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Growth and Decline: A Typology for Understanding Patterns of Population and Economic Change in Rural Texas Counties.

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Growth and Decline: A Typology for Understanding Patterns of Population and Economic Change in Rural Texas Counties.

by

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Dissertation

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Dedication

This dissertation is dedicated to David, in appreciation of his love and support, and to those who appreciate the beauty found in rural America.

Acknowledgements

As with many endeavors, this dissertation cannot be credited to just one person but instead came about due to the support given to me by others. First, I would like to thank David for his encouragement and support. From the first day of the program to the last final moments, he has always had faith in my abilities.

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Growth and Decline: A Typology for Understanding Patterns of Population and Economic Change in Rural Texas Counties.

Donna Marie Aguiniga, Ph.D.

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This study developed a new typology to better understand patterns of change in rural counties. A cluster analysis was performed to group rural Texas counties by the population percent change and per capita personal income percent change that occurred between the years 2000 and 2007. A stable five-cluster solution was selected as the most appropriate. The clusters were described as Declining Population/Stable Economy, Growing Population/Growing Economy, Declining Population/Growing Economy, Growing Population/Stable Economy, and Declining Population/Declining Economy based on the means of the cluster variates. The clusters were then profiled to determine how they differed on a series of identified factors that have been found in the literature to affect population and economic growth in rural areas. Clusters were found to differ on net migration, foreign born migration, race/ethnicity of residents, percentage of commuters, economic dependence status, and number of two and four-year education institutions. Generated maps of the clusters revealed that bordering a neighboring state or country may play a role in a county's population and economic growth; thus, it is recommended

that additional attention needs to be given to understanding and facilitating cross border collaborations. Recommendations were also made for community development efforts to focus on improving educational access in rural counties and developing services to draw in foreign born immigrants.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1: INTRODUCTION

Rural America is changing as counties experience population and/or economic growth or decline. Many rural counties are facing problems as they struggle to adapt their population and economic development to the trends in American society. Between 1990 and 2000, approximately 71 percent of rural counties (1,451 counties) gained population; however, almost one-third of those counties have lost population since 2000 (Johnson, 2006). In addition to population changes, many rural counties have faced new economic challenges as they have gained or lost industries, including those related to retirement, tourism-based, or manufacturing companies. How well counties are able to capitalize on their assets and overcome any perceived deficiencies, such as limited natural amenities, may ultimately help determine their ability to thrive in modern society.

Yenerall (1999) discusses three types of changing rural communities: 1) *declining* towns with an aging populace and an outmigration of younger residents; 2) e*xpanding* towns, which have an influx of new residents; and 3) *stable* towns, which have maintained a steady population. While this categorization provides a quick way to classify rural communities, it is merely a starting point for understanding patterns of change. There needs to be a greater understanding of why communities have divergent population trends and different levels of economic growth or decline. Is there something unique about those counties which register growth or decline in their population or which show marked economic prosperity or loss? The focus of this study will be on trying to discern the intersection between population and economics and the underlying factors within counties that may be linked to growth or decline.

Problem Statement

Changing Rural Communities

Many rural communities are disappearing due to the migration of residents to urban environments, the declining birthrate in rural areas, and the aging and eventual death of older residents. Other communities are recovering as people either retire to the countryside, move to technically rural “edge communities” which reside on the outskirts of metropolitan areas or follow the construction of prisons and industry (Johnson & Beale, 1995; 1998).

Those communities that are expanding tend to have desirable attributes, such as close proximity to larger metropolitan areas or abundant natural amenities, which appeal to newcomers. However, for towns without these attributes, the future is not as bright. These communities must find ways to maintain their population while attracting new people seeking to relocate to a rural setting.

> While stagnant population growth keeps some rural communities from thriving, actual out-migration creates a devastating downward spiral of problems for others. . . .Communities in population decline also struggle to maintain social, recreational and other quality-of-life services and opportunities for its residents. Most people want to live and work in communities with a decent quality of life (W.K. Kellogg Foundation, 2004).

One factor that has caused significant upheaval is the decline in the traditional occupations associated with rural life (Cromartie, 1998; Murray & Dunn, 1996). The number of people associated with agriculture, the historical mainstay of rural communities, has been greatly reduced; whereas in 1900, 43 percent of employed persons worked in agriculture, by the year 2000, only 1.6 percent of the American workforce was employed in agriculture (Dimitri, Effland, & Conklin, 2005). A similar falling off has been reported in extraction-based industries such as lumber and mining (Cromartie, 1998, Johnson, 2006). For both farming and the extraction-based industries, consolidation and mechanization have contributed to the loss of jobs as fewer people are needed to work. The problem of lost career options faced by many rural American communities is compounded by intergenerational and high poverty (Beale, 2004; Joliff, 2004).

An associated trend of decline and loss has occurred with the population of rural communities. While not the sole reason rural population has occurred, the loss of economic resources provided by agriculture and other land-based industries has led to the flight of rural residents to urban settings. In addition to their immediate economic concerns, many rural communities are facing a dramatic decline in the youth among their resident populations. This is a two-pronged problem. First is an aging rural population caused by many older Americans either continuing to reside in their rural communities as they grow older or moving to a rural community in their retirement (though for many communities, this in-migration of retirees increases the population) (Johnson, 2006; McLaughin & Jensen, 1998). Second, many of the younger residents of rural communities find themselves moving away from the community for either educational or career opportunities (Johnson, 2006; Smith-Mello, 1996)

Boomtowns

As previously mentioned, there are some rural communities that have reported growth and appear to be prospering over the last decade or so. Some of these growth communities are boomtowns, communities with rapidly increasing populations often due to increased demands for energy production (e.g., oil towns). Other rural communities that have experienced growth, often quickly enough to also be known as boomtowns, are areas with high natural amenities (Beyers & Nelson, 2000; Cromartie, 1998, McGranahan, 1999) and retirement and tourist communities (Johnson, 2006; Reeder & Brown, 2005).

Boomtowns frequently face significant strain on their social services and find themselves vulnerable to a changing economic market or limited availability of natural resources (Davenport & Davenport, 2005). As new residents move in, an associated rise in living costs may become prohibitive to longtime residents; oftentimes, housing prices and local taxes rise (Reeder & Brown, 2005). Despite the possible challenges, there are many boomtown communities which absorb the new residents and increase in economic power and move onto a new state of development and prosperity.

Inadequate Community Development Models

Compounding the issue of growth and decline in rural communities is the inadequacy of current community development models. A review of two current models, Community Economic Development and Asset Building Community Development, illustrates the limitations inherent in both models when planning development efforts in rural areas.

Community Economic Development

Community Economic Development (CED) is a model for implementing development in communities and neighborhoods which lack economic resources. It is a "strategy for intervening and taking responsibility within a community," which builds off of the knowledge of the residents and agencies active in the community (Champagne, 2005, p. 3). CED takes into account the fact that external forces impact the course of a community and that change is a collective process, to be undertaken by the community as a whole rather than an individual leader or agency (Champagne, 2005; Keane, 1990). Simon (2001) portrays CED as a model focused on creating opportunities for low-income residents in which non-governmental organizations play a significant role. CED defines community by residence with an emphasis on geographic place and boundaries.

CED emphasizes the meeting of local needs through the development of local resources. CED differs from other community development models in its provision of four specific benefits to communities (Simon, 2001, p. 66-79). The first characteristic is that benefits of the community development must be directly accessible to residents (e.g.,, reduced tax , job opportunities). The second benefit is the links which are built between local businesses and/or organizations. The development of increased social capital, through the formation of these relationships between agencies and businesses, is a desired outcome of these links (Champagne, 2005). The new inter-group networks will ultimately provide further impetus to development initiatives. Simon (2001) and Keane (1990) both recognize the import given by CED on reducing the negative environmental impact of development on the local community. This directly benefits the community as development is not undertaken for development's sake but attention is instead given to quality-of-life issues of residents. CED desires sustainable development that will not destroy a community's resources and leave it in a more vulnerable position later down the road (Champagne, 2005). Finally, CED emphasizes "a stable, independent community structure" (Simon, 2001, p. 72). The development model recognizes that locally owned businesses aid in the community's survival as they are more likely to reinvest in the community and less likely to depart in times of brief economic downturns. Residential control of resources means that communities are not as subject to the whims of outside forces.

A downside to the CED model is that it may result in a closing off of communities from their neighbors. Simon (2001) writes that communities competing for the same resources may not view each other as potential allies and oftentimes communities do not look to see what resources they have to offer each other. Because of the myopic view communities may have, they may plan their development without considering the needs of their neighborhoods or the impact of the development on their neighbors' functioning. Some CED communities may reject development which does not fit in with desired plans, often to the detriment of those in need (Simon, 2001). For example, if a community has determined a certain direction for its development, they may reject low-income or multi-family housing or the building of group home facilities as unsuitable.

Asset Building Community Development

Another popular model of development is asset building. Asset building posits that every community has the necessary components for development (Beaulieu, 2002;

Kretzmann & McKnight, 1993; Scales & Streeter, 2001). Its goal is to use asset building and identification to discover these existent resources. Because the emphasis is on identifying community held assets, development needs to be locally driven (Beaulieu, 2002; Kretzmann & McKnight, 1993; Scales & Streeter, 2001). There is an emphasis on relationships in this model. The key is to build networks between individuals, groups, businesses and organizations. For this relationship building to occur, good communication is vital (Beaulieu, 2002).

Kretzmann and McKnight (1993) believe that attempting to drive development from the outside is less likely to succeed for several reasons. Overall, there is decreased buy-in to the development project from locals. Outsiders attempting to implement a project may not possess the necessary clout (social capital) to accomplish the goals. Furthermore, development projects from the outside may not mesh with the residents' goals for the community. Without the input and energy from local residents, development attempts are unlikely to maintain their momentum. In addition to being locally driven, the asset building development model stresses the importance of inclusiveness of all community members. Community development/ improvements cannot truly happen unless all parts of the community are involved (Beaulieu, 2002).

The asset building model contends that problem identification is counterproductive to successful development in a community (Beaulieu, 2002; Kretzmann & McKnight, 1993). Identifying problems leads to an emphasis on the community's needs, which can lead to a negative impact on both residents' and outsiders' perceptions of the community. Trying to solve the identified needs can become a neverending task in which community agencies and initiatives get bogged down. Agencies take a dominant role in service provision and people become "consumers" of problem-solving organizations (Beaulieu, 2002). This disempowers community residents and leaves them vulnerable to the whims of agencies and funding streams. In an attempt to solve the needs, they are often addressed in a fragmented manner (Beaulieu, 2002; Kretzmann & McKnight, 1993). Instead of becoming opportunities for community growth and innovation, old solutions to old problems are applied again and again. Community needs are shuffled back to traditional institutions for them to handle (Beaulieu, 2002). For example, concerns regarding education are handled by the school board, while problems with crime are shunted to the police. This treats the needs as existing in an independent state to each other when in reality a link may exist between them.

The asset building development model thus focuses attention on "strengths, assets and capacities" inherent to every community (Scales & Streeter, 2001). In rural communities, these strengths, assets and capacities may take the shape of voluntary associations, the strong networks of both formal and informal relationships between community members, the town's history and traditions, and the land itself. Building on the skills of residents is viewed as the best way to handle community issues and using the talents and skills of residents empowers them (Beaulieu, 2002). However, asset building's contention that each community holds the keys to its own development does not fully consider the barriers faced by communities, which either due to poverty, poor education or the out-migration of younger residents, lack resources necessary to maintain development initiatives.

Critique of Development Models

Both models of development give emphasis to local-level development. Both CED and asset building recognize the importance of local residents and involvement in initiating and maintaining development activities. This is especially necessary in rural areas where there may be only limited outside interest in developing a rural community and traditional rural distrust against outsiders may hinder development activities not undertaken by locals.

However, neither model presents a realistic picture of the difficulties in attracting growth in less structurally or ecologically advantaged communities. Though there is information on using the asset-building model in rural areas (Scales & Streeter, 2001), it does not adequately address constraints among rural areas including the geographic isolation of the community and the lack of political clout in accessing resources. Most importantly, from the perspective of this study, the models do not address the fundamental differences between counties, which may make development more or less successful depending upon the attributes of the region. The characteristics of rural residents and of the counties themselves, be it the educational attainment level of residents or the type of natural typology within the county, may be critical elements to the type of community development activities which may be successful. Not all counties have the same building blocks, so to assume that all counties have an equal likelihood of attracting new residents and new businesses is a fallacy. This study will help tie more closely together the relationship between population and economic growth and determine the importance, if any, of the underlying characteristics counties.

Study Purpose

A better understanding of rural areas will provide practical guidance to community development efforts. Intervention efforts and policy *should* be developed based on a thorough understanding of the dynamics occurring in rural counties; therefore, this study will provide a new typology of rural counties based on a combination of variables not previously found in the literature. The purpose of this study is to develop a rural county-based typology based on the interaction between population and economic factors. To fulfill this purpose, the following research question will be answered:

Research Question

Can meaningful categories of rural counties be developed based on the interaction between population and economic factors?

The analysis to answer this research question will take place in three steps.

- *Step One* will be a description of the characteristics of the sample used in this study. The purpose of this description is to provide a context to better understand rural counties and how the developed taxonomic categories compare.
- *Step Two* will be a cluster analysis of population and economic variables. The typology based on population and economics is supported by a theoretical foundation discussed in Chapter Three. The cluster analysis will help determine if the generated taxonomy supports the typology.

- *Step Three* will be the application of geographic information systems technology to generate a series of maps, which will provide a visual element to aid in interpreting the developed categories.

Study Significance and Innovation

This study builds extensively off of the research literature surrounding rural demographics and development. It uses variables that have been previously identified in the literature as impacting the population and/or economy of rural areas. However, this study expands the knowledge base of rural development in three key ways:

1. The study provides a new typology of rural counties developed from the intersect of two factors, population and economics.

Categories and typologies are a popular way of classifying communities and counties. In rural literature and research there are typologies based on population density (Office of Management and Budget [OMB], 2003), natural amenities (McGranahan, 1999), and economic dependence (Economic Research Service [ERS], 2005) to name a few. Based upon a search of the literature, this is the first typology of rural counties developed on the relationship of these two factors.

2. The study will confirm the usefulness of the typology by assessing how different identified factors may be distributed over county types and what patterns may be discerned.

Research has shown the importance of several elements in affecting a rural county's population and/or economics. Natural amenities (Beyers & Nelson, 2000; Cromartie, 1998, McGranahan, 1999), proximity to urban areas (Aldrich, Beale &

Kassel, 1998), and migration patterns of foreign-born residents (Jensen, 2006; Johnson, 2006) are but a few of the factors that have been proven to play a role in rural counties. However, a review of the literature shows that these variables tend to be looked at in isolation, with little attention given to understand how they may relate to each other.

3. This study provides an understanding of the dynamics of rural counties that is missing from current development models.

Current development models do not provide enough consideration to the unique qualities of the counties in which they are located. It is naïve to consider that all rural areas have an equal playing field when trying to establish and sustain development efforts. Identifying the factors that are found in each typology category will allow counties to understand how they differ from and are similar to other rural counties. Counties will then be able to better model their development activities after the efforts of similar counties that show stable and/or increasing population trends and economic changes. Ultimately, rural county development may then be more effective in meeting the goals of the residents.

Relevance to Social Work

The social work profession has a long history of community development efforts. From the settlement houses of the late 1800s and early 1900s to current grassroots efforts, social workers have worked within neighborhoods and communities to generate change and improve the lives of residents. The role of mapping and examining the geographic location of people and phenomenon has a long history in social work. For example, Florence Kelly's 1893 *Slums of the Great Cities Survey Maps* provided a revolutionary analysis of social inequality as it relates to geographic location (Steinberg & Steinberg, 2006). This study will ultimately help social workers and residents understand their counties better and thus make development projects more productive by tailoring them to both the needs and realities of the region.

Furthermore, one of social work's hallmark functions within society is to work with people who are disenfranchised and oppressed. Rural Americans are more likely than their urban counterparts to reside in poverty and are less likely to have advanced education. Rural residents tend to have less political clout and more barriers than urban residents when trying to establish programs and services within their communities. As a whole, rural Americans can be thought of as less able to access the wealth and power of mainstream, urban society. It is a natural fit for social workers to research for and advocate with this population to help improve the overall quality of life for rural residents.

CHAPTER TWO: DEFINITIONS AND CONTEXT

To better understand the importance of this study, it is necessary to understand the complexity of rural America and the context in which the typology is created. The chapter begins with a review of several definitions of rural and the difficulty these various definitions can create in studying rural communities. The meaning of development is then discussed, providing an understanding of the reasoning behind and difficulties associated with development in rural areas. The chapter then continues with an examination of the state of rural America. Rural poverty, one of the critical defining elements of rural America, the role of social structures, and a discourse on the economic resources of rural America in general are reviewed.

Defining Rural

The word rural is often the catchall term used to describe everything that is not defined as urban; it is imbued with a common, if vague, identity in American (and worldwide) consciousness. In order to understand the context of rural research, it is critical to understand what is meant by rural. A review of two of the more widely used ecological definitions in research and then a brief discussion of more informal definitions provide a glimpse of the complexity of understanding rural.

Ecological definitions

Ecological definitions of the term focus on the characteristics of small population size, low population density and isolated populations (Ashley & Maxwell, 2001). It is from the ecological meaning that most official definitions of rural are based. See Table 1.

Table 1. Population Distribution

Type	***Population***	***Percent of US Population***	***Number of***
U.S. Census Bureau			***Areas***
Urban Area	196,116,457	69.7	466
Urban Cluster	30,195,525	10.7	3,168
Rural	55,109,924	19.6	----
OMB			***Counties***
Metropolitan	232,579,940	83	1,089
Micropolitan	29,412,298	10	690
Noncore	19,429,668	7	1.362

Adapted from Isserman, A. (2005). In the national interest: Defining rural and urban correctly in research and public policy. *International Regional Science Review, 28*(4), 465-400.

United States Census Bureau

The United States Census Bureau measures urban as settled areas with high population densities, with rural existing as a catchall for everything else. Urban areas (settlements of at least 50,000 people) and urban clusters (settlements of at least 2,500) consist of census tracts with a population density of at least 1,000 people per square mile and the adjacent census tracts with a population density of at least 500 residents per square mile (United States Census Bureau [UCSB], 2007). By default then anything that is not classified as urban is deemed rural.

Office of Management and Budget

The Office of Management and Budget has two systems for defining counties by population. The first categorizes counties as either metropolitan or nonmetropolitan. Nonmetropolitan counties are, like with the Census definition, defined by default. Any county that does not meet the population deemed necessary to qualify as metropolitan is automatically categorized as nonmetropolitan. Metropolitan counties have either an urbanized area of at least 50,000 residents or are an adjacent county with at least 25 percent commuting occurring (in either direction) between the two counties. All other counties are categorized as nonmetropolitan. As of 2003, there are 1,089 metropolitan and 2,052 nonmetropolitan counties in the United States (ERS, 2003).

The OMB also provides a classification of counties as metropolitan, micropolitan, or non-core. The requirements for a metropolitan county remain the same. However, non-metropolitan counties are divided into two categories. Micropolitan counties are defined as those which contain an urban cluster of at least 10,000 people or are an adjacent county which has at least 25 percent commuting interdependence. In the United States, over 60 percent of people who do not reside in metropolitan counties reside in micropolitan counties. The national average county population for micropolitan counties is 43,000 (ERS, 2006). Non-core counties are defined as counties that neither contain an urban cluster of at least 10,000 residents nor have sufficient between-county commuting with either micropolitan or metropolitan counties. Non-core counties tend to have low population density and the geographic isolation tends to exacerbate difficulties in development efforts. The national average county population for non-core counties is 14,000 (ERS, 2006).

Informal definitions

There are several informal definitions of rural that may also be appropriate depending upon one's purpose (Howell, Tung, & Harper, 1996). Rural may be defined based on occupational terms, in which what is rural is based on traditional occupations (e.g., farming, mining) in rural areas. However, as stereotypical jobs decrease, the accuracy of this definition decreases. An environmental definition highlights the reliance and closeness to nature found in rural areas. Finally, there is a mythos regarding rurality in America (cf. Martinez-Brawley, 1990; Murray & Dunn, 1996). A cultural definition emphasizes the independent, self-sufficiency of rural residents, the importance of family and friendship ties among the people and the following of traditional moral standards contained with the public consciousness.

Problems caused by definitions

The lack of a common definition causes problems for rural communities and researchers looking to study them. Oftentimes, one is unable to determine what is meant by the term rural and each person brings their own meaning to the term. In fact, as seen with the OMB definitions, other terms (e.g., non-metropolitan, non-core) may be substituted for rural, further muddying people's understanding. The definitions are arbitrary and, as such, have no inherent meaning beyond what is prescribed at that moment. Is a community with 2,501 residents measurably less rural than one with 2,500? Communities that are determined to be adjacent to an urban area, and as such have lost their rural designation, may still perceive themselves as rural communities and continue to struggle with rural issues.

The changing definitions of rural may also have a larger impact on service provision for rural residents and communities (Isserman, 2005). Because the percentage of Americans residing in rural settings changes depending upon the definition used, it is possible that fewer people are classified as rural (than in actuality are rural) and subsequently the government may reduce overall funding for rural communities. Estimates of the United States population who are rural can range from 17 to 49 percent

(Cromartie & Bucholtz, 2008). The allocation of resources to rural communities has important ramifications for the ability of communities to sustain their population and maintain economic feasibility in current society.

Finally, the changing meaning of rural also makes it difficult to compare studies. Rural communities may vary wildly in size and location depending upon researcher's needs and comparing the results from one study to another may be close to meaningless because of the variation in the researcher's designation of rural.

Defining Development

It is important to understand development when considering the creation of the typology. Portes (1976) discusses development as moving society through increasingly higher stages of functioning through dividing and uniting society. It may also be seen as a bipolarization of states, the extremes on either end representing disparate ways of being (Portes, 1976). Development is not synonymous with growth, though the two are often used interchangeably. However, while bigger is better when discussing growth, it does not guarantee a better state of being for that which is being developed. Indeed, uncontrolled growth can often have a negative impact on the development of social and economic functioning within a community.

When discussing development in terms of rural communities it is useful to focus on the primary goals of rural development. The desired outcomes of rural development are specific to each community (Beaulieu, 2002; Kretzmann & McKnight, 1993; Simon, 2001). The outcomes may include the generation of local economy (Humphrey & Wilkinson, 1993), the elimination of population decline (Humphrey & Wilkinson, 1993), and/or to increase the quality of life for rural residents through social opportunities and improved social services (Beyers & Nelson, 2000).

Challenges with Development

Rural counties are each unique and as such have different needs in terms of development. However, much of the literature focuses on rural community development geared towards counties that have high-natural amenities (Johnson, 2006). There has been a boom in the creation of recreation/ tourism and retirement communities (Davenport & Davenport, 2005; Reeder & Brown, 2005). Beyers and Nelson (2000) credit the interest in enjoying the natural environment as the success behind these recreation/ tourism communities. Development in these communities becomes geared towards industries with mixed results. There is often an influx of service-oriented jobs, which have historically been low-wage with few or no benefits. Overall, a greater proportion of low-skill jobs are found in rural areas as compared to urban settings (Bowers & Gale, 2000; Gibbs, Kusmin, & Cromartie, 2005). On a more positive note, there is evidence that the greater diversification of industries that occurs to meet the needs of the visiting and new residents in recreation and retirement communities may leave these towns less vulnerable to economic downturns (Reeder & Brown, 2005).

Problems can build in rural communities with a new influx of development. Oftentimes, the force of development can cause the area to become unaffordable to current residents (e.g., Aspen, CO). Housing prices and local taxes rise (Reeder & Brown, 2005). In addition, Reeder and Brown (2005) discuss the degradation of natural resources that occurs. As people flock to the area to enjoy the environment, the creation of new industries and access routes and the resultant pollution harm the environment. Particularly in recreational/ tourism communities, the influx of (seasonal) residents can disrupt the social networks of a community. A struggle between old and new residents can arise as each group has their own views on how the community should function (Davenport & Davenport, 2005; Reeder & Brown, 2005). Still, there is some evidence that towns with rapid growth eventually adapt as residents embrace new opportunities for growth while maintaining the social networks which create their attachment to the place (Brown, Dorius, & Krannich, 2005).

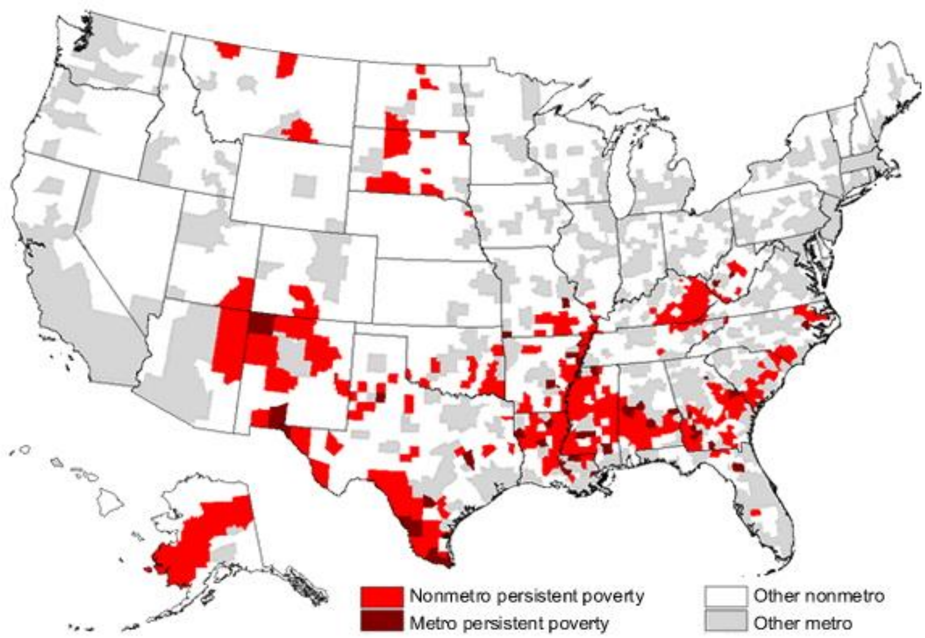
Finally, the implications of development (and growth) need to be considered when analyzing rural counties that have remained stable in their population and economic health. These counties may be the ideal to which declining counties should aspire. Where they may not have the influx of new residents and economic health that growing counties demonstrate, these stable counties may also avoid the possible breaks in social structure and high costs that often affect the communities within a county.

