COUNTRY AIN'T COUNTRY NO MORE: A TYPOLOGY OF THE NATION'S FAST GROWING PERIPHERAL COUNTIES

Meghan Zimmerman Gough

Thesis submitted to the Faculty of the Virginia Polytechnic Institute and State University in partial fulfillment of the requirements for the degree of

Master of Urban and Regional Planning

Robert E. Lang, Chairperson
C. Theodore Koebel
Thomas Sanchez

June 30, 2003
Blacksburg, VA

Keywords: metropolitan growth, suburban fringe, exurbia, planning policy, growth management

COUNTRY AIN'T COUNTRY NO MORE:
A TYPOLOGY OF THE NATION'S FAST GROWING PERIPHERAL COUNTIES

Meghan Zimmerman Gough

ABSTRACT

This study uses data on the fast-growing peripheral counties located in the 50 largest metropolitan areas to test the null hypothesis that counties located on the metropolitan fringe are demographically homogenous. Using multivariate analysis, the analysis statistically identifies distinct groups of counties in the metropolitan fringe. In contrast to much of the standard literature, the research rejects the null hypothesis and suggests that more than one exurbia exists.

This study also explores the varying pressures and demands faced by the different exurban county types in response to massive and compounding growth stresses, recognizing the complexity of managing growth in the fringe and the implications for planners. It is expected that counties identified as "similar" will experience common-responses to different programs and policies addressing growth pressures. Similar counties should therefore use these results to facilitate information exchange concerning successful or unsuccessful strategies.

ACKNOWLEDGEMENTS

I would like to thank several people who contributed to my research in one way or another. First, I would like to thank my research advisor, Dr. Robert E. Lang, for his willingness to work with me, and his passion for research and discovery. His enthusiasm is contagious. My experience working with Rob played an important role in my decision to pursue a doctoral degree. I also thank my committee members, Dr. C.T. Koebel and Dr. Thomas Sanchez for their valuable editing and suggestions.

I thank the Metropolitan Institute at Virginia Tech for funding my research and hiring me as a Research Associate during my time at the University. I also thank the Metropolitan Institute for identifying and supplying the county cases for this project.

Thanks also to all the people from the Department of Urban Affairs and Planning at Virginia Tech who provided friendship, helpful suggestions, willingness to discuss and challenge my ideas, and a solid academic foundation from which I can leap to my next step.

Finally, I would like to thank my incredible husband and family for endless support and belief in all my adventures.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES AND MAPS

CHAPTER ONE: INTRODUCTION AND JUSTIFICATION

He was raised on a tractor in overalls and boots
Been to college and then law school since leaving his roots
Came home in a Lexus, he left in a Ford
Country ain't country no more

He told his daddy catch up with the times
He said now a days people trade heifers online
Dad ain't selling deals with a handshake like before
Country ain't country no more
No, country ain't country no more

The back forty was sold to make up for hard times
Then sold by the half acre lot overnight
The houses went up and the trees were cut down
And there went the finest deer hunting around
Lord, everyone's locking their doors
'Cause country ain't country no more

Now his dad sits in traffic looking 'round at the change
Watching crews turn the county road into four lanes
The old Sunday drive has turned into a chore
Country ain't country no more
Lord, country ain't country no more[1]

Country Ain't Country No More captures the essence of the new nationwide pattern of settlement on the metropolitan fringe. This new growth pattern includes low-density, centerless, and "sprawling" development found around major metropolitan areas in rural locations and small towns (Lang 2002, Nelson 1992). Popular culture such as the song *Country Ain't Country No More* captures the essence of the new nationwide pattern of settlement and development occurring on the regional fringe. This new metropolitan growth pattern includes low-density, centerless, and "sprawling" development trends that are found around rural locations, small towns and major metropolitan areas (Lang 2002,

[1] *Country Ain't Country No More*, lyrics by Casey Beathard, Teresa Boaz & Carson Chamberlain, 2002.

Nelson 1992). These areas are the suburbs of the suburbs, spreading further from the regional core. As exemplified by the *County Ain't Country No More* lyrics, some of the implications of continued decentralization to the rural fringes of the metropolitan area include encroachment upon agricultural and environmentally important open lands, destruction of natural habitats, increased infrastructure demand and intensification of suburban congestion.

The manner in which current metropolitan decentralization occurs is the center of much debate due to the effects and inefficiencies associated with such growth, as well the public policy implications surrounding the management of growth and urban sprawl. The fast-growing areas include the places that planning theory and practice identify as the Smart Growth battle line. The fringe represents the fastest-growing component of the landscape in the continental United States, yet it remains understudied (Davis et al. 1994, Audirac 1999). Moreover, deconcentration to the urban-rural fringe offers the "greatest challenge to growth management and urban containment policies" (Audirac 1999, p. 8). Much of the existing literature requests additional study of the urban-rural fringe so that decision-makers do not miss the opportunities to effectively manage growth in these areas (Nelson 1992, Nelson & Sanchez 1999, Nelson & Sanchez 1997).

This study investigates the geography and demographics of fast-growing counties located on the metropolitan fringe in order to develop a typology for determining the growth dynamics of these counties. While there might have been little need for such a typology previously, the increased importance and power of non-central metropolitan locations makes this analysis a valuable contribution to the urban classification research literature. This knowledge will contribute to a better understanding of growth and development patterns in these newly developing areas nationwide.

While these counties experience similar rates of growth, they may have dissimilar demographic characteristics, therefore representing significantly different types of places. Identification of similarities between certain counties may reveal potential for valuable exchanges of ideas and information concerning common growth pressures. While

possibly dissimilar in geographic location, the counties may experience similar challenges with growth pressures. The ability to predict and understand changes in land use patterns is useful for policymakers concerned with planning, environmental protection, and quality of life issues.

These similar counties should collaborate to exchange useful ideas or find new and creative ways to achieve needs specific for their community type. For example, two counties included in this study, Douglas County, CO and Loudoun County, VA, currently exchange information on ways to address growth pressures. The Leesburg Today covered the story: "The similarities of our jurisdictions present a tremendous learning opportunity…the challenges are the growing work force, how you provide services to a larger, more diverse community" (Brumback 2002).

The primary research objective underlying the construction of this typology is to classify an *a priori* group of fast-growing counties into clusters based on growth-related demographic variables. By quantitatively identifying similarities and differences among the nation's fast-growing peripheral counties, classifying them based on this data, and interpreting the resulting categories, this research sets the stage for further investigation into current and future growth implications for the nation's expanding metropolitan areas. A solid understanding of these places allows for identification of potential planning reform, as well as future research needs on the function, form and future of the nation's fast-growing counties.

Objective: The purpose of this study is to develop a typology for the fast-growing peripheral counties in the nation. Given the criteria for inclusion, these counties have a similar population, size and growth rate. However, it is not known what additional factors contribute to the fast-growing settlement patterns experienced by these counties and what commonalities exist between seemingly unrelated counties. Classifying and analyzing these fast-growing counties according to growth-related demographic characteristics generates the necessary insights into the differences and specific planning implications of these counties.

Null Hypothesis: The forty-seven counties included in this study will be statistically homogenous across the variables included in the study. Given the methods applied for the study, this indicates that a single cluster of counties will exist, validated by a low agglomeration coefficient between two clusters and one cluster.

Alternative Hypothesis: The literature offers little guidance as to the potential clusters of counties; therefore no clearly defined alternative to the null hypothesis exists. The analysis will help identify potential order that exists within the forty-seven counties. Any potential groupings will be validated by the increased agglomeration coefficient between clusters.

CHAPTER TWO: LITERATURE REVIEW

Trends in Settlement Patterns

"The phenomenon of suburbs is almost as old as cities. Where there is tight circumscription, there will be spill. Where people live in close quarters, they will be tempted to rid themselves of noxious but necessary activities and some forms of low life, or else move away from them" (Kostof 1992, p. 47)

Examination of the formation and characteristics of the current metropolitan settlement patterns in the United States demands an understanding of preceding trends. Knowledge of how the outer rings of the city emerged over the past century aids in understanding the current metropolitan organizational and social hierarchy. Contemporary settlement patterns appear to follow trends of decentralized social power: central city growth gave way to suburban growth and power and more recently, the exurban fringe has gained new power.

Years Prior to World War II

Mass suburbanization took place in the years following World War II. However, suburbs extending out from the city core existed long before 1950. In fact, in a review of the literature Kostof (1992) suggests that the concept of the suburb extends back to the ancient Middle East where a suburban belt containing residences and farms circled the city. While early suburbs housed their own commercial centers, they were ultimately dependent on the central city.

The advent of urban transportation aided suburbanization. The American city prior to 1850 concentrated people in relatively compact settlement patterns, as most services were located within walking distance. However, the electric streetcars, introduced in cities by the late nineteenth century, opened up the suburbs for further expansion. Faster than the horsecar, streetcars could reach the suburbs more quickly, thereby extending convenient commuting distances up to ten miles from the city core (Warner1995, Muller 1981). Settlement patterns followed linear development along these transit lines. Suburban

construction during this time included single-family, two or three-family dwellings, as well as commercial and apartment structures (Hayden 2003).

These early suburbs housed about a quarter of the non-rural population by 1920 (Muller 1981), but remained dependent upon the city for most services. As only middle and upper-income people could afford to locate in these new suburbs, economic segregation increased.

After 1920, adoption of the private automobile initiated large-scale suburbanization. Land areas between the rail lines and stations opened up for development, altering the dense radial settlement patterns. Highways built to accommodate automobile travel further shaped the suburban geography, and commuting extended once again. Commuter suburbs were largely bedroom suburbs that held some local convenience services. Some suburbanites ordered plans for stylistically diverse homes from catalogues. These homes represented a change from the more densely settled suburbs of years before, and were located farther from public transportation (Hayden 2003). The socially and economically dominant city still remained the location for most services, employment, entertainment and shopping (Palen 1995). Early suburbanization resulted in a more dispersed settlement pattern and a greater class distinction (Muller 1981). The Great Depression and World War II interrupted metropolitan settlement and the suburbs started their trend toward domination of metropolitan and national growth in the years following.

After 1920, common adoption of the private automobile initiated large-scale suburbanization. Land areas between the rail lines and stations opened up for development, altering the dense radial settlement patterns. Highways built to accommodate automobile travel further shaped the suburban geography, and commuting extended once again. Commuter suburbs were largely bedroom suburbs that held some local convenience services. Some suburbanites ordered stylistically diverse homes from catalogues to build by themselves. These homes represented a change from the more densely settled suburbs of years before, and were located further from public

transportation (Hayden 2003). Most larger services, employment, entertainment and department stores remained in the socially and economically dominant city (Palen 1995).

The suburbs started their trend toward domination of metropolitan and national growth in the years following 1930. Early suburbanization resulted in a more dispersed settlement pattern and a greater class distinction (Muller 1981).

Post-War Settlement Patterns

Before WWII the central city core held the majority of social and economic power. After WWII, the center of social and economic power shifted to the suburbs. These post-War settlement patterns can be categorized as "independent suburbs," "suburbs dependent on other suburbs," and finally "growing power of the fringe" as a way to capture the social and economic power transition to the suburbs and beyond.

Independent Suburbs

Suburbs became socially dominant over and independent from the city after the War. Jobs, homes and retail shopping started moving to the suburbs. In his review of the post - War suburbs, Kenneth Jackson (1985) reports that by 1950 the population growth rate of the suburbs was ten times the rate of the central city. In absolute terms, approximately nine million people moved to the suburbs in the 1940-1950 decade.

The mass conversion of rural farm tracts to suburban housing can be attributed several factors. The significant housing shortage and a rapid increase in population after the Depression and WWII, rising real incomes, long-term mortgage credit, affordable housing, cars, and changing tastes, and plentiful land were driving factors for suburban expansion. The Department of Veterans Affairs (VA) and the Federal Housing Authority (FHA) government guaranteed loans provided to the soldiers returning from War. These loans subsidized purchase of new single-family homes in suburbia, which were both available and less expensive than housing in the city (Palen 1995). Therefore, single-family homes offered the most affordable housing option during this time due to federal

subsidies for buyers and developers. These mass-produced look-alike homes, made famous by the Levitt brothers' *Levittown*, contributed to the widespread conformity of the suburbs (Hayden 2003). The post-War suburbs were built at low densities, and in most cases were automobile dependent (Jackson 1985). This housing boom revealed the consequences of restricting city growth with the ring of independent suburbs – all the growth took place in the suburbs.

Until approximately the 1960s, the physical expansion of urbanization into the suburbs was considered a positive transformation, despite the longer commute times that resulted from the new development. After this time people started to focus on national population increases, air pollution, loss of open space and farmland, and habitat destruction. Many chose to address these concerns by limiting the physical growth of cities. Vance (1977) observed that attacks on suburban expansion—or "urban sprawl"— represented a reversal in a "long-standing liberal stance that called for suburbs".

Population in the United States appeared to be growing faster in non-metropolitan areas than metropolitan areas for the first time in the 1970s, representing a "population turnaround" or "rural renaissance." Some argued that the growth of the non-metropolitan areas was spillover from metro area growth, the result of under bounded and lagging metropolitan boundaries. Others believed that this growth trend represented a different and unprecedented change in settlement patterns in the United States.

In order to further investigate the hypotheses, Vining and Strauss (1977) used the Hoover Index to measure the evenness with which population is distributed over U.S. territory (a rise in the index represents increased population concentration). While the index was high for the 1960s, this study showed an unprecedented decline in the 1970s for metropolitan counties, as well as sub-state economic areas. Evidence of new growth in non-adjacent non-metropolitan areas demonstrated a "clean break" with settlement patterns of the past. While later research supported the 1970s "clean break" theory (Long & Nucci 1995, Vining et al. 1981), others (Gordon, 1979) argued that it was not a "clean break", but a "continued wave" of urban decentralization. Subsequent research on this

suggestion failed to support the "continued wave" argument (Long & Nucci, 1995), and thus confirmed the "clean break" of the 1970s. However, it is likely that both patterns may have contributed to decentralization trends.

Increasing scholarly research on the settlement patterns reflected the nation's interest in the new patterns of development. Suburbia during the early post-War decades was primarily a residential location. However, continued suburban population growth and the movement of some commercial and economic functions to the outlying areas took their toll on city health.

Suburb Dependent on Another Suburb

Retail suburbanized during the 1970s, further stripping the power of the once-dominant city. This trend continued during the 1980s and 1990s as suburban office space and manufacturing complexes moved to the outer suburbs. Some called the peripheral suburbs the "outlying central places", which were tied economically to other suburbs through automobile dependency (Palen 1995). Most commuting by the mid-1980s shifted to between suburbs as opposed to between suburbs and the city as had previously been the trend (Nelson and Deuker 1990).

Well before the 1980s a multinucleated-patterned metropolis existed, termed by Pierce Lewis as the "galactic metropolis" (1983). The well-known "edge cities", defined by journalist Joel Garreau, formed and thrived during this time period (1991). Edge cities grew quickly from 1960 to 1990, with jobs expanding faster than housing, and polynucleated suburban office parks and malls clustered around major highway junctions (Garreau 1991).

The residential development located near highways made employment and retail centers accessible to commuters. In her summary of suburban housing models in the United States, Dolores Hayden (2003) explains that even starting in the 1960s, housing development appeared to be placed in relation to highway access, in the these "Edge

Nodes". However, because noise and other factors made these nodes undesirable places to live, most people chose to venture further out to live on the urban-rural fringe.

Research in the 1990s found that some of the factors that characterized the 1970s population turnaround such as more growth in non-metro areas than metro areas returned in the 1990s (Long & Nucci 1995). However, a complete return to the turnaround of the 1970s did not occur in the 1990s because a significant amount of non-metropolitan land was added to the metropolitan boundary. In other words, faster growth in outlying areas during the 1990s was likely to be classified as metropolitan growth due to the territory transfer. Many authors suggest that these outer-cities are not an extension of the core-periphery model, but a new organizational form altogether (Palen 1995, Fishman1987, Muller 1981). In this case, multiple outlying suburbs replace the functions previously provided by core cities.

Although only a few decades ago the United States comprised mostly city dwellers, the nation is now largely suburban in terms of population distribution, economics and culture (Palen 1995). Today the suburbs house and employ more Americans than central cities. In fact, as of 1999 New York and Chicago were the only metropolitan areas that held the majority of their office space in the primary downtown areas (Lang 2000). Cities as well as the older inner suburbs continue to face the challenge of attracting people back to their residences or workplaces. Cities and their downtowns no longer struggle for dominance, but for their very survival (Fulton 1996). The suburbs and these outer cities are not "sub" to the city anymore, and as John Palen reports, the suburban areas now dominate the metropolitan landscape (1995).

Growing Power of the Metropolitan Fringe

The contemporary metropolitan fringe located between the built-up suburbs and the rural countryside currently experiences intense growth and change in the landscape. In the 1990s, sprawling settlement patterns in this area attracted attention as they consumed open space and rural areas. These new outer peripheral areas are increasing in both economic and political power (Palen 1995, Daniels 1999).

The metropolitan fringe represents the current frontier of development. Society longs to continue to move beyond that which is already developed to breach newer frontiers. In the early 19th century, Friedrich Ratzel traveled to America to observe and comment on the geography of the land. He noted the immense growth and the ever-narrowing gap between city and country. Ratzel also explored the endless number of deserted frontier towns through much of America, and the "ruins" left by those who have breached newer frontier (1988, p. 285). Almost two centuries after this classic appraisal of the American landscape, the idea of a "frontier" remains meaningless. Americans appear to maintain these characteristics and preferences, confident that they hold access to an endless amount of land and need no regard for boundaries of urban expansion. Such characteristics contribute to persistent attraction and settlement in low-density areas in the suburbs of the suburbs, the fringe of the metropolitan area.

Homes are the focus for consumers, not community or the neighborhood. Larger and larger homes scatter the landscape, adding to more land consumption (Hayden 2003). People search for "elbow room" on private lots with considerable open spaces (Daniels 1999).

As the fringe continues to get pushed out and collects more economic and political power, the inner rings of older suburbia are left behind battling urban disamenties. Increasingly still, people tend to commute between more dispersed locations, such as these outer suburb and fringe locales (Lang 2000). As people with economic and political clout continue to concentrate in the metropolitan fringe, analysts anticipate significant changes to the nation's settlement patterns. Some question whether a newly

formed political consensus led by the new power of the metropolitan fringe will demand a more environmentally and socially responsible settlement pattern (Hayden 2003).

Theoretical Explanations of Organizational Form

The growth of suburbs beyond the city created a "realm" of human organization based on the extension of city functions (Vance 1977). These realms can be explained by a theoretical approach to community spatial organization, called human ecology. Human ecology builds from plant and animal ecology, defined as the study of the form and development of organization in populations, considering the maintenance of multiplying organisms in a limited environment. The underlying assumption of ecology is the continuous adjustment of organisms in their environment (Hawley 1950).

Human ecology uses these and other considerations from plant and animal ecology to study the form and development of human communities within the population. Building on the assumption of continuous development, human ecology analyzes the evolutionary organization and process of this adjustment. This approach hinges on the belief that physical and spatial structure affects culture and social behavior of the community.

Literature on human ecology produced its own theory or model regarding metropolitan growth patterns. While metropolitan growth may seem randomly distributed, advocates of human ecology believe metropolitan growth follows distinct patterns. Vance (1977) explains that as the city grows, it "gives birth" to offspring that are biologically dependent upon the city for services and its functions. The progeny of the city remain dependent until the economic and social services and activities of the parent city are replicated in the offspring. Eventually, the offspring accumulate all the traits of the parent city, and therefore become independent. The offspring no longer need to return to the parent city for services.

Darwin's "survival of the fittest" theory holds true for this theory, as the spatial area evolves through an ecological process of competition. New populations "invade" existing populations, and push previous land uses out to be replaced with new uses. This

succession of populations and land uses takes place through the invasion – succession process found in plant or animal ecology. Interestingly, another element of this process includes the segregation of new groups and new land uses (Palen 1995). On the ground, segregation may include the separation based on ethnicity (immigrants), race, or social classes.

The biological metaphors used in human ecology appear to describe the process of adjustment that has taken place in the United States over the last century. For example, the city did remain the center for functional services and needs after the formation of suburbs on the outskirts, until the suburbs could be independent. Robert Fishman (1987) proposes that the intense post-War suburbanization of traditionally urban services and functions has effectively transformed the basic human ecology on which suburbia was based. Instead of a central urban core from which to build, suburbia now holds numerous cores of important economic enterprises that act as the "central core". He suggests that suburbanization created a "new form of city". While his argument appears valid, perhaps this is a matter of semantics, and the suburb *is* the new "city" that eventually produces its own offspring in the form of the outer suburbs or exurbs.

