Understanding Urban, Metropolitan and Megaregion Development to Improve Transportation Governance

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(ABSTRACT)

Since the 1950s, myriad forces have expanded America's urban, metropolitan and megaregion development forms. Using a net worker exchange model, the geographic extent of commuter sheds is documented for 22 metropolitan areas within the continental United States. In addition to commuting patterns, county-to-county migration data provide collaborating evidence for the extent of metropolitan commuter sheds. Actual commuter sheds are significantly larger than the boundaries of Metropolitan Planning Organizations, created by the federal government to review and approve transportation investments in metropolitan areas.

For contiguous metropolitan areas, criteria are suggested for recognizing Transportation Megaregions based on their role as global gateways and their potential for high-speed rail service. By gaining a better understanding of development patterns at urban, metropolitan and megaregion scales, the dissertation addresses ways to improve transportation governance. The focus of this study is not on the civil engineering aspects of transportation planning. Rather, the dissertation sets forth a new paradigm for transportation governance that includes scale-dependent decision-making and funding strategies.

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INTRODUCTION

Within the past century, the geographic scale of our daily world has grown from the city (Warner 1962 and Jackson 1985), to large agglomerations of urban realms (Vance 1964 and 1977) and even global networks (Sudjic 1992; Taylor and Lang 2005). Unfortunately, many of our transportation planning concepts have not adapted to the increased scale and polycentric nature of current development patterns. For example, a key tenet in the current definition of core-based statistical areas is the percentage of workers commuting to a central county or counties (Frey Wilson, Berube and Singer 2004) but recent research documents the rapid growth in jobs outside central cities (Lang 2003) and the prevalence of commuting between suburban locations (Transportation Research Board 2006). Alan Pisarski's summary of commuting in large metropolitan areas with more that five million people indicates 47.7% of commuters now travel between suburban locations compared to only 13.7% making the trek from suburbs to the central city. As stated succinctly by Giuliano (1989: 153) "Market orientation of firms is shifting more heavily to national and international networks, thus access to the interstate highway system and to major airports may be far more important than relative access within the metropolitan area."

Even though academic literature calls for large-scale infrastructure planning (Baldassare, Hassol, Hoffman and Kanarek 1996; Cervero 1998; TRB 2001) there are significant limitations on multi-state and even metropolitan scale planning in America. Cultural and governmental constraints hark back to when the colonists formed a new union with unique limitations on federal government. An example is the division of federal power to three distinct functions with integrated checks and balances. In the early years of our nation, primary powers of the federal government were focused on national defense and interstate commerce, which is one of the most powerful arguments for transportation planning. Robert Fishman provides a very insightful summary of the cultural challenges to planning in America. Fishman states, "the basic themes of the urban conversation are always the same: how to justify public action to a society that is deeply individualistic; how to support long-term investment strategies in a society built on short-term gains; how to justify the taxation of private profit for the common resources and common good." (2000: 5)

Research Questions

My dissertation research includes two distinct modes of reasoning. First, historical-dialectic logic is used to analyze background information, review past research and build a theoretical foundation for the dissertation. Using primarily textual and map evidence, I draw upon the body of scholarly knowledge for answers to the following questions:

1. What do we know about the interaction between development and transportation at various geographic scales?
2. Why plan at the scale of megaregions rather than at metropolitan, state and national levels? (Dewar and Epstein 2007)

The second mode of reasoning used in the dissertation research is positivistic-quantitative logic. Geographic information systems and statistical analysis are employed to answer the following questions:

1. How good is the fit between metropolitan commuter sheds, statistical area designations and the boundaries of Metropolitan Planning Organizations[1] ?

2. What are appropriate methods and useful data for megaregion planning? (Dewar and Epstein 2007)

3. What is a megaregion, and how does one determine where a megaregion exists? (Dewar and Epstein 2007)

Research Context

A major caveat for this research is the uncertainty of extrapolating demographic and development trends to the year 2030. For example, major changes in oil supply/price have not been modeled and may accelerate a switch in preferences from suburban to walkable urban development. On the other hand, the magnitude and life-cycle of the built environment restricts rapid alteration of development patterns, even with powerful change agents. With acknowledgment of these countervailing forces that may influence expected outcomes, the following sections establish the research context. The first section provides an overview of current geographic concepts used by various federal agencies for demographic analysis, management and budgeting purposes, and transportation planning. The second section introduces the topic of development and

[1] Metropolitan Planning Organizations (MPOs) are established by the federal government for transportation planning purposes. MPO boundaries must include the existing urbanized area and extend to the contiguous area expected to become urbanized within 20 years. The area may include the entire Metropolitan Statistical Area or a Combined Statistical Area.

transportation interaction. In the third section, problems and weaknesses in current practice are illustrated using a series of maps that compare MPO boundaries to other geographic areas.

Geographic Areas and Concepts

Frey, Wilson, Berube and Singer (2004) provide an excellent "Field Guide" for understanding recent revisions in census terms and geographic areas. A basic building block for many of the statistical areas is the urban area. An urbanized area consists of a central place(s) and adjacent territory with a general population density of at least 1,000 people per square mile of land area. Once an urban area reaches at least 50,000 people, the surrounding county becomes a metropolitan statistical area. In addition to metros, the Census Bureau recently created micropolitan statistical areas for urban clusters between 10,000 and 50,000 people. Both micropolitans and metropolitans are known as Core-Based Statistical Areas (CBSA). The core-based orientation of the census concepts is clearly seen in the evaluation of commuting patterns. In addition to the population threshold, an outlying county is included in the metropolitan area if 25% of the employed residents work within the central county(s) or 25% of the jobs within the outlying county are held by residents of the central county(s).

A Combined Statistical Area (CSA) is comprised of multiple metropolitan or micropolitan areas with at least 15% of commuters traveling to or from the core-based central county(s) of the larger metropolitan area. At this employment interchange level, the local legislative delegation is given the option of deciding if their jurisdiction will join the CSA. When employment interchange reaches 25%, the Office of Management and Budget requires a county to become part of the CSA. Thus the current methodology for forming a CSA is both technical and political. There are currently 123 CSAs in the United States.

The recognition of very large-scale urban form as an object of study was initially discussed with negative overtones by City Beautiful scholars such as Patrick Geddes and Lewis Mumford (Baigent 2004). In contrast, Jean Gottman (1961) provided the first major work that interpreted “megalopolis” in more favorable terms. Following closely after Gottman’s discourse on the northeastern urban agglomeration (extending from Boston to Washington, DC) Jerome Pickard (1962) expanded the megalopolis concept to the entire continental United States. Recent works by Nelson and Lang (2007) have refined the concept and recommended the term “megapolitan” as a fitting addition to our typology of scale-dependent urban form. The most recent literature review by Dewar and Epstein (2007) suggests “megaregion” as the consensus term for the recognition of large-scale urban form.

To illustrate these geographic concepts, the following maps of the United States divide the continent in half. Figure 1 shows urban, metropolitan and combined statistical areas in the eastern half of the continent, with the western half shown in Figure 2. Urban areas are shown by the solid black areas, such as the distinct band of urbanization along the northeast coast from Boston to Washington, DC. Metropolitan areas are displayed with grey shading. A lighter shade was used for Metropolitan Statistical Areas (MSA) and a darker grey for Combined Statistical Areas (CSA). For example, the Minneapolis-St. Paul metropolitan area can be seen in the upper left corner of the following map. Because megaregions are a new urban form not yet formally recognized by federal agencies, there are no officially-recognized megaregions shown in the following two maps.

A comparison of the eastern and western halves of the continent reveals several distinguishing characteristics that are important for the analysis of metropolitan areas and megaregions. First, western counties are generally larger in geographic area, which limits commuting across county boundaries. Second, less urban develop in the west limits the number of potential megaregions, but several possible areas are clearly evident along the coast in California and in the northwest corner of the continental U.S.

Figure 1 - Eastern U.S. Metro and Combined Statistical Areas

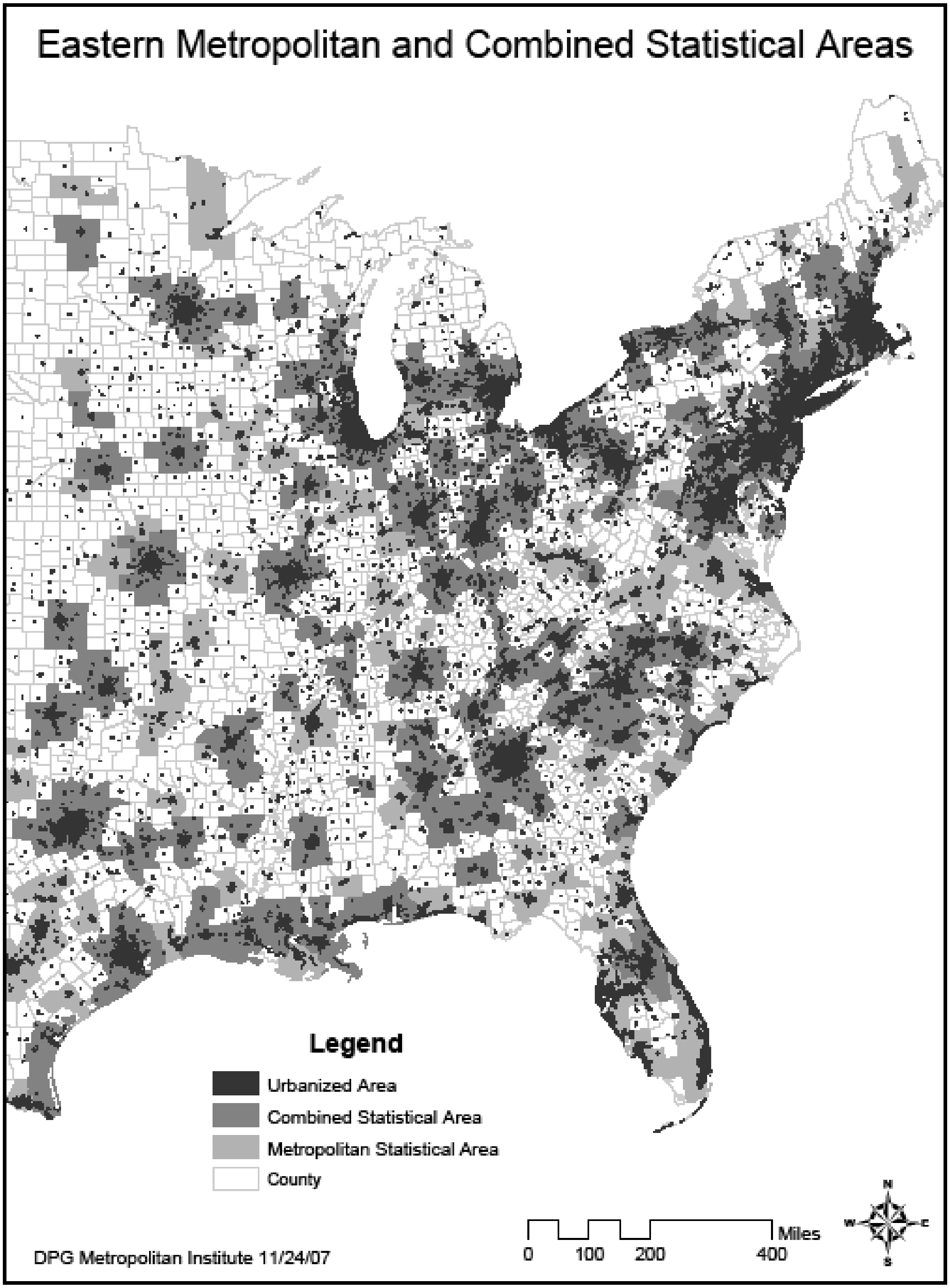
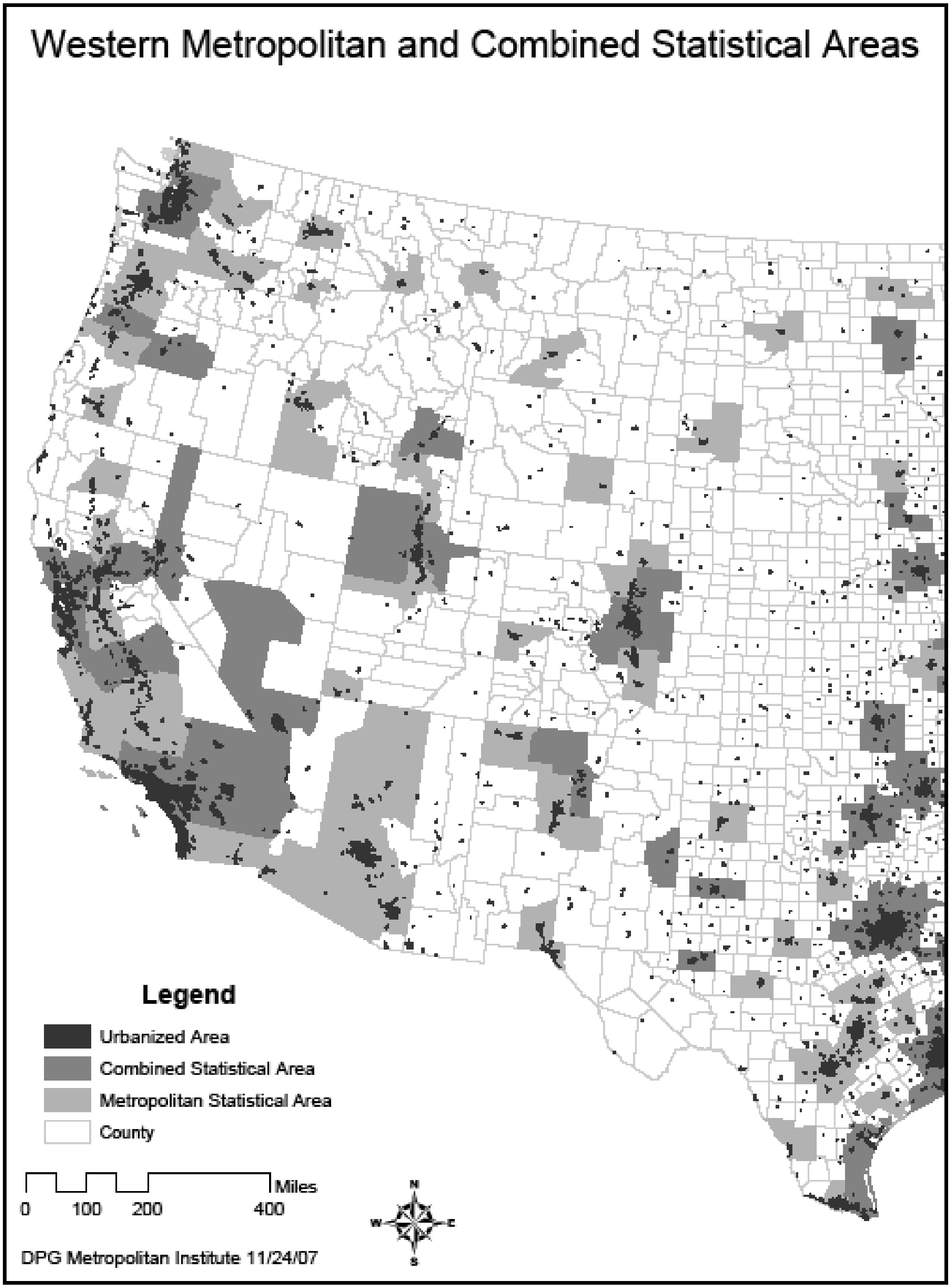


Figure 2 – Western U.S. Metro and Combined Statistical Areas



Development and Transportation Interaction

The current transportation governance structure in America is founded on the old Chicago School with its monocentric concept of workday travel between bedroom communities and the central city. My dissertation proposes a new paradigm for transportation governance that is more polycentric, edgeless and galactic (Hackworth 2005; Lang 2003; Lewis 1995) while acknowledging the tremendous increase in geographic area for commuter sheds.

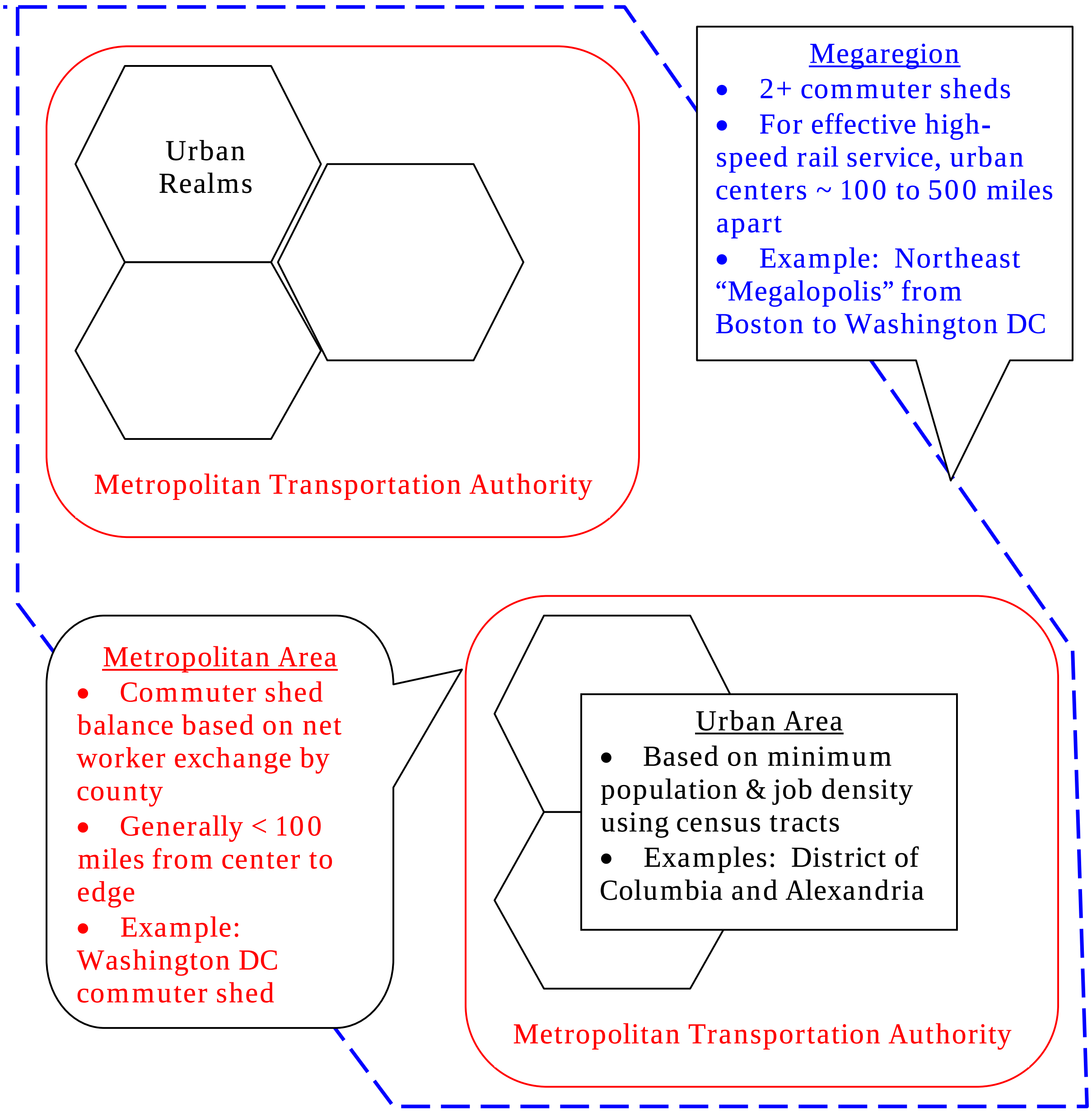
For the largest metropolitan areas in the United States, actual commuter sheds are compared to current MPO boundaries. This dissertation also recommends metropolitan-scale transportation authorities for commuter sheds within megaregions. In contrast to the current MPO role, which is limited to planning and coordinating transportation improvements that must be approved by local governments, the recommended Metropolitan Transportation Authorities (MTA) would have power to plan, construct and operate transportation systems within a metropolitan commuter shed.

Figure 3 illustrates key geographic concepts that compose the new paradigm for transportation governance. At the urban scale, population and job density (i.e. employment centers) would become the criteria for designation of urbanized areas. Current methodologies only examine residential density and do not accurately indicate the extent of the urban area. Focusing solely on residential development ignores one end of home-based work trips. Census tracts are recommended units of analysis for designating urban areas.

Urban realms, like the District of Columbia and Alexandria, combine to form commuter sheds in which the number of jobs roughly balances the number of workers. Current MSAs and CSAs are compared to projected commuter sheds in 2030 using a Net Worker Exchange Model. As a general rule of thumb researchers have identified a 100-mile radius (from center to edge) as indicative of metropolitan commuter sheds (Friedmann and Miller 1965; Sudjic 1992; Davis, Nelson and Dueker 1994).

For transportation planning and governance, large-scale megaregions are comprised of multiple metropolitan commuter sheds. For effective high-speed rail service within a megaregion area, historic urban centers should be located approximately 100 to 400 miles apart. Gottman's Megalopolis is a good example of the megaregion concept, which is formally defined by my dissertation research.

Figure 3 – Illustration of Key Geographic Concepts

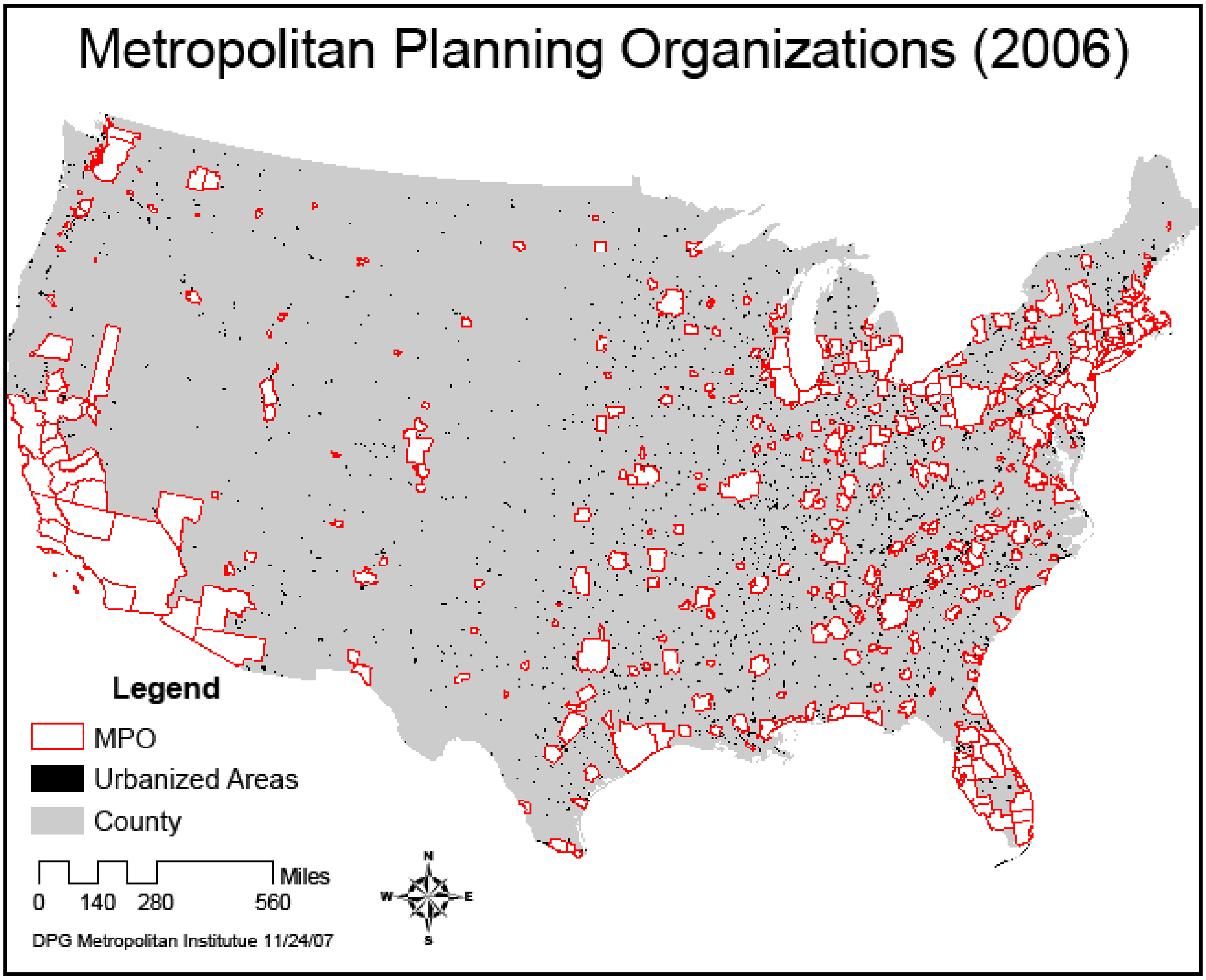


Intergovernmental Coordination Weaknesses

To improve transportation governance, intergovernmental coordination is essential between the Census Bureau (methods and data collection), the Office of Management and Budget (designation of statistical entities) and Federal Highway

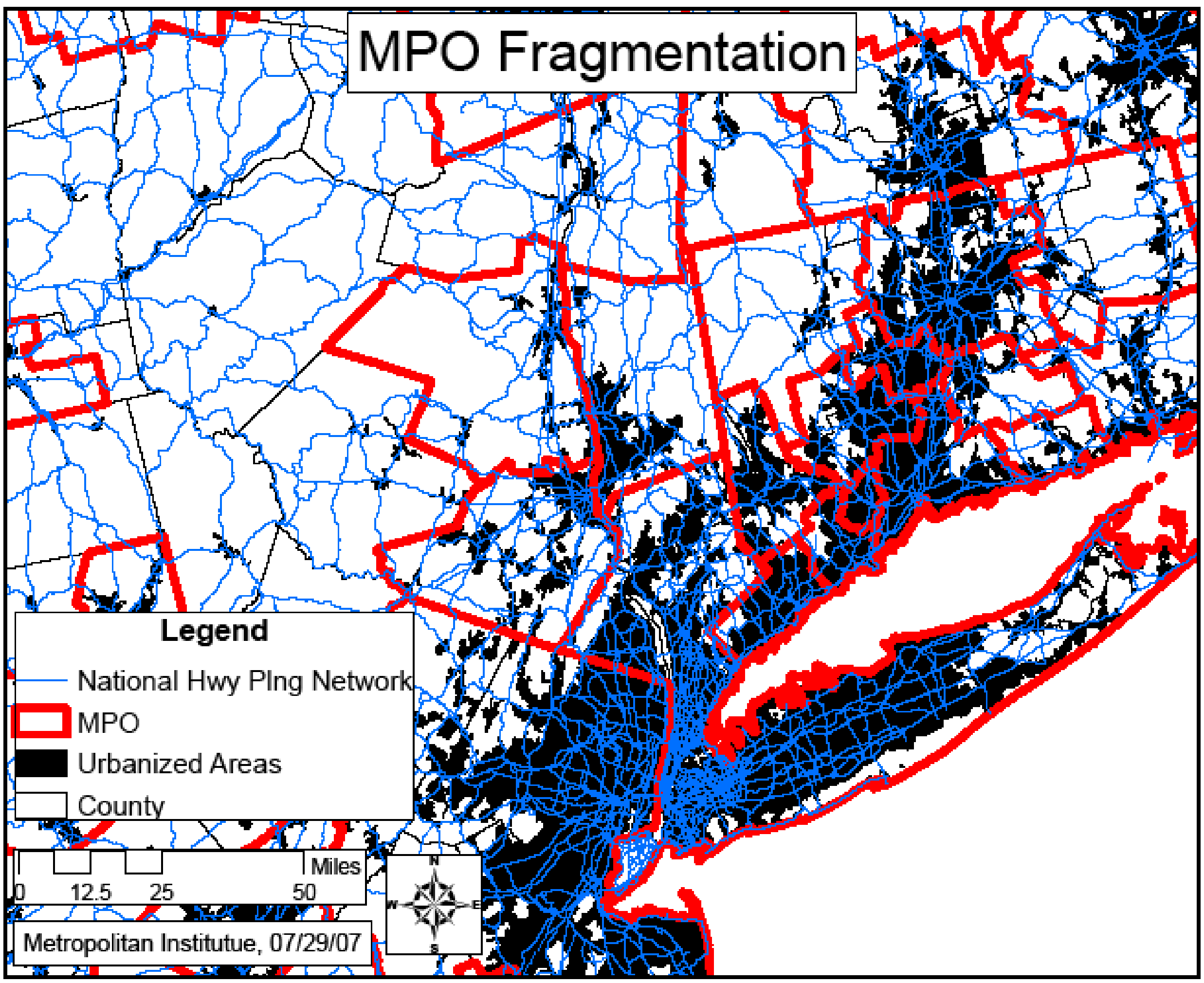
Administration (transportation planning and funding). MPOs have a lead role in transportation planning as both a conduit for federal funds and in their coordinating role for local governments. Federal regulations currently require a Metropolitan Planning Organization to be formed when an urbanized area reaches a population threshold of 50,000 and thus qualifies to become a new metropolitan statistical area. MPO boundaries must include the existing urbanized area and extend to the contiguous area expected to become urbanized within 20 years. The area may include the entire metropolitan statistical area or combined statistical area. A map of the 378 MPOs within the continental United States is shown in Figure 4.

Figure 4 - MPO Boundaries in 2006



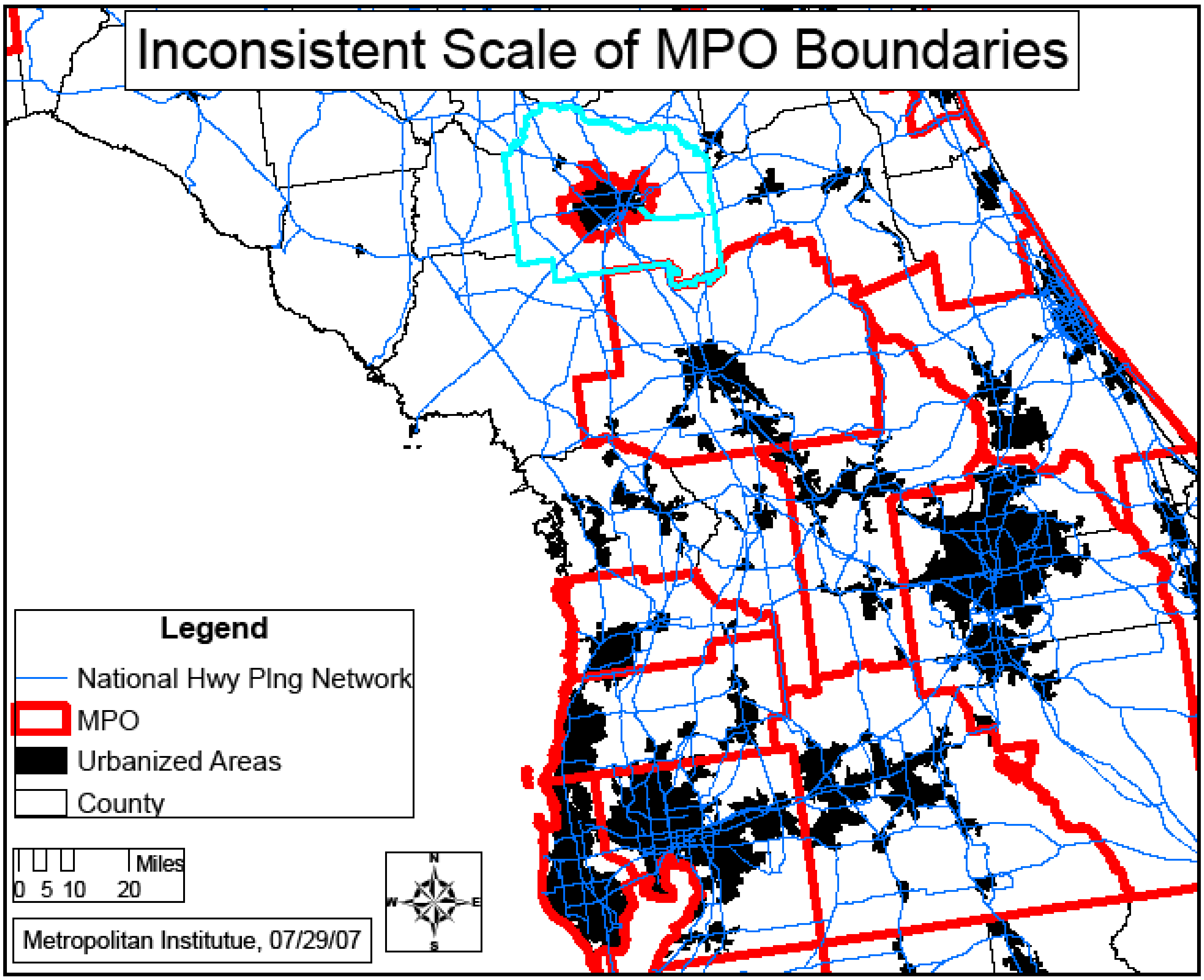
The following three maps demonstrate the Federal Highway Administration's (FHWA) flexibility in the formation of MPO boundaries by local governments. According to federal regulations, MPO boundaries are supposed to include existing urbanized areas and extend to the contiguous area expected to become urbanized within 20 years. Figure 5 shows the boundaries of various MPOs surrounding New York City. In general, MPO boundaries significantly underestimate the extensive commuter sheds in most metropolitan areas.

Figure 5 – Example of MPO Fragmentation Problem



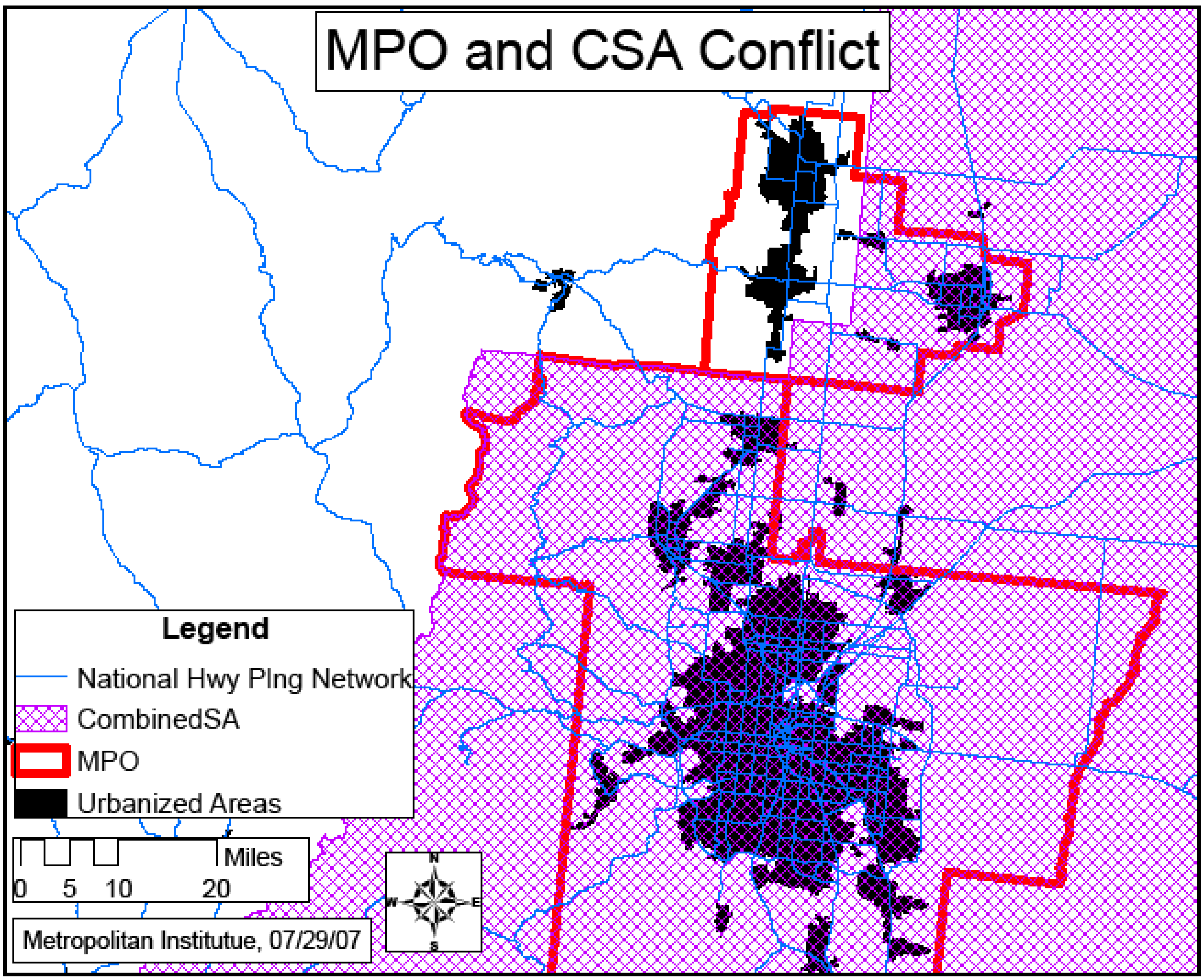
MPO boundaries also show significant inconsistencies in their geographic extent. For example, Figure 6 indicates a tight MPO boundary around Gainesville, Florida, compared to the boundary of Alachua County (highlighted in turquoise). Immediately to the south, the MPO covers all of Marion County, Florida.

Figure 6 - Example of Inconsistent MPO Size



A third problem is the conflict between MPO and CSA designations within metropolitan areas. For example, Weld County Colorado recently joined the Denver Combined Statistical Area (CSA). Larimer County, located along the I-25 corridor north of Denver, exhibits strong commuting ties with the Denver metropolitan area, but is not currently part of the CSA. As shown in Figure 7, the major urban areas within these two counties are part of the same MPO.

Figure 7 – Example of MPO and CSA Conflict



Past Research and Theory Building

Theories help us combine philosophy, logic and observational science to frame a body of knowledge. We look to theories for insights that enhance our ability to think comprehensively and understand causal relationships. In general, the progression of thought is from concepts to fundamental assertions to general propositions and testable hypotheses. The outcome of theoretical inquiry is the application of explanatory principles to a class of phenomena.

Understanding urban, metropolitan and megaregion development to improve transportation governance draws upon four distinct fields of study: 1) planning/governance, 2) geography, 3) economics/public finance and 4) transportation. In keeping with the theme of scale-dependent transportation governance, the following discussion of urban development theories is organized according to the "scale" of classic urban development theories. These sections address the early monocentric theories, the more recent polycentric concepts and the global cities framework, which I find most useful for understanding megaregion development.

Monocentric Urban Form

Urban development scholars have noted that firms locate close to markets or resource endowments to maximize profits. The spatial form associated with early monocentric theories is the pattern of concentric rings described by Burgess (1925). Using a theoretical framework of hierarchal market areas, Christaller (1933) and Losch (1940) explain spatial distribution as a tiered arrangement of central places with their respective spheres of influence. Although the graphic pattern of their market areas appears polycentric, hinterlands are focused on, and organized by, their respective centers.

The benefits of agglomeration help to explain cumulative causation, or self-maintaining feedback, that leads to economic polarization (Myrdal 1957; Hirschman 1958). Agglomeration effects of natural economic spaces are also referred to as growth poles (Perroux, 1950). Land prices and rents tend to rationally sort firms to locations where the advantages of spatial proximity match their willingness to pay for the site (Muth 1961; Mills and Lav 1964; Alonso 1968). Thus we typically find high-rise offices in high-value areas of urban centers. In keeping with this theme, Kaldor (1970) explains how support functions and labor markets gain specialized skills and efficiency.

Weaknesses in monocentric theories are due to underlying assumptions that have become increasingly outdated. For example, employment is no longer concentrated in the center of the city, households have multiple workers and location is only one variable in complex trade-offs between housing and transportation costs. In addition to these weaknesses, strong cultural forces and changes in transportation technology have transitioned monocentric cities to polycentric urban forms. The following sections review scholarly contributions (presented in chronological order) that explain the transition from monocentric to polycentric development.

Hoyt (1939)

As a housing economist, Homer Hoyt provides a valuable analysis of <u>The Structure and Growth of Residential Neighborhoods in American Cities</u>. It is unfortunate that analytical techniques he pioneered became associated with discriminatory “red-lining” practices used by mortgage lenders. Hoyt was innovative in the use of block-level, time-series maps to illustrate dynamic change in urban areas. His book had two major purposes. First, Hoyt demonstrated techniques for mapping and measuring growth in cities. Second, Hoyt used principles of urban growth to explain spatial patterns. For example, Hoyt understood city shape to be determined primarily by topography and transportation.

By looking at rents, housing attributes and racial segregation, Hoyt concluded the concentric circle theory of urban growth was only a loose generalization. A better understanding was his favored-sector concept that found the highest rents tend to locate in a radial wedge that comprise a quarter or less of the urban area. The "fashionable" residential areas tend to dictate the outward spread of the same pattern. Hoyt documented a connection between high-end jobs and high-end residential, noting the following locational preferences for high end development: 1) seeks higher ground, 2) locates along water fronts not used for industry, 3) grows toward free, open country, 4) gravitates toward the homes of community leaders, 5) high-end retail and services follow high-end residential development, 6) high-end residential follows the fastest transportation routes, 7) favored sector is stable over time.

Warner (1962)

Streetcar Suburbs contains numerous photos and maps to aid the reader's understanding of the time period. Warner's story of the development of Boston begins with a brief description of the 1850s seaport town that was small enough to walk across. By the end of his story, the Boston of 1900 had grown to ten square miles and encompassed 31 separate jurisdictions. Surrounding the central business district was the inner ring area of low-income, attached, rental housing. The outer ring suburbs contained middle to upper income residents living in newer, detached and predominantly owner-occupied housing.

Electric streetcars began service in Boston during 1889. A Brookline real estate developer played a prominent role in consolidating transit companies. Warner maintains that the location of streetcar lines were the primary determinants of where suburban development occurred. Decision makers during this period lived in the new suburbs and were sympathetic to the rural ideal. In contrast to current practice, local governments typically constructed the local streets within new suburbs at taxpayer's expense. Even though there were no zoning laws at this time, market forces effectively guided thousands of individual purchase/construction decisions, resulting in relatively uniform suburbs that sorted themselves out by income level. By 1900, the trolley lines extended about six miles from the central business district, with a typical door-to-door commute time of about one hour. The predominant subdivision pattern consisted of grid streets with deep, narrow lots of 30 to 60 feet. The practice of small scale retail and service businesses "following rooftops" can be traced back to these early streetcar suburbs where commercial strips appeared along the transit lines.