Rural Poverty

One of the most significant problems facing rural American communities is the high poverty rates (being at or below the federal poverty line) experienced by many of their residents. "[N]onmetro poverty has historically been and remains higher than metro poverty, which was 12.2 percent in 2005, compared to 14.5 percent for nonmetro counties (Kusmin, 2007, p. 4). For many of the poor residing in rural America, poverty has become an intergenerational trend. Persistent poverty counties are those that have recorded 20 percent or higher rates of poverty for the last four decennial censuses. Of the

386 counties classified as persistently poor, 340 (88 percent) are in rural areas; within those counties resides approximately 14 percent of the rural population (Joliffe, 2004). See Figure 1.

Figure 1. Persistent Poverty Counties, 1970-2000



Persistent poverty counties--20 percent or more residents were poor as measured by each of the last four censuses, 1970, 1980, 1990, and 2000.

Source: Economic Research Service, USDA.

Using Census 2000 data, an additional 58 non-metro counties can be classified as high poverty (20 percent or higher poverty rates) (Beale, 2004). Because of the sheer length and depth of poverty experienced by these counties, they are likely unable to have a sufficient tax base in order to provide the infrastructure necessary to provide a wide range of development opportunities for their residents.

Rural poverty is also more likely to affect racial and ethnic minority groups. A significant portion of the persistently poor counties are counties with historically high populations of Black, Hispanic and Native American citizens; the other significant grouping is found in the Southern Highland counties, more commonly known as the Appalachian region, whose residents have a unique ethnic identity in the United States (Beale, 2004). A review of Figure 1 shows the geographic clustering of these counties, with a significant portion found in the state of Texas.

Black, Native American and Hispanic residents in rural areas are approximately 2.5 to 3 times more likely to be poor than white rural residents (Joliffe, 2004). When viewed as a county total, the reduced income of counties with non-White majorities is especially compelling if one considers the impact on development. For counties with a primarily Black population, the income of the county is 67 percent of the national average ("$259 million versus $387 million"). For counties with a majority Hispanic population, the county income is 66 percent of the non-metro county average ("$257 million versus $387 million"), and for counties with a majority Native American population, the county income is only 48 percent of the non-metro county average ("$186 million versus $387 million") (Probst, Samuels, Jespersen, Willert, Swann, & McDuffie, 2002, p. 2-3). This disparity in income is clear grounds for the argument that opportunities available for some rural counties may not be economically feasible for others to attain.

Social Structure

The role of community social structure has traditionally been very important in rural regions. However, as changes occur within the town there is often an associated decline of traditional supports (Rowles, 1998). It is a common misperception that people in rural areas belong to close, self-contained nurturing communities, however changes in the social structure alter the development of relationships among rural residents. “The notion of social credit and mutual support as part of an assumed obligation, a social contract among generations, is less viable in many communities because the stable environmental conditions that nurtured such a milieu no longer survive” (Rowles, 1998, p. 114).

With the disruption of essential social supports there may be a disruption in the functioning of the area and the sense of community among the rural residents. The traditional social norms and values, “informal means of control and regulation,” are no longer sufficient to maintain order in the community (Davenport & Davenport, 2005, p. 18). Furthermore, the social structure of a community can influence the direction of development (Martinez-Brawley, 1990). How the residents manage their relationships with each other and with external resources may either create or hinder employment and development opportunities within the county.

Economic Resources

In addition to the changes wrought on a community’s social structure, rural change and development has a very real impact on county economic resources. Counties may experience a decrease in economic resources due to the loss of employers as industries relocate to overseas locations (Murray & Dunn, 1996; Thompson, 2007). The impact of lost industries is compounded as local, supporting businesses often close because of the reduced need for their services (e.g., a local office supply store no longer has sufficient business to remain open once the main industry of the town closes). To further exacerbate the problems caused by loss of jobs, rural towns also suffer from loss of taxable income caused by the disappearing businesses (Davenport & Davenport, 2005). The reduced tax base often makes rural counties unable to adequately fund public services which may serve as a draw to bring in new residents and businesses.

As previously mentioned, development in rural areas may not take a big picture approach and plan for long-term consequences of development opportunities. Rural communities may take desperate measures in order to attract economic opportunities to their towns. At times, this may mean giving economic resources away, such as community-owned property and either reducing or eliminating taxes the industry would have to pay (King, Mauer, & Huling, 2003; Tootle, 2004). Communities often find themselves competing with each other for low-wage industries and may find themselves inviting in industries (e.g., prisons) that appear beneficial but which may ultimately have a detrimental effect on the community's social and/ or economic functioning. For example, Goetz and Rupasingha (2006) found that Wal-Mart had a negative impact on social connectedness and civic engagement at the county-level and that the presence of Wal-Mart resulted in decreased economic opportunities for communities. As Wal-Mart draws residents away from smaller, local businesses, the ties among community members are reduced. This results in the reduction and/or closure of local shops and a decreased sense of belonging among residents (Goetz & Rupasingha, 2006). Residents without a sense of attachment may be more likely to move onward to a new community and continue a trend of flight from rural counties.

The reality is that desire and commitment to attract development opportunities are insufficient for some counties "if other employment-attracting factors, such as proximity to inputs and markets and a threshold labor force size, are absent” (Bowers & Gale, 2000). Therefore, in rural communities, economic networks (the horizontal and vertical connections that generate and foster economic development) should take the opportunity to learn from similarly situated communities (Flora & Flora, 1993). Counties should model their development efforts from the development successes and challenges of their peers. It is this thinking, that like should learn from like, that drives the development of this rural county typology.

CHAPTER THREE: THEORETICAL FRAMEWORK AND IDENTIFIED FACTORS

This chapter provides a comprehensive overview of the theoretical framework used to develop this research. A review of the New Economic Geography theory is followed by a discussion of systems theory in relation to community development. The chapter concludes with a thorough examination of known factors which impact population and/or economic change in rural areas.

Theoretical Framework

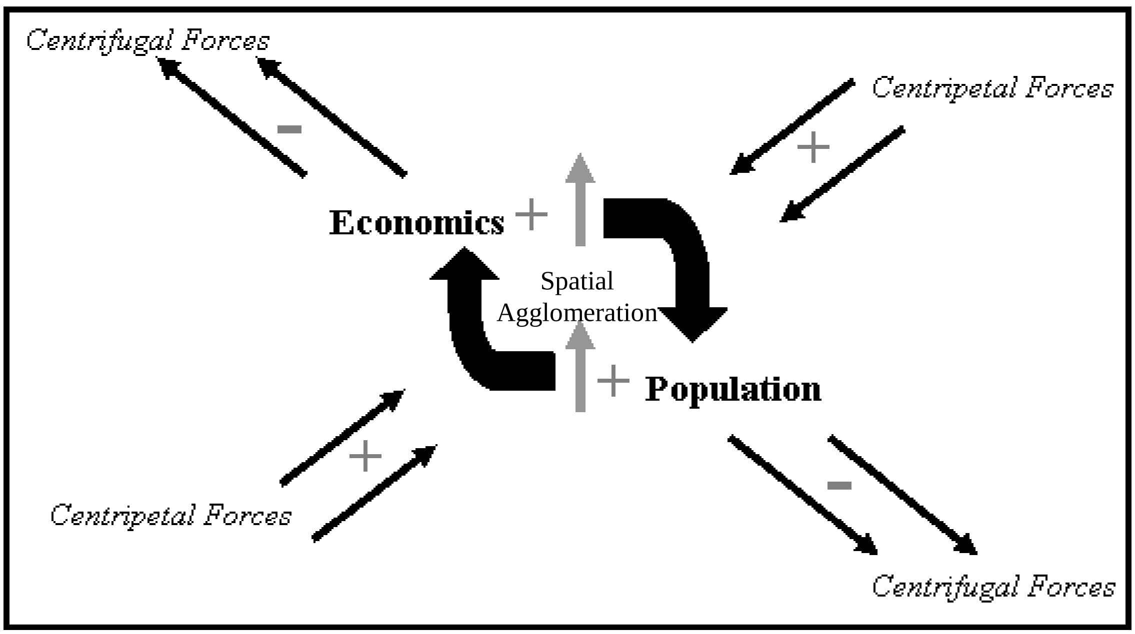
There is a link in both urban and rural communities between the economy and the population (Millward, 2003). Oftentimes, a growth in one may demonstrate a correlated growth or decline in the other. Though this connection may seem intuitive, it is important to understand the foundation of this cycle, thus allowing for a more realistic picture of the challenges facing many rural communities looking to (re)vitalize their economy and/or population. The New Economic Geography (NEG) theory provides a sound framework for how economics and population are linked.

New Economic Geography Theory

NEG was first conceptualized in 1991 by Nobel Laureate economist Paul Krugman as a method for understanding how economic activity and population growth and concentration are linked. Briefly, economic and population growth are tied together in a cycle. As economic growth increases, the population grows to meet the demands of industry and to capitalize on economic opportunities. As the population grows, industries and mobile businesses are attracted to the area to take advantage of the labor and consumer pool resulting in economic growth and power. See Figure 2. Furthermore, the

NEG theory has been utilized to understand economic and population activity on a variety of geographic scales. Ottaviano and Puga (1998) discuss the use of NEG to explain industrial agglomeration from the small-scale city level to industrial activities which span international boundaries. Agglomeration can occur within the context of a neighborhood or be applied to patterns within the larger global economy (Fujita & Krugman, 2004; Fujita & Mori, 2005). Therefore, it is appropriate to utilize NEG during a discussion of county level change. A more detailed explanation of NEG follows.

Figure 2. Model of New Economics Geography



Agglomeration

Key to NEG is the idea of *agglomeration*. In the context of NEG, agglomeration can be simply defined as the "clustering of economic activity," with an associated increase in population (workers) within a geographic space (Fujita & Krugman, 2004, p. 140). NEG holds that agglomeration is increased because of the links between industries, fixed production costs and the reduced costs of transports. Industries tend to locate in areas of high population for one primary reason, the money saved on producing and developing goods. “Fixed production costs imply that firms prefer to serve consumers from a single location, while transport costs imply that firms prefer to locate near large consumer markets” (Hanson, 2000, p. 479). The more industries in an area, the more industries are drawn to each other. The location of economic activities in proximity to one another draws in both mobile firms and workers, thus creating “positive feedback” and ultimately creating areas with more economic power (Venables, 2006, p. 65). As transportation costs decrease between outlying communities and the industry core, these communities are absorbed and become part of the agglomeration (Henderson & Wang, 2005).

Location

Location plays a critical role in understanding the difficulties some areas have had in accessing and obtaining financial capital. Historically, the agglomeration of industry and workers has occurred in places with a geographic advantage, such as a location next to a water source or political boundaries (Fujita & Krugman, 2004). An advantageous location then strengthens industries’ market potential. Lopez-Rodriguez and Faina (2006) define the role of market potential as “the potential demand for goods produced in a location as the sum of the purchasing power in all other locations, weighted by transport costs” (p. 386). What this market potential speaks to is the role of location in helping to determining the income for those who produce goods; goods located close to consumers have higher potential earning power. Because of this link between economics and geography, economic prosperity accumulates in populated areas and the isolation and sparse population in rural America are at a disadvantage in today's economy (Wiggins & Proctor, 2001). "In recent decades, many small communities built to serve the 19th century's farm population have become nonviable due to population loss and geographic concentration of fewer, larger firms supplying wider and wider market areas" (Bowers & Gale, 2000, p. 4).

Centrifugal Forces

The tendency towards agglomeration does not stand unchallenged. Krugman (1994, 1998) outlines some of the external or "centrifugal forces" which "pull away" from the concentration of people and industries. See Table 2. These centrifugal forces allow for the development of multiple areas of economic and population agglomeration. Common centrifugal forces include those associated with the costs of doing business and remaining competitive. As the amount of available fixed resources decrease in agglomerated areas, there is an associated rise in price; a prime example is the limited resource of land and a subsequent increase in the cost of rent as available land dwindles. This type of expense results in people being drawn to develop new locations for industry and population growth. A different kind of centrifugal force can be found in the "pure external diseconomies" found in agglomerated areas (Krugman, 1998). These diseconomies include higher crime rates and more pollution than are typically found in less developed areas. A pull is created in people and industries towards less developed areas to escape these associated costs that come with spatial agglomeration. For rural counties looking to bolster their economic development and population, centrifugal forces provide the potential to attract industry, and subsequently workers, from the agglomerated areas of metropolitan counties.

Table 2. Forces Affecting Geographical Concentration

Centripetal forces	***Centrifugal forces***
Market-size effects (linkages)	Thick labour markets
Immobile factors	Land rents
Pure external economies	Pure external diseconomies

Source: Krugman, P. (1998). What's new about the new economic geography. *Oxford Review of Economic Policy, 14*(2), 7-17.

Limitations of NEG

The NEG theory clearly illustrates an underlying link between population and economics. However, these two factors are not enough to understand patterns of growth and decline. Lopez-Rodriguez and Faina's (2006) research into the role of location and market share found that though market potential was a driving force in regional income in Europe in the 1980s, by the 1990s the significance of market potential was lessened. This means that, in at least this one instance, income and large consumer markets are not tied as closely together as in the past. An ideal location is not sufficient to harness economic power; similarly, a poor location is not an automatic deterrent to economic success (Venables, 2006). One possible explanation is that decreased costs of transportation and both up- and downstream supply chains mean that agglomeration is not as beneficial in today's economy (Black & Henderson, 1999). This gives credence to the idea that development efforts in new areas, for example rural counties in the United States, have the potential to have a significant impact on the economic health of the region. This also means that more than traditional economic factors must be considered, something which is deliberately ignored in many economic models, including NEG. Krugman (1998) states that "it is necessary to cut through the complexities of the real world and focus on a more limited set of forces" (p. 8-9) when analyzing economic geography. "To isolate the forces that influence industry location, most theoretical work abstracts away from the natural characteristics of regions, such as climate or natural resource supplies" (Hanson, 2000, p. 480). This approach towards minimization of factors is counter to the development of this county typology and is the point where the addition of systems theory as a theoretical framework for the analysis comes into play.

Systems Theory

This study takes a holistic perspective of the interaction between elements within county-level systems. While NEG provides a solid foundation for why the construction of the typology is based on population and economics, systems theory provides an additional perspective to better understand the difference and similarities happening within and between the different county types.

Systems theory provides a framework by which to understand the world through the interactions of elements or parts of a system (Von Bertalanaffy, 1950; Capra, 2004). Systems should be examined in whole; systems are best understood in context of the whole, with valuable insight and explanation lost when only parts of the system are examined (Zastrow, 2010). A county is one type of system, with a variety of elements or sub-systems that work in harmony or disjuncture with each other. These elements are dependent upon each other, meaning that as one changes, others change in relation. For example, as the transportation system improves within a county, it is likely to have a positive impact on economic growth; conversely, as the transportation system erodes, a county's economic health may be negatively impacted.

Systems Theory and Community Development

Community development has a natural tie to systems theory as development models must take into consideration a variety of information, input, and system levels when considering which actions to take. Using the systems framework helps in "searching out relationships and patterns of interactions" (Cook, 1994, ¶23). Some past development efforts have treated development as having a holy grail, one element that if it were improved would result in automatic improvement for the entire system (Cook). Though not always explicitly stated, this connection between systems and community development can be seen at play in the asset building community development model discussed in Chapter One. For communities seeking to improve their opportunities, they must identify the smaller subsystems (e.g. educational systems, racial/ethnic minority populations) that exist within the larger community system. Understanding the relationship between the system and subsystems is critical to being able to tap into underutilized sources of resources and energy to fuel development.

For this study, simply exploring the individual relationships of each identified factor and demographic with population and economics is insufficient to properly understand the changes in the rural county systems. In order for community development efforts to reach their optimal success, the interactions between the county system and its subsystems needs to be better understood. A typology that explores and highlights the multiple influences onto the systems' functioning would more adequately express the complex interactions occurring in rural counties.

Identified Factors in Rural Population and Economic Change

There has been a variety of research conducted into what factors influence population and economic trends in rural communities. In addition to rampant poverty in many rural areas, there are several other key variables which research has shown to affect population percent changes and/or economic trends.

Demographic Shifts

Age

Many rural counties are facing a dramatic shift in the age distribution of their residents. This is a two-pronged problem. First, rural America is experiencing a growing population of older adults (age 65+) caused by many older Americans either aging in place in or moving to a rural community in their retirement (Johnson, 2006; McLaughin & Jensen, 1998). Second, many of the younger residents of rural communities are moving away from the community for either educational or career opportunities (Johnson, 2006; Smith-Mello, 1996). This leaves communities with a declining workforce as older persons retire and there is no younger generation to step into the jobs. This shrinking workforce can make it difficult for communities to attract new industries and businesses.

Migration

On a hopeful note for rural areas, there has been a notable increase in the number of racial and ethnic minority group immigrants to rural areas. During the 1990s, the influx of foreign-born immigrants helped many counties in the Midwest maintain their population (Jensen, 2006). “Between 2000 and 2004, immigration accounted for 62 percent of the rural migration gain and 31 percent of the overall population increase in rural areas” (Johnson, 2006, p. 26). Furthermore, recent immigrants to rural areas tend to be between the ages of 18 and 64, with approximately 75 percent of adult immigrants being married (Jensen, 2006). The immigrants often have children once settled into their new communities, thus adding to the population growth (Mather & Pollard, 2007). However, there is a significant area of concern regarding immigration to rural areas. Recent rural immigrants are very likely to be undereducated and impoverished. The types of employment, particularly farm work, manufacturing, and processing plants, which are typically available to immigrants may not be sufficient to pull these residents out of poverty (Jensen, 2006; Mather & Pollard, 2007). It is possible counties that experience a high influx of foreign-born immigrants may demonstrate a decline in some economic indicators, such as per capita personal income, because of the typically low-wage employment opportunities that are available to immigrants. Furthermore, rural communities may lack the capacity or willingness to provide services to an influx of new residents. If foreign-born immigrants enter the labor force at a lower wage than established residents are willing or able to do so, the resulting competition for jobs may create an ‘us versus them’ mentality that divides the community.

Natural Amenities

It is well-documented that the presence of natural amenities increases the likelihood of development (Cromartie, 1998; Johnson, 2006; McGranahan, 1999; Reeder & Brown, 2005). McGranahan identified three categories of natural “amenities: mild climate, varied topography, and proximity to surface water" as key factors in the population growth of rural counties (p. iii). Desired characteristics for rural towns include the presence of water (e.g., lakes, rivers, oceans), interesting landscape in the forms of hills, mountains and/ or vegetation, and a moderate climate. Counties that possess a high level of these amenities tend to have significant population growth, especially in the West and Southwest regions of the country. Conversely, counties without these attributes have tended to experience a marked decrease in the overall population.

High-natural amenities counties are concentrated in several regions of the United States: the mountains and coasts of the West, the upper Great Lakes, New England, the Appalachian and Ozark foothills, and the eastern seaboard from Virginia south (Johnson, 2006). There is a dearth of these counties in the Midwest region of the county, an area which continues to experience declining populations due to low birth rates and out-migration. Because there is an unequal distribution of natural amenity counties across the country, it is feasible to assume that differences may exist in how these counties may be able to be developed. It may be necessary for counties to pattern their economic and population development activities on growing counties that have a similar do not exclude the impact of natural amenities when following the development patterns of successful communities.

Economic Dependence

The economic dependence of a county can also have a significant impact on its future. Counties which are not diversified may be more vulnerable to economic and population downturns. As previously mentioned, there has been a notable decline in the traditional occupations such as farming, lumber, and mining (Cromartie, 1998; Johnson, 2006; Murray & Dunn, 1996). McGranahan and Beale (2002) found that rural counties with which did not have industries outside of agriculture experienced population loss that more diversified counties did not.

Rural residents are also more likely to be employed in certain low-skill professions than their urban counterparts. There has been a notable decline in low-skills professions, such as agriculture (field work) and manufacturing, and a shift towards low-level service sector work (Gibbs, Kusmin, & Cromartie, 2005). (High level service work, requiring an educated workforce, is more likely to be found in metropolitan areas (Bowers & Gale, 2000; Gibbs et al., 2005).) Counties which have been dependent for decades upon manufacturing as a main employment source are increasingly vulnerable to factory closures due to overseas relocations of factories and technological innovations which require less manpower (Glasmeieran & Salant, 2006).

Proximity to Other Communities

Proximity to another town increases the likelihood of the community population either maintaining or growing (Aldrich et al., 1998; Krannich & Humphrey, 1983; Millward; 2003; Reeder & Brown, 2005). For rural communities close to urban centers, they may serve the role of "bedroom" communities (Johnson, 2006). These bedroom communities become places for residents to sleep, whereas retail and social activities are completed in the urban setting. This may cause long-time residents to feel newcomers have no investment in the community. Indeed, proximity to an urban setting may result in decreased shopping at local businesses for all residents (Keane, 1990). However, it is possible for bedroom communities to have an increase in not only residents but in the number of businesses and industries. Oftentimes, these smaller communities serve as alternative locations for businesses not wanting to locate in urban centers due to pollution, traffic and high costs (Johnson, 2006). Partridge, Rickman, Ali, & Olfert (2008) examined the relationship between population growth and proximity to agglomerated regions and market potential. They found that rural and small urban counties demonstrate a negative relationship between distance to agglomerated areas and population growth; as counties become more rural, more removed from urban areas, their population goes down.

Commuting Distance

People in rural communities often commute to work. Seventy-five percent of rural communities have commuting rates greater than 35 percent (Aldrich et al., 1998). Contrary to popular belief, the majority of this commuting takes place between rural communities. Only 10 percent of commuting from nonmetropolitan regions is to metropolitan areas (Aldrich et al.). There is an economic interdependence between (rural) communities which is often ignored (Simon, 2001). Unfortunately, rural communities tend to think of themselves as separate entities and give little to no attention to the needs of nearby communities. A rural community looking to increase economic development may be served by finding access (i.e. through commuting) to jobs in other communities (Aldrich et al.).

Transportation

The presence of transportation routes is an important consideration for rural areas that can help in economic development activities. The role of transportation in linking residents to services and providing access for commercial shipping is critical for economic development in rural regions (Stommes & Brown, 2002). This is easily seen by the growth of communities alongside interstates and with relatively close access to airports. New residents may hesitate to move to a location if they feel they will be "cut off" and industries need to be able to efficiently ship and obtain product. Gale and Brown (2000) found that airport access was a unique problem for rural manufacturers (as compared to their urban counterparts), with 13.5 percent of surveyed manufacturers reporting it a major problem in the West South Central region (Arkansas, Louisiana, Oklahoma, and Texas) of the country.

Education Systems

The presence of a college or university has the potential to bring an influx of new students to the area, bring in educated employees to the area to work at the school, and to raise the education of the general populace of the community. Garza and Eller (1998) contend that "rural community colleges in the most persistently poverty-stricken regions of the country can increase access to higher education serve as a catalyst for economic development, thereby helping the poor to become more economically independent and helping local economies become more competitive" (p. 32). The presence of a university or college may serve to help rural counties retain their young adult population. "The strength of the tie between education and economic outcomes is influenced in part by the extent to which small rural counties lose young adults through outmigration (Gibbs, 2005, p. 22).

It is possible that the benefit of universities is not as great in rural areas as hoped. Florax and Folmer's (1992) found that the economic benefits of universities are directed towards metropolitan areas rather than the university's surrounding environment. Beck, Elliott, Meisel, and Wagner (1995) found that long-term economic gains were more likely to be associated with metropolitan, rather than rural, universities. However, they also noted that residential universities in rural areas do have positive short-term economic benefits as they draw in students and their dollars to the region.

Health Care

There is conflicting literature on the economic and population impact of a hospital in rural areas. Doeksen, Johnson, Biard-Holmes, & Schott (1998) declare the health care sector to have a significant role within a community, beyond the provision of health care, in attracting new business and economic growth and retirees seeking to relocate. In their analysis of nine rural Oklahoma counties, Doeksen et al. found that approximately 14 percent of county employment is either directly or indirectly related to healthcare and that hospitals were likely to be a county's second-largest employer. Cordes, Van der Sluis, Lamphear, and Hoffman (1999) examined the economic impact of rural hospitals in Nebraska and found that hospitals had a positive impact on local economies, with the economic benefits increasing as the hospital size increased. A more recent analysis examining the economic impact of rural hospital closures found that if a county's sole hospital closed, it was likely the local economy would decline and recovery would prove difficulty (Holmes, Slifkin, Randolph, & Poley, 2006). However, it is important to note that in their study, Holmes et al.'s analysis revealed that in counties with more than one hospital, a hospital closure did not appear to have a long-term impact on economic health. Furthermore, both Pearson and Tajalli (2003) and Stensland, Mueller and Sutton (2002) examined hospital closures occurring in rural communities and found no negative impacts on the economic health.

Classification of Identified Factors

Whereas the inclusion of a variety of factors is more consistent with systems theory, it is useful to use NEG terminology to classify these factors as either centripetal or centrifugal forces influencing rural population and economic change. See Table 3. What quickly becomes apparent is that almost all of the factors can be classified as having either a centripetal or centrifugal force depending upon the perspective or attributes possessed by the counties. For example, whereas the influx of older adults (e.g. retirees) may serve to increase population in some counties, counties that experience a growing percentage of older adults due to the flight of younger residents may record a corresponding decrease in overall population.