In any case, according to human ecology theorists, growth does not occur haphazardly. Interestingly, this theoretical approach implies that current metropolitan organization is not a result of direct public planning efforts. Instead, the spatial organization results from competition for space – in some cases planning may only act as the "referee" in the competition.

Forces of Deconcentration

Critics of human ecology do not agree with the application of a biological metaphor as a means to describe the human behavior that guides metropolitan organization. They argue that human behavior can be modified and changed based on other forces such as culture and values. As applied to existing settlement forms, the American preference for open spaces may be the reason that the suburbs never became the dense hubs that the central

city used to represent. Instead, these preferences altered the organizational form by quickly spreading out "progeny" into more decentralized areas. Others suggest that new stages of growth act independently of prior stages if technological innovations can lead to new structural transformations (Berry 1996). Within the broader literature, the four main forces that drive deconcentration to the urban-rural fringe include decentralizing employment, technological advancements, cultural preferences and public policy biases.

Decentralizing Employment

One of the most common contributors to deconcentration is the decentralization of employment opportunities (Lang 2000, Cervero 1984, Doherty 1992, Gordon et al. 1989, Grubb 1982). Employment appears to be shifting to the suburban employment ring, presenting opportunities for people to live further out and to commute to the suburbs for employment. Opportunities for flexible work hours and ride-sharing programs support the decision to commute further for work. Residents living in the metropolitan fringe largely depend on the suburbs or "edge cities" for employment, and not the city (Daniels 1999). Overall, the suburbanization of employment due to growth of edge cities and suburbia continues to further metropolitan fringe development (Cervero1984, Daniels & Lapping 1996, Kutay 1986). It is expected that the growing presence of residents on the fringe will encourage even more decentralization of employment (Nelson 1992).

Technological Advancements

Improvements in technology, such as those leading to increased telecommunication possibilities also support decentralized growth (Kutay 1986, Cervero 1984). The development of the computer, Internet capabilities, and cell phones dramatically reduce locational constraints of employment. As a result, these technological advancements fuel fringe growth as the need for centralized employment diminishes.

Expansion of household "technologies" such as on-line shopping opportunities, communications, and electricity into the metropolitan fringe also promote deconcentration (Nelson 1992). Instead of only attracting those who choose to live a more rustic lifestyle, the rural fringe can now accommodate those wanting rural living

with urban amenities. More than public services, household technological advances allow people to receive most necessities via electronic request. According to the *Country Ain't Country No More* lyrics, technological advancements remove the face-to-face interaction for the farming business as the Internet provides online cattle trading. Today, the buying and selling of most anything—from groceries to cars can be completed electronically, removing the need for human interaction or physical accessibility.

Cultural Preferences

Cultural preferences generally center on the urge to escape from urban disamenities. People believe that the further they get from the core of metropolitan areas, the less crime, congestion, pollution, noise, and in some cases, the less racial diversity they encounter (Cervero 1984, Daniels & Lapping 1996, Grubb 1982, Squires 2002). People also prefer the flexible property regulations that exist in the fringe (although they tend to want regulation for their neighbors but not for themselves).

Non-economic reasons such as retirement destinations as well as environmental amenities attract people to the fringe. The fastest growing new community in the nation is the retirement community –self-contained, gated communities that are restricted to older residents (Palen 1995). Environmental amenities also lure people to move to the fringe. In a study completed in a California county that contained both fringe suburban and exurban attributes, almost three quarters of the surveyed population ranked natural environmental factors as the leading reason for locating in the county (Crump 2003).

Some argue that much of society desires a Jeffersonian "gentleman farmer" lifestyle, accompanied by anti-urban sentiment. Such preferences for rural lifestyles lead people to move to and beyond the urban fringe (Fisher & Michelson 1981, Crump 2003). Others disagree with claims of a gentleman farmer or back-to-the-land movement similar to that of the 1970s. In fact, many believe that agriculture has little to do with fringe growth. Herbers (1986) states that the current "movement" includes middle-class people searching for more independence and space than the suburbs offer. Observations such as

this explain why the rural land in the metropolitan area, with its small base population, experiences the highest growth rate.

Another argument explaining deconcentration revolves around society's longing to "super-size" the American Dream. People want less expensive, larger homes. Society wants bigger amenities in general, and the fringe offers more land and lower prices. Housing sizes in the outlying suburbs continuously grow regardless of lot sizes and despite shrinking family sizes. In the past several years such "mega" homes have been given the name "McMansions" (Harden 2002). Other bigger amenities include the deluge of Standard Utility Vehicles (SUVs) populating driveways. The current fascination with the SUV and monster homes speaks to the yearning for a superior American Dream.

David Brooks cleverly reports on the cultural preferences of the fringe residents in his article, *Patio Man and the Sprawl People*:

> "(they) want to leave behind the dirt and toxins of their former existence--the crowding and inconvenience, the precedents, and the oldness of what suddenly seems to them a settled and unpromising world. They want to move to some place that seems fresh and new and filled with possibility…they are leaving older suburbs--which have come to seem as crowded, expensive, and stratified as cities--and heading for newer suburbs, for the suburbia of suburbia. (The Weekly Standard, p. 24, 8/12/2002).

Based on these observations, people appear to be more interested in personal space. Such characteristics can be traced back to early American pioneers. Daniel Boone knew it was time to relocate when he could see the smoke from his neighbors' cabins. This attitude continues to exist in the minds of Americans, and has resulted in key lifestyle forces evident in fringe inhabitants of today. It is interesting to note that these cultural preference factors that drive current deconcentration, also fueled suburbanization.

Public Policy Biases

Some argue that the United States federal government policies, whether intentional or not, have stimulated the unbounded extension of the suburbs and exurbs (Bourne 1980, Nivola 1999, Jackson 1985). The argument implies that government actions favor new

construction over rehab or reuse of existing buildings or land, highways over public transit, owner-occupied single family over renter-occupied multi-family housing, growing areas over depressed, and newly developed areas over older areas, which act to decentralize jobs and populations (Bourne 1980). Pietro Nivola (1999) suggests that these accusations can be confirmed by observing the minimal part that cities play in the significant growth of their regions. In several cases, cities experienced single-digit growth rates, while the regions grew by 50 or 60 percent. In percentage terms, the metropolitan fringe represents the fastest growing part of their regions. Thus, observers maintain that government has influenced such dramatic settlement patterns.

While the literature seems to highlight public policy bias as the guiding force for suburban and exurban expansion, others question the validity of this argument. By contrast, they indicate that the city is not deprived of opportunity and that public policies actually *favor* cities. Further, the fact that cities simply do not offer enough incentive to attract residents explains the lack of city growth and development (Gordon and Richardson 2000).

Despite the exact forces that contribute to deconcentration, all major regions of the nation have experienced a similar change in settlement patterns, an indicator that "broad-based forces" currently contribute to population deconcentration in the United States (Long and Nucci 1995). Especially since World War II, this pattern of deconcentration engulfed the rural countryside with sprawling suburbs and exurbs.

The Urban-Rural Fringe

Definitions and Characteristics

The urban-rural fringe located beyond the suburbs represents the foremost area of growth and change in the United States today (Audirac 1999). Several different names characterize this area, including: Exurbia (Spectorsky 1955), Countrified City (Doherty 1992), Galactic City (Lewis 1995), Metropolitan Orbit (Blumenfeld 1983), Penturbia (Lessinger 1987), "New American Heartland" (Herbers 1986) and the

Technoburb/Techno-City (Fishman 1987). Because 'metropolitan fringe', 'urban-rural fringe' and 'exurbia' are most common in the literature, these names will be used interchangeably in the following review.

Census definitions of exurbia or the urban-rural fringe do not exist, so literature depends on "working definitions" of this land area. Different definitions commonly describe the metropolitan fringe as having low population density, appearing semi-rural because it locates on the edge of most urban development, existing over an extended rural field beyond the edge of urban development, and characteristic of neither city nor country (Doherty 1992, Leinberger 1996, Nelson 1999). It is important to note that the fringe landscape exhibits both suburban and more rural characteristics (Lamb 1983). This study defines the urban-rural fringe as the outer suburbs and exurbs located within the metropolitan area that may exhibit both suburban and rural characteristics.

Characterizations of the fringe vary. Some indicate that only large lots and expensive houses are found in the fringe (Spectorsky 1955). Others find the metropolitan fringe includes dichotomies such as expensive country estates and simple mobile homes, and households with small-town characteristics next to households of urban-oriented commuters. Such claims indicate that the fringe is a mix of urban and rural cultures and characteristics, further supporting the idea that it is neither city nor country (Davis et al. 1994).

The location of the fringe also differs depending on the author or study. A sample of the locational ranges consists of 50-70 miles from the central city of an MSA (Blumenfeld 1983, Nelson 1999), 10-40 miles outside of metropolitan centers (Daniels and Lapping, 1996), or 60-70 miles from a beltway (Davis et al. 1994). Development of a consistent definition may aid in impacting state or federal policies that can influence the current patterns of development. However, some consider the metropolitan fringe as transitional and dynamic, making it difficult to fall under a strict definition. Fringe "boundaries" may depend on factors specific to the area. For example, the location and extent of the fringe

may depend on the distance from and size of its metropolitan core, or the population size of the MSA (Blumenfeld 1983, Auridac 1999, Morrill 1992

Demographics

The demographics of the people who live in exurbia also remain the center of much speculation and disagreement. Because a formal definition or delineation of the area does not exist, some suggest using a continuum between hypothetical extremes represented by "rurality" and "urbanity" to explain the demographics of people in the fringe areas (Lang 1986, Nelson 1992). As a general interpretation of this logic, outer suburban and exurban ecological, occupational, and sociological characteristics fall in the middle of the continuum. However, a continuum based on a residential location only offers a general distinction in demographic characteristics. Moreover, distinction between urban and rural becomes increasingly blurred as urban-to-rural migration brings urban people who have stronger ties to urban culture than rural culture, and maintain urban characteristics.

Since 1955, a body of literature identified a marked difference in the people who live in the metropolitan fringe or exurbia compared to those who live closer to the central city in the traditional suburbs. Generally, people on the fringe were almost always more affluent, commuted longer distances to work, were less racially diverse, and were employed in white-collared jobs (Spectorsky 1955). More recent studies found metropolitan fringe residents characteristically diverse and suggested that they did not fall into a predicted "type" (Davis et al. 1994, Audirac1999).

A recent body of literature found distinct demographic similarities between fringe and traditional suburban residents. One study determined that fringe residents have some socio-economic characteristics in common with suburbanites, but still commute longer and prefer more rural amenities such as open space and large lot homes (Davis et al. 1994). In consideration of household characteristics including income, occupation, commuting, and employment accessibility, others found that fringe residents are not demographically different from traditional suburban residents (Nelson and Sanchez 1997, 1999).

Classification Literature

Classification acts as a tool to simplify data observations into meaningful categories. The goal of classification is to find similar entities that fall into a particular group while ensuring significant distinction between those entities and other groups. In his review classification literature, Brian J.L. Berry (1996) discusses the usefulness of classifications. Urban hierarchies (distinction between hamlet, city and metropolitan area), government hierarchies (distinction between the county seat and state capital), and even the classifications of city, suburb and exurb identify the roles and functions specific to those categories. He states, "lacking predictive models, city managers should look to the experiences of cities similar to theirs for hints as to the actions that might produce sought-after objectives, or about the undesirable consequences of proposed policy initiatives"(p. 675). Classification reveals these "similar" places, which can act as indicators for successful programs or policies. Examples of classification of cities, regions and localities span the literature.

Nelson (1955) completed one of the earlier classifications of American cities, categorizing cities based on the predominance of different economic activities. He measured the proportion of the labor force performing a certain service type to determine the city-level distribution of services. This study successfully classified cities into nine major categories, suggesting that the distribution of specific economic activities is not the same in every city. These differentiations may call for specific needs for different city types. Moreover, Nelson observed that a classification study is not necessarily an end in itself, but rather can be used a reference tool for further research. He stated that classifications group similar places "objectively and understandably, and (then can be) subjected to further analysis"(p. 204-205). Nelson concluded that although few use classification for this purpose, it is the further analysis that remains primarily valuable, such as the consideration of other similarities or perhaps regional trends.

Hill, Brennan and Wolman (1998) recently completed a classification of central cities of the United States and found that nationally, cities can be categorized as either "stressed" or "healthy". Within these two subsets, they uncovered thirteen clusters of cities, using variables to measure central city function, social outcomes, and spatial structure. They also developed a method to cluster and statistically validate their classification[2]. Their study identified distinct differences in the nation's cities, and suggested that formulation of public policies should be based on the assumption that all cities have similar needs.

Classification of counties also exists in the literature. A typology of small towns and rural municipalities in New Jersey provided evidence for the redistribution of population to the urban-rural fringe (Airola and Parker 1983). The researchers clustered counties on variables such as density, land use, socioeconomic and demographic variables. Results identified the existence of different community types in the urban-rural fringe: urban counties (older manufacturing centers), suburban counties (low density development), agricultural counties, and retirement counties. This study suggests that further work on the topic should emphasize the complexity of managing growth on the urban-rural fringe. The observation of different county types has implications for the design of programs and policies affecting metropolitan fringe communities.

Berry (1996) concluded that a majority of classifications completed in the past several decades could be considered "classification for the sake of classification". He suggests that a meaningful classification needs to identify 1) the city's primary growth period, linking the settlement patterns to formative technology; 2) the types of cities emerging as a response to recent technology; and 3) the ability of earlier periods to adjust to the new technology. His review suggests that places grouped based on such growth characteristics may come closer to common-response factors wanted by policymakers.

[2]This study adopts portions of their methodology.

Planning Implications

Fast-growing metropolitan fringe development, typically characterized by uncoordinated, low-density, and leapfrog development extending outward into open space or rural areas presents many implications for planners. Much of the literature generally labels this type of development as "sprawl". The literature highlights implications including infrastructure investments costs, land resource losses, transportation impacts, social and economic concerns, and quality of life issues.

Infrastructure Investment

Among other factors, capital costs for providing public services and infrastructure vary depending on the lot size, density, type of dwelling unit, and proximity to service providers. Low-density development typical of the metropolitan fringe results in greater development costs associated with new infrastructure (Heimlich and Anderson 2001). Fringe households may demand that more urban-level services such as public services, facilities and transportation infrastructure be extended over large amounts of land for low-density development, thereby resulting in high costs (Nelson 1992, Nelson and Dueker 1994). Continued metropolitan expansion will require that resources be allocated to these costly public services and infrastructure.

Land Resources

Land resources such as farmland and natural environmental resources are threatened as the outward expansion of the metropolitan area continues. In their popular review, *Costs of Sprawl –2000*, Burchell et al. (2002) report that over the next 25 years, the nation will convert 18.8 million acres of land. Just over 7 million acres of that land will comprise converted agricultural land, and approximately another 7 million will consist of environmentally fragile lands. In many areas, the fringe is the battleground between residential development and farming interests, and/or between developers and environmentalists who want to salvage open space or natural habitats. These natural environmental areas offer a variety of resources such as natural habitat, and important

environmental amenities such as flood control and natural filtration. Policies are needed in the fringe areas to retain valuable land resources.

Transportation Impacts

Expansion of the metropolitan fringe may exacerbate existing transportation problems such as travel costs and suburban congestion (Nelson 1992). Growth in outlying areas may create longer commuting times, extending commuter sheds into undeveloped rural areas, fueling sprawl and increasing reliance on the automobile (Lang 2000). Moreover, less compact development on the fringe may result in more vehicle miles traveled, increasing travel costs. Low-density development also increases dependence on the automobile and therefore higher automobile emissions (Heimlich and Anderson 2001). Due to such resource pressures, it is suspected that traffic congestion, and therefore air and water pollution will grow increasingly worse due to the exclusive reliance on the automobile (Leinberger 1996).

Social and Economic Concerns

Fringe development also may produce negative social and economic implications. Formation of a socially and economically homogenous population, as predicted by some, will exacerbate existing socioeconomic issues in the city, and compound an economically segregated population (Fisher and Michelson 1981). Along with the central cities, fringe development may also contribute to the deterioration of edge cities and older suburbs. Decentralization farther from the city, and now beyond the inner suburbs and edge cities separates the poor from employment opportunities, representing a spatial mismatch of employment and housing (Fulton 1996, Squires 2002, Burchell et al. 2002). Implications for these trends include potential decline of the inner suburbs, followed by weakened property values, and a rise in crime rates (Leinberger 1996).

Quality of Life Issues

Although difficult to quantify, the preservation of community quality of life remains an important concern in fast-growing areas. For many people who locate in the metropolitan periphery, landscape and environmental amenities rank among the highest valued factors

(Crump 2003). Growth and development in the metropolitan fringe effectively alter the landscape and natural environment that are important to the quality of life in the metropolitan fringe. Continued growth consumes the open space and viewsheds that many residents value, pushing people to move further out on the metropolitan periphery so they can regain such amenities. Preferences such as these present strong challenges to containing spatial expansion of development.

A common request in the literature is the development of planning programs and policies that address the specific needs for growth on the metropolitan fringe. These needs differ from rural and urban areas alone, so application of land use planning must specifically address the needs of the new settlement pattern (Lang 1986, Davis et al. 1994). The new policies may be a mix of urban and rural policies, as the fringe area appears to represent a mix of both. Some suggest that the new growth should be addressed with tools such as urban growth boundaries, town population caps, purchase of development rights, transfer of development rights, and regional planning (Daniels and Lapping 1996, Doherty 1992).

The metropolitan fringe continues to be the center of development conflicts and concerns, and represents one of the greatest challenges for growth management and land use planners in general (Audirac 1999, Nelson 1999). Research defends claims that current trends of deconcentration will continue, supporting the need for additional research dedicated to understanding the residents and characteristics of the fringe (Lang 2000). Planners need to focus more attention on achieving a more comprehensive understanding of factors in the metropolitan fringe in order to establish effective growth management policies that are supported by citizens with a range of interests.

CHAPTER THREE: METHODOLOGY

Theory, Definitions and Background

Definitions

The Office of Management and Budget (OMB) defines metropolitan areas for the purpose of collecting federal data. A metropolitan area is an area containing a large nucleus and adjacent communities (counties) that are economically integrated with the nucleus. Each metropolitan area contains either a central city of 50,000 residents or more, or a total population (including the integrated communities) of at least 100,000 residents. Two types of metropolitan areas exist: the consolidated metropolitan area (CMSA) and the Metropolitan Statistical Area (MSA). A CMSA includes a larger area than the MSA, as it holds in excess of 1 million people and is divided into multiple primary metropolitan statistical areas (PMSAs) that are economically integrated with parts of the larger metropolitan area. A MSA is smaller than the CMSA, and generally comprises less than 1 million people, or does not have areas that can be classified as distinct PMSAs.

This study used the metropolitan designation as the means to identify the fast-growing peripheral counties. Many studies analyzing the outer suburbs and/or metropolitan fringe locations rely on a differentiation between city, suburb and exurb. Such designations lead to definitional obstacles because clearly defined boundaries between these places do not currently exist. Further, due to the fast-changing pace of growth and development within these places, it is difficult to accurately characterize and distinguish city, suburb and exurb. Comparison of Phoenix, AZ to cities in New Jersey exemplifies that uneven comparisons can result. Outlying suburbs tend to be much denser in the east than in the west, so regionally contingent issues exist with suburban designations.

Use of metropolitan and nonmetropolitan designations represents a cleaner split between areas than do the internal split of the metropolitan areas into city, suburb, and exurb. Metropolitan designations are more effective in delineating areas that describe the social

and economic functional ties between the urban cores and the outlying integrated areas (U.S. Office of Management and Budget). Additionally, many agree that the use of the metropolitan area designation focusing on the counties outside of the central city reflects more of the "suburban reality" than does the use of individual suburban boundaries (Palen 1995). Although this designation of counties within metropolitan areas also includes some areas that are more "rural" in nature, this does not distort the population data given the focus of this study on outlying suburban and metropolitan fringe areas.

Although cases in this study are selected on the basis of metropolitan and non-metropolitan distinctions or boundaries, "suburbia" and "exurbia" are frequently used as descriptors (not boundaries) throughout the study and therefore require explanation. No universally agreed upon definition for suburbs or exurbs exists. The commonly perceived boundary between the city and the suburb are loosely based upon social, racial, and economic boundaries (Palen 1995). Although the U.S. Census does not recognize the suburb, this study uses the general government definition for suburbia, "the MSA area outside of the central city" definition (U.S. Census, "Geographical Mobility: March 1995-March 1996," Current Population Reports P20-497. November 1997, page 5). The Bureau of the Census judges whether the area is "metropolitan" in character, and should be included in the MSA. Therefore, the approximation for "suburbia" when mentioned in the study includes the "metropolitan-oriented" territory of the county outside the central city.