Warner discussed three themes that fostered growth of the suburbs. First was a romantic belief in capitalism among recent immigrants, who endured hard work with the hope that they could succeed. Second was nostalgic nationalism that provided an identity and support network necessary to survive in crowded immigrant housing. Third, Warner makes an extensive case for the rural ideal as a strong longing in American culture. The rural ideal included forces both pushing and pulling people to the suburbs. Inner city dwellers were pushed to the suburbs by physical deterioration, crowding and "strangers" while being pulled to the suburbs by privacy, security and natural surroundings.

Jackson (1985)

The book Crabgrass Frontier offers an historical perspective on the dynamics of American land use patterns. Jackson maintains that the housing pattern during the electric streetcar period became increasingly dominated by separation, suburban character and racial/economic exclusion. In comparison to western European housing patterns, urbanized areas in America generally lack an "edge" or distinct boundary between town and country. Jackson concludes that American suburbanization has been facilitated by governmental policies.

Jackson's commentary on cause and effect relationships is very perceptive. In contrast to physical science, he points out that social science is limited by hypotheses that are not testable in a controlled experimental setting. Given the complex interaction of people and their environment, Jackson claims that cultural values help explain suburbanization. In other words, transportation technologies are important, but not the singular "cause" of suburbanization. According to Jackson, the factors contributing to suburbanization in America include the strong-family emphasis in our Judeo-Christian heritage, the abundance of land, the status and security associated with owning land, fear of epidemic diseases and romantic ideals about country living. A major theme found in Crabgrass Frontier is the notion of an individual house, surrounded by a yard, protecting the family from intrusions into private space.

At the beginning of the electric streetcar era, urban centers in America were primarily walking cities characterized by muscle-powered transportation, small land parcels with buildings close to the street, mixed land use pattern, short distances from home to work (if not at the same location), high status residences near the city center and low income residences on the periphery. Although accelerated by the electric streetcar, the inside-out transformation of cities began slowly with increasing transportation options that emerged from 1815 to 1875. Examples discussed by Jackson include steam ferries, railroads, omnibuses (essentially a large public carriage pulled by a team of horses) and horsecars. The latter was an improved form of omnibus that traveled on iron rails, thus greatly reducing the rolling resistance. These transportation modes began to interconnect and integrate service starting in the 1850s. The transition to mechanized intra-urban transit began in 1867 when the first cable car system was installed in New York. Cable cars reached their peak in 1890, with systems in 23 cities. The mechanized cable cars were cleaner, more powerful and faster than the horsecars they replaced. The first successful electric streetcars were used in Richmond, Virginia, beginning in 1887. The common name of "trolley" began to be used because of the electrical connection, or "troller", that was pulled along behind the streetcar on an overhead wire. Compared to cable cars, the electric trolleys were cheaper to construct and operate, they could obtain speeds of 10-20 miles per hour and they offered quicker acceleration. In modern nomenclature, we use the term "light rail" to distinguish electric streetcars from heavy rail systems. The latter run on tracks that are separated from other vehicles and pedestrians (either above or below ground) with power provided from a third rail located near the base of the passenger cars.

Following the example of electric power companies, trolley operators tried to balance the load by having trip attractors at both ends of the streetcar lines. Jackson provided several examples of these "attractions," such as Coney Island Amusement Park. Even though residential densities decreased during the time of the trolley, nonresidential development was intensified in downtown business districts through the use of high-rise, steel-framed skyscrapers with electric elevators. Radial transit lines were ideally suited to the daily routine of concentrating people within these downtown activity centers.

Streetcar companies experienced exponential growth in their service areas and ridership during the early years of the 20th century, partly due to joint ventures that combined transit operations and real estate development. To provide access for customers, transit lines were proactively constructed to new real estate development projects. Jackson provided several examples of transit and real estate synergy in Oakland, Los Angeles and Washington, DC. An interesting local case study was the Chevy Chase Land Company that purchased 1,712 acres, constructed a transit line along Connecticut Avenue to draw upscale homebuyers to their model homes (first subdivision in 1893), created amenities like Rock Creek Park and established minimum construction standards for the new houses.

It was interesting to read Jackson's chapter on municipal annexation, which is still a contentious land use policy question in modern planning practice. Major annexations in Philadelphia, Chicago and New York during the 1880s and 1890s were attributed to boosterism and economies of scale. Given Jackson's earlier discussion of rapid suburbanization during the time of the trolley, it seems the author missed an opportunity to frame the annexation story in the context of fiscal and political changes of the time period. Central cities at the beginning of the suburbanization boom had the political power to forcibly annex the growing tax base in the early suburbs. However, the time of the trolley eventually increased the population and wealth of the suburbs, resulting in curtailment of this practice. At the beginning of the 20th century, there appears to be a shift in power within state legislatures that made incorporation of new jurisdictions less difficult, while essentially limiting annexations to voluntary action by individual property owners.

McShane (1994)

Down the Asphalt Path provides a history of streets and their use, from muscle-powered transportation in walking cities through 1917, when electric trolley use peaked and automobiles were becoming the dominant form of mechanized transportation. The book, based on McShane's dissertation, claims the automobile triumphed because it was more than just a form of travel. According to McShane, rapid acceptance grew because the motorcar was a status object and symbol of liberation.

In his chapter titled "The Motor Boys Rebuild Cities" McShane discusses the City Beautiful movement that was popular during the 1890s through the 1920s. City planners, architects, engineers and public-works czars (e.g., Robert Moses in mid-century New York) changed the physical appearance of urban areas with Olmstead-style parkways, Burnham-style boulevards and parking garages. McShane explains how major public works projects were made possible by new financial resources, such as the first gas taxes (imposed by Oregon in 1919) and toll facilities.

Although this book is focused on the interaction between automobiles and cities, it does address road building in rural areas. McShane claims the prevalence of two-lane farm-to-market roads is due to the domination of State legislatures by rural interests.

Surplus capacity in rural areas facilitates very low-density development, while congestion problems in urban areas are hindered by inefficient service delivery from fragmented local governments.

Polycentric Metropolitan Development Patterns

During the automobile age, decreasing transportation costs and the decline in manufacturing (corresponding to a rise of services) led to more polycentric urban forms. The literature on polycentric development is extensive, but the following nine works provide an adequate understanding of this body of knowledge. Contributions are discussed in chronological order.

Vance (1964)

In Geography and Urban Evolution in the San Francisco Bay Area, Vance describes the bay area as a modern day city of urban realms with the downtown peninsula just another component of the larger system. Witnessing booming suburbanization during the 1950s, Vance was quick to understand the fundamental change in urban form ushered in by the automobile. He relied on journey-to-work data to help establish the important concept of "urban realms." In contrast to the core-based connotation of the term "metropolis," Vance suggested "sympolis" to distinguish sub-areas that function together as peers of equal hierarchical position.

Vance (1977)

James Vance offers a concise answer to the question of "Why cities?" stating that some urban areas may be special purpose centers of government, religion or education, but generally their reason for being is economics. In his book This Scene of Man: Role and Structure of the City in the Geography of Western Civilization, Vance builds on the urban realm concept, pointing out the large geographic scale of modern cities limits daily interact to smaller realms. The differentiation of roles that occurs among urban realms also occurs for entire metropolitan areas in relationship to the rest of the nation, and even on a global scale for a few "primate" cities. According to Vance, as complexity and choice increases over time, the outlying realms become more independent from the historic core. To help understand the nature and extent of urban realms, he suggests consideration of the following: 1) terrain and topographic barriers, 2) overall size of the metropolis, 3) amount and type of economic activity and 4) geography of transportation within the region. (See page 411) Vance notes that transportation innovation is a main force in determining the scale of cities, but the full exploration of this topic was reserved for another book (Vance 1986).

Davis, Nelson and Dueker (1994)

The authors of the journal article titled "*The New Burbs: The Exurbs and Their Implications for Planning Policy*", survey new home buyers in the exurbs of Portland, Oregon, to discover "What types of people are moving to the exurbs?" "Why are these people moving to exurbia?" and "What impact does exurban living have on commuting?" Their results indicate that over half of the exurban migrants are already living in the metro area (i.e. moving out from the city and suburbs), changing only their residential location but with few job changes. The migrants to exurbia were predominantly white-collar workers with higher incomes, two wage earners and few single working adults. Because of these findings, the Internal Revenue Service county-to-county migration data should be very useful for documenting the extent of commuter sheds because many of the newcomers to exurbia are already living in the area and retain a regular commute to the same job. Motivations for exurban living were primarily a desire for more open space and rural amenities, with finding the best/most affordable house at the top of the list. Because they typically retained the same job, moving to the exurbs initially results in a longer commute. In the long run, exurban residents may seek out new jobs closer to home, but this question was beyond the scope of the point-in-time analysis.

Lewis (1995)

In a book edited by Emery Castle, Pierce Lewis discusses the "*Urban Invasion of Rural America: Emergence of the Galactic City*." Lewis describes the galactic city as traditional urban functions in a new spatial pattern with the limited access highway serving as the new main street. After passage of the 1956 Interstate Highway Act, rural landscapes became a locational amenity of the galactic city. This idea has been confirmed in several first-hand conversations between developers, realtors, farmers and the author (who lives in western Loudoun County, Virginia). As the area transitioned from rural to exurban, the "value" of farms is no longer connected to agricultural production from the land but rather, the economic reason for farms is to qualify the land for agricultural property tax exemptions.

Calthorpe and Fulton (2001)

In The Regional City, Peter Calthorpe and William Fulton discuss planning for the end of sprawl. Their work is linked to planners and architects who began realizing in the 1920s the fundamental change in the scale of urban areas due to the automobile and communications technology. Calthorpe and Fulton use the term "regional city" for the new metropolitan form characterized by car dependency, decentralized service-driven economy and communities of interest rather than communities of place. Most of their recommended policy changes (such as an endorsement of urban growth boundaries) are from a regulatory mindset. The authors use case studies of Portland, Seattle and Salt Lake City to illustrate the advantages of the emerging regional city that will have "transit, affordable housing fairly distributed, environmental preserves, walkable communities, urban reinvestments, and infill development." (See page 12)

My dissertation builds on the idea expressed by Calthorpe and Fulton regarding the role of each Metropolitan Planning Organization (MPO). These metropolitan-wide agencies provide a "policy and institutional framework that can serve as the foundation for a consistent regional strategy." (See page 62) The authors call for federal policies and investments to reinforce the regional city concept, pointing out federal dollars are often the single biggest source of funding for transportation construction and operations.

Champion (2001)

The article, "*A Changing Demographic Regime and Evolving Polycentric Urban Regions*," extends the field of housing demography (Myers, 1990) to the entire urban context. Champion's exploratory research is helpful in its description of Polycentric Urban Regions (PUR). It summarizes major demographic trends such as longer life expectancy and lower fertility, countered by increased immigration, as the driving force behind population growth (especially in America). The article concludes with a challenge to researchers to "pay more attention to the potentially important role of demographic developments in reshaping the urban region." (Page 674)

Dear (2002)

Michael Dear compiled book chapters to support the premise that Los Angeles and the "LA School" are successors to the Chicago School. The latter is monocentric and with a modernistic view that the center organizes the hinterland. In contrast, the new LA School is post modern, post polycentric and regards the hinterland as more important than the historic center. Dear describes a five-county southern California megalopolis with approximately 16 million people and suggest this area is the prototype for future urban development.

Lang (2003)

In the book Edgeless Cities, Robert Lang analyzed office development trends and discovered that most new space was not in older central cities or a few "edge cities" as documented by Joel Garreau, but rather in edgeless suburban locations. This finding is important for understanding modern metropolitan development because the dispersion of office jobs to the suburbs expands the sprawling commuter shed. According to Lang, "a revolution in metropolitan form occurred in the past several decades – the regional office hierarchy has been turned upside down." (See page 56) To explain this point, data on office floor area was tabulated by location (primary downtown, secondary downtown, edge cities or edgeless suburban space) and organized into a typology of metropolitan areas (see Figure 4-17). Examples of metropolitan areas are given for four types: core-dominated, balanced, dispersed and edgeless. Lang adds the findings of other researches on both sprawl and density measures to illustrate the complexity of metropolitan areas when examined from different perspectives.

Hackworth (2005)

"*Emergent Urban Forms or Emergent Post-Modernisms?*" is a complex journal article written for academics, yet it shares some methodological similarities with Hoyt's earlier (1939) analysis of urban form that was intended for more plebian distribution. Using extensive data sets at the census tract level for each decade from 1970 through 2000, Hackworth creates density gradients and maps to document similar patterns of urban development within the ten largest metropolitan areas in the United States. Rather than a quasi-random pattern, as postulated by postmodern urban theory, Hackworth finds similarities in the revitalization of inner cities, decline of inner-ring suburbs and continued outward expansion of suburbanization. Hackworth's analysis of population density gradients provides evidence for increasing polycentricity, but not randomness. According to Hackworth, "newer suburbs experienced an almost unqualified valorization." (Page 514) Although not the primary focus of his analysis, wealth accumulation through suburban real estate investment continues to be a powerful variable in explaining our emergent urban forms.

Megaregions in the Context of Global Cities

As the geographic scale of urban development increased over time, new terms have been introduced to aid our conceptual understanding. Early scholars used "megalopolis" but more recent works (Nelson and Lang 2007; Dewar and Epstein 2007) have suggested megaregion as a better way to extend the metropolitan concept to the larger "mega" scale. The following sections review a dozen scholarly contributions on megaregion development, arranged in chronological order.

Gottman (1961)

In 1961 the geographer Jean Gottman provided an in-depth analysis of the urbanized northeastern seaboard of the United States that he called Megalopolis. He gives credit for this term to an ancient philosopher in Alexandria, named Philo Judaeus, who used the name Megalopolis for the great city of ideas that commands our material world. Gottman presents evidence of how wealth and knowledge are concentrated in the modern day Megalopolis, with a new mix of businesses, finances, management, research, education, government and entertainment. According to Gottman, transportation and communications continue to be key support functions that demonstrate the integration of the region and require macro-scale infrastructure planning.

Pickard (1962)

The Urban Land Institute published two articles by Jerome Pickard on urban regions of the United States. Although he did not use the same term as Gottman, Pickard essentially described megalopolis as "continuous grouping, clustering and linking of cities and towns in close proximity with the majority of the population living in urban settlements." (1962: 3) The purpose of this article was to describe the current geography and demography of 21 urban regions, with projections of future conditions in 1980. Looking twenty years into the future, Pickard predicted 25 urban regions that would contain approximately two-thirds of the nation's population but only cover ten percent of the land area.

Regional Plan Association (1967)

The Region's Growth, published by the Regional Plan Association (RPA) in 1967, is an extensive study that complements Gottman's study of Megalopolis and Pickard's forecast of the urban region for the year 2000. Demographic data is presented for a 31-county area surrounding New York City and a larger 150-county area that extends from Boston to Washington, DC. The RPA describes this larger area as a "chain of cities, not a single super-city." (Page 8) Their concept of autonomous nodes is very similar to Vance's urban realms.

This book provides additional links to urban development literature through its discussion of New York as one of five world cities, including Tokyo, London, Paris and Moscow. Confidence in the continued growth of these cities is based on classic location theory (minimizing transportation costs) and agglomeration benefits associated with cities (lower transaction costs, enhanced communication and synergy of ideas).

The RPA provides five reasons for studying larger urban regions: 1) facilitating high-speed ground transportation, 2) locating airports and enhancing air travel, 3) providing adequate water, 4) ensuring major parks and recreation areas and 5) locating freeways. Their discussion of employment includes a useful distinction between population-leading jobs, such as manufacturing and high-end office jobs, versus population-following jobs such as retail and restaurant workers. The only weakness in the RPA study was their prediction that only a minor amount of office development would take place in scattered locations. (See page 117) It is understandable that RPA's worldview from Manhattan made it hard to foresee extensive suburban office development in unmarked edgeless cities as documented by Lang (2003).

Pickard (1970)

By 1970, Dr. Pickard was working for the U.S. Department of Housing and Urban Development and prepared an article for Futurist magazine titled "*Is Megalopolis Inevitable?*" Defining urban regions as areas of at least one million residents and a population density of at least three times the national average, Pickard extended his forecast of urban regions to the year 2000. In his discussion of planning implications due to urbanization, Pickard highlights government fragmentation as a significant problem. Pickard states "large metropolises are showing clear tendencies to become poly-nuclear" and "regional planning for clusters of urbanized areas in close proximity will become an absolute necessity." (Page 154)

Zelinsky, 1973

Cultural Geography combines anthropology and geography in mainly descriptive research. Zelinsky provides insight for understanding macro-scale development patterns. First, Americans highly esteem time and tend to measure distance by time, not physical units. Second, cultural geography implies self-awareness. Thus the Census Bureau's practice is to seek local input on defining geographic areas and affiliations.

We can use cultural geography to help us identify megaregion boundaries. For example, there is a significant cultural distinction between St. George, Utah (Mormon) and Las Vegas, Nevada (secular or humanistic). Given our mobile society, Zelinsky contends self-selection reinforces cultural geography and offers southern Florida and southern California as examples of urban regions that have strengthened their role as gateways to Latin America.

Fishman (1990)

The journal article, "*Megalopolis Unbound*" Fishman discusses America's new city that is symbolically represented by a network of superhighways uniting a region into a vast super-city. Changing commuting patterns is a key indicator of the new urban form. For example, Fishman summarizes 1980 census data indicating twice as many commuters traveled from suburb to suburb on their daily journey to work than suburb to central city. Thus the two primary shapers of the decentralized New City are the automobile and the single-family house. Fishman does not view the process through rose-colored glasses and frequently offers cautious speculation that the new city form could degenerate due to congestion and the lack of both diversity and vitality that characterize great cities.

Fishman offers a synopsis of how federal, state and local government has "indefatigably promoted expansion" through housing and fiscal policies, defense spending, highway construction and governance practices (1990: 35-36). In the latter category, Fishman discusses the combined forces of limited annexations and fragmentation of local governments whereby "developers learned they could play one small local planning board off another, escaping all control."

Sudjic (1992)

100 Mile City is an esoteric book that resonates with architects and planning theorists who love discourse on the reasons for our collective and individual behavior. Although I liked the book and generally agree with Sudjic commentary, I will limit my review to the subject matter related to my dissertation.

Sudjic's concept of the city is not tied to a literal 100 miles, but rather a nebulous, large area of overlapping force fields. For the affluent, home is the center of life but mobility is the lifeblood that energizes world cities. In contrast to the Regional Plan Association's top-five list of world cities, Sudjic does not acknowledge Moscow, but includes LA with New York, London, Paris and Tokyo. These five financial centers dominate cultural life, have more in common with each other than the counties that surround them, and are becoming increasingly polarized (i.e. very rich and very poor).

In his chapter on the world of work, Sudjic points to the changing pattern of employment as a key reason for the geographic spread of cities as they become dotted with high-intensity activity centers. His discussion of freeway vs. metro (transit) also concludes that door-to-door travel time is the key determinant of distance.

Meinig (2004)

The Shaping of America: A Geographical Perspective on 500 Years of History is the fourth book in a series, focusing on the timeframe of 1915 through 2000. In his discourse on regionalism, Meinig makes a good case for defining regions depending on their collective functions, with cohesiveness at the grassroots level being a prerequisite for success. He describes America as a "bicoastal" nation that has become more balanced over time through growth in the south and west. Meinig supports this claim with data on the change in congressional seats from 1950 through 1990 when the northeast and mid-west lost seats that were gained by California (22), Florida (15) and Texas (8). (See map on page 288)

Carbonell and Yaro (2005)

In their 2005 article "*American Spatial Development and the New Megalopolis*" Carbonell and Yaro cite spatial development policies and practices in the European Union as a model for America to emulate. The authors make the connection between the American megalopolis (Boston to Washington, DC) and similar networks of cities in Europe and Asia. Carbonell and Yaro state "Major public and private investments are being made in high-speed rail, broadband communications and other infrastructure to strengthen transportation and economic synergies." (Page 2) The precedent for federal coordination of national infrastructure system has already been set in the provision of freight railroads, airports and interstate highways. Carbonell and Yaro suggest the federal government could also lead in coordinating infrastructure planning for inter-modal, high-speed transportation networks. The article concludes with a call for governance and funding changes to acknowledge that megaregion areas "capture the true economic and social geography of their communities. And they have the size, capacity and expertise to undertake complex planning strategies." (Page 4)

Taylor and Lang (2005)

"*U.S. Cities in the World City Network*" is relevant to my dissertation research in its concepts and methods. It essentially operationalizes Castells (1996) concept of "space of flows" and provides a broad, systems perspective on the complexity and interdependencies of networked cities. Possible indicators of megaregion boundaries may include airport hubs and feeder areas; pro football teams; and market areas used by businesses.

Hall and Pain (2006)

The book Polycentric Metropolis: Learning from Mega-City Regions in Europe discusses many of the same concepts and public policy issues as the megaregion studies being conducted in the United States. The terminology and geographical units require "translation" but appear to be similar trains on parallel tracks. For example, this book uses the term "Mega-City Region" (MCR) as an equivalent to "megaregion" used by American researchers. The central hypothesis, confirmed by their study, is that MCRs are polycentric and becoming more so over time.

The EU is dealing with similar dynamics and problems as those existing in American megaregions: 1) unsustainable sprawl, 2) suburb-to-suburb commuting that is impossible to serve with public transportation, 3) social and spatial fragmentation, and 4) lack of governance and policy instruments. Hall and Pain state, "Functional regional inter-linkages should be facilitated by addressing specific issues that cannot be resolved through market processes, such as investment in large-scale infrastructure. Transport is highlighted as a crucial area for management as well as investment." (Page 121) The Mega-City Region is acknowledged by the authors as having great policy importance for "transportation infrastructure, education, housing and urban planning." (Page 198)

Vicino, Hanlon and Short (2007)

The findings of Vicino, Hanlon and Short's 2007 journal article, titled "*Megalopolis 50 Years On: Transformation of a City Region*," are consistent with major themes in the literature. The authors use new quantitative methods to reveal fine-grained transformations in the built environment over time. The authors use place-level census data in a principal component analysis to derive five composite variables that focus on: income/education, poverty, immigrants/renters, older-housing and Black/government workers. Component scores for each place became the data inputs for a cluster analysis yielding five neighborhood typologies: 1) affluent places, 2) places of poverty, 3) Black middle-class places, 4) immigrant gateways and 5) middle-America places. The re-evaluation of Megalopolis upholds the original concept and basic urban form, even though the area has experienced significant transformations. In their conclusion, Vicino, Hanlon and Short highlight five trends: 1) wealth and education remain the major determinants of the social landscape, 2) polarization is increasing, even in the suburbs, 3) immigrant gateways have now extended into the suburbs, 4) decaying inner rings and growing outer rings are the prevalent suburban pattern, and 5) Black middle-class places have emerged, especially near Washington, DC and Baltimore.

METHODS

Through its quantitative approach, this dissertation provides a rigorous methodology for determining additions to metropolitan statistical areas and the geographic extent of future metropolitan-scale commuter sheds. County-to-county Internal Revenue Service (IRS) migration data were used to evaluate metropolitan connectivity. Also, this section describes methods used to evaluate megaregion scale development.

Model for Crafting Urban Areas

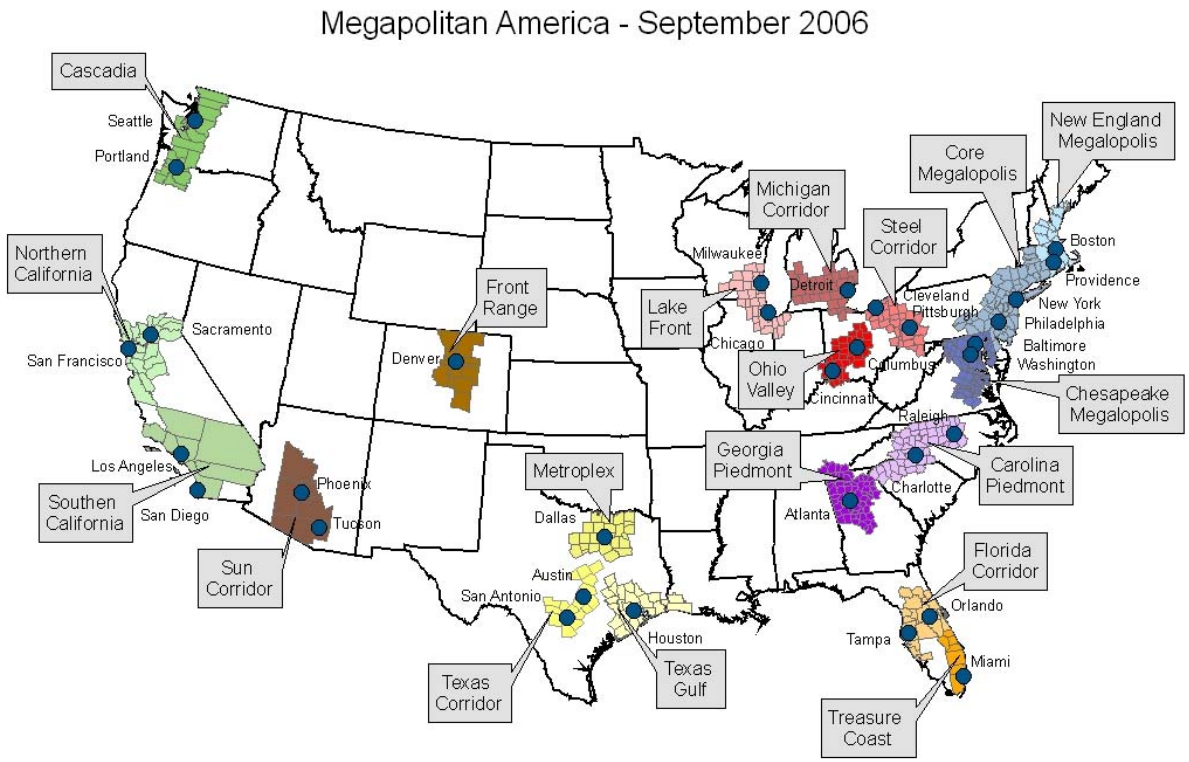
Frank (1994) demonstrated the effects of urban form on travel behavior, indicated by factors such as employment density at the census tract level. At the urban scale, it is the concentration of population and jobs that creates the sense of space associated with urban environments. Current methodologies that only examine residential density do not accurately indicate the extent of urban areas and only reflect one end of home-based work trips.

Although small-area job data has been a major weakness in transportation planning efforts, a new federal program is making valuable progress in plugging this data-gap. Longitudinal Employer-Household Dynamics (LEHD) is formulating cooperative arrangements with federal, state and private sector sources to provide detailed job data necessary for understanding commuter flows at the sub-county level. The primary data source for this innovative program is the quarterly workforce report required of employers as part of the federal unemployment insurance program. Although the identification of urban areas is only a minor topic in this dissertation, LEHD data was used to evaluate metropolitan scale connectivity as described further in the following section.

Model for Crafting Metropolitan Commuter Sheds

Urban areas, or realms, aggregate to form metropolitan-scale commuter sheds. The major methodological change proposed in this dissertation is to transition away from only evaluating commuting to the core-based central county(s). In recognition of current polycentric urban form, the recommended approach is to determine net worker inflow or outflow for each county, which can be summed to identify commuter sheds. As a general rule of thumb, researchers have identified a 100-mile radius (from center to edge) as indicative of metropolitan commuter sheds. (Friedmann and Miller 1965; Sudjic 1992; Davis, Nelson and Dueker 1994) The expected geographic pattern for metropolitan commuter sheds should be similar to Combined Statistical Areas but larger than most MPO areas. Commuter sheds were evaluated for 22 statistical areas, selected from the megapolitan areas designated by Lang and Nelson (2007) and shown below in Figure 8.

Figure 8 – Megapolitan America (September 2006)



To select the specific areas to evaluate, I made a composite list of projected population plus jobs in 2030 for each Combined and Metropolitan Statistical Area (using OMB's 2005 definitions). I sorted the list of statistical areas in descending order and numbered the 22 commuter sheds to be evaluated, as shown in Figure 9. Rows with grey shading and regular font are the "second-tier" statistical area in their respective megaregion. In other words, I will evaluate New York not Philadelphia, Los Angeles not San Diego, Tampa not Orlando, San Jose not Sacramento, Cleveland not Pittsburgh and Cincinnati not Columbus. The rows with light blue shading and italic font are statistical areas that might not qualify as a megaregion area when evaluated from a transportation perspective. These are geographically isolated areas that lack connectivity to adjacent metropolitans and do not function as global gateways (i.e. no significant international air travel and lacking a seaport). Although Denver has similar locational characteristics as Minneapolis, St. Louis and Kansas City, it was evaluated due to its prior designation as the Front Range Megaregion in *Planning* Magazine. Las Vegas and Indianapolis (see the rows with black shading and white letters) are potential additions to megaregion areas that were not previously identified in *Planning* Magazine.

Figure 9 – Projected Population plus Jobs in 2030 by Statistical Area

Rank	2005 SA #	2005 SA Title	# Co.	Population Plus Jobs
1	408	New York-Newark	30	40,943,667
2	348	Los Angeles-Lon	5	35,689,044
3	176	Chicago-Napervi	16	19,836,807
4	548	Washington-Balt	28	19,425,765
5	488	San Jose-San Fr	11	15,697,096
6	148	Boston-Worceste	17	15,171,254
7	206	Dallas-Fort Wor	19	14,682,006
8	33100	Miami-Fort Laude	3	13,174,256
9	288	Houston-Baytown	12	12,382,201
10	122	Atlanta-Sandy S	33	12,286,774
	428	Philadelphia-Ca	13	12,151,680
11	38060	Phoenix-Mesa-Sco	2	10,317,911
12	220	Detroit-Warren-	9	9,811,247
13	500	Seattle-Tacoma-	7	8,751,268
	378	*Minneapolis-St.*	*18*	*8,307,594*
14	*216*	*Denver-Aurora-B*	*11*	*7,124,558*
	41740	San Diego-Carlsb	1	6,973,834
15	45300	Tampa-St. Peters	4	6,034,993
	422	Orlando-The Vil	5	5,816,156
16	332	Las Vegas-Parad	2	5,596,157
	472	Sacramento--Ard	6	5,439,169
	476	*St. Louis-St. C*	*17*	*5,415,318*
17	184	Cleveland-Akron	8	5,339,856
18	172	Charlotte-Gasto	13	5,109,647
19	38900	Portland-Vancouv	7	4,757,125
	430	Pittsburgh-New	8	4,701,058
	312	*Kansas City-Ove*	*17*	*4,503,124*
20	178	Cincinnati-Midd	16	4,340,337
	198	Columbus-Marion	12	4,328,116
21	294	Indianapolis-An	15	4,290,725
22	41700	San Antonio, TX	8	4,280,540
		Total for Continental United States	3,076	620,970,356

Source: Projections from Woods & Poole Economics, Inc. (2007) compiled by DPG, Metropolitan Institute, 09/27/07.

Model for Crafting Megaregions

For the purpose of transportation governance, this dissertation recommends large-scale megaregions comprised of multiple metropolitan commuter sheds where the urban centers are approximately 400 miles apart. As interstate commerce justifies interstate highways, so does global commerce justify megaregion scale transportation infrastructure. Globalization and the importance of world cities in modern economies is clearly linked to transportation gateways such as airports, seaports, high speed rail service and its connection to multi-modal terminals within our largest cities. (Noeyelle 1983; Sudjic 1992; Taylor and Lang 2005; Hall and Pain 2006)

To identify megaregion areas suitable for high speed rail service, county boundaries provide adequate geographic areas for demographic analysis because of inherent differences between intra-urban transit rail service and inter-city high-speed rail service. The former makes frequent stops and works best along high-density corridors. The latter is center-to-center service that makes few stops. For high-speed rail, population and job density along the corridor is not as important as the magnitude of population and jobs accessible to multi-modal terminals within urban centers.

Databases

Spatial and tabular databases used in the dissertation are described below.

GIS Files

Multiple Geographic Information System (GIS) files were downloaded from various federal government web sites for use in this dissertation. GIS files were decompressed, edited to remove areas outside of the continental United States and converted to the Albers equal-area projection (USGS continental) to provide consistent spatial alignment of the various data layers. Datasets used in this analysis include: Counties, Combined Statistical Areas, Metropolitan Statistical Areas, Urbanized Areas and the National Highway Planning Network line segments.

Because Woods & Poole county equivalents are not identical to federal government GIS and demographic data, the latter were edited and aggregated to match the Woods & Poole geography. Figure 10 lists the counties or independent cities that were aggregated to match the Woods & Poole county equivalents.

Figure 10 – Conversion of Census Geography to W&P County Equivalents

W&P "FIPS"	*County Name*	*Additional Areas*	*2000 FIPS for Areas Combined*
04027	La Paz, AZ	Yuma	04027 and 04012
35061	Valencia, NM	Cibola	35061 and 35006
51901	Albemarle, VA	Charlottesville	51003 and 51540
51903	Allegheny, VA	Clifton Forge and Covington	51005, 51560 and 51580
51907	Augusta, VA	Staunton and Waynesboro	51015, 51790 and 51820
51909	Bedford, VA	Bedford City	51019 and 51515
51911	Campbell, VA	Lynchburg	51031 and 51680
51913	Carroll, VA	Galax	51035 and 51640
51918	Dinwiddie, VA	Colonial Heights and Petersburg	51053, 51570 and 51730
51919	Fairfax, VA	Fairfax City and Falls Church	51059, 51600 and 51610
51921	Frederick, VA	Winchester	51069 and 51840
51923	Greenville, VA	Emporia	51081 and 51595
51929	Henry, VA	Martinsville	51089 and 51690
51931	James City, VA	Williamsburg	51095 and 51830
51933	Montgomery, VA	Radford	51121 and 51750
51939	Pittsylvania, VA	Danville	51143 and 51590
51941	Prince George, VA	Hopewell	51149 and 51670
51942	Prince William, VA	Manassas and Manassas Park	51153, 51683 and 51685
51944	Roanoke, VA	Salem	51161 and 51775
51945	Rockbridge, VA	Buena Vista and Lexington	51163, 51530 and 51678

51947	Rockingham, VA	Harrisonburg	51165 and 51660
51949	Southampton, VA	Franklin City	51175 and 51620
51951	Spotsylvania, VA	Fredericksburg	51177 and 51630
51953	Washington, VA	Bristol	51191 and 51520
51953	Wise, VA	Norton	51195 and 51720
51958	York, VA	Poquoson	51199 and 51735
55901	Menominee, WI	Shawano	55078 and 55115

Exogenous Variables from Woods & Poole

Past (1990 and 2000) and projected population, median age and jobs (i.e. employment by place of work) for each county in the continental United States were obtained from Woods & Poole Economics, Inc. Additional exogenous variables used in the logistic regression models are Gross Regional Product (GRP) and a proprietary Woods & Poole "Wealth Index" for each county in the continental United States. GRP is reported in millions of constant 2004 dollars. According to the technical documentation, Wealth Index is "a measure of the relative total personal income per capita, weighted by source of income....Relative income per capita is weighted positively for a relatively high proportion of income from dividends, interest and rent, and negatively for a relatively high proportion of income from transfer payments. Since dividends, interest and rent income are a good indicator of assets, the Woods & Poole Wealth Index attempts to measure relative wealth." (2006: 33-34)

Daytime Population

In both 1990 and 2000 the Census Bureau tabulated long-form responses on commuting patterns, published as part of the Census Transportation Planning Package (CTPP) or available on the internet as "County-to-County Worker Flow" files. These sources provide detailed data on workers (16+ years old) and the county in which they worked during the week prior to the census date. In addition to indicating journey-to-work patterns, the data are summarized by place of work to yield the number of jobs in each county. A concise, county-level summary of the worker flow data is available from the Census Bureau under the title, "Estimated Daytime Population and Employment-Residence Ratios." A sample of this database is shown in Figure 11.

Figure 11 – Daytime Population and Employment from Census Bureau

Census 2000 PHC-T-40. Estimated Daytime Population and Employment-Residence Ratios: 2000

Table 2. The United States, States, Counties, Puerto Rico, and Municipios

NOTE: Data based on a sample. For information on confidentiality protection, sampling error, nonsampling error, definitions, and count corrections see http://factfinder.census.gov/home/en/datanotes/expsf3.htm.

FIPS state code	FIPS county code	Total resident population	Total workers working in the area	Total workers living in the area	Estimated daytime population	Daytime population change due to commuting		Workers who lived and worked in the same county		Employ-ment residence ratio	Area name
						Number	Percent	Number	Percent		
(1)	(2)	(3)	(4)	(5)	(6) = (3)+(4)-(5)	(7) = (6)-(3)	(8) = (7)/(3)*100	(9)	(10) = (9)/(5)*100	(11) = (4)/(5)	
		281,421,906	128,168,928	128,279,228	281,311,606	-110,300	0.0	94,052,108	73.3	1.00	**United States**
01		4,447,100	1,863,386	1,900,089	4,410,397	-36,703	-0.8	1,421,893	74.8	0.98	**Alabama**
01	001	43,671	11,619	19,808	35,482	-8,189	-18.8	7,871	39.7	0.59	Autauga County
01	003	140,415	52,198	62,219	130,394	-10,021	-7.1	45,208	72.7	0.84	Baldwin County
01	005	29,038	11,460	10,023	30,475	1,437	4.9	8,370	83.5	1.14	Barbour County
01	007	20,826	4,298	7,875	17,249	-3,577	-17.2	3,199	40.6	0.55	Bibb County

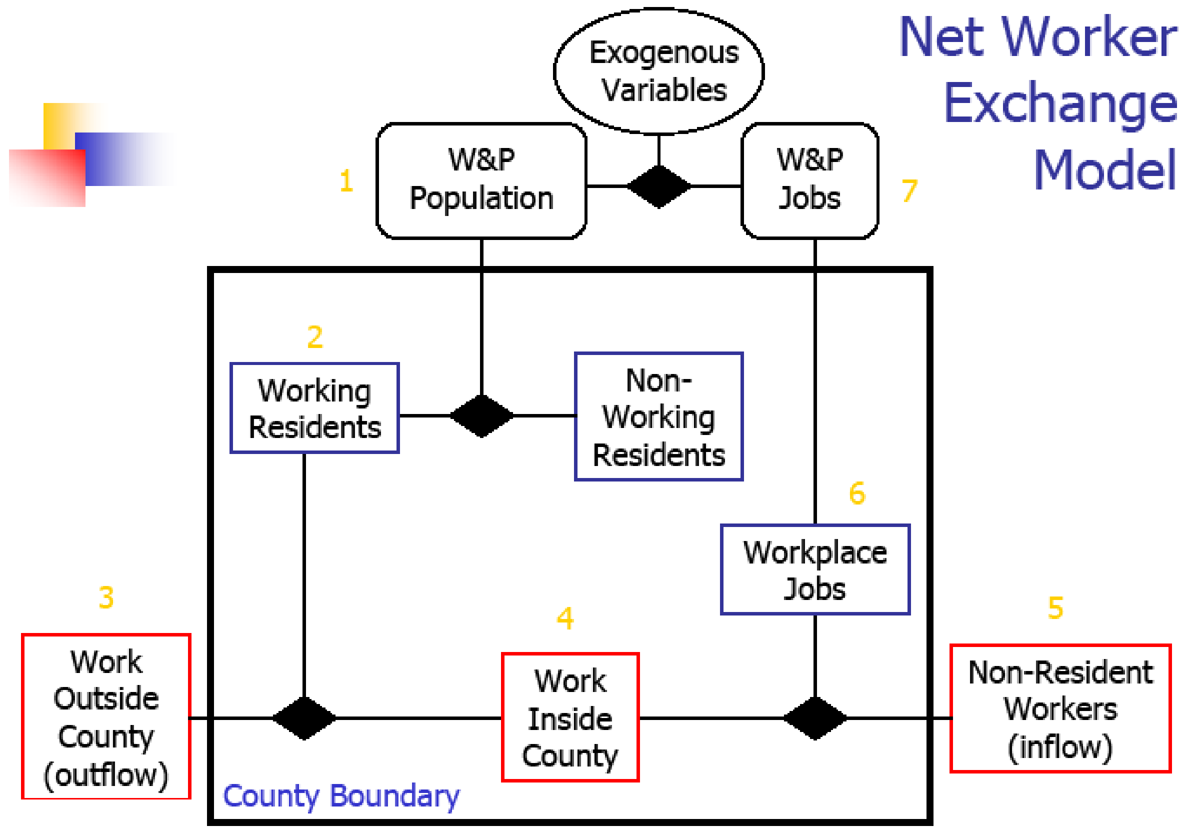
Net Worker Exchange

A key metric for this dissertation is the concept of net worker exchange that builds upon the daytime population analysis described above. In terms of complexity, net worker exchange occupies the middle-ground between the simple concept of jobs-housing balance and the complexity of commuter-flow data needed for the classic, four-step, computerized transportation model. (Meyer and Miller 2001) A static picture of jobs and housing units in a community has limited utility because of dynamic commuting patterns. For example, in Alexandria Virginia where the Metropolitan Institute is located, the community has a balanced jobs-housing ratio, yet there is significant commuting because many service jobs are filled by workers who can not afford to live in Alexandria and many of the higher income residents of Alexandria have jobs in the greater Washington DC area.

The Census Bureau's core-based statistical areas are conceived as concentric rings with counties used as boundaries to delineate the geographic area either inside or outside the statistical area. In contrast, metropolitan commuter sheds might include multiple employment centers in a large geographic area in which counties form "seams" or "links" between trip attractors. Given the different concepts, metropolitan commuter sheds evaluations are not concerned with the details of specific county to county flows, but the overall balance between worker inflows and outflows.

Net worker exchange, illustrated in Figure 12, is a useful measure for identifying the geographic extent of commuter sheds. For each county, worker outflow is subtracted from worker inflow to yield the net worker exchange. To reveal the extent of the commuter shed, the net worker flow for each county is summed until the counties that function as employment centers (i.e. net inflow of workers) are balanced with the counties that serve as bedroom communities (i.e. net outflow of workers).

Figure 12– Net Worker Exchange Model



As shown in the above diagram, the number of non-resident workers (i.e. inflow) is derived by subtracting resident workers (i.e. those working inside their county of residence) from the total number of workplace jobs. For consistency in deriving the commuter shed balance, inflow workers will be assigned a positive number and outflow workers will be assigned a negative number.

Variables in the Database

A large SPSS database was created for this dissertation research. There are 3,076 cases, or units of analysis, which are Woods & Poole county equivalents. The database includes 159 variables, with the large number of variables partly due to several time periods for each variable type. For example, most variables will include historic data for 1990, 2000 and 2005, plus projected data for 2010, 2015, 2020, 2025 and 2030. To save space, Figure 13 has hidden rows indicating multiple years that are not shown in the list of variables.