Table 3. Rural Factors as Centripetal or Centrifugal Forces

Identified Rural Factors	***Centripetal***	***Centrifugal***
Age	Influx of older adults	Exodus of younger residents
Migration	In-migration (retirees, foreign-born immigrants)	Out-migration (unemployed, young adults)
Race/Ethnicity	n/a	n/a
Educational Attainment	High attainment	Low attainment
Natural Amenities	High natural amenities	Low natural amenities
Economic Dependence	Diversified	Limited, Traditional
Unemployment	Low unemployment	High unemployment
Proximity to Other Communities	Within optimal commuting range	Outside optimal commuting range
Hospitals	Presence	Absence
Two and Four Year Institutions	Presence	Absence
Transportation Alternatives	Presence	Absence

Development of Typology Framework

The typology framework utilizes the relationship between population and economics as discussed in the NEG theory. Building off of the classification briefly described early by Yenerall (1999) of expanding, stable, and declining rural communities (based on population) and incorporating the element of economics, this study explores the relationship between population and economics and how they illustrate growth and decline in rural counties. Figure 3 illustrates one possible typology framework that may emerge from the cluster analysis, a 3X3 typology that outlines the nine possible combinations of population and economic trends.

Figure 3. Possible 3X3 Typology

Growing Population	GD	GS	GG
Stable Population	SD	SS	SG
Declining Population	DD	DS	DG
	Declining Economics	Stable Economics	Growing Economics

Additional analysis will determine if typology categories can be distinguished from each other by the presence or absence of the aforementioned identified factors. For example, do counties found in the growing population/growing economy category have similar characteristics? Are those characteristics distinguishable from the characteristics found amongst declining population/declining economy counties?

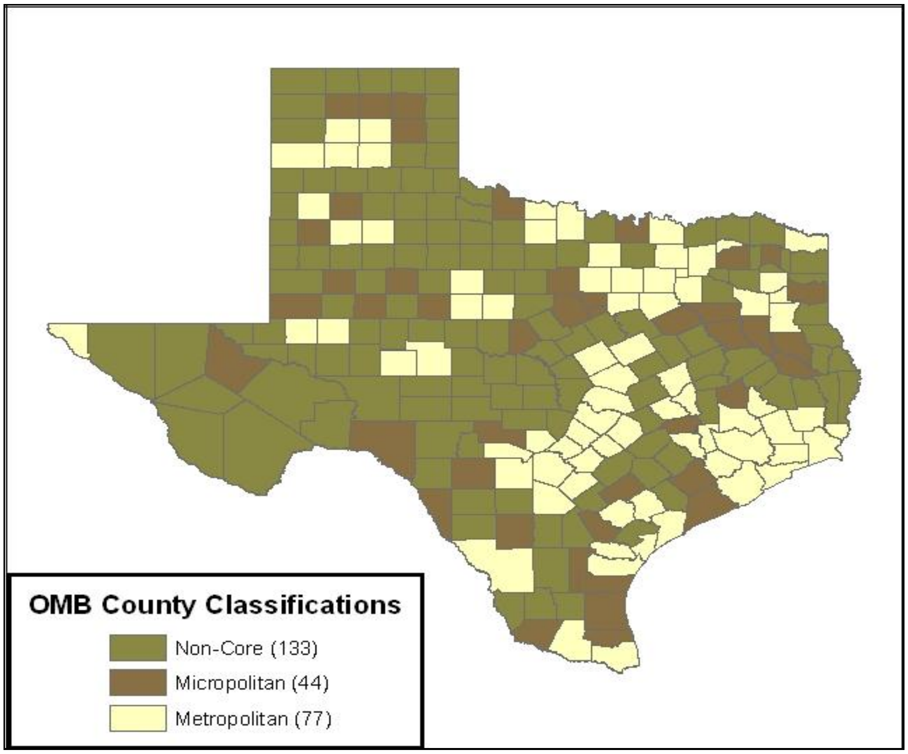
CHAPTER FOUR: METHODOLOGY

This study used secondary data in a descriptive examination of rural counties and cluster analysis to group rural counties based on the interaction between population percent changes and economic trends. Additionally, the analysis utilized geographic information systems mapping software to develop a series of maps to provide a visual output of the results. The study used data from a variety of sources: the United States Census Bureau, the Bureau of Economic Analysis, the Economic Research Service from the United States Department of Agriculture, the Bureau of Labor Statistics, the National Center for Education Statistics, and the Texas Hospital Association.

Sample

The study sample is comprised of the 254 counties in the state of Texas. Counties were then categorized as metropolitan, micropolitan, or non-core using the Office of Management and Budget's (OMB) designation based on county population. This 2003 measurement of county type "provides a framework for better understanding population growth and economic restructuring in small towns and cities that up to now have received less attention than metro areas" (ERS, 2006). This definition was selected as it recognizes not only more isolated, non-core counties as rural, but that the small towns and lack of access to metropolitan areas experienced by micropolitan counties results in different growth and development experiences than metropolitan counties. Micropolitan counties often have largely rural attributes in occupation, culture, and environment, and for the purposes of this study will be considered rural.

Figure 4. OMB County Types in Texas



Data Source: 2003 Office of Management and Budget County Designations

While the OMB categorization of counties is not ideal, the multiple definitions of rural (as discussed in Chapter Two) and the limited data collected about rural areas have precluded a universally accepted measurement of rural. Therefore, for purposes of evaluating rural counties, both micropolitan and non-core counties were used in this study (n=177). County-level data is used for this study because of the lack of available data for smaller units of measurements in rural areas (e.g., villages, towns). Figure 6 shows the distribution of the county types across the state of Texas.

Variables

The variables are developed using data from the years 2000 and 2007. The year 2000 was chosen as the initial time point due to the wealth of data available from the

USCB and other sources. Having variables that share an origin point will allow for analysis to determine the relationship between the independent variables and the change conveyed by the dependent variables. The dependent variables capture the change that has occurred within the counties in the seven year period from 2000 to 2007. The independent variables provide a snapshot of the counties at the year 2000.

Dependent Variables

For both the population percent change and per capita personal income percent change, the following formula was used: Percent Change = $(X_2\text{-}X_1)/X_1*100$. This is the formula used by both the United States Census Bureau (USCB) and the Bureau of Economic Analysis (BEA) to determine percent change. The percent change used in this analysis spans a seven year time period. It is feasible that a county may have experienced a year (or even several) of growth or decline that is atypical; using the percent change occurring between 2000 and 2007 will assess the overall pattern within a county.

Population Percent Change

The total number of residents residing within the county shall be used as the measure of population. The USCB's decennial census population results and population estimates for non-census years will be the source of the data. The USCB provides the most accurate count of people in the United States and is a widely accepted source for population figures. The population estimates computated at the USCB have been widely accepted for use in demographic research. Understanding the percent change in a county's population is necessary to properly categorize it within the typology. The population percentage change between 2000 and 2007 is being used because measuring county population percent change is a key focus of this study and a critical piece for the development of the typology.

Per Capita Personal Income Percent Change

Per Capita Personal Income Percent Change is the dependent variable used as an economic indicator within rural counties. Per capita personal income is a widely used, comprehensive measure of household income compiled on an annual basis by the BEA (Lenze, 2006). Personal income measures income from a wide variety of sources: “the sum of wage and salary disbursements, supplements to wages and salaries, proprietors' income with inventory valuation and capital consumption adjustments, rental income of persons with capital consumption adjustment, personal dividend income, personal interest income, and personal current transfer receipts, less contributions for government social insurance” (Bureau of Economic Analysis, 2008). The effects of inflation were removed from the variable. Per capita personal income was selected as an economic indicator because of its comprehensiveness and because of the availability of data for years within the study’s timeframe. There is precedent for using per capita personal income when examining agglomeration effects on non-metropolitan (and metropolitan) economic activity at the county level (see Hammond, 2006).

Independent Variables

Demographics

Net migration. The net migration change occurring in a county is a ratio-level variable used as a population indicator. The flow of new residents in (and out) of rural counties is a critical factor in their ability to sustain and/or increase their population. The data are from the 2000 Decennial Census.

Percentage of foreign born immigrants. The percentage of foreign-born immigrants is a ratio-level variable used as a population indicator. It is necessary to understand the changes in foreign-born immigration. Foreign-born immigrants tend to be younger, married, and have more children (Jensen, 2006). For rural counties, this influx of younger residents could bring new life to rural counties. Conversely, foreign-born immigrants tend to have less education and economic power, which could have a negative impact on a county's economic health. The data are from the 2000 Decennial Census.

Percentage of older adults. The percentage of older adults in a county is a ratio-level variable. Understanding the aging of rural America is pivotal to understanding changes and development in rural areas. In many rural counties, there has been a significant increase in the percentage of older adults, due to either an increase in the number of older adults due to in-migration or an increase in the proportion of older adults because of the out-migration of younger adults. It is necessary to understand how this variable relates to overall population and economic trends. The data are from the 2000 Decennial Census.

Race/ethnicity. Three variables will be created to capture the racial and ethnic diversity of counties: the percentage of the county population who self-identify as white, the percentage of the county population who self-identify as black, and the percentage of the county population who self-identify as Hispanic. These variables will be metric level variables. Race and/or ethnicity are critical to understanding economic trends in rural counties. A nationwide analysis of counties reveals that persistently poor counties are more likely to be designated as a racial/ethnic minority county (ERS, 2005). The data are from the 2000 Decennial Census.

Percentage of residents with a bachelor's degree. A metric level variable of the percentage of residents with at least a bachelor's degree will be constructed using data from the 2000 Decennial Census. Education is important for the economic health of rural counties. Oftentimes in rural counties, the relatively low educational attainment (in comparison to metropolitan counties) serves as a deterrent to economic development, particularly with the advancements in technology and the loss of low-skill manufacturing jobs to other counties (Glasmeieran & Salant, 2006).

Economy

County economic dependence. The economic dependence of the counties will be six dichotomous variables. In 2004, the Economic Research Service categorized all counties in the United States into six, mutually exclusive categories of economic dependence based upon the specialized economic activity of the county. See Appendix A for economic dependence definitions.

Unemployment . Unemployment is a metric level variable. The unemployment is a popular measure of economic status and is regularly used in indexes to determine state economic activity and growth (Crone & Clayton-Matthews, 2005). For this analysis, the unemployment used is at the county level. The data are from the 2000 Decennial Census.

Percentage of commuters. The percentage of residents who commute to their employment is used as a metric level variable. Research has shown that there is a one-hour optimal distance for employees to commute (Millward, 2003). For counties with high percentage rates of commuters, it is feasible to assume that residents enjoy (relatively) close proximity to other communities. Since counties which have an inter-county commuting of 25 percent or more are classified by the OMB at the most populated level (Example: if a non-core county by population has a commuting of 26 percent with an adjacent metropolitan county, it is then designated as a metropolitan county), it is logical to assume that the vast majority of this commuting then represents either intra-county or inter-county commuting between rural (non-core and/or micropolitan) counties. This assumption is further strengthened by research showing that the vast majority of rural commuting occurs between rural communities (Aldrich et al., 1998). The data are from the 2000 Decennial Census.

Geography

Natural amenities. The presence of natural amenities in a county has a significant impact on both its economics and population. Natural amenities serve to bring in new residents and to create tourism and recreational economic opportunities (Cromartie, 1998; Johnson, 2006; McGranahan, 1999; Reeder & Brown, 2005). McGranahan (1999) categorized United States counties into a scale of natural amenities that range from zero to seven. The scale was created using standardized scores of the average temperatures (January and July), sunlight, and humidity for a 30-year period (1940-1970), land topography, and water area for all counties in the contiguous 48 states. Counties are ranked on a one to seven scale, with one indicating low natural amenities and seven indicating high natural amenities.

Square miles. The number of square miles per county is a metric level variable. This variable is included because the size of the county may affect the impact of other factors, such as the presence of hospitals or colleges, on the county's population and/or economy. The data are from the 2000 Decennial Census.

Services

Hospitals. Hospitals are included in the analysis a metric level variable of the number of hospitals within each county. The data was collected from publicly available information on the Texas Hospital Association website. The city location for each hospital was matched to its corresponding county. The total number of hospitals for each county was then tallied. While the economic impact of hospitals is contested, it will be useful in this analysis to determine if different typology categories have statistically different numbers of hospitals.

Two and four year institutions. Two and four year colleges and universities are included in this analysis as a metric level variable. A list of two and four year colleges and universities which award associate, bachelor, graduate, and/or professional degrees was compiled from public access data on the National Center for Education Statistics website. The city name for each institution was then matched to its corresponding county. The total number of two and four year colleges and universities was then tallied for each county. Again, while the impact of higher education institutions is contested, it will be useful in this analysis to determine if different typology categories have statistically different numbers of colleges/universities.

Transportation. Transportation access is key to both population and economics. Transportation is measured in three ways: the presence of state and interstate highways, the presence of railroad lines, and the presence of a commercial or air taxi airport. Public access GIS shapefiles for the state and interstate highways and railroads from the Texas General Land Office are used. Data about Texas airports was accessed from the Federal Aviation Administration website. The presence of each of these transportation variables would allow for greater ease of movement for either population and/or economic goods.

Analyses

A cluster analysis of the relationship between population and economics in rural Texas counties was performed. In building the typology, the emphasis was on grouping counties by the variables population percent change and per capita personal income percent change. "[C]luster analysis identifies cases in a sample with similar scores on all variables of interest, and puts them together to form clusters, or subgroups of cases" (Rapkin & Luke, 1993, p. 251).

Overview of Cluster Analysis

When conducting a cluster analysis, Hair et al. (2008) have proposed a six-stage model, which will be utilized in this study to guide the cluster analysis process. The six-stage process is outlined in Table 4. Each stage is discussed and its specific application in this study is reviewed.

Table 4. Six Stages of Cluster Analysis

Stage	**Purpose**
One	Determine Objectives
Two	Select Research Design
Three	Meet Assumptions
Four	Derive Clusters and Assess Fit
Five	Interpret the Clusters
Six	Validate and Profile Clusters

Adapted from Hair, J.F., Black, W.C., Babin, B.J., Anderson, R.E., & Tatham, R.L. (2006). *Multivariate data analysis* (6th ed.). Upper Saddle River, NJ: Pearson Education.

Stage One

The first stage is to determine the objective of the cluster analysis. The purpose of this research is to develop a new rural typology. Whereas the typology is based on a theoretical foundation, the cluster analysis is an appropriate method to support the typology through the generation of a confirmatory taxonomy (Hair, Black, Babin, Anderson, & Tatham, 2008). In addition, the cluster analysis aided with data simplification, by reducing the 177 rural counties into a manageable number of clusters, and with relationship identification, which allowed for profiling of the counties.

Stage Two

In this stage, four critical aspects of the research design are reviewed. First, sample size was evaluated. Sample size is important as it helps ensure that small groups within the population and the structure of cluster formation are represented appropriately (Hair et al., 2008). The sample size of 177 rural counties is sufficient. Second, important to examine in this stage are outliers. The sample was evaluated for outliers in several ways, including a univariate approach of standardizing the variables, a bivariate examination of the plotted variables, and the calculation of the Mahalanobis Distance between the two variables. Results of outlier examination will be discussed in the next chapter.

The third aspect of research design considered at this stage of the process is the decision of how to measure similarity. There are three main methods of determining similarity: 1) correlation measures, 2) distance measures, and 3) association measures. Correlation and association measures are inappropriate for this analysis. Correlation measures are rarely used with cluster analysis as they measure the pattern of the relationship between the variables rather than the magnitude of the relationship. Association measures are used with nonmetric variables; both the variables included in the cluster analysis are metric. Distance measures determine the proximity of observations to another across all variables included in the analysis. When measurements of distance are computed, the inverse of this distance measure can then be viewed as a measurement of similarity. For the cluster analysis, two distance measures were utilized: Euclidean distance and Squared Euclidean distance. Euclidean distance is the most recognized measure of distance (Rapkin & Luke, 1993). Squared Euclidean distance was chosen for its usefulness with correlated variables (as Population percent change and Per Capita Personal Income Percent Change are).

Finally, the issue of standardization of variables is addressed in this stage. Standardization is an important technique used to minimize the differences between scales that may unduly influence the generation of clusters. In addition, standardization is used when variables utilizing the same scale (as is the case with Population Percent change and Per Capita Personal Income) register a significant difference between their dispersion of answers, as evidenced by their standard deviations (Hair et al, 2006). Due to the more than doubled difference between the standard deviations for the two variables used with this cluster analysis, variables were standardized using the most common standardization technique of z-scores.

Stage Three

The third stage of cluster analysis examines the assumptions inherent in the procedure. Issues of normality, linearity, and homoscedasticity do not impact cluster analysis; instead, the focus of attention is on sample representativeness and multicollinearity. The focus of this research is on uncovering county type variations within the state of Texas. As all rural counties in Texas were included in this sample, it does meet the assumptions of representativeness. The second assumption is in regards to multicollinearity. For cluster analysis, the inherent problem with multicollinearity lies not with discerning the impact of the variables, but in the weighting of variables that may occur. As there are an equal number of variables (one each) in the correlated measures, the issue of implicit weighting is eliminated.

Stage Four

The fourth stage of cluster analysis involves 1) the selection of a clustering algorithm to partition the variables into groups and 2) choosing the appropriate number of clusters (Hair, et al.) A hierarchical clustering procedure is preferred when alternative clustering solutions need to be examined to determine which is the most appropriate and the sample size is not large (under 300) (Hair et al.) For the hierarchical clustering procedure, two different agglomerative clustering algorithms were chosen. Agglomerative techniques are those that create a separate cluster for each individual case. The two clusters closest in distance are then joined to create a larger cluster. This process is repeated *n-1* times until all cases are joined into one large cluster. The first was the average linkage (within-group) method; the second was the complete linkage (or furthest-neighbor) method. The average linkage method was selected, as it is not dependent upon extreme values and tends to generate clusters with small within-group variation. The complete linkage method was chosen as it generates compact clusters and is many "find it the most appropriate for a wide range of clustering applications" (Hair, et al.). It should be noted that the Ward method, while one of the more popular clustering techniques, was not used, as it tends to generate similarly-sized clusters and often obscures the identification of small, but important, groups within the sample. When a scatterplot of the variables was generated, it was noted that the distribution would seem to have clusters of disparate sizes, and it was important that the distinction between the cases was not artificially lost with the Ward method.

The second task of this stage in the analysis is to determine the appropriate number of clusters. While there is no one established method for determining when the most representative number of clusters has been created, criteria have been established to aid in the process. The method selected for this analysis is to measure the percent change in heterogeneity between the agglomeration coefficients for each cluster solution. According to Hair and colleagues (2008), this method has the advantage of being "the simplest and most widespread rule" (p. 594). Potential cluster solutions are selected when there is a marked increased in the agglomeration coefficient than is found with other numbers of cluster solutions. Increases in the agglomeration coefficient indicate a loss of homogeneity within the cluster groups.

In addition to this generally accepted rule, it is also recommended that practical considerations be given as to the number of clusters that could be easily managed and communicated (Hair et al., 2008). A variety of cluster solutions should be calculated and the top alternative solutions are chosen. Because this relationship has not previously been explored in this manner, cluster analysis will forego any a priori assumptions regarding the boundaries for the typology categories. However, Hair et al. (2008) state that it is appropriate to have an idea about the number of possible categories. Guided by the 3X3 typology that can be generated using Yenerall's (1999) definition of declining, stable, and growing communities and the two selected variables for population and economic change, it is possible that a nine cluster solution may be appropriate. Therefore, the data analysis will consider a practical range of solutions from two to ten and use the percentage changes in heterogeneity stopping method to look for the most appropriate cluster solutions.

Upon identification of possible cluster solutions, a non-hierarchical, k-means algorithm clustering procedure may then be performed using the seed points (cluster centroids) generated by the two most appropriate hierarchical clustering solutions. Utilizing both hierarchical and non-hierarchical methods allows the cluster membership to be refined and results in a more accurate model (Hair et al.). Utilizing a non-hierarchical procedure allows variables to be reassigned from their original hierarchical cluster solution to the cluster group that is most appropriate. This reassignment is not possible with hierarchical methods; once a case is assigned to a cluster, it cannot be moved later in the analysis to a more appropriate cluster.

Stage Five

After the most appropriate cluster solutions have been identified, each cluster needs to be interpreted through a description of the cluster variate characteristics. A common method for interpretation is through analysis of the cluster centroids (with raw data as opposed to any standardized data that may have been used) generated during stage four. Identification provides guidance in deciding which of the cluster solutions to keep. Cluster identification can also be used to determine how closely the cluster solutions match research expectations. An Analysis of Variance (ANOVA) statistic can be conducted to help determine how the clustering variates contribute to the discrimination between the clusters (StatSoft, Inc., 2010). While the significance of the F value does not mean the same as with a traditional ANOVA test, it can be used as a guide. An ANOVA test used at this stage of the cluster analysis is simply indicating if there are differences between clusters, with cluster groupings intended to maximize any differences. The ANOVA test does not help determine if the cluster solution is valid because the dependent variable for the test is one of the same variables used to create the cluster (Rapkin & Luke, 1993).

Stage Six

The final step is to then validate the cluster solution and generate profiles using the identified factors to determine if there are notable differences between counties based on their underlying characteristics. Profiling and interpreting the clusters may also help in determining the appropriate number of clusters (Rapkin & Luke, 1993). Clusters should have meaning that can be interpreted and which provide practical guidance. If clusters do not demonstrate significant differences between each other, it is an indication that a different number of clusters may be warranted.

Validation of the cluster is used to assess its usefulness and accuracy of group membership. As all rural counties in Texas are used in the analysis, validating the cluster analysis to determine generalizability to other rural Texas counties is unnecessary. However, a validity check of the top cluster solutions' stability can be performed utilizing a non-hierarchical k-means test with random seed points (Hair et al., 2006). If the results are similar to the selected cluster solution, it provides support to the underlying structure of the distinct groups.

Profiles of each cluster can be undertaken through a series of post-hoc one-way ANOVAs (Humphreys & Rosenheck, 1995; Rapkin & Luke, 1993) and chi-square tests (Hair et al., 2006; Humphreys & Rosenheck). The use of ANOVAs will reveal how the clusters are unique from each other. (ANOVAs are also used in multiple discriminant analysis (MDA) to help identify variables to enter into the analysis. While MDA can be used with cluster analysis to help profile clusters, it is not used for this analysis because MDA only retains variables that are significantly different across all identified groups. Due to the nature of this typology, it is likely that some clusters may share similar patterns on some variables, while having significant differences on others.)

Geographic Information Systems

For this study, geographic information systems (GIS) data was used in conjunction with the cluster analysis to provide a visual representation of demographic and economic changes and distributions in Texas counties. ESRI's ArcView computer program was used to run GIS spatial analysis and generate maps.

Modern technology has created a digital form of mapping and spatial analysis through the use of GIS data. GIS data uses digital representations to generate locations and phenomenon that occur on or near the Earth's surface (ESRI, 2006). Using GIS data provides another way to understand and communicate data about the world and people and how the two interact as a system.

Specifically, the third step of the analysis will include an overlay of the various categories of the transportation variable onto a map of Texas counties. The counties will be classified and color-coded by their appropriate typology type as determined in Step Three. This visual representation will allow for a more graphic understanding of transportation accessibility than may be provided by other forms of the variable, such as a count of the number of airports or the miles of interstate within a county. In addition, maps will make it easy to determine if the counties within each category are clustered in close proximity to each other or if they are scattered across the state and the distribution of non-core and micropolitan counties within each cluster.

CHAPTER FIVE: ANALYSIS

This chapter provides a description of rural counties. The results of the cluster analysis and the profiles of the clusters generated are then reviewed. Lastly, the series of maps generated using the geographic information systems data and the study variables are presented.

Characteristics of the Sample

In order to better understand the status of rural counties in Texas, a brief description of the counties used in this analysis is provided. In total, 177 of the 254 counties in Texas were included in the cluster analysis. One hundred thirty-three counties are classified as non-core counties; forty-four counties are micropolitan counties, which have an urban cluster of at least 10,000 or a commuting of at least 25 percent in either direction with a county classified as micropolitan.

On average, rural counties in Texas have recorded a 1.69 percent decline in their population between 2000 and 2007; however, a one-way t-test ($t(175) = -3.495$, $p < .001$) reveals that there is a significant difference between non-core and metropolitan counties. Non-core counties have had a 2.88 percent decline in population, whereas micropolitan counties have registered a 1.90 percent increase. Per capita personal income has recorded a 14.97 percent growth in the rural counties between 2000 and 2007, after an adjustment has been made for inflation. While there are differences between non-core and metropolitan counties, the differences in per capita personal income are not statistically significant ($t(175) = .937$, $p < .350$). See Table 5.

Table 5. Means and t-tests of Select Sample Characteristics by County Type

County Characteristics	*All Rural Counties n=177* $\bar{x}$ *(SD)*	*Non-Core Counties n=133* $\bar{x}$ *(SD)*	*Micropolitan Counties n=44* $\bar{x}$ *(SD)*	*Group Differences t*
Population percent change 2000-2007	-1.69 (8.11)	-2.88 (8.23)	1.90 (6.61)	-3.495*
Per Capita Personal Income Percent Change 2000-2007	14.97 (17.54)	15.68 (18.76)	12.82 (13.11)	.937
Demographics (%)				
Migration				
Net	-1.58 (4.61)	-1.71 (4.84)	-1.18 (3.86)	-.659
Foreign-Born	.04 (.06)	.03 (.05)	.07 (.07)	-3.764*
Race/Ethnicity				
Hispanic	29.23 (23.76)	27.71 (22.31)	33.84 (27.48)	-1.342
White	63.45 (21.62)	65.37 (20.3)	57.63 (24.54)	2.077**
Black	5.89 (6.98)	5.57 (6.93)	6.88 (7.13)	-1.082
65+ Years	16.41 (4.23)	17.28 (4.23)	13.76 (2.98)	6.070*
4-year degree	11.48 (3.47)	11.37 (3.50)	11.81 (3.4)	-.730
Geography				
Square Miles	1093.6 (735.41)	1112.45 (800.09)	1036.6 (494.05)	.592
Natural Amenities	4.06 (.59)	4.05 (.58)	4.07 (.63)	.736
Employment/Economy (%)				
Unemployed	5.3 (4.34)	4.98 (3.76)	6.24 (5.65)	-1.684**
Commute	26.51 (11.50)	28.26 (11)	21.23 (11.49)	3.638*

*p<.001, **p<.05

Demographics

Rural Texas counties reported a 1.58 percent decrease in net migration in 2000; the percent of foreign-born migration, however, recorded a .04 increase. Analysis found a significant difference (t (175) = 3.764, p < .001) between the percent of foreign-born migration occurring with non-core counties as compared to that of micropolitan counties, with non-core counties registering .04 percent less foreign-born migration. In 2000, 29.23 percent of rural county residents self-reported their ethnicity as Hispanic, 63.45 percent self-reported as non-Hispanic White, and 5.89 percent self-reported as Black. Analysis revealed the one difference ($t(175) = 2.077$, $p < .05$), in regards to racial/ethnicity characteristics, between non-core and micropolitan counties is that non-core counties have significantly more White residents. The percent of rural Texas residents age 65 or older is 16.41 percent; non-core counties have a significantly higher ($t(175) = 6.070$, $p < .001$) percent of older adults (17.28 percent) than micropolitan counties (13.76 percent). Lastly, 11.48 percent of rural residents report having earned a four-year college degree. There were no significant differences found between non-core and micropolitan county residents.

