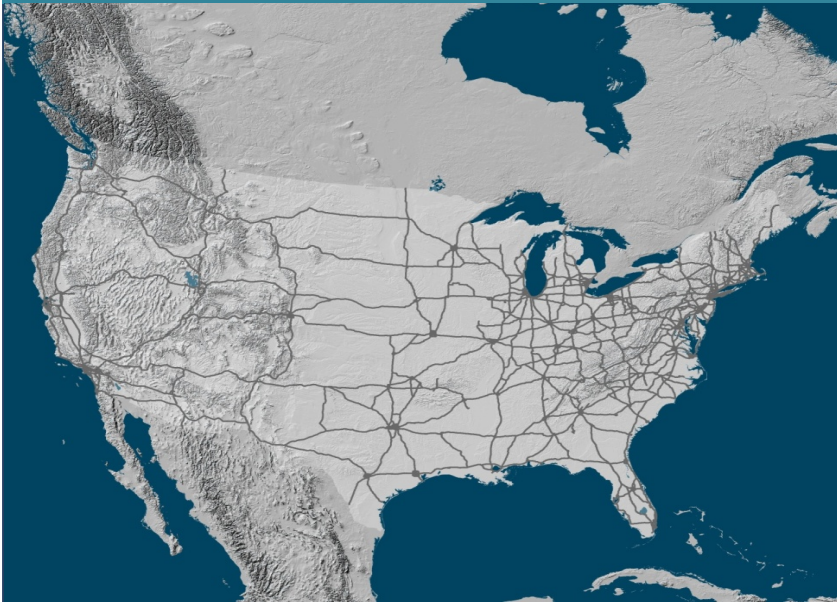


# Megaregions:

Literature Review of the Implications for  
U.S. Infrastructure Investment and Transportation Planning



For  
**U.S. DEPARTMENT OF TRANSPORTATION**  
Federal Highway Administration

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Literature Review of the Implications  
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# Megaregions:

## Literature Review of the Implications for U.S. Infrastructure Investment and Transportation Planning

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## EXECUTIVE SUMMARY

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In the twenty-first century, the United States faces increasing challenges in terms of economic competitiveness, quality of life, traffic congestion, aging transportation infrastructure, and scarcity of natural resources. These challenges are particularly difficult because they are not confined to traditional geographic or political borders, but arise from the interactions between cities and regions. In order to address these challenges, local, state, regional, and federal actors may be well served by planning for critical infrastructure on a scale larger than has been common in transportation and regional planning history and practice. One potential approach to address these challenges, and take advantages of the opportunities that arise from growing urban agglomerations, is the idea of the “megaregion.”

*Megaregions: Literature Review of the Implications for U.S. Infrastructure Investment and Transportation Planning* was prepared for the U.S. Department of Transportation, Federal Highway Administration by the Georgia Institute of Technology’s Center for Quality Growth and Regional Development. The report summarizes recent literature and places current megaregion research within the context of both previous regional planning

efforts and selected regional planning initiatives, related to transportation infrastructure investment, both inside and outside the United States.

### What are megaregions?

Megaregions are geographic areas that will contain two-thirds of the nation’s population by 2050 (Amekudzi, Thomas-Mobley & Ross, 2007). They can be

*Megaregions could become places that operate—and thrive—at the center of a new economic and planning geography, one in which high value is placed on networks and on building attractive and healthy urban areas.*

understood as networks of metropolitan centers and their surrounding areas, connected by existing environmental, economic, cultural, and infrastructure relationships. As economic drivers, megaregions will continue to attract new populations and require new

investments in infrastructure and greater focus on environmental preservation, including climate change. Currently published studies suggest the existence of as many as ten megaregions, all including multiple cities and most crossing state borders, in the United States, with some reaching into neighboring countries. Since 2005, annual roundtables concerning megaregion development have brought together leading urban and regional planners, academics, metropolitan policy-makers, elected officials, and business and civic leaders to discuss efforts at

megaregion coordination and planning framing a new direction.