Figure 13– List of Variables in SPSS Database

#	*Name*	*Label*
1	wpco	WP_FIPS
2	name	WP_County
3	T22_2005	Top22ComShedsBeforeEdits
4	T22CShed35	Top22ComShedsAfterEdits
6	state	
7	CSAorMulti	CSA2005 ~= '' | MultiCoMetro = 1 (FILTER
8	CSA2005	
9	CSA_title	
10	Metro2005	
13	MultiCoMet	1=yes
14	Metro_title	
15	GRP90	WP_Gross Regional Product (2004$M)
23	WI90	WP_Wealth Index
31	pop90a	WP_Population
39	jobs90a	WP_Jobs
47	jobs10adj	AdjJobs(PctReductionForIn/OutBalance)
52	wkrpctchg	90to00WkrToPopPctChange
53	wkrpop90a	WkrToPopRatio90a
61	porwkrs90a	WkrsByPlaceOfRes
64	aawkrs10p	AgeAdjustedWkrs
69	otflwpctch	90to00OutflowToWkrPctChange
70	outpct90a	OtflwToWkrsRatio
78	outflw90a	OutflowWkrs
86	otbws90a	OutboundWkrShare(pct*-100)
94	wrkincor90	WrkInCoOfResidence
102	wkplwp_pc	90to00WkplToWPJobsPctChange
103	wkplwp90a	CTPPwkplToWPJobsRatio90a
111	wkpljobs90	WorkplaceJobs90a
119	nrwkrs90a	NonResidentWkrs(inflow)90a
127	inbws90a	InboundWkrShare(pct*100)
135	netwkrx90a	NetWkrExchange90a
143	medage10p	WP_MedianAge2010
148	ageadj10p	AgeAdjustmentFactor
153	PRE_1	PredictedProbEmplCtrs2030
154	PGR_1	PredictedGroup
155	PRE_2	PredictedProbBdrmCo2030
156	PGR_2	PredictedGroup
157	PopJobs2000	PopPlusJobs2000
158	PopJobs30	WPpop+jobs2030
159	PJNetIncr	NetIncrPopJobs2000to2030

Database Refinement

After creation of the net worker exchange database, aggregate comparisons were made of worker inflow and outflow for each of the projection years. Conceptually aggregate workers for the entire continental U.S. should roughly match the number of workplace jobs. Also, the number of workers that leave their county of residence for work (i.e. outflow) should be approximately the same as the number of nonresident workers that flow into another county. Initially the 3,076 county equivalents in the database showed a significant aggregate increase in worker inflow over time due to the fact that Woods & Poole job projections increased faster than population projections. To achieve better commuter balance for the entire continental U.S., two universal refinements were applied to every county in the database. These refinements are described in the next two sections.

Age-Adjusted Workers

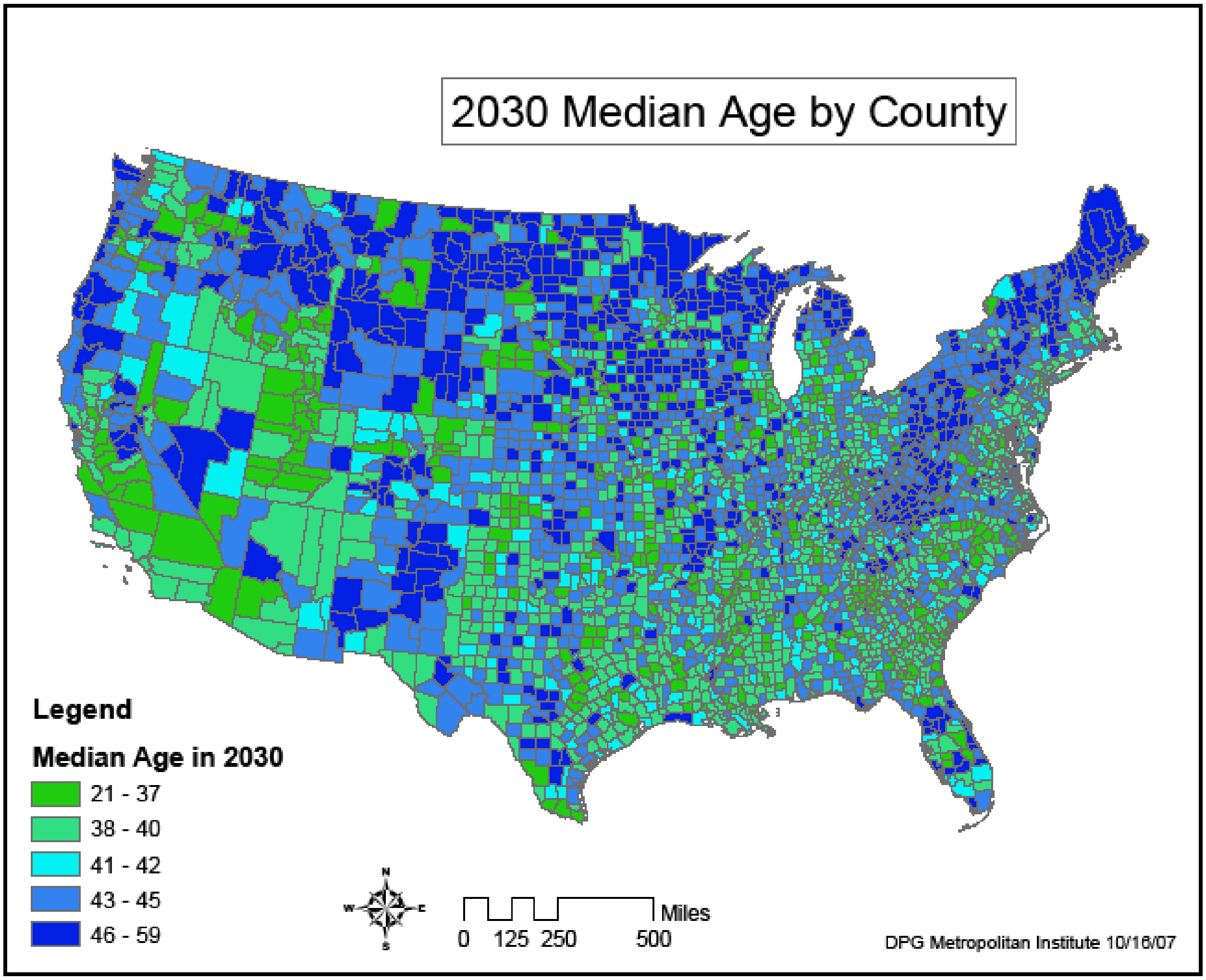
Median age varies significantly across the continental U.S. with metropolitan, fast-growth areas generally younger than rural areas that have stable (or even declining) populations. (Katz and Lang 2003; Berube, Katz and Lang 2006) Also, population and labor force pyramids prepared by Toossi (2002) indicate a strong correlation between these variables when graphed in five-year age cohorts. Given these relationships, projected median age by county (see Figure 14) was used to increase or decrease the projected number of workers within each county. Age-adjusted workers were derived for each year in the net worker exchange database (i.e. 2010, 2015, 2020, 2025 and 2030) but only the specific calculations for 2030 will be explained in detail.

According to Woods & Poole (2007) median age by county in 2030 ranges from a low of 20.97 years in Madison, Idaho to a high of 59.20 years in Curry, Oregon. If a county is younger than the projected national median age of the labor force (40.0 years in 2030 as shown in Figure 6 of Toossi 2002), more persons are in the labor force and we expect an increase in the number of workers. In the case of Madison, Idaho the specific calculations are shown in the following formula [1 + (((40 - 20.97)/40)/3) = 1.16]. In other words, the maximum age-adjustment for the youngest county was an increase of approximately 16% to the number of workers in Madison County, Idaho. At the other extreme, the maximum age-adjustment for the oldest county was a decrease of approximately 16% to the number of workers in Curry County, Oregon, as derived from the following formula [1 – (((59.2 - 40)/40)/3) = 0.84].[2]

The number "3" in the above formulas is a dampening factor that referenced a cell in the database worksheet used to conduct "what-if" evaluations obtained by increasing or decreasing the value. With a dampening factor of "9" in 2010, adjusting the number of workers by median county age adequately balanced the aggregate net worker exchange in 2010. Because Woods & Poole expects jobs to increase faster than population, more age-adjustment (i.e. less dampening) was required to balance aggregate net worker exchange over time.

[2] Multiplying by 0.84 is mathematically the same as reducing the total by 16%.

Figure 14 – Projected Median Age by County in 2030



After making the age-adjustments described above, the ratio of workers to population were compared to actual and projected labor force rates. As shown in the bottom row of Figure 15, the difference between labor force and the number of workers (also know as the unemployment rate), reasonably fluctuates from a low of 4.4% to a high of 7.7%. Based on this evaluation, the county-by-county age adjustments to the projected number of workers seems to yield reasonable results that are consistent with the projected labor force rates published by Toossi (2002).

Figure 15 – Comparison of Labor Force and Worker Rates

Economic Dependency Ratio

	1970	1980	1990	2000	2010	2020	2030
Persons Not in Labor Force	140.4	108.9	98.3	93.9	90.3	97.4	106.4
Persons in Labor Force	100	100	100	100	100	100	100
Total Persons	240.4	208.9	198.3	193.9	190.3	197.4	206.4
Pct in Labor Force	41.6%	47.9%	**50.4%**	**51.6%**	**52.5%**	**50.7%**	**48.4%**

Source: Table 7, "A Century of Change: U.S. Labor Force, 1950-2050" by Mitra Toossi, Monthly Labor Review, Bureau of Labor Statistics, May 2002.

Net Worker Exchange Data (in millions)

	1990	2000	2010	2020	2030
	Actual		Projected		
Age-Adjusted Workers	114.24	127.43	139.08	149.67	160.96
Population	248.0	280.4	309.8	341.0	375.7
Pct Working	**46.1%**	**45.4%**	**44.9%**	**43.9%**	**42.8%**
Labor Force to Worker Difference	4.4%	6.1%	7.7%	6.8%	5.6%

Universal Percentage Reduction in Jobs

The second universal adjustment to the database was a percentage reduction in the number of projected jobs for each county. To balance aggregate worker outflows and inflows, the following percentage adjustments in projected jobs were required: 1.5% reduction in 2015, 2.6% reduction in 2020, 3.4% reduction in 2025, and a 3.7% reduction in 2030.

Individual County Adjustments

Figure 12 above illustrates key relationships and the components used to derive the net worker exchange for each county. The diamond shapes represent individual county adjustments that account for demographic changes over time. The Net Worker Exchange Model includes three "demographic dials" that extrapolate past trends (based on actual 1990, 2000 and 2005 data) into the future. The three demographic dials derive ratios for workers to population, outflow workers to resident workers (i.e. outflow percentage) and CTPP workplace jobs to BEA jobs.

The first demographic dial accounts for the changing ratio of workers to total population from 1990 to 2000. For larger counties, the American Community Survey has also published 2005 data. If three data points were available, I derived a trend line forecast of the worker percentage for 2010, 2015, 2020, 2025 and 2030. If only two data points were available for a county, I used a logarithmic curve to project the worker percentage over time. A logarithmic curve increases or decreases at an ever decreasing rate. In other words, the 1990 to 2000 change is moderated over time as the curve flattens out.

A similar process was followed to project outflow worker percentage, which is the second demographic dial. As illustrated in Net Worker Exchange Model diagram, subtracting the number of outflow worker from the total number of working residents yields the number of people who work in their county of residence. If necessary to avoid illogical results (discussed further below), the outflow percentage was manually increased until the spreadsheet indicated a minor amount of worker inflow for the county.

A third demographic dial was required to account for the difference between CTPP jobs used in the daytime population methodology published by the Census Bureau and the typically larger number of jobs reported by Woods & Poole. Using actual county data for 1990 and 2000, I used a logarithmic curve to project the ratio of CTPP to BEA jobs for each county in 2010, 2015, 2020, 2025 and 2030. Over time, the CTPP to W&P job ratio declines from an aggregate average of 0.716 in 2010 to 0.685 in 2030. The third demographic dial was rarely used to make individual county adjustments except to counter apparent CTPP data problems in the following counties: 1) Bexar (San Antonio); 2) Hillsborough (Tampa); 3) Broward (Ft. Lauderdale) and 4) Dade (Miami).

By separately deriving ratios and then applying them to the independent variables, it was easier to identify and correct illogical results. The most common database problem was a negative number of non-resident workers (i.e. inflow). This is an illogical result because it would mean there were more residents working in the county than workplace jobs in the county. To correct this problem, the outflow percentage could be manually increased or the percentage of working residents could be decreased to yield a smaller number of workers going to jobs located in their county of residence. The most appropriate adjustment was made based on the geographic and demographic characteristics of the individual county. For example, in Maricopa County (greater Phoenix, Arizona) increasing the outflow percentage is not possible because there is no adjacent county that functions as an employment center capable of receiving the additional workers. Therefore, the most appropriate adjustment for this county was to reduce the percentage of workers relative to the total population.

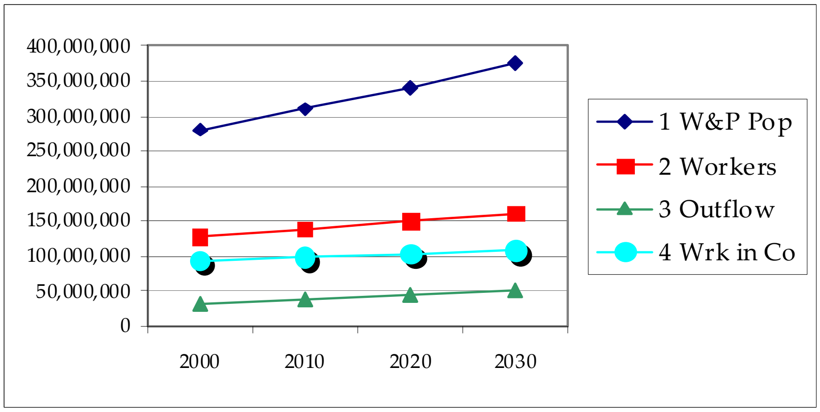
Evaluation of Refinements

After making the database refinements described above, aggregate data were re-evaluated to confirm that commuter balance had been achieved for the entire continental United States. Figure 16 summarizes the seven key variables used in the net worker exchange model. For ease of comparison, the row numbers shown in the first column below are the same as those in the graphic depiction of the Net Worker Exchange Model.

Figure 16 – Aggregate Data for Seven Key Variables

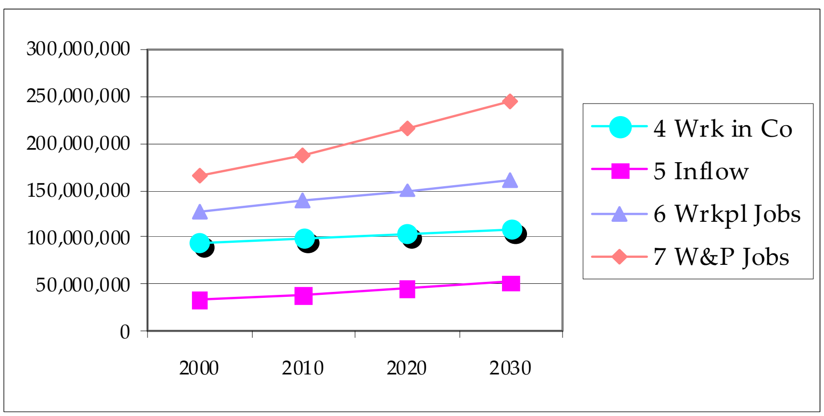
Residential Variables

	2000	2010	2020	2030
1 W&P Pop	280,377,306	309,819,241	341,021,129	375,681,545
2 Workers	127,412,089	139,079,136	149,674,640	160,958,282
3 Outflow	**33,201,364**	**39,406,838**	**45,405,287**	**52,078,213**
4 Wrk in Co	94,210,725	99,672,298	104,269,353	108,880,069



Nonresidential Variables

	2000	2010	2020	2030
4 Wrk in Co	94,210,725	99,672,298	104,269,353	108,880,069
5 Inflow	**33,099,651**	**39,282,278**	**45,571,381**	**52,311,463**
6 Wrkpl Jobs	127,310,376	138,954,576	149,840,734	161,191,531
7 W&P Jobs	165,600,481	187,282,722	216,285,363	245,288,811
Out/In Ratio	**1.00**	**1.00**	**1.00**	**1.00**



Source: #1 and #7 from Woods & Poole Economics, Inc. 2007.
#2 - #6 from Net Worker Exchange Database, DPG 09/27/07.

Analysis

The five major analytical processes used in the dissertation are described below.

Logistic Regression Yielding Predicted Employment Centers

The "Employment Centers" model is applicable to counties with a positive net worker exchange in 2030 and was used to indicate the likelihood of an individual county becoming a future statistical area. The following independent variables were used in logistic regression model: 1) workplace jobs, 2) non-resident workers (inflow), 3) inbound worker share, and 4) gross regional product.

Logistic Regression Ranking of Bedroom Communities

A "Bedroom Communities" model predicts the likelihood of an individual county becoming part of a statistical area by applying a logistic regression to counties with negative net worker exchange in 2030. The four independent variables included in the bedroom communities model are: 1) place of residence workers, 2) outflow percentage, 3) outflow workers (absolute), and 4) wealth index.

Net Worker Exchange Evaluation of Major Commuter Sheds

The steps used to determine the commuter shed balance for a metropolitan area are listed below:

1. Using SPSS software, create a case summary report that sums net worker exchange by statistical area in the year 2030.

2. Using SPSS software, create and save in the database a predicted probability score for "bedroom counties" (i.e. those with net outflow of workers in 2030) using the logistic regression model described above.

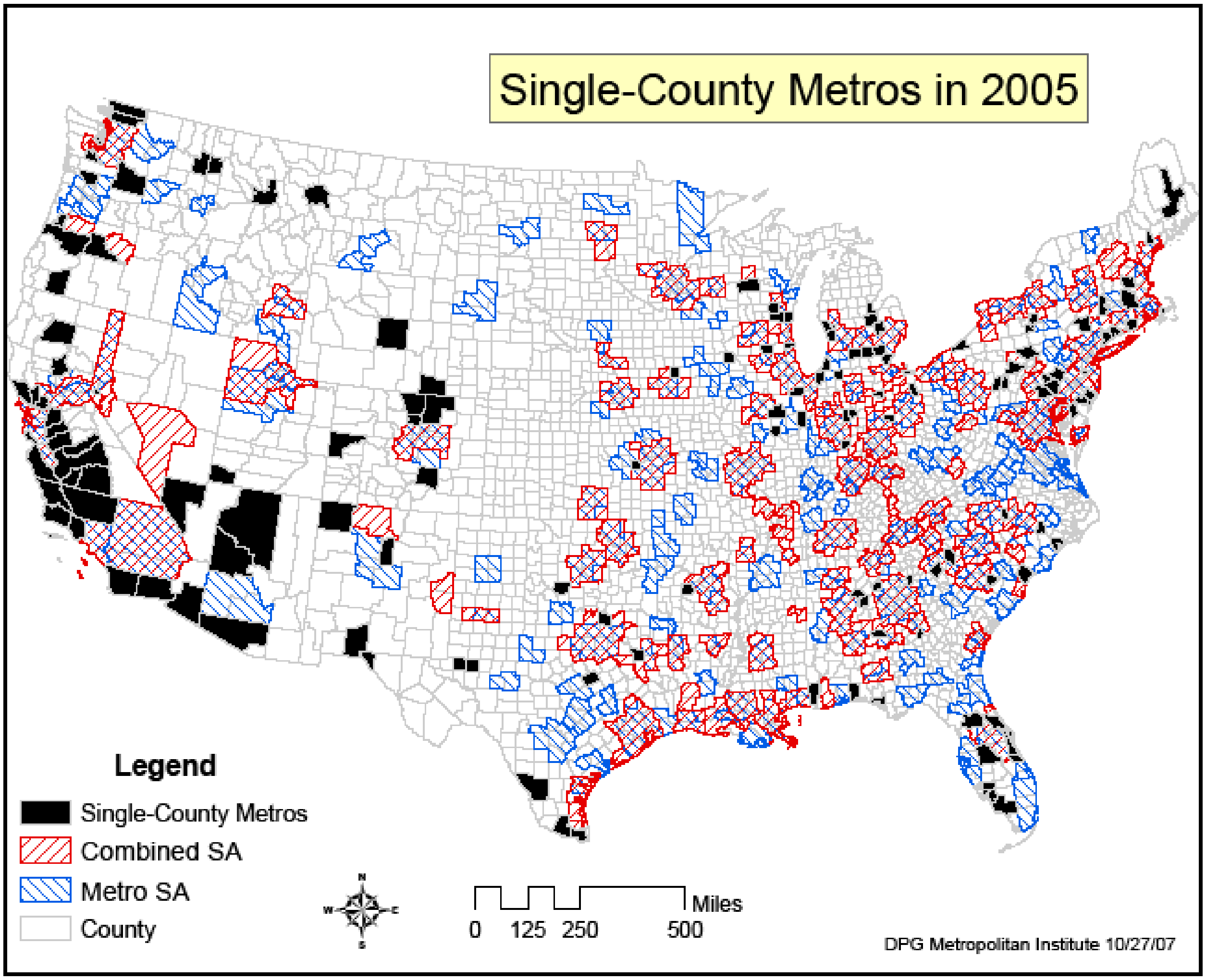
3. Save the SPSS database as a DBF file, switch to ArcMap and join the DBF file to the shapefile of Woods & Poole county equivalents.

4. Using ArcMap, select by location the counties that intersect the existing CSA boundary of the metropolitan area being analyzed. Open the database file in its own window and show only the selected counties. Rank order (sort descending) the selected counties according to their predicted probability score. Counties already included in the CSA will be at the top of the list with a score of one; under these is a rank-ordered list of counties that should be individually added until a net worker flow balance is achieved.

The following rules were followed to determine commuter shed boundaries. If an existing CSA had a negative worker exchange in 2030, indicating workers leaving the area for work, counties with the lowest predicted probability scores were evaluated to determine if IRS migration data confirmed connectivity to the CSA. As discussed further in the results section, two existing CSA (Atlanta and Washington, DC) appear to have a couple of outlying counties that lack significant connectivity. Although these counties qualify for inclusion in the CSA by having at least 15% of commuters working in the central county(s) of the statistical area, it appears the absolute number of commuters is not significant.

If an existing CSA had a positive net worker exchange in 2030, indicating workers commuting into the area, adjacent counties were added to the commuter shed according to their predicted probability score. If the county to be added was located between two existing statistical areas, further analysis of both commuting and migration patterns was conducted to determine which statistical area had the strongest connectivity. Existing CSAs and multi-county MSAs were treated as barriers to further expansion of the commuter shed. Because single-county metros have achieved statistical area status due to population size (not commuter connectivity) these areas were added to commuter sheds. Figure 17 indicates single-county metros according to 2005 OMB designations.

Figure 17 - Single-County Metros



County-to-County Migration

County-level migration data are available from the U.S. Internal Revenue Service (IRS). Files are organized by state, with detailed data for each county indicating both inflows and outflows of the number of returns and exemptions. The number of returns is roughly equivalent to census data on households and the number of exemptions is an approximation of persons. By comparing addresses from one year to the next, the IRS reports the number of non-migrants and county-level migration data.

IRS migration data are useful in two distinct ways. First, migration data helps identify “linking counties” that form the seams between metropolitan areas. An example of this scenario is in central Florida, where Polk County functions as a linking county between the dominant metropolitan areas of Orlando on the east and Tampa on the west. A second utility for IRS migration data is to help evaluate the geographic extent of a megaregion area. Households tend to migrate over time from a more urban location to either suburban or exurban locations, with the primary wage earner often retaining their same job. (Davis, Nelson and Dueker 1994) Therefore, IRS data should identify outlying counties that are connected by intra-megaregion migration.

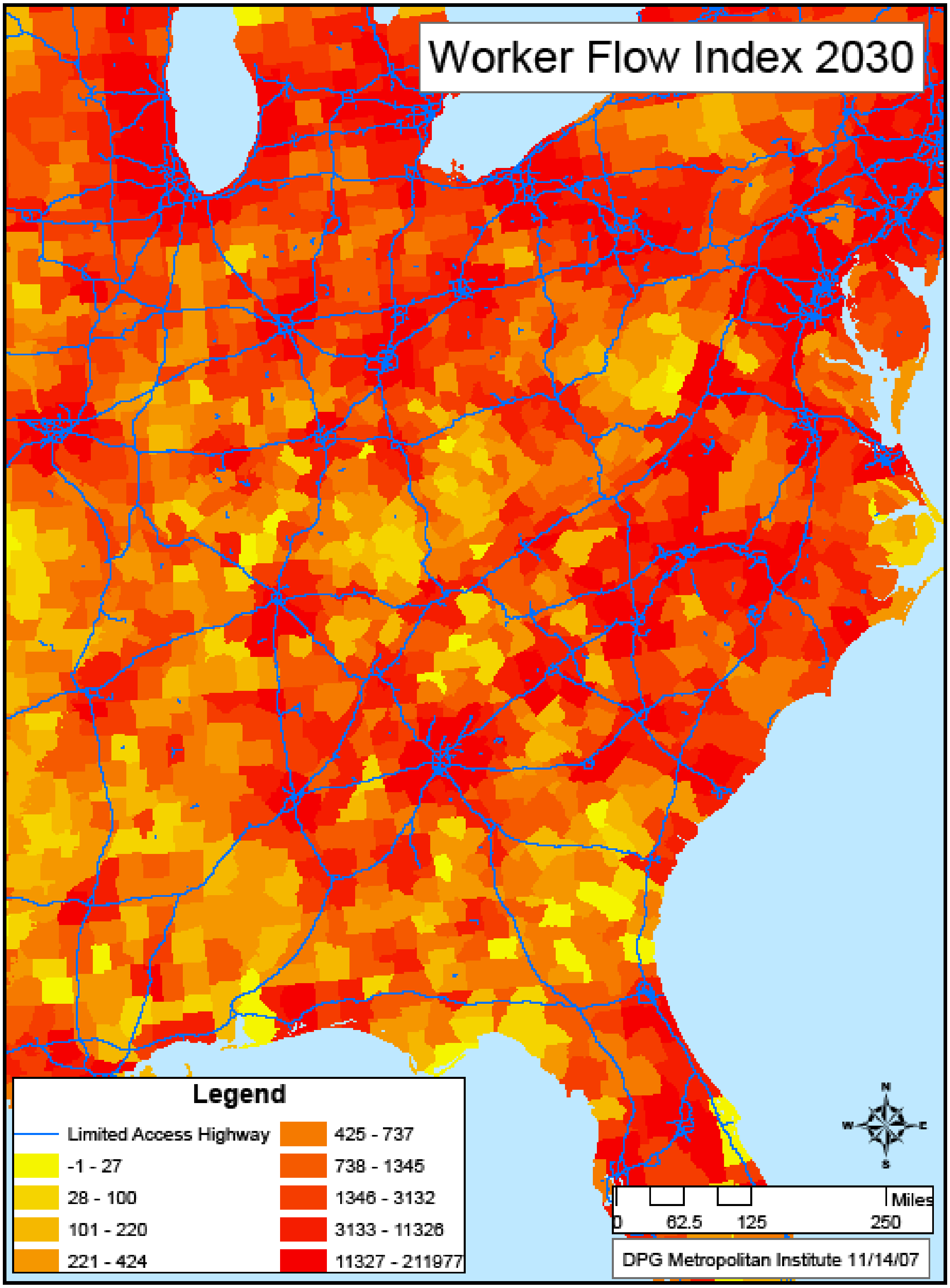
Worker Flow Index

The importance of movement in understanding urban-scale development (Hillier 1999) was the genesis of the worker flow index described below. To help visualize the movement of workers and define megaregion-scale development, a Worker Flow Index was created for each county in the continental United States. The index takes into account the share of workers flowing in and out of a county as well as the absolute number of workers coming and going. In combination, the outflow and inflow percentages help reduce, or normalize, the amount of variation in worker outflow plus inflow. If a county only had 1% of workers commuting out and 1% of the workplace jobs held by non-resident workers (i.e. inflow), the absolute number of outflow plus inflow workers would be reduced by a factor of 0.01 multiplied by 0.01, which equals 0.0001. At the other extreme, if a county had 99% of workers commuting out and 99% of the workplace jobs held by non-resident workers, the absolute number of outflow plus inflow workers would be reduced by a factor of 0.99 multiplied by 0.99, which equals

0.98. The formula for deriving the Worker Flow Index is [(outflow / workers) x (inflow / workplace jobs) x (outflow + inflow)].

Figure 18 shows the projected Worker Flow Index in 2030 for counties in the eastern half of the continental U.S. The counties in yellow have the least amount of worker movement in and out of the county. Counties shown with dark orange have the most movement of workers in and out of the county. Limited access highways are also shown to provide geographic references that help locate major urban areas. In general, the smaller, more intensely developed eastern counties have more worker movement across county boundaries than western counties that are typically larger in land area. Conceptually, many western counties are like islands with their urban areas relatively isolated from adjacent counties.

Figure 18 – Eastern U.S. Worker Flow Index in 2030



RESULTS

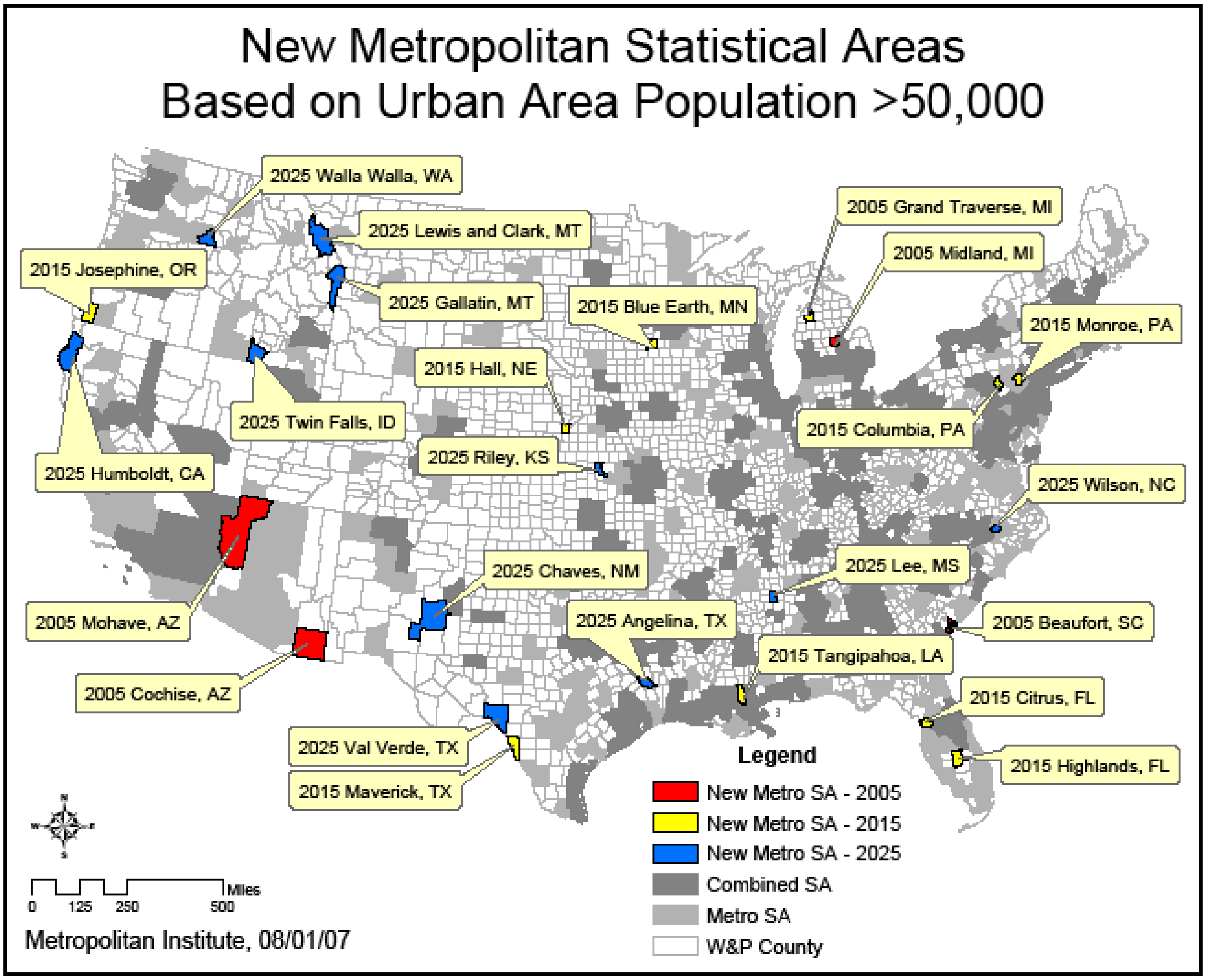
This chapter identifies additions to metropolitan areas based on population growth and commuting patterns (both inbound to new employment centers and outbound to other counties within metropolitan commuter sheds). SPSS model outputs are provided in Appendix A for both the Employment Center Model and the Bedroom Communities Model. After the discussion of metropolitan commuter sheds, the geographic focus zooms out to identify megaregion-scale development patterns.

Metropolitan Additions Based on Population Increase

Future metropolitan additions based on achieving an urban area population of at least 50,000 were identified using Woods & Poole population projections. The methodology assumes the year 2000 ratio of urban area to total county population holds constant through 2025. Based on 2005 population estimates available online from the American Community Survey, several counties have already qualified to become new metropolitan areas.

As shown in Figure 19, the additional metropolitan areas based on population growth are dispersed throughout the continental U.S. According to the current MPO regulations, each of these areas would likely establish its own transportation planning organization rather than join an existing MPO. Commuting patterns will also be considered to determine if an individual county becomes a single-county metropolitan area or joins an existing statistical area.

Figure 19 – Metropolitan Additions Based on Population Increase



Metropolitan Additions Based on Inbound Worker Flow Model

Using a logistic regression model, future employment centers (counties) were identified as likely statistical areas by the year 2030. Figure 20 lists the 17 employment centers, rank ordered by their predicted probability (PRE_1), along with key demographic data. The Woods & Poole job forecast (jobs30wp) was not used directly in the logistic regression but was an exogenous variable used to derive workplace jobs (wkpljobs30). Another exogenous variable that was used in the logistic regression was projected Gross Regional Product in 2030 for each county (expressed in millions of 2004 dollars). Figure 20 also lists projected non-resident workers (nrwkrs30p) that live outside the county but commute in for work and the projected inbound worker share (inbws30p). The latter represents the percentage of worker inflow compared to jobs in the county.

For the employment center logistic regression model, the overall percentage correct increased from 71.1% to 87.7% (see Appendix A for SPSS model output). All four of the independent variables in the model are significant to three decimal places. Two goodness-of-fit measures are reported for the model. The Cox and Snell R-Square of 0.477 takes sample size into account, with a maximum score less than one. The Nagelkerke R-Square of 0.682 has a maximum possible score of one. Both measures are good for this type of demographic model.

Beaufort, South Carolina, and Midland, Michigan, were both identified as future metropolitan areas based on population growth and the likelihood of being a statistical area based on demographic characteristics similar to other employment centers. Several of the employment centers have nearby military bases, such as Camp LeJeune near Craven, North Carolina or other federal installations like the national laboratories in Los Alamos, New Mexico. The only other western county to be identified as an employment center is Pitkin, Colorado, which is home to several ski resorts near Aspen.

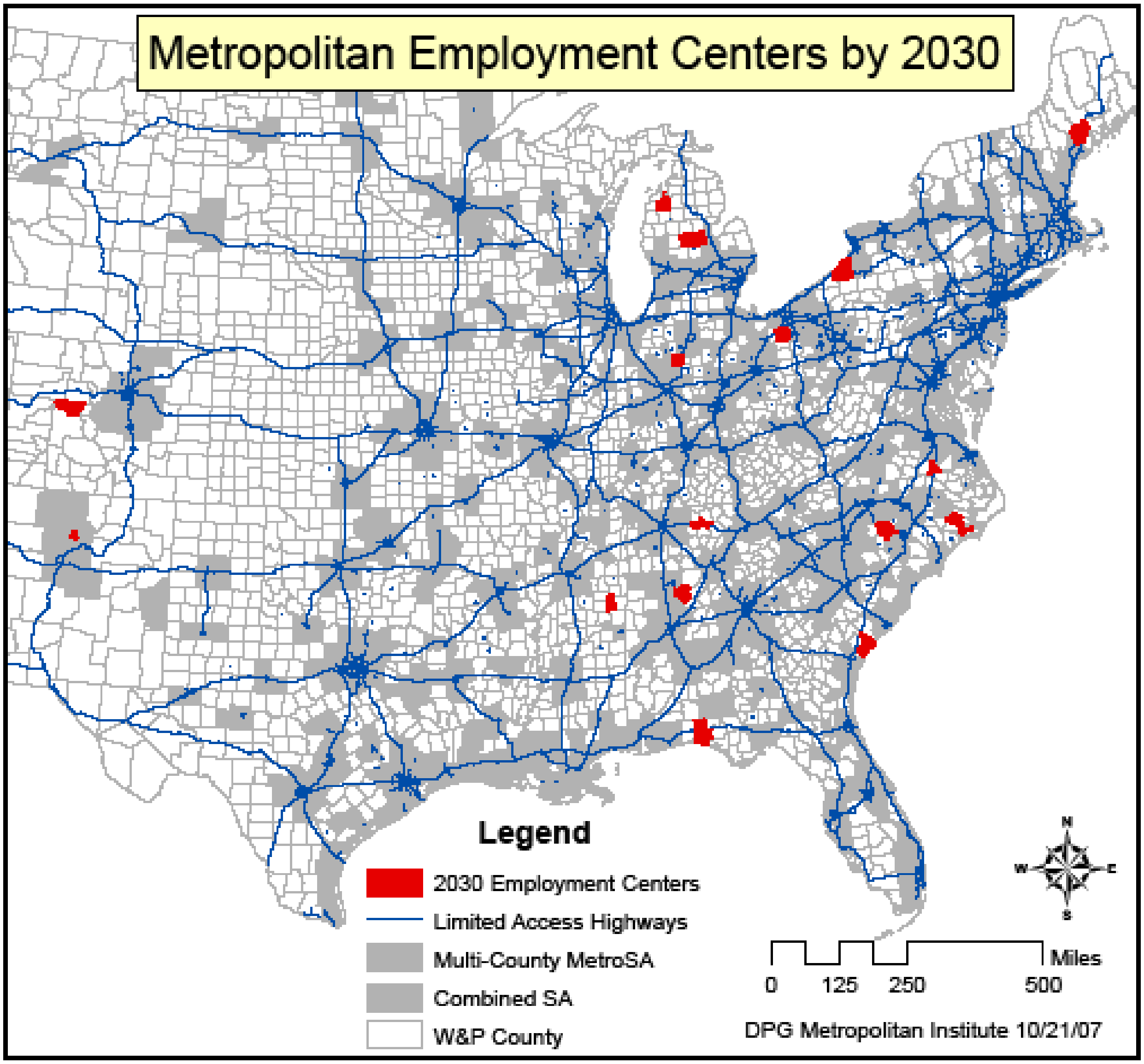
Figure 20 – Summary Data on Additional Employment Centers

wpco	*name*	*PRE_1*	*jobs30wp*	*wkpljobs30*	*nrwkrs30p*	*inbws30p*	*GRP30**
45013	BEAUFORT, SC	0.96968	176,675	123,354	52,632	42.7	$13,367
39169	WAYNE, OH	0.78416	80,070	64,854	30,335	46.8	$5,825
47141	PUTNAM, TN	0.76909	56,345	46,559	26,251	56.4	$3,619
26073	ISABELLA, MI	0.76326	55,955	55,115	26,087	47.3	$3,309
23011	KENNEBEC, ME	0.63885	101,344	73,866	26,271	35.6	$6,934
18053	GRANT, IN	0.63547	42,599	33,871	20,371	60.1	$3,056
37049	CRAVEN, NC	0.63062	84,447	54,351	28,716	52.8	$7,958
12131	WALTON, FL	0.62852	45,373	47,741	21,442	44.9	$2,761
51923	GREENSVILLE	0.62652	14,691	10,228	8,782	85.9	$949
28081	LEE, MS	0.59625	96,044	63,828	25,616	40.1	$6,614
37125	MOORE, NC	0.56738	62,158	45,425	22,176	48.8	$4,522
36013	CHAUTAUQUA	0.56592	85,241	66,930	22,872	34.2	$5,595
26055	Grand Traverse	0.56471	96,440	69,301	23,593	34.0	$6,242
08097	PITKIN, CO	0.55497	38,306	27,745	17,225	62.1	$2,836
26111	MIDLAND, MI	0.53352	62,112	47,196	22,307	47.3	$5,160
35028	LOS ALAMOS	0.50842	30,228	27,950	17,419	62.3	$3,793
01095	MARSHALL, AL	0.50165	56,062	47,795	19,290	40.4	$3,372

* *Gross Regional Product is in millions of 2004 dollars.*

The 17 counties listed above are mapped below in red (see Figure 21). Two counties in Michigan are adjacent to each other and appear as one area.