Geography

The average size of rural counties in Texas is 1093.6 square miles. In regards to natural amenities, rural counties have a mean score of 4.06 on the zero to seven scale developed by McGranahan (1999). There were no significant differences between non-core and micropolitan counties in either the size of the counties or their level of natural amenities.

Economy

The rural counties in Texas had an unemployment rate of 5.3 percent in 2000. There is a significant difference ($t(175) = -1.684$, $p < .05$) in the unemployment between county types, with micropolitan counties recording a 1.26 percent higher rate of unemployment than those found in non-core counties. Residents of rural counties had a commuting of 26.51 percent, with 7.03 percent more residents in non-core counties commuting as compared to residents living in micropolitan counties ($t(175) = 3.638$, $p < .001$).

Table 6 present the frequency counts of the six economic-dependence categories and the number of colleges and hospitals per county type. Forty-three (24.29%) rural counties are classified as farming dependent; 33 of these farming dependent counties are non-core. Mining dependent counties (15) make up 8.47 percent of rural counties, with the majority of them (12) found in non-core counties. Designated manufacturing counties are found in 23 (12.99%) of rural counties; seventeen are located in non-core counties, and six are located in micropolitan counties. Twenty-five (14.12%) rural counties have been designated as FS Government economic dependent counties. Nineteen of these FS Government counties are found in non-core counties; six are found in micropolitan. Service dependent counties comprise 7.91 percent (14) of rural counties; a higher percentage (9.09 versus 7.52) of service dependent counties is found in micropolitan counties as compared to non-core counties. Lastly, there are 42 non-core and 15 micropolitan counties designated as non-specified in regards to economic dependence.

Services

The vast majority of rural counties have no advanced educational institutions. Of the 177 counties, 146 (82.49%) do not have a two or four-year college or university, and 28 (15.82%) have only one. Non-core counties are more than twice as likely as micropolitan counties to not have a college. Only three counties, representing just 1.69 percent of rural counties, have two or more colleges; all three are micropolitan counties.

Almost one-third of rural counties (28.81%) do not have a hospital within their boundaries. Non-core counties are just over three times more likely than micropolitan counties to not have a hospital. Sixty-eight non-core and twenty-eight micropolitan counties have one hospital. Lastly, 30 rural counties, 19 of them non-core and 11 of the micropolitan, have two or more hospitals.

Table 6. Frequency Counts of Select Sample Characteristics by County Type

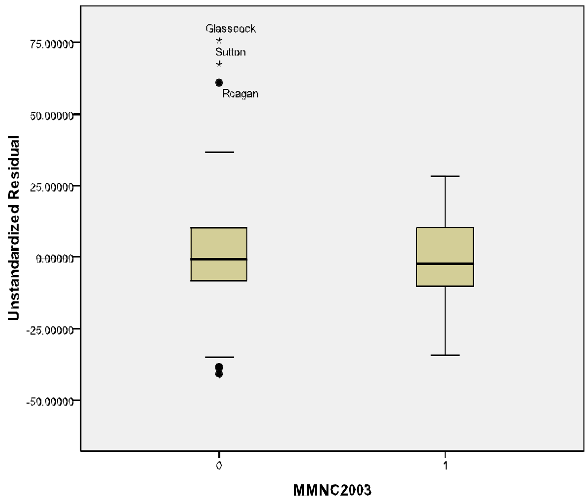
County Characteristics	***All Rural Counties n=177 Freq (%)***	***Non-Core Counties n=133 Freq (%)***	***Micropolitan Counties n=44 Freq (%)***
Economic Dependence Status			
Farming	43 (24.29)	33 (24.81)	10 (22.73)
Mining	15 (8.47)	12 (9.02)	3 (6.82)
Manufacturing	23 (12.99)	17 (12.78)	6 (13.64)
FS Government	25 (14.12)	19 (14.29)	6 (13.64)
Service	14 (7.91)	10 (7.52)	4 (9.09)
Nonspecified	57 (32.20)	42 (31.58)	15 (34.09)
Services			
Colleges/Universities			
N=0	146 (82.49)	127 (95.49)	19 (43.18)
N=1	28 (15.82)	6 (4.51)	22 (50)
N≥2	3 (1.69)	0	3 (6.82)
Hospitals			
N=0	51 (28.81)	46 (34.59)	5 (11.36)
N=1	96 (54.24)	68 (47.22)	28 (63.64)
N≥2	30 (16.95)	19 (14.29)	11 (25)

Cluster Analysis

Outliers

The data was examined for outliers; standardized z-scores for samples larger than 80 are considered outliers when scores exceed four (Hair et al., 2006). An examination of the cluster variables at the univariate level found the county Glasscock was a significant outlier for the variable per capita personal income percent change (z= 8.89). Calculating and plotting the unstandardized residual of the interaction between population percent change and per capita personal income percent change revealed, through the visual inspection of the generated boxplot (see Figure 3), that the counties Glasscock, Reagan, and Sutton are outliers.

Figure 5. Boxplot of Unstandardized Residuals



For larger samples (n > 80), Mahalanobis D^2 scores greater than three or four can be considered outliers (Hair et al., 2006). Calculation of the Mahalanobis D^2 statistic confirmed that the counties Glasscock, Reagan, and Sutton are outliers, with scores of 10.76, 6.79, and 6.56 respectively. Furthermore, when the cluster analysis was performed with all 177 rural counties, it was noted that for different computations, utilizing different algorithms and distance measures, the counties Glasscock, Reagan, and Sutton were oftentimes the last, or near the last, three counties to be joined into clusters. This joining into cluster groups occurred late in the clustering sequence, oftentimes within the last few clusters to be formed. These preliminary cluster results helped confirm that these three counties are outliers. Based on these findings, it is appropriate to remove these three counties from analysis at this time. The hierarchical cluster analysis was then conducted with 174 counties.

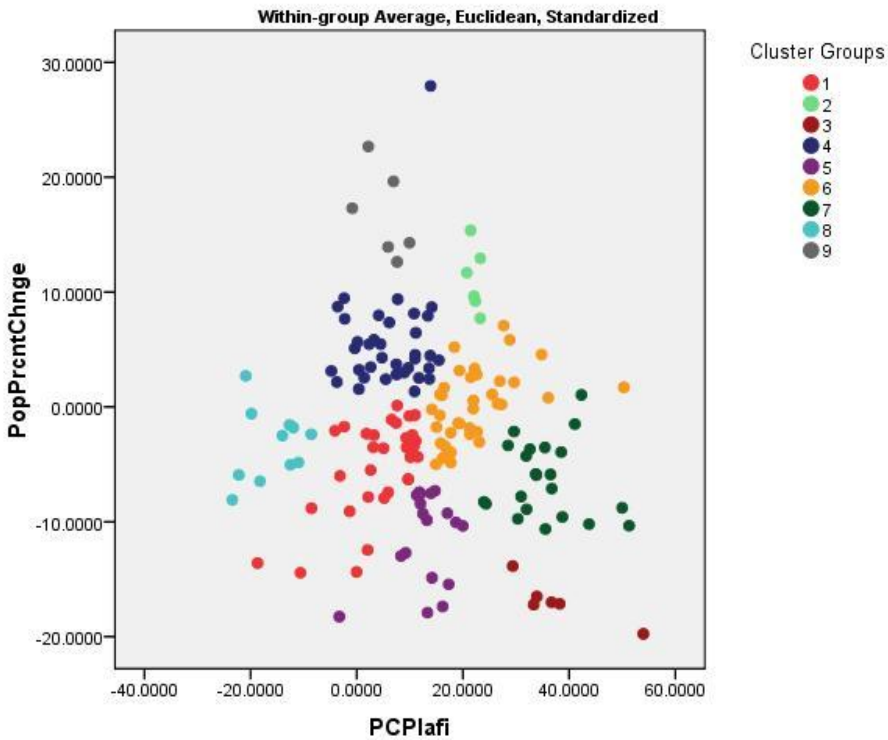
Multiple hierarchical cluster analyses, each utilizing one of the two selected algorithms paired with one of two selected distance measures, were performed. Using the percent change in heterogeneity stopping rule, each analysis was evaluated for large increases in the agglomeration coefficient. For each analysis, solutions immediately prior to large coefficient jumps, which still provided sufficient homogeneity between clusters, were identified. See Table 7 for a selected presentation of the agglomeration coefficients and subsequent percent increase in heterogeneity between each cluster solution for the Within-group Average, Euclidean analysis.

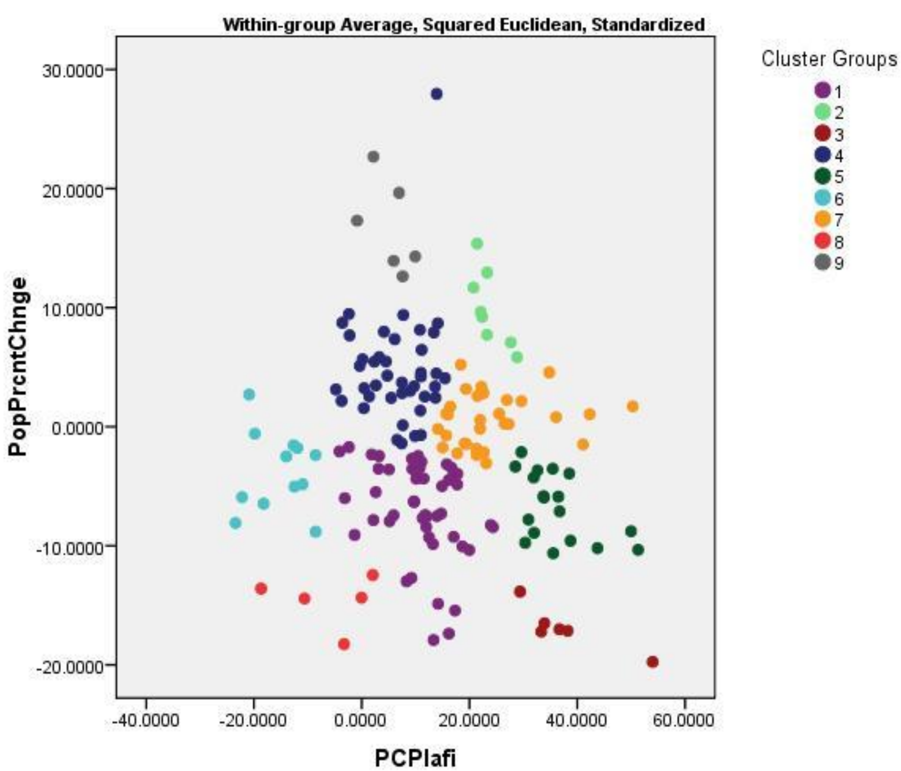
Table 7. Partial Within-Average, Euclidean Agglomeration Schedule

Stage	*Agglomeration Coefficient*	*Percent Increase to Next Stage*	*Number of Clusters*
165	.822	10.71	9
166	.910	4.9	8
167	.955	3.56	7
168	.989	3.44	6
169	1.023	18.96	5
170	1.217	1.72	4

The means of the variables for each of the selected cluster solutions were evaluated. Similar patterns of cluster grouping were noted across several of the solutions. For example, the Within-group Average, Euclidean and the Within-group Average, Squared Euclidean nine-cluster solutions results had similar, though not identical, patterns of clustering. To illustrate the underlying similarity between methods, Figure 6 displays the scatterplots for the nine-cluster hierarchical solutions for these two analyses.

Figure 6. Selected Hierarchical Nine-Cluster Solutions





An examination of the data and a visual examination of scatterplots generated from the results of all the possible combinations of the selected algorithms and distance measures indicate that the Within-group Average, Euclidean cluster solutions appeared to provide the most logical group of clusters. The nine-group and five-group Euclidean cluster solutions warranted further analyses. In addition, the eight-group cluster will be examined, as it represents a more manageable number of clusters than the nine-group cluster but still provides distinction not available in the five-group cluster. After the selection of the three hierarchical cluster solutions, a k-means cluster analysis was conducted for each. The results of each k-means cluster solution are presented.

Nine-Cluster K-Means Solution

For the first k-means analysis, a nine-cluster solution was specified. Using the clusters seeds (cluster centroids) from the selected nine-cluster hierarchical solution, the analysis was performed and counties were reassigned to the most appropriate cluster. See Table 8 for the original and refined centroid means and cluster sizes.

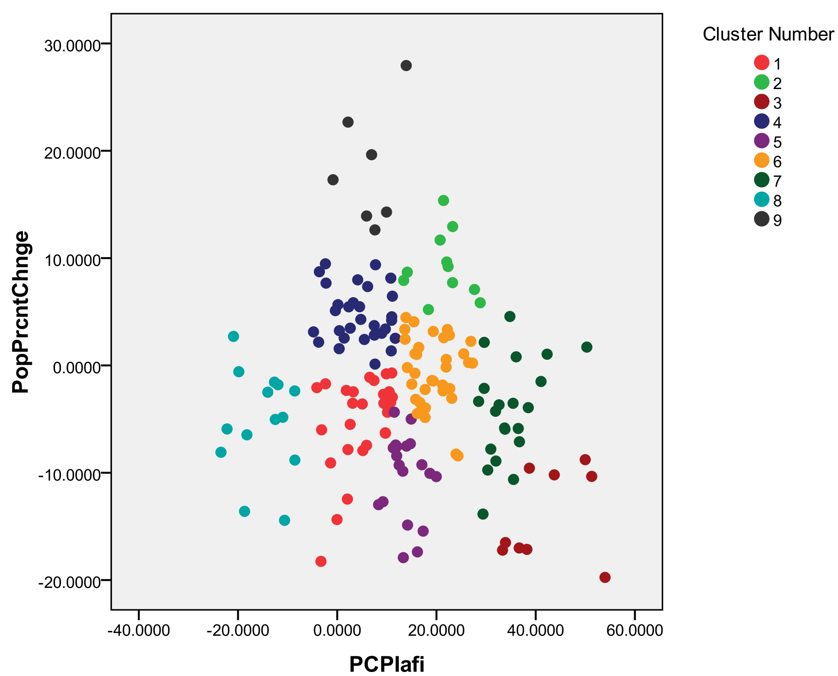
Table 8. Nine-Cluster Solution Centroids

	Cluster Centroids of Nine-Cluster Solution								
Hierarchical Cluster Number	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***
Number of Counties	32	6	6	36	18	37	22	11	6
Population Percent Change	-5.24	11.09	-16.91	5.55	-11.35	.02	-6.31	-3.31	16.74
Per Capita Personal Income Percent Change	3.97	22.18	37.58	6.23	12.91	22.02	35.53	-15.93	5.28
K-Means Cluster Number	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***
Number of Counties	28	11	9	30	19	35	21	14	7
Population Percent Change	-5.17	9.21	-14.06	4.71	-10.28	-.68	-4.18	-5.24	18.34
Per Capita Personal Income Percent Change	5.09	21.41	42.21	4.46	13.79	19.40	34.75	-15.22	6.51

Both variables, population percent change and per capita personal income percent change , were significant contributors to the solution, at the $p < .001$ level, with $F_{8, 165}$ scores of 73.671 and 184.568 respectively. Cluster one contained 28 counties; it had population loss of -5.17 percent and per capita personal income growth of 5.09 percent. Cluster two was comprised of 11 counties and registered growth in its population and per capita personal income ($\bar{x}$ = 9.21, 21.41). Cluster three held nine counties; this cluster had population loss ($\bar{x}$ = -14.06) coupled with economic gain in per capita personal income ($\bar{x}$ = 42.21). The fourth cluster, with 30 counties, had population growth of 4.71 percent and per capita personal income growth of 4.46 percent. Cluster five contained 19 counties; this cluster had population loss ($\bar{x}$ = -10.28) and per capita personal income growth ($\bar{x}$ = 13.79). The sixth cluster was comprised of 35 counties and recorded population loss ($\bar{x}$ =

-.68) and per capita personal income growth of 19.40 percent. Cluster seven, with 21 counties, registered population loss of .4.18 percent and per capita personal income growth of 34.75 percent. The eighth cluster of 14 counties had loss of population and per capita personal income had respective losses of 5.24 and 15.22 percent. The final, ninth cluster had seven counties; it registered population growth of 18.34 percent and per capita personal income growth of 6.51 percent. A scatterplot of the nine-cluster solution is provided in Figure 6.

Figure 6. Nine-Cluster Solution Scatterplot



Eight-Cluster K-Means Solution

For the second k-means analysis, an eight-cluster solution was specified. Again, clusters seeds (cluster centroids) generated by the hierarchical analysis, in this instance the eight-cluster solution, were used. The analysis was performed and counties were assigned to the most appropriate cluster. See Table 9 for the original and refined centroid means and cluster sizes.

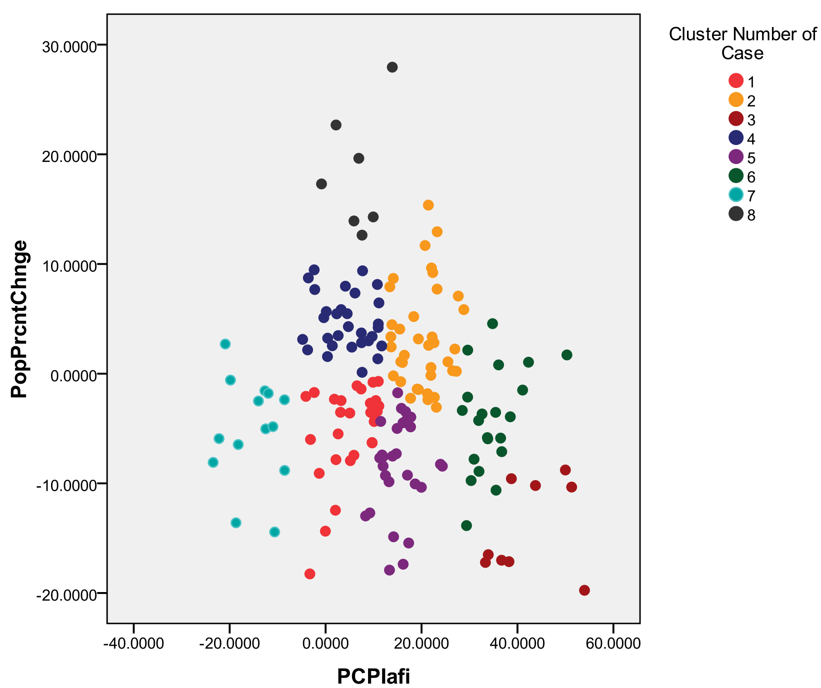
Table 9. Eight-Cluster Solution Centroids

	Cluster Centroids of Eight-Cluster Solution							
Hierarchical Cluster Number	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***
Number of Counties	32	43	6	36	18	22	11	6
Population Percent Change	-5.24	1.57	-16.91	5.55	-11.35	-6.31	-3.31	16.74
Per Capita Personal Income Percent Change	3.97	22.04	37.58	6.23	12.91	35.53	-15.93	5.28
K-Means Cluster Number	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***
Number of Counties	28	37	9	30	28	21	14	7
Population Percent Change	-5.17	3.25	-14.06	4.71	-8.5	-4.18	-5.24	18.34
Per Capita Personal Income Percent Change	5.09	20.27	42.21	4.46	15.23	34.75	-15.22	6.51

Both variables, population percent change and per capita personal income percent change , were significant contributors to the solution, at the $p < .001$ level, with $F_{7, 166}$ scores of 65.05 and 204.88 respectively. Cluster one contained 28 counties; it had population loss of -5.17 percent and per capita personal income growth of 5.09 percent. Cluster two was comprised of 37 counties and registered growth in its population and per capita personal income ($\bar{x}$ = 3.25, 20.27). Cluster three held nine counties; this cluster had population loss ($\bar{x}$ = -14.06) coupled with economic gain in per capita personal income ($\bar{x}$ = 42.21). The fourth cluster, with 30 counties, had population growth of 4.71 percent and per capita personal income growth of 4.46 percent. Cluster five contained 28 counties;

this cluster had population loss (x̄ = -8.5) and per capita personal income growth (x̄ = 15.23). The sixth cluster was comprised of 21 counties and recorded population loss (x̄ = -4.18) and per capita personal income growth (x̄ = 34.75). Cluster seven, with 14 counties, registered population loss of 5.24 percent and per capita personal income loss of 15.22 percent. The eighth cluster of seven counties had population and per capita personal income growth of 18.34 and 6.51 percent respectively. Figure 7 is a generated scatterplot of the eight-cluster solution.

Figure 7. Eight-Cluster Solution Scatterplot



Five-Cluster K-Means Solution

The final k-means solution to be examined is a five-cluster solution. This solution is the most parsimonious solution examined; however, valuable distinction between cluster groups may have been lost as a result. See Table 10 for the original and refined centroid means and cluster sizes.

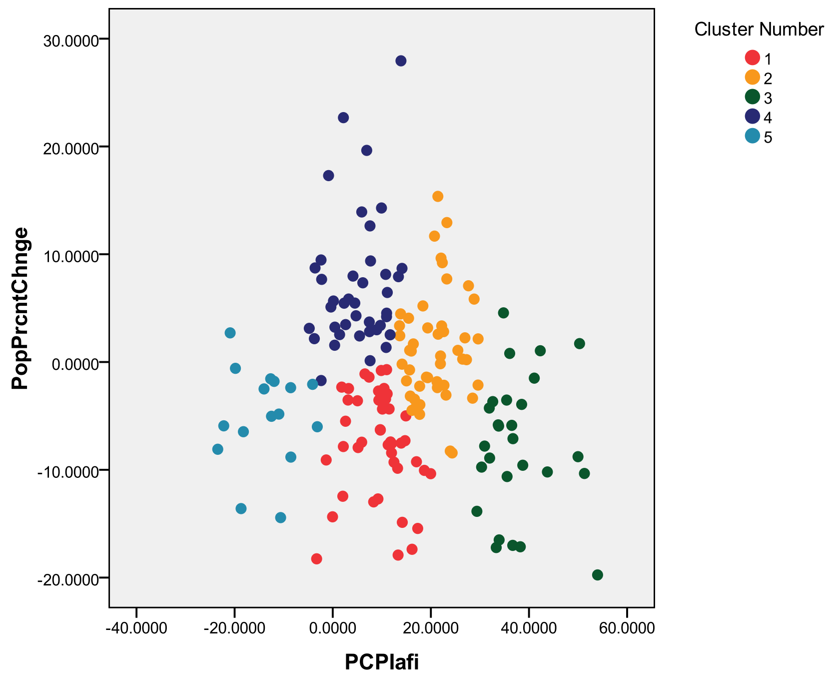
Table 10. Five-Cluster Solution Centroids

	Cluster Centroids of Five-Cluster Solution				
Hierarchical Cluster Number	***1***	***2***	***3***	***4***	***5***
Number of Counties	50	43	28	42	11
Population Percent Change	-7.44	1.57	-8.58	7.15	-3.31
Per Capita Personal Income Percent Change	7.19	22.04	35.97	6.09	-15.93
K-Means Cluster Number	***1***	***2***	***3***	***4***	***5***
Number of Counties	44	47	27	40	16
Population Percent Change	-7.51	1.22	-7.81	7.11	-5.09
Per Capita Personal Income Percent Change	9.41	20.74	37.85	5.11	-13.77

As with the eight and nine-cluster solutions, population percent change and per capita personal income percent change were both significant contributors to the solution, at the $p < .001$ level, with $F_{4, 169}$ scores of 51.937 and 278.769 respectively. Cluster one represented 44 counties. These counties recorded a -7.51 percent loss of population coupled with a 9.41 percent increase in per capita personal income. The second cluster was comprised of 47 counties; it had a percent increase in population and per capita personal income of 1.22 and 20.74 respectively. The third cluster, with 27 counties, had population loss of 7.81 percent and per capita personal income growth of 37.85 percent. Cluster four held 40 counties; this cluster recorded population growth ($\bar{x} = 7.11$) coupled with economic gain in per capita personal income ($\bar{x} = 5.11$). The fifth cluster contained

16 counties; the cluster had population loss of 5.09 percent and per capita personal income loss of 13.77 percent. A scatterplot of the five-cluster solutions is presented in Figure 8.

Figure 8. Five-Cluster Solution Scatterplot



Validity of Cluster Solutions

The stability of two solutions, the nine-cluster and the five-cluster, were evaluated. The nine-cluster solution was favored over the eight-cluster solution as it did appear to provide some valuable distinction between disparate groups. The five-cluster solution was selected for continued analysis as it still provides sufficient division between dissimilar groups but is less unwieldy than the larger cluster solutions. For each analysis, two non-hierarchical k-means cluster analyses, with each utilizing a random seed point, were performed. For the nine-cluster solution, there was some instability noted, particularly in regards to cluster six. While several of the clusters formed mirrored the earlier findings, overall, it appeared this was the not the best option for continued analysis. The results of the two random seed point analyses are presented in Table 11.