Megaregions are places that operate—and thrive—at the center of a new economic and planning geography, one in which high value is placed on networks and on building attractive and healthy urban areas. The exact nature of regional functional relationships and interactions can be difficult to measure (Hoover, 1971). However, planning at an inter-jurisdictional level, with an emphasis on how economic and network interactions are set in a spatial context, could lead to more efficient public investments resulting in increased global economic competitiveness. Currently state or local governments compete against each other for funds and projects. The megaregion, in contrast, offers a framework for inter-jurisdiction cooperation. Since infrastructure serves as the skeleton that links towns, cities, neighborhoods, and regions, and since transportation has historically proved advantageous to cities and regions alike (Fujita et al. 2001), it is particularly worthwhile to consider transportation planning and investment at the scale of the megaregion.

### **A historical perspective on regional planning**

Historically, regional planning efforts have originated at the state level, which have been very limited in scope, or imposed by the federal government. Examples of federal regional planning in the United States include the Tennessee Valley Authority (TVA), the Appalachian Regional

Commission (ARC), and the highway system. There have been few cases of successful ambitious “bottom-up” efforts at regional planning and investment coordination.

Economic development remains one of the more popular spurs to regional activity (Weitz & Seltzer, 1998). Cisneros (1996) distinguished between “things-regionalism,” which he identified as special districts charged with specific public-works projects, and what he called “people-regionalism,” which focused on equity issues and regional development. “Everybody wins as regions become global competitors,” he asserted. An example of a regional body focused on economic development is the Southern Growth Policies Board, which was formed in 1971 and has 13 states<sup>1</sup> as members; among its regional goals are encouraging entrepreneurship, increasing knowledge creation, and sustaining a quality of life “that is attractive to globally competitive businesses and employees” (Southern Growth Policies Board, n.d.). But while such organizations as the Southern Growth Policies Board may be able to produce useful research, their influence on economic-development policies is unclear.

Another frequent source of cooperation between states is environmental issues, especially water. Water can be a source of interstate conflict (most recently among Georgia, Florida, and Alabama), but the boundary-crossing nature of water

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<sup>1</sup> Alabama, Arkansas, Georgia, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, Virginia, and West Virginia.

management has been acknowledged multiple times. Lepawsky (1950) observed, “Few functions of the American Federal system seem less suited physically to state boundaries than the management of our water resources.” In 1961, the Delaware River Basin Commission (DRBC) was formed by four states (New York, New Jersey, Pennsylvania, and Delaware) and the federal government. Although Derthick (1974) charged that “[t]he DRBC’s actual functions have fallen far short of its formal powers,” the DRBC has been influential in settling water-related disputes between the participating states (Collier, 2007).

*Megaregions provide a strategy to act globally, while addressing local quality-of-life issues.*

opportunity for the United States to create regionally cooperative efforts with enough local buy-in to be able to make informed decisions.

In addition, transportation can spur interstate cooperation. Grant (1955) called the creation of the Holland Tunnel “an amazing example of stop-and-go driving through the obstacle course of interstate metropolitan co-operation.” The commission to study transport connections between New York City and New Jersey was proposed by the New York state legislature in 1906; construction on the tunnel did not begin until 1919 (Grant, 1955). The tunnel was actually governed by two different state commissions simultaneously until 1931, when it was placed under the governance of the Port Authority of New York and New Jersey (Grant, 1955). However, such examples as the ongoing New York-New Jersey cooperation are rare in American policy-making.

