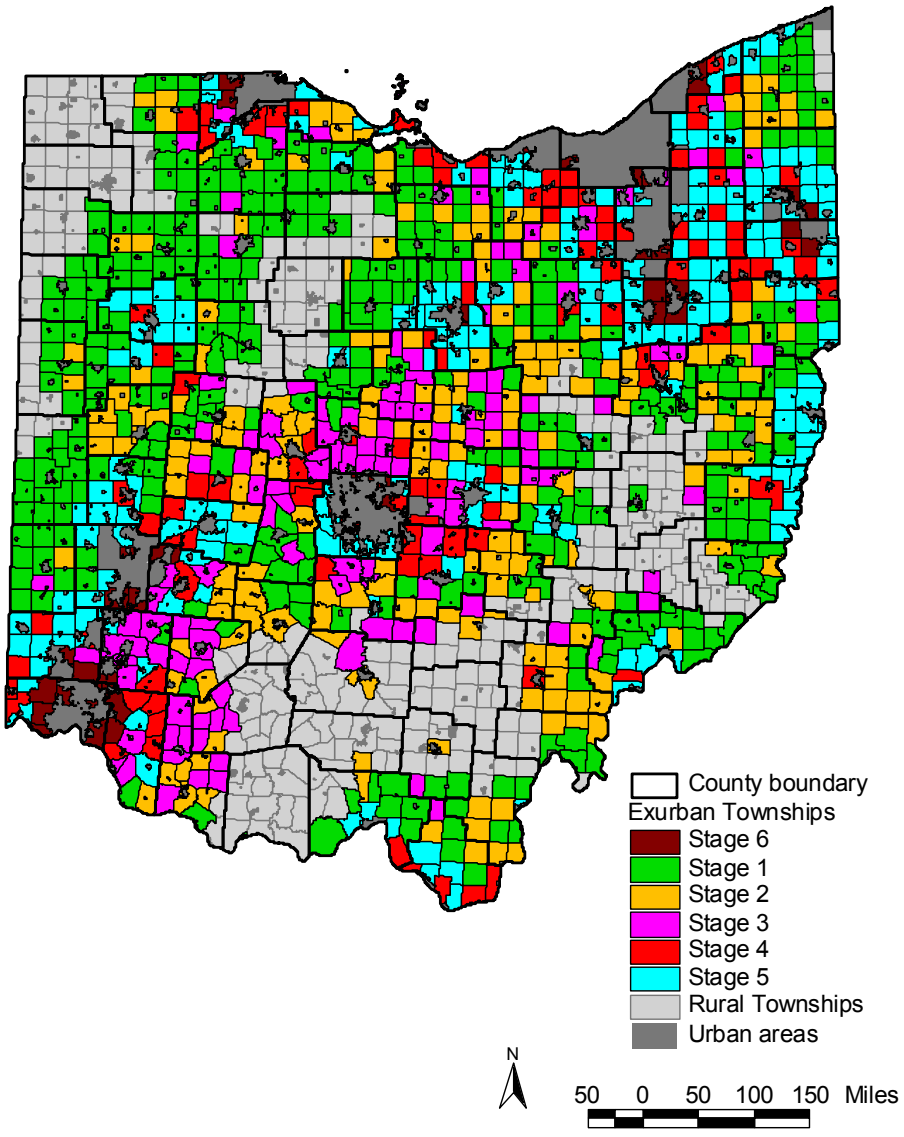
Suburban-Exurban-Rural Continuum for Ohio Townships



The exurban score is a scalar measure for townships based on the following variables:
(1) distance to nearest urbanized area outer boundary,
(2) population density in 2000, and
(3) proportion of township land that was urban in 1992/3.