Table 11. Nine-Cluster Random Solution Centroids

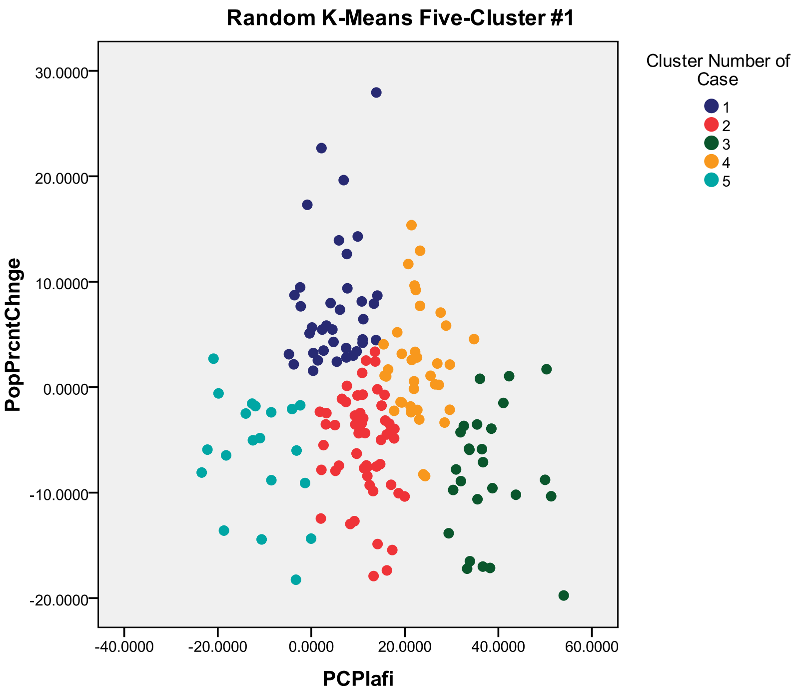
	Cluster Centroids of Nine-Cluster Solution								
Initial Centroids #1	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***
Population Percent Change	15.37	-4.22	-8.09	3.12	-17.21	.7988	22.67	-19.75	-18.26
Per Capita Personal Income Percent Change	21.43	16.90	-23.44	-4.79	33.32	36.07	2.17	53.98	-3.28
Final Centroids #1	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***
Number of Counties	28	46	12	31	12	20	8	5	12
Population Percent Change	5.21	-5.86	-4.17	2.79	-11.99	-.74	17.22	-9.47	-10.43
Per Capita Personal Income Percent Change	17.13	14.78	-16.16	2.59	33.34	32.36	6.66	49.86	-.06
Initial Centroids #2	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***
Population Percent Change	-17.21	-5	27.94	-18.26	-5.92	-19.75	1.71	12.94	9.47
Per Capita Personal Income Percent Change	33.32	14.91	13.90	-3.28	-22.21	53.98	50.31	23.27	-2.39
Final Centroids #2	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***
Number of Counties	21	40	7	14	12	4	6	35	35
Population Percent Change	-8.9	-6.55	18.34	-8.53	-4.17	-12.27	.45	3.58	3.72
Per Capita Personal Income Percent Change	32.68	13.43	6.51	-.89	-16.16	49.75	40.51	20.92	4.51

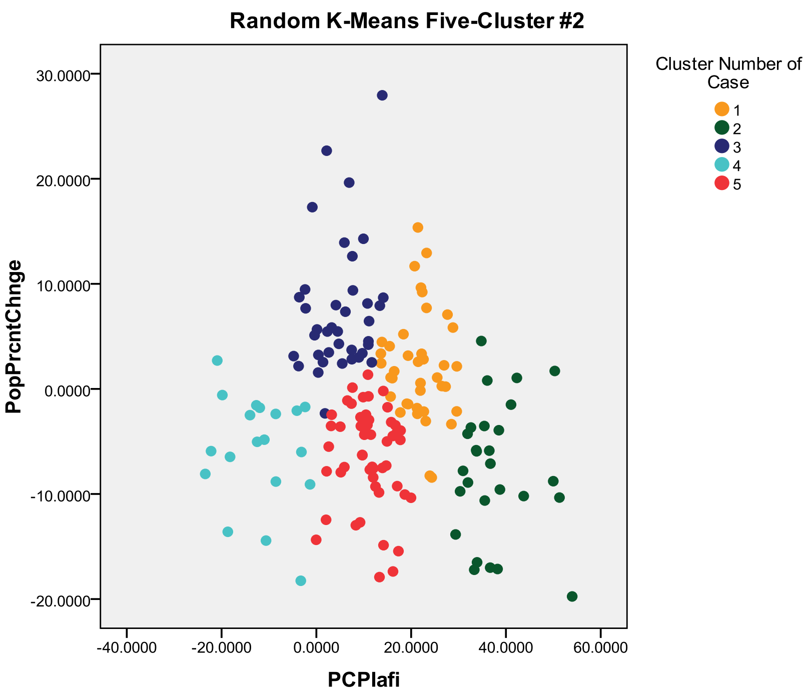
With the five-cluster solution, there was good underlying stability noted in the cluster groupings for both of the random start analyses. The initial seed points and final cluster solutions are presented in Table 12. In addition, the scatterplots from both the five-cluster random solutions are shown in Figure 9.

Table 12. Five-Cluster Random Solution Centroids

	Cluster Centroids of Five-Cluster Random Solution				
Initial Centroids #1	***1***	***2***	***3***	***4***	***5***
Population Percent Change	22.67	-12.98	-19.75	4.56	-8.09
Per Capita Personal Income Percent Change	2.17	8.34	53.98	34.81	-23.44
Final Centroids #1	***1***	***2***	***3***	***4***	***5***
Number of Counties	37	55	26	36	20
Population Percent Change	7.75	-5.56	-8.29	2.18	-6.24
Per Capita Personal Income Percent Change	5.15	11.31	37.96	22.85	-11.37
Initial Centroids #2	***1***	***2***	***3***	***4***	***5***
Population Percent Change	12.94	-19.75	7.67	-8.09	-17.37
Per Capita Personal Income Percent Change	23.27	53.98	-2.26	-23.44	16.17
Final Centroids #2	***1***	***2***	***3***	***4***	***5***
Number of Counties	39	27	38	19	51
Population Percent Change	2.14	-7.81	7.43	-5.81	-6.38
Per Capita Personal Income Percent Change	21.66	37.85	5.00	-11.97	11.09

Figure 9. Five-Cluster Random Solution Scatterplots

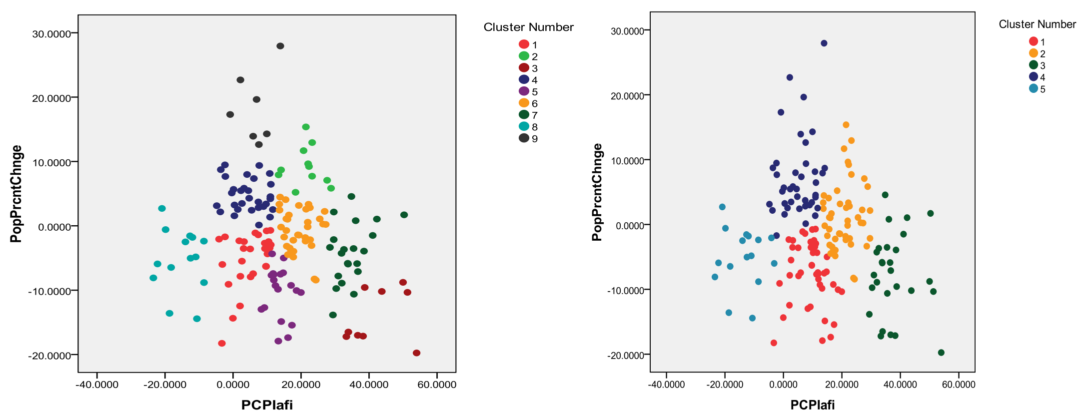




Selection of Final Cluster Solution

The five-cluster k-means solution appeared to the most appropriate for continued development of the taxonomy. This solution appeared to provide the most parsimonious cluster taxonomy while still providing valuable categorization of the counties. There was some loss of discrete information, in comparison to the eight and nine-cluster solutions; however, this loss was deemed acceptable. A side-by-side comparison revealed how the clusters shifted and recombined from the nine-cluster solution to the five-cluster solution. See Figure 10. In general, clusters one and five of the nine-cluster solution combined, as did clusters two and six, three and seven, and clusters four and nine to form the clusters of the five-cluster solution; cluster eight gained two counties in the five-cluster solution as compared to the nine-cluster solution.

Figure 10. Side-by-Side Comparison of Nine and Five Cluster Solutions



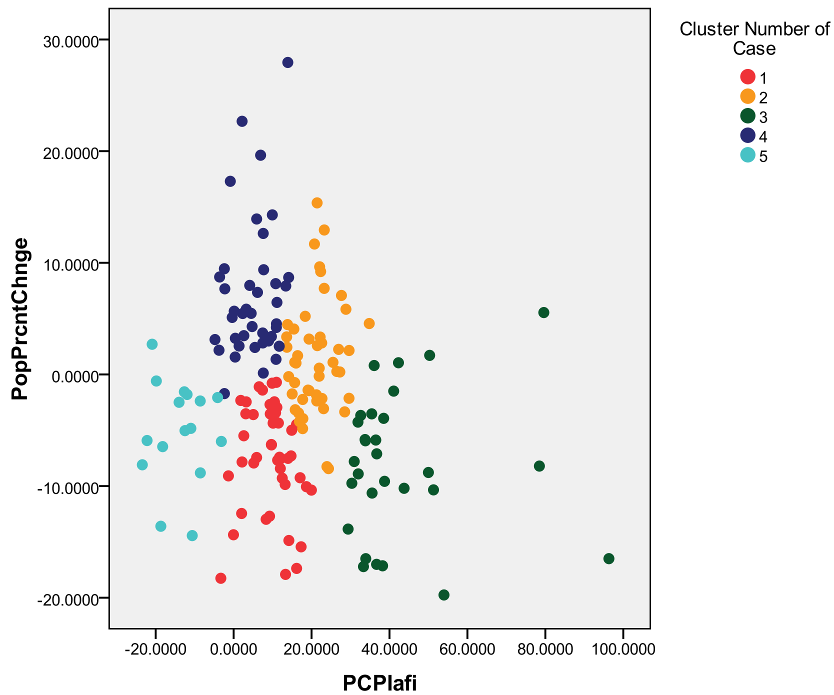
Inclusion of Outliers

Once a stable cluster-solution had been selected, the k-means analysis was rerun to determine if the inclusion of the identified outliers would be possible. While k-means analysis is particularly vulnerable to outliers (Hair et al., 2006), using the cluster centroids and set number of clusters generated from the original hierarchical analysis provided enough initial structure to prevent the cluster groups from being drastically affected. The slight rearrangements in clusters and the changes in the cluster centroids found in the solution with outliers were deemed acceptable and worth having all 177 rural counties included in the typology development. See Table 13 and Figure 11.

Table 13. Five-Cluster Solution Centroids with Outliers

	Cluster Centroids of Five-Cluster Solutions				
Hierarchical Cluster Seeds	***1***	***2***	***3***	***4***	***5***
Population Percent Change	-7.44	1.57	-8.58	7.15	-3.31
Per Capita Personal Income Percent Change	7.19	22.04	35.97	6.09	-15.93
K-Means Cluster Number	***1***	***2***	***3***	***4***	***5***
Number of Counties	44	47	27	40	16
Population Percent Change	-7.51	1.22	-7.81	7.11	-5.09
Per Capita Personal Income Percent Change	9.41	20.74	37.85	5.11	-13.77
K-Means Cluster Number with Outliers	***1***	***2***	***3***	***4***	***5***
Number of Counties	45	47	29	40	16
Population Percent Change	-7.44	1.42	-8.09	7.11	-5.09
Per Capita Personal Income Percent Change	9.56	21.13	42.81	5.11	-13.77

Figure 11. Five-Cluster Solution with Outliers Scatterplot



A comparison of the cluster variates, population percent change and per capita personal income percent change, revealed that both contributed to the solution at the $p \leq .001$ level, with $F_{4, 172}$ scores of 53.375 and 160.413 respectively. A Tukey HSD post-hoc analysis was performed to determine how these variates differed among the clusters. See Table 14.

Table 14. Five-Cluster Solution Variates

Variable	**1 (n=45)**	**2 (n=47)**	**3 (n=29)**	**4 (n=40)**	**5 (n=16)**	**(F) Test Statistic[a]**	**Multiple comparison[a]**
Population percent change	-7.44	1.42	-8.09	7.11	-5.09	53.375[a]	1<2[a] 4>2>3,5[a]
PCPI Change	9.56	21.14	42.81	5.11	-13.77	160.413[a]	2>4[a] 5<1,2,4<3[a]

[a] $p \leq .001$

Cluster one had a population loss of 7.44 percent and per capita personal income growth of 9.56 percent. Cluster two had population growth of 1.42 percent and per capita personal income growth of 21.14 percent. The third cluster had population loss ($\bar{x}$ = -8.09) and per capita personal income growth ($\bar{x}$ = 42.81). Cluster four had both population and per capita personal income growth, 7.11 percent and 5.11 percent respectively. The fifth cluster showed both population ($\bar{x}$ = -5.09) and per capita personal income loss ($\bar{x}$ = -13.77).

Cluster one population percent change was less (MD [mean difference] = 8.86, $p \leq .001$) than cluster two. Cluster two had a significantly smaller (MD =-5.69, $p \leq .005$) population percent change than cluster four, but showed greater population percent change than clusters three (MD = -5.69, $p \leq .001$) and five (MD = 6.50, $p \leq .001$). Cluster two per capita personal income percent change was higher (MD = 16.02, $p \leq .001$) than cluster four. Cluster five per capita personal income percent change was less than clusters one, two, and four (MD = -23.34, -34.91, -56.58, $p \leq .001$). Clusters one, two, and four registered lower per capita personal income percent change than cluster three (MD = -11.57, -21.67, -37.7, $p \leq .001$). Therefore, cluster five per capita personal income percent change was also less than cluster three (MD = -56.58, $p \leq .001$).

Interpretation of Clusters

Part of this stage of the cluster analysis is to develop descriptive terms of the cluster groups. The growth and decline in the population and per capita personal income percent changes will be described utilizing Yenerall's (1999) terms of stable, growing, and declining. A brief rationale for the descriptors' definitions is first provided; then, the five clusters are provided descriptive names.

While demographers may refer to a stable population as one that maintains a constant age structure with consistent levels of fertility, mortality, and migration (Preston, Heuveline, & Guillot, 2001) that definition of stability is too restrictive for the purposes of this typology. This typology is not seeking to hold rural counties to a hypothetical constant, but is instead trying to provide guidance for rural residents and those interested in community development about larger patterns of growth and decline. By using Texas rural counties as the basis for comparison, the extreme variance found elsewhere in the United States is not included. This will allow for a like versus like comparison to occur. Residents and other interested parties will be able to better understand how they fare in comparison to their Texas neighbors. The mean population percent change across all rural Texas counties between 2000 and 2007 is a recorded loss of 1.69 percent. If a cluster records a percent population percent change between zero and -1.69 loss, it shall be classified as having a stable population. By default, any decrease in population larger than -1.69 percent shall constitute a declining population; any increase in population shall indicate a growing population.

In regards to changes in per capita personal income, guidance in describing clusters is found in the overall mean for all rural counties in Texas ($\bar{x}$=14.97). Per Capita Personal Income Percent Change that ranges between 0 and 14.97 percent will be considered stable; greater than 14.97 percent will signify growth, and less than zero will signify decline. Utilizing this method of determining the boundaries between declining, stable, and growing clusters also allows for the same method (i.e. utilizing the average mean for rural Texas counties) for both variables.

Using these parameters, cluster one can be described as declining population/stable economy (DP-SE). Cluster two is categorized as growing population/growing economy (GP-GE). The third cluster is described as declining population/growing economy (DP-GE). Cluster four represents counties with a growing population/stable economy (GP-SE). The fifth cluster is categorized as declining population/declining economy (DP-DE). An overlay of the cluster groups on the proposed 3X3 typology is found in Figure 12.

Figure 12. Overlay of Five-Cluster Solution on 3X3 Typology

	Declining Economy	Stable Economy	Growing Economy
Growing Population		4	2
Stable Population			
Declining Population	5	1	3

Profile of Clusters

Upon the final selection of the five-group cluster solution that includes the outlier counties, a series of one-way ANOVA tests were performed in order to profile the clusters. See Table 15 for mean scores and ANOVAs for the identified factors (e.g. dependent variables) for each cluster. Tukey HSD post-hoc tests were then utilized to determine how the groups differed from each other in regards to the identified factors.

Net migration was found to differentiate between clusters. The DP-SE and DP-GE clusters had significantly lower rates of net migration than clusters GP-GE and GP-SE ($p \leq .001$). In addition, the GP-GE cluster had lower rates of net migration than cluster four ($p \leq .001$). The GP-SE cluster had higher rates of net migration than the DP-DE cluster ($p \leq .001$); cluster GP-SE also had higher rates of net migration than the DP-DE cluster five ($p \leq .05$). Clusters DP-SE and DP-GE had significantly ($p \leq .005$) lower rates of foreign-born migration than the GP-SE cluster. The GP-GE cluster had higher rates ($p \leq .05$) of foreign-born migration than the DP-GE cluster.

There were some significant differences between clusters in regards to the race/ethnicity of residents. Cluster GP-SE had a lower percentage of Hispanic residents than the DP-GE cluster ($p \leq .001$) and the GP-GE cluster ($p \leq .01$). The GP-GE cluster had a lower percentage of Hispanic residents than cluster DP-GE ($p \leq .05$). There was a significant difference between the percentage of White residents, with cluster GP-SE having a greater percentage of residents than the DP-GE cluster ($p \leq .01$) and the GP-GE cluster ($p \leq .05$). Cluster GP-SE had a higher percentage of Black residents than the cluster DP-GE ($p \leq .001$) and cluster GP-GE ($p \leq .05$).

The GP-GE cluster was found to have significantly higher ($p \leq .05$) rates of unemployment than cluster DP-DE. Cluster DP-DE had more mining dependent counties than any of the other clusters ($p \leq .05$). Cluster DP-SE had fewer service dependent counties than the cluster DP-GE ($p \leq .05$). There were no other significant differences found between the clusters.

Table 15. Profile of Five-Cluster Solution

Variable	1 (n=45)	2 (n=47)	3 (n=29)	4 (n=40)	5 (n=16)	(F) Test Statistic[a,b,c]	Multiple comparison[a,b,c]
Demographics							
Migration							
Net	-3.84	-.46	-5.16	3.1	-3.69	32.462 [a]	4>2>1,3[a] 4>5[a] 2>5[c]
Foreign-Born	.02	.05	.01	.07	.04	7.923[a]	4>1,3 [a] 2>3 [b] 2>1 [c]
Ethnicity							
Hispanic	26.09	33.63	41.61	16.62	34.27	6.218[a]	4<3 [a] 4<2 [b] 1<3 [c]
White	66.47	59.58	54.91	72.09	60.18	3.623[b]	3<4 [b] 2<4 [c]
Black	7.03	6.89	1.82	7.81	6.90	5.928[a]	3<4 [a] 2<4 [c]
65+ Years	16.06	15.94	15.45	16.48	3.86	2.406	
4-year degree	11.32	11.33	10.56	12.19	12.24	1.169	
Geography							
Square Miles	1099.74	1031.96	1237.66	1010.72	1203.43	.572	
Natural Amenities	3.96	4.13	4.03	4.15	3.94	.920	
Economy							
Unemployed	4.77	6.78	5.39	4.91	3.21	2.662[c]	2>5 [c]
Commute	25.33	25.69	25.78	29.72	25.59	1.010	
Economic Dependence Status							
Farming	.29	.32	.10	.23	.19	1.355	
Mining	.07	.09	.03	.05	.31	3.255[c]	1,2,3,4<5 [c]
Manufacturing	.13	.09	.14	.20	.06	.801	
FS Government	.11	.13	.17	.15	.19	.232	
Service	.02	.09	.21	.08	.00	2.550[c]	1<3 [c]
Nonspecified	.38	.30	.34	.30	.25	.319	
Services							
Colleges/ Universities	.07	.30	.03	.43	.06	4.905[a]	1,3<4 [b]
Hospitals	1.07	1.02	.66	1.08	.56	1.844	

[a] $p \leq .001$, [b] $p \leq .01$, [c] $p \leq .05$

GIS Maps

Using the cluster analysis results, a series of maps have been developed. See Figures 13-19. These maps, in part, provide a visual interpretation of the cluster data. In addition, the individual cluster maps also illustrate each cluster's proximity to or possession of highways, airfields and airports, and railroad lines.

Cluster Solution Maps

The first map is of the five-cluster solution, with each cluster marked in a different color. See Figure 13. In general, it appears that the DP-SE cluster is found primarily in west and panhandle Texas. The GP-GE cluster is the most widely scattered cluster, with counties dispersed across the state. The DP-GE cluster is grouped in west and south Texas. The GP-SE cluster is primarily located in the eastern half of the state, with a few disparate counties located on or near the Mexico border or in the panhandle region of the state. The DP-DE cluster seems to be the second most widely dispersed group, with counties located in almost all areas of the state, the exception being the central region.

For comparison purposes, a map of the nine-cluster solution was also generated. See Figure 14. When compared to the five cluster solution group, it is readily apparent where clusters merged. Using the nine-cluster solution clusters as the starting point, a visual examination reveals that a rough accuracy can be claimed in saying that overall cluster five and one combined into the SP-GE cluster, cluster two and six formed the GP-GE cluster, cluster seven merged with cluster three to become the DP-GE cluster, clusters four and nine created the GP-SE cluster, and, lastly, cluster eight became cluster five, the

DP-DG cluster. A set of transportation maps for the five-cluster solution, providing visual representation of commercial and air taxi airports, highways, and railroads across the state is provided. See Figure 15.

Individual Cluster Maps

In addition to the map that contains all the clusters, a series of individual maps are created for each of the five clusters. See Figures 16-20. There is a large map for each cluster series which highlights the counties contained in the cluster; the names of each county are also provided. An additional map of each cluster provides more detailed information about the division of non-core and micropolitan counties and the presence of commercial or air taxi airports.