As indicated in the review of the literature, several definitions of "exurbia" exist. Most rely on ecological or spatial definitions of the exurbs, such as the distance from the central city, the relative density of the area, or simply the characteristics and culture of the area. In this study, a general definition used to describe exurbia includes those places that are located in the metropolitan area beyond the suburbs, comprise lower densities, and are characteristically neither city nor country. Suburbia and exurbia are used in the study mainly to distinguish the geography of these places within the metropolitan areas. The counties in the study include both outlying suburban places and places more exurban in nature located within the metropolitan area.

County-Level Units

Counties are used as the data units in this study because of the number of advantages of using county-level data. First, OMB uses counties as the building blocks of metropolitan areas. Given the nature of this research project, the "building blocks" of the metropolitan area play an important role in capturing the growth of the region. Second, county boundaries rarely change. Researchers can aggregate over several decades due to the consistent data that are available at the county level unit of analysis for the entire nation through county, state and federal agencies. Third, considerable amounts of data are collected on the county level, allowing research and comparison on several variables. A fourth advantage is that a significant amount of research on the topic of modern growth patterns is built upon county analysis, therefore county analysis contributes to the existing understanding of county growth trends.

As a final justification for the use of counties as the unit of analysis, counties increasingly participate in important government responsibilities throughout the nation. As the largest subdivision of the state, counties have historically performed as "agents of the state" and continue to do so as compounding suburbanization of the nation contributes to more county responsibility (Burchell et al. 2000). Many counties are directly involved with current land-use issues given both their political power and land-use planning capabilities. County land-use issues also assemble into regional land-use planning. For example, counties represent the Councils of Governments (COGs) and Metropolitan Planning Organizations (MPOs), and serve to advise decision-makers on regional planning programs and policy issues. County-level analysis remains important, as it will continue to play an important role in addressing both local and regional planning problems associated with growth.

County-level analysis however, faces the disadvantage of notable regional and/or population differences among counties due to their relatively large data units. For example, Nye County, NV, with a land area of 18,147 square miles represents an anomaly among counties. In this huge county, a majority of the residents live in the

southeast corner, while the rest of the county remains essentially barren. The west also includes larger counties than the east in general given the significant annexation that took place in the west compared to the organic growth of eastern counties (Lang et al. 1997). Using political jurisdictions as the unit of measurement also presents challenges due to the differences in territory.

Population and Size

This project uses a previously identified set of forty-seven counties as the research cases (Table 1). These counties, referred to as "New Metropolis Counties", were selected based on four separate criteria (Lang 2002). First, they are part of the nation's 50 largest CMSAs or MSAs (Map 1). Second, These counties grew at double-digit rates for every census decade since 1950, and, third, were added to the metropolitan area since 1971. Fourth, the Counties selected also have populations of 200,000 or less because as they grow beyond this general number they become bigger places and integrate further with the metro area containing more traditionally urban demographics. Given these criteria, the counties are fast growing, include places throughout the United States that are *somewhat* new to the region and new to our understanding, and are largely located along the metropolitan fringe.

Table 3.1 New Metropolis Counties

County	Added to MSA	State	Metro Area	1950 Population	2000 Population	Numeric Change	Percent Change
Barrow County	1983	GA	Atlanta	13,115	46,144	33,029	252%
Cherokee County	1973	GA	Atlanta	20,750	141,903	121,153	584%
Douglas County	1973	GA	Atlanta	12,173	92,174	80,001	657%
Forsyth County	1973	GA	Atlanta	11,005	98,407	87,402	794%
Henry County	1973	GA	Atlanta	15,857	119,341	103,484	653%
Paulding County	1973	GA	Atlanta	11,752	81,678	69,926	595%
Rockdale County	1973	GA	Atlanta	8,464	70,111	61,647	728%
Hays County	1973	TX	Austin	17,840	97,589	79,749	447%
Fairfield County	1973	OH	Columbus	52,130	122,759	70,629	135%
Johnson County	1973	TX	Dallas	31,390	126,811	95,421	304%
Douglas County	1981	CO	Denver	3,507	175,766	172,259	4912%
Livingston County	1973	MI	Detroit	26,725	156,951	130,226	487%
Allegan County	1993	MI	Grand Rapids	47,493	105,665	58,172	122%

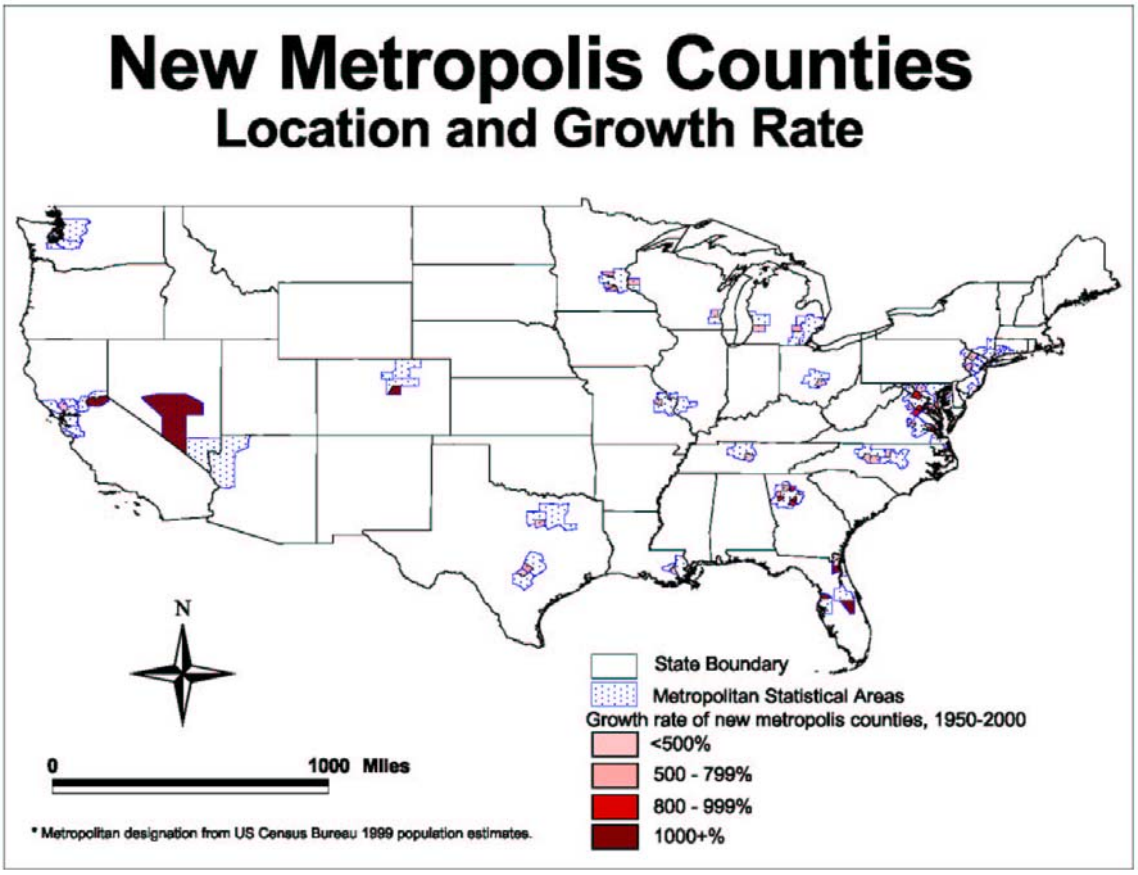
County	Added to MSA	State	Metro Area	1950 Population	2000 Population	Numeric Change	Percent Change
Davidson County	1973	NC	Greensboro	62,244	147,246	85,002	137%
Randolph County	1971	NC	Greensboro	50,804	130,454	79,650	157%
Clay County	1973	FL	Jacksonville	14,323	140,814	126,491	883%
Nassau County	1973	FL	Jacksonville	12,811	57,663	44,852	350%
Nye County	1993	NV	Las Vegas	3,101	32,485	29,384	948%
Washington County	1971	WI	Milwaulkee	33,902	117,493	83,591	247%
Carver County	1973	MN	Minneapolis	18,155	70,205	52,050	287%
Scott County	1973	MN	Minneapolis	16,486	89,498	73,012	443%
Sherburne County	1973	MN	Minneapolis	10,661	64,417	53,756	504%
St. Croix County	1973	WI	Minneapolis	25,905	63,155	37,250	144%
Rutherford County	1973	TN	Nashville	40,696	182,023	141,327	347%
St. Charles Parish	1983	LA	New Orleans	13,363	48,072	34,709	260%
Hunterdon County	1983	NJ	New York City	42,736	121,989	79,253	185%
Sussex County	1983	NJ	New York City	34,423	144,166	109,743	319%
Gloucester County	1973	VA	Norfolk	10,343	34,780	24,437	236%
James City County	1973	VA	Norfolk	6,317	48,102	41,785	661%
Osceola County	1973	FL	Orlando	11,406	172,493	161,087	1412%
Orange County	1973	NC	Raleigh	34,435	118,227	83,792	243%
New Kent County	1981	VA	Richmond	3,995	13,462	9,467	237%
Powhatan County	1973	VA	Richmond	5,556	22,377	16,821	303%
El Dorado County	1983	CA	Sacramento	16,207	156,299	140,092	864%
Comal County	1973	TX	San Antonio	16,357	78,021	61,664	377%
Napa County	1973	CA	San Francisco	46,603	124,279	77,676	167%
Island County	1993	WA	Seattle	11,079	71,558	60,479	546%
Warren County	1993	MO	St. Louis	7,666	24,525	16,859	220%
Hernando County	1983	FL	Tampa	6,693	130,802	124,109	1854%
Calvert County	1983	MD	Washington	12,100	74,563	62,463	516%
Charles County	1973	MD	Washington	23,415	120,546	97,131	415%
Culpeper County	1993	VA	Washington	13,242	34,262	21,020	159%
Frederick County	1983	MD	Washington	62,287	195,277	132,990	214%
Loudoun County	1971	VA	Washington	21,147	169,599	148,452	702%
Queen Anne's County	1983	MD	Washington	14,579	40,563	25,984	178%
Spotsylvania County	1993	VA	Washington	11,920	90,395	78,475	658%
Stafford County	1983	VA	Washington	11,902	92,446	80,544	677%

Source: Lang and Zimmerman Gough 2003 (forthcoming).

The criteria used to establish this set of counties serves as justification for use of the forty-seven cases in this study. The criteria identify cases that exist as the result of descriptive analysis, using growth as well as "newness" to the metropolitan area as a basis. Growth represents an important element of the research focus, as the study addresses fast-growing counties. By definition, the counties used in this study are located

along the urban-rural fringe. Therefore, focusing on counties added to the metropolitan area within the past few decades allows for analysis of the places located on the metropolitan fringes where growth issues are paramount and frequently debated.

Map 3.1 New Metropolis Counties: Location and Growth Rate



Source: Lang and Zimmerman Gough 2003 (forthcoming).

Classification and Typology Building

Classification acts as a tool to simplify data observations into meaningful categories or groupings. By providing order to information, classification allows for a means to achieve a deeper understanding of the subject area (Berry 1972). Classification can be used for data exploration, hypothesis testing, and is the basis of typology building. The goal of classification is to find similar entities that fall into a particular group while ensuring significant distinction between those entities and other groups. Therefore,

resulting groups are internally homogenous, or comprise entities with minimal intra-group variation. Conversely, variation between different groups is maximized.

Cluster analysis is a common technique used to separate a set of data by grouping entities into homogenous subgroups based on their similarities. The results generate clusters that yield a classification scheme. The cluster represents an explanatory "type" that underlies the data. Although some literature distinguishes between the terms cluster analysis and classification, this project will follow the work of Everitt (1974) by using these terms interchangeably, with both indicating methods of analysis to group entities.

Important to the research goal of finding a typology for fast-growing counties, cluster analysis identifies categories within a mixture of entities that represent distinguishable populations. These categories can further simplify the observations by reducing the information on the entities with minimal information loss about the entities (Lorr 1983). As applied to counties, cluster analysis resolves the mixture of characteristics within and between counties to identify emerging clusters of similarity, thus reducing the complexity of forty-seven entities to establish a smaller and more manageable number of groups to comprehend.

Generalizability

It is anticipated that the knowledge and information gained from this study may be generalizable on a regional basis. These counties are largely located in the eastern half of the United States. The geographic location of these counties can be directly linked to the underlying population criteria for the determination of these fast-growing peripheral counties. As these counties have a population of 200,000 or less according to the 2000 Census, the research methods may not apply to all western counties primarily because those counties are spatially, and therefore numerically too large to qualify. In other cases the western counties may be urban counties such as Maricopa County, AZ, (which include Phoenix) where the counties are essentially the entire metro area. In such examples, these large counties are bigger than the San Francisco or Boston metro areas.

Due to these regional constraints, a user of this research should expect to be able to specifically apply this classification scheme to determine the needs of fast-growing eastern counties.

Methodology Analysis

The forty-seven peripheral counties were classified into similar groups using a two-stage methodology. Agglomerative hierarchical cluster analysis served as the grouping procedure to establish groups of counties within the universe of the forty-seven county cases, based on relevant demographic variables. Following this cluster procedure, forty-seven counties started out representing forty-seven separate clusters. Then individual clusters were subsequently grouped into a smaller number of clusters based on similar attributes until all the counties were grouped together in a single cluster.

The second stage utilized discriminant analysis to statistically validate the resulting groups deduced from cluster analysis, and to further ascertain the specific variables that characterize and differentiate between the resulting clusters of counties. As discriminant analysis depends on an *a priori* group of observations, the cluster analysis provided the observations, and then discriminant analysis tested the goodness-of-fit of the prior cluster assignments. Discriminant analysis effectively tested the internal validity of the resulting clusters, thereby ensuring that the cluster analysis results created homogeneous clusters[3]. Details regarding the methodology used for the cluster analysis and discriminant analysis follow.

Agglomerative Hierarchical Cluster Analysis

As previously indicated, cluster analysis is a common technique used to separate a set of data by grouping entities into homogenous subgroups based on their similarities. Hierarchical clustering methods are either agglomerative or divisive. Divisive methods begin with a single cluster and proceed by subdividing the cluster into separate *n* entities. Agglomerative methods, which are more widely used, proceed by a series of successive

[3] Hill et al. (1998) used similar methods in their classification of 508 central cities in the United States

fusions of *n* entities into groups or clusters. Agglomerative hierarchical cluster analysis was employed in this analysis to determine a data-derived typology from the "universe" of New Metropolis Counties, or the fast growing peripheral counties in the United States.

As applied to this analysis, agglomerative hierarchical cluster analysis is a multivariate technique that proceeds through a series of successive fusions of *n* counties. The technique starts by forming *n* clusters, and then reduces the clusters to *n*-1 clusters, *n*-2 clusters, etc., repeating this process until only one cluster remains. Using a hierarchical as opposed to a non-hierarchical cluster method, resultant classifications (or clusters) have an increasing number of nested classes (or clusters), and so larger clusters may contain smaller clusters. Therefore, hierarchical clustering algorithms impose a hierarchical structure on the data.

Related to this hierarchical structure, a general disadvantage to hierarchical clustering techniques is that it does not allow for reallocation of entities (Everitt 1974). For example, if an entity was classified in an early cluster, no provision exists to reassign the entity a more appropriate cluster. However, the advantages of an agglomerative hierarchical clustering algorithm outweigh the disadvantages for the proposed project. This technique is advantageous to use given its ability to identify distinct groups within a population and its capability of running the analysis without requiring a prior specification for the number of resulting clusters (Hill et al. 1998, Everitt 1974). This second point allows the investigator to determine the suitable number of clusters, given factors indicating the level of similarity between clustering stages.

Ward's Method

Many agglomerative hierarchical methods exist, and each method uses a similarity or variable distance matrix between the entities (Everitt 1974). Fusion occurs between entities or groups of entities that are the most similar. Methods differ in the ways to define similarities or differences. Ward's Method mathematically seeks to find the most "efficient" step at each stage of fusions of the entities, via the minimization of the squared Euclidian distances between each entity's standardized score on each of the

measured variables (Ward 1963). This method measures the loss of information by calculating the total sums of squared deviations of every point from the mean of the cluster to which it belongs (Everitt 1974). At each cluster stage, the method considered the combination of every potential pair of clusters, and combined cases whose fusion yielded the smallest increase in the error sum of squares, using the following equation:

$$\Sigma \ x_i^2 - \ 1/n \ (\Sigma x_i)^2$$

The procedure thus reduces the county clusters to a single cluster containing all the counties, and produces a complete hierarchical structure. The Ward method proposes that the greatest amount of information is available when the set of *n* entities is ungrouped, or unclustered, as the grouping of increasingly dissimilar entities yields less precise information (1963). Consequently, the goal of each stage in the procedure is to form groups with minimized sum of squared within-group deviations about the group mean.

Discriminant Analysis

Discriminant analysis was used both as a classification tool and a way to determine the relative importance of variables in classifying the clusters. Discriminant analysis depends on an *a priori* group of observations. In this case, the cluster analysis provided these observations, and discriminant analysis tested the goodness-of-fit of the prior cluster assignments. This step effectively tested the internal validity of the resulting clusters, thereby ensuring that the cluster analysis results created homogeneous clusters. While cluster analysis used a mathematical method through error sums of squares to differentiate cases into similar groups, discriminant analysis created predictor functions to "discriminate" between cases and place them into similar groups.

Variable Selection

The basis of a classification ultimately depends on the purpose of the research, which is represented by the variables used in the analysis. Variables used in the cluster and discriminant analysis represent those noted in the literature as general characteristics of

residents living on the periphery of metropolitan areas. Variable selection does not involve statistical process, however, and therefore the selection reflects a separate initial categorization. Therefore, the choice of variable selection is of high importance because it reflects the investigator's judgment as to the relevance of the variable to the purpose of the analysis (Everitt 1974). Variables that lack theoretical relevance to for inclusion may essentially distort the cluster analysis results. Previous classification literature used economic and demographic variables for classification of regions or cities (Berry 1996, Airola and Parker 1983, Hill et al. 1998, Nelson 1955).

Table 2 lists the eighteen demographic and economic variables collected for analysis. All variables were obtained from the United States Bureau of the Census (http://www.census.gov/). Specifically, data sources included Census 2000 Sample File (SF) 3, Census 2000 Demographic Profile (DP) data, Census Population Estimates, and the Census County Business Patterns (as defined in the North American Industry Classification System (NAICS)). Given the information sources, these data will consistently be available for replication in the future as well as for cross-section comparison.

All variables fell into one of seven sub-categories of variables, depending on the characteristics indicated by the variable. The first category of variables considers the level of racial diversity found in these counties through measurement of the percent non-Hispanic white residents living in the counties. However, the investigator did not expect this variable to be a strong discriminator between counties as the literature suggests that fringe counties attract predominately white residents. Consequently, variation among the counties would remain limited.

The second category estimates the economic capacity of these counties, on both the supply and demand side of the labor market, respectively. The percent of work force in white-collared jobs (defined as Management, Professional and Related Occupations) measures the higher-end occupation distribution of the population, while the percent of total industry establishments started from 1990 to 2000 indicates healthier, growing

places. Literature suggests a potential decentralization of business to the fringe areas. Counties that attract new residents are expected to contain more white-collared jobs and more new business establishments. Conversely, places that associate with a more rural, blue-collar environment that was likely typical of these counties several decades ago may cluster.

The level of education attainment of adults comprises the third category of variables. This variable tests the theory that these places comprise a higher-educated population. This category may be highly associated with the economic variables as a higher educated workforce is expected to hold white-collared jobs.

The forth category of variables records the median household income, percent of persons below the poverty level, and income disparity (measured as the difference between the 2nd and 8th deciles). These variables describe income distribution within the counties to determine both the underlying central tendencies and disparities of the residents.

Percent homeownership, change in median value of owner-occupied housing, percent of single-family detached homes, and percent of mobiles homes make up the fifth category, the housing variables for these counties. These variables test the literature on the theory that although housing found in the fringe may be predominately owner-occupied single-family detached homes, mobiles homes are also common, as some residents have located on the fringe because they were priced out of the suburbs. Literature also suggests that homes located in the fringe are inexpensive because the land values are cheaper.