Figure 21 - Additional Employment Centers by 2030



Metropolitan Additions Based on Outbound Worker Flow Model

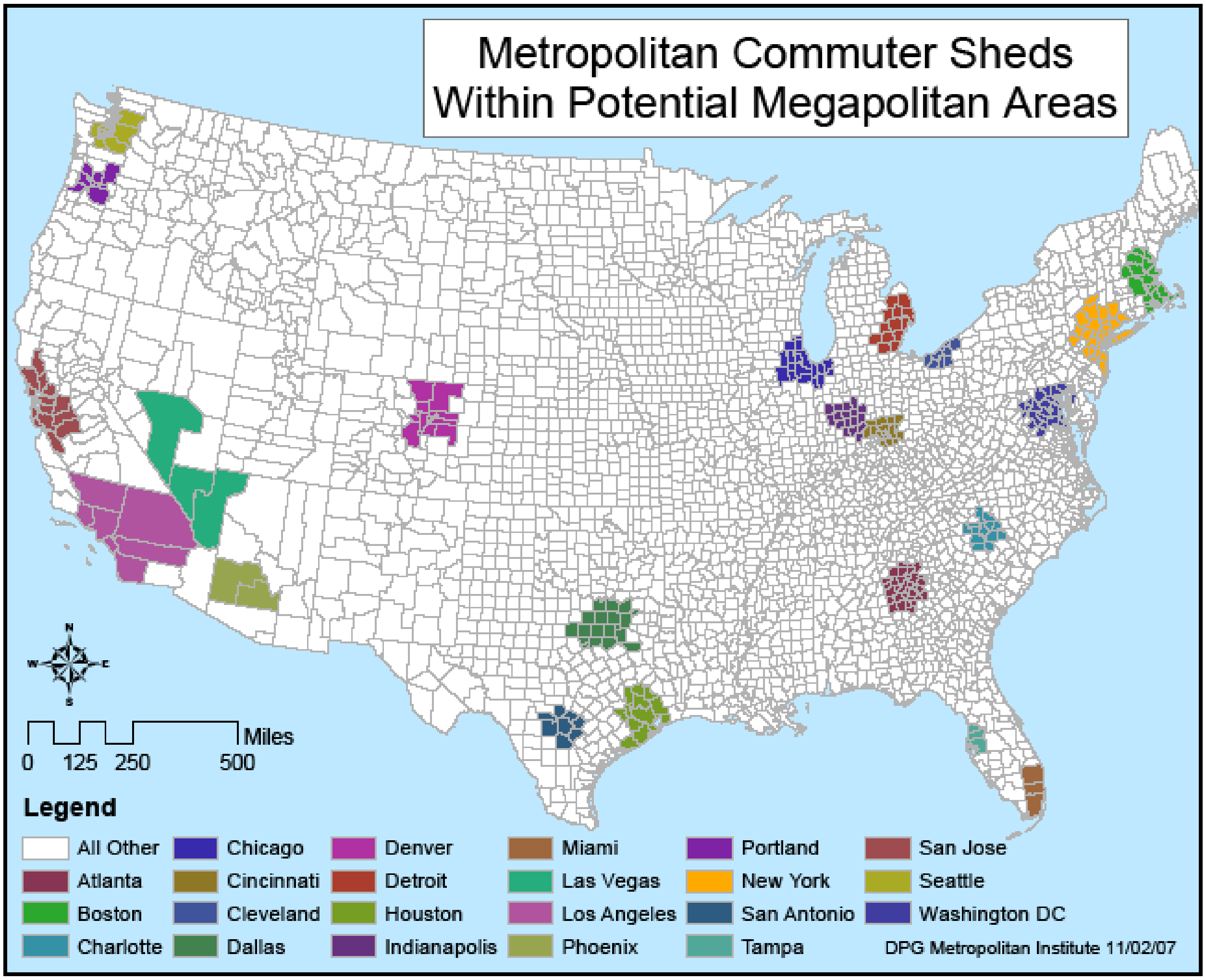
In contrast to the employment centers model discussed above, the Bedroom Communities model (i.e. net outbound workers) only indicates relative rankings, or scores, for the selection of additional counties needed to achieve commuter shed balance. The bedroom communities logistic regression model for counties with a negative worker exchange in 2030 (i.e. 1,869 of the total 3,076 Woods & Poole county equivalents in the continental United States) successfully increased the overall percentage correct from 56.3% to 80.4%. The SPSS model output (see Appendix A) indicates three of the independent variables in the model are significant to three decimal places and the significance for age-adjusted workers was 0.026. Two goodness-of-fit measures are reported for the model. Although the Cox and Snell R-Square of 0.394 and the Nagelkerke R-Square of 0.529 are lower than the scores obtained for the employment centers model, the method was a useful means to indicate the likelihood of a county joining a statistical area by 2030. The connectivity of counties adjacent to a statistical area was further evaluated using migration and commuting patterns.

Discussion of Metropolitan-Scale Commuter Sheds

The Net Worker Exchange Model was used to determine the geographic extent of the 22 largest metropolitan areas in 2030 (based on total population plus jobs and current statistical area definitions for CSAs or Metros). Single-county metropolitan statistical areas were added to commuter sheds if supported by a high predicted probability in the Bedroom Communities logistic regression model and the connectivity to a particular commuter shed was confirmed by migration data and/or commuting patterns. Multi-county metropolitan statistical areas were treated as barriers to further expansion of the commuter shed.

Each of the 22 maps presented in the following section indicate the extent of the commuter shed (with various colors) and the boundaries of the current MPO areas with bold yellow lines. The commuter sheds evaluated are shown in Figure 22.

Figure 22 – Map of Commuter Sheds Evaluated



Summary data for the 22 commuter sheds are listed in Figure 23. For 11 of the 22 areas analyzed, metropolitan commuter sheds are significantly larger than indicated by current OMB and MPO designations. Light green shading highlights the 11 commuter sheds where the number of counties was increased between 2000 and 2030 in order to balance workplace jobs and workers. Nine of the areas retained a balance between workplace jobs and workers over the thirty years. The stable commuter sheds do not have any color shading. Based on projected net worker exchange in 2030, the Atlanta and Washington DC statistical areas (shown with light yellow shading in Figure 23) are too large. In these two areas, migration and commuting data were used to identify "outlier" counties that have weak connectivity to the remainder of the metropolitan area.

To account for the variation in population and jobs by commuter shed, the net worker exchange in 2030 was compared to the average of workplace jobs and workers. In other words, perfect commuter shed balance is represented by the mid-point between the number of workplace jobs and workers. Therefore, the percent out of balance (as shown in the far right column in the table below) is the variation in net worker inflow or outflow from the midpoint. For example, the 32 counties in the Atlanta commuter shed in 2030 have a projected net worker exchange of -36,544. The negative number indicates an aggregate outflow of 36,544 workers, which is only 1.1% of the midpoint between 3,270,484 jobs and 3,307,028 working residents within the 32 counties.

Generally, the net worker exchange model was successful in balancing metropolitan-scale commuter sheds, with only two commuter sheds being more than ten percent out of balance in 2030. The Cleveland CSA has a 15.1% surplus in jobs. In contrast, the Denver CSA has 13% surplus in workers.

Figure 23 – Evaluation of Commuter Shed Balance

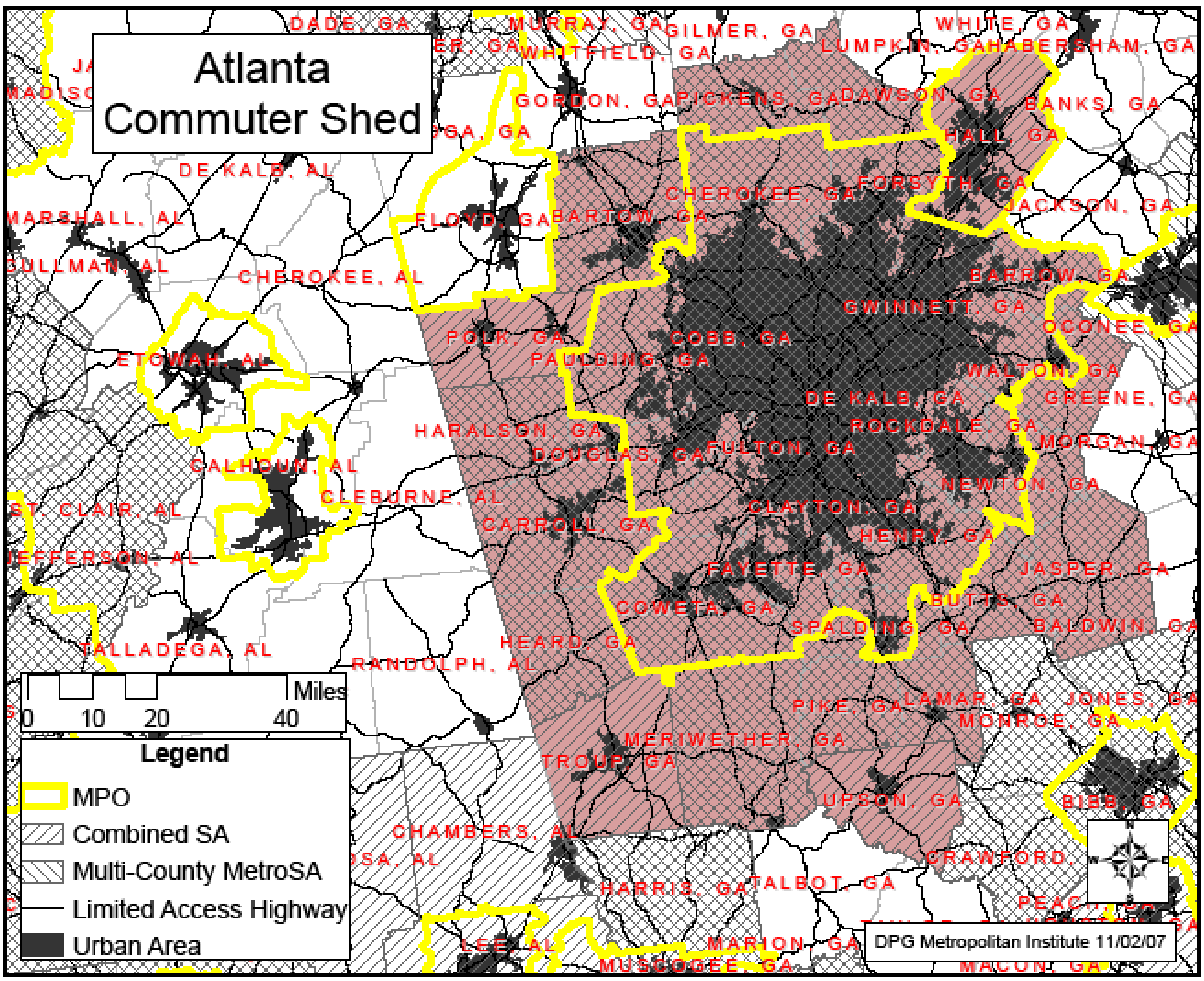
	Statistical Area	Major City	Current Statistical Area Counties	Net Worker Exchange 2000	Commuter Shed Counties 2030	Workplace Jobs 2030	Workers 2030	Net Worker Exchange 2030	Percent Out of Balance
1	122	Atlanta	33	35,566	32	3,270,484	3,307,028	(36,544)	-1.1%
2	148	Boston	17	22,563	19	4,207,933	4,173,284	34,649	0.8%
3	172	Charlotte	13	14,350	13	1,391,668	1,317,222	74,446	5.5%
4	176	Chicago	16	38,131	18	5,369,073	5,181,353	187,720	3.6%
5	178	Cincinnati	16	6,768	17	1,237,292	1,237,272	20	0.0%
6	184	Cleveland	8	41,977	8	1,638,011	1,407,569	230,442	15.1%
7	206	Dallas	19	23,786	19	3,844,829	3,944,225	(99,396)	-2.6%
8	216	Denver	11	9,099	12	1,933,298	2,211,460	(278,162)	-13.4%
9	220	Detroit	9	36,357	13	2,829,470	2,713,178	116,292	4.2%
10	288	Houston	12	12,000	13	3,150,551	3,145,417	5,134	0.2%
11	294	Indianapolis	15	18,882	17	1,236,632	1,201,487	35,145	2.9%
12	33100	Miami	3	20,947	3	2,939,827	3,001,857	(62,030)	-2.1%
13	332	Las Vegas	2	11,849	3	1,465,447	1,457,100	8,347	0.6%
14	348	Los Angeles	5	(22,757)	7	9,733,133	9,737,228	(4,095)	0.0%
15	38060	Phoenix	2	3,126	2	2,577,142	2,593,173	(16,031)	-0.6%
16	38900	Portland	7	8,264	7	1,313,813	1,406,366	(92,553)	-6.8%
17	408	New York	30	103,125	33	10,181,210	9,995,966	185,244	1.8%
18	41700	San Antonio	8	(5,312)	8	1,081,090	1,136,691	(55,601)	-5.0%
19	45300	Tampa	4	487	4	1,374,061	1,480,880	(106,819)	-7.5%
20	488	San Jose	11	83,664	15	4,559,106	4,181,967	377,139	8.6%
21	500	Seattle	7	4,623	7	2,349,181	2,381,266	(32,085)	-1.4%
22	548	Washington, DC	28	69,872	27	5,067,787	5,112,428	(44,641)	-0.9%
		All Other Counties	2,800	(639,080)	2,779	88,440,479	88,633,846	(193,367)	-0.2%
		TOTAL	3,076	(101,713)	3,076	161,191,517	160,958,263	233,254	0.1%

Source: DPG Metropolitan Institute 11/02/07.

Atlanta

Atlanta and Washington DC are the only two CSAs larger than necessary to achieve commuter shed balance in 2030. As shown in Figure 24 below, the Atlanta CSA currently includes a ring of counties outside of the MPO boundary (shown in yellow). At the southwest corner of the CSA, Chambers County, Alabama, is currently in the CSA but connectivity to the Atlanta commuter shed is not supported by IRS migration data or recent LEHD commuting data.

Figure 24 – Atlanta Commuter Shed



From 2002 to 2004, outbound worker flow from Chambers County, Alabama, has shifted from the northeast (toward La Grange and Atlanta) to south, with Lee County, Alabama, capturing 25% of the outflow in 2004. According to the latest LEHD data, Chambers County no longer meets the 15% commuting threshold required for voluntary inclusion within a CSA.

IRS migration data also fails to support the inclusion of Chambers County within the Atlanta commuter shed. Between 2004 and 2005, 16.7% of the new households came from Troup County, Georgia, but the major source was from Lee County, Alabama.

Migration into Chambers County, AL

2004-2005

	Returns (~ households)		
Non-Migrants	11,928		
Pct In-Migration	5.2%		
Total In-Migration	648		
Foreign Immigrants			
From Different State		352	
From Same State		296	
From Atlanta Commuter Shed*			108
Pct of Total In-Migration			16.7%

** Only from Troup County, GA*

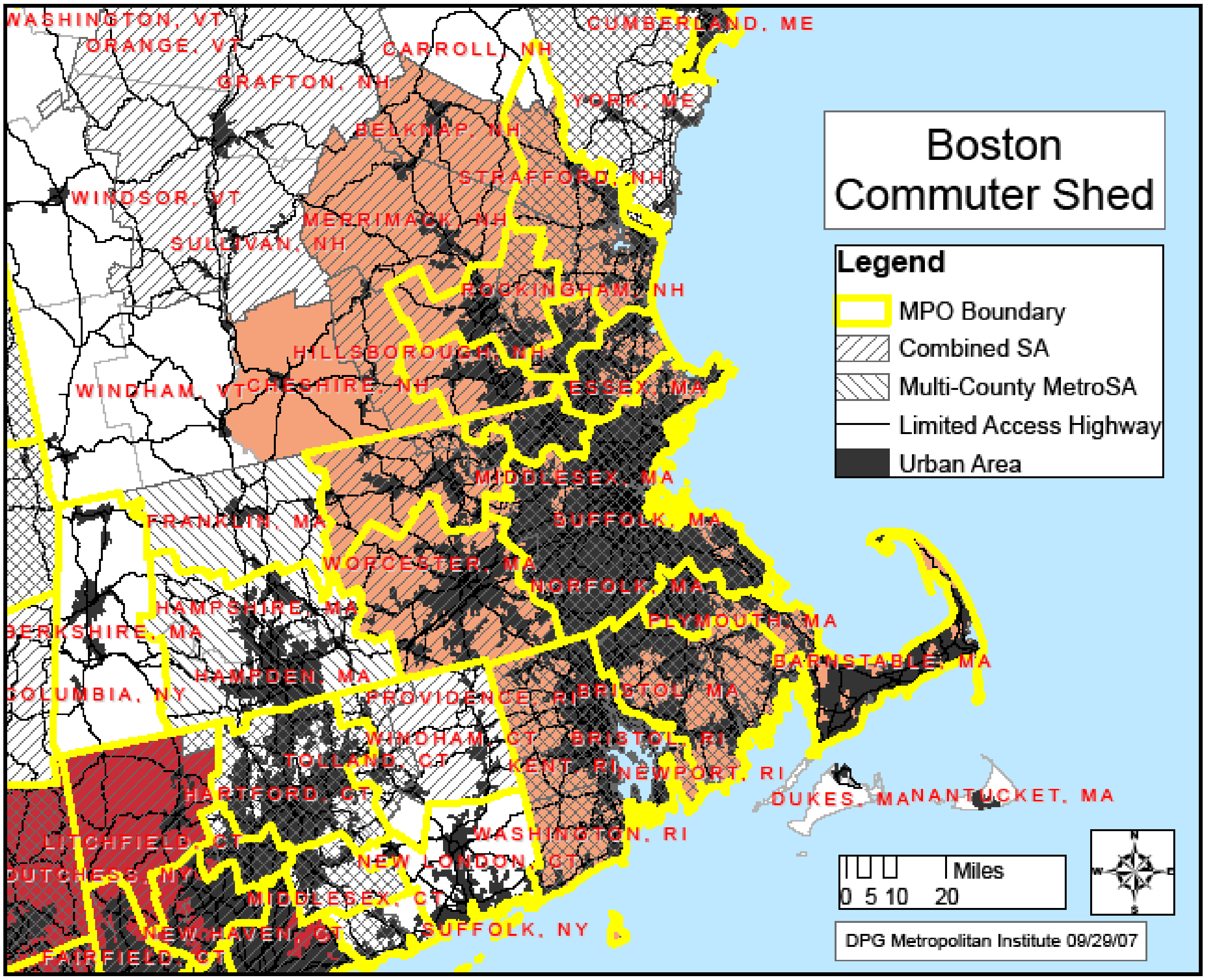
The major source was Lee County, AL.

Boston

When a Core-Based Statistical Area (CBSA) obtains an Employment Interchange Measure (EIM) of 15%, the Census Bureau contacts the local Congressional Delegation to find out if the area wants to voluntary become part of Combined Statistical Area (CSA). Between 2003 and 2005, the Providence metropolitan area opted to join the Boston combined statistical area. The area added to the CSA is comprised of three counties in Rhode Island (Providence, Kent and Washington) plus Bristol County in Massachusetts.

As shown in Figure 25, transportation planning in the Boston commuter shed is very fragmented with over a dozen MPOs serving the metropolitan area. According to the Net Worker Exchange Model, both Barnstable County, Massachusetts, and Cheshire County, New Hampshire, will be part of the Boston commuter shed in 2030. The predicted probabilities were 0.56 for Barnstable County and 0.30 for Cheshire County. Connectivity to Boston was confirmed by the IRS migration data discussed below.

Figure 25 – Boston Commuter Shed



The following table indicates almost half of the new households moving into Barnstable between 2004 and 2005 came from the Boston commuter shed, with Middlesex County being the major source.

Migration into Barnstable County, MA
2004-2005

	Returns (~ households)		
Non-Migrants	90,846		
Pct In-Migration	5.2%		
Total In-Migration	4,961		
Foreign Immigrants		200	
From Different State		2,254	
From Same State		2,507	
From Boston Commuter Shed*			2,478
Pct of Total In-Migration			49.9%

* *Major source was Middlesex County, MA*

From 2004 to 2005, almost 40% of the new households moving into Cheshire County came from the Boston commuter shed. The major source was from Hillsborough County, New Hampshire, located to the east of Cheshire County.

Migration into Cheshire County, NH
2004-2005

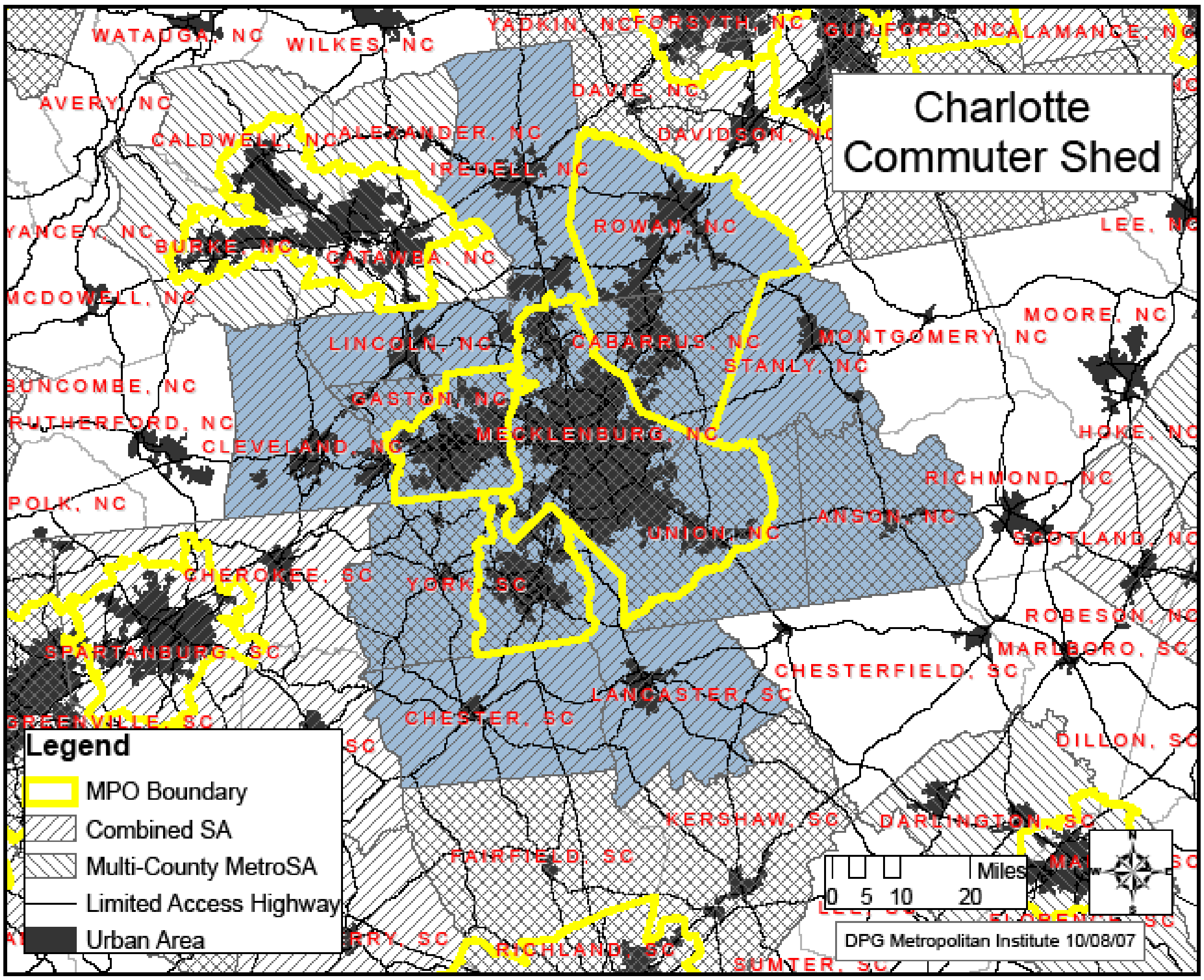
	Returns (~ households)		
Non-Migrants	28,340		
Pct In-Migration	6.3%		
Total In-Migration	1,903		
Foreign Immigrants		36	
From Different State		1,319	
From Same State		548	
From Boston Commuter Shed*			758
Pct of Total In-Migration			39.8%

* *Major source was Hillsborough County, NH*

Charlotte

Although the Charlotte CSA is a strong employment center, many of the adjacent counties are already in other statistical areas (see Map 26). The three counties eligible for inclusion in the commuter shed all have low predicted probabilities from the Bedroom Communities Model.

Figure 26 – Charlotte Commuter Shed



Of the three eligible counties, Chesterfield, South Carolina, had the highest predicted probability of 0.15, but less than 25% of the in-migration came from the Charlotte commuter shed. As shown in the table below, the major source of in-migration was from Darlington County, South Carolina, located to the south of Chesterfield. Because Montgomery and Rutherford Counties had even weaker migration connectivity and lower predicted probabilities, no counties were added to the Charlotte commuter shed.

Migration into Chesterfield County, SC

2004-2005

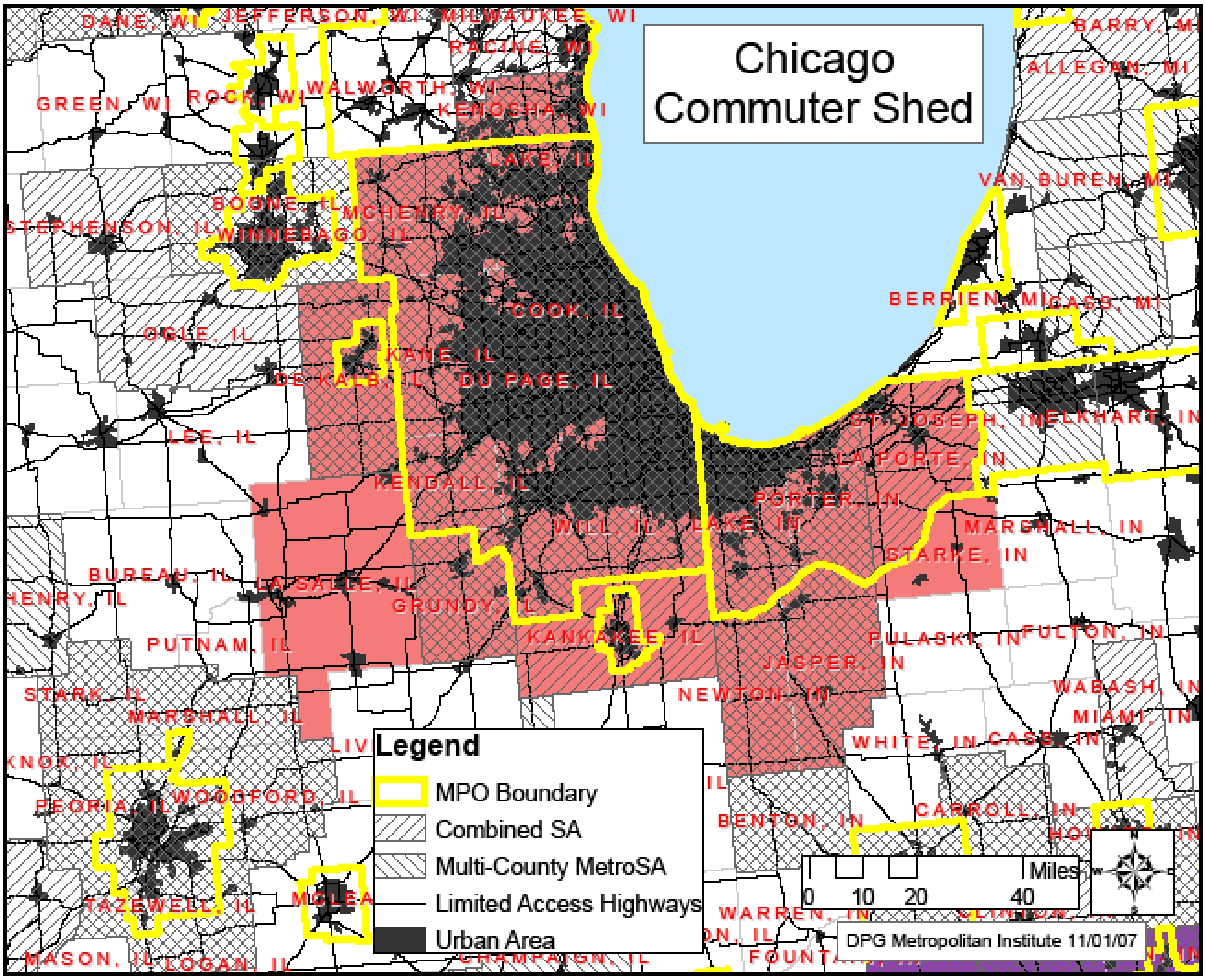
	Returns (~ households)		
Non-Migrants	13,979		
Pct In-Migration	4.7%		
Total In-Migration	695		
Foreign Immigrants			
From Different State		358	
From Same State		337	
From Charlotte Commuter Shed*			173
Pct of Total In-Migration			24.9%

* *Major source was Darlington County, SC*

Chicago

Figure 27 indicates four MPOs within the projected commuter shed of Chicago in the year 2030. The net worker exchange indicates the Chicago CSA needs additional bedroom communities to balance commuter flows. Among adjacent counties, La Salle, Illinois, and Starke, Indiana, both have strong connectivity to Chicago.

Figure 27 – Chicago Commuter Shed



Between 2004 and 2005, 46.5% of the new households moving into La Salle County came from the Chicago commuter shed. According to the Bedroom Communities logistic regression, La Salle has a predicted probability of 0.71 of being a statistical area by 2030.

Migration into LaSalle County, IL

2004-2005

	Returns (~ households)		
Non-Migrants	42,790		
Pct In-Migration	5.0%		
Total In-Migration	2,248		
Foreign Immigrants		23	
From Different State		506	
From Same State		1,719	
From Chicago Commuter Shed*			1,045
Pct of Total In-Migration			46.5%

** Major source was Bureau County, IL*

The predicted probability for Starke County, Indiana is lower at 0.43, but the IRS migration data shown below indicate significant in-migration from the Chicago commuter shed. Iroquois, Pulaski and White counties were also evaluated but not added to commuter shed because of lower predicted probabilities and less in-migration from greater Chicago.

Migration into Starke County, IN

2004-2005

	Returns (~ households)		
Non-Migrants	7,887		
Pct In-Migration	6.9%		
Total In-Migration	581		
Foreign Immigrants			
From Different State		153	
From Same State		428	
From Chicago Commuter Shed*			284
Pct of Total In-Migration			48.9%

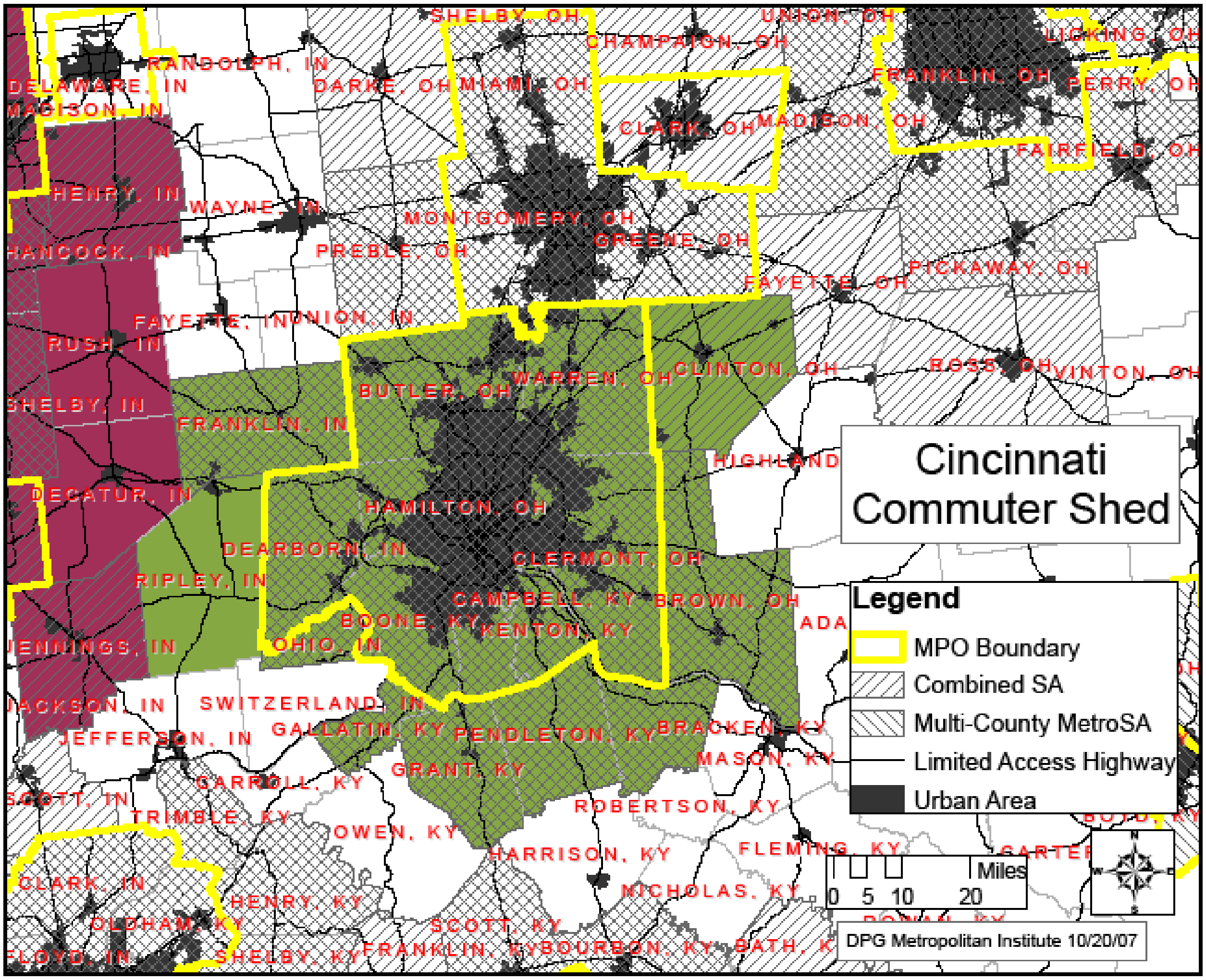
** Major source was Marshall County, IN*

Walworth County, Wisconsin, is located at the boundary between the Chicago and Milwaukee CSAs. With a predicted probability of 0.97, the key question regarding Walworth is the relative strength of its connectivity to either Chicago or Milwaukee. Commuting data from the 2000 census indicates Walworth already qualifies to be part of the Milwaukee CSA. According to the latest (2004) LEHD commuting data, Walworth has strengthened commuting ties to Milwaukee. Over 25% of Walworth's resident workers now head to jobs in the Milwaukee metropolitan area but only 5% head toward Chicago. Based upon Walworth's commuting patterns, it was not added to the Chicago commuter shed.

Cincinnati

According to the 2005 OMB definitions, Cincinnati CSA is comprised of 16 counties. As discussed further below, Rush and Decatur Counties are clearly connected to the Indianapolis commuter shed but Ripley County, Indiana, has stronger connections to the Cincinnati commute shed. As shown in Figure 28, the MPO area should be expanded to include another ring of counties on the east, south and west side of Cincinnati.

Figure 28 – Cincinnati Commuter Shed



Of the counties adjacent to the Cincinnati commuter shed, Ripley County had the second highest predicted probability (0.58) from the Bedroom Communities logistic regression. From 2004 to 2005, 78.2% of household in-migration was from the Cincinnati commuter shed. LEHD commuting data from 2004 indicates 16.4% of Ripley County resident workers head to the Cincinnati commuter shed while 15.1% travel to jobs in the Indianapolis commuter shed. Thus Ripley County functions as a linking county between the two metropolitan areas.

Migration into Ripley County, IN

2004-2005

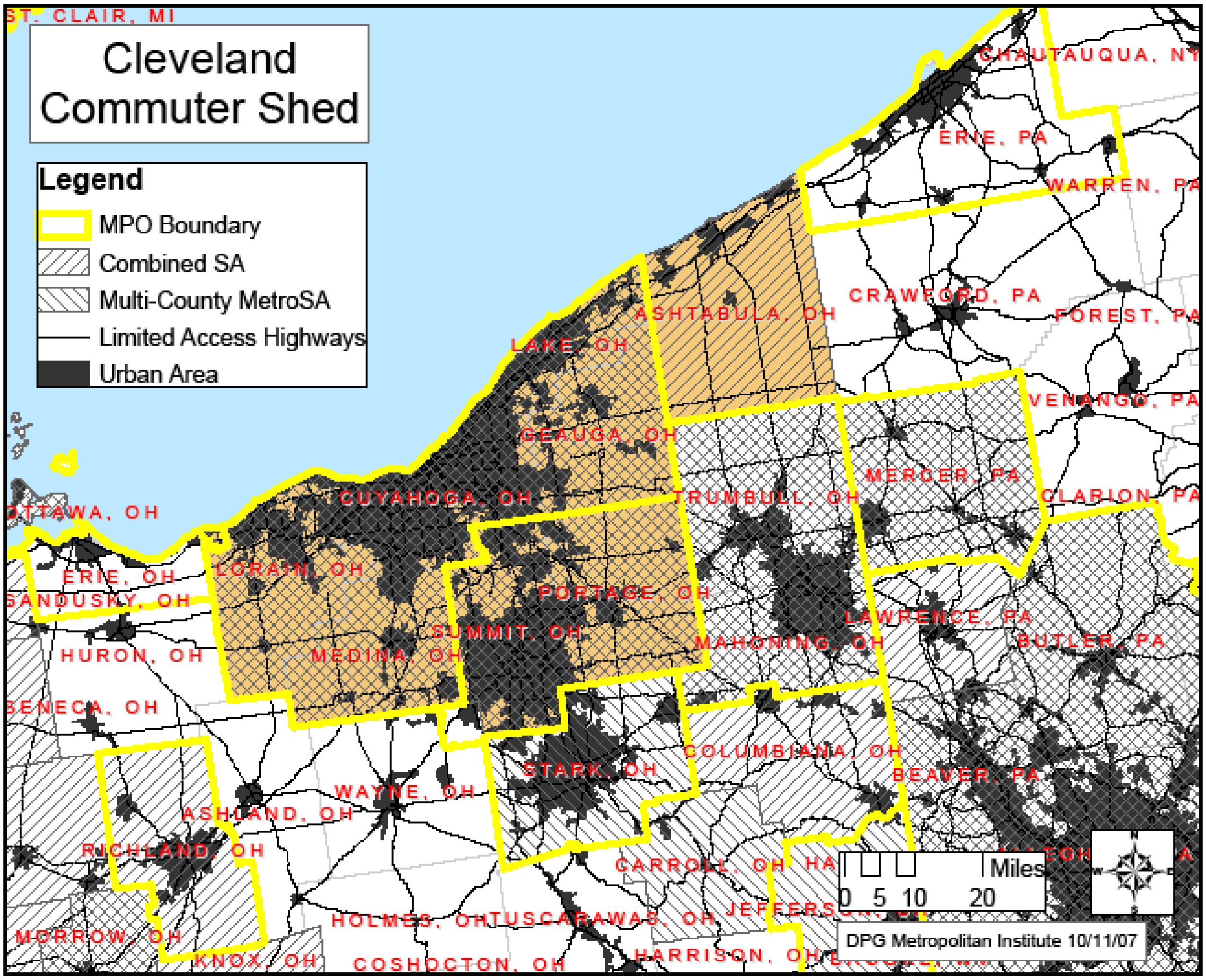
	Returns (~ households)		
Non-Migrants	9,462		
Pct In-Migration	6.4%		
Total In-Migration	649		
Foreign Immigrants			
From Different State	211		
From Same State	438		
From Indianapolis Commuter Shed		38	9.6%
Fron Cincinnati Commuter Shed*		309	78.2%

** Major source was Dearborn County, IN*

Cleveland

As shown in Figure 29, the eight-county Cleveland CSA is currently divided into two MPO areas. Although the net worker exchange in 2030 indicates high inflow, the commuter shed has limited expansion options because it is surrounded by existing metropolitan statistical areas and counties that function as minor employment centers (i.e. net worker inflow). For example, Wayne County, Ohio, (located south of Cleveland) has a projected net inflow in 2030 of less than 4,000 workers. Adding Wayne County to the Cleveland commuter shed would make it more out of balance.

Figure 29 – Cleveland Commuter Shed



Only two adjacent counties have a net worker outflow, but neither exhibits strong connectivity to the Cleveland commuter shed. The table below indicates Crawford County, Pennsylvania, only received 2.8% of its in-migration from the Cleveland commuter shed between 2004 and 2005. Also, Crawford County had a weak predicted probability of only 0.17 in the Bedroom Communities logistic regression.

Migration into Crawford County, PA

2004-2005

	Returns (~ households)		
Non-Migrants	30,973		
Pct In-Migration	4.0%		
Total In-Migration	1,305		
Foreign Immigrants		16	
From Different State		485	
From Same State		804	
From Cleveland Commuter Shed*			37
Pct of Total In-Migration			2.8%

** Major source was Erie County, PA*

Ashland County, Ohio, had a slightly higher predicted probability of 0.26 from the logistic regression model, but in-migration from the Cleveland commuter shed is not very strong. As shown in the table below, the major source of in-migration was from Richland County, located to the southeast (i.e. the opposite direction from Cleveland).

Migration into Ashland County, OH

2004-2005

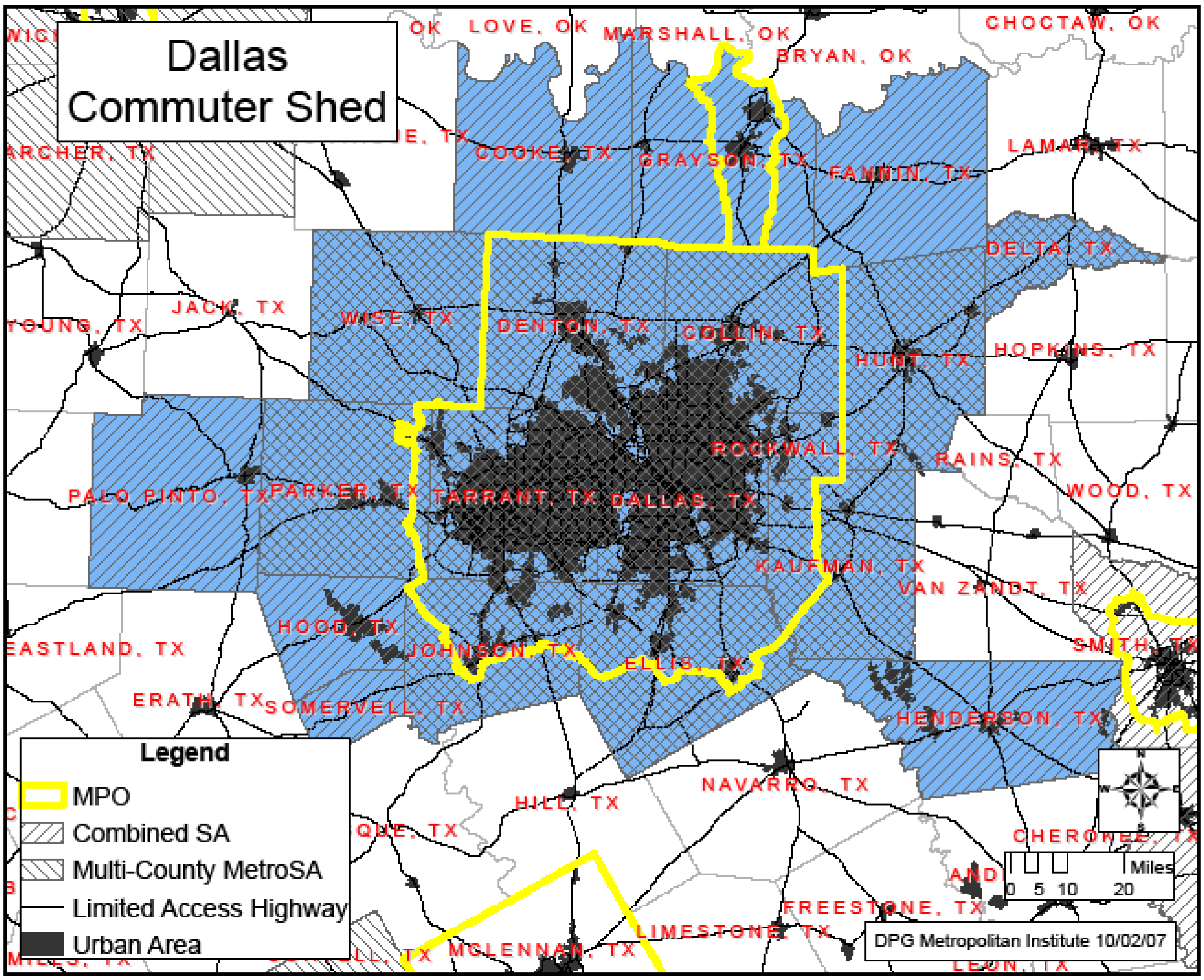
	Returns (~ households)		
Non-Migrants	19,037		
Pct In-Migration	5.5%		
Total In-Migration	1,116		
Foreign Immigrants		21	
From Different State		199	
From Same State		896	
From Cleveland Commuter Shed*			292
Pct of Total In-Migration			26.2%

** Major source was Richland County, OH*

Dallas

As shown in Figure 30, a ring of perimeter counties should be added to the current Dallas and Fort Worth MPO area in order to represent the projected extent of the commuter shed in 2030. The 19 counties currently in the CSA are projected to have approximately the same number of workplace jobs and workers in 2030.