Figure 13. Five Cluster Solution Map

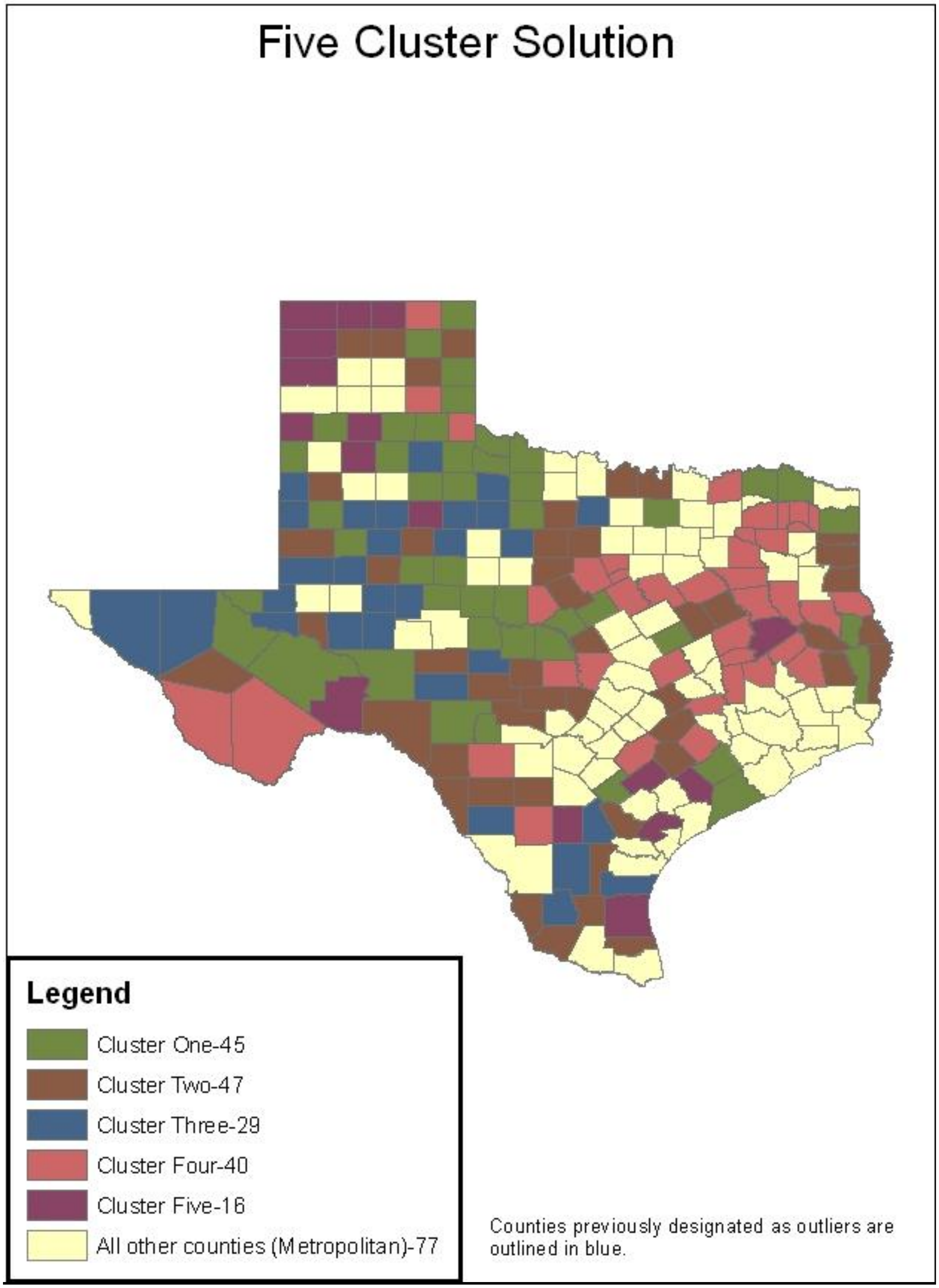


Figure 14. Nine Cluster Solution Map

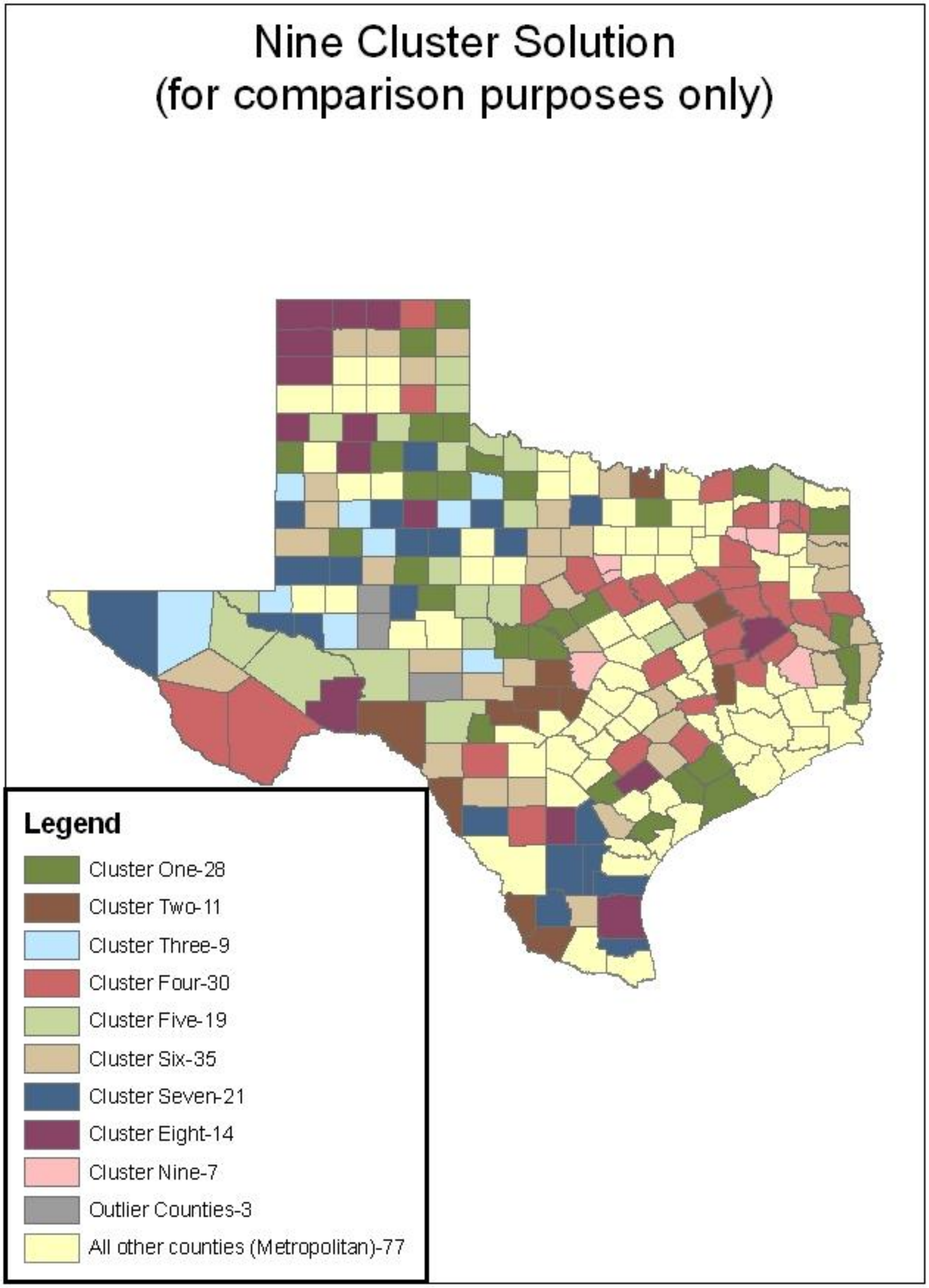
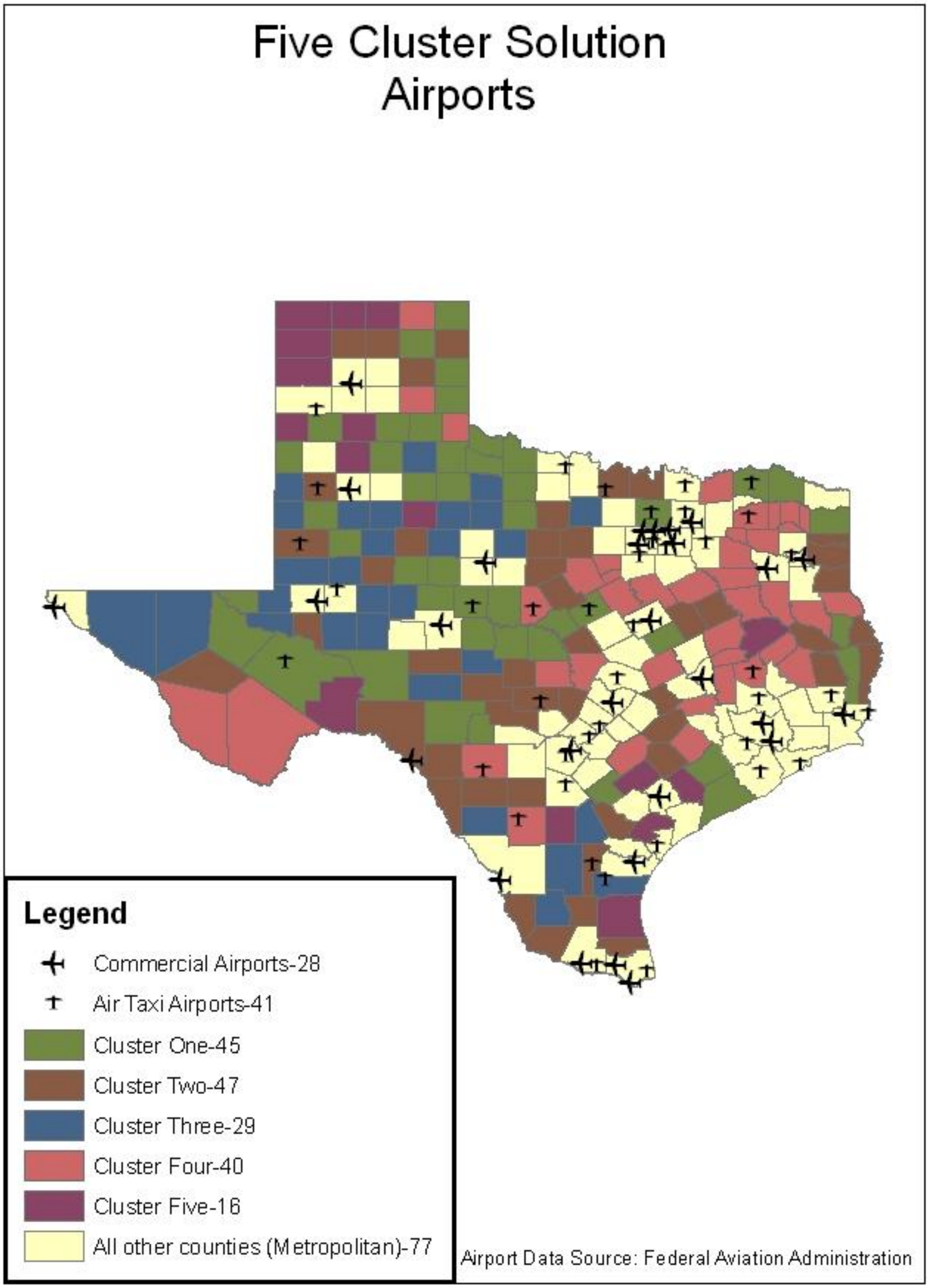
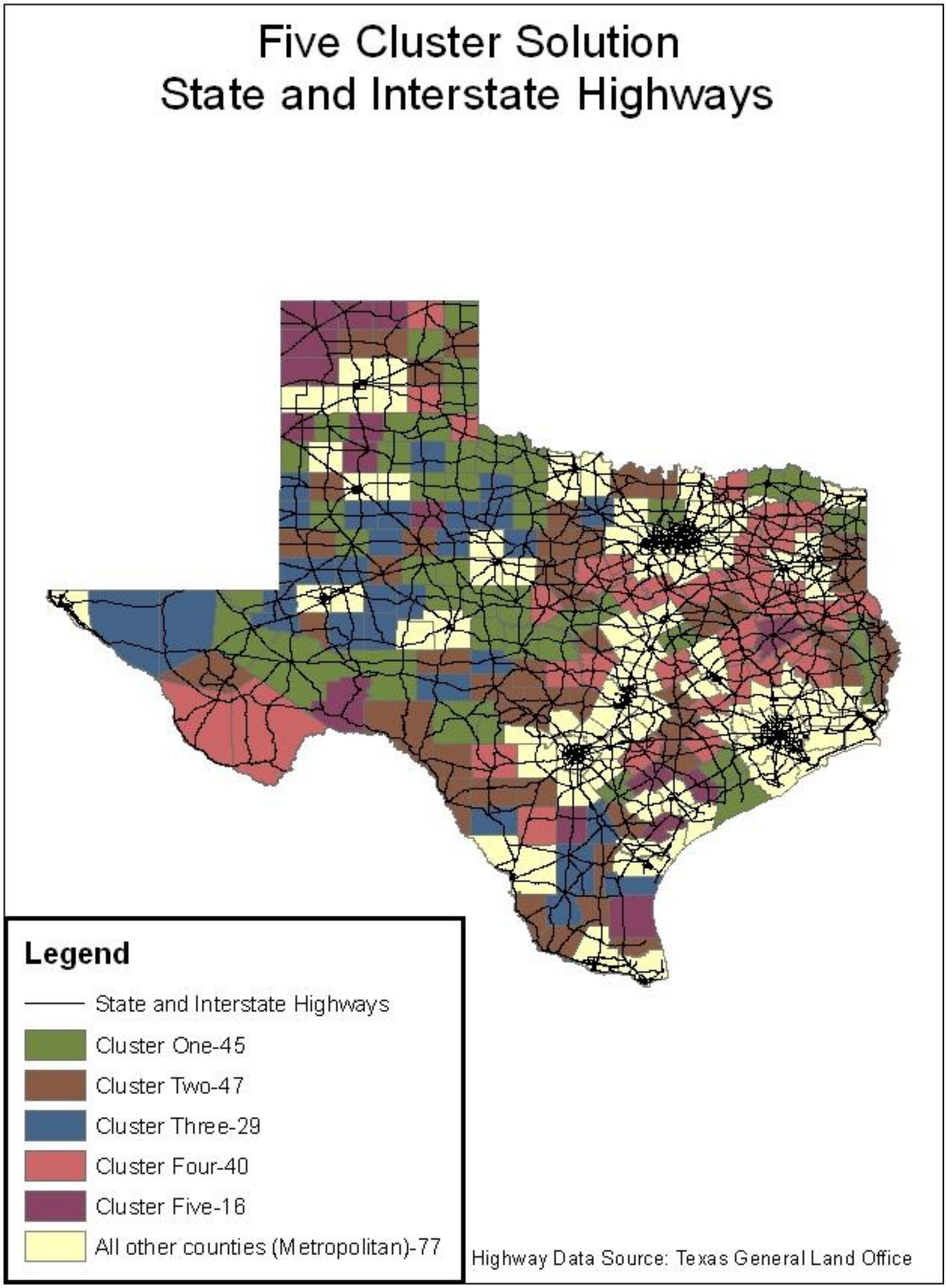


Figure 15. Five Cluster Solution Transportation Map Series




Five Cluster Solution
State and Interstate Highways
Legend
State and Interstate Highways
Cluster One-45
Cluster Two-47
Cluster Three-29
Cluster Four-40
Cluster Five-16
All other counties (Metropolitan)-77
Highway Data Source: Texas General Land Office

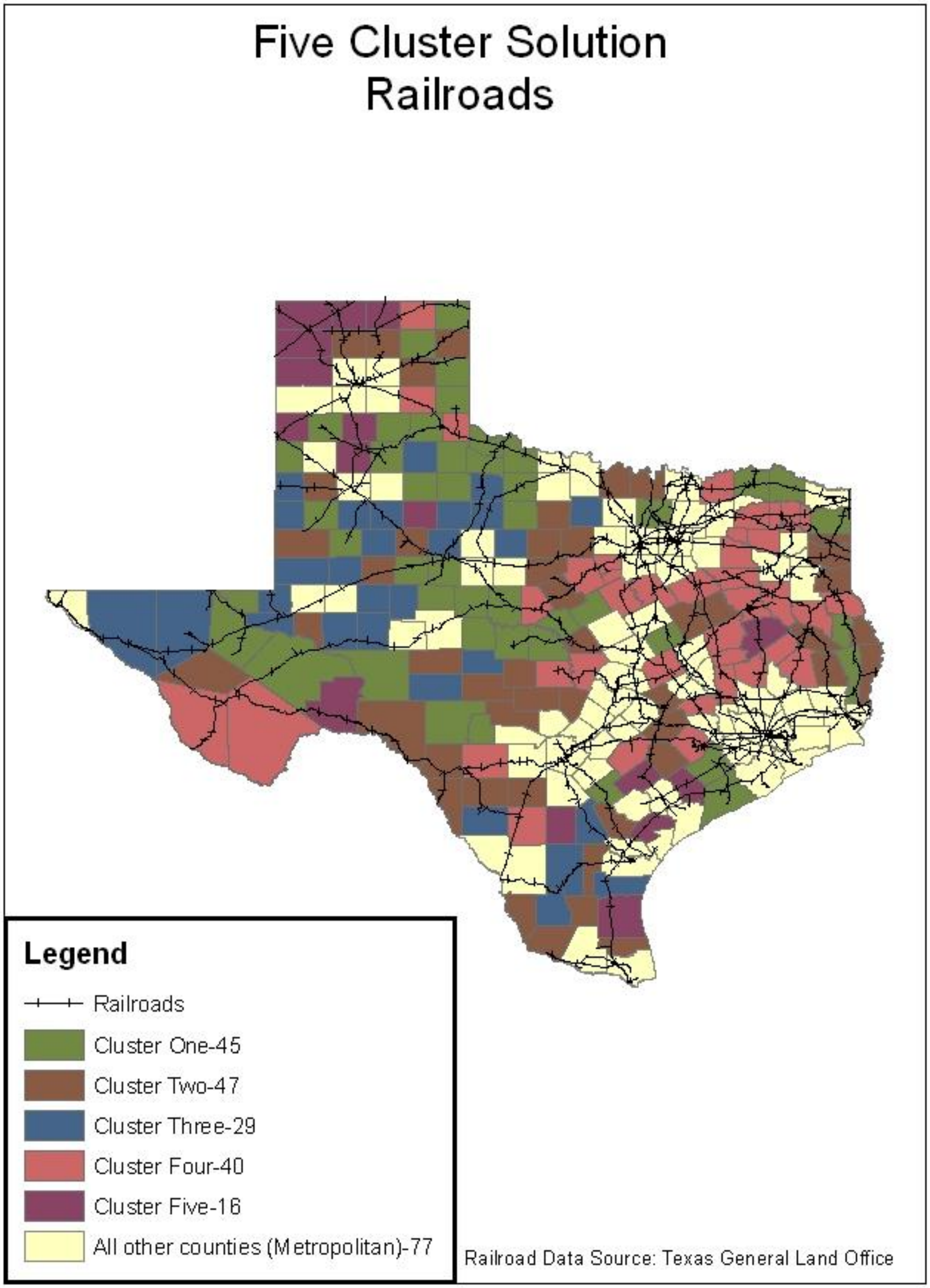
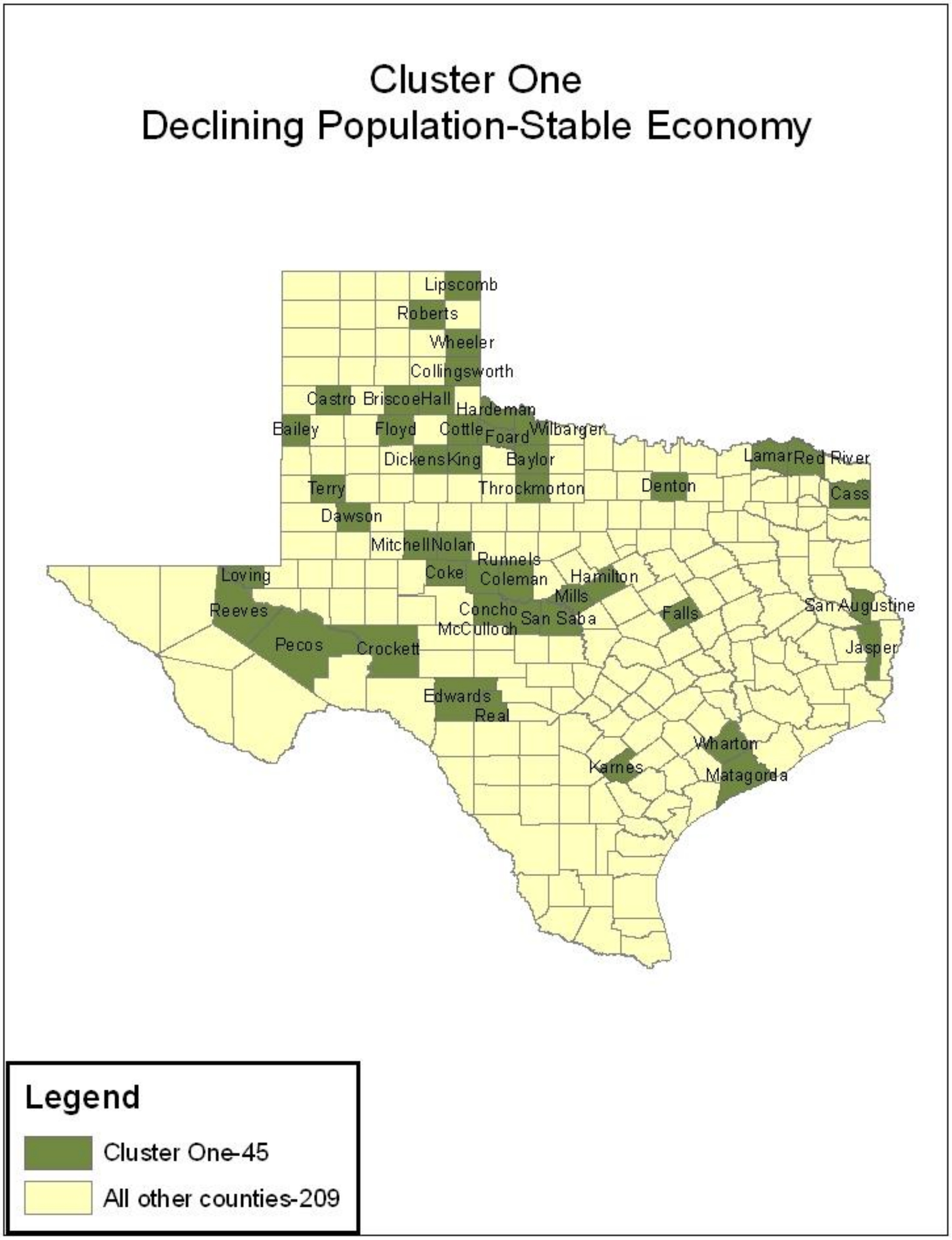

Five Cluster Solution
Railroads
Legend
Railroads
Cluster One-45
Cluster Two-47
Cluster Three-29
Cluster Four-40
Cluster Five-16
All other counties (Metropolitan)-77
Railroad Data Source: Texas General Land Office

Figure 16. Cluster One Map Series



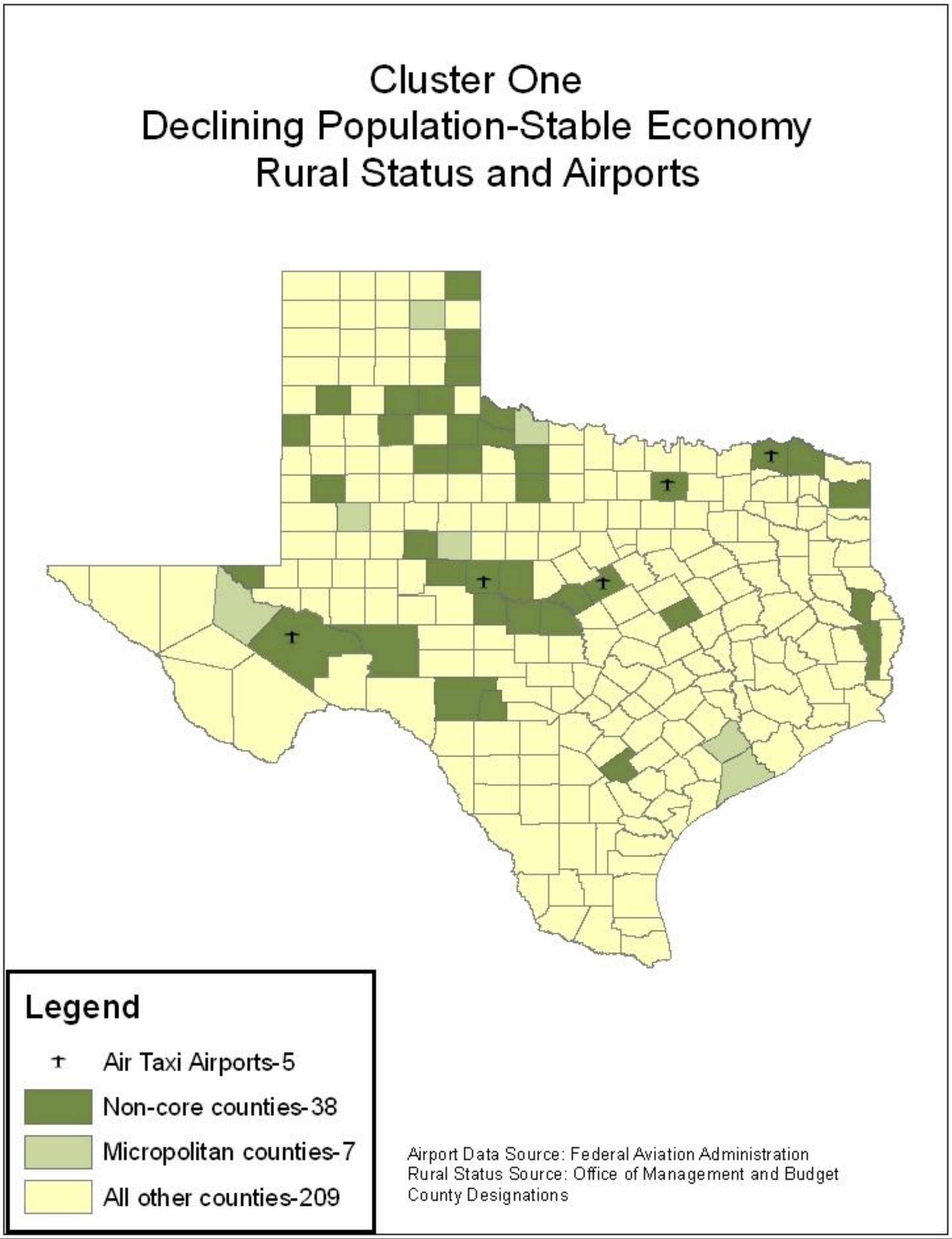
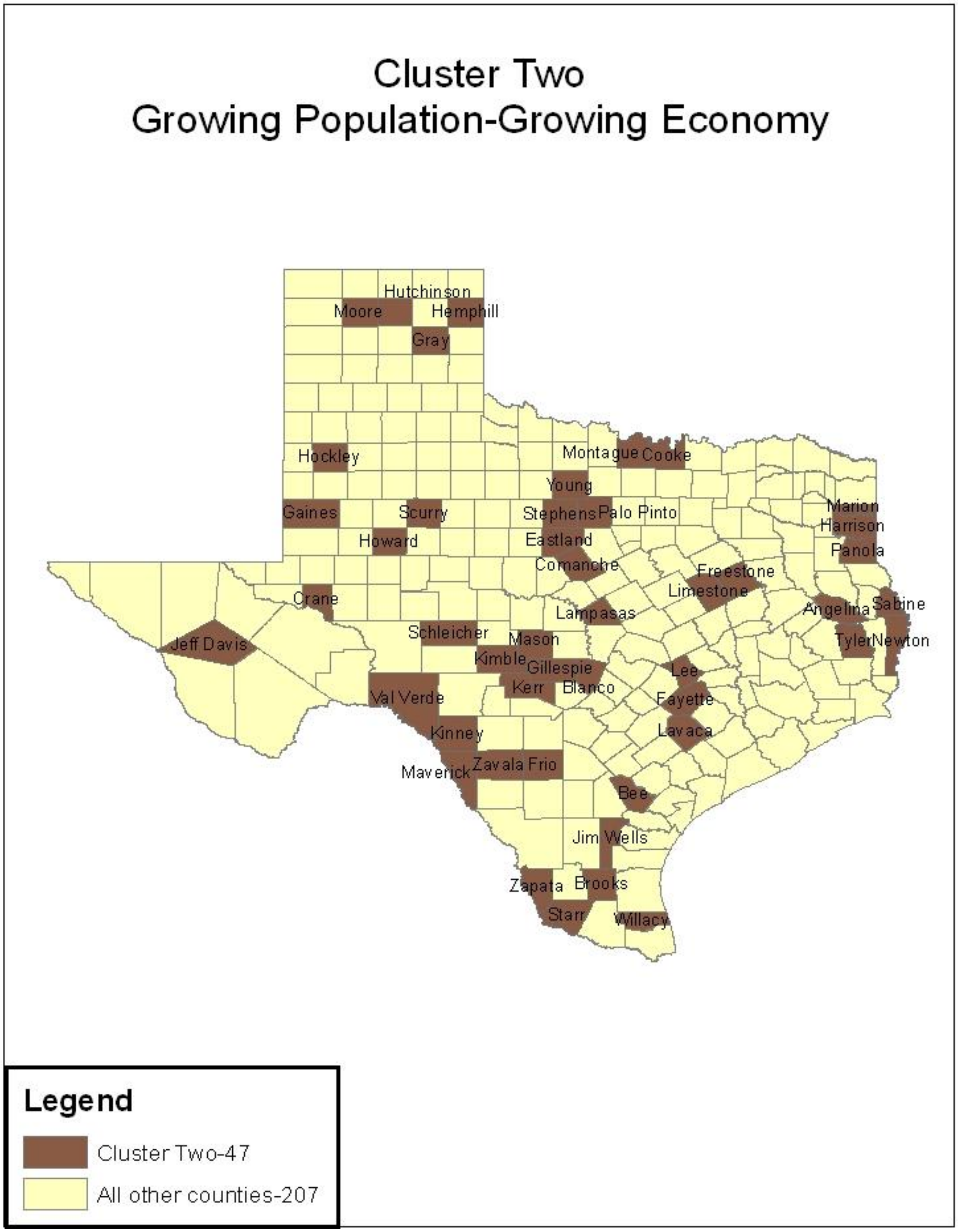