Transportation-oriented variables fall within the sixth category. Mean travel time of residents, percent of workers who commute outside the county, and percent of households with three or more vehicles measure the level of automobile dependence, characteristic of localities on the metropolitan fringe.

Table 3.2 Variables Collected for the Analysis

Race
1. Percent Non-Hispanic White

Economic

2. Percent Work Force in White-Collared Jobs
3. Percent of Total 2000 Industry Started from 1990-2000

Education

4. Percent Who Attained Bachelor's Degree or Higher

Income

5. Median Household Income
6. Income disparity (difference between the 2nd and 8th decile)
7. Percent of Persons Below Poverty Level

Housing

8. Percent Homeownership
9. Percent Change in Median Value of Owner-Occupied Housing from 1990 to 2000
10. Percent Single-Family Detached Housing
11. Percent of Housing Units that are Mobile Homes

Transportation

12. Mean Travel Time
13. Percent of Workers Over 16 Years Commuting Outside County of Residence
14. Percent Households with Three or More Vehicles

Growth

15. Growth Rate from 1990 to 2000
16. Percent People under 18 Years Old
17. Percent 65 and over, who live in owner-occupied housing and have moved there from 1990 to 2000
18. Percent population change due to net domestic migration from 1990 to 1999

Sources: Census 2000 Sample File (SF) 3, Census 2000 Demographic Profile (DP) data, Census Population Estimates, and Census County Business Patterns (as defined in the North American Industry Classification System (NAICS)).

The final category measures county growth and growth-related issues typical of peripheral counties. Growth rate and the percent of people less than 18 years old consider the growth-related concerns with a growing population and anticipated or current pressure s on schools to accommodate growth. Percent of population change due to domestic migration and percent of homeowners 65 and over who move there in the last decade suggest the high growth endured by these places, but also indicate the attraction to these counties in general or as retirement locales.

Using the Statistical Package for the Social Sciences (SPSS) software, a correlation procedure produced Pearson product-moment correlations, summarizing the relationship between two variables at a time for all eighteen variables. The sign of the correlation

coefficient (+ or -) indicates a positive or negative relationship between two variables. The value of the correlation coefficient ranges from -1 to +1; the power of the relationship between the variables is determined by the size of the correlation coefficient. Irrespective of sign, correlation coefficients of 0.10, 0.30, and 0.50 suggest a low, moderate and high correlation between two variables, respectively (Green et al. 2000). Based on these rankings, "high" variable correlations (at the 0.01 significance level) noted in Table 3 served as the tool to select the five most important variables[4].

The validity of a test ultimately depends on the whether the data meet the assumptions of the test. Pearson's product-moment correlation assumes that the variables are bivariately normally distributed, indicating that a linear relationship is the only type of statistical relationship that exists between the two variables. Examination of Probability P-P Plots (Appendix A) confirms linearity in the data points for these variables.

The next step in the variable selection process involved determining the appropriate number of variables to include in the analysis, given the number of cases. Due to such a large number of variables and fewer than fifty cases, the degrees of freedom for errors are small. As such, the appropriate number of variables was determined by dividing the number of cases by ten[5]. Given that forty-seven cases exist for the analysis, five variables were selected from the initial eighteen variables.

The five selected variables included Percent Non-Hispanic White, Percent Single-Family Detached Homes, Mean Travel Time, Percent Population Change Due to Domestic Migration, and Median Household Income. These five variables were chosen because they acted as "representatives" for the entire eighteen original variables as they were highly correlated with several of the original variables based on the Pearson's correlations. In addition, it should be noted that the five variables were not highly correlated with each other, thus avoiding redundancy of individual variables.

[4] The five most "important" variables were those with numerous highly correlated relationships with other variables in the original list. Together the five variables did not show overlapping correlations that would place more emphasis on a particular variable.

Additionally, some of the selected variables such as those measured in percentages and others measured in minutes had different variable scaling. Because differences in scaling may affect cluster solutions, variables were standardized (*z-scores*) prior to running the cluster analyses (Green et al. 2000).

Table 3.3 Correlation Matrix Results

Percent Non-Hispanic White
(+) Percent Homeownership (.527)
(-) Percent Individuals in Poverty Status (-.546)
Percent Homeownership
(+) Percent Non-Hispanic White (.527)
(+) Percent Single-Family Detached (.577)
(+) Percent Workers Who Commute Beyond County (.530)
(-) Percent Individuals in Poverty Status (-.642)
Percent Single-Family Detached Homes
(+) Percent Homeownership (.577)
(+) Percent Households with 3 or More Vehicles (.585)
(+) Percent Workers Who Commute Beyond County (.567)
(-) Percent Housing that are Mobile Homes (-.602)
Mean Travel Time
(-) Percent Change in Median Value of Owner-Occupied Housing, 1990 to 2000 (-.519)
Percent Households with 3 or More Vehicles
(+) Percent Single-Family Detached Housing (.585)
Percent Under 18 Years Old
(+) Median Household Income (.574)
(-) Percent Individuals in Poverty Status (-.604)
Percent With a Higher Education
(+) Median Household Income (.679)
(+) Percent White-Collared Jobs (.954)
(+) Difference in 2nd and 8th Decile (.709)
Percent White-Collared Jobs
(-) Percent Housing that are Mobile Homes (-.596)
(+) Percent with a higher Education (.954)
(+) Difference in 2nd and 8th Decile (.755)
(+) Median Household Income (.786)
Difference in 2nd and 8th Decile

[5] Procedure as recommended by the Statistical Consulting Center of Virginia Polytechnic Institute and State University.

(-) Percent Housing that are Mobile Homes (-.538)
(+) Percent with a higher Education (.709)
(+) Percent with White-Collared Jobs (.755)
(+) Median Household Income (.744)

Percent Individuals in Poverty Status

(-) Percent Non-Hispanic White (-.546)
(-) Percent Homeownership (-.642)
(-) Percent Under 18 Years Old (-.604)
(+)Percent Housing that are Mobile Homes (.607)
(-) Median Household Income (-.833)

Percent Housing that Are Mobile Homes

(-) Percent White-Collared Jobs (-.596)
(-) Difference in 2nd and 8th Decile (-.538)
(-) Percent Single-Family Detached Housing (-.602)
(+)Percent Individuals in Poverty Status (.607)
(-) Median Household Income (-.674)

Percent Workers Who Commute Beyond County

(+) Percent Homeownership (.530)
(+) Percent Single-Family Detached (.567)
(+) Percent Total Industry Establishments Created since 1990 (.504)

Percent Total Industry Establishments Created Since 1990

(+) Percent of Workers Who Commute Beyond County (.504)
(+) Percent Homeowners 65 and Over Who Moved in Residence since 1990 (.507)
(+) Growth Rate, 1990-2000 (.630)
(+) Population changes Due to Net Domestic Migration (.634)

Percent Change in Median Housing Value, 1990-2000

(-) Mean travel Time (-.519)

Growth Rate from 1990 to 2000

(+) Percent Total Industry Establishments Created since 1990 (.630)
(+) Percent Homeowners 65 and Over Who Moved in Residence since 1990 (.633)
(+) Percent Population Changes Due to Net Domestic Migration (.975)

Percent Population Changes Due to Net Domestic Migration

(+) Percent Total Industry Establishments Created since 1990 (.634)
(+) Percent Homeowners 65 and Over Who Moved in Residence since 1990 (.658)
(+) Growth Rate (.975)

Percent Homeowners 65 and Over Who Moved in Residence since 1990

(+) Percent Total Industry Establishments Created since 1990 (.507)
(+) Percent Population Change Due to Domestic Migration (.658)
(+) Growth Rate (.633)

Median Household Income

(+) Percent Under 18 Years Old (.574)

(+) Percent With a Higher Education (.679)
(+) Percent White-Collared Jobs (.786)
(+) Income Difference Between 2nd and 8th Deciles (.744)
(-) Percent Individuals in Poverty Status (-.833)
(-) Percent Housing Units that are Mobile Homes (-.674)

Examination of the resulting agglomeration schedule from the cluster analysis showed that the population contained five clusters, as a noted increase existed in the rate and acceleration of the coefficient with the move from five clusters (stage 42) to four clusters (stage 43). Figure 1 illustrates the cluster "break" points at two and five clusters, based on the agglomeration coefficients (points differentiated by yellow triangles).

Table 3.4 Agglomeration Schedule, Five Variables

Nclust	**Stage**	**Coefficients**	**Rate**	**Acceleration**
46	1	0.11915515	0.00	0.00
45	2	0.30025107	151.98	0.00
44	3	0.55348865	84.34	-44.51
43	4	0.86361274	56.03	-33.57
42	5	1.20022843	38.98	-30.44
41	6	1.53882889	28.21	-27.62
40	7	1.90658845	23.90	-15.29
39	8	2.2923932	20.24	-15.33
38	9	2.69026008	17.36	-14.23
37	10	3.13558583	16.55	-4.62
36	11	3.68472538	17.51	5.80
35	12	4.27441902	16.00	-8.62
34	13	4.88159721	14.20	-11.24
33	14	5.5013948	12.70	-10.62
32	15	6.12396448	11.32	-10.87
31	16	6.75627329	10.33	-8.76
30	17	7.39006017	9.38	-9.15
29	18	8.40768129	13.77	46.79
28	19	9.43062778	12.17	-11.64
27	20	10.7328147	13.81	13.49
26	21	12.1437484	13.15	-4.79
25	22	13.5876779	11.89	-9.55
24	23	15.0479504	10.75	-9.62
23	24	16.5887532	10.24	-4.72
22	25	18.1777839	9.58	-6.45
21	26	19.7846675	8.84	-7.72
20	27	21.5047184	8.69	-1.65
19	28	23.5586752	9.55	9.86
18	29	26.0135121	10.42	9.10
17	30	28.7449471	10.50	0.77

16	31	31.6785921	10.21	-2.80
15	32	35.0563776	10.66	4.48
14	33	38.5695161	10.02	-6.01
13	34	42.2768809	9.61	-4.08
12	35	46.0113205	8.83	-8.10
11	36	50.9518575	10.74	21.56
10	37	56.5193494	10.93	1.76
9	38	62.726058	10.98	0.50
8	39	69.5764755	10.92	-0.55
7	40	78.2956264	12.53	14.75
6	41	87.852559	12.21	-2.60
5	*42*	*98.9003915*	***12.58***	***3.02***
4	*43*	*118.835699*	*20.16*	*60.29*
3	44	143.755552	20.97	4.03
2	*45*	*172.263633*	***19.83***	***-5.43***
1	*46*	*230*	*33.52*	*69.01*

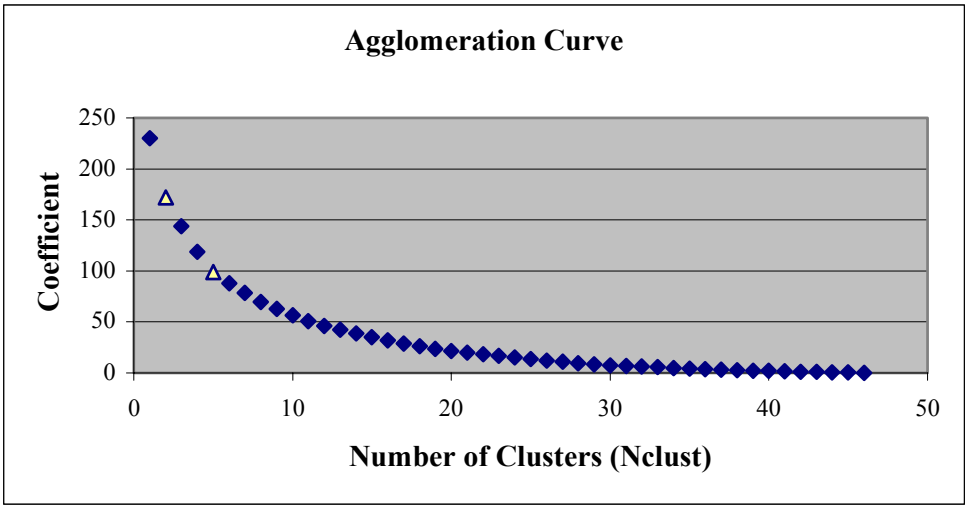


Figure 3.1 Agglomeration Curve, Five Variables

However, before proceeding on to interpretation of the clusters, an *F* test initially tested the equality of group means for the two-cluster solution, to ensure that the means of the five variables were not the same between the two clusters. Further, discriminant analysis should not be used without obtaining a significant *F* test (Green et al. 2000). The test indicated that all the variables were *not* different between the two groups at the 0.05 significance level. The Non-Hispanic White variable mean did not differ between the two clusters, questioning the importance or effectiveness of this variable to classify the

counties[6]. Based on this information, the cluster analysis was performed again with only four variables, excluding the Non-Hispanic White variable. Consequently, the Results Chapter following the methodology proceeds with using only four variables, Percent Single-Family Detached Homes, Mean Travel Time, Median Household Income, and Percent of Population Increase Due to Domestic Migration.

[6] The literature supports this result, as the fringe comprises a predominately non-Hispanic white population. The average percentage of the non-Hispanic white population in the forty-seven county cases exceeds the national average by more than 15 percent (U.S. Census Bureau, 2000).

CHAPTER FOUR: RESULTS

Four key variables, Percent Single-Family Detached Homes, Mean Travel Time, Median Household Income, and Percent of Population Increase Due to Domestic Migration served as the basis for classification of the forty-seven counties. The agglomeration schedule was used to identify the number of clusters within the universe of the forty-seven counties. Then discriminant analysis was used to further analyze and validate the *a priori* group of clusters identified by cluster analysis. Finally, statistical output from discriminant analysis helped determine underlying characteristics of the resulting clusters.

Clusters Solution Selection

All clustering techniques involve the determination of the number of clusters present in the data. While some research inherently identifies a certain number of resulting clusters appropriate for the data, no clear indicator for the appropriate number of clusters existed for this analysis. Using agglomerative hierarchical cluster analysis, the number of clusters existing in the data is dependent upon the loss of information associated with each cluster stage (Ward 1963). The agglomeration coefficient provides the means to measure within-group variance of the clusters combined at a particular stage, and thus determines the appropriate number of clusters.

Agglomeration Coefficient

The agglomeration coefficient has been used as an effective guide in determining the proper number of clusters when using agglomerative hierarchical cluster analysis (Hill et al. 1998). Using this technique, the loss of information associated with each stage determines the appropriate number of clusters. The agglomeration coefficient provides insight into natural "breaks" in the clustering method: the clustering stages with high rates or a high acceleration in the agglomeration coefficient demonstrate combinations of dissimilar entities. Because the target is to minimize within-group variation, thus keeping

entities grouped in similar clusters, these breaks indicate an appropriate number of clusters for the data.

Table 4.1 contains the agglomeration schedule for the cluster analysis performed on the forty-seven county cases, based on the four selected variables. The first column (Nclust) lists the number of clusters found within the cluster solution for the associated cluster stage. The cluster stage number follows in the second column, showing that the number of stages in the clustering process is one less than the number of cases (in this case, forty-six stages and forty-seven counties). The stage numbering follows the logic that the starting point contains 47 counties, and the first stage or cluster solution contains forty-six counties. The third column (Coefficients) contains the agglomeration coefficient, indicating the within-group variance of the clusters combined at that particular stage.

Table 4.1 Agglomeration Schedule, Four Variables

Nclust	**Stage**	**Coefficients**	**Rate**	**Acceleration**
46	1	0.06190502	0.00	0.00
45	2	0.15728103	154.07	0.00
44	3	0.27289098	73.51	-52.29
43	4	0.39222087	43.73	-40.51
42	5	0.51813654	32.10	-26.58
41	6	0.65148162	25.74	-19.84
40	7	0.82037024	25.92	0.73
39	8	1.02508951	24.95	-3.74
38	9	1.26148004	23.06	-7.59
37	10	1.51126315	19.80	-14.14
36	11	1.83789947	21.61	9.15
35	12	2.16627956	17.87	-17.33
34	13	2.5077534	15.76	-11.78
33	14	2.85753206	13.95	-11.52
32	15	3.23335957	13.15	-5.70
31	16	3.61662948	11.85	-9.87
30	17	4.0378773	11.65	-1.74
29	18	4.49700331	11.37	-2.38
28	19	4.98921615	10.95	-3.74
27	20	5.55630315	11.37	3.85
26	21	6.17592082	11.15	-1.89
25	22	6.81836981	10.40	-6.72
24	23	7.63659416	12.00	15.36
23	24	8.5750035	12.29	2.40
22	25	9.55369945	11.41	-7.12
21	26	10.5584883	10.52	-7.85

20	27	11.5647975	9.53	-9.38
19	28	12.8641154	11.24	17.88
18	29	14.4480581	12.31	9.59
17	30	16.1821653	12.00	-2.52
16	31	18.0460467	11.52	-4.03
15	32	19.9542759	10.57	-8.19
14	33	22.0420267	10.46	-1.05
13	34	24.6889416	12.01	14.77
12	35	27.6808358	12.12	0.91
11	36	31.4072112	13.46	11.09
10	37	36.2016239	15.27	13.40
9	38	41.2250426	13.88	-9.10
8	39	46.6355807	13.12	-5.42
7	40	52.5669911	12.72	-3.09
6	41	61.6761587	17.33	36.25
5	42	70.7946524	14.78	-14.68
4	*43*	*81.1766216*	***14.66***	***-0.81***
3	*44*	*99.0362274*	*22.00*	*50.02*
2	*45*	*124.105884*	***25.31***	***15.06***
1	*46*	*184*	*48.26*	*90.65*

The fourth (Rate) and fifth (Acceleration) columns are calculated to measure the within-group variance. Specifically, the fourth column shows the percent change in the agglomeration coefficient from the previous stage, interpreted as the rate of change or the slope of the agglomeration schedule. The fifth column calculates the percent change in the percent change, measuring the acceleration of change in the agglomeration schedule.

More than the agglomeration coefficient itself, the fourth and fifth columns of the tables help select the number of clusters in the population. Because the grouping stages continue until only one cluster remains, a complete hierarchical structure as well as a quantitative estimate of the information loss at each cluster stage may be obtained. For this study, the notable increases in both the rate and acceleration of the agglomeration schedule indicate combinations of dissimilar counties within the cluster stage[7]. The cluster stage at which a notable increase in these numbers exists represents a combination of counties that are dissimilar. Therefore, the cluster stage previous to this dissimilar combination denotes a cluster break.

[7] Hill et al. (1998) use a similar procedure to define "marked" increases in the agglomeration schedule.

Figure 4.1 illustrates the cluster "break" points (yellow triangles), based on the agglomeration coefficients. As indicated by the figure, the increase in the agglomeration coefficient, or the increase in within-cluster variation, remains consistently gradual until the clusters are fused from four clusters to three clusters. This marked increased in the agglomeration coefficient between cluster four and cluster three indicates that four clusters of similar counties exist in the data, which become significantly less similar if they are fused into three clusters. Likewise, the agglomeration coefficient dramatically increases with the fusion of two county clusters to a single county cluster. Based on the methods used in the analysis, this increase indicates that two similar county types exist in the data.

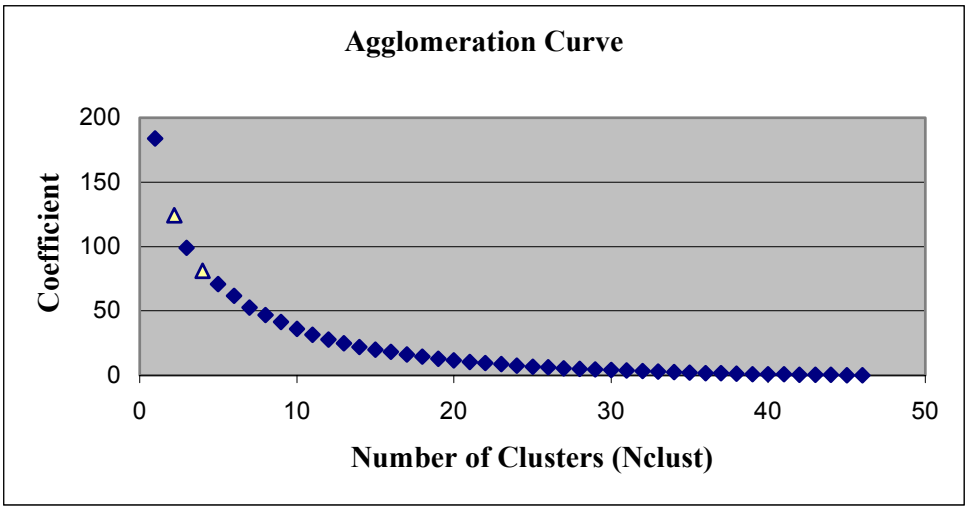


Figure 4.1 Agglomeration Curve, Four Variables

Agglomeration Schedule

Examination of the agglomeration schedule shows that the population contains four clusters, as a noted increase exists in the rate and acceleration of the coefficient with the move from four clusters (stage 43) to three clusters (stage 44). Moving from four to three clusters results in a rate increase from 14.66 percent to 22 percent, and an acceleration increase from –0.81 percent to 50.02 percent. In this case, the slope of the agglomeration schedule and the acceleration of the slope increase noticeably. When the clusters fuse from four to three clusters, within-group variation increases indicating a large

heterogeneous grouping. Therefore, the within-group populations combined in four clusters can be interpreted as more homogenous than the within-group populations fused into three clusters.