Figure 30 – Dallas Commuter Shed



Because the Dallas CSA has a slight negative net worker exchange in 2030 (i.e. an outflow of workers), migration data was examined for two outlying counties to evaluate their connectivity to the commuter shed. On the eastern edge, Henderson County obtained 40.6% of new households from the Dallas commuter shed and shows strong connectivity with the major source of in-migration being Dallas County.

Migration into Henderson County, TX
2004-2005

	Returns (~ households)		
Non-Migrants	21,752		
Pct In-Migration	9.0%		
Total In-Migration	2,147		
Foreign Immigrants		15	
From Different State		359	
From Same State		1,773	
From Dallas Commuter Shed*			871
Pct of Total In-Migration			40.6%

** Major source was Dallas County, TX.*

On the west side of the CSA, Palo Pinto County also exhibits a strong migration connection with 47.9% of the new households coming from the Dallas commuter shed. The major source was Parker County, located to the east of Palo Pinto (i.e. toward Fort Worth).

Migration into Palo Pinto County, TX
2004-2005

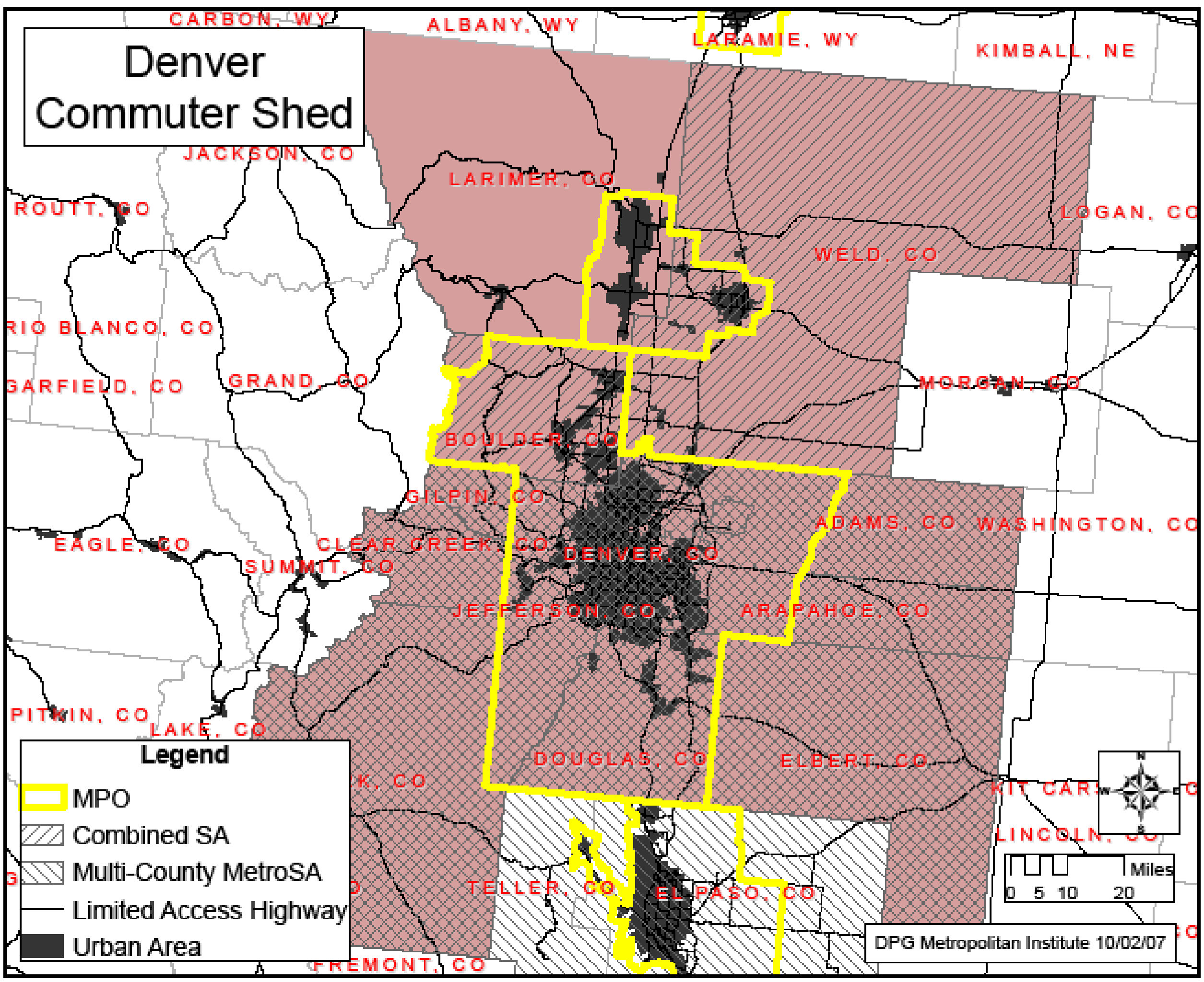
	Returns (~ households)		
Non-Migrants	7,964		
Pct In-Migration	8.3%		
Total In-Migration	720		
Foreign Immigrants			
From Different State		123	
From Same State		597	
From Dallas Commuter Shed*			345
Pct of Total In-Migration			47.9%

** Major source was Parker County, TX.*

Denver

In contrast to many commuter sheds, the Denver metropolitan area currently has only two MPOs as shown in Figure 31. According to the Bedroom Communities logistic regression, by 2030 Larimer County will join the CSA and ideally one MPO would provide transportation planning for the entire Front Range area, extending from the south side of the Denver urban area to Ft. Collins at the north end of the I-25 corridor.

Figure 31 – Denver Commuter Shed



Between 2004 and 2005, 33.8% of the new households moving into Larimer County were previously living in the Denver commuter shed. The major source of in-migration was Weld County. The predicted probability of Larimer become a statistical area by 2030 was 0.91.

2004-2005 Migration into Larimer County, CO

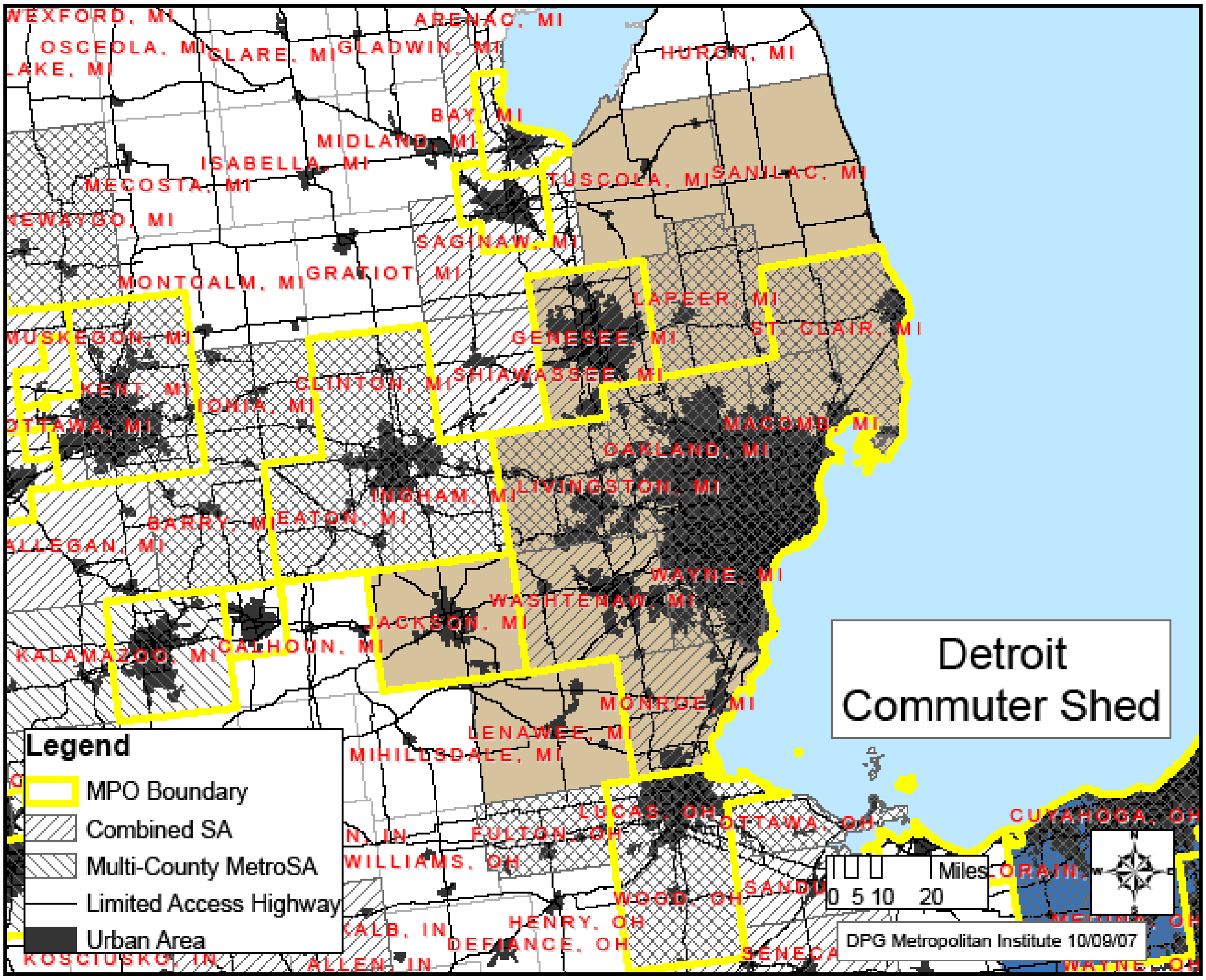
	Returns (~ households)		
Non-Migrants	92,061		
Pct In-Migration	8.9%		
Total In-Migration	9,007		
	Foreign Immigrants	153	
	From Different State	4,905	
	From Same State	3,949	
	From Denver Commuter Shed*		3,040
	Pct of Total In-Migration		33.8%

**Major source was Weld County, CO*

Detroit

Figure 32 indicates three MPOs currently provide transportation planning functions within the Detroit commuter shed. With significant job growth in the Detroit area, four additional counties are expected to join the CSA by 2030.

Figure 32 – Detroit Commuter Shed



Located southwest of Detroit, Lenawee County, Michigan, has the highest predicted probability (0.89) of becoming a statistical area by 2030. With 50.7% of the workers migrating in from the Detroit commuter shed, this county demonstrates strong connectivity to the metropolitan area.

Migration into Lenawee County, MI
2004-2005

	Returns (~ households)		
Non-Migrants	35,648		
Pct In-Migration	4.5%		
Total In-Migration	1,685		
Foreign Immigrants		12	
From Different State		519	
From Same State		1,154	
From Detroit Commuter Shed*			854
Pct of Total In-Migration			50.7%

** Major source was Washtenaw County, MI*

Although in-migration from the Detroit commuter shed is not as strong, Jackson County had the second highest predicted probability (0.76) of becoming a statistical area by 2030. LEHD commuting data for 2004 confirms connectivity with 23.7% of Jackson County resident workers heading to jobs in the Detroit commuter shed.

Migration into Jackson County, MI
2004-2005

	Returns (~ households)		
Non-Migrants	55,242		
Pct In-Migration	4.6%		
Total In-Migration	2,642		
Foreign Immigrants		22	
From Different State		709	
From Same State		1,911	
From Detroit Commuter Shed*			966
Pct of Total In-Migration			36.6%

** Major source was Washtenaw County, MI*

The table below indicates 45.1% of Tuscola County household in-migration from 2004 to 2005 came from the Detroit commuter shed. Tuscola County's predicted probability of becoming a statistical area by 2030 was 0.59. In 2004, LEHD data indicates 28.9% of commuters went to work in the Detroit commuter shed.

Migration into Tuscola County, MI
2004-2005

	Returns (~ households)		
Non-Migrants	21,066		
Pct In-Migration	4.8%		
Total In-Migration	1,072		
Foreign Immigrants			
From Different State		167	
From Same State		905	
From Detroit Commuter Shed*			484
Pct of Total In-Migration			45.1%

** Major source was Genesee County, MI*

IRS in-migration data shown below reveals a strong connection between Sanilac County and the Detroit commuter shed. Although the predicted probability from the Bedroom Communities Model is relatively weak at 0.30, IRS migration data indicates Sanilac County is already strongly connected with approximately 69% of the new households coming from the Detroit commuter shed.

Migration into Sanilac County, MI
2004-2005

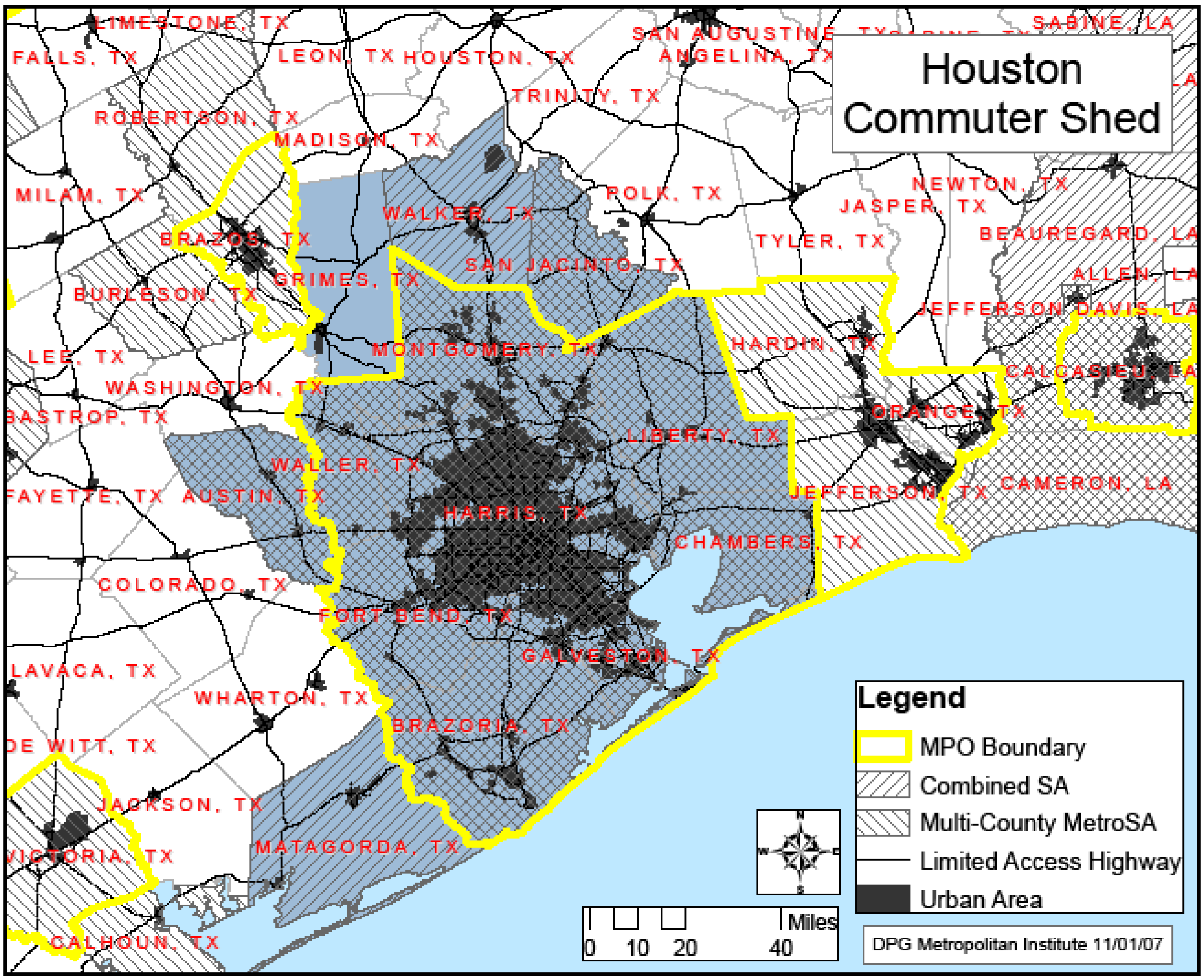
	Returns (~ households)		
Non-Migrants	15,656		
Pct In-Migration	5.1%		
Total In-Migration	840		
Foreign Immigrants			
From Different State		136	
From Same State		704	
From Detroit Commuter Shed*			578
Pct of Total In-Migration			68.8%

** Major source was St. Claire County, MI*

Houston

By 2030, Grimes County is expected to be part of the Houston commuter shed. Located on the north side of Houston, Grimes County is the linking county between Houston and College Station (see Map 33). To have the MPO cover the entire commuter shed, the MPO boundary needs to add five counties by 2030.

Figure 33 – Houston Commuter Shed



As shown in the following table, Grimes County received significant in-migration (46.1%) from the Houston commuter shed from 2004 to 2005. Although weaker, the College Station metropolitan area also contributed 16.1% of the households moving into Grimes County.

Migration into Grimes County, TX

2004-2005

	Returns (~ households)			
Non-Migrants	6,849			
Pct In-Migration	8.5%			
Total In-Migration	640			
Foreign Immigrants				
From Different State		89		
From Same State		551		
From Houston Commuter Shed*			295	46.1%
From College Station Commuter Shed			103	16.1%

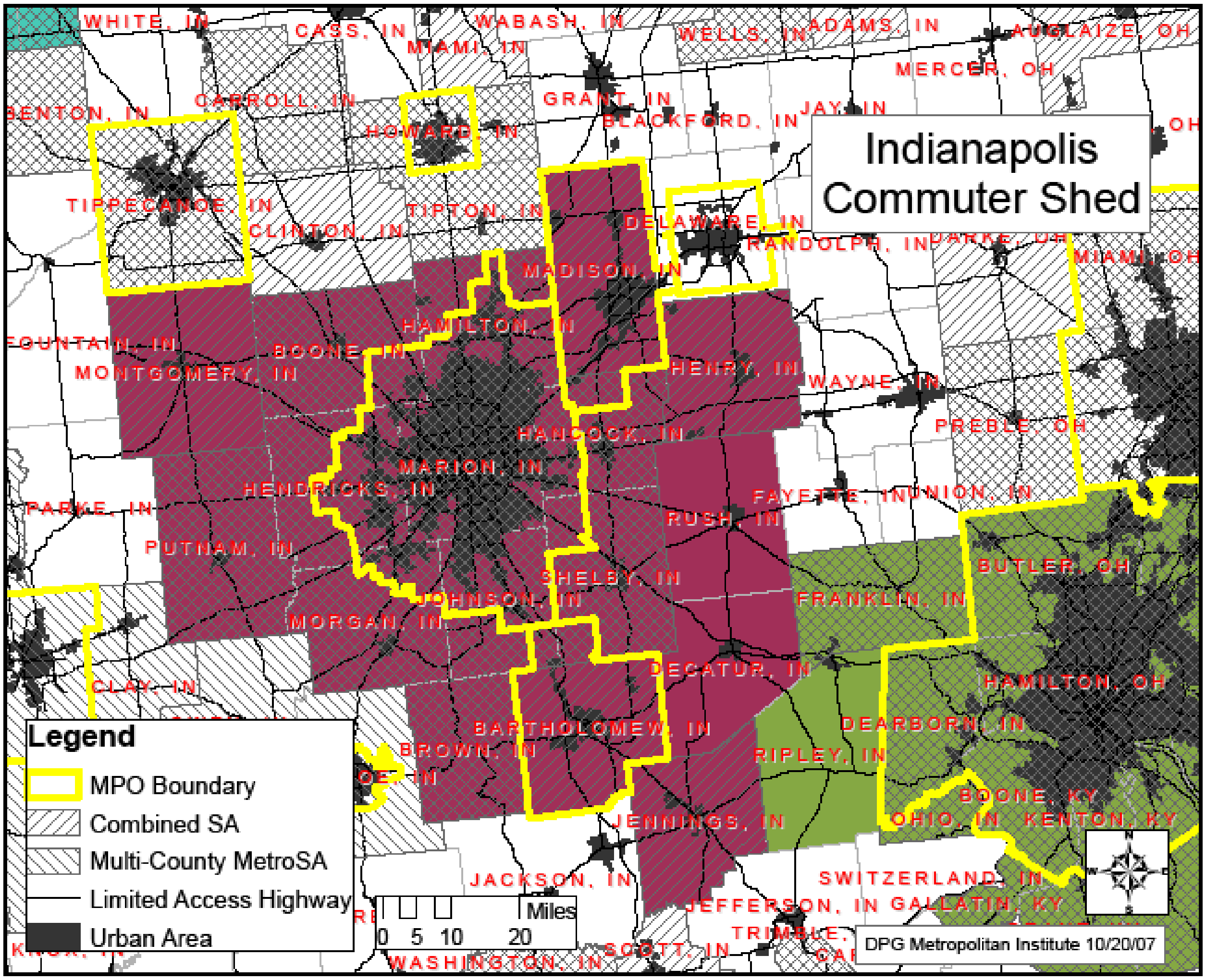
* *Major source was Harris County, TX*

Although Trinity County, Texas, had the highest predicted probability (0.41), LEHD commuting data did not confirm connectivity to the Houston commuter shed. In 2004, Angelina County, Texas, (in the opposite direction from Houston) received 13.8% of outbound workers, which is more than any other single county.

Indianapolis

The Indianapolis CSA is currently comprised of 15 counties. As indicated by the yellow lines in the map, there are currently three MPOs within an area that functions as a single commuter shed. A positive net worker exchange in 2030 indicates workers flowing into the area, meaning additional counties are needed to balance the commuter shed. As shown in Figure 34, a one-county wide area separates the Indianapolis and Cincinnati statistical areas.

Figure 34 – Indianapolis Commuter Shed



Of the counties adjacent to the Indianapolis CSA, Rush County had the highest predicted probably score of 0.60 from the Bedroom Communities logistic regression. Both commuting and migration patterns confirm that Rush and Decatur Counties are part of the Indianapolis commuter shed. As shown in the table below, 46.6% of Rush County in-migration from 2004 to 2005 was from the Indianapolis commuter shed. In 2004, LEHD commuter shed data indicates 27.8% of Rush County resident workers head westward to jobs in Marion and Shelby Counties.

Migration into Rush County, IN

2004-2005

	Returns (~ households)			
Non-Migrants	6,376			
Pct In-Migration	5.8%			
Total In-Migration	395			
Foreign Immigrants				
From Different State		71		
From Same State		324		
From Indianapolis Commuter Shed*			184	46.6%
Fron Cincinnati Commuter Shed			11	2.8%

Major source was Shelby County, IN

Because Decatur County is a minor employment center (net worker inflow) it did not receive a predicted probability score. IRS migration data indicates 36.1% of the annual migration came from the Indianapolis commuter shed. In 2004, LEHD commuter shed data indicates 16.9% of resident workers head west and northwest to jobs in the Indianapolis commuter shed.

Migration into Decatur County, IN

2004-2005

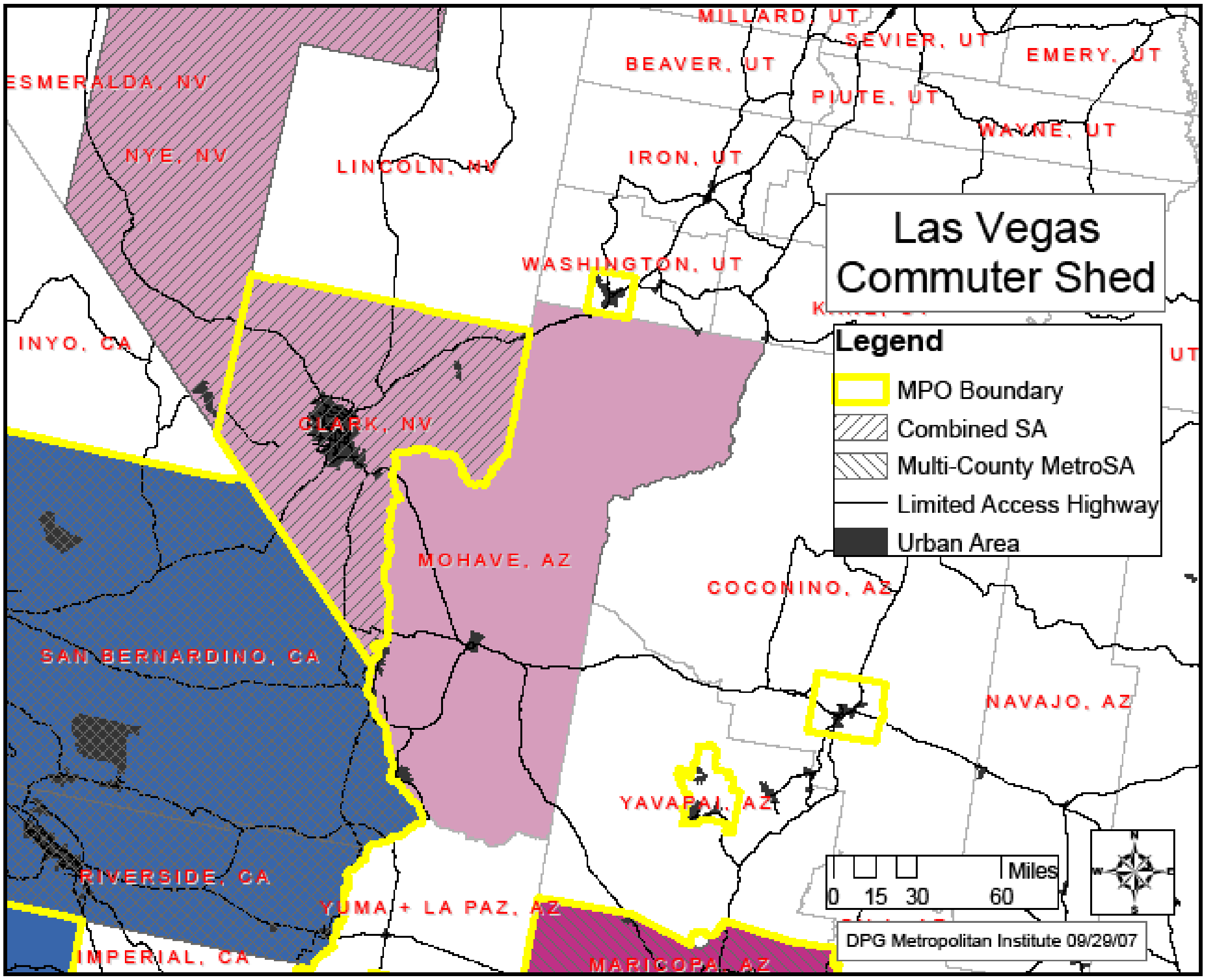
	Returns (~ households)			
Non-Migrants	9,470			
Pct In-Migration	5.9%			
Total In-Migration	593			
Foreign Immigrants				
From Different State		130		
From Same State		463		
From Indianapolis Commuter Shed*			214	36.1%
Fron Cincinnati Commuter Shed			33	5.6%

Major source was Shelby County, IN

Las Vegas

The Las Vegas commuter shed shown in Figure 35 has already expanded westward to encompass Pahrump (in Nye County, Nevada) and will expand to the southeast by 2030 to include Mohave County, Arizona. Based on 2004 to 2005 IRS data, the major source of in-migration for Mohave County was from Clark County, Nevada (9.8%). Even though migration data supports connectivity, it is commuting patterns that provide the strongest evidence. Commuter connectivity between Clark County and Mohave County, Arizona has been increasing over time. Mohave County is located on the state line between Nevada and Arizona, with Bullhead City the prime center of urban activity. In 1990, 17.6% of Mohave County workers headed across the state line to jobs in Clark County. By 2000, approximately 19.7% of workers were traveling to Clark County. With this level of worker interchange, Mohave County already qualifies for voluntary inclusion in the Las Vegas CSA. Some residents of Bullhead City are making the one-way commute of approximately 100 miles to Las Vegas, but there are also a significant number of service jobs in the Nevada casinos immediately across the Colorado River in Laughlin, Nevada and in the recreation areas near Lake Mead.

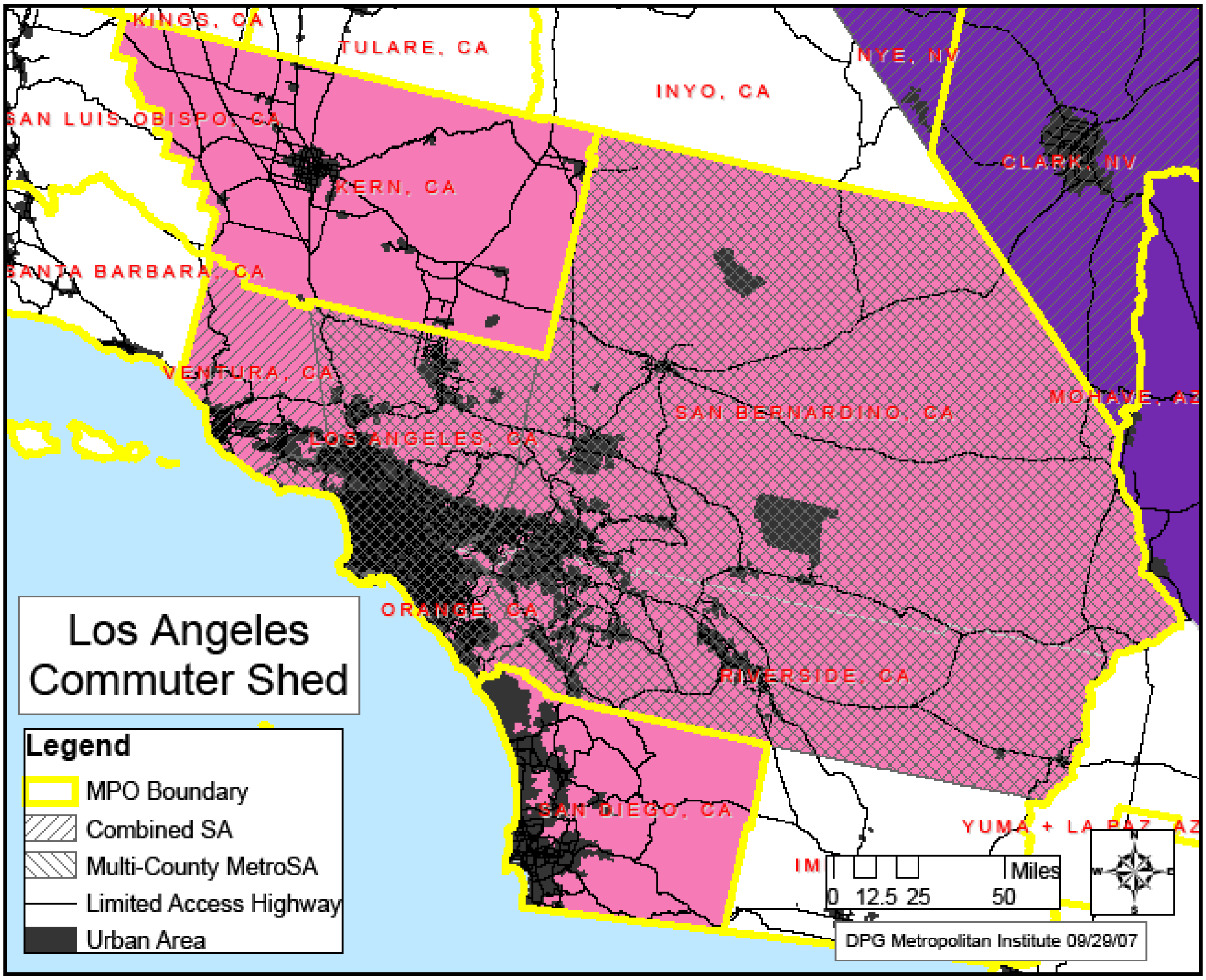
Figure 35 – Las Vegas Commuter Shed



Los Angeles

As shown in Figure 36, the Los Angeles commuter shed will likely include Kern and San Diego Counties by 2030. Currently there are three separate MPOs serving this commuter shed.

Figure 36 – Los Angeles Commuter Shed



The large size of many western counties tends to dampen the magnitude of commuting to adjacent counties. Such is the case in southern California between the Los Angeles and San Diego metropolitan areas. Even with the long commutes, LEHD data for 2004 indicates 16.5% of San Diego's resident workers are heading to jobs in the Los Angeles commuter shed. IRS migration data also confirms San Diego's connectivity, with 23.2% of household in-migration in 2005 coming from the Los Angeles commuter shed.

Migration into San Diego County, CA
2004-2005

	Returns (~ households)		
Non-Migrants	997,060		
Pct In-Migration	6.0%		
Total In-Migration	64,089		
Foreign Immigrants		5,888	
From Different State		34,698	
From Same State		23,503	
From Los Angeles Commuter Shed*			14,844
Pct of Total In-Migration			23.2%

** Major source was Los Angeles County, CA*

A key question for the Southern California area is the strength of the connectivity to the northern most counties. As shown in the table below, Kern County received almost half of household in-migration during 2005 from the other counties in the Los Angeles commuter shed. The predicted probability of Kern County becoming a statistical area by 2030 was 0.43.

Migration into Kern County, CA
2004-2005

	Returns (~ households)		
Non-Migrants	199,255		
Pct In-Migration	6.0%		
Total In-Migration	12,612		
Foreign Immigrants		240	
From Different State		3,299	
From Same State		9,073	
From Los Angeles Commuter Shed*			6,008
Pct of Total In-Migration			47.6%

** Major source was Los Angeles County, CA*

In 2005, in-migration accounted for a 6% increase in households within Santa Barbara County, with 24.5% of the new households migrating from the Los Angeles commuter shed. Countervailing evidence for not including Santa Barbara County in the commuter shed include a low predicted probability of 0.18 and insignificant net worker outflow of. Based on these considerations, Santa Barbara was not added to the commuter shed.

2004-2005 Migration into Santa Barbara County, CA

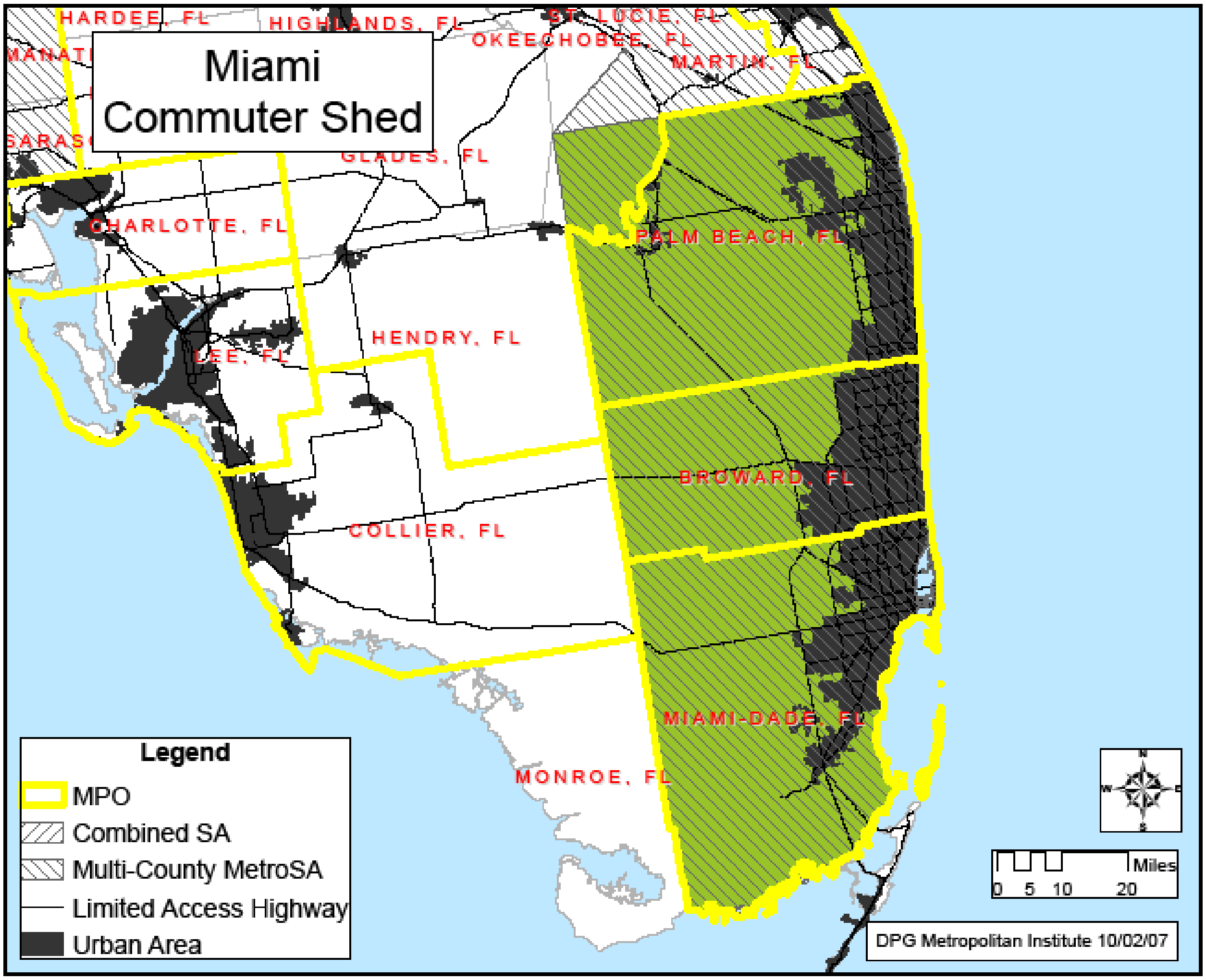
	Returns (~ households)		
Non-Migrants	127,800		
Pct In-Migration	6.0%		
Total In-Migration	8,153		
Foreign Immigrants		324	
From Different State		2,970	
From Same State		4,859	
From Los Angeles Commuter Shed*			2,000
Pct of Total In-Migration			24.5%

* *Major source was Los Angeles County, CA*

Miami

Given its location between the ocean and the Everglades, this three-county metropolitan statistical area has a compact linear form that does not allow geographic expansion of the commuter shed. As shown in Figure 37, the 2030 commuter shed is currently divided into three separate MPO areas.

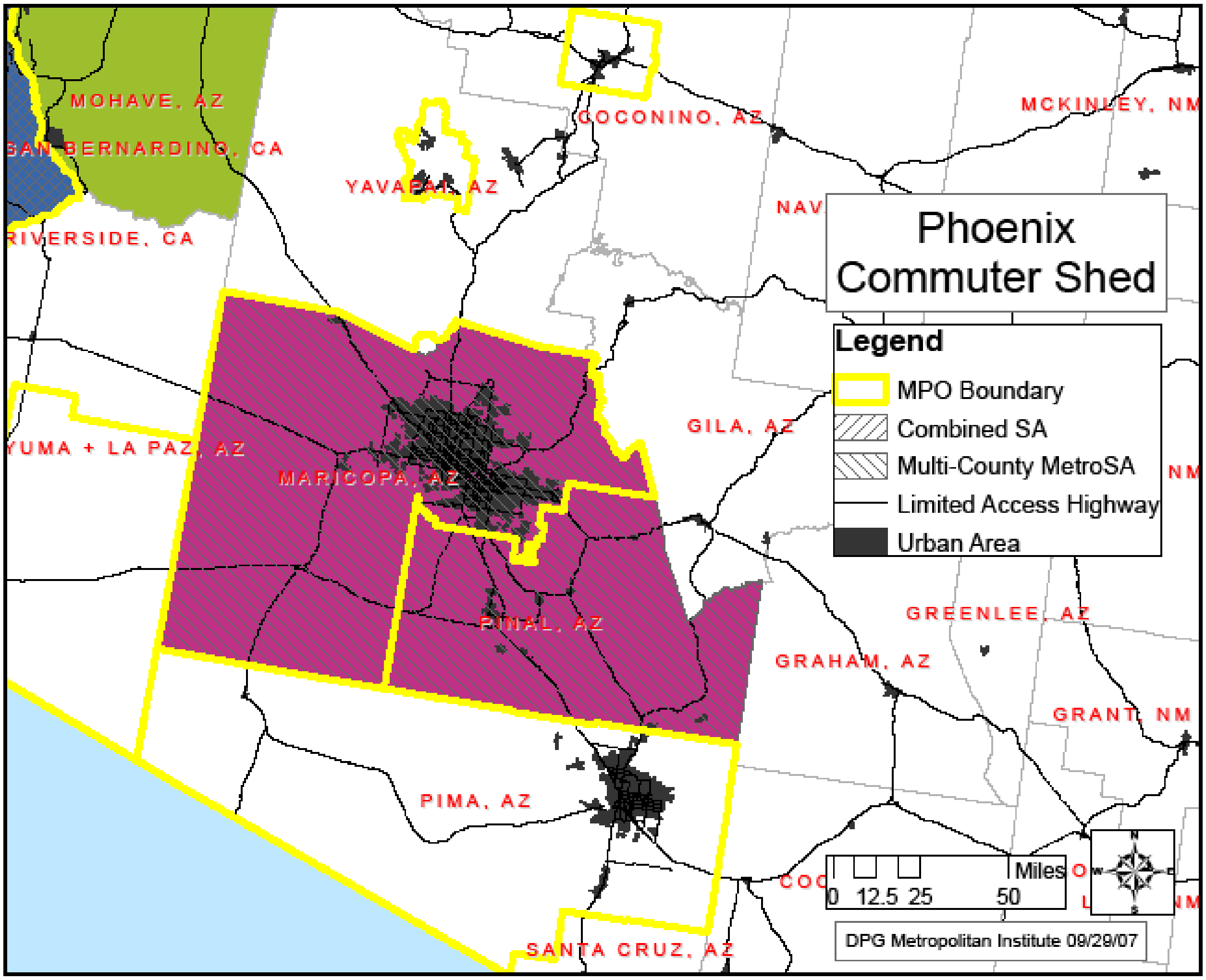
Figure 37 – Miami Commuter Shed



Phoenix

Based on strong commuter connectivity, Pinal and Maricopa Counties should be within the same MPO. (See Figure 38) Unfortunately, Arizona data are not yet available on the LEHD website, so recent commuting patterns can not be evaluated. According to net worker exchange in 2030, no additional counties are needed to balance the commuter shed.