Cluster One
Declining Population-Stable Economy
Rural Status and Airports
Legend
Air Taxi Airports-5
Non-core counties-38
Micropolitan counties-7
All other counties-209
Airport Data Source: Federal Aviation Administration
Rural Status Source: Office of Management and Budget
County Designations

Figure 17. Cluster Two Map Series



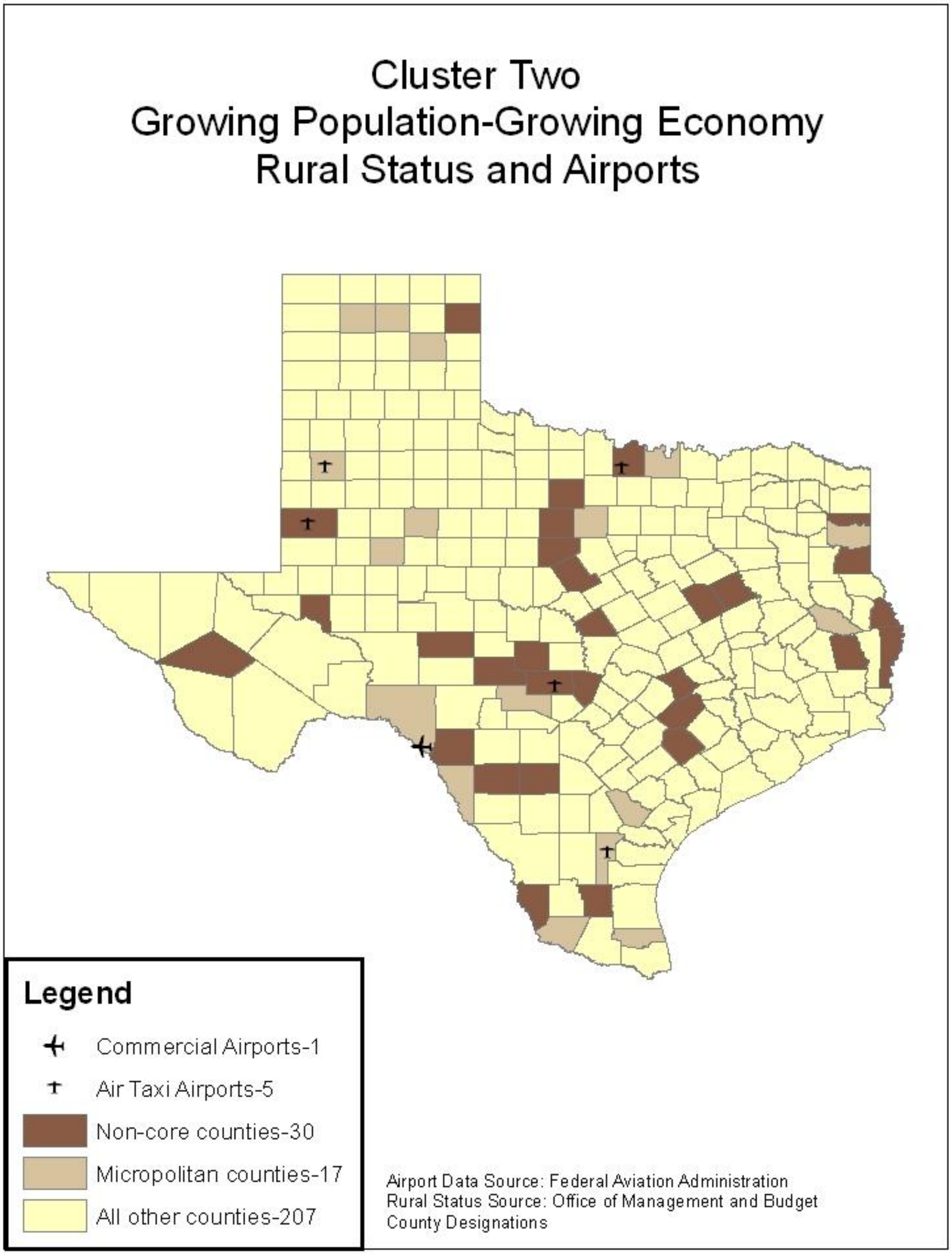
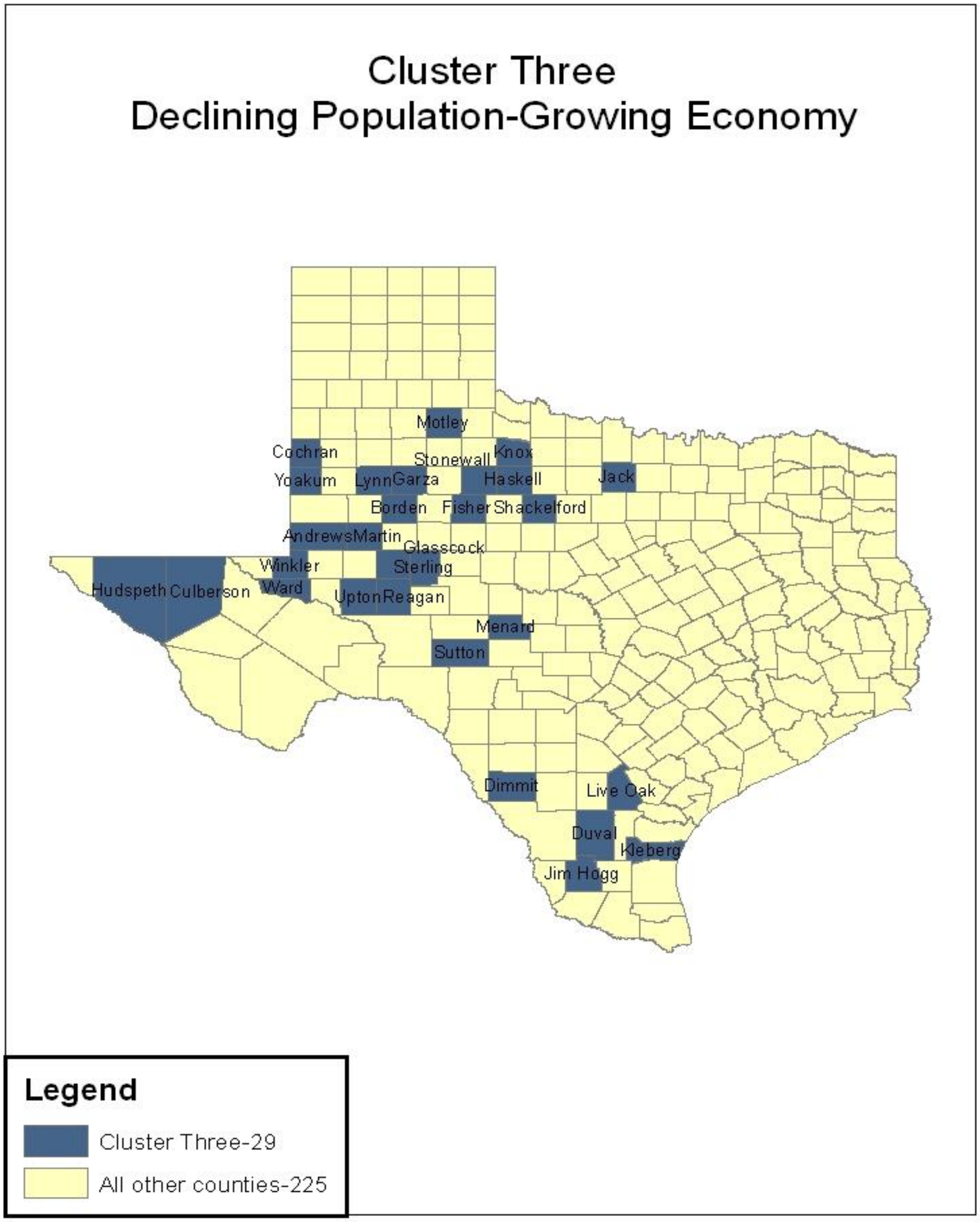

Cluster Two
Growing Population-Growing Economy
Rural Status and Airports
Legend
Commercial Airports-1
Air Taxi Airports-5
Non-core counties-30
Micropolitan counties-17
All other counties-207
Airport Data Source: Federal Aviation Administration
Rural Status Source: Office of Management and Budget
County Designations

Figure 18. Cluster Three Map Series



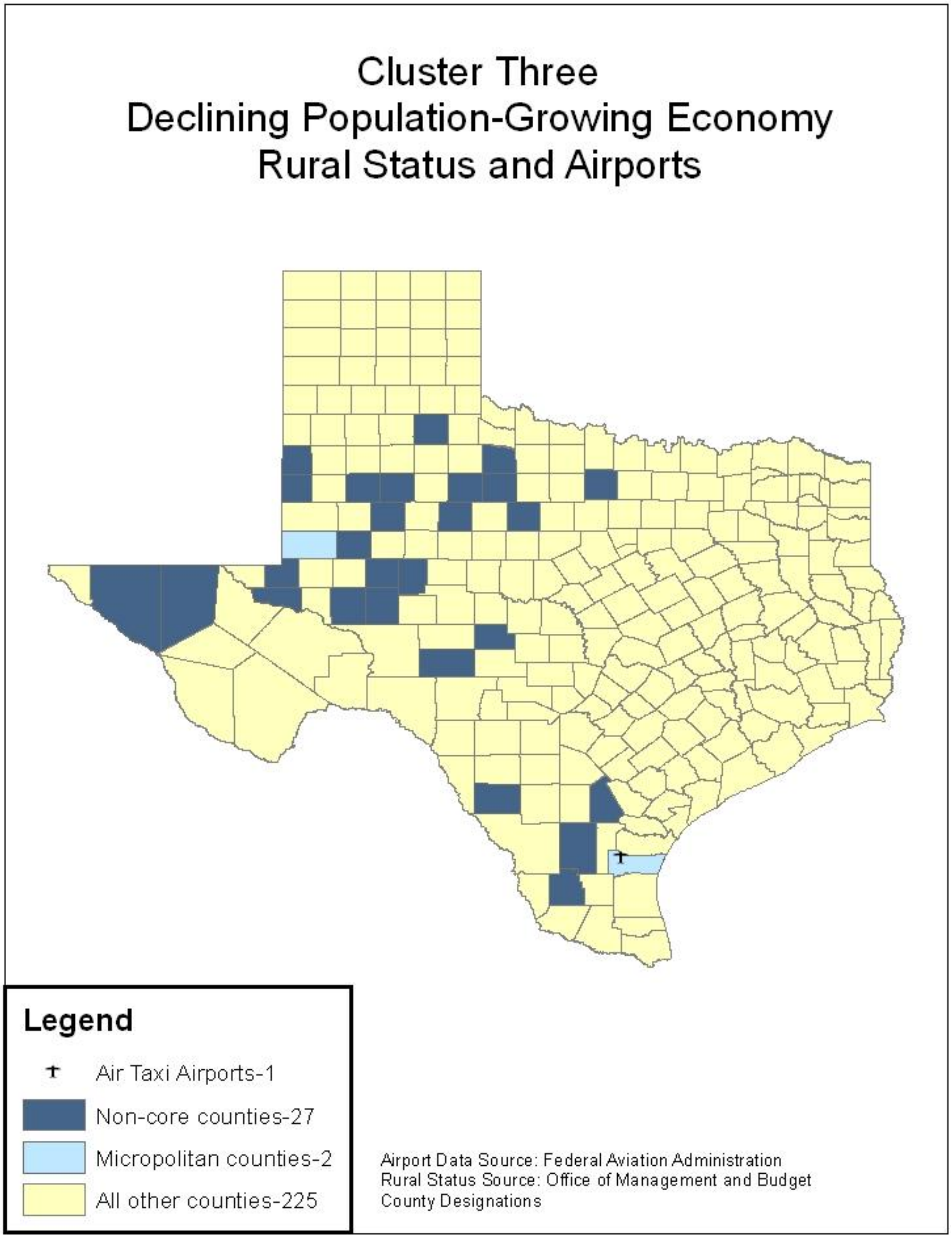
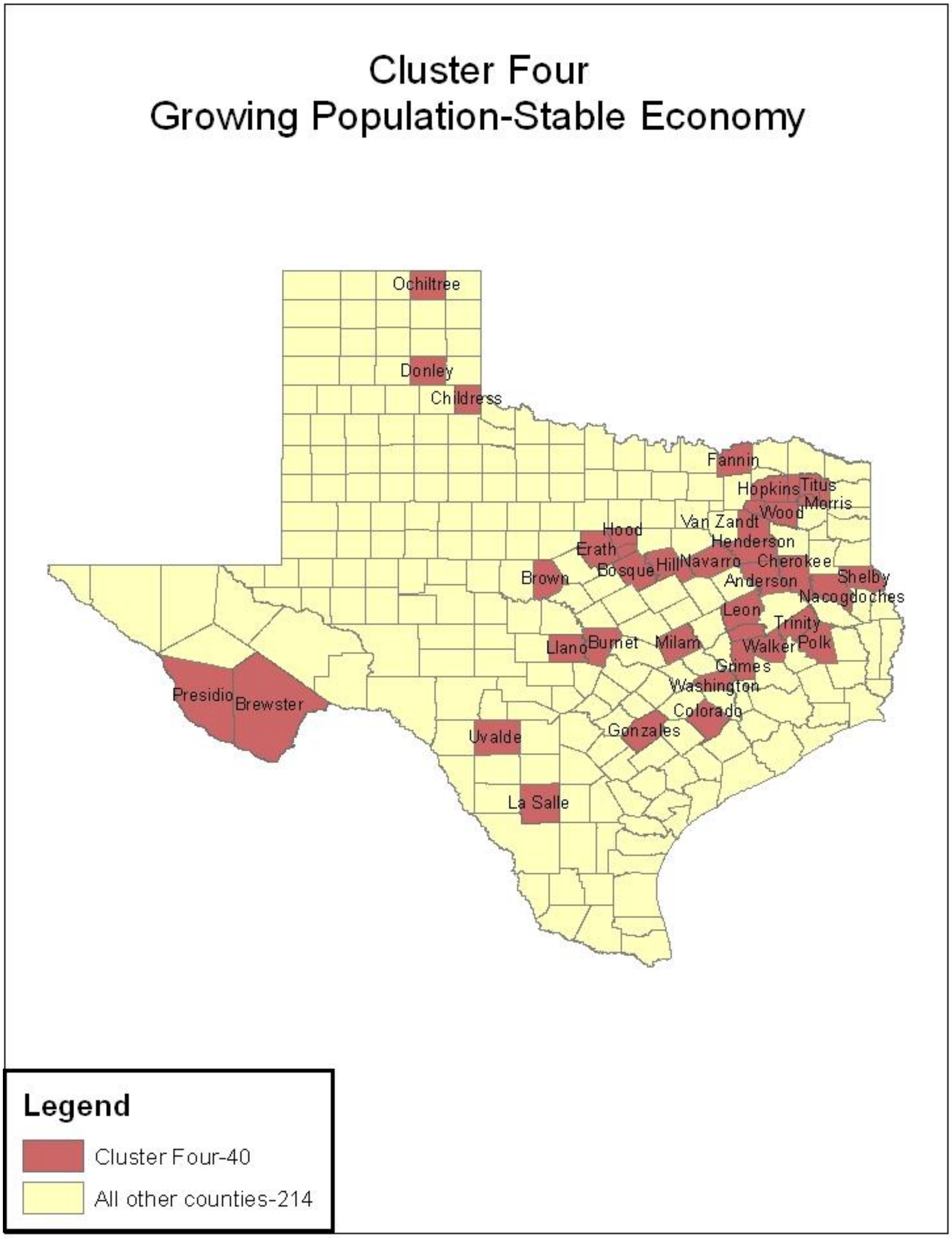

Cluster Three
Declining Population-Growing Economy
Rural Status and Airports
Legend
Air Taxi Airports-1
Non-core counties-27
Micropolitan counties-2
All other counties-225
Airport Data Source: Federal Aviation Administration
Rural Status Source: Office of Management and Budget
County Designations

Figure 19. Cluster Four Map Series



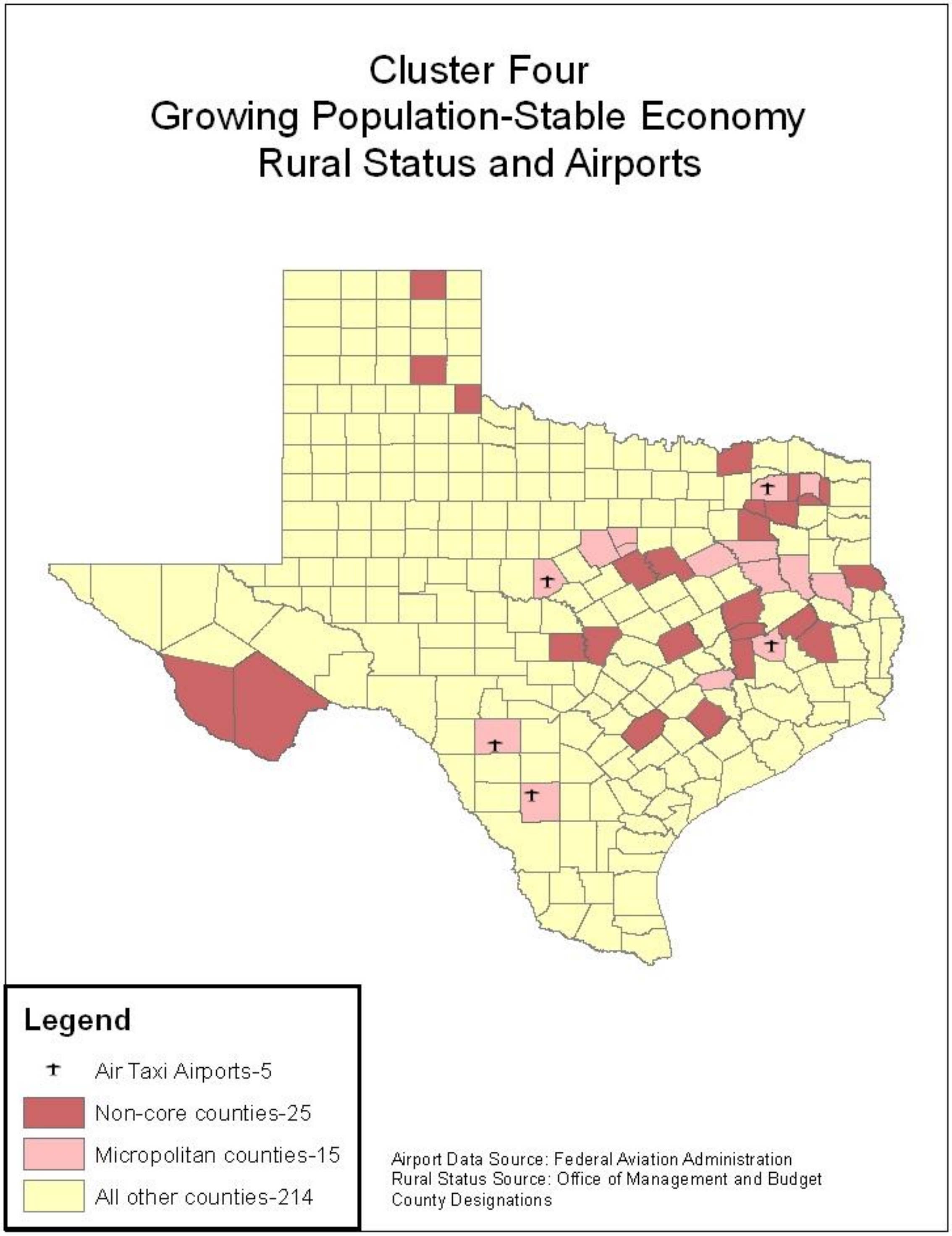
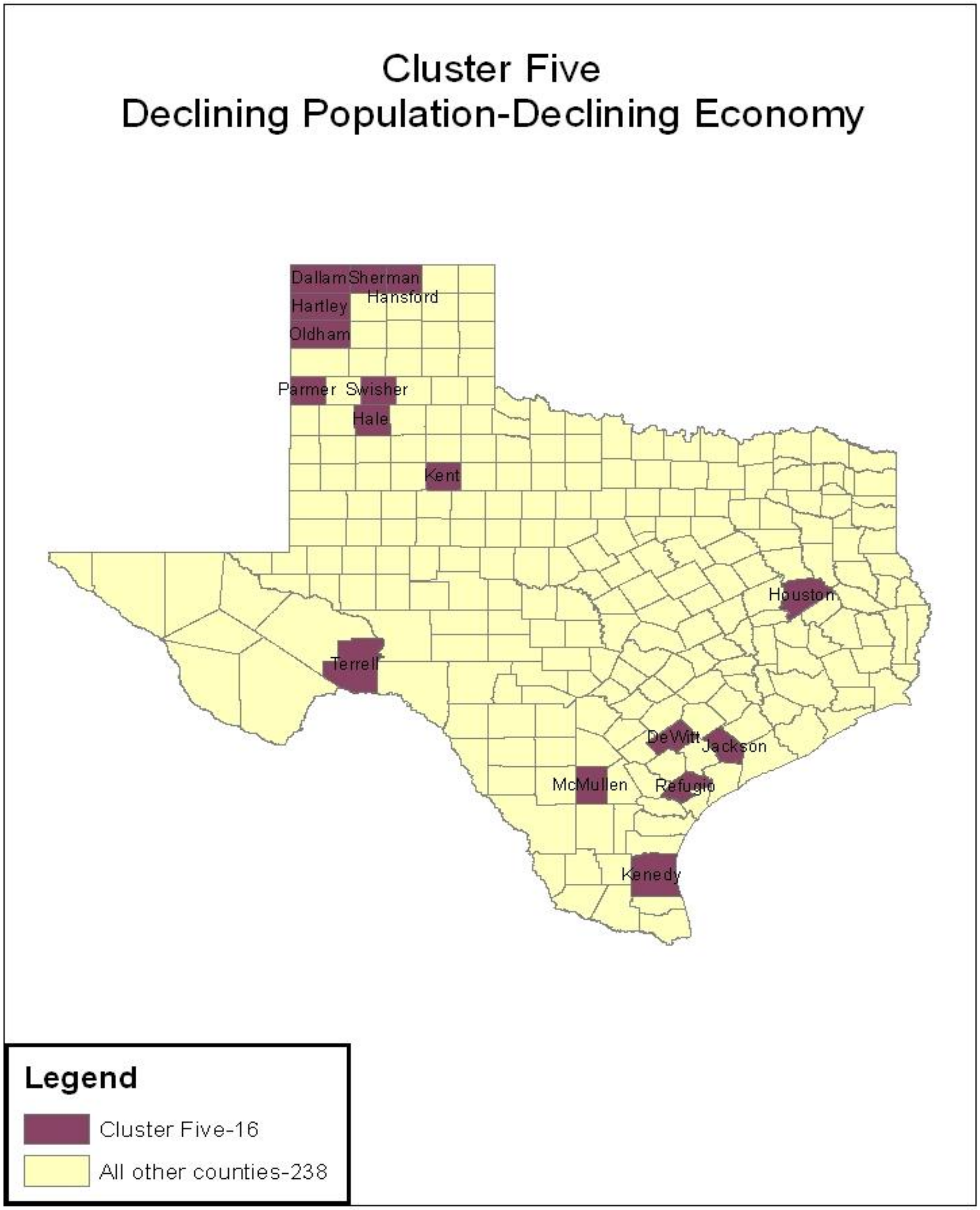
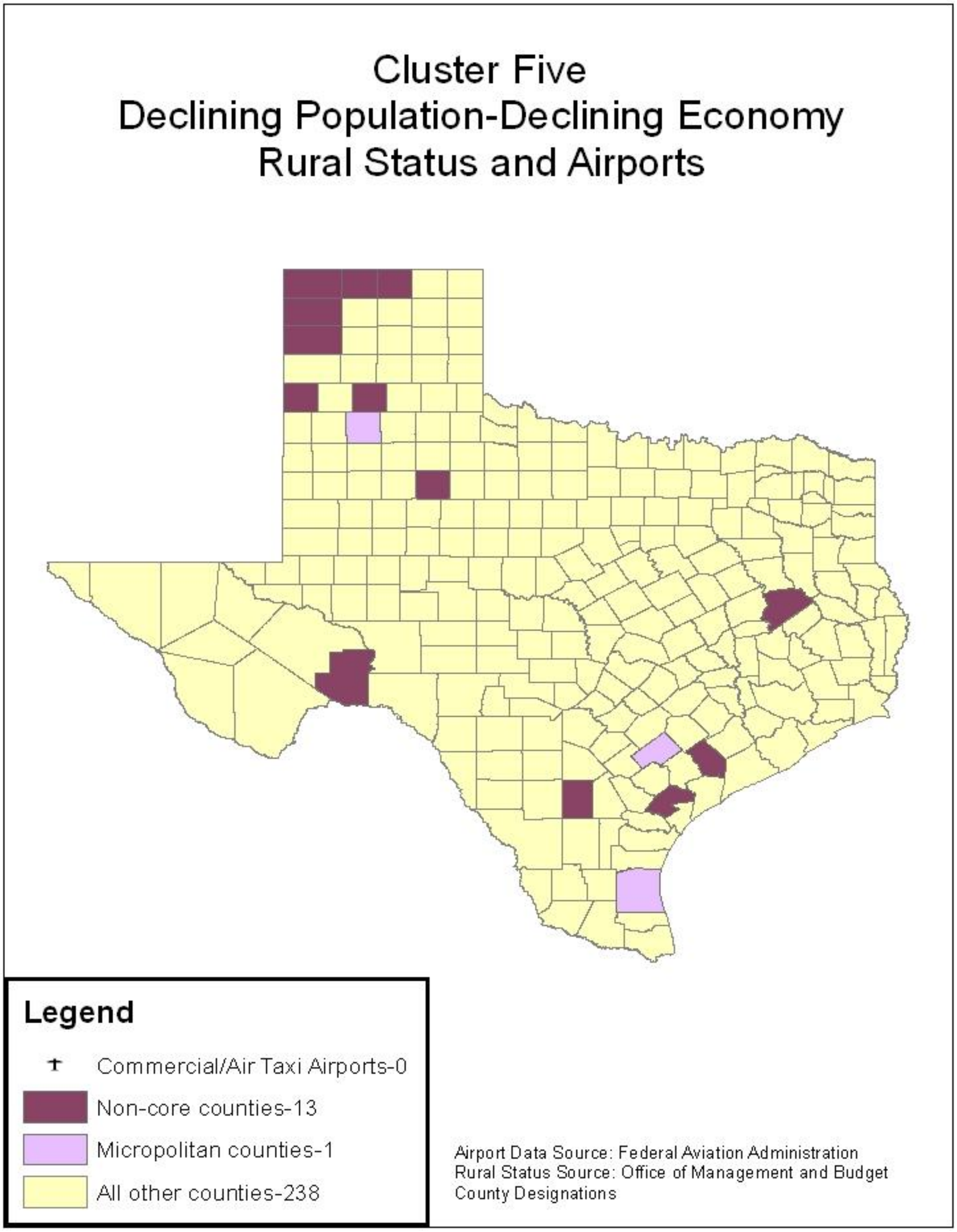

Cluster Four
Growing Population-Stable Economy
Rural Status and Airports
Legend
Air Taxi Airports-5
Non-core counties-25
Micropolitan counties-15
All other counties-214
Airport Data Source: Federal Aviation Administration
Rural Status Source: Office of Management and Budget
County Designations

Figure 20. Cluster Five Map Series




Cluster Five
Declining Population-Declining Economy
Rural Status and Airports
Legend
Commercial/Air Taxi Airports-0
Non-core counties-13
Micropolitan counties-1
All other counties-238
Airport Data Source: Federal Aviation Administration
Rural Status Source: Office of Management and Budget
County Designations

CHAPTER SIX: DISCUSSION

The purpose of this research was to develop a typology of rural counties that could be used to guide development efforts. New Economic Geography (NEG) provided a theoretical foundation that allows an understanding of the relationship between population and economics. Systems theory provided a rationale to examine other elements (e.g. educational systems, natural amenities) in order to try and understand why counties showed different patterns of growth and decline. A cluster analysis was performed to determine if meaningful categories of rural counties could be developed based on the interaction between population and economics. The results were then profiled to detect underlying differences between the county clusters. GIS data was used to develop a series of maps that allow for visual interpretation of the typology clusters. This chapter provides a discussion of the clusters, highlighting the unique characteristics of each. Community development implications of the study findings are discussed. Limitations and future areas of research are also reviewed.