Elsewhere in the world, transportation investment is being approached regionally by both federal governments and local actors. Examples of regional infrastructure planning emerging from the coordinated efforts of local actors include the Randstad or “Deltametropolis” in the Netherlands and transport planning in the Yangtze River delta in China. Megaregions represent an

### **From regions to megaregions**

Why do we need planning at this larger scale? Economic and social interactions are taking place at the megaregion scale beyond the boundaries of either individual municipalities or metropolitan areas (Zhang et al., 2007). The megaregion presents a new perspective on defining regionalism that captures the economic, political and spatial level at which planning should be conducted in order to respond to the challenges of agglomerations of economic activity and population. It also recognizes the new context in which large-scale regions exist—one of global economic and environmental issues taking place on a larger scale. Megaregions provide a strategy to act globally, while addressing local quality-of-life issues. This expanded regional footprint is a vehicle for accommodating growth and economic development through collaborative megaregional transportation planning and other infrastructure, policy, implementation,

and operations. Similar cooperative initiatives in infrastructure investment and economic development are beginning both in Asia and Europe.

Since approximately 80 percent of the world's carbon emissions are produced from urbanized areas (Aitch, 2007), it is reasonable to assume that megaregions have a significant impact on the increase of carbon emissions and climate change. At the same time, this means that the megaregion approach is a potential solution to mitigate greenhouse gas emissions by adopting coordinated policies on land use, transport pricing, and freight transportation. Also, regional coordination under megaregion planning could help adapt existing and new transportation infrastructure to the demands of more extreme climate events.

Megaregions will experience key challenges in the coming decades, including: rapid population growth, expansion of suburban landscapes, aging infrastructure, social equity challenges, strained ecosystems, and uneven inter- and intra-regional growth patterns. Many megaregion areas in the United States are already faced with issues stemming from sprawling development patterns, escalating land consumption, and increased traffic congestion. It is expected that these areas will continue to grow in population and the potential addition of millions of residents will only exacerbate existing problems in metropolitan and regional planning for these regions (National Surface Transportation Policy and Revenue Study Commission, 2007). These issues have several things in common: they are

spatial; they are not confined by existing political boundaries; they affect future generations; and they are interrelated (Ross et al., 2007).

As United States megaregions grow, will they remain competitive in the changing global marketplace? Will they be places in which residents can enjoy stable and comfortable lives? Will there be sufficient transportation choices? Can continued growth and development occur in a sustainable manner? If these areas continue to form without planning, will this create a nation whose global competitiveness is threatened by social and environmental problems? These challenges reach across traditional jurisdictional boundaries, making the current planning strategies inadequate and demanding a new planning perspective (Contant et al., 2005).

Current economic development planning tends to ignore the spatial distribution of impacts caused by investments and programs. Local comprehensive planning is spatial in focus and concept, but is also shaped by parochial interests, ignoring the cumulative effects of many individual decisions on the surrounding region. Transportation planning connects regions, but fails to address adequately the land use and environmental impacts of infrastructure decisions. Other single-function planning efforts, such as watershed planning or energy development planning, are also incapable of fully addressing the issues that affect the entire region. Most importantly, current planning, whether it is guided by an issue or by

proximity, lacks a common vision. Although researchers, planners, engineers, politicians, and decision-makers each appreciate the interconnectedness of issues by content and by space, they currently have no guiding vision of what the future should hold, and no plan to get there. The megaregion, integrating a better understanding of the connections and operation of these systems, provides a more effective strategy.

### **Megaregions and infrastructure**

The supply of infrastructure has not met increasing demand. More attention and resources must be allocated to providing mobility within critical corridors including the interstate highway system. This is particularly true in urban areas, since their vitality is crucial with respect to global competition and due to rapid increase in travel demand during the past several decades. Large metropolitan areas continuously expand connecting to other urban areas, sharing transportation networks and environmental systems at a large geographic scale making its management difficult for any individual metro region. Interstate highways within megaregions are currently more congested than many of those in non-megaregions with fewer miles of highway per capita.