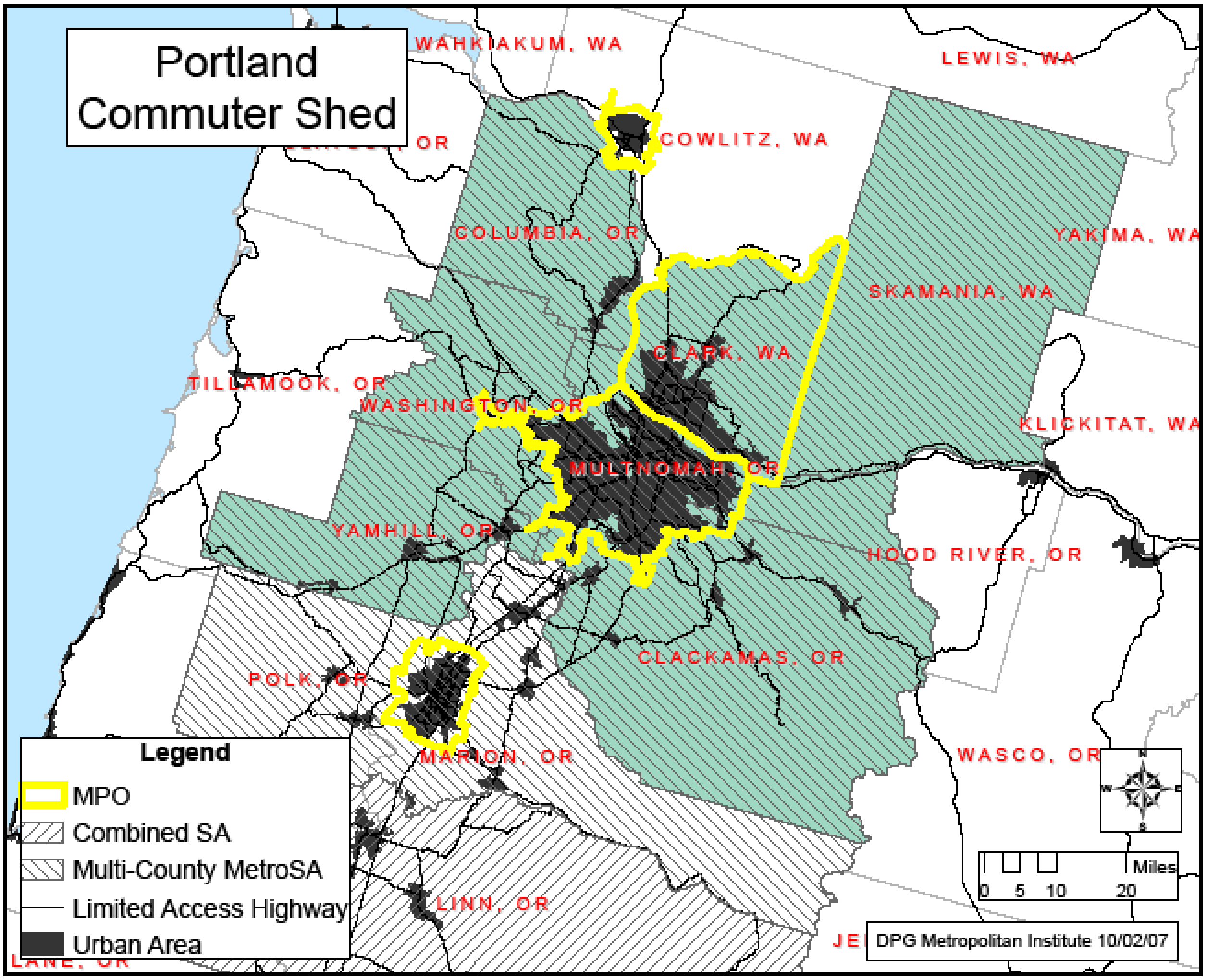
Figure 38 – Phoenix Commuter Shed



Portland

Portland's commuter shed includes the seven counties currently designated as a metropolitan statistical area. As shown in Figure 39, two MPOs divide the contiguous urbanized area, but do not encompass the much larger commuter shed. Projected 2030 worker flows do not require additional counties to achieve commuter balance.

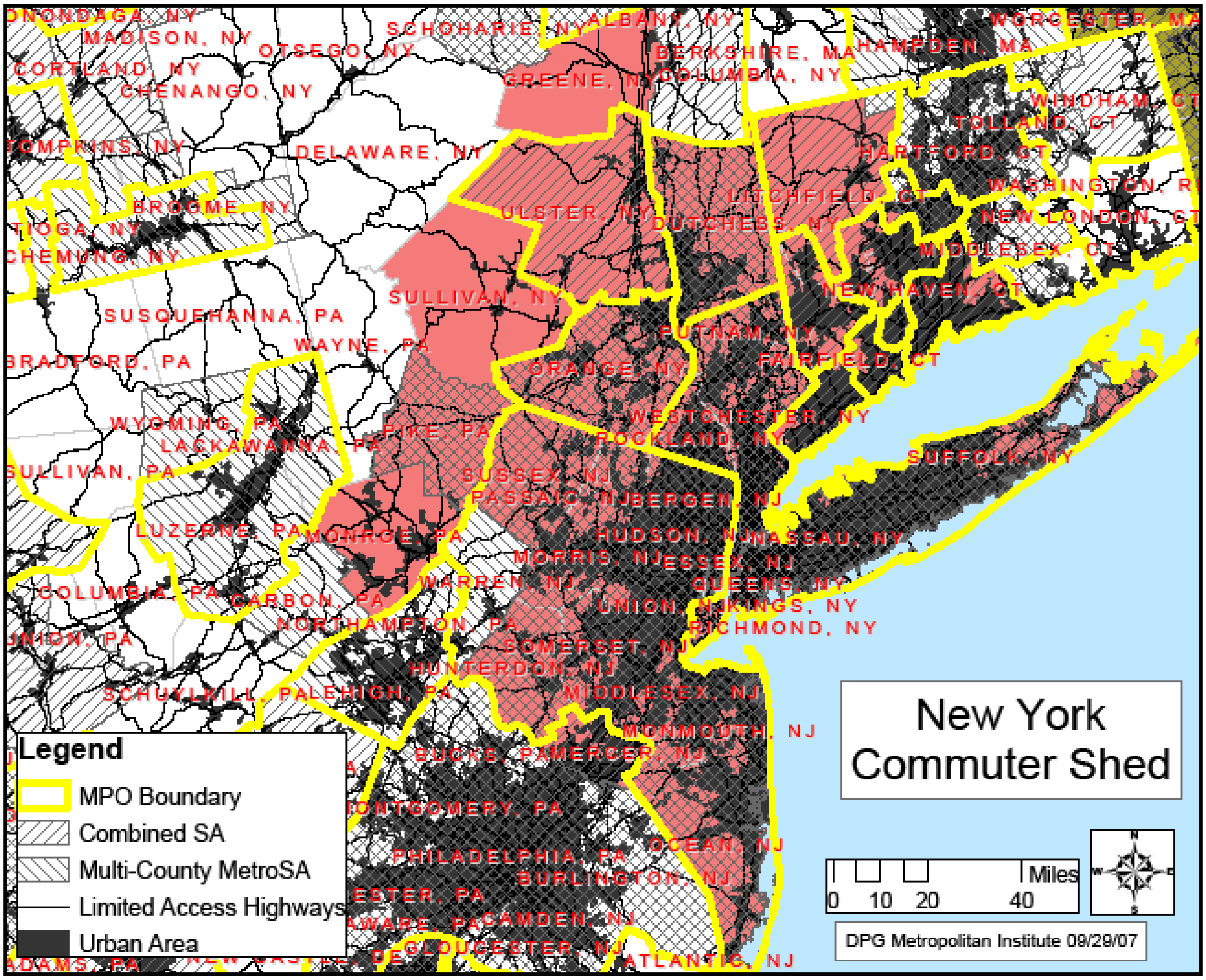
Figure 39 – Portland Commuter Shed



New York

Figure 40 reveals MPO fragmentation of the New York commuter shed into more than a dozen separate transportation planning organizations. Three additional counties are expected to become part of the commuter shed by 2030.

Figure 40 – New York Commuter Shed



Monroe County, Pennsylvania, has a 0.99 predicted probability of becoming a statistical area by 2030. As shown in the table below, 60.9% of household in-migration from 2004 to 2005 came from the New York commuter shed.

Migration into Monroe County, PA

2004-2005

	Returns (~ households)		
Non-Migrants	51,736		
Pct In-Migration	8.8%		
Total In-Migration	4,994		
Foreign Immigrants		28	
From Different State		3,766	
From Same State		1,200	
From New York Commuter Shed*			3,040
Pct of Total In-Migration			60.9%

* *Major source was Queens County, NY*

In one year, Sullivan County, New York, had 1,308 households move in from the New York commuter shed. Sullivan County's predicted probability of becoming a statistical area by 2030 was also high at 0.73.

Migration into Sullivan County, New York

2004-2005

	Returns (~ households)		
Non-Migrants	25,329		
Pct In-Migration	6.7%		
Total In-Migration	1,822		
Foreign Immigrants			
From Different State		484	
From Same State		1,338	
From New York Commuter Shed*			1,308
Pct of Total In-Migration			71.8%

* *Major source was Orange County, NY*

Although Greene County, New York, is approximately 100 miles from Manhattan, IRS migration data supports its connectivity to the New York commuter shed. In 2005, 42.1% of the households moving into Greene County came from the New York commuter shed. The predicted probability of Greene County becoming a statistical area by 2030 was 0.41.

Migration into Greene County, New York

2004-2005

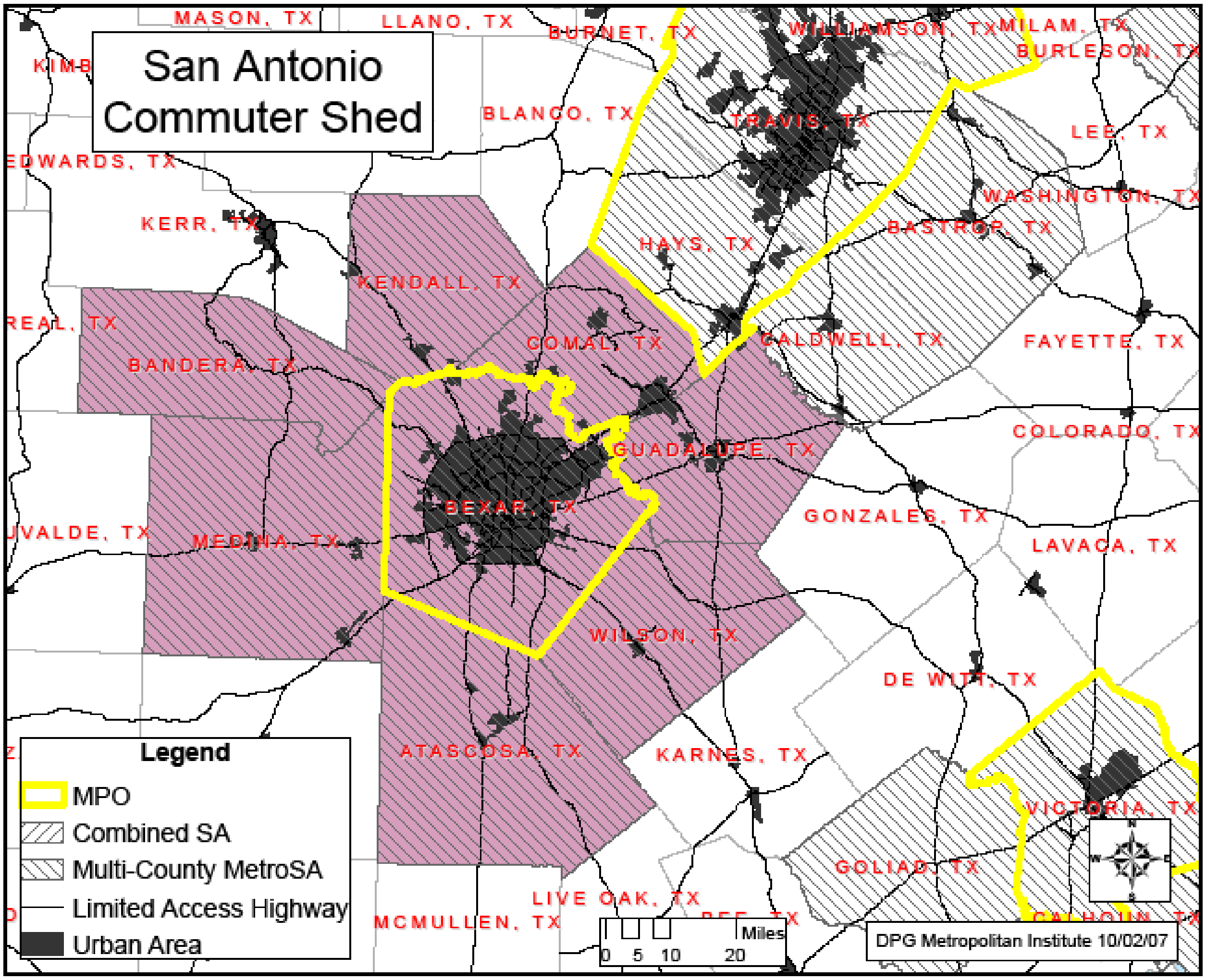
	Returns (~ households)		
Non-Migrants	16,326		
Pct In-Migration	6.8%		
Total In-Migration	1,184		
Foreign Immigrants			
From Different State		265	
From Same State		919	
From New York Commuter Shed*			498
Pct of Total In-Migration			42.1%

* *Major source was Ulster County, NY*

San Antonio

Net worker exchange in 2030 does not support expansion of the San Antonio commuter shed. Even though the current metropolitan statistical area boundary documents that at least 25% of the workers in each of the surrounding counties is working in Bexar County, the current MPO boundary only covers the core of the commute shed. (See Figure 41) Seven additional counties should be added to the MPO area to adequately represent the commuter shed.

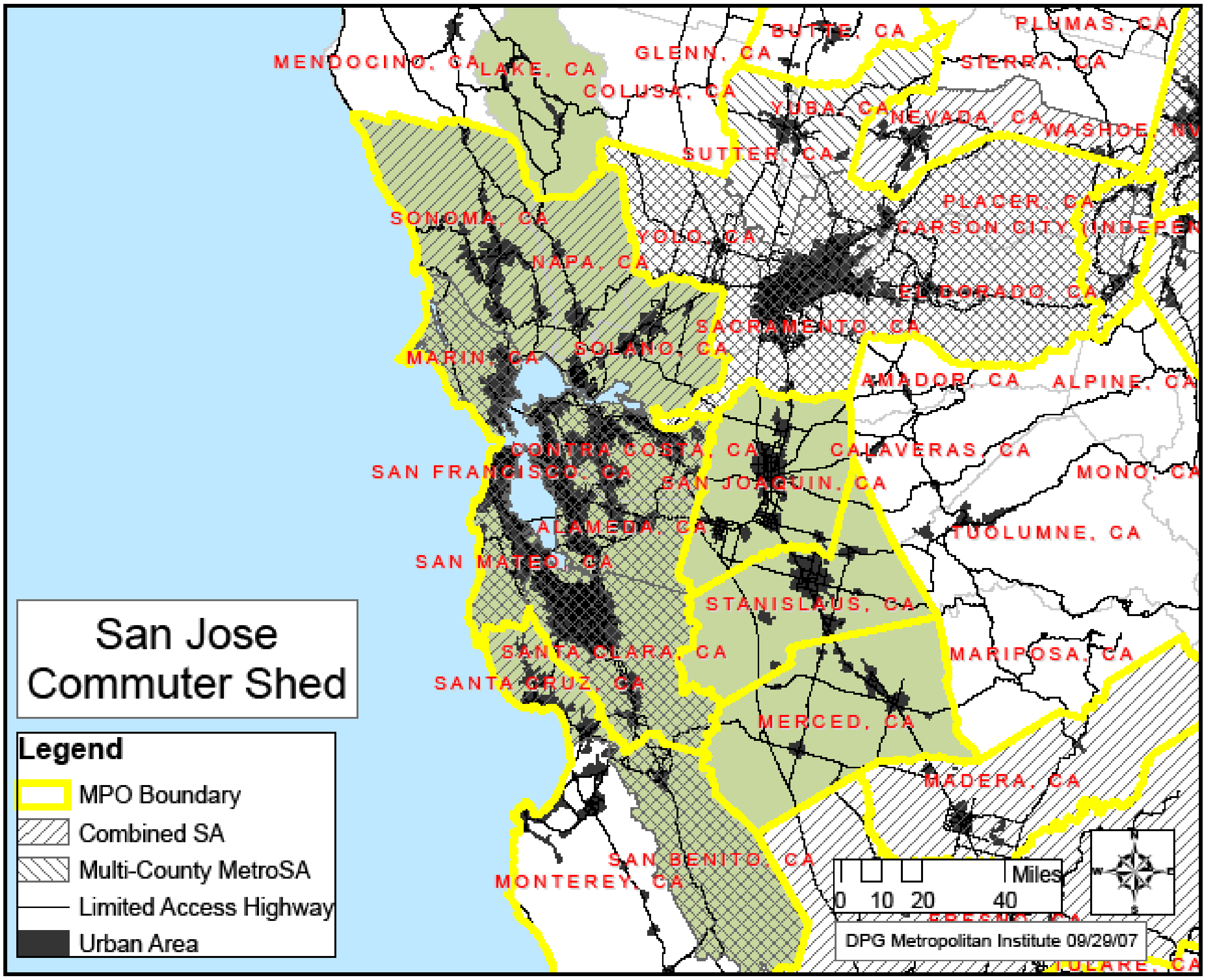
Figure 41 – San Antonio Commuter Shed



San Jose

As shown in Figure 42, the three large inland counties of San Joaquin, Stanislaus and Merced, currently have their own MPOs. According to the 2030 Bedroom Communities logistic regression, these three counties will become part of the San Jose commuter shed, along with Lake County (located at the north end of the commuter shed).

Figure 42 – San Jose Commuter Shed



San Joaquin County had a predicted probability of 0.99 from the logistic regression model. As shown in the table below, IRS migration data provides convincing evidence of connectivity with 60.9% of the in-migration coming from the San Jose commuter shed. An interesting pattern can be seen by examining the major source of in-migration in the next three tables. A migratory path seems evident as households move outward from Alameda to San Joaquin to Stanislaus to Merced.

Migration into San Joaquin County, CA
2004-2005

	Returns (~ households)		
Non-Migrants	185,722		
Pct In-Migration	6.8%		
Total In-Migration	13,554		
	Foreign Immigrants	115	
	From Different State	2,031	
	From Same State	11,408	
	From San Jose Commuter Shed*		8,250
	Pct of Total In-Migration		60.9%

* *Major source was Alameda County, CA*

The predicted probability for Stanislaus is also 0.99 and 60.8% of the in-migration was from the San Jose commuter shed.

Migration into Stanislaus County, CA
2004-2005

	Returns (~ households)		
Non-Migrants	145,147		
Pct In-Migration	6.0%		
Total In-Migration	9,326		
	Foreign Immigrants	72	
	From Different State	1,615	
	From Same State	7,639	
	From San Jose Commuter Shed*		5,669
	Pct of Total In-Migration		60.8%

* *Major source was San Joaquin County, CA*

Merced is the southern-most county but the predicted probability remained high at 0.97. In-migration declined slightly with 52.5% of the new households coming from the San Jose commuter shed.

Migration into Merced County, CA

2004-2005

	Returns (~ households)		
Non-Migrants	63,191		
Pct In-Migration	6.5%		
Total In-Migration	4,366		
	Foreign Immigrants	29	
	From Different State	634	
	From Same State	3,703	
	From San Jose Commuter Shed*		2,293
	Pct of Total In-Migration		52.5%

Major source was Stanislaus County, CA

Although the predicted probability of Lake County becoming a statistical area by 2030 is much lower at 0.22, IRS migration data clearly indicates connectivity. In 2005, 53.5% of the household in-migration was from the San Jose commuter shed.

Migration into Lake County, CA

2004-2005

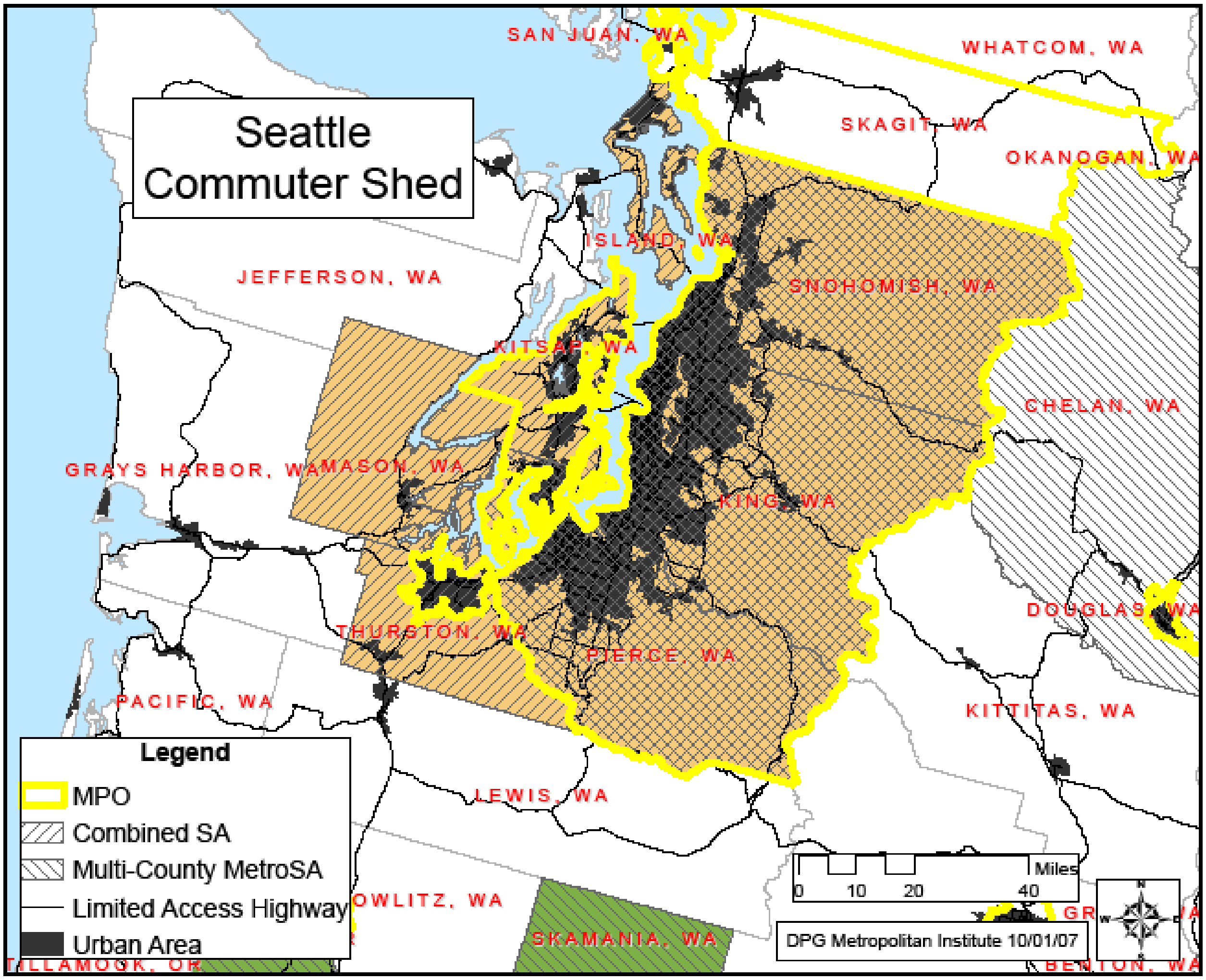
	Returns (~ households)		
Non-Migrants	17,510		
Pct In-Migration	8.9%		
Total In-Migration	1,720		
	Foreign Immigrants		
	From Different State	296	
	From Same State	1,424	
	From San Jose Commuter Shed*		921
	Pct of Total In-Migration		53.5%

Major source was Sonoma County, CA

Seattle

Net worker exchange in 2030 is balanced for the Seattle CSA without any additional counties. Also, Figure 43 reveals the MPO boundary includes Snohomish, King and Pierce Counties, which covers most of the commuter shed.

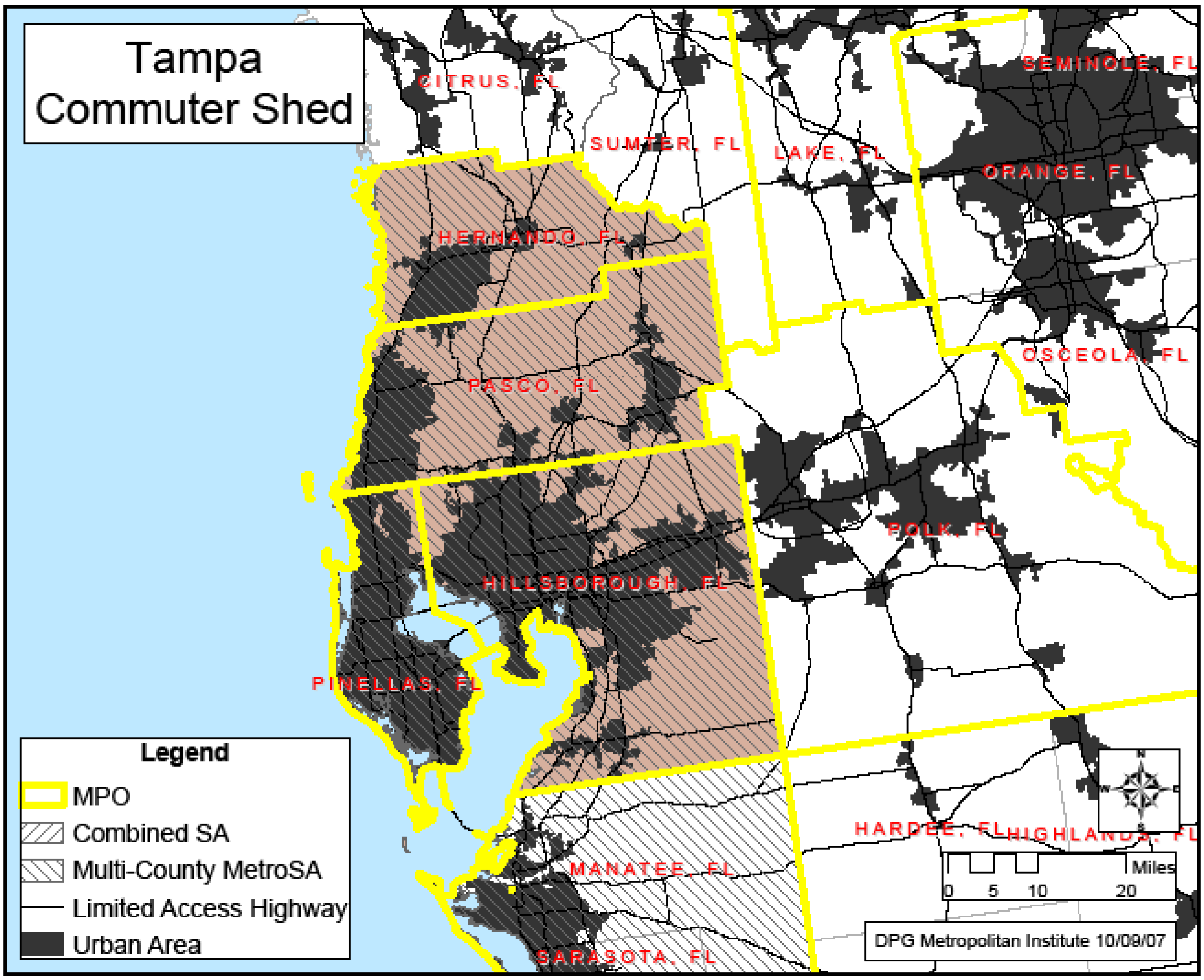
Figure 43 – Seattle Commuter Shed



Tampa

In 2030, the Tampa MSA exhibits a negative worker exchange. In other words, there is no need to expand the commuter shed because there is a minor net outflow of workers to adjacent counties. The commuter shed is currently divided into four separate MPO areas, as shown in Figure 44.

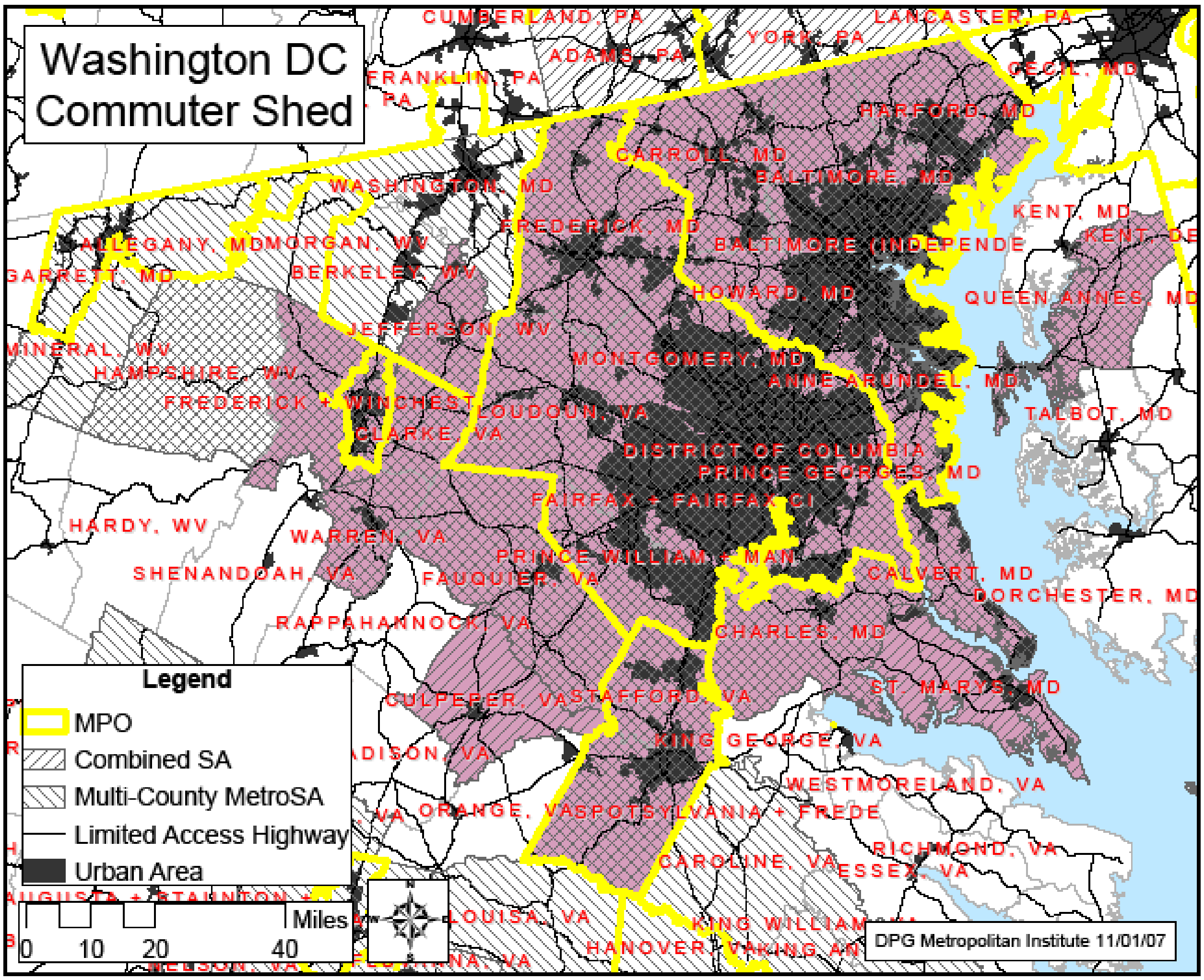
Figure 44 – Tampa Commuter Shed



Washington, DC

As shown in Figure 45, the Washington DC commuter shed includes Baltimore and five MPO areas. Based on current commuting patterns, IRS migration data and projected net worker exchange in 2030, Hampshire County, West Virginia, should be dropped from the CSA.

Figure 45 – Washington, DC Commuter Shed



According to 2004 LEHD data, 24.1% of Frederick County resident workers travelled to jobs located in the Washington DC commuter shed. IRS migration data also indicates strong connectivity with 67.2% of household in-migration coming from the Washington DC commuter shed.

Migration into Frederick County, VA

2004-2005

	Returns (~ households)	
Non-Migrants	8,521	
Pct In-Migration	15.3%	
Total In-Migration	1,545	
Foreign Immigrants		18
From Different State		558
From Same State		969
From Washington DC Commuter Shed*		1,038
Pct of Total In-Migration		67.2%

* *Major source was Winchester, VA*

Hampshire County, West Virginia, is currently in a statistical area along with the City of Winchester and Frederick County, Virginia. In contrast to Frederick's connectivity, Hampshire is isolated from the Washington DC commuter shed. In 2005, only 53 households (9.1% of total in-migration) came from the commuter shed located east of Frederick County. LEHD commuting data also indicates very weak connectivity between residents of Hampshire County and jobs located outside of West Virginia. In 2004, only 230 Hampshire County resident workers traveled to jobs located outside of West Virginia.

Migration into Hampshire, WV

2004-2005

	Returns (~ households)			
Non-Migrants	7,317			
Pct In-Migration	7.4%			
Total In-Migration	585			
Foreign Immigrants				
From Different State		438		
From Same State		147		
From Winchester and Frederick Co., VA*			121	20.7%
Remainder of the Washington DC Commuter Shed			53	9.1%

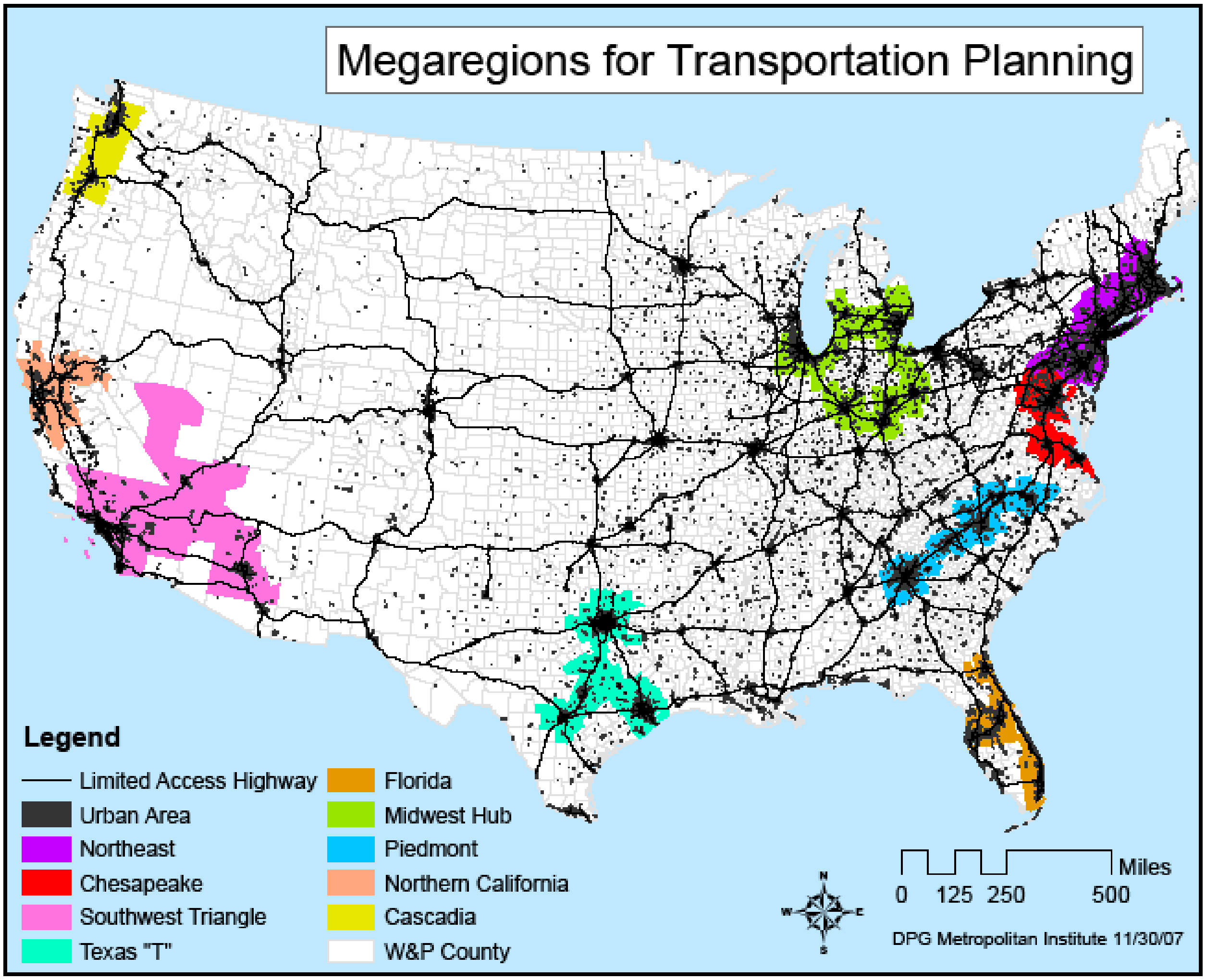
* *Major source was Frederick County, VA*

Discussion of Transportation Megaregions

The extent of the commuter sheds described above suggests limiting application of the term "megaregion" to multiple, contiguous metropolitan areas. In other words, Gottman's megalopolis seems to be the best conceptual model for the Transportation Megaregions discussed below. To be designated as a Transportation Megaregion the following three tests must be satisfied. First, Transportation Megaregions are global gateways (i.e. areas with major seaports and international airports) that facilitate movement of people and goods to and from the continental United States. Second, Transportation Megaregions are contiguous statistical areas with urban centers located approximately 100 to 400 miles apart. Third, Transportations Megaregions include end-point statistical areas projected to add at least one million persons and jobs over the next 20 to 30 years. As shown in Figure 46, there are nine geographic areas that satisfy the three tests for designation as Transportation Megaregions.

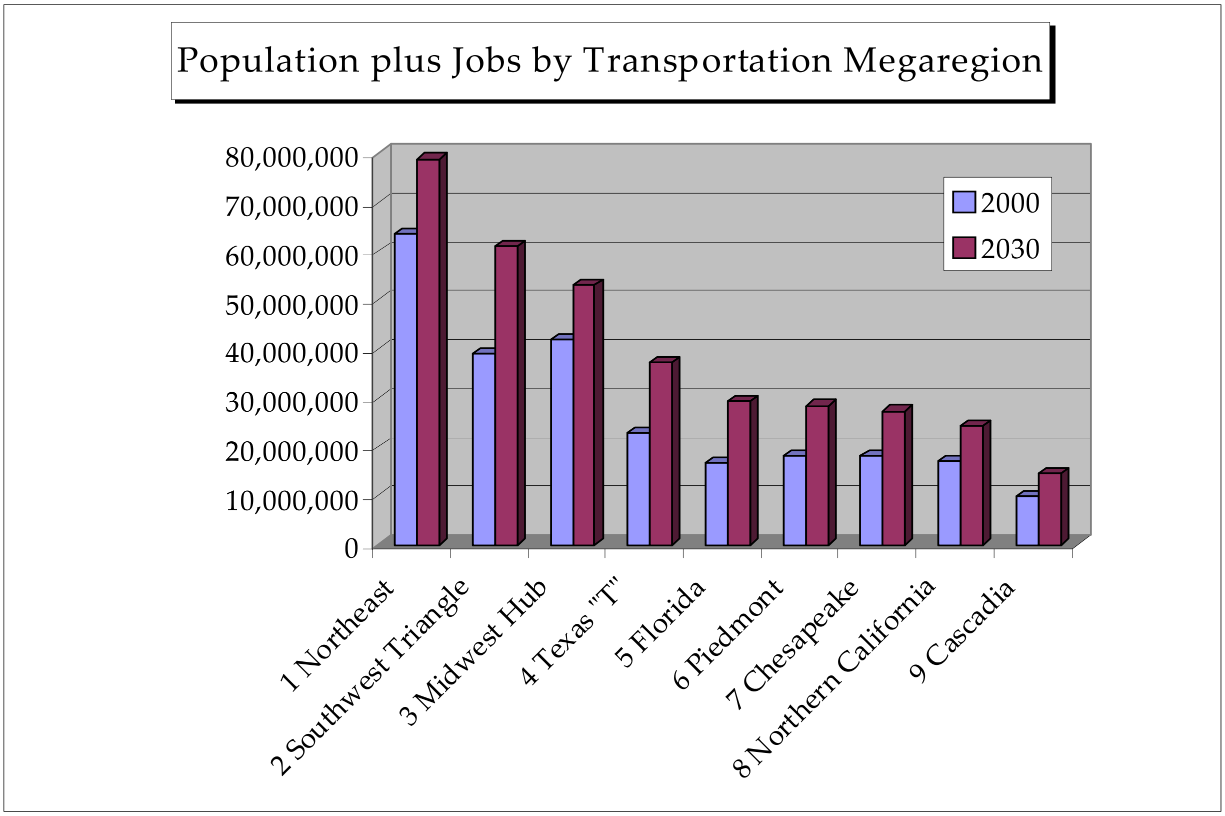
Eight of the nine Transportation Megaregions contain the nation's most active water ports. On the west coast, Transportation Megaregions include major seaports in Seattle, San Francisco/Oakland, Los Angeles/Long Beach and San Diego. On the Gulf of Mexico, major seaports within Transportation Megaregions include Houston and Tampa. East coast Transportation Megaregions include seaports located in Miami, Jacksonville, Norfolk, Baltimore, New York and Boston. The Midwest Hub Megaregion includes water transportation of freight via the Great Lakes and the St. Lawrence Seaway. Only the inland Piedmont Megaregion lacks a seaport, but has several airports (e.g. Atlanta and Charlotte) that serve as global gateways for both people and goods.