Cluster Categories

Cluster One - Declining Population/Stable Economy (DP-SE)

The second largest cluster is primarily located in the western and Panhandle regions of Texas, though its members are found across the state. The DP-SE cluster experienced the second largest loss of population among the five clusters. The DP-SE cluster had the second largest percentage of White residents and second smallest percentage of Hispanic residents. This cluster also had relatively few colleges and universities per county, comparable to the results found with the other two clusters

(DP-GE and DP-DE) that recorded population loss. This result supports that the absence of educational institutions may act as a centrifugal force in regards to population.

Cluster Two - Growing Population/Growing Economy (GP-GE)

Categorized by a stable population and economic growth, this cluster has the largest number of counties. The counties are dispersed across the state and are located both adjacent to and apart from their metropolitan counterparts. A commonality among these counties is a relatively large Hispanic population (in comparison to the DP-SE and DP-GE clusters). This cluster also had the highest unemployment; this finding was counterintuitive, as it was expected that a high unemployment might serve to drive residents from the area. In addition, it has fewer railroad lines and airports than all clusters except for the DP-DE cluster. Availability of transportation methods is tied to an increase in population and economics per the NEG theory; however, this cluster again breaks from expected patterns. It may be that the availability of highways and the access they provide to metropolitan counties serves to counteract the lack of the other methods of transportation.

Two factors which serve as a centripetal force to these counties are the relatively high number of colleges and universities and hospitals as compared to the clusters which recorded population loss (DP-SE, DP-GE, DP-DE). Research suggests these services provide economic opportunities for residents and communities (Doeksen et al., 1998; Cordes et al., 1999; Garza & Eller, 1998).

Cluster Three - Declining Population/Growing Economy (DP-GE)

The DP-GE cluster had the highest level of population loss and was the most tightly clustered, in geographic terms, of all the clusters. Its counties were located in the western and southern regions of the state, with no counties found in other regions. Even though there was only minimal foreign-born migration occurring in all the clusters, it is interesting to note that this cluster had the smallest gain. Due to Texas' proximity to Mexico, it is feasible to assume that many of the foreign-born immigrants may be Hispanic. While the Hispanic population in this cluster was the largest overall, it does not appear that this served to draw in foreign immigrants looking to move to the United States. One possible explanation for population loss may involve the limited transportation options; there are few railroad lines and only one air taxi airport in this cluster. In addition, the unemployment rate was the second highest of all the clusters, which may have kept people from moving to these counties. An additional factor to explain the population loss may be that this cluster has the fewest number of colleges and universities, and, while the findings were not statistically significant, it has almost half the number of hospitals found in the GP-SE and the GP-GE clusters.

In stark contrast to the population loss, there was significant economic growth that occurred. There were significantly more counties that had an economic dependence on the service industry. Service industries have been an area of economic growth in rural counties (Gibbs, Kusmin, & Cromartie, 2005). The presence of service industries may serve to explain at least some of the economic growth that has occurred.

Cluster Four - Growing Population/Stable Economy (GP-SE)

The second cluster to demonstrate population growth had differences in racial/ethnic characteristics that set it apart from the other groups. This cluster had a significantly greater percentage of White and Black residents and smaller percentage of Hispanic residents in the year 2000 than any of the other clusters. This cluster was also the only one to register a gain in net migration. The rural counties were primarily clustered in the eastern half of Texas, and many may act as a secondary ring of growth for major metropolitan areas. This explanation is supported by the almost four percent more residents who commute as compared to the other four clusters. While it is not possible to confirm at this time between which counties this commuting occurs, it is a reasonable possibility that many residents are taking advantage of their proximity to some of the metropolitan communities in Texas (e.g. Dallas, Houston, Tyler).

Cluster Five - Declining Population/Declining Economy (DP-DE)

The smallest, and most troubled, of the categories represents counties experiencing decline in both their population and economy. These counties are found in several regions in the state, with a noticeable absence in the central region of the state. Counties in this cluster are more likely categorized as mining dependent as compared to all other cluster groups. This results mirrors findings that show counties with extraction-based industries are more likely to experience job loss and out-migration (Cromartie, 1998; Johnson, 2006; Murray & Dunn, 1996), indicating that having a traditional industry, such as mining, does act as a centrifugal force in regards to population and economic growth. While it was not statistically significant, it is interesting to note that this cluster had no counties designated as service dependent. Much of the economic growth in rural areas has been attributed to service industries; the counties in this cluster have not experienced this influx of economic growth.

Another item of note is that the DP-DE cluster had the lowest unemployment of any cluster. Whether it was because of the location or the type of industry, the low unemployment did not serve as an incentive to draw in new residents. This is counter to an intuitive position, stated in Chapter Three, that low unemployment would serve as a centripetal force and encourage agglomeration of residents and industry. One explanation may be the low unemployment is indicative of counties that have lost members of their working age population to out-migration, thus leaving fewer adults to be counted as unemployed.

Community Development Implications

The purpose of this typology was to help improve community development efforts. This research starts to illuminate some of the underlying issues that may be associated with growth and decline. Ultimately, county residents and development staff who understand the distribution of counties among the various clusters and the differences between those clusters may prove more successful in their attempts to attract and retain population and economic growth. Recommendations for areas of focus are provided.

Comparisons Between Clusters

The DP-SE and GP-SE clusters are alike in many ways, including having higher percentages of White residents and lower percentages of Hispanic residents than the other clusters, comparable numbers of hospitals and airports, and similar unemployment rates. However, one cluster is gaining population while the other is losing. There are two notable differences between the two clusters: the GP-SE cluster has a greater number of colleges and universities and a greater number of transportation options, specifically railroads and highways and interstates. One possible interpretation is that development efforts in the DP-SE cluster may be best served by concentrating on increasing educational opportunities for residents and transportation access. While this may not counter the advantage the GP-SE cluster enjoys through its spatial proximity to metropolitan counties, these efforts should act as centripetal forces to help draw in new residents.

Of the three clusters (GP-GE, DP-GE, DP-DE) with a high percentage of Hispanic residents (n > 33%), the only cluster to not lose population also had a high number of colleges and hospitals. Just as with the other two clusters, it appears that education is the critical element.

One area of note with this cluster analysis and mapping was the wide dispersion found in some of the clusters. Many counties are turning to a more inclusive method than the community economic development model and are instead focusing on regional economic development activities. However, it is important to recognize that counties may be unable to capitalize on these regional activities. For example, the DP-DE counties are found next to all other county clusters; furthermore, some are adjacent to metropolitan counties while others are surrounded by other rural counties. Despite their location, oftentimes next to more prosperous areas, these counties are not reaping the same benefits as their neighbors. The differences found between counties suggest that regional economic development may not meet the needs of all counties within its boundaries equally. It also calls into question who is making the decisions in regional development.

Perhaps the more prosperous counties dictate the terms of the development and do not take the needs of less affluent or powerful counties into consideration.

Border Counties

There is an interesting dichotomy among counties that border other states (i.e. Louisiana, Oklahoma, and New Mexico) or the country of Mexico. Examination of Figure 16 reveals that 30 percent (n=14) of the counties within the GP-GE cluster are border counties. It is likely that at least part of the growth that the counties within these clusters experienced is due to factors related to this border. For example, Gaines County, located on the western side of the Texas Panhandle, enjoys close proximity to Hobbs, New Mexico. Hobbs, while not a large city (Census 2000 population=28,657 residents), does provide access to employment, educational (it has two institutions of higher education), and recreational opportunities such as a race track and casino (City of Hobbs, 2009). Conversely, seven (43.75%) of the counties found in the DP-DE cluster also share borders with other states or Mexico. Just as positive population or economic growth on the other side of the border can bolster a Texas county, the absence of such activity can also be felt by Texas residents and communities.

Texas-Mexico border counties. Six of the counties within the GP-GE cluster share a border with Mexico. This type of growth is common among many of the United States counties that are adjacent to Mexico (Anderson, Gerber, Foster, 2007). An examination of Table 8 and Figure 14, which provide details regarding the nine-cluster solution, reveals that the population growth among these counties was even greater before cluster two and cluster six were joined. Though the five-cluster solution was found to be the most appropriate, looking back at this preliminary solution provides insight into the Texas-Mexico border counties.

Much of the population and economic growth among these counties may be tied to the increase in trade between the United States and Mexico that occurred when Mexico joined the General Agreement for Tariffs and Trade in 1986 and the North American Free Trade Agreement in 1993. The rapid expansion of maquiladoras (manufacturing plants) on the Mexico side of the border provided increased economic growth for both countries. "Since most of the trade between the U.S. and Mexico is overland in trucks and trains, the communities on the border are directly affected by the economic activity associated with this increase in trade and investment" (Anderson, 2010, p. 342). This is congruent with NEG, as transportation methods are a contributing factor to the agglomerative effects of population and economics.

Future research is needed to understand why the one DP-DE border county, Terrell County, differs from its neighbors. While Terrell Davis has no border crossing stations neither do Kinney and Jeff Davis counties (Anderson, 2010); however, these counties are members of the in the GP-GE cluster and have been able to prosper despite having the same transportation barriers. See Figure 14.

Non-Core and Micropolitan Counties

The mapping allowed a clearer understanding of how the differences in non-core and micropolitan counties are played out between cluster types. Non-core counties do not have an urban cluster of at least 10,000 residents. The results of this cluster analysis indicate that the only two clusters (GP-GE and GP-SE) to register a growing population were also the two with the lowest proportion of non-core to metropolitan counties. See Table 16.

Table 16. Ratio of Non-Core to Micropolitan Counties

Cluster	*# of Non-Core Counties*	*# of Micropolitan Counties*	*Ratio of Non-Core to Micropolitan Counties*
DP-SE	38	7	5.43:1
GP-GE	30	17	1.76:1
DP-GE	27	2	13.5:1
GP-SE	25	15	1.67:1
DP-DE	13	3	4.33:1

An examination of the maps provides some insight to these results, as it appears that the majority of the non-core counties in the GP-GE and GP-SE clusters are adjacent to metropolitan counties. This finding is consistent with the concept of agglomerative effects of population and economic activity, as conceived in the NEG theory. While there is not sufficient commuting occurring between the non-core and metropolitan counties to change the non-core counties' designation, it does suggest that proximity to larger communities may be acting as a draw, if not for employment purposes then for access to other amenities.

Of the 12 non-core counties in these two counties, nine border either Mexico or another state. This does not mean that non-core counties which are not adjacent to metropolitan counties have no chance of a growing population, but, it is probable they are going to have additional challenges to overcome to draw in new residents. A more in-depth analysis of the three counties which register population growth without abutting metropolitan counties should be conducted in the future to examine additional factors, such as social networks, that may account for these counties success.

An examination of the rural status maps of the counties (see Figures 16-20) also shows that proximity to metropolitan counties is not a guarantee of growth, especially population growth. Forty-eight (58.5%) of the non-core counties found in the DP-SE, DP-GE, and DP-DE counties are adjacent to metropolitan counties without being able to effectively utilize the proximity benefits of those more urban areas to draw in new residents.

Overall Recommendations

Education

Based on the overall findings, it appears that continued investment in education is critical for rural areas to attract and retain residents. Counties that are able to provide educational opportunities for residents are better able to develop a workforce that will be equipped to tap into industry trends. Accessible education may also prevent the flight of young adult residents from rural counties. As previously mentioned, there is a noticeable trend of younger residents moving to more metropolitan areas to access educational and career opportunities. Once they moved from the region, these young adults do not tend to return (Stockdale, 2006). If there are educational opportunities located in the rural county, it may entice some younger adults to receive their education in their home community.

Internet access. Advancements in online technology have allowed people the opportunity earn a college degree from almost anywhere in the world. However, rural residents are still less likely than their urban counterparts to have high-speed Internet access (Whitacre & Mills, 2007). While it is possible that this is due in part to failure to adopt available technology by rural residents, analysis of Internet use by resident income and general population characteristics provides evidence that availability is limited in some rural settings (Stenberg, Morehart, Vogel, Cromartie, Breneman, & Brown, 2009). In order to best capitalize on educational (and entrepreneurial) opportunities afforded by new educational technologies, rural counties need to advocate for and invest in high-speed Internet access.

Foreign-born migration

Foreign-born migration between the years 2000 and 2007 accounted for 27.60 percent of population growth in Texas, for an average annual growth of 3.94 percent (USCB, 2009a). None of the clusters attained near that level of foreign-born migration; no cluster group attained even one percent of foreign-born population growth. This has been an area of major growth for other rural communities in the United States and can be a source of population and economic growth for Texas. However, rural communities are oftentimes closed off to newcomers due to distrust of outsiders or have negative perceptions of foreign-born immigrants (Fennelly, 2008). Fennelly and Federico (2006) found that rural residents are more likely to have restrictive attitudes towards foreign-born immigration due to fears of costs associated with immigrants, negative attitudes towards immigrants, and a preference for a "monocultural view of American culture" (p. 172).

Due to the realities of racial barriers in Texas (McClain et al., 2008; Morales, 2009; Tafoy, 2004) it is not unfounded to state that rural counties may not capitalize on opportunities to attract foreign-residents. Even if counties have a high Hispanic population, due to power and resource inequities, White residents are more likely control the towns. Policy guidelines need to be provided which can be utilized by rural communities to draw in foreign-born immigrants. As part of the guidelines, education and dedicated funds need to be provided to rural communities to ease development tensions and provide social service supports to new residents.

Limitations of Research

There are limitations to this study that must be acknowledged. First, this study utilizes county-level data, when it may have been more appropriate or desirable to analyze community-level growth and decline. However, rural counties are a widespread unit of measurement used to generate typologies, such as those based on natural amenities (McGranahan, 1999) or economic dependence (ERS, 2005). In addition, and perhaps more importantly, it is quite common in rural research for studies to focus on counties because of the limited availability of data for smaller units of measurement (e.g. towns). Many of the government agencies (e.g. USCB, BEA) do not collect data for rural communities as frequently as they do for metropolitan or urban communities. At the time of this study, the most recent American Community Survey 3-year results, conducted by the USCB, were only available for geographic areas of at least 20,000 residents, while the even more current American Community Survey 1-year results are only for geographic areas of 65,000 residents or more (USCB, 2009b). Because of the lack of consistent, reputable data for smaller units, this study focused on counties and understanding county-level patterns of growth and decline.

To further compound the issue, the county-level data for many of the variables used is from the year 2000. For all the metric variables except the cluster variables, population percent change and per capita personal income percent change, this was the most current, reliable data available. The lack of more current data was taken into consideration in the design of the research. The year 2000 was used as a benchmark, to determine how counties measured in on the selected variables, and how those characteristics might be different in counties which measured different patterns of population and/or economic growth in the time period spanning the years 2000 and 2007.

This research is exploratory in nature and, as such, needs replication and continued evaluation. The cluster variables were chosen with care, but it may be that additional or different variables would be appropriate in future analysis to provide an even greater understanding of variations among the cluster groups. Similarly, factors were identified in a review of the research for use in interpreting the clusters and gaining insight into how they differ from each other. While there were significant findings that helped differentiate between the clusters, it is highly probable that further analysis and research could identify additional factors that would provide even greater clarity.

Directions for Future Research

There are several distinct future directions in which to take this specific research and methods of analysis. They are replication with more current data, replication in other states, and inclusion of additional factors.

As previously mentioned, this research utilizes data from the year 2000. However, the 2010 census is currently underway, and in a relatively short time, more current data will be available. Depending upon the questions and definitions used, it may even be possible to compare the 2000 and 2010 census data directly to detect patterns of growth and decline. Even if that is not possible, the 2010 data will provide a more current snapshot of rural counties that may illustrate some of the positive changes that might have occurred due to improved access to technology and education (e.g. Internet access in rural areas, online access to college courses) and some of the negative impacts of the current economic recession (e.g. high unemployment). With updated data, it will be possible to try and replicate the findings to determine if the same pattern of clusters is found.

Replication of the study results may also be undertaken using data from other states. This research is specific to the state of Texas; however, the underlying theory and method of analysis can be used with the same data from any state. It will then be possible to create a cluster solution that is most appropriate for that particular state. While those results may not specifically mirror the findings of the Texas data, it is possible to follow the steps undertaken in this study and utilize the same variables. Ultimately, improved insight could be gained into how patterns of population and economic change vary across the country. In addition, it may be that different identified factors may prove to be more useful in explaining cluster membership. For example, states such as Colorado and Montana, which have more varied extremes between natural topography and climate than are found in Texas, may discover that natural amenities are critical for growth to occur.

An additional avenue for future research is to seek out and identify additional factors. This study is a first step in trying to identify underlying differences between counties in order to guide development efforts. It is probable that there are additional factors not included in this research that may also prove useful. The inclusion of more economic factors, such as civilian labor force and number of businesses, may be useful to provide more insight into the patterns of economic change. In addition, it may be useful to examine the social networks and capital within and between communities. Counties whose residents enjoy high levels of cohesion and social capital may be better equipped to attract, or at least not lose, residents.

APPENDIX A

Table 17. County Typology Definitions

Economic Type	**Definition**
Farming-dependent	Either 15 percent or more of average annual labor and proprietors' earnings derived from farming during 1998-2000 or 15 percent or more of employed residents worked in farm occupations in 2000.
Mining-dependent	15 percent or more of average annual labor and proprietors' earnings derived from mining during 1998-2000.
Manufacturing-dependent	25 percent or more of average annual labor and proprietors' earnings derived from manufacturing during 1998-2000.
Federal/State Government-dependent	15 percent or more of average annual labor and proprietors' earnings derived from Federal and State government during 1998-2000.
Services-dependent	45 percent or more of average annual labor and proprietors' earnings derived from services (SIC categories of retail trade; finance, insurance, and real estate; and services) during 1998-2000.
Nonspecialized	Did not meet the dependence threshold for any one of the above industries.

Source: Economic Research Service. (2005). *Measuring Rurality: 2004 County Typology Codes. Retrieved April 14, 2009 from http://www.ers.usda.gov/briefing/rurality/typology/*

APPENDIX B

Table 18. Texas Counties and OMB County Designation

County Name	Rural Status*	County Name	Rural Status*	County Name	Rural Status*	County Name	Rural Status*
Anderson	1	Chambers	2	Ellis	2	Hemphill	0
Andrews	1	Cherokee	1	Erath	1	Henderson	1
Angelina	1	Childress	0	Falls	0	Hidalgo	2
Aransas	2	Clay	2	Fannin	0	Hill	0
Archer	2	Cochran	0	Fayette	0	Hockley	1
Armstrong	2	Coke	0	Fisher	0	Hood	1
Atascosa	2	Coleman	0	Floyd	0	Hopkins	1
Austin	2	Collin	2	Foard	0	Houston	0
Bailey	0	Collingsworth	0	Fort Bend	2	Howard	1
Bandera	2	Colorado	0	Franklin	0	Hudspeth	0
Bastrop	2	Comal	2	Freestone	0	Hunt	2
Baylor	0	Comanche	0	Frio	0	Hutchinson	1
Bee	1	Concho	0	Gaines	0	Irion	2
Bell	2	Cooke	1	Galveston	2	Jack	0
Bexar	2	Coryell	2	Garza	0	Jackson	0
Blanco	0	Cottle	0	Gillespie	0	Jasper	0
Borden	0	Crane	0	Glasscock	0	Jeff Davis	0
Bosque	0	Crockett	0	Goliad	2	Jefferson	2
Bowie	2	Crosby	2	Gonzales	0	Jim Hogg	0
Brazoria	2	Culberson	0	Gray	1	Jim Wells	1
Brazos	2	Dallam	0	Grayson	2	Johnson	2
Brewster	0	Dallas	2	Gregg	2	Jones	2
Briscoe	0	Dawson	1	Grimes	0	Karnes	0
Brooks	0	De Witt	1	Guadalupe	2	Kaufman	2
Brown	1	Deaf Smith	2	Hale	1	Kendall	2
Burleson	2	Delta	2	Hall	0	Kenedy	1
Burnet	0	Denton	0	Hamilton	0	Kent	0
Caldwell	2	Dickens	0	Hansford	0	Kerr	1
Calhoun	2	Dimmit	0	Hardeman	0	Kimble	0
Callahan	2	Donley	0	Hardin	2	King	0
Cameron	2	Duval	0	Harris	2	Kinney	0
Camp	0	Eastland	0	Harrison	1	Kleberg	1
Carson	2	Ector	2	Hartley	0	Knox	0
Cass	0	Edwards	0	Haskell	0	La Salle	1
Castro	0	El Paso	2	Hays	2	Lamar	0

Lamb	2	Montgomery	2	Rockwall	2	Travis	2
Lampasas	0	Moore	1	Runnels	0	Trinity	0
Lavaca	0	Morris	0	Rusk	2	Tyler	0
Lee	0	Motley	0	Sabine	0	Upshur	2
Leon	0	Nacogdoches	1	San Augustine	0	Upton	0
Liberty	2	Navarro	1	San Jacinto	2	Uvalde	1
Limestone	0	Newton	0	San Patricio	2	Val Verde	1
Lipscomb	0	Nolan	1	San Saba	0	Van Zandt	0
Live Oak	0	Nueces	2	Schleicher	0	Victoria	2
Llano	0	Ochiltree	0	Scurry	1	Walker	1
Loving	0	Oldham	0	Shackelford	0	Waller	2
Lubbock	2	Orange	2	Shelby	0	Ward	0
Lynn	0	Palo Pinto	1	Sherman	0	Washington	1
Madison	0	Panola	0	Smith	2	Webb	2
Marion	0	Parker	2	Somervell	1	Wharton	1
Martin	0	Parmer	0	Starr	1	Wheeler	0
Mason	0	Pecos	0	Stephens	0	Wichita	2
Matagorda	1	Polk	0	Sterling	0	Wilbarger	1
Maverick	1	Potter	2	Stonewall	0	Willacy	1
McCulloch	0	Presidio	0	Sutton	0	Williamson	2
McLennan	2	Rains	0	Swisher	0	Wilson	2
McMullen	0	Randall	2	Tarrant	2	Winkler	0
Medina	2	Reagan	0	Taylor	2	Wise	2
Menard	0	Real	0	Terrell	0	Wood	0
Midland	2	Red River	0	Terry	0	Yoakum	0
Milam	0	Reeves	1	Throckmorton	0	Young	0
Mills	0	Refugio	0	Titus	1	Zapata	0
Mitchell	0	Roberts	1	Tom Green	2	Zavala	0
Montague	0	Robertson	2				

*0=Non-core; 1=Micropolitan; 2=Metropolitan
Source: 2003 Office of Management and Budget County Designations

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