A large heterogeneous grouping also occurs with the move from two clusters to one cluster, resulting in a marked increase in the rate from 25.31 percent to 48.26 percent, and the acceleration from 15.06 percent to 90.65 percent. These results show that the population divides into two major clusters of similarity, and a total of four clusters of similarity are nested within those two clusters. The heterogeneous group resulting from the fusion of two clusters to a single cluster demonstrates that all the county cases are not the same. Therefore, the investigator rejected the null hypothesis that the entire sample of forty-seven counties included in this study would be statistically homogenous.

The resulting dendrogram (Figure 4.2) illustrates this combination process by combining clusters at different increments, and also shows the hierarchical structure placed on the data. Much of the literature equates the hierarchy of the dendrogram to a tree, beginning at the branches, and eventually assembling to the trunk (Lorr 1983). The branches (clusters) that are most similar or "closest" merge together, and at the next levels the closest combined branches merge until all are merged and reach the trunk. The dendrogram clearly illustrates the process of building a nested hierarchy.

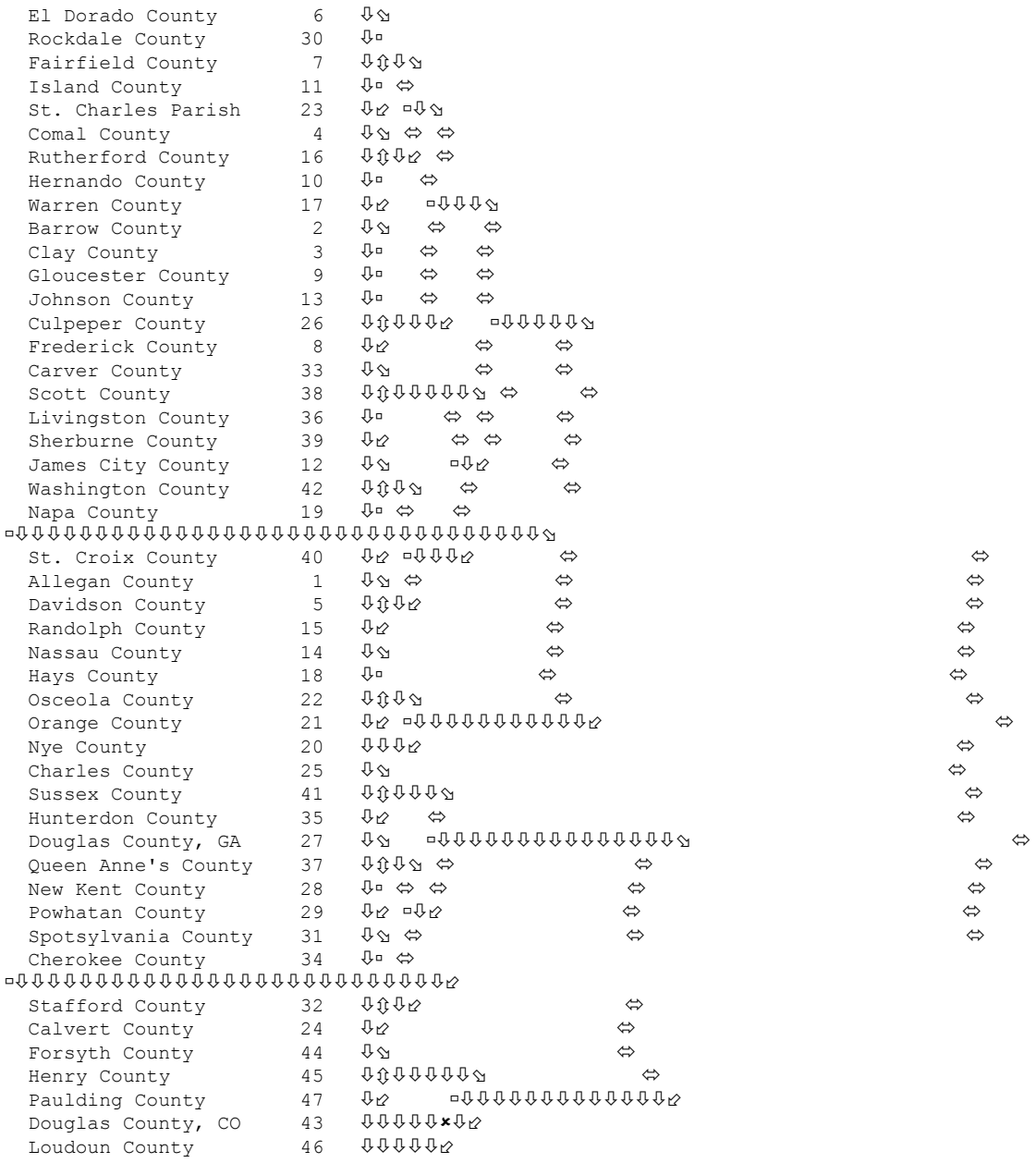


Figure 4.2 Dendrogram Plot

Discriminant Analysis

Discriminant analysis allowed for validation of the cluster solutions selected using the cluster analysis, and also helped identify the most important variables that guided the classification process. As discriminant analysis requires *a priori* groups of observations, the same cluster analysis was run again and the four cluster and two cluster solutions were saved using the "Save Cluster Memberships" option. This option assigned corresponding cluster numbers to the forty-seven county cases, first labeling them as falling within a universe of two clusters, and then further splitting into a universe of four clusters. The saved cluster memberships were then used in subsequent analyses, specifically discriminant analysis.

Agglomerative hierarchical cluster analysis methods internally indicate the validity of the clusters based on the rate and acceleration of the agglomeration coefficients in the agglomeration schedule. Discriminant analysis acts as a second indicator of validity for the cluster solutions selected using the cluster analysis. An important point to identify is that two groupings of the cases were compared in this step: the groupings from the cluster analysis (four-cluster and two-cluster solutions) and the groupings from the discriminant analysis of the four-cluster and two-cluster solutions (discriminant groupings).

Discriminant Classification Results

Discriminant analysis produces a predicted group assignment for county cases, based on an aggregate discriminant score. Each county receives an aggregate discriminant score, determined by summing the weighted discriminant scores [8] for each function. The final weighted score is used to assign the county to its discriminant grouping. Discriminant analysis uses the discriminant score to indicate if the discriminant-generated assignment matches the prior cluster assignment. Determination of the goodness-of-fit of the county assignment depends on the percent of counties that were assigned similarly in both the discriminant assignments and the cluster assignments.

[8] The weighted scores are based on the percentage of overall explained variation accounted for by the discriminant function.

The first classification predicted group membership based on the discriminant functions derived from all the cases in the analysis. In other words, a case (county) was classified by a function derived from *all* the counties, including that particular county. A "hit ratio" is the percentage of the counties that were classified similarly in the cluster analysis and the discriminant analysis. Using this method, the four-cluster solution had a 95.7 percent hit ratio, meaning that 95.7 percent of the original clustered cases for the four-cluster solution were correctly classified based on the discriminant analysis results (Table 4.2). The two-cluster solution had a 93.6 percent hit ratio, indicating that 93.6 percent of the original clustered cases for the two-cluster solution were correctly classified according to discriminant analysis (Table 4.3).

While these classification results validate the original cluster solution, it remains questionable if the classification could be used to predict a county that was not used to derive the discriminant functions. Cross-validation in discriminant analysis classifies cases using the "leave-one-out" option, producing a more honest evaluation of the classification, and a better estimation of how well the classification would predict a new county. With this option, classification functions are derived based on all cases (counties) *except* for one. The one county left out is then classified, thereby predicting group membership from counties not used to derive the classification function. This is repeated forty-seven times until all counties are left out once and classified based on functions derived from the 46 other counties. Cross validation had an 87.2 percent hit ratio for the four-cluster solution, and a 91.5 percent hit ratio for the two-cluster solution.

Table 4.2 Discriminant Analysis Classification Results, Four-Cluster Solution

		Ward Method	Predicted Group Membership				Total
			1	2	3	4	
Original	Count	1	24	0	2	0	26
		2	0	5	0	0	5
		3	0	0	11	0	11
		4	0	0	0	5	5
	%	1	92.3	.0	7.7	.0	100.0
		2	.0	100.0	.0	.0	100.0
		3	.0	.0	100.0	.0	100.0
		4	.0	.0	.0	100.0	100.0
Cross-validated	Count	1	22	2	2	0	26
		2	0	5	0	0	5
		3	0	0	11	0	11
		4	1	0	1	3	5
	%	1	84.6	7.7	7.7	.0	100.0
		2	.0	100.0	.0	.0	100.0
		3	.0	.0	100.0	.0	100.0
		4	20.0	.0	20.0	60.0	100.0

The top sections of the tables (Original) show how well the classification function predicts in the cases. The correctly classified cases appear in a diagonal line in the table. For example, in the four-cluster table, twenty-four of the twenty-six cases (92.3 percent) were classified correctly in the first cluster. The rest of the cases were correctly classified in the clusters, with all five cases (100 percent) correctly classified in the second cluster, eleven cases (100 percent) correctly classified in the third cluster, and five cases (100 percent) correctly classified in the forth group. In total, two counties were misclassified in the cluster analysis, according to the discriminant grouping. Based on the discriminant functions, these two counties would be assigned to another cluster.

Table 4.3 Discriminant Analysis Classification Results, Two-Cluster Solution

		Ward Method	Predicted Group Membership		Total
			1	2	
Original	Count	1	29	2	31
		2	1	15	16
	%	1	93.5	6.5	100.0
		2	6.3	93.8	100.0
Cross-validated	Count	1	28	3	31
		2	1	15	16
	%	1	90.3	9.7	100.0
		2	6.3	93.8	100.0

The bottom sections of the tables (Cross-validated) show the same information for the cross-validation results. In the four-cluster sample, six counties were misclassified in the cluster analysis, according to the cross-validation discriminant grouping results. Due to the more conservative cross-validation classification, four additional counties were misclassified, in comparison to the original discriminant classification.

It is interesting to note that the predicted membership or hit ratio based on the discriminant classification was higher for the four-cluster solution than the two-cluster solution. In other words, the hit ration decreased as the number of clusters decreases. Following this logic, the more nested clusters (represented by the four-cluster solution) are more similar than the two-cluster solutions; therefore the counties have higher predicted classifications when they are clustered into four groups.

However, cross-validation methods yielded a different pattern. When a case was left out of the discriminant function derivation and then classified, hit ratios *increased* as the number of clusters was reduced. In this case, it is reasonable that a county (which was not part of the function that the classification was built upon) would have a higher hit ratio in the two-cluster solution than the four-cluster solution. Because the clustering is hierarchical, counties that were assigned to clusters at earlier cluster stages (four-cluster

solution) stay together in larger, subsequent stages as the clusters become more heterogeneous.

There is not a specific hit ratio minimum that indicates a valid cluster solution. However, the hit ratios exceeded 87 percent using the most conservative measure. These high percentage results validate the cluster solutions selected using the cluster analysis, so the stability of the solution substantiates the cluster groups. As a final verification of internal cluster validity, t-tests were also run between the mean discriminant scores of the cluster solutions and of the discriminant groupings, also validating the assignment of counties to the specific cluster solutions.

Discriminant Functions

An *F* test initially tested the equality of group means for the four-cluster and two-cluster solutions. This test ensured that the means of the four variables were not the same across the four clusters, and not the same across the two clusters. Significance at the 0.05 level indicated that the variable means were not all the same among the cluster solutions, and that subsequent analysis may be completed on the solutions.

Discriminant analysis also identified the most important variables that guided the classification process. Discriminant analysis produces linear combinations of quantitative predictors called "discriminant functions". The number of discriminant functions depends on the number of clusters minus one ($N_c - 1$) or the total number of variables used in the analysis, whichever is smaller. For the four-cluster solution, four variables and four clusters existed, so three discriminant functions were produced (4 clusters – 1). For the two-cluster solution with four variables and two clusters, only one discriminant function was produced (2 clusters – 1). The identities of the different clusters rely on certain function characteristics.

Tables 4.4 and 4.5 display several statistics associated with the discriminant functions for the four-cluster and two-cluster solution, respectively. Discriminant functions are listed in the first columns of the tables. In theory, the discriminant functions maximize the

separation among the clusters. The functions are orthogonal to each other and the first function explains more of the variability than the second function, which in turn explains more than the third function (Green et al. 2000).

Table 4.4 Discriminant Analysis Output, Four-Cluster Solution

Function	Eigenvalue	% of Variance	Cumulative %
1	3.214	57.5	57.5
2	2.092	37.4	95.0
3	.280	5.0	100.0

Table 4.5 Discriminant Analysis Output, Two-Cluster Solution

Function	Eigenvalue	% of Variance	Cumulative %
1	2.055	100.0	100.0

The second column in Tables 4.4 and 4.5 lists the eigenvalues associated with the discriminant functions. Eigenvalues reflect how well the functions discriminate between clusters. The first function discriminates the best, followed by the second, third and forth functions. In the four-cluster solution, the first function explained 57.5 percent of the variance in the clusters, the second function explained an additional 37.4 percent of the variance, and the third function only explained an additional 5 percent of the variance. Because the two-cluster solution only had a single function, that function explained 100 percent of the variance.

Function Interpretation

Descriptor names can be assigned to the discriminant functions, based on the variables that are highly associated with the functions. The magnitude of the standardized coefficients for the four predictor variables in the discriminant functions (Table 4.6) helped identify each variable's separate contribution to the discriminant function. These coefficients indicated the relative importance of the variables in predicting the counties.

Only a single function existed in the two-cluster solution, limiting function interpretation. As a result, only functions for the four-cluster solution were explored in detail.

Table 4.6 Standardized Canonical Discriminant Function Coefficients, Four-Cluster Solution

	Function		
	1	2	3
Percent Single-Family Detached Homes	.594	-.445	-.649
Median Household Income	.632(*)	-.068	.004
Percent Population Change from Net Domestic Migration	.233	.950(*)	-.177
Mean Travel Time (Minutes)	.461	-.181	.869(*)

Median Household Income (.632) contributed most to Function 1, Percent Population Change from Net Domestic Migration (.950) made the greatest contribution to Function 2, and Mean travel Time (.869) had the most important individual contribution to Function 3.

The Structure Matrix coefficients measure correlations between variables and the discriminant functions (Table 4.7). The size of the correlation coefficients between the four predictor variables and the function helped identify the variables that were most strongly related to a function, and were used to assign labels to the functions. Specifically, the largest absolute structure correlation associated with each discriminant function determined the function label.

Table 4.7 Structure Matrix, Four-Cluster Solution

	Function		
	1	2	3
Percent Single-Family Detached Homes	.589(*)	-.365	-.527
Median Household Income	.498(*)	.092	-.002
Percent Population Change from Net Domestic Migration	.410	.871(*)	-.107
Mean Travel Time (Minutes)	.521	-.095	.736(*)

Function 1 and Function 2 dominate the analysis, as they account for 57.5 percent and 37.4 percent of the explained variation in the discriminant analysis, respectively, or a total of 95 percent of the variation. Function 1 was most highly correlated with Percent Single-Family Detached Homes (.589) and Median Household Income (.498). This function measures higher income earners who live in single-family detached homes so the function was named the *American Dream Function.*

Function 2 captures the in-migration variable, so it was called *Growth Magnet Function*. This function had an extremely high correlation with Percent Population Change from Net Domestic Migration (.871). Because Functions 1 and 2 dominate the analysis, it can generally be deduced that most of the county groupings can be explained by their income, residential and growth characteristics.

Function 3 represents a high commuting population, as Mean Travel Time (.736) had the largest correlation. Although to a lesser extent, this function had an inverse correlation with Percent Single-Family Detached Homes (-.527), indicating that the population lives in attached, multifamily or mobile homes. Based on these characteristics, Function 3 was labeled the *Modest Commuter Function*. The influence of this function was small, however, as it only accounted for 5 percent of the explained variation in the discriminant analysis.

Cluster Interpretation: Four Cluster Solution

Group centroids are the mean values on the discriminant functions for each cluster, or the cluster mean score for the function. The group centroid outputs also helped determine the underlying characteristics of the clusters (Table 4.8). Clusters that scored highest for a specific function tended to have characteristics of the function, thus recognizing the discriminant functions that best described each cluster. All four clusters strongly associated with Function 1 or Function 2. It is reasonable to expect that no cluster identities were strongly based solely on the characteristics of Function 3 because this function only accounted for a minimal amount of the variation in the discriminant analysis.

Table 4.8 Functions at Group Centroids, Four-Cluster Solution

Clusters	Functions		
	American Dream	Growth Magnet	Modest Commuter
1	-.756	-.425	-.364
2	-3.025	1.707	.982
3	1.932	-1.256	.549
4	2.704	3.266	-.295

Cluster 1: Mid-Scale Exurbia

Cluster 1 represents the standard cluster because it did not score very high on any particular function. Mid-Scale Exurbia county type comprises the more than half of the counties in the analysis, characterizing the majority of the counties. The cluster showed a somewhat strong inverse relationship with Function 1 (American Dream Function), explained by the slightly lower percentage of single-family detached homes and a lower median household income in comparison with the other county clusters. Moderate population increases due to in-migration and slightly shorter commute times agree with the relatively low negative relationships with Function 2 (Growth Magnet Function) and Function 3 (Modest Commuter Function)[9].

Because Mid-Scale Exurbia includes a majority of the counties, it appears that the typical fast-growing peripheral county has a high in-migration rate, longer commute times, higher household incomes, and higher percentage of single-family detached homes compared to the national average. However, relative to the other fast-growing counties on the metropolitan fringe, the majority of these counties do not have exceptionally high or low numbers for these variables. All the Midwestern counties fall under the Mid-Scale Exurbia county type.

Table 4.9 Mid-Scale Exurbia Counties

County	State	Mean Travel Time	Median Household Income	Percent Single-Family Detached Homes	Percent Population Change, Domestic Migration
Allegan	MI	23.4	45,813	73.10	7.62
Barrow	GA	33.7	45,019	73.46	29.27
Carver	MN	25.6	65,540	74.13	25.97
Clay	FL	33.5	48,854	68.79	24.32
Comal	TX	28.2	46,147	70.23	41.77
Culpeper	VA	37.9	45,290	79.12	14.66
Davidson	NC	22.8	38,640	71.77	8.11
El Dorado	CA	29.7	51,484	80.10	20.10
Fairfield	OH	27.7	47,962	80.44	16.70
Frederick	MD	31.9	60,276	65.05	16.90
Gloucester	VA	33.9	45,421	75.87	12.59
Hernando	FL	29.3	32,572	70.74	33.38
Island	WA	28.8	45,513	74.78	7.90
James City	VA	24.6	55,594	66.91	25.17
Johnson	TX	31.8	44,621	64.71	18.70
Livingston	MI	31.0	67,400	81.98	22.86
Napa	CA	24.3	51,738	67.08	2.18
Randolph	NC	23.6	38,348	64.44	10.07
Rockdale	GA	29.5	53,599	76.93	19.29
Rutherford	TN	26.8	46,312	68.26	32.86
Scott	MN	24.3	66,612	77.59	27.83
Sherburne	MN	29.9	57,014	81.57	38.95
St. Charles	LA	26.5	45,139	75.72	4.56
St. Croix	WI	26.1	54,930	72.68	13.48
Warren	MO	29.4	41,016	74.38	24.29
Washington	WI	23.2	57,033	67.65	14.81
Cluster Average		***28.4***	***49,919***	***72.98***	***19.78***
Total County Average		***30.5***	***53,632***	***73.67***	***29.40***

[9] Analysis of the clusters was completed relative to the forty-seven county cases, which were selected based on their growth characteristics. The reader should remember that observations are made in comparison to the fast-growing peripheral counties, not in comparison to the national average.