Schwieterman & Scheidt (2007) indicate that about 63% of the proposed mileage for High Speed Rail (HSR) service is included in HSR corridors that cross state lines. All but one of the 43 states containing routes under consideration for HSR service has interstate corridors slated for consideration. The location of the proposed HSR

coincides with the economic core of most megaregions and would serve to provide greater mobility in a more sustainable way. In fact, some corridors, such as the Chicago-Detroit-Pontiac corridor, are divided into several segments reflecting differences in operations and in management/ownership. These segmentations may negatively affect both the development process and future operations in the long run.

While the freight transportation system includes a complex network of roads, rail, water, and air, more than half of exporting goods were moved by trucks in 2002. This trend is expected to continue over the next few decades.

The reliance on trucking is higher in megaregions than non-megaregions. The congestion caused by truck traffic on highways may negatively affect economic productivity, increasing the costs of goods movements and generating problems for production schedules. Since these trends are estimated to continue or worsen in the future, a strategic approach to development of freight transportation infrastructure in megaregions, focusing on highways and alternative modes should be considered.

In order to prepare a strategy to effectively face these challenges, the demands of freight movements, the types of infrastructure that efficiently meet these demands, and the geographic areas where these demands will increase should be researched by analyzing the characteristics (e.g. commodity groups) of goods and their

possible transportation modes for each megaregion.

At the same time, an effort to protect environmentally sensitive areas and ecosystems from the encroachment of transportation infrastructure should be made. The concept of a green highway that connects “green infrastructure” may bridge the gap between the transportation networks and environmental systems by more fully integrating the concept of sustainability into transportation planning and practice.

To address economic competitiveness in the global economy and preservation of environments into the interstate planning and programming process, a megaregions context is extremely promising.

### **Megaregions in the United States and abroad**

Throughout the country, large-scale regional efforts are underway to examine the relationships, challenges, and opportunities that unite people across jurisdictional boundaries. One of these is a new initiative which has been launched to address America’s anticipated growth before the year 2050 and the challenges and opportunities associated with the emergence of megaregions. This initiative, “America 2050: Towards a National Strategy for Prosperity, Equity and Sustainability” was coordinated by the Regional Plan Association, the Lincoln Institute of Land Policy, and the Southern California Association of Governments and was comprised of ground-up megaregion research, planning, and coordination

efforts taking place in ten of the emerging megaregions across the country.

Since 2005, annual Roundtables for Megaregion Development have brought together leading urban and regional planners, academics, metropolitan planning directors, elected officials, and business and civic leaders to share progress reports, research methods, and strategies on megaregion coordination as well as to discuss nation-wide policies that underpin these efforts. The Roundtables included setting goals for America 2050 for each year and discussions of leadership and the strategic path of the initiative.

The Center for Quality Growth and Regional Development (CQGRD) at the Georgia Institute of Technology convened federal and state legislators, mayors, public- and private-sector representatives, academics, and other community leaders in a symposium in 2006, in order to provide a broad initial overview of the concepts of megaregions and megaregion planning. In 2007, CQGRD hosted the second symposium, an assembly of academics, to discuss and examine the theoretical constructs surrounding megaregions.

*Megaregions: Literature Review of the Implications for U.S. Infrastructure Investment and Transportation Planning* describes several megaregions that are currently being defined and researched through different initiatives within the United States. They include the Piedmont Atlantic Megaregion (PAM), the Northeast Megaregions, Northern California, Southern California, the Great Lakes

Megaregion, and the Texas Triangle Megaregion.

The cases examined in this literature review suggest that interest in regional approaches to infrastructure and transportation planning is not limited to the North American megaregions. Regional coordination of infrastructure investments is increasingly regarded as a way to enhance the productivity of the entire region while preserving elements that would lead to greater quality of life, such as the Randstad's Green Heart. In the Philippines and Africa, regional coordination and cooperation are seen as a way to improve economic returns on infrastructure investment, while in China, regionalism is a tool to respond to rapidly increasing transportation demands. The European Union (EU) hopes that the EU-wide Trans-European Transport Networks will promote economic growth throughout while limiting the negative environmental impacts of transportation.