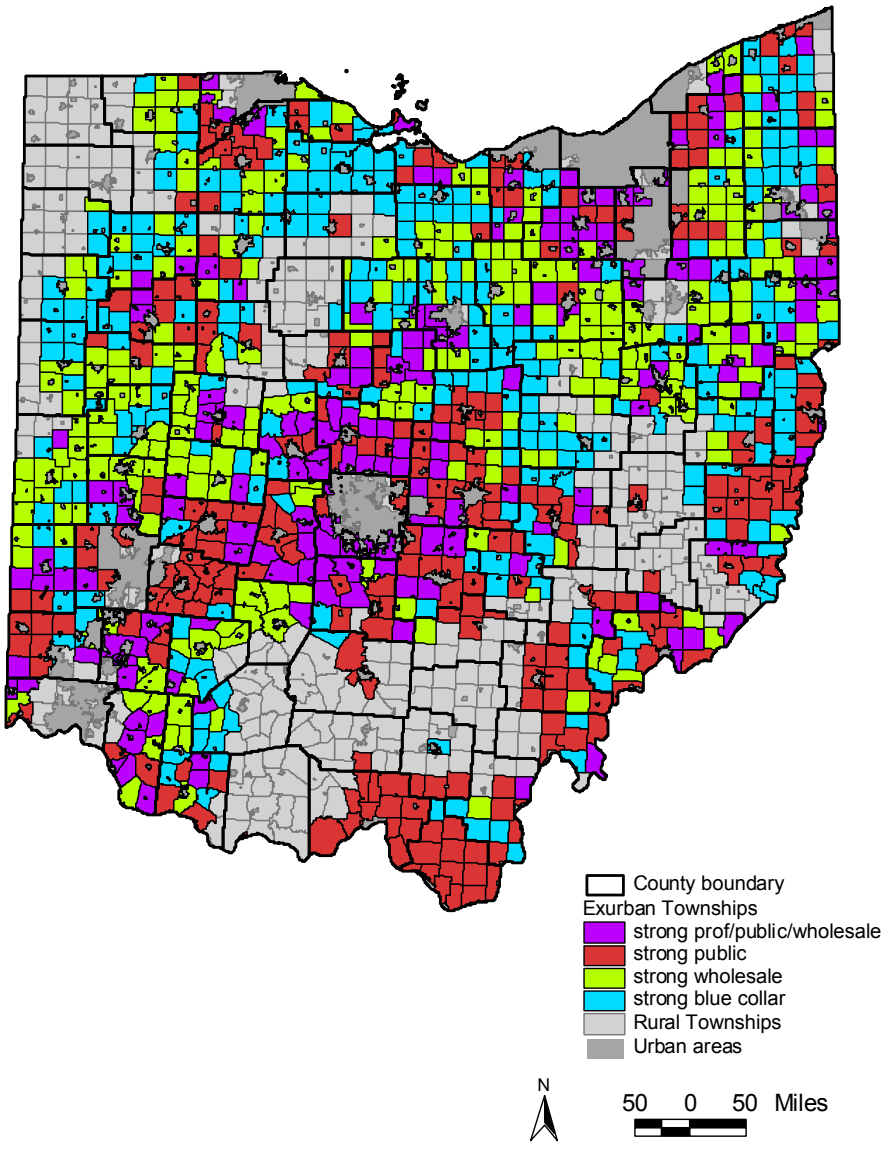
Map 2

Stage of Exurban Development



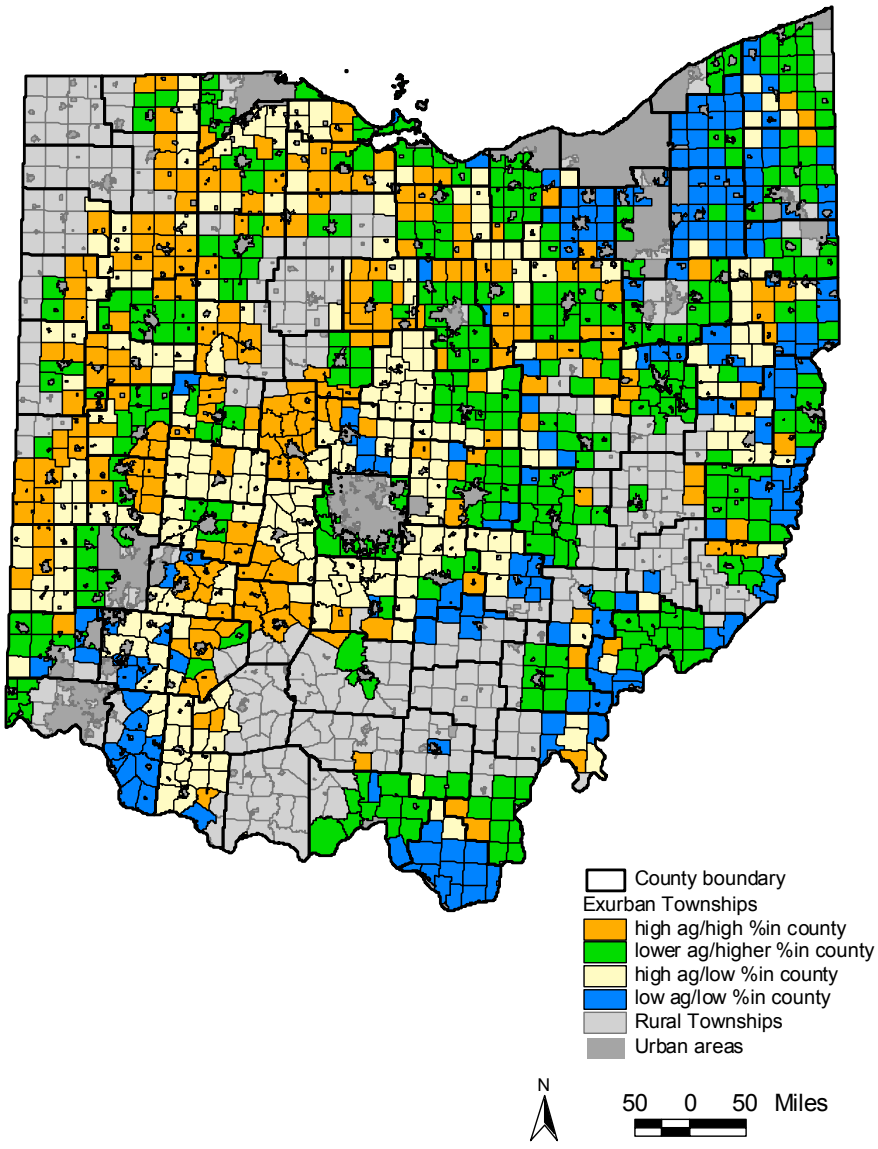
Map 3

Urban Economic Clusters



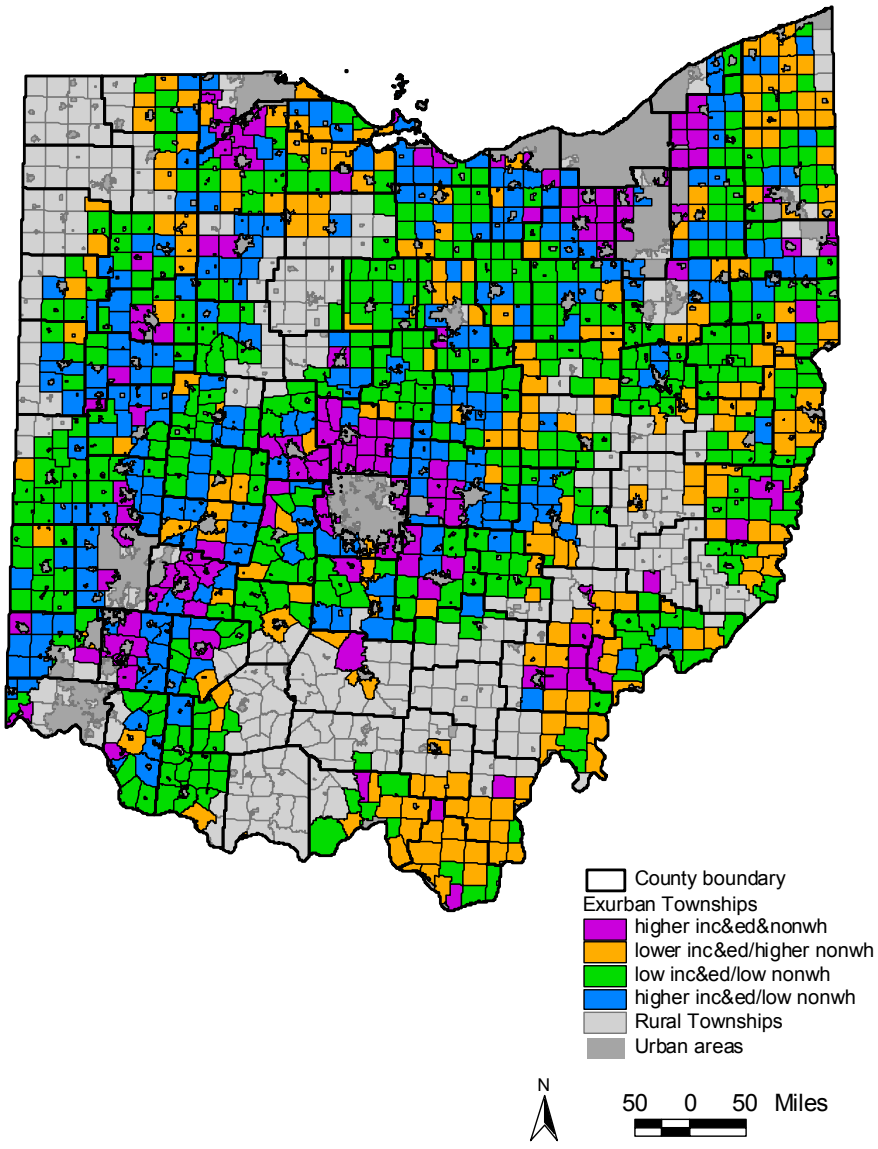
Map 4

Rural Economic Clusters



Map 5

Socioeconomic Clusters



[1] An exception is Davis, Nelson, and Dueker (1994), who compare residents of exurban small towns with residents of unincorporated areas and find significant differences.

[2] Map 4 is based on a slight consolidation of the rural economic clusters that combines clusters 3 and 4 into one cluster characterized by low-medium agriculture and medium-high proportion of residents working in the same county where they live.

[3] Map 5 is based on a consolidation of the urban economic clusters that combines clusters 1 and 2 into one cluster characterized by medium-high education/income and medium-high nonwhite proportion and that combines clusters 3 and 4 into one cluster characterized by low-medium education/income and medium-high nonwhite proportion.