Cluster 2: Downscale Exurbia

Cluster 2 scored highest with an inverse relationship to the American Dream Function, so it is labeled the Downscale Exurbia cluster. This cluster includes counties with the lowest household incomes and lowest single-family detached homes relative to the other counties, which verifies the interpretation of Function 1. In fact, in relation to the average percent single-family detached homes for all the counties, this county type has over 20 percent fewer homes that are single-family detached (Table 4.10). A detailed review of the counties reveals high percentages of mobile homes and other combinations of multiple-unit attached housing structures (U.S. Census Bureau). In comparison with the other county types, Downscale Exurbia counties have the lowest percent homeownership. At 69.4 percent homeownership, these counties rank just above the national average homeownership rate of 66.2 percent.

This county type also scored fairly high on the Growth Magnet Function. Counties in this cluster have somewhat high population change due to in-migration, specifically in Nye County, NV where 65 percent of the county population change from 1990-1999 came from in-migration to the county. Because of the low household incomes of this county type, it is possible that some of the in-migration numbers came from residents who were placed out of the more expensive areas closer to Las Vegas, NV, but who remain in close proximity of the city.

Finally, Downscale Exurbia scored moderately on the Modest Commuter Function. Interestingly, although these counties have the shortest commute times relative to the other county clusters, Mean Travel Time represented an important characteristic in this cluster. The lower percentage of single-family detached homes, which also scored high in the function interpretation, explains the positive relationship with this function. The dramatically lower percentage of single-family detached homes in these counties was strong enough to indicate a positive relationship between this cluster and the Modest Commuter Function. While some of the commuters in this cluster commute into the rest

of the metro area, most of the commuters are local people who may work in service-oriented employment.

Table 4.10 Downscale Exurbia Counties

County	State	Mean Travel Time	Median Household Income	Percent Single-Family Detached Homes	Percent Population Change, Domestic Migration
Hays	TX	28.0	45,006	58.59	30.63
Nassau	FL	28.2	46,022	54.72	22.92
Nye	NV	28.6	36,024	38.83	65.00
Orange	NC	22.0	42,372	53.59	11.50
Osceola	FL	28.1	38,214	59.99	27.43
Cluster Average		***27.0***	***41,528***	***53.14***	***31.50***
Total County Average		***30.5***	***53,632***	***73.67***	***29.40***

Cluster 3: Exurban Dream

The Exurban Dream county type scored highest with a positive relationship to the American Dream Function. The driving force of this relationship appears to be the percentage of single-family detached homes. The forty-seven counties included in the study already exceeded the national average for this variable (60.3 percent) by 13.3 percent. Cluster 3 far exceeded the average for all counties in the study, with an average of 82.85 percent single-family detached homes. Therefore, less than 20 percent of the housing units in these counties are something other than single-family detached homes. Also consistent with the interpretation of the function, these counties have high median household incomes relative to the other clusters.

A strong inverse relationship exists between Exurban Dream counties and the Growth Magnet Function. Although these counties may have grown fast for several decades, as a group they did not experience a dramatically high percent of population change due to domestic in-migration rates from 1990-1999, relative to the other clusters. The in-migration percentages for cluster 3 exceed those of Mid-scale Exurbia counties, however.

Cluster 3 scored positively with the Modest Commuter Function, but only slightly. In this case, the high commute time drove the mean score. Table 4.11 illustrates that these counties endure an average of 35.9-minute commutes, exceeding the national average by over 10 minutes, and the county case average by over 5 minutes. Counties included in

this cluster have the highest commutes of all the clusters, and include the highest percentage commuting to other counties. The relationship between this cluster and the function may have been stronger if the counties did not have such high percentages of single-family detached homes. The Exurban Dream county type places the single-family home on a pedestal. In order to live where they live, residents have to telecommute using home offices or endure long commutes to employment locations.

Table 4.11. The Exurban Dream Counties

County	State	Mean Travel Time	Median Household Income	Percent Single-Family Detached Homes	Percent Population Change, Domestic Migration
Calvert	MD	39.8	65,945	88.72	33.91
Charles	MD	39.3	62,199	71.07	9.00
Cherokee	GA	34.4	60,896	85.42	41.78
Douglas	GA	32.3	50,108	74.71	18.03
Hunterdon	NJ	33.5	79,888	75.14	7.94
New Kent	VA	34.0	53,595	91.70	19.49
Powhatan	VA	34.8	53,992	94.21	38.92
Queen Anne's	MD	33.6	57,037	83.20	15.65
Spotsylvania	VA	37.1	57,525	79.05	41.43
Stafford	VA	37.7	66,809	76.21	35.37
Sussex	NJ	38.3	65,266	80.68	2.57
Cluster Average		***35.9***	***61,205***	***82.85***	***24.01***
Total County Average		***30.5***	***53,632***	***73.67***	***29.40***

Cluster 4: Hyper Growth Exurbia

All the counties included in cluster 4, the Hyper Growth Exurbia counties, experienced extremely high growth over the past decade, explaining the extremely high mean discriminant score for the Growth Magnet Function. As shown in Table 4.12, the average percent domestic population growth over the last decade tripled that of the average for all county types. The cluster name, Hyper Growth Exurbia, describes the high growth characteristics associated with this cluster. In fact, 1990-2000 total population growth rates for all counties in this cluster exceeded 96 percent. The five counties included in this cluster ranked among the seven fastest growing counties in the

nation[10], giving the cluster an average 122.3 percent total population growth rate over the last decade.

These counties also have high discriminant means on the American Dream Function, supported by high values for percent of single-family detached homes. Perhaps more specifically, this high mean may reflect the high median household income. The median income exceeds the average county case income by almost $15 thousand. Additionally, with an average median household income of $68,387, this county cluster exceeds the national median household income by over $18,000.

A fairly insignificant mean discriminant score exists for the Modest Commuter Function for the Hyper Growth County Type. However, these counties do endure the second highest average commute time relative to the other clusters. The small negative mean discriminant function can be attributed to the high percentage of single-family detached homes found in these counties.

Table 4.12. Hyper Growth Exurbia Counties

County	State	Mean Travel Time	Median Household Income	Percent Single-Family Detached Homes	Percent Population Change, Domestic Migration
Douglas	CO	32.3	82,929	85.94	131.80
Forsyth	GA	33.2	68,890	86.53	102.36
Henry	GA	32.7	57,309	83.12	77.86
Loudoun	VA	30.8	80,648	57.33	59.02
Paulding	GA	39.1	52,161	86.18	74.93
Cluster Average		***33.6***	***68,387***	***79.82***	***89.19***
Total County Average		***30.5***	***53,632***	***73.67***	***29.40***

Regional Trends

A majority of the counties included in this study locate in the eastern portion of the nation. The smaller eastern counties reflect the fact that there has been continuous settlement in eastern states, including rural settlement. The county seat represented the market, and the rest of the county was farmland that surrounded that market. The

[10] The U.S. Census Bureau's county growth rate ranking, 1990-2000: Douglas County, CO (1), Forsyth County, GA (2), Henry County, GA (4), Loudoun County, VA (6), and Paulding County, GA (7).

counties grew organically as land was settled. Conversely, the arid and rugged land of the West resulted in less continuously settled land patterns. Western counties are therefore much larger, and encompass land areas bigger than some small eastern states. Because Western counties in some cases include the entire metro area, the populations are much higher. Given the 200,000 population limit for New Metropolis Counties, the counties represented in this study are largely located in the east.

Although not apparent for all county types, geographic trends appear to exist for Exurban Dream counties and the Hyper Growth Exurbia counties. All Exurban Dream counties locate in the southern portion of the United States. Seven of the eleven counties in this category are found in Virginia and Maryland. A majority of the Hyper Growth Exurbia counties includes counties located on the fringe of the Atlanta, GA metropolitan area. In fact, although this category represents one of the smallest county types, it includes the largest number of Atlanta counties. As one of the fastest-growing metro areas, Hyper Growth Exurbia accurately portrays these counties located on the fringe of Atlanta.

Summary

The patterns of the means for the discriminant functions appear consistent with the interpretation of the four clusters. By considering the characteristics of the counties within the clusters, the four clusters represent four community types located on the metropolitan fringe. Mid-scale Exurbia represents communities that are separated from the other three communities because they do not have extreme characteristics. Downscale Exurbia includes lower-income communities, who may have been priced out of the traditional suburbs and moved to the fringe looking for cheaper alternatives. Exurban Dream counties characterize more affluent communities, perhaps living in a landscape of country estates. Finally, Hyper Growth Exurbia distinguishes affluent comminutes that are growing faster than any counties in the nation.

Correlated Community Characteristics

Housing Values

Mean travel time inversely correlates with percent increase in median housing value (see Table 3.3). The literature supports this correlation, as an inverse relationship exists between the value of land and the status of those who occupy it. Theoretically then, the longer people commute, the wealthier they are and the lower their housing values. It appears that this trend applies generally to the forty-seven cases in comparison to the national average, but it also holds true for different community types within the forty-seven cases.

The clusters in the data find that the wealthier communities do in fact have longer commutes. Median values of owner-occupied homes are not less expensive in the wealthier communities, however, the percent change in median housing values (1990-2000) does follow the theory. The county cluster with the shortest commute time (Downscale Exurbia) enjoyed the highest housing value percent change, and the county cluster with the longest commute time (Exurban Dream) had the smallest percent change in housing values.

Employment and Spatial Factors

Following the theory that wealthier people commute longer, it can be assumed that a more affluent community settles further from their place of employment. According to the results, clusters 3 and 4 are the wealthiest, have the longest commutes, have the greatest percentage of higher education, and have the highest percentage of people employed in white-collar jobs. As supported by the literature, many people who move out to these areas are employed in professional jobs that allow them to telecommute from home offices, or have flex-time so that they only drive to work a few days a week. Such opportunities may allow people to locate further out in the rural areas.

Interestingly, the mean travel time for these communities follows the amount of land area in the county. The communities with more average land (mi^2) experience shorter commute times. Considering the population density (people/ mi^2), these trends generally

hold, as the two most dense community types endure longer commute times. Consequently, longer commute times may mean longer commute miles to allow for homes in rural landscapes, or more time spent in traffic congestion. Further research may reveal a combination of both travel distance and time spent in traffic congestion.

Automobile Dependency

Counties with a high percentage of single-family detached homes also housed a high percentage of workers who commute beyond the county boundaries and who have the highest percentage of households with three or more vehicles. These additional factors speak to the level of automobile dependency in these community types. Because these counties are typically less dense than areas closer to the central core, public transportation is both absent and most likely inefficient.

Retirement Destinations

The percentage of population changes due to net domestic migration also correlates with the percent of homeowners 65 and over who moved in their residence since 1990. Consistent with the literature, older residents move to fringe counties for retirement purposes. Two county types, Downscale Exurbia and Hyper Growth Exurbia, experience high percentages of homeowners 65 and over who moved into their homes since 1990. In both county types, almost half of the homeowners within this age group moved to their current homes in the fringe since 1990.

Affluence or Lack of Poverty

While the literature may vary slightly on the wealth of the metropolitan fringe, standard literature frequently states that these places tend to hold more affluence. Median household income shows the central tendency of income. With an average median household income of $53,632, these counties indeed rank above the national average median household income of $41,994.

However, median household income does not explain whether income earners in these counties are mostly above the national average, or if an income disparity exists between

the very wealthy and those who have been priced out of the suburbs and pushed to the fringe. After considering potential disparities, the data shows that overall inordinate income disparities do not appear to exist within the fringe counties. The average disparity between the top 80% and lowest 20% income earners is $55,994, while nationally the disparity is $59,271[11].

Therefore, these places may not be significantly wealthier than other places, but may simply have less poverty. In fact, the national average of residents below the poverty line is 12.4 percent, and the average for New Metropolis Counties falls at a much lower 6.8 percent. Only two counties in the study, Orange County, NC and Hays County, TX exceed the national average, at 14.1 and 14.3 percent, respectively. Further, over a third of the fringe counties have less than 5% of residents below the poverty line.

Cluster Interpretation: Two Cluster Solution

The hierarchical method subsequently fused clusters 1 and 2, as well as clusters 3 and 4, forming two large groups of counties within the forty-seven county cases. It appears that the two clusters were formed such that the more modest income earners gathered into one cluster, and the higher income earner into another cluster. These two distinct groups of counties can be called Upscale Exurbia and Downscale Exurbia.

Upscale Exurbia

One cluster of counties resides predominately in single-family detached homes, are wealthier, and have higher commute times. This cluster includes the Exurban Dream counties and the Hyper Growth Exurbia counties, and more closely resembles the exurbia of standard literature. Of the forty-seven counties, one-third of the counties are identified as Upscale Exurbia counties.

Given the massive and concentrated growth in Upscale Exurbia, the major concerns for this county type center on managing growth. These counties include the fastest-growing

counties in the entire nation. Consequently, this county type endures a different magnitude of growth than the other county types. The total growth rates, as well as growth due to domestic migration for this county type illustrate the demands placed on these counties to accommodate new growth.

In response to the growth in this area, Upscale Exurbia faces a fiscal challenge of attracting ratable development to increase fiscal capacity to fund schools. Especially in counties where ceilings are placed on property taxes, funds must be raised to build much needed services and infrastructure needed by new residents. As opposed to other counties, Upscale Exurbia has the potential to attract higher end retail and housing that may bring tax "winners" to these counties.

Another concern is that of less than sophisticated existing infrastructure. People move to Upscale Exurbia counties, which do not have the infrastructure to support large growth – many of these counties are dependent on gravel roads and septic tanks. The influx of such tremendous growth places demand on less than sophisticated infrastructure, and can quickly transition these places into privately wealthy and publicly poor communities.

Downscale Exurbia

The second cluster reflects Downscale Exurbia, characterizing the dominant county type in exurbia. Two-thirds of the forty-seven counties comprise Downscale Exurbia, which contains residents who live a relatively more modest lifestyle, housed not only in single-family detached homes, but also multifamily and mobile homes. The median household income of this group is somewhat lower, and the mean travel times are shorter. Although these characteristics typify more counties in exurbia, popular literature and media do not highlight these counties because they are less appealing or attractive to general audiences.

Concerns for the downscale exurban county type include low levels of services. However, while Upscale Exurbia may be able to attract tax "winners", Downscale Exurbia has a lower opportunity for ratable development. Starter homes and other tax "losers" make it difficult to generate revenue in this county type. Although it is not

evident from standard literature, a majority of the counties on the metropolitan fringe are characteristic of Downscale Exurbia.

Summary

Median household income and single-family detached housing, and commute times characterized the overarching characteristics that drove the 2-cluster solution. Interestingly, population change due to domestic migration appeared to play a somewhat smaller role in this clustering stage. If this variable played a larger role in grouping the similar county types, the most affluent (cluster 4) and least affluent (cluster 2) counties could have merged as a single county type. It is likely that differences in wealth, housing type, and commuting time distinguished county types more effectively because all the counties had somewhat high growth rates, per the county selection criteria.

In summary, the null hypothesis that the entire sample of forty-seven counties included in this study would be statistically homogenous was rejected. This decision was validated by the high agglomeration coefficient between two clusters and one cluster, indicating a heterogeneous grouping. Instead, the alternative hypothesis was accepted, stating that the sample of forty-seven counties included in this study would be statistically divided into separate categories of similarity. The cases clustered into four larger populations, and then into two smaller populations, validated by the increased agglomeration coefficient in the 44^{th} and 46^{th} clustering stages.

CHAPTER FIVE: DISCUSSION

Classification: Importance of Growth Basis

As mentioned previously, Berry (1996) suggested that in order to create a meaningful classification, one must identify a primary growth period that links the settlement patterns to technology, the type of places emerging in response to the technology, and a record of the ability of places to adjust to new technology. Places grouped based on these characteristics may demonstrate common-response factors important to policymakers.

The county cases used for this classification follow Berry's suggestion for a meaningful classification. This research meets the first suggestion, to *identify the primary growth period, linking the settlement patterns to formative technology*. By definition, the counties were selected on growth rates, as they had to have double-digit growth for each Census since 1950. Further, this study also identified the domestic migration growth rates over the last decade for each county. Following the literature, the primary growth period for these counties emerged in the years following World War II (1950). The settlement patterns of this time period can be linked to the widespread use of the automobile, and the government subsidies for new single-family homes. The 1990-2000 decade represents the more recent growth period for counties currently located on the metropolitan fringe. Computer technology that allows people to telecommute, and have flex-time represents formative technology of this time period, as people can locate further into the rural areas and still work almost anywhere. The *types of cities emerging as a response to recent technology* include these fringe counties.

The condition and settlement patterns of the suburbs illustrate the *ability of earlier periods to adjust to the new technology*. The suburban growth response to technologies resulted in mainly fragmented, uncoordinated growth, characteristic of "sprawl". Some of the counties included in this study are more suburban in nature, and are characterized by such growth. Examples of the suburban settlement patterns existing today fuel a significant amount of the debate surrounding sprawl.

Following Berry's logic, because these counties group on growth characteristics, a better chance exists that the clusters of counties will express common-response factors. This factor is especially important, given the overarching goal of the study. Linkage of similar counties experiencing common growth challenges presents the opportunity to facilitate information exchange between counties. As such, counties with common domestic in-migration rates, residential preferences, mean travel time or median household income may respond to growth pressures similarly in the form of common resulting settlement patterns. Therefore, opportunities exist for counties to note successful and unsuccessful growth management strategies of common counties.

Common Growth Stresses

While this study identified that fast-growing counties located in the metropolitan fringe are not homogenous, these differing county types do experience some common growth stresses. Specifically, given their fast growth rates and location on the periphery of more established development, these counties face challenges of 1) addressing environmental impacts due to extended development; 2) meeting demands for improved and additional infrastructure; and 3) maintaining quality of life for residents via sustainable growth management policies. The shift of new growth to these counties also creates new social dynamics and political considerations applicable to the metropolitan fringe counties.

Land Resource Impacts

Land resource concerns represent the most critical impacts resulting from fringe growth. Some efforts towards slowing growth center on implementation of large lot zoning practices. Subdividing land into three-acre, five-acre, and twenty-acre lots demonstrates a common practice for farmland or habitat preservation. However, many people now recognize that large lots actually consume more land, and as actually serve as a source of sprawl – or "Gucci sprawl", as some describe these large lot fringe estates. Large lot zoning may result in more green space, but many argue that it effectively fragments

habitats and prime farmland as opposed to protecting these lands (Whoriskey 2003). Wildlife habitat diminishes as lands are subdivided, and farmland conversion continues.

Other environmental concerns include air quality and water quality issues. The increasing commute times for residents locating in the metropolitan fringe translate into increased air pollution from vehicle emissions. On-site septic systems and wells allow for a significant amount of the scattered development characteristic of the fringe. Lack of proper maintenance of these systems threatens the quality of groundwater, on which some residents depend for drinking water. Destruction of the environmental quality that initially attracted people to the fringe could result in relocation of residents.

Infrastructure Stresses

Dispersed development patterns in the fringe exacerbate infrastructure demands and increase the costs of these services (Nelson and Dueker 1990). Infrastructure in the form of roads, sewer and water, schools, and services such as fire and police forces cost money. Metropolitan fringe residents depend largely on cars and roads for travel. Growth in this area contributes to more and longer trips into suburban areas. Dual career households are becoming more common, and compound the problem of travel behavior and traffic congestion in suburban areas. Moreover, due to the low-density development in these areas, public transportation connecting residential areas with employment may not be practical or economical.

The cost of utilities and services to these areas may be borne by fringe residents, but the argument also exists that because utility companies (electric/gas, phone) must extend the services to such a small number of people on the fringe, suburban and city residents subsidize the extensions (Daniels 1999). Costly extensions over large areas at low densities take much of the needed public and private capital from the inner suburbs and cities.

Quality of Life

A big challenge for all the fringe county types includes finding ways to accommodate new development without compromising the quality of life of these areas. In general, the rural environment, open spaces, less traffic and little crime attract residents to the metropolitan fringe. However, compounding growth in these areas threatens the amenities that draw people there in the first place. The increasing number of residents in the fringe will encourage the decentralization of more employment, adding to the challenge of containing the spatial expansion of the area.

As development and the suburbs continue to move outward, fringe residents will be concerned that the disamenities of the suburbs and the city are likewise moving out. The impacts of development change the aesthetics of the landscape. Disappearance of the valued amenities contributes to the fact that the metropolitan fringe represents the "battleline" of smart growth and sprawl. The fringe county types need sustainable development policies that can accommodate growth while maintaining social and environmental quality of life.

Social Dynamics

The shift of new growth to these counties also creates new social dynamics. Examination of these counties shows that some of the development is more suburban in nature. In these areas, residents typically expect the development to occur as it has over previous years. Residents there recognize the existence of local land-use planning actions. Although every resident may not agree with the idea of a government agency dictating what a resident can do with his or her property, some residents understand that land-use planning can aid in addressing significant growth pressures, based on past development (Daniels 1999).