Figure 46 – Recommended Megaregions for Transportation Planning



Transportation Megaregions contained approximately 55.6% of the population plus jobs in the continental United States in the year 2000. By 2030, their share increases to 57.1%. From 2000 to 2030, Transportation Megaregions are projected to capture 61.1% of the increase in population and jobs in the continental U.S. In the chart below (see Figure 47) Transportation Megaregions are rank-ordered according to projected population plus jobs in 2030.

Figure 47 – Population Plus Jobs by Transportation Megaregion



To confirm the role of Transportation Megaregions as global gateways, Figure 48 provides a rank-ordered list of overseas visitors to select U.S. cities during 2001-2002. The top 20 cities listed are located within Transportation Megaregions.

Figure 48 – Overseas Visitors to Select U.S. Cities

CITY VISITATION**	2002 SHARE	2002 VISITATION	2001 SHARE	2001 VISITATION
New York City	22.20%	4,244	22.00%	4,803
Los Angeles	11.80%	2,256	12.90%	2,816
Miami	11.50%	2,198	11.70%	2,554
Orlando	9.80%	1,873	11.30%	2,467
San Francisco	8.60%	1,644	9.00%	1,965
Las Vegas	6.40%	1,223	6.90%	1,506
Metro DC Area	5.40%	1,032	5.50%	1,201
Chicago	5.30%	1,013	4.90%	1,070
Boston	4.30%	822	4.90%	1,070
Atlanta	2.80%	535	3.20%	699
San Diego	2.30%	440	2.70%	589
Philadelphia	2.20%	421	1.90%	415
Tampa/St. Petersburg	1.90%	363	2.30%	502
Houston	1.90%	363	1.90%	415
San Jose	1.80%	344	1.90%	415
Dallas/Ft. Worth	1.70%	325	1.60%	349
Seattle	1.60%	306	1.60%	349
Ft. Lauderdale	1.50%	287	1.90%	415
Detroit	1.30%	249	1.30%	284
Phoenix	1.30%	249	1.20%	262
Denver	1.30%	249	1.10%	240
New Orleans	1.20%	229	1.80%	393
Minn./St. Paul	0.70%	134	1.20%	262
Baltimore	0.70%	134	0.70%	153
Sacramento	0.70%	134	0.70%	153
Salt Lake City	0.60%	115	0.70%	153
Portland	0.60%	115	0.50%	109
Cincinnati	0.50%	96	0.50%	109
Pittsburgh	0.50%	96	0.50%	109
Columbus	0.50%	96	0.40%	87
Austin	0.40%	76	0.60%	131
Charlotte	0.40%	76	0.50%	109
San Antonio	0.40%	76	0.50%	109
Cleveland	0.30%	57	0.50%	109

* Excludes Canada and Mexico

Source: U.S. Department of Commerce, Office of Travel and Tourism Industries, 5/03

To determine specific routes and locations for future high speed rail stations, the ideal “distance” should be determined by door-to-door travel time, not a precise linear measurement. If the distance is too short, travelers will drive and if the distance is too long, travelers will fly. The general rule of thumb is that high-speed rail is ideally suited for city centers that are located between 100 and 400 miles apart (Lynch 1998). Beyond 400 miles, air travel offers greater time savings. Figure 49 indicates megaregion areas that are potential candidates for high-speed rail service and the distance between city pairs. Given its linear form, the Piedmont Megaregion has the greatest distance between end-point metropolitan areas. Although passengers are not likely to travel all the way around the Midwest Hub, the circular service area will require more linear feet of track than the Piedmont Megaregion. On the east coast, the Northeast and Chesapeake high-speed rail systems should be connected (probably in Philadelphia) to allow passengers to travel between these Transportation Megaregions.

Figure 49 – Distance between Urban Centers by Megaregion

	Megaregion	***City Pair***	***Miles***
1	Northeast	Boston to Philadelphia	321
2	Southwest Triangle	Phoenix to Las Vegas	287
2	Southwest Triangle	Las Vegas to Los Angeles	270
2	Southwest Triangle	Los Angeles to San Diego	121
3	Midwest Hub	Chicago to Cincinnati	260
4	Texas "T"	Dallas to San Antonio	275
4	Texas "T"	Houston to Dallas	239
4	Texas "T"	Houston to San Antonio	197
5	Florida	Jacksonville to Miami	351
6	Piedmont	Raleigh to Atlanta	411
7	Chesapeake	Washington DC to Virginia Beach	208
8	Northern California	San Jose to Sacramento	117
9	Cascadia	Seattle to Portland	173

The third test for an area to be designated as a Transportation Megaregion is the projected increase in population and jobs over the next 20 to 30 years. As shown in Figure 50, each of the end-point statistical areas or megaregion “anchors” has a projected increase of at least one million persons and jobs from 2000 to 2030. Statistical areas with a projected increase in population and jobs less than one million are also listed if they are located between the major megaregion anchors, or they are part of the metropolitan commuter shed. In combination, the Northeast and Chesapeake Megaregions will add approximately 24.6 million residents and jobs. The Southwest Triangle is expected to add 22 million residents and jobs between 2000 and 2030, which is a greater increase than any other single megaregion.

As measured by number of counties, the Midwest Hub exceeds all other megaregions with 115 counties. There is a tie for second place with the Northeast and Piedmont each having 86 counties. At the other end of the spectrum is the Southwest Triangle with only 13 counties.

Figure 50 – List of Statistical Areas by Transportation Megaregion

	SA 2005	SA Title	#Co	Pop & Job Incr	Transportation Megaregion
1	408	New York-Newark	30	7,559,916	Northeast
1	148	Boston-Worceste	17	3,170,123	Northeast
1	428	Philadelphia-Ca	13	2,369,345	Northeast
1	39300	Providence-New B	6	681,719	Northeast
2	348	Los Angeles-Lon	5	10,094,774	Southwest Triangle
2	38060	Phoenix-Mesa-Sco	2	5,097,300	Southwest Triangle
2	332	Las Vegas-Parad	2	3,292,453	Southwest Triangle
2	41740	San Diego-Carlsb	1	2,415,377	Southwest Triangle
2	37100	Oxnard-Thousand	1	637,803	Southwest Triangle
3	176	Chicago-Napervi	16	4,878,904	Midwest Hub
3	220	Detroit-Warren-	9	1,338,287	Midwest Hub
3	198	Columbus-Marion	12	1,254,068	Midwest Hub
3	294	Indianapolis-An	15	1,225,235	Midwest Hub
3	178	Cincinnati-Midd	16	1,004,939	Midwest Hub
3	266	Grand Rapids-Mu	7	688,377	Midwest Hub
4	206	Dallas-Fort Wor	19	5,555,242	Texas "T"
4	288	Houston-Baytown	12	4,649,284	Texas "T"
4	12420	Austin-Round Roc	5	1,980,216	Texas "T"
4	41700	San Antonio, TX	8	1,572,081	Texas "T"
5	33100	Miami-Fort Laude	3	5,371,233	Florida
5	422	Orlando-The Vil	5	3,013,047	Florida
5	45300	Tampa-St. Peters	4	2,176,138	Florida
5	27260	Jacksonville, FL	5	1,048,196	Florida
5	15980	Cape Coral-Fort	1	790,549	Florida
6	122	Atlanta-Sandy S	33	4,757,554	Piedmont
6	172	Charlotte-Gasto	13	1,992,493	Piedmont
6	450	Raleigh-Durham-	8	1,683,110	Piedmont
6	268	Greensboro--Win	10	714,995	Piedmont
7	548	Washington-Balt	28	6,740,724	Chesapeake
7	47260	Virginia Beach-N	14	1,005,789	Chesapeake
7	40060	Richmond, VA	17	895,707	Chesapeake
8	488	San Jose-San Fr	11	3,780,653	Northern California
8	472	Sacramento--Ard	6	2,355,343	Northern California
9	500	Seattle-Tacoma-	7	2,796,072	Cascadia
9	38900	Portland-Vancouv	7	1,580,564	Cascadia

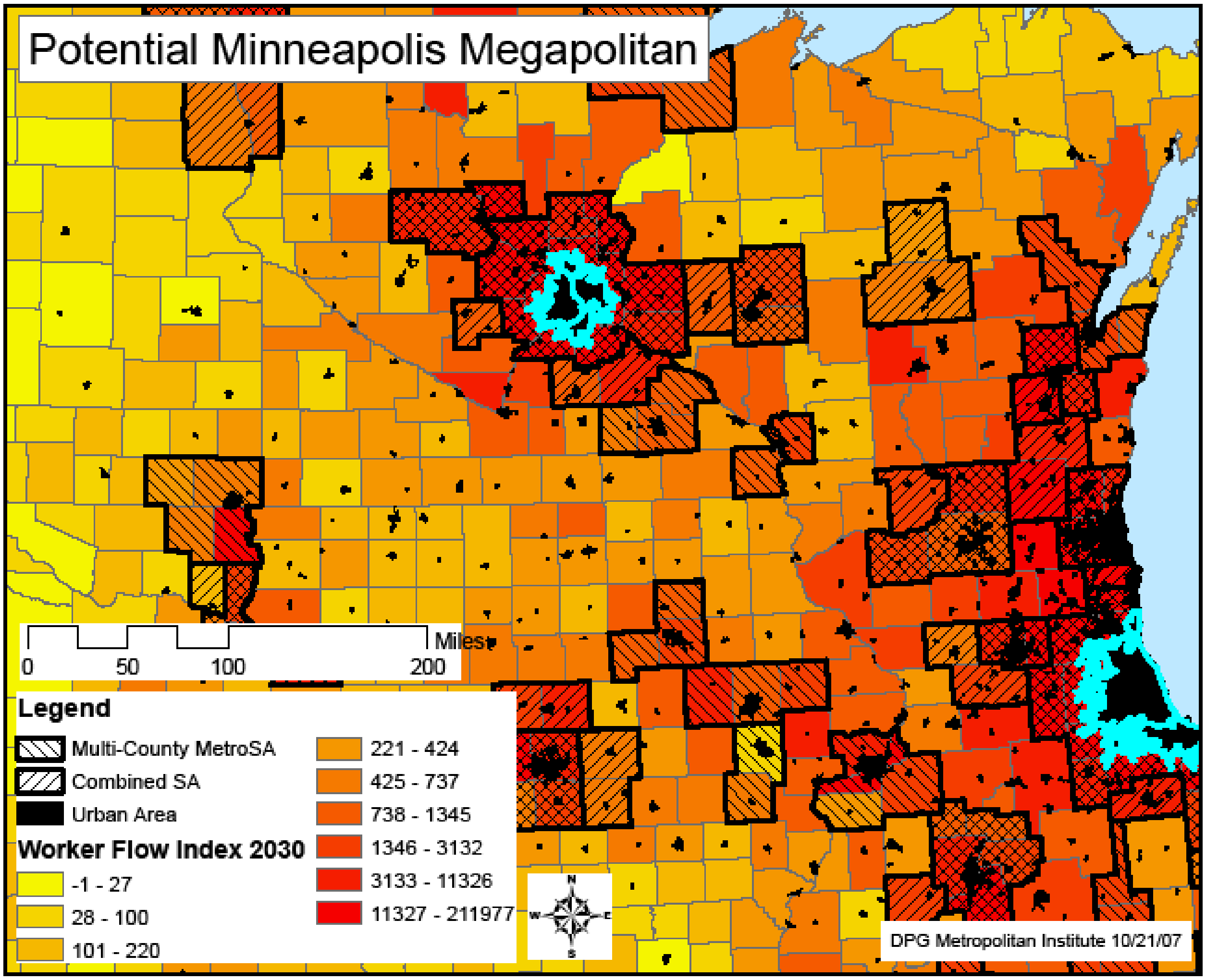
Figure 51 provides a rank-ordered list of statistical areas with a population plus job increase of at least 592,000 (the projected increase for the Cleveland CSA) representing the least growth of any of the 22 commuter sheds analyzed above. Pittsburgh is the other “anchor” statistical area in the Steel Corridor megapolitan area indentified by Lang and Nelson (2007). Because of the relatively flat population and job projections, along with the limited role of the Steel Corridor as a global gateway, this area does not qualify as a Transportation Megaregion. At the top of the table are two major, fast-growth CSAs (Minneapolis and Denver) that also do not qualify as Transportation Megaregions, but for different reasons as discussed below.

Figure 51 – Population and Job Increase for Non-Megaregion Areas

SA 2005	*SA Title*	*#Co*	*Pop & Job Incr*
378	Minneapolis-St.	18	2,697,375
216	Denver-Aurora-B	11	2,600,829
482	Salt Lake City-	8	1,488,253
400	Nashville-David	14	1,393,402
312	Kansas City-Ove	17	1,332,292
476	St. Louis-St. C	17	968,082
32580	McAllen-Edinburg	1	862,758
314	Knoxville-Sevie	12	853,764
46060	Tucson, AZ	1	815,108
260	Fresno-Madera,	2	778,532
42260	Sarasota-Bradent	2	772,879
142	Birmingham-Hoov	8	743,641
430	Pittsburgh-New	8	739,639
416	Oklahoma City-S	8	711,118
10740	Albuquerque, NM	4	694,582
350	Louisville-Jeff	16	683,545
32820	Memphis, TN-MS-A	8	678,726
36420	Oklahoma City, O	7	675,461
376	Milwaukee-Racin	5	647,013
14260	Boise City-Nampa	5	612,979
16700	Charleston-North	3	594,525
22220	Fayetteville-Spr	4	593,210
184	Cleveland-Akron	8	592,036

The following two maps and related text explain why Minneapolis and Denver are not regarded as Transportation Megaregions. As evident in maps of the continental U.S., major urban areas become fewer and more isolated in the western states. Although Minneapolis is located about 400 miles from Chicago, the two major urban centers are clearly separated by multi-county rural areas. Figure 52 indicates a distinct ring of counties around Minneapolis with relatively low Worker Flow scores, as indicated by the yellow and light orange colors. In contrast to the rural ring surrounding Minneapolis, the identified Transportation Megaregions all have continuous connectivity indicated by existing statistical areas or counties with high Worker Flow scores that will likely be joined to metropolitan commuter sheds by 2030.

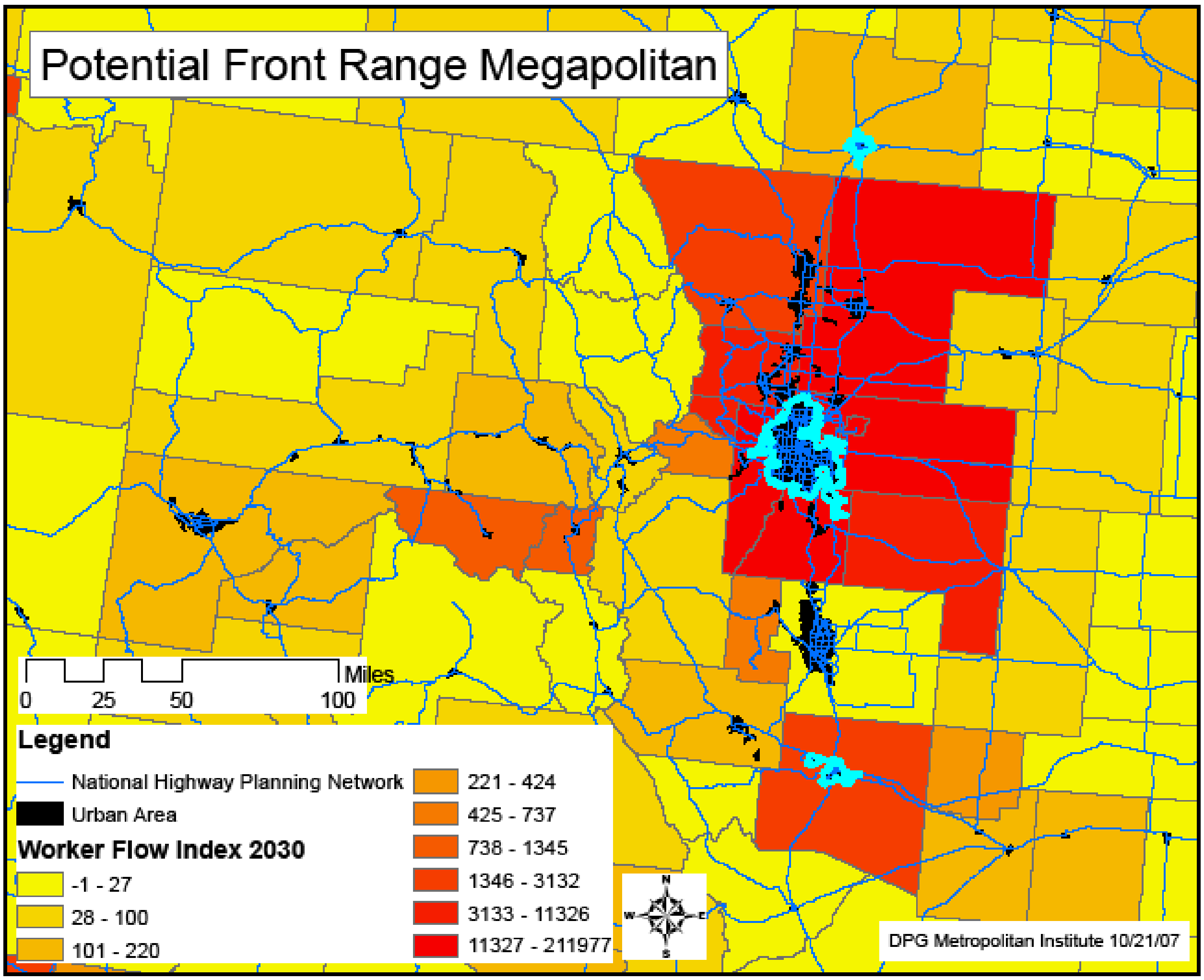
Figure 52 – Potential Minneapolis Megapolitan



As shown below in Figure 53, the area extending from Cheyenne, Wyoming, on the north to Pueblo, Colorado, on the south was identified by Lang and Nelson (2007) as the Front Range Megapolitan. The primary reasons for not designating this area as a Transportation Megaregion are the close proximity of the urban centers and the lack of another major metropolitan area to “anchor” the megaregion corridor. Cheyenne and

Pueblo are each about 100 miles from the center of Denver, which is the minimal distance for high-speed rail service, but these are relatively minor urban areas. Although Colorado Springs is larger than Cheyenne and Pueblo, this metropolitan area is an independent employment center that is not within the Denver commuter shed and it might be located too close to Denver for effective high-speed rail service.

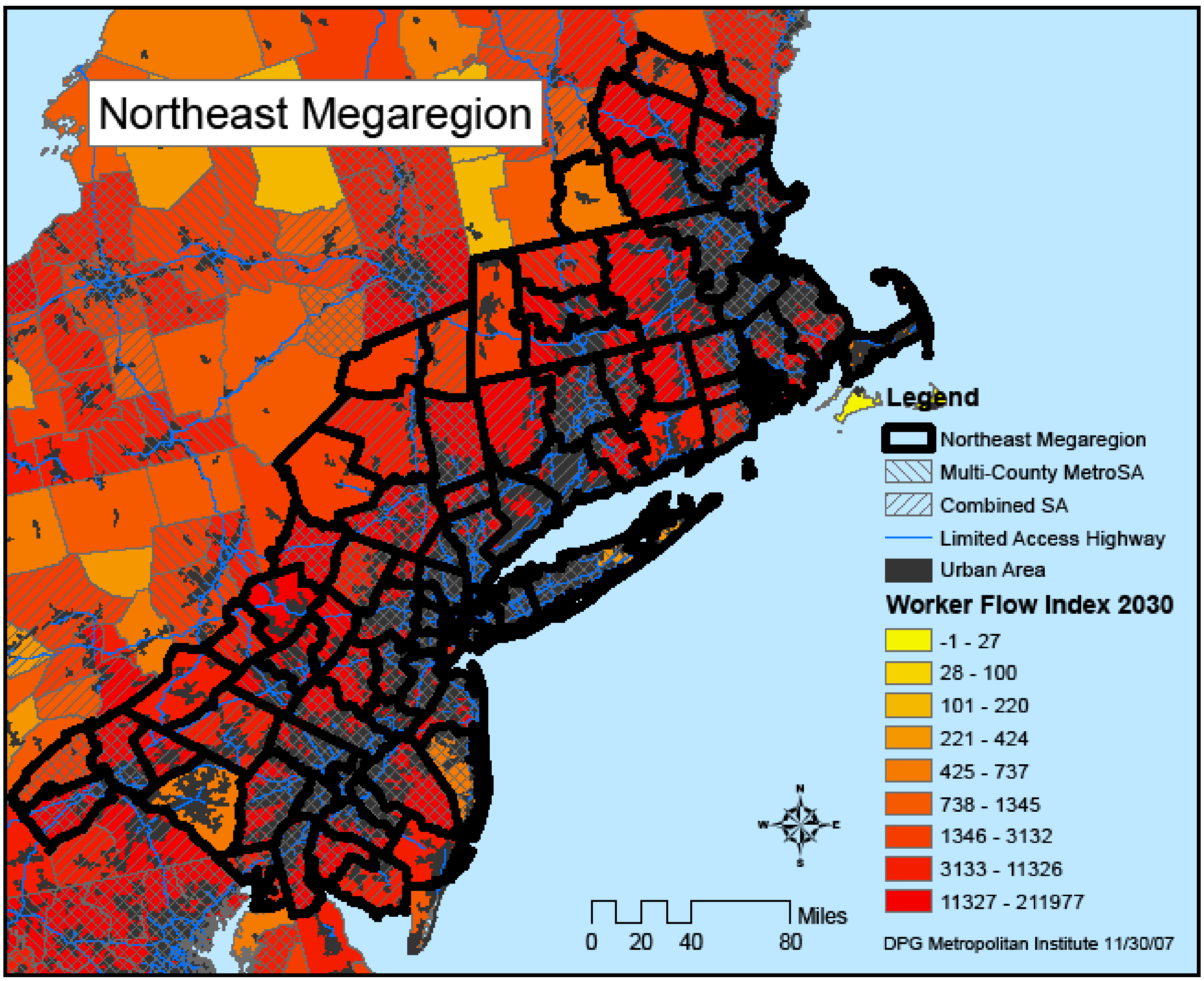
Figure 53 – Potential Front Range Megapolitan



Northeast

Since the 1960s the "poster-child" for the megaregion concept has been the northeast seaboard of the United States. As shown in Figure 54, a continuous urban area extends from Boston to Philadelphia. In addition to the 2005 statistical area designations, the Northeast Megaregion includes a few additional counties with strong commuter and migration connectivity to their metropolitan commuter sheds.

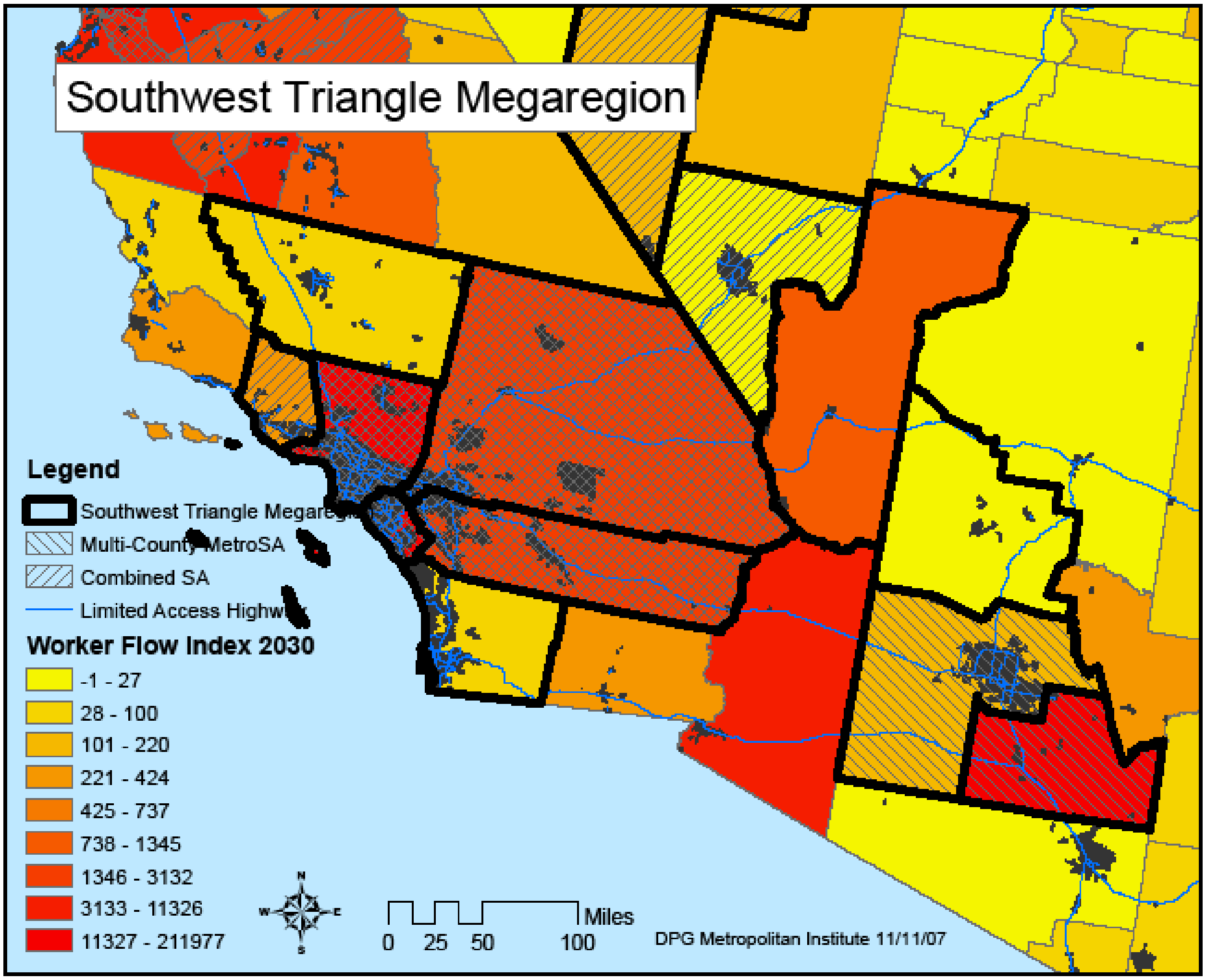
Figure 54 – Northeast Megaregion



Southwest Triangle

As shown in Figure 55, the three metropolitan “anchors” or commuter sheds that define this megaregion area include Los Angeles, Las Vegas and Phoenix. As demonstrated in the above discussion of commuter sheds, there is strong connectivity between Los Angeles and San Diego. A future high-speed rail line should initially link San Diego, Los Angeles, Las Vegas and Phoenix. In the long-run, a high-speed rail line will likely connect southern and northern California, with a possible extension from Phoenix to Tucson.

Figure 55 – Southwest Triangle Megaregion



IRS data reveals an interesting migration pattern in the Southwest Megaregion. Figure 56 indicates significant household in-migration from the Los Angeles commuter shed to each of the "linking counties" between the major urban centers in the Southwest. Based on tax returns filed in 2004 and 2005, the four linking counties received 6,625 new households from the Los Angeles commuter shed, with the distribution to each county shown in the table below. As a percent of each county's in-migration, Mohave had the highest relative connectivity to the Los Angeles commuter shed. Because total migration into Pima County was greater than the amount of migration into Mohave, the Los Angeles commuter shed only accounted for 10.5% of the new households in Pima County. In addition to significant in-migration from the Los Angeles commuter shed, Yavapai County attracted 355 new households from the Las Vegas commuter shed. The strongest migration into Yavapai was from the south (Maricopa, Pinal and Pima) with 2,024 households moving in during a single year. Maricopa was the major source of in-migration for Yavapai County.

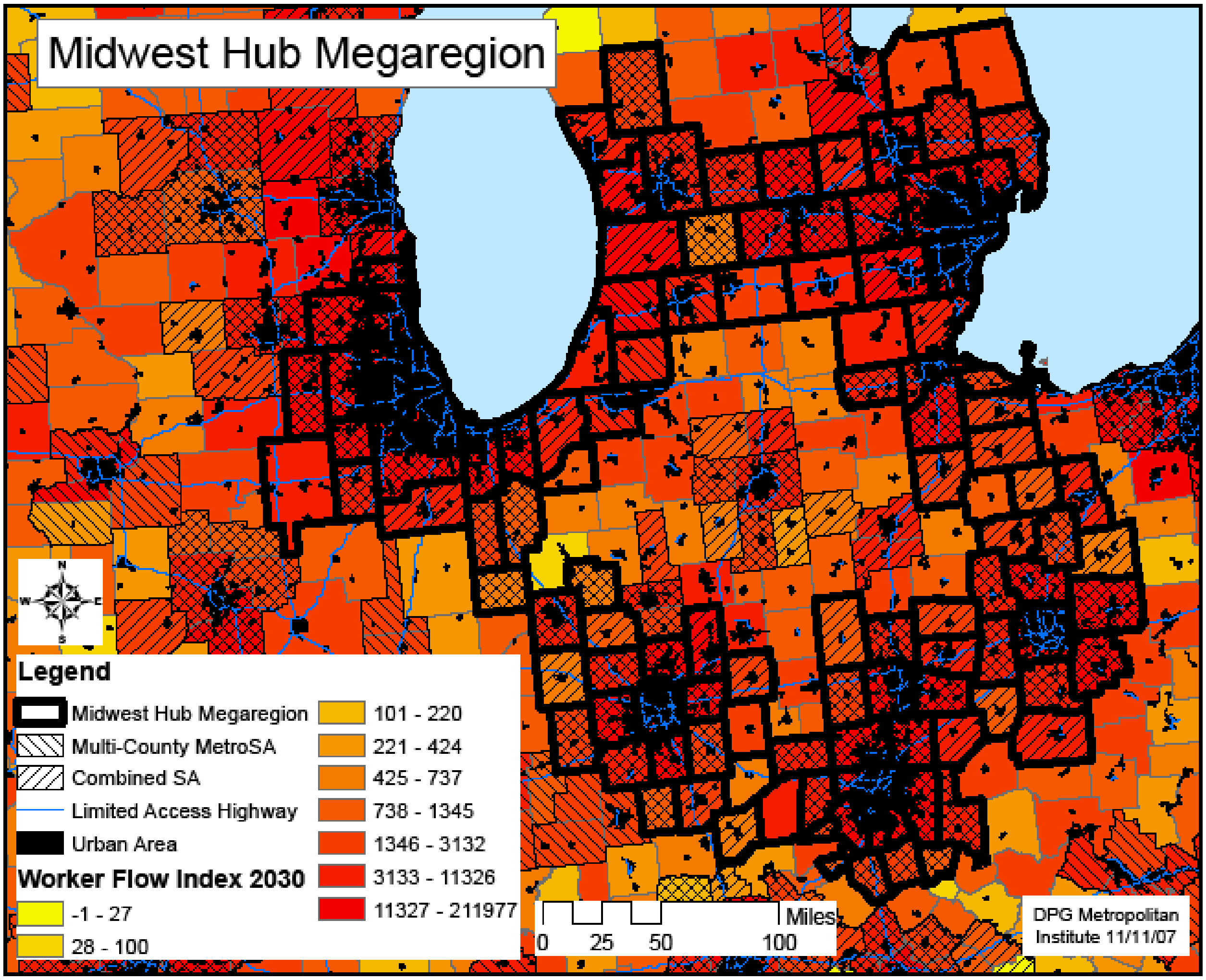
Figure 56 – Migration from Los Angeles Commuter Shed

Receiving County	*# of Households*	*Percent of In-Migration (relative to each county)*
Mohave	2,413	34.0%
Yavapai	1,368	19.3%
Pinal	700	6.8%
Pima	2,144	10.5%

Midwest Hub

Lang and Nelson (2007) identified three separate megapolitan areas that roughly correspond to the Midwest Hub Megaregion shown in Figure 57. A continuous ring of urban development links the primary cities of Chicago and Detroit, to the second-tier cities of Indianapolis, Cincinnati and Columbus.

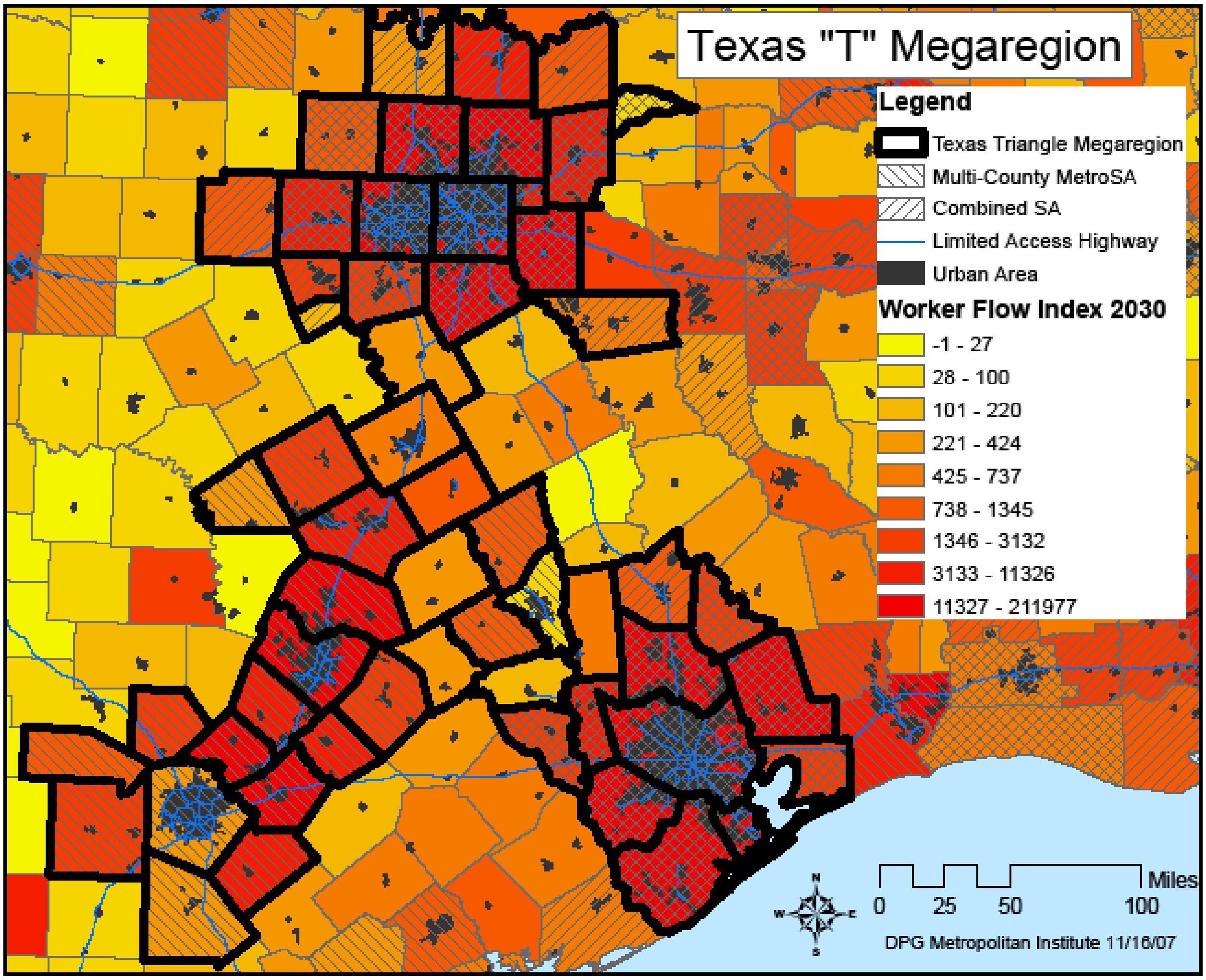
Figure 57 – Midwest Hub Megaregion



Texas "T"

As shown in Figure 58, the three end-points for the Texas "T" Megaregion include Dallas, Houston and San Antonio. The actual configuration of a future high-speed rail line will require further study. One possible configuration would run along the corridor from Dallas to San Antonio, with a second line running from Austin to College Station and Houston. Under this scenario, Austin would become the "central station" of the Texas "T" high-speed rail line.

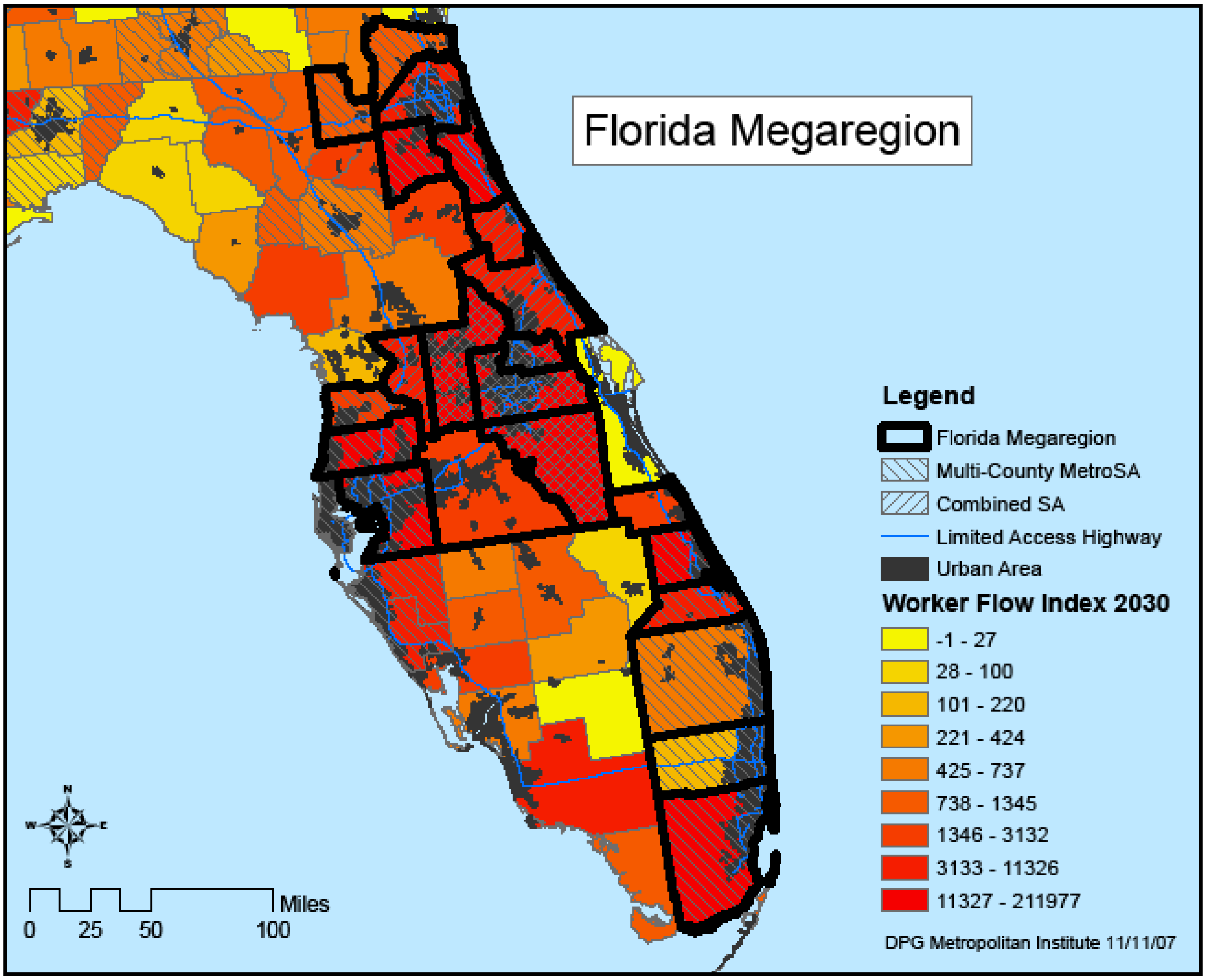
Figure 58 – Texas "T" Megaregion



Florida

The Orlando metropolitan area in central Florida will likely become the "central station" of the Florida high-speed rail line, with links to Miami, Tampa and Jacksonville. Although there is strong connectivity between Tampa, Bradenton and Sarasota, these smaller metropolitan areas may not generate sufficient ridership to justify high-speed rail service. Figure 59 reveals high worker flow indices for the counties along the I-95 corridor between Jacksonville and Daytona Beach.