What is most striking about the cases outside the United States, when compared to the cases within the United States, is the difference between those projects that originate at the federal level or higher and those that originate at the local level. The EU has the scope to propose a transportation network far more ambitious

than any one of its member states could suggest, but control of funding remains with the member states. It is difficult to predict at this stage whether the New Partnership for Africa's Development (NEPAD) Spatial Development Initiatives and the Philippine super regions will be implemented as proposed. However, NEPAD would not be able to control the

*The United States is expected to continue to grow. Future planners and policy-makers will have to decide how best to provide economic opportunities, safe and healthy environments, and adequate infrastructure.*

direction of infrastructure investments in its member countries, and the Philippine super-region project may suffer from its association with an unpopular president. The most successful cases appear to be those where local actors take the lead, as in the Yangtze River Delta and the Randstad. Since

China's state government has empowered cities to decide on and finance major infrastructure investments, further regional efforts in China may originate from actors within the metropolitan areas, especially dominant actors such as Shanghai's city government, rather than be imposed by the state government.

In the United States, as we have seen, the locally-originated regional associations have tended to be weaker than those that originated at the federal level. Yet the federal programs—the TVA, the highway system, and to a lesser extent the ARC—have been accused of not being sufficiently sensitive to regional needs. Has the time come for empowered regional planning from the bottom up in the United States? It

may be that megaregions can be the first (North) American example of regionally cooperative approaches with enough local buy-in to be able to act decisively. The Metropolitan Planning Organizations, a case of a federal creation and empowerment of regional organizations, could possibly become actors within a megaregion framework. The international examples show how local actors can recognize common needs and coordinate infrastructure planning in hopes of bettering the region.

### **Informing the future**

The United States is expected to continue to grow, in terms of population and in terms of economic activity, and future professionals and policy-makers will have to decide how best to provide that

population with economic opportunities, safe and healthy environments, and adequate infrastructure. Megaregions offer a way to support these important agglomerations. While the megaregions identified to date differ in infrastructure needs, demography, economy, regional growth, geography, history, and culture, megaregion leaders in each have the opportunity to refine their approach to develop different strategies to preserve the strengths of the respective megaregions and enhance their future competitiveness. Nonetheless, the articulation of each megaregion and the concept of the “megaregion” as an economic and population agglomeration is increasingly important and may prove to be vital to the United States in its ongoing challenge to preserve its stature in the global economy.



## SECTION I. OVERVIEW

### A. Research Background

More than 50 years ago, French geographer Jean Gottmann (1957) suggested a newly emerging urban form, calling it megalopolis, which was characterized by economic continuation of metropolitan areas. He then posed several questions:

How did Megalopolis happen to arise and with such a shape? What are the present main functions of this area, its role within the American economy? What are the present problems of internal organizations, and what solutions have been attempted? (Gottmann, 1957)

As planners and policy makers face contemporary issues—infrastructure degradation, natural resource limitations and an economic environment more dependent on global trade—it is not surprising that similar questions are still being asked. While the terminology has changed from “megalopolis” to “megaregion”, the underlying concept remains the same. Economic, environmental and human forces are creating large polycentric agglomerations of urbanization that spill over current political boundaries.

Approximately nine additional megaregions have emerged or begun to emerge across the country since Gottmann suggested the idea of the megalopolis in the northeast region (Lang and Dhavale, 2005; Regional Plan Association, 2006). As a result, spirited discussions of this concept have been ongoing in the academy and in media, business, and political circles.