Another large portion of development on the metropolitan fringe remains exurban in nature, characterized by more rural attributes. Development in these areas locates on greenfields, or previously undeveloped land. Many residents in these areas are not as familiar with land-use planning efforts and may experience more social issues associated

with land management. Property rights advocates and landowners in these areas fight zoning restrictions that limit development.

For example, in Loudoun County and Spotsylvania County, VA, builders, developers and long-time landowners filed lawsuits against the local governments, arguing an illegal "taking" of the property values. While new residents to the fringe can afford to support slow-growth efforts because many times their wealth results from employment elsewhere, long-time residents hold their wealth in the land, and want the ability to sell the land if needed. The lawsuits represent the push to remove slow-growth supervisors from office (Laris 2003). Other slow growth opponents also realize the effect of slowed growth on their local tax base, and therefore want to eliminate growth restrictions.

However, it appears that current growth pressures may play a part in forcing a change in the traditional mindset against planning and zoning. As Washington Post staff writer Michelle Boorstein covers in her article, these fringe counties once welcomed growth, but are realizing that the growth may be "swallowing" them up now. Due to ease of development in these areas as compared to the more restrictive land-use planning regulations in the inner suburbs, the rate of development soars in the outer suburbs. For example, given the compounding growth pressures in Spotsylvania County, VA, the Planning Department said the county should expect to build a new school every year for the next 15 years should they choose to do nothing about the continuing development (p. A01, March 9, 2003).

Such dramatic pressures created a shift in the attitudes toward land-use planning, as landowners recognize the legal development potentials under unrestrictive zoning. Two Virginia counties located on the metropolitan fringe, Loudoun County and Stafford County, endured an influx of residents moving from more central locations or counties. Recently, these counties elected boards of supervisors who support slow-growth efforts. Boorstein reports that new dialogue exists between landowners and farmland preservation/conservationists as they work through common growth concerns.

These differing social dynamics and attitudes add to the challenges in addressing the battleline of sprawl, smart growth, and fringe development in general. Within the metropolitan fringe, concerns and interests of residents vary greatly. Some encourage growth so they can subdivide and sell their large parcels, which represent their life savings or "wealth". Others support managed growth in these areas in effort to protect farmland and the environmental amenities of natural lands. New residents to the area generally support slow growth as a means to protect the rural surroundings of their investment. Still others remain wary of becoming overwhelmed with compounding growth, as these places in which they live accept more and more development. Decision-makers and politicians face the challenge of balancing competing interests in these counties.

Political Consequences

The emergence of the metropolitan fringe, and the growing numbers living in these partly suburban partly exurban counties yield important political consequences. Currently these counties predominately vote Republican. In fact, according to USA TODAY election records (2002), forty-three of the forty-seven counties in this study voted for George W. Bush in the 2000 presidential election. In percentage terms, 91.4 percent of these counties voted for Bush. Such an extreme Republican leaning is not surprising, as Non-Hispanic whites – Republicans' core constituency – comprise a strong majority of the voters in these fringe counties.

In his article, *Time to Meet the Exurban Voter*, David Brooks (2002) suggests that the rise of the fast-growing peripheral counties represents a demographic shift currently favoring the Republicans. He indicates that the rural areas and fast-growing exurban counties such as Douglas County, CO and counties located around Atlanta strongly contributed to the 2002 Republican wins. Brooks argues that people living these fringe areas represent the "late-swinging voters".

Although whites still make up an overwhelming percent of U.S. voters, large constituencies located in rural America are diminishing relative to other voter groups,

says Ruy Teixiera (2003), who wrote a recent article in *The Washington Monthly* on the topic. He suggests that as these counties grow larger, the votes tend to shift to a more Democratic vote. As an example, Loudoun County, VA moved from a 66-33 Republican vote in 1988 to a 56-41 vote in 2000. Teixiera argues that political dominance fueled by these fringe counties will not last, as "today's right-leaning exurb is tomorrow's left-leaning suburb" (Tuxiera 2003). So the exurban counties may be Republican, but as they shift to become more suburban in nature, they likewise become more Democratic.

Interestingly, however, over half of all voters already reside in the suburbs, which questions Tuxiera's expectation that conversion of these fringe counties to suburban counties will drive Democratic support. Anticipation to see the political effects brought by fringe voters remains the center of much speculation. The burgeoning populations in the fringe counties only increase the number of voters in these areas – voters concerned with new and rapid growth and congestion. Decision-makers and politicians should not underestimate the increasing political clout of these semi-rural fringe counties, as these residents appear to represent an increasingly strong voice.

Policy Implications for County Types

The policy implications applicable to all the county types revolve around the consequences of sustained growth in semi-rural environments. The results of this study show that four different county types exist in the data: Exurban Dream, Hyper Growth Exurbia, Downscale Exurbia, and Mid-Scale Exurbia. While most of these counties extend deeply into what were agricultural areas only 20 years ago, their differing demographic and growth characteristics suggest that each county type may confront differing planning and policy challenges.

Exurban Dream

The Exurban Dream county type is characterized by extremely high numbers of single-family detached homes. This county type also endures the highest mean travel time of all

the county types. These factors suggest that Exurban Dream counties comprise commuter sheds for residents who want to live in their dream home. Residents can drive further out to these areas and afford a larger home due to the cheaper land prices on the fringe. The obvious trade-off for residents living in this county type includes extended commute times.

The resulting growth challenges faced by this county type include transportation demands and the ability to create a sense of community within the neighborhood. Because these counties experience the longest commute times, they contribute to demands for extensive roads and highways. Likewise, the long commutes and automobile dependence compound growing congestion and traffic concerns. These high commuting numbers suggested that people would rather commute than live in the busy suburbs.

As noted earlier, Hayden (2003) suggested that by the 1990s, many consumers were concerned with the house instead of the neighborhood. This description may characterize the Exurban Dream counties, as the residents only have stake in their private home, and have little time or interest for the neighborhood as a whole. Much of the "free time" in these areas may be spent commuting or in the home office if they have the option to telecommute a few days a week. Therefore, residents create their private environment within the household, and have little need interact with the neighborhood. Planners must consider ways to address this concern, such as finding ways to make residents true stakeholders in community.

Hyper Growth Exurbia

Enormous population growth distinguishes the Hyper Growth Exurbia counties from other county types in the metropolitan fringe. While all four county types grow fast by definition, Hyper Growth Exurbia counties include the fastest-growing counties in the entire nation. Consequently, this county type endures a different magnitude of growth than the other county types. The total growth rates, as well as growth due to domestic migration for this county type illustrate the demands placed on Hyper Growth Exurbia counties to accommodate new growth.

The major challenge for Hyper Growth Exurbia counties centers on infrastructure demand. Residents want more roads to be built because they already face intense congestion. Simultaneously, they do not want any more new growth. However, roads and infrastructure in general attract growth. While regional growth management represents an essential planning tool for all these fast-growing county types, Hyper Growth Exurbia counties need to implement regional growth management policies immediately. Because infrastructure brings growth, carefully managing infrastructure investments will reinforce a desired settlement pattern.

Downscale Exurbia

Downscale Exurbia counties differ from the other counties because they have a much lower percentage of single-family detached homes and the residents are less affluent than in other county types. Also, as indicated previously, Downscale Exurbia comprises a large number of homeowners age 65 and over. As a result, the major challenges that this county type likely encounters include affordable housing issues and the additional needs for housing older retired residents.

Mobile homes represent a large percentage of housing units in this county type. The percent of mobile homes in each of the counties included in the type exceed the national average (7.6 percent). For example, in Nassau County, FL and Nye County, NV, mobile homes make up 26.1 percent and 49.4 percent of the housing units, respectively. Multifamily attached housing units represent a large portion of the remaining housing in these counties. These numbers suggest that residents demand for affordable housing options in these counties, explained by the lower median household income in Downscale Exurbia. At the same time, the counties probably face increasing NIMBYism, the typical suburban opposition of mobile homes and apartment complexes that lower the value of single-family detached homes. In the face of expanding growth, these counties must work to keep affordable housing, as it is necessary for production and preservation for healthy communities.

A high percentage of homeowners 65 and over who moved into their residence since 1990 resides in this county type, indicating that people in retirement age may tend to settle in these counties for retirement purposes. Perhaps the influx of retirees, empty nesters, may be attracted to less upkeep and responsibility of mobile and attached homes. In response to a large number of retired homeowners, Downscale Exurbia should incorporate the services and needs of an aging community.

Mid-Scale Exurbia

Mid-Scale Exurbia comprises some of the characteristics of all the county types, but on a more moderate scale. For example, these counties have relatively high percentages of single-family detached homes and high commute times, but not as high as the Exurban Dream counties. These counties have high in-migration rates, but not as enormous as the Hyper Growth Exurbia counties. Finally, these counties have a lower income average, but not as low as Downscale Exurbia.

Consequently, Mid-Scale Exurbia faces all the planning challenges that the other county types encounter. Interestingly, a majority of the fast-growing peripheral counties included in this study fall into this county type. While the infrastructure demands, needs for a sense of community, retirement service requirements, and affordable housing necessities may not be as pressing as in other county types, these concerns also apply to Mid-Scale Exurbia and must be addressed.

Information Exchange

Classification has clear public policy purposes. Instead of finding areas of concentrated social problems and needs of the poor that city classifications highlight, this classification identifies areas of concentrated and specific growth problems, such as significant physical and fiscal pressures related to growth –some of which includes important environmental, economic and social implications.

As indicated in the literature, the most valuable use of a classification is the ability it provides for further analysis. Identification of counties that grow similarly and comprise similar demographic characteristics represents the first step in county-level collaboration on growth management issues. Given this information, similar counties need find forums to communicate experiences and ideas to find effective ways to address complex issues that remain critical to the environmental, economic and social health of their communities. Counties can compare experiences and best practices as a way to solve common growth pressures and problems.

This study contributes to the knowledge of the metropolitan fringe by identifying similar county types located on the metropolitan fringe. Information-exchange between similar counties can help in the struggle to address complex issues associated with compounding growth. Identification of counties that grow similarly and comprise similar demographic characteristics represents the first step in county-level collaboration on growth management issues.

Planners, decision-makers, and concerned citizens should use these findings as an opportunity to bring counties together to seek valuable and effective planning policies. As noted earlier, because this classification was built on growth characteristics, it is likely that counties categorized into the same county type will experience common response factors. Therefore, solutions that work effectively for one county will likely be effective in another county included in that same county type. Interestingly, the fast-growing counties that have already publicly collaborated on growth issues, Loudoun County, VA and Douglas County, CO, fall into the same county type (Hyper Growth Exurbia) according to this study. Other counties included in this study should likewise collaborate to exchange useful tools or find new and creative ways to achieve the goals of their communities in the face of the growth challenges before them.

Addressing Fringe Growth Management

Settlement patterns on today's metropolitan fringe appear to maintain trends similar to the days of Daniel Boone. When areas become too congested and people feel they lack adequate "elbow room", the frontier is once again breached (Daniels 1999). People pioneer into the next frontier where they can escape the disamenties and start fresh again in private lots. The massive growth endured by counties on the metropolitan fringe represents the current frontier. This frontier represents a complex challenge for planners as it offers the opportunity to manage growth before these places further expand as unmanaged dispersed growth. The appropriate planning question is not how can this growth be directed back to the city, but rather how can planners manage the location and configuration of the development in the fringe.

Growth management deliberately guides growth by influencing the location, timing, sequence and rate of development. A more accurate characterization describes growth management as a means to accommodate current development and anticipate future development requirements, while maintaining community qualities. Managing growth on the metropolitan fringe is especially important, as the majority of growth has occurred in metropolitan fringe areas – and many believe this will continue to be the trend (Burchell et al. 2002).

Achievement of effective growth management policies for the four metropolitan fringe county types identified by this study should incorporate several basic principles essential to effective growth management, such as those identified by Richardson et al. (2003): comprehensive planning, consistency, coordination, concurrency, cooperation, containment, collaboration and carrots. These principles can be applied as tools necessary to help manage growth in the nation's fast-growing peripheral counties:

- The Comprehensive Plan allows localities to guide orderly development based on community goals. Special consideration of future population projections in these

fast-growing areas can help form the county's future goals and objectives (Danielson 1999).

- Consistency helps avoid negative impacts on adjacent jurisdictions, which is an important consideration for localities on the metropolitan fringe.
- Coordination and cooperation aid in prevention of simply pushing development further outward in the fringe, as these principles depend on regional efforts in managing growth.
- Containment policies can encourage growth in areas suitable for development, and discourage growth in areas that the community wants to preserve.
- Carrots, or incentives, play an important part in encouraging localities to participate in effective growth management.
- Concurrency demands that adequate services be available before development starts. This principle acts to absorb growth and development impacts prior to development.
- Finally, collaboration may represent one of the most important growth management principles in the fringe. Because the metropolitan fringe represents the center of the sprawl debate, collaboration of residents in the planning process with different interests remains important in order to determine a well-supported vision based on all values and interests[12].

While these fringe county types need to recognize the importance of addressing their different needs, the next steps in the process should incorporate regional or statewide efforts. Based on a review of efforts to manage growth throughout the nation, the most effective efforts occur when local decisions are made in a regional or statewide framework (Richardson et al. 2003). Development impacts areas on a regional scale, so the interests and concerns of an entire metropolitan area should be incorporated to coordinate growth appropriately.

[12] These principles are noted as described by Richardson et al. (2003).

CONCLUSIONS

Using a two-step method, these counties were statistically classified into different groups of similarity based on demographic variables. Hierarchical cluster analysis differentiated counties into distinct groups. The agglomeration coefficient served as the methodology to identify four optimal cluster solutions within the data that aggregate into two cluster groupings. Then discriminant analysis tested the internal validity of the clusters, using the four and two-cluster solutions as the *a priori* grouping. Discriminant analysis also identifies the characteristics that differentiate the cluster groupings by ascertaining the variables that drive the clustering process. These methods found that the cluster solutions of demographically similar counties were statistically valid, and could serve to predict the appropriate grouping of other fringe counties.

This study shows that while fast-growing counties located on the metropolitan fringe may grow similarly, they are not homogenous. The study's major finding is that more than one exurbia exists. While research and media interests tend to focus on the upscale versions of exurbia, the less extravagant exurbia remains unrecognized or unnoticed. These results should help reframe current assumptions about the people who live in exurbia and their interests and concerns about the current growth pressures.

The metropolitan fringe currently absorbs a significant amount of the nation's growth. Commutersheds now reach deep into areas that were agricultural or forested areas only a couple decades ago. Compounding development in the fringe places enormous pressure on counties to accommodate this growth. Currently, sustained growth strains existing infrastructure, encroaches upon prime farmland and destroys natural habitat. These issues should concern planners and residents alike. Management on the fringe should not be a case of growth or no growth, but an effort to turn unmanaged growth into sustainable growth. As growth trends are not anticipated to change in the near future, effective growth management policies must be implemented to deliberately guide growth.

This study shows that not all counties on the fringe are similar, so they may not demand the same planning policies.

The county typologies revealed in this study are not definitive as additional research may further develop them. Initial next steps include a more in depth analysis of the two large clusters of exurban counties. While data used in this study are important identifiers for county types, additional demographic data such as house size and lot size could enhance the typology. Inclusion of data on the county structure or form such as such as county office locations could also act as effective indicators for county types.

Other future research on this topic could include case studies of the distinct exurban county types, including an examination of growth management programs and policies adopted within the counties. In-depth analysis and comparison of selected counties may help discern additional similarities or differences between the county types, important to connecting peer counties that face similar growth problems.

REFERENCES

Airiola, T.M. and R.A. Parker. 1983. Population redistribution within the rural-urban fringe: a typology of small towns and rural municipalities in the state of New Jersey. *Environment and Planning A*. 15: 1457-1474.

Audirac, Ivonne. 1999. Unsettled views about the fringe: rural-urban or urban-rural frontiers. In Congested Countryside: The Rural Urban Fringe in North America. Ashgate Publishing Company, Brookfield, VT.

Beale, C. L. 1997. Nonmetro Population Growth Rebound of the 1990's Continues, But at a Slower Recent Rate. *Rural Conditions and Trends*, 8 (2): 46- 51

Berry, B.J.L. 1996. Technology-Sensitive Urban Typology. *Urban Geography* 17(8): 674-689.

Berry, B.J.L. and K. Smith. 1972. *City Classification Handbook.* New York, Wiley-Interscience.

Blumenfeld, H. 1983. Metropolis Extended. *Journal of the American Planning Association* 52(3): 346-348.

Boorstein, M. 2003. Va. Growth Alters Attitudes: Stafford, Spotsylvania Try Zoning Restrictions. *The Washington Post*, 4 May.

Brooks, D. 2002. Patio Man and the Sprawl People: America's Newest Suburbs. *The Weekly Standard*, 19 August.

Brooks, D. 2002. Time to Meet the Exurban Voter. *The New York Times,* 10 November.

Brumbeck, T. 2002. High growth Note Swapping: Douglas County, CO Delegation Visits Loudoun. *Leesburg Today* 29 Aug. Online edition. 29 Aug <www.LEESBURG2DAY.com>.

Bourne, L. S. 1980. Alternative perspectives on urban decline and population deconcentration. *Urban Geography* 1:39-52

Burchell, R.W., G. Lowenstein, W.R. Dolphin, C. C. Galley, A. Downs, S. Seskin, K.G. Still, T. Moore. 2000. Costs of Sprawl – 2000. Washington D.C.: National Academy Press.

Cervero, R. 1984. Managing the traffic impacts of suburban office growth. *Transportation Quarterly* 38(4): 533-550

Crump, J. R. 2003. Finding a Place in the Country: Exurban and Suburban Development in Sonoma County, California. *Environment and Behavior*. 35(2): 187-202

Daniels, Thomas L. and Mark Lapping. 1996. The two rural Americas need more, not less planning. *Journal of the American Planning Association*. 62(3): 285-288

Davis, July S., Arthur C. Nelson, Kenneth J. Deuker. 1994. The New 'Burbs: The Exurbs and Their Implications for Planning Policy. *Journal of the American Planning Association*. 60(Winter): 45-59

Doherty, J.C. The Land of In-Between. *Planning*. May 1992: 24-25

Everitt, B.S. 1974. *Cluster Analysis*. New York: Halsted Press.

Fisher, James, S. & Ronald L. Mitchelson. 19981. Forces of Change in American Settlement Pattern. *Geographical Review*, 71(3): 298-310

Fishman, Robert. 1987. Beyond Suburbia: The Rise of the Technoburb, In *Bourgeois Utopias: The Rise and Fall of Suburbia.* Basic Books, Inc, New York.

Fulton, William. Are Edge Cities Losing Their Edge? *Planning*. May 1996: 4-7

Garreau, J. 1991. *Edge City: Life on the New Frontier*. New York: Doubleday.

Gordon P. and Richardson H. 2000. Critiquing Sprawl's Critics. *Policy Analysis* no. 365, Washington D.C.

Gordon, P., Kumar, A, and H. Richardson. 1989. The Influence of Metropolitan Spatial Structure on Commuting Time. *Journal of Urban Economics* 26: 138-151

Gordon, P. 1979. Deconcentrating without a 'clean break'. *Environment and Planning A,* 11:281-290

Green, S.B., N.J. Salkind, and T.M. Akey. 2000. Using SPSS for Windows: Analyzing and Understanding Data. (2nd Ed.) NJ, USA: Prentice-Hall.

Grubb, Norton. 1982. The Flight to the Suburbs of Population and Employment, 1960-1970. *Journal of Urban Economics* 11: 348-367

Harden, B. 2002. Big, Bigger, Biggest: The Supersize Suburb. *New York Times*, 20 June.

Hawley, A.H. 1950. *Human Ecology: A Theory of Community Structure*. New York: Ronald Press Company.

Hayden, D. 2000. *Model Houses for the Millions: The Making of the American Suburban Landscape, 1820-2000*. Working Paper, Lincoln Institute of Land Policy.

Heimlich. R.E. and W.D. Anderson. 2001. *Development at the Urban Fringe and Beyond: Impacts on Agriculture and Rural Land*. AER –803. USDA, Economic Reserve Service.

Herbers, J. 1986. *The New Heartland*. New York: Times Books.

Hill, N., J.Brennan, and H.L.Wolman. 1998. What is a Central City in the United States? Applying a Statistical Technique for Developing Taxonomies. *Urban Studies* 35(11): 1935-1969.