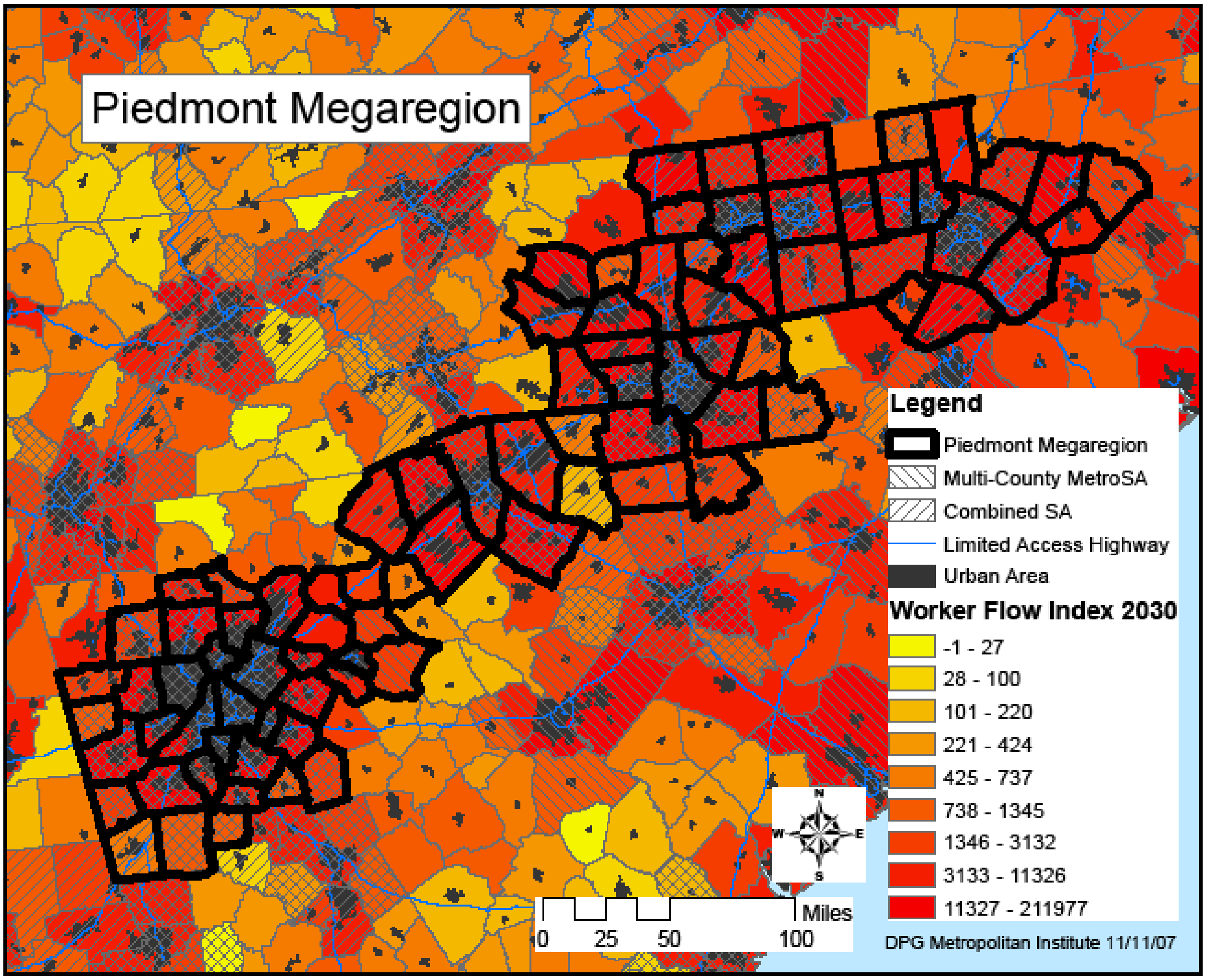
Figure 59 – Florida Megaregion



Piedmont

Atlanta and Raleigh anchor a chain of metropolitan areas that cover approximately 400 miles in the Piedmont area of Georgia, South Carolina and North Carolina. Additional metropolitan areas within this megaregion include Greenville-Spartanburg, Charlotte and Winston-Salem. As shown in Figure 60, continuous statistical areas extend from the I-95 corridor east of Raleigh to the Greenville CSA. The four counties that separate the Greenville and Atlanta CSAs are discussed below.

Figure 60 – Piedmont Megaregion



Between Greenville and Atlanta/Athens are four counties along the I-85 corridor that are not currently in a statistical area. IRS migration data, summarized in Figure 61, clearly indicates the connectivity these four counties have to the Atlanta/Athens and Greenville areas. Driving along I-85 from Atlanta to Greenville, you would pass through the four counties in the order listed below. The Athens MSA is located south of Jackson, Banks and Franklin Counties. Percentages indicate the share of household in-migration over one year, as determined by 2004 and 2005 tax returns filed with the IRS.

Figure 61 – Migration Summary for GA to SC Linking Counties

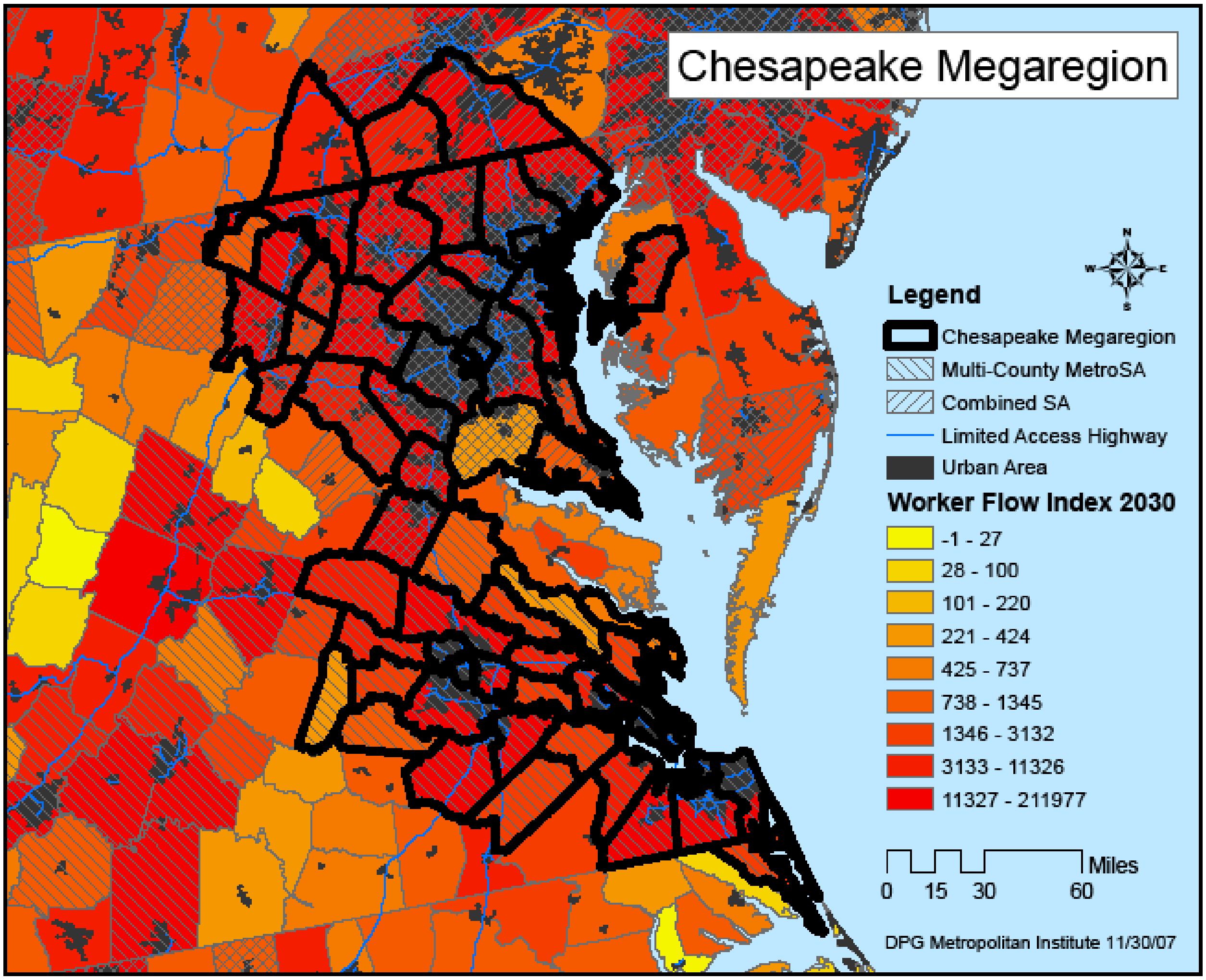
County	*From Atlanta Commuter Shed*	*From Athens MSA*	*From Greenville CSA*
Jackson	52.2%	-	-
Banks	27.6%	4.2%	-
Franklin	10.8%	7.2%	-
Hart	16.2%	5.5%	3.9%

Although 2004 journey-to-work data for Jackson County, available from the LEHD website, indicate strong connectivity to the Atlanta and Athens commuter sheds, the county was not part of a statistical area in 2005 due to the narrow Employment Interchange Measure that only considers travel to the central county (or counties) in the metropolitan area. In 2004, approximately 15.2% of Jackson County's resident workers headed to work in Gwinnett County (Atlanta area), 13.9% worked in Clarke County (Athens area), and 10.6% worked in Hall County (Gainesville area).

Chesapeake

From south to north, the major urban areas in this megaregion include Virginia Beach, Richmond, Washington DC and Baltimore. The Chesapeake Bay is the identifying landmark for the megaregion, which extends north to include a single row of Pennsylvania counties to the west of Lancaster. Based on migration and commuting patterns, these counties exhibit greater connectivity to the Chesapeake than to the Northeast Megaregion.

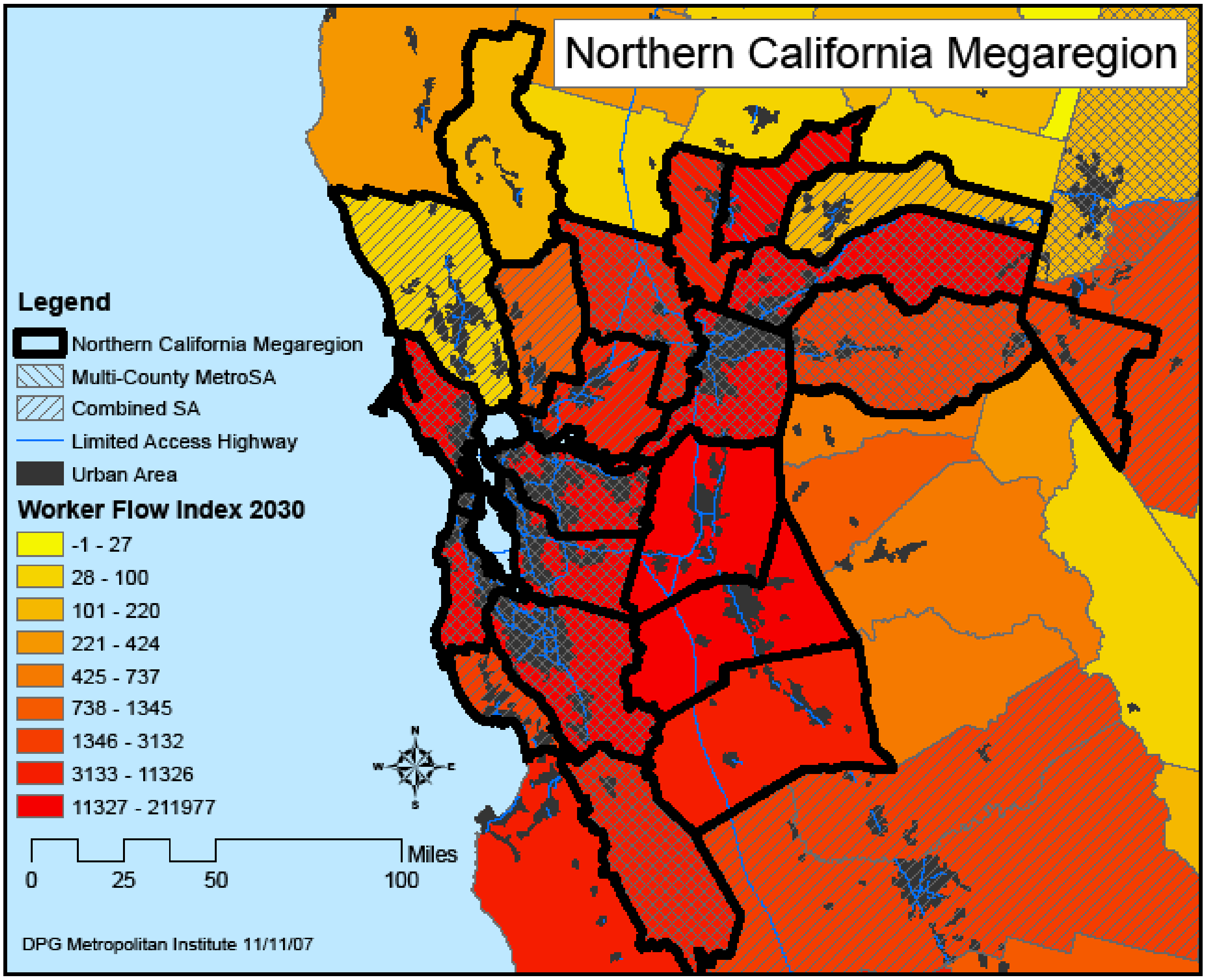
Figure 62 – Chesapeake Megaregion



Northern California

San Jose has continued to expand and now has more residents and jobs than San Francisco. As shown in Figure 63, the Northern California Megaregion extends from San Jose northward to San Francisco and Oakland, then eastward to Sacramento. The Reno and Lake Tahoe area was not included because it lacks sufficient population and job growth to qualify as a megaregion anchor.

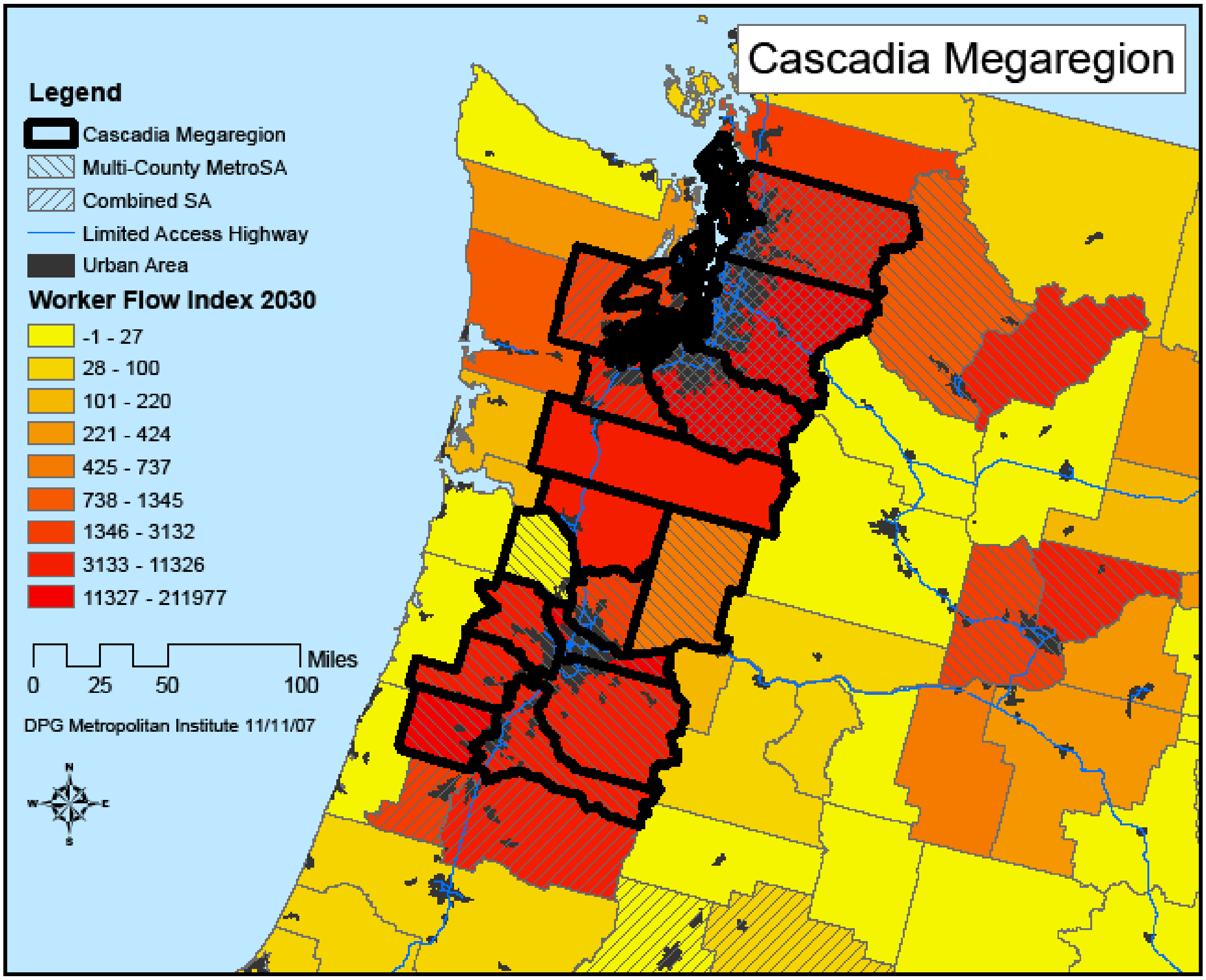
Figure 63 – Northern California Megaregion



Cascadia

Seattle's air and seaports are important global gateways into the continental United States. Figure 64 indicates a continuous corridor of counties with high worker flows extending from the Seattle CSA to the Portland MSA. Counties with light orange or yellow shading are relatively self-contained with minimal movement of workers to or from other counties.

Figure 64 – Cascadia Megaregion



Conclusions and Policy Implications

This final chapter summarizes research findings and provides concise answers to the research questions. The middle section of this chapter describes a new paradigm for transportation governance, with recommendations and ideas that emanate from the dissertation research. The final section identifies shortcomings in current practice and recommends possible solutions intended to improve planning and governance.

Answers to Research Questions

What do we know about the interaction between development and transportation at various geographic scales?

Figure 65 illustrates the influence of geographic scale on our travel perspective, the context of development decisions, and transportation infrastructure. Urban-scale development is uniquely experienced by muscle-powered travel that is not practical at larger geographic scales and development decisions have a fine-grained focus on individual streets, block patterns and neighborhoods. Planning for urban-scale transportation infrastructure involves streets, bike and pedestrian improvements, and transit systems.

As geographic scale increases to the metropolitan commuter shed, our travel perspective becomes predominantly vehicular. At the metropolitan level, development decisions are concerned with intra-city markets and the connectivity of different urban realms to the commuter shed. Transit service is important for both urban and metropolitan development, but long-distance vehicular travel is concentrated on arterial streets and limited access highways. In other words, transportation planning for metropolitan commuter sheds only has a minor concern for local and collector streets.

For large megaregions, travel by common carriers becomes an important component in our travel experience. Development decisions at the megaregion scale are made in the context of interstate commerce, global gateways and multi-modal terminals. Thus, airports, sea ports, and freight rail become important components in the megaregion transportation system. At the megaregion scale, automobile and truck traffic between commuter sheds is primarily taking place on limited access highways. In comparison to European and Japanese infrastructure, the current lack of high-speed rail service within Transportation Megaregions is the major transportation shortcoming in the United States.

Figure 65 – Development and Transportation Interaction by Geographic Scale

Scale	Travel Perspective	Context for Development Decisions	Transportation Infrastructure
Urban	Muscle-powered	• Streets/Blocks • Neighborhoods	• Pedestrian • Bicycle • Streets • Transit
Metropolitan	Vehicular	• Commuter shed • Intra-city markets & connectivity	• Transit • Arterial streets • Limited access highways
Megaregion	Common carrier	• Inter-city/state commerce • Global gateways	• Limited access highways • High-speed passenger rail • Airports • Seaports • Freight trains

Why plan at the scale of megaregions rather than at metropolitan, state and national levels? (Dewar and Epstein 2007)

Megaregions facilitate functional boundaries that are appropriate for their purpose. For transportation planning, metropolitan commuter sheds are larger than our major cities and the boundaries of most MPOs. Because commuter sheds include multiple counties and often extend across state lines, megaregions are needed to fill a current void in our governance structure.

As interstate commerce justifies interstate highways, global commerce justifies transportation planning for megaregions. Globalization and the importance of world cities in modern economies is clearly linked to transportation gateways such as airports, seaports, high speed rail service and its connection to multi-modal terminals within our largest cities. (Noeyelle 1983; Sudjic 1992; Taylor and Lang 2005; Hall and Pain 2006) In recent years, much of the planning discourse has recognized congestion problems as a significant issue, especially for airports and interstate highways. Planning at the megaregion scale is a promising strategy for innovative multi-modal transportation solutions to address congestion problems.

Finally, megaregion planning will facilitate intergovernmental coordination among federal agencies, state and local governments. To improve transportation governance, intergovernmental coordination is essential between the Census Bureau (methods and data collection), the Office of Management and Budget (designation of statistical areas) and the Federal Highway Administration (transportation planning and funding).

How good is the fit between metropolitan commuter sheds, statistical area designations and the boundaries of Metropolitan Planning Organizations?

As demonstrated in the results chapter, actual commuter sheds are often larger than current statistical area designations and much larger that many MPO areas. For most statistical areas, the difference between metropolitan and combined statistical areas is only a couple of counties and calls into question the utility of creating different statistical areas. The commuter shed concept is a viable alternative to the current two-tiered statistical area system and would provide a significant improvement to inconsistent and fragmented MPO boundaries.

What are appropriate methods and useful data for megaregion planning? (Dewar and Epstein 2007)

This dissertation demonstrated all three models of regional definition described by Dewar and Epstein (2007). First, a "linkages framework" was employed in the evaluation of journey-to-work commuting patterns and through the evaluation of household migration patterns. Second, the Worker Flow Index provided a "gradient framework" that indicated relative movement between counties and thus helped delineate megaregions. Third, a "bounded framework" was used to identify specific counties in contiguous geographic areas.

Figure 66 summarizes spatial and demographic measures by geographic scale. At the urban scale, a fine-grained unit of analysis is needed. The current Census Bureau methodology for determining urbanized areas solely on population density should be expanded to also consider job density (ideally for small geographic areas like census tracts). For metropolitan areas and megaregions, counties are appropriate units of analysis.

Figure 66 – Spatial and Demographic Measures by Geographic Scale

Scale	Spatial Measures	Demographic Measures
Urban	Census Tract	Population and employment centers
Metropolitan	Groups of counties that form commuter sheds (similar to current statistical area concepts)	1. Net worker exchange by county 2. Commuter shed balance 3. Migration connectivity
Megaregion	Contiguous metropolitan commuter sheds with city centers ~100-400 miles apart	End-point commuter sheds projected to add at least one million persons and jobs from 2000 to 2030

What is a megaregion, and how does one determine where a megaregion exists? (Dewar and Epstein 2007)

To be designated as a Transportation Megaregion three tests must be satisfied. First, Transportation Megaregions are global gateways that facilitate movement of people and goods to and from the continental United States. Second, Transportation Megaregions are contiguous commuter sheds with urban centers located approximately 100 to 400 miles apart, which is ideal for high-speed rail service. Third, Transportation Megaregions include end-point commuter sheds (similar to metropolitan or combined statistical areas) projected to add at least one million persons and jobs from 2000 to 2030.

New Paradigm for Transportation Governance

Figure 67 summarizes key points from the literature review and methods chapters. The old paradigm for understanding development patterns and planning transportation systems tends to be monocentric or core-based, with key concepts linked to the Chicago School. In contrast, the new paradigm is polycentric, edgeless and galactic. The LA School recognizes the importance of the hinterlands, thus providing a better conceptual roadmap for the new paradigm, but their post-modern lens sees randomness that ignores the interaction between transportation systems and development patterns (Hackworth 2005; Vicino, Hanlon, and Short 2007). In contrast to the old paradigm's use of the Employment Interchange Measure, which only looks at the percentage of commuting to the urban core, this dissertation described new methods (e.g. Worker Exchange Model and the Worker Flow Index) that are better suited to the complexities of the modern metropolitan area.

This dissertation demonstrated the fragmentation of metropolitan-scale commuter sheds into multiple transportation planning areas. Under the new paradigm for transportation governance, changes to federal legislation should be considered to consolidate MPOs currently operating within a single commuter shed. Along with consolidation, additional powers should also be considered. In contrast to the current MPO role, which is limited to planning and coordinating transportation improvements that must be approved by local governments, federal legislation should consider the creation of Metropolitan Transportation Authorities, within the designated Transportation Megaregions, that would have power to plan, construct and operate all transportation systems within a metropolitan commuter shed.

A final distinctive quality of the new paradigm for transportation planning and governance is the recognition of megaregions, which were not formally acknowledged in the old paradigm. Transportation Megaregions are determined by global gateways (major seaports and international airports) and high-speed rail service areas. Specific recommendations regarding organizational structure, responsibilities/representation, and funding policies are presented in the following three sections.

Figure 67 – Old vs. New Paradigm Comparison

Old Paradigm	New Paradigm
Monocentric	Polycentric, edgeless, and galactic
Chicago School (core-based)	LA School (hinterlands also important)
Narrow 1) smaller urbanized areas 2) Employment Interchange Measure 3) population focus	Broad 1) larger commuter sheds 2) Worker Exchange Model and Flow Index 3) population and employment centers
Metropolitan Planning Organizations (limited to planning and coordinating)	Metropolitan Transportation Authorities within Megaregions (plan, construct, and operate)
	Megaregions based on global gateways (major seaports and international airports) and high-speed rail service areas

Organizational Structure

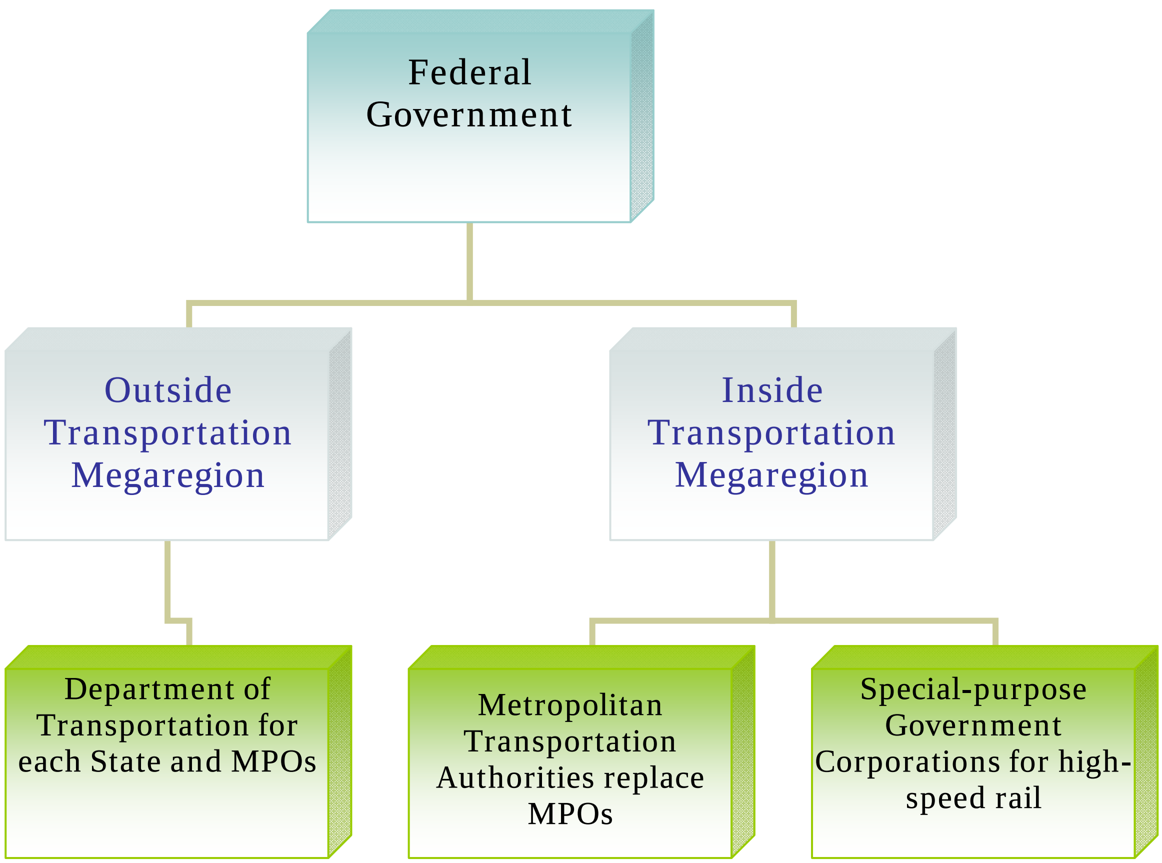
A proposed organization chart for federal interaction with transportation service providers is shown in Figure 68. Under the new paradigm for transportation governance, metropolitan areas within Transportation Megaregions would form transportation authorities that interact directly with the federal government. Outside of Transportation Megaregions, the Department of Transportation for each state would continue with current responsibilities and decision making procedures.

Metropolitan-scale transportation authorities have several precedents that serve as role models and provide best management practices. For example, the Port Authority of New York and New Jersey has a long history of managing port activities (air and sea) and providing transit service. A more recent example is the Georgia Regional Transportation Authority (GRTA) that operates in the Atlanta metropolitan area. GRTA is an innovative effort to improve traditional transportation governance by establishing an authority to address transportation issues over a large geographic area (Nelson 2000). According to Meyer and Miller (2001), GRTA is an example of political-bargaining in transportation decision making. To address mobility problems in the Atlanta metro area, the new authority was given control of transportation investment decisions that were previously controlled by the MPO and Georgia DOT.

The most recent example is in the State of Virginia where the General Assembly authorized several urban regions to form transportation authorities. Although the Virginia legislation is a major step toward solving transportation problems in major urban areas, the state law adds another transportation bureaucracy on top of the current MPO process. A better solution is to implement federal legislation to consolidate and replace the current MPO structure with transportation authorities in the identified Transportation Megaregions.

Several U.S. Government Corporations also provide adequate precedents for providing high-speed rail service within Transportation Megaregions. For example, the Tennessee Valley Authority was created in 1933 to provide electric power, the St. Lawrence Seaway Development Corporation was created in 1954 to operate and maintain that part of the seaway within the United States and in 1971, the National Railroad Passenger Corporation, also know as Amtrak, was created to provide passenger rail service. (See Figure 3-1 in Salamon 2002)

Figure 68 – Organizational Chart for Federal Transportation Governance



Responsibilities and Representation

In most urban areas, current transportation responsibilities are a confusing mixture of politically derived arrangements. The new paradigm for transportation governance calls for scale-dependent strategies for specific types of infrastructure. Using a functional classification system for roads is one way to clarify the decision-making process and jurisdictional responsibilities. Within Transportation Megaregions, the proposed MTAs would take over responsibility for arterial streets and limited access highways within the metropolitan commuter shed. Local governments would only have responsibility for collectors and local streets. This new approach would replace the current, often confusing pattern whereby state, county and municipal governments have responsibility for a mixture of individual streets within an urban area. Governance responsibilities by functional classification are summarized in Figure 69. Outside of Transportation Megaregions, State Departments of Transportation would continue in their current roles and responsibilities.

Figure 69 – Governance Responsibility by Functional Classification of Roads

Functional Classification	Travel Lanes	Speed (mph)	Access Spacing	Governance Outside Transportation Megaregion	Governance Within Transportation Megaregion
Local	2	25	Unlimited	Local Government	Local Government
Collector	2-3	35	Urban Blocks	Local Government	Local Government
Arterial	2-6	35 to 55	½ mile or greater	State DOT	Metropolitan Transportation Authority
Limited Access Highway	4+	55+	Limited (2+ miles)	State DOT	Metropolitan Transportation Authority

In contrast to the voting structure of the proposed Hampton Roads Transportation Authority, where each jurisdiction in the service area has one vote, the recommended representation for Metropolitan Transportation Authorities is to base the number of votes on the relative amount of population and jobs in each county. In Virginia, independent cities should be considered part of the surrounding county, like the approach used by Woods & Poole Economics to create county equivalents. Because metropolitan commuter sheds are based on counties, the smallest county (in terms of population plus jobs) would have one vote in policy decisions. All other counties in the MTA service area (i.e. commuter shed) would have proportionately more votes, based on their respective number of residents plus jobs (relative to the smallest county).

Funding Policies

Federal funding should also be evaluated for consistency with the new paradigm for transportation governance. Rather than continue with the current transmittal of funds from the federal government to a state Department of Transportation (DOT) and then to local governments, the recommended flow of money would vary for areas inside and outside Transportation Megaregions. Metropolitan areas that form MTAs would interact directly, and receive direct funding from the federal government. To address equity concerns, federal funds should be distributed to State DOTs and Metropolitan Transportation Authorities based on latest decennial census data regarding year-round population and jobs (i.e. employment by place of work). The federal government should also facilitate user charges, including congestion pricing on interstate highways with Transportation Megaregions. The recommended policy direction is to have MTAs function like a transportation utility that annually evaluates service demands and sets rates to fund essential operating, maintenance and capital costs (McCarthy 2001).

Under the new paradigm for transportation governance the economic rules that influence development patterns should be changed to align market forces with policies that maximize the nation's investment in transportation infrastructure (Moore, Thorsnes and Appleyard 2007). The "big idea" discussed below is to alter property tax policies to encourage infill development and more intense redevelopment within the service areas of intra-city, fixed-rail transit service. Almost all local governments depend on property taxes as a major source of revenue, which is currently derived primarily from the value of improvements. The traditional improvements-driven approach dampens investment and encourages speculative land holdings in urban areas. Transitioning property taxes to be determined primarily by parcel size and land value would provide an economic incentive for infill development and capital investment within transit service areas. Given the wide spread use of GIS technology and computerized tax records in most urban areas, it is possible to identify transit service areas (based on distance from transit stations) and apply different tax assessment methodologies for land and improvements. To minimize transition problems, the switch from improvements-based to land-based property taxes should be phased in over a period of several years.

Scale dependent funding policies for transportation infrastructure are summarized in Figure 70. At the urban scale, the major policy change is to no longer spend any federal funding on local and collector streets, which become the responsibility of local governments. At the metropolitan scale, greater reliance on user charges (including congestion pricing on limited access highways) is the major funding recommendation. At the megaregion scale, supplemental federal funding will be needed for the construction of high-speed passenger rail systems, contingent upon local governments altering property tax assessment methods to obtain more revenue from land and less from improvements.

Figure 70 – Scale-Dependent Transportation Infrastructure Funding

Scale	Transportation Infrastructure	Funding Sources
Urban	• Pedestrian/bike facilities • Local and collector streets • Transit	• No federal funds for local and collector streets
Metropolitan	• Transit • Arterial streets • Limited access highways	• Existing Revenues (e.g. gas tax) • User charges and congestion pricing
Megaregion	• Airports • Seaports • High-speed rail • Multi-modal terminals • Freight railroads	• Supplemental federal funding for high-speed rail contingent on property taxes derived primarily from land values (not improvements) within the service area of intra-city rail transit systems

Current Practice Problems and Solutions

This final section is a brief post-script that identifies three problematic aspects of current planning practice. The following paragraphs summarize each problem and recommend a possible solution.

First, actual commuter sheds are significantly larger than indicated by current MPO boundaries. Federal regulations currently allow very narrow delineation of the

MPO area, which at a minimum must include the existing urbanized area and extend to the contiguous area expected to become urbanized within 20 years. The MPO boundary may include the entire metropolitan statistical area or combined statistical area, but this is only an option and not a requirement. MPO boundaries should be expanded to match actual commuter sheds, which can be determined by following the methodology demonstrated in this dissertation.

Second, population in the continental United States continues to concentrate in urban areas. Counties are formally recognized as metropolitan statistical areas once their urbanized area population exceeds 50,000 residents. As shown above in Figure 19, the continental U.S. will add more than two dozen metropolitan statistical areas over the next 20 years due solely to population increase. Rather than continue the current practice of designating single-county metros that surpass a population threshold, the statistical area designation should be reserved for multi-county areas with connectivity demonstrated by commuting and migration patterns.

Third, federal agencies currently consider the percentage of employment interchange as the sole metric for adding counties to statistical areas. As demonstrated in the evaluation of commuter sheds in Atlanta and Washington DC, outlying rural counties might not have significant connectivity to the metropolitan area, even though they surpass the commuting threshold. This occurs because the number of workers in the county is so small that it only requires an insignificant number of outbound workers to meet the 15% employment interchange requirement. A better approach is to use a measure like the Worker Flow Index that considers both absolute number and share of workers to indicate commuter connectivity.

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APPENDIX A – SPSS MODEL OUTPUT

The output files inserted below were produced by SPSS software. The predicted probability and predicted group for each county were saved in the SPSS database.

Employment Centers Model

Logistic Regression - V3 Employment Centers Model 2030

Notes

Output Created		28-SEP-2007 07:32:46
Comments		
Input	Data	C:\Documents and Settings\guthried\My Documents\V2Dissertation\NetWkrXbyWPCoV3.sav
	Active Dataset	DataSet1
	Filter	netwkrx30p >= 0 (FILTER)
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	1208
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing
Syntax		LOGISTIC REGRESSION VARIABLES CSAorMulti /METHOD = ENTER wkpljobs30 inbws30p nrwkrs30p GRP30 /SAVE = PRED PGROUP /CRITERIA = PIN(.05) POUT(.10) ITERATE(20) CUT(.5) .
Resources	Elapsed Time	0:00:00.13
	Processor Time	0:00:00.13
Variables Created or Modified	PRE_1	Predicted probability
	PGR_1	Predicted group

```
[DataSet1] C:\Documents and Settings\guthried\My
Documents\V2Dissertation\NetWkrXbyWPCoV3.sav
```

Case Processing Summary

Unweighted Cases[a]		N	Percent
Selected Cases	Included in Analysis	1208	100.0
	Missing Cases	0	.0
	Total	1208	100.0
Unselected Cases		0	.0
Total		1208	100.0

a. If weight is in effect, see classification table for the total number of cases.

Dependent Variable Encoding

Original Value	Internal Value
Not Selected	0
Selected	1

Block 0: Beginning Block

Classification Table[a,b]

			Predicted		
			CSA2005 ~= '' | MultiCoMetro = 1 (FILTER)		Percentage Correct
	Observed		Not Selected	Selected	
Step 0	CSA2005 ~= '' | MultiCoMetro = 1 (FILTER)	Not Selected	859	0	100.0
		Selected	349	0	.0
	Overall Percentage				71.1

a. Constant is included in the model.

b. The cut value is .500

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	-.901	.063	201.330	1	.000	.406

Variables not in the Equation[a]

			Score	df	Sig.
Step 0	Variables	wkpljobs30	192.466	1	.000
		inbws30p	180.327	1	.000
		nrwkrs30p	207.988	1	.000
		GRP30	158.150	1	.000

a. Residual Chi-Squares are not computed because of redundancies.

Block 1: Method = Enter

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	782.379	4	.000
	Block	782.379	4	.000
	Model	782.379	4	.000

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	670.049[a]	.477	.682

a. Estimation terminated at iteration number 10 because parameter estimates changed by less than .001.

Classification Table[a]

Observed			Predicted: CSA2005 ~= '' | MultiCoMetro = 1 (FILTER) — Not Selected	Predicted: CSA2005 ~= '' | MultiCoMetro = 1 (FILTER) — Selected	Predicted: Percentage Correct
Step 1	CSA2005 ~= '' | MultiCoMetro = 1 (FILTER)	Not Selected	812	47	94.5
		Selected	102	247	70.8
	Overall Percentage				87.7

a. The cut value is .500

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	wkpljobs30	.000	.000	18.709	1	.000	1.000
	inbws30p	.051	.008	36.618	1	.000	1.053
	nrwkrs30p	.000	.000	23.744	1	.000	1.000
	GRP30	.000	.000	15.110	1	.000	1.000
	Constant	-4.729	.361	171.735	1	.000	.009

a. Variable(s) entered on step 1: wkpljobs30, inbws30p, nrwkrs30p, GRP30.

Bedroom Communities Model

Logistic Regression - V3 Bedroom Communities Model 2030

Notes

Output Created		28-SEP-2007 07:47:00
Comments		
Input	Data	C:\Documents and Settings\guthried\My Documents\V2Dissertation\NetWkrXbyWPCoV3_3.sav
	Active Dataset	DataSet1
	Filter	netwkrx30p <= 0 (FILTER)
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	1869
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing
Syntax		LOGISTIC REGRESSION VARIABLES CSAorMulti /METHOD = ENTER aawkrs30p outpct30p outflow30p WI30 /SAVE = PRED PGROUP /CRITERIA = PIN(.05) POUT(.10) ITERATE(20) CUT(.5) .
Resources	Elapsed Time	0:00:00.16
	Processor Time	0:00:00.16
Variables Created or Modified	PRE_2	Predicted probability
	PGR_2	Predicted group

```
[DataSet1] C:\Documents and Settings\guthried\My
Documents\V2Dissertation\NetWkrXbyWPCoV3_3.sav
```

Case Processing Summary

Unweighted Cases[a]		N	Percent
Selected Cases	Included in Analysis	1869	100.0
	Missing Cases	0	.0
	Total	1869	100.0
Unselected Cases		0	.0
Total		1869	100.0

a. If weight is in effect, see classification table for the total number of cases.

Dependent Variable Encoding

Original Value	Internal Value
Not Selected	0
Selected	1

Block 0: Beginning Block

Classification Table[a,b]

			Predicted		
			CSA2005 ~= " | MultiCoMetro = 1 (FILTER)		Percentage Correct
	Observed		Not Selected	Selected	
Step 0	CSA2005 ~= " | MultiCoMetro = 1 (FILTER)	Not Selected	1052	0	100.0
		Selected	817	0	.0
	Overall Percentage				56.3

a. Constant is included in the model.

b. The cut value is .500

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	-.253	.047	29.391	1	.000	.777

Variables not in the Equation[a]

			Score	df	Sig.
Step 0	Variables	aawkrs30p	149.765	1	.000
		outpct30p	422.220	1	.000
		outflow30p	258.375	1	.000
		WI30	122.671	1	.000

a. Residual Chi-Squares are not computed because of redundancies.

Block 1: Method = Enter

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	937.595	4	.000
	Block	937.595	4	.000
	Model	937.595	4	.000

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	1623.763[a]	.394	.529

a. Estimation terminated at iteration number 7 because parameter estimates changed by less than .001.

Classification Table[a]

	Observed		Predicted: CSA2005 ~= " | MultiCoMetro = 1 (FILTER) Not Selected	Predicted: CSA2005 ~= " | MultiCoMetro = 1 (FILTER) Selected	Predicted: Percentage Correct
Step 1	CSA2005 ~= " | MultiCoMetro = 1 (FILTER)	Not Selected	931	121	88.5
		Selected	245	572	70.0
	Overall Percentage				80.4

a. The cut value is .500

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	aawkrs30p	.000	.000	4.980	1	.026	1.000
	outpct30p	6.493	.472	189.536	1	.000	660.391
	outflow30p	.000	.000	72.591	1	.000	1.000
	WI30	.023	.004	26.633	1	.000	1.023
	Constant	-5.857	.440	176.781	1	.000	.003

a. Variable(s) entered on step 1: aawkrs30p, outpct30p, outflow30p, WI30.

VITA

Dwayne Pierce Guthrie is a member of the American Institute of Certified Planners (AICP). Since graduating with a Masters degree in urban and regional planning from the University of Florida in 1979, Mr. Guthrie has worked for a large city/county planning commission (eight years) an engineering firm (two years) and a planning consulting firm (18 years). Throughout his 28 years of work experience, Mr. Guthrie has helped local governments with demographic analysis, capital improvements planning and fiscal evaluations. The major focus of his work as a planning consultant has been the preparation of development impact fees for approximately 90 jurisdictions in 24 states. Mr. Guthrie began his doctoral studies at Georgia Tech in 2001 and transferred to Virginia Tech (Alexandria campus) in 2004. He is married and has seven children.

Mr. Guthrie's dissertation defense was during the Fall Semester of 2007.