Why are megaregions so important now? Megaregions are geographic areas that will contain two-thirds of the nation’s population by the middle of the 21st century (Amekudzi, Thomas-Mobley, Ross 2007) and represent a new and potentially fruitful context for American transportation planning and other decision making related to social and economic development. These regions are characterized as networks of metropolitan centers and their surrounding areas, connected by existing environmental, economic, and infrastructure relationships. As megaregions expand and continue to attract significant amounts of the country’s population, economic activity, and global connections, they struggle with intense traffic congestion, pressures on the natural environment, resource constraints, and other negative externalities associated with rapid urban growth. Given continued growth, the emerging question is how American planners, elected officials, and policy makers should structure transportation and infrastructure investment in order to address the particular challenges and opportunities presented by megaregions.

Historically, multi-state transportation and infrastructure planning has been difficult to accomplish in the American political context, partly due to the lack of multistate leadership, overlapping roles between multistate organizations and metropolitan planning organizations (MPOs), and funding problems (Cambridge Systematics, 2005). However, an examination of international urban development and transportation infrastructure investment shows the benefits of such inter-jurisdictional approaches, which can include specializing infrastructure investment, sharing transport infrastructure, and diversifying economic activities (Glaeser, 2007; Sassen, 2007). Extending transportation and infrastructure planning at the scale of the megaregion could thus lead to significant benefits for the included areas. The megaregion planning framework in the United States has the potential to preserve and enhance the

quality of life and economic vitality of its most populous and dynamic geographic areas, as well as to compete with megaregions already engaging in polycentric approaches to transportation planning in Europe and Asia.

## **B. Report Organization**

This report explores the practical implications of megaregions with respect to infrastructure investment and transportation planning by reviewing literature from several disciplines, as well as previous and current research on megaregions. This review provides a basis of knowledge of the current state of thinking on megaregion planning, both in the United States and abroad, and a fuller understanding of opportunities and challenges from the viewpoint of the practitioner, the academic, and the policy maker. The review focuses on existing and historic planning practice in the United States and infrastructure provision beyond the metropolitan scale and spatial planning in the European Union and Asia. In the case of foreign nations where population agglomeration in dense urban areas has led to spatial planning at the megaregion scale, the report gives an overview of the decision-making structure employed; the relevant performance of the region in economic development, environmental quality and social equity; the history of megaregion planning institutions; and the local, regional and global contexts, in terms of governance and policy. We also analyze current and historic multi-state planning efforts in the United States from both a functional and a legal perspective.

Specifically, Section II explores the literature on regionalism, spatial planning, economic geography, governance, and globalization to inform the development of the megaregions framework. It concludes with examples of historic and current regional boundary delineation methods. Section III provides examples of regional policy and planning actions in the United States, followed by the documentation and examination of megaregional studies and research activities both in the United States and abroad. Section IV draws conclusions from the body of literature and case studies examined in this report to frame the next steps in the examination of megaregions for transportation planning, policy, and operations in the United States.

## SECTION II.

# FOUNDATIONS AND METHODS OF DELINEATION

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This section begins with a reflection on the academic literature in its relation to the concept of megaregions for transportation planning and operations. It concludes by examining methods that have been used to delineate the boundaries of different types of regions, especially megaregions.

### A. Examining the Literature

The megaregions concept is a relatively new area of academic pursuit: there exist only a limited number of peer-reviewed articles and books on the subject. However, there is a breadth of writing on topics closely related to megaregions including discussions of regionalism, globalization, global climate change, governance, economic geography, and spatial planning.

#### 1. Regionalism

Currently, major issues and concerns facing regions in the United States are typically addressed at a level dictated by jurisdiction rather than function. However, in many instances the spatial dimensions defining functions have surpassed traditional jurisdictional boundaries, creating new and dynamic patterns of urban space and functionality at metropolitan and regional levels (Salet *et al.*, 2003a). For example, development patterns in one jurisdiction may lead to traffic congestion in another, which may lead to air quality and health problems in yet another. All of these issues are interrelated, yet the decision-making and planning happens at the individual jurisdiction's discretion with suboptimal results for all parties concerned. This implies that functional relationships already exist in space, but the planning for these relationships often does not. Thus, planning for and discussion of these functional relationships is not taking place at the same scale as the relationships themselves.