Jackson, K. 1985. *Crabgrass Frontier: The Suburbanization of the United States*. New York: Oxford University Press.

Kostof, S. 1992. *The City Assembled: The Elements of Urban Form Through History*. Thames and Hudson Ltd., London

Kutay, Ayudan. 1986. Effects of telecommunications technology on office location. *Urban Geography* 7(3): 243-257

Lamb, R. F. 1983. The extent and form of exurban sprawl. *Growth and Change*: 14(1): 40-47.

Lang, R. E. and M. Z. Gough. 2003. New Metropolis Counties. Washington, DC: Fannie Mae Foundation. Census Note: 02-05 (forthcoming).

Lang, R.E. 2002. *Metropolitan Growth Counties*. Washington, DC: Fannie Mae Foundation and Metropolitan Institute at Virginia Tech. Census Note 02-01.

Lang, R.E. 2000. *Office Sprawl: The Evolving Geography of Business*. Washington, DC: Brookings Institution Center on Urban and Metropolitan Research.

Lang, R. E., D. E. Popper and F. J. Popper 1997. Is There Still a Frontier? The 1890 US Census and the Modern American West. *Journal of Rural Studies* 13(3): 377-86.

Lang, Marvel. 1986. Redefining urban and rural for the U.S. Census of Population: Assessing the need and alternative approaches. *Urban Geography* 2:118-134

Laris, M. 2003. Nearly 200 Lawsuits Challenge Loudoun Slow-Growth Plan. *The Washington Post*, 6 February, A01.

Leinberger, Christopher B. 1996. Metropolitan Development Trends of the Late 1990s: Social and Environmental Implications. In *Land Use in America*, Island Press, Washington D.C.

Lessinger, Jack. 1987. The emerging region of opportunity: a new kind of real estate consumer holds the key to long-term growth and profits. *American Demographics*, 9(6): 32-38

Lewis, Pierce. 1995. The Urban Invasion of Rural America: The Emergence of the Galactic City. In *The Changing Countryside*. ed. Emery N. Castle, 39-62

Long, L. and A. Nucci. 1997. The 'clean break' revisited: is US population again deconcentrating?. *Environment and Planning A,* 29:1355-1366

Lorr, M. 1983. *Cluster Analysis for Social Scientists: Techniques for Analysis and Simplifying Complex Blocks of Data*. California, Jossey-Bass.

Lucy, William H. Watch Out: It's Dangerous in Exurbia. *Planning*. November 2000: 14-17.

Morril, Richard. 1992. Population redistribution within Metropolitan Regions in the 1980s: Core, Satellite, and Exurban Growth. *Growth and Change*. 23(3): 277-292

Morrill, Richard, L. 1980. The Spread of Change in Metropolitan and Nonmetropolitan Growth in the United States, 1940-1976. *Urban Geography* 1(2): 118-129

Muller, P.O. 1981. *Contemporary Suburban America*. Prentice Hall, New Jersey.

Nelson, Arthur C. 1999. *The exurban battlefield*. In Congested Countryside: The Rural Urban Fringe in North America. Ashgate Publishing Company, Brookfield, VT.

Nelson, Arthur C. and T. Sanchez. 1999. Debunking the Exurban Myth: A Comparison of Suburban Households. *Housing Policy Debate*. 10(3): 698-709

Nelson, Arthur C. and T. Sanchez. 1997. Exurban and Suburban Households: A Departure from traditional Location Theory. *Housing Policy Debate*. 8(2): 249-276

Nelson, Arthur C. and Kenneth J. Dueker. 1990. The Exurbanization of America and Its Planning Policy Implications. *Journal of Planning Education and Research*. 9(2): 91-100

Nelson, Arthur C. 1992. Characterizing Exurbia. *Journal of Planning Literature*. 6(4): 350-368

Nelson, H. 1955. A service classification of American cities. *Economic Geography* 31(3): 189-210.

Nivola, Pietro S. 1999. *Laws of the Landscape: How Policies Shape Cities in Europe and America*. The Brookings Institution, Washington, D.C.

Palen, J.J. 1995. *The Suburbs*. McGraw-Hill, Inc.

Patel, Dinker I. 1980. *Exurbs: Urban residential developments in the countryside*. Washington, D.C.: University Press of America.

Ratzel, F. 1988. *Sketches of Urban and Cultural Life in North America*, edited & translated by Stewart A. Stehlin, Rutgers Univ. Press. [Originally *Stadte- und Culturbilder aus Nordamerika* (1876)].

Richardson, J. J., M. Z. Gough, and R. Puentes. 2003. Is Home rule the Answer?: Clarifying the Influence of Dillon's Rule on Growth Management. Washington, DC: Brookings Institution Center on Urban and Metropolitan Research.

Spectorsky, Auguste C. 1955. *The Exurbanites*. Philadelphia: Lippincott.

Squires, Gregory D. 2002. Urban Sprawl and the Uneven Development of Metropolitan America. *In Urban Sprawl: Causes, Consequences & Policy Responses*. The Urban Institute Press, Washington, D.C.

Tuxiera, R. Deciphering the Democrats' Debacle: Why the Republican majority (probably) won't last. The Washington Monthly: May 2003.

United States Bureau of the Census Homepage: (www.census.gov). Accessed on December 13, 2002.

United States Bureau of the Census, "Geographical Mobility: March 1995-March 1996," Current Population Reports P20-497. November 1997, page 5.

USA TODAY, Election 2000 Homepage: (http://www.usatoday.com/news/vote2000/cbc/map.htm). Accessed on January 6, 2003.

Vance, J.E. 1977. *This Scene of Man: The Role and Structure of the City in the Geography of Western Civilization*. Harper's College Press, New York.

Vining D.R., R. Pallone and D. Plane. 1981. Recent migration patterns in the developed world: a clarification of some differences between our and IIASA's findings. *Environment and Planning A*, 13:243-250

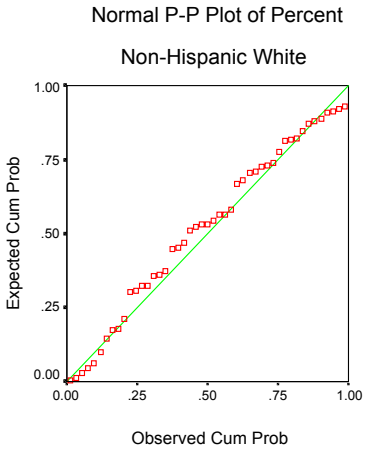
Vining D.R. and A. Strauss. 1977. A demonstration that the current deconcentration of population in the United States is a clean break with the past. *Environment and Planning A*, 9:751-758

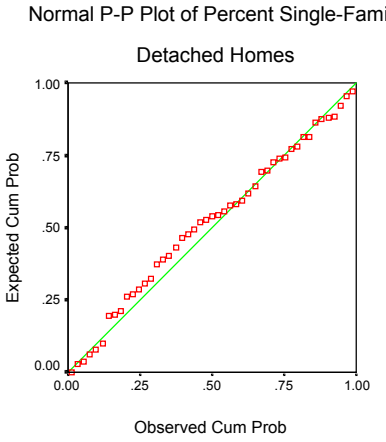
Warner, S.B., Jr. 1995. *The Urban Wilderness: A History of the American City*. University of California Press, London, England

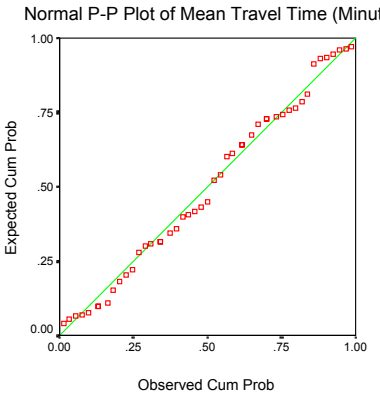
Whoriskey, P. 2003. Density Limits Only Add to Sprawl: Large Lots Eat Up Area Countryside. *The Washington Post*, 9 March, A01.

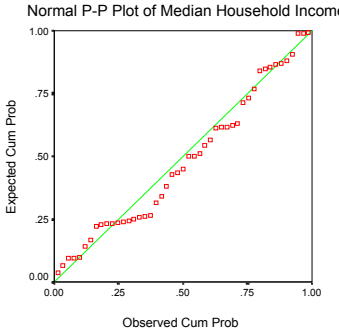
APPENDIX A

P-P Plot Tests for Normal Distribution

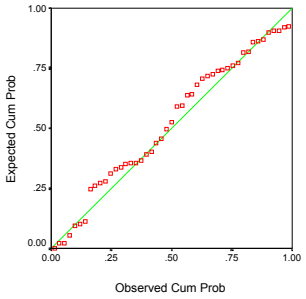




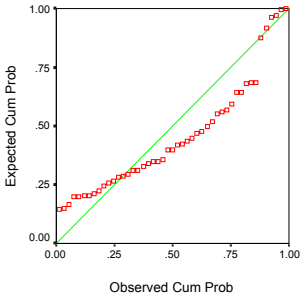




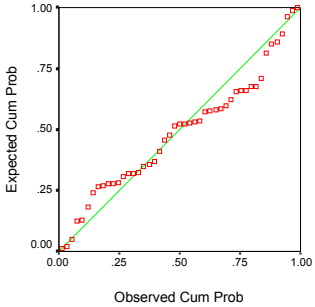
Normal P-P Plot of Percent Homeownership



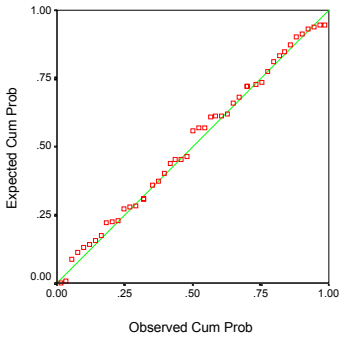
Normal P-P Plot of Percent Population Change from Net Domestic Migration



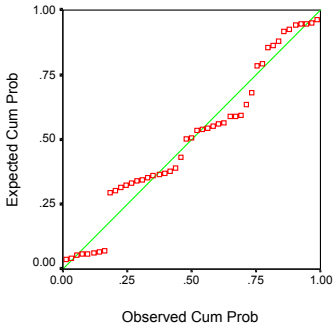
Normal P-P Plot of Percent Households with 3 or More Vehicles



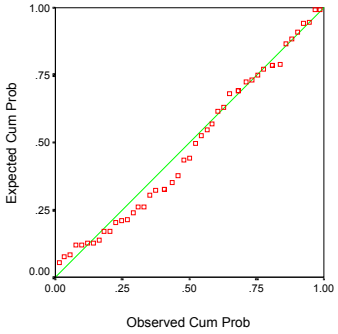
Normal P-P Plot of Percent under 18 Years



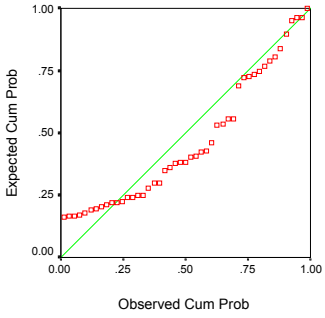
Normal P-P Plot of Difference in Second and Eighth Decile



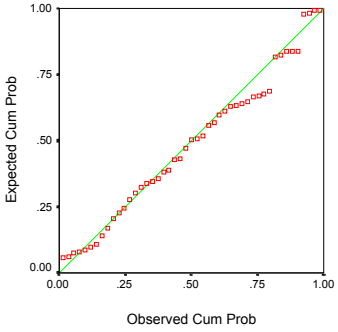
Normal P-P Plot of Percent Individuals in Poverty Statu



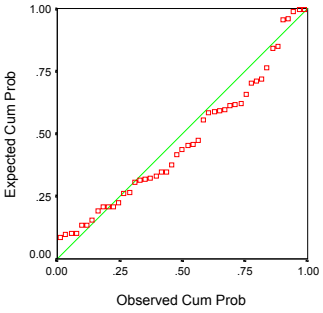
Normal P-P Plot of Percent Housing that are Mobile Homes



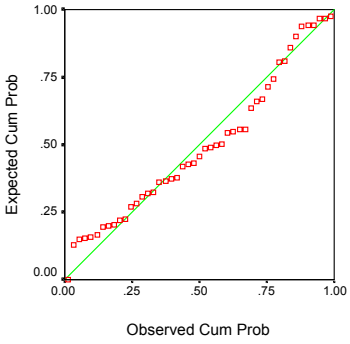
Normal P-P Plots of Percent White-Collared Jobs



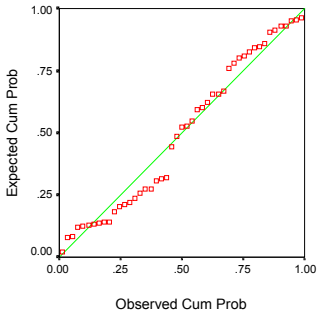
Normal P-P Plot of Percent 25 or Over with Higher Education



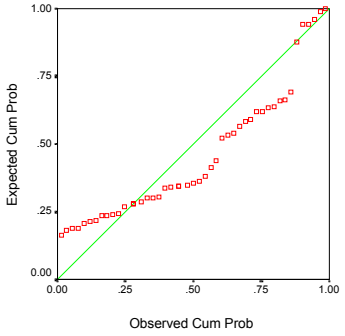
Normal P-P Plot of Percent Total Industry Establishments Started in 1990-2000



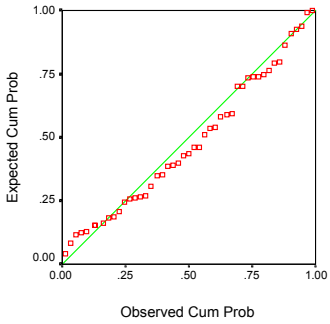
Normal P-P Plot of Percent Change in Median Housing Value, 1990-2000



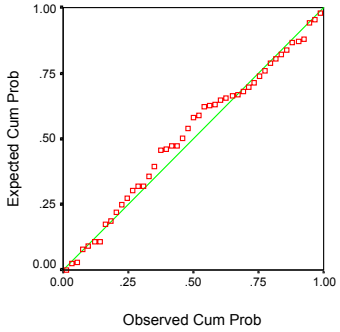
Normal P-P Plot of Growth Rate, 1990-2000



Normal P-P Plot of Percent Homeowners 65 and Over Who Moved There Since 1990



Normal P-P Plot of Percent of Workers 16 and over who Commute Beyond County



MEGHAN ZIMMERMAN GOUGH

208 ELLETT ROAD • BLACKSBURG, VA 24060
(540) 552-6045 • MZGOUGH@VT.EDU

Education

Master of Urban and Regional Planning, GPA: 3.97 **July 2003**

College of Architecture and Urban Studies
Virginia Polytechnic Institute and State University, Blacksburg, VA
Focus Areas: Growth Management, Land Use Planning, and Environmental Planning
Thesis Title: *A Typology of the Nation's Fast-Growing Peripheral Counties*

- Graduate Urban Affairs and Planning Association, Chairperson
- Graduate Student Assembly, Student Delegate

Bachelor of Science, Biology, GPA 3.1 **December 1997**

College of Science and Mathematics
James Madison University, Harrisonburg, VA
Minor: Environmental Science

- Education Abroad Program, Monteverde, Costa Rica
- Microbiology Research Experience

Honors

- 2003 C. David Loeks Award, Outstanding Second Year Graduate Student in Urban & Regional Planning
- 2002 Virginia Planning Citizens Association Fellowship, Outstanding First Year Graduate Student
- VPI & SU Chapter (Chapter #25) Phi Kappa Phi Honor Society
- *Tri-Beta* Biological Honor Society

Research Experience

Research Associate – Metropolitan Institute at Virginia Tech (www.mi.vt.edu) **2002– Present**
Virginia Polytechnic Institute and State University, Blacksburg, VA

- Researched changing regional growth patterns, focusing on key demographic forces shaping metropolitan growth
- Coordinated the *Post Suburbia: Examining the New Metropolitan Form* symposium, held at the 2002 Association of Collegiate Schools of Planning conference

Growth Management Research – Urban Affairs and Planning Department **Summe r 2002**
Virginia Polytechnic Institute and State University, Blacksburg, VA

- Researched literature concerning the relationship between growth management and Dillon's Rule
- Reviewed and compiled a summary of state statutes for state level growth management

Graduate Research Assistant – Virginia Center for Housing Research **Fall 2000**
Virginia Polytechnic Institute and State University, Blacksburg, VA

- Organized the launching of a new Virginia Tech research institute
- Initiated and managed correspondence with administration, faculty and University public relations

Regional Planning Experience

Environmental Component of Comprehensive Plan, Montgomery County, VA **Fall 2002**

- Developed the water resources components and aided the development of the open space component of the of the County Comprehensive Plan
- Created County goals, objectives, strategies and indicators for the water resource component
- Conducted public visioning sessions, presented final proposal to the County Planning Commission

Future Land Use Study for Prices Fork, Montgomery County, VA **Fall 2002**

- Created a model for analyzing and evaluating future land use opportunities in the County
- Developed potential future land use scenarios

Comprehensive Plan, Town of Ridgeway, VA **Spring 2002**

- Commissioned by the Town Council to provide an evaluation of current land-use needs and future goals
- Constructed and directed visioning sessions and door-to-door surveys to identify public goals for future growth

Conferences and Training

Dispute Resolution Training, Institute for Environmental Negotiation **June 2003**
Community Solutions for Community Issues, Fairfax, VA

44th Annual American Collegiate Schools of Planning Conference **November 2002**
Waters and Shores, Baltimore, MD

2002 Virginia Chapter of the American Planning Association Conference **March 2002**
Annual Planning Conference, Roanoke, VA

Professional Experience

Project Success Facilitator **Spring 2003**
Center for Academic Enrichment and Excellence, Blacksburg, VA

- Established a goal-setting and self-assessment seminar that assisted students in improving their grades and enhancing their study skills
- Provided a supportive and positive atmosphere to help students achieve academic success and personal development

Team Leader, Environmental Scientist **February – July 2001**
DynCorp, Information and Enterprise Technology, Reston, VA

- Supervised and oversaw team personnel
- Managed team operational activities and maintained timely delivery of all deliverables

Associate Environmental Scientist **1998 - 2001**

DynCorp, Information and Enterprise Technology, Reston, VA

- Provided technical support and customer service to the Environmental Protection Agency (EPA) in support of the hazardous waste clean-up efforts
- Presented training sessions around the nation on how to use EPA's sample collection tools

Botany Volunteer

The Nature Conservancy, Arlington VA **Summer 1997**

- Developed portion of the Conservancy's Latin America botanical databases, focusing on neotropical plant species

Earth Team Volunteer

Natural Resource Conservation Service, Harrisonburg, VA **Spring 1997**

- Provided organizational and manual support for erosion control efforts, assisting private landowners in protecting natural resources

Professional Certifications and Memberships

- American Planning Association, Student Member
- OSHA 40-Hour Hazardous Waste Operations & Emergency Response (HAZWOPER) Training
- OSHA 8-Hour HAZWOPER Refresher Training

Publications

Lang, R. E. and M.Z. Gough. 2003. Growth Counties. Washington, DC: Brookings Institution Center on Urban and Metropolitan Research (forthcoming).

Lang, R. E. and Meghan Z. Gough. 2003. New Metropolis Counties. Washington, DC: Fannie Mae Foundation. Census Note: 02-05 (forthcoming).

Lang, R.E. and M. Z.Gough. 2003. MEGA Counties. Washington, DC: Fannie Mae Foundation. Census Note: 02-02 (forthcoming).

Richardson, J. J., M. Z. Gough, and R. Puentes. 2003. Is Home rule the Answer?: Clarifying the Influence of Dillon's Rule on Growth Management. Washington, DC: Brookings Institution Center on Urban and Metropolitan Research.

M.E. Zimmerman and D. Tulis. 2000. Proceedings of the 19th Annual National Conference on Managing Environmental Quality Systems: Development of FORMS II Lite 4.0: A Rapid Prototype Approach. Albuquerque, New Mexico.

B.A. Wiggins, R.W. Andrews, R.A. Conway, C.L. Corr, E.J. Dobratz, D.P. Dougherty, J.R. Eppard, S.R. Knupp, M.C. Limjoco, J.M. Mettenburg, J.M. Rinehardt, J. Sonsino, R.L. Torrijos, AND M.E. Zimmerman. 1999. Use of antibiotic resistance analysis to identify non-point source of fecal pollution. Appl.Environ.Microbiol. 65:3483-3486

Special Skills

- Independent and collaborative research
- Oral presentation/public speaking
- Meeting and group discussion facilitation
- Technical writing
- Interpersonal communication
- SPSS proficiency

- Project coordination and management
- Detail orientation