This is not to say that the spatial mismatch between jurisdiction and functionality has been completely ignored. Over the past century in the United States, there have been many discussions of planning and addressing problems on various regional scales (Wheeler, 2002; Levine, 2001). In recent decades, regional planning and advocacy of regional approaches have focused more on potential economic benefits, with assertions that regionalism will lead to greater economic growth, even though these economic benefits have not always been readily apparent (Levine, 2001).

Some regional cooperation, particularly at the economically functional level, is already happening in the United States. This is primarily occurring in areas of service delivery, including parks and recreation, transportation, and wastewater treatment (Gyourko, 1997). But this cooperation, while providing some economic benefits (primarily through greater efficiencies and economies of scale), is somewhat singularly focused and has not been a panacea for urban or fiscal problems happening at the same scale, such as concentration of poverty, housing affordability, or lack of health-care coverage (Gyourko, 1997, Levine, 2001).

The nature of our existing regional planning focus, while based on economics, is not explicitly spatial (Levine, 2001). Therefore, as regions continue to expand into megaregions,

the planning functions and underlying incentives for cooperation are not expanding accordingly.

Whether this lack of spatial focus is a function of the capacity of regionalism *per se* or a symptom of a different issue is not clear. One possible reason for the perceived inability of regionalism to address the previously mentioned problems is suggested by Barnes & Ledebur (1998; cited by Levine 2001: p.191):

Local decisions are often driven primarily by highly localized interests, which can result in minimal improvements in productivity and competitiveness at great cost; that is, political autonomy creates a false sense of economic autonomy and produces decisions that are often zero-sum or even negative-sum for the region as a whole.

The space of economic functionality is thus not promoted because decision-making entities and governance functions are based on legal jurisdiction and not on the economically functional region. There are no explicit incentives for addressing the broader spatial implications of local issues outside of the localized interests driving many of the decision-making processes. This deficiency of explicit incentives leads to a lack of focus on the space affected by economic decisions, even while the effects of these economic decisions on space are continually expanding. Indeed, Barnes and Ledebur (1998) suggest that current incentives to promote inter-jurisdictional cooperation are limited to four instances:

- economies of scale in service provision;
- significant spillover effects;
- responses to external threats; and
- federal or state programs that promote some form of cooperative action.

Currently, transfer of resources between a city and its surrounding regions is often treated by decision-makers as an externality; only with explicit economic benefit or jurisdictional requirement will jurisdictions cooperate (Gyourko, 1997). As such, any potential benefits resulting from cooperation between these areas may not be considered in planning or the decision-making process, producing, as Levine (2001) suggests, counter-productive results. This implies that planning at an economically functional level, regardless of the scale, will only occur when the direct economic benefit of that planning is clear to decision-makers or the proper incentives are implemented.

## **2. Globalization**

The growth and complexity of megaregions exerts influence on multiple economic scales: local, regional, national, and global. Additionally, regional economies are expanding in focus and becoming more influenced by global forces. Increasingly, cities and their surrounding regions do not function as islands (Jensen & Richardson, 2001). Salet *et al.* (2003a) suggest that “regional economies have become more dependent on their position in global networks than on the traditional powers and investments of local industries and local entrepreneurs.”

With respect to regional growth and competitiveness, what happens outside the region may be as important as what happens inside the region. Regions, especially those that can offer a diversity of skills, innovation and production while remaining relatively flexible, are becoming increasingly engaged in global trade (Levine, 2001). This has led to, in some cases, the economies of regions driving the national economy rather than the traditional

macroeconomic thought of national economies shaping the region (Levine, 2001). Additionally, Porter (2001, p. 156) has argued that “[p]rosperity in the modern, global economy is increasingly rooted in the micro-economic capacity of economic areas.” Thus, the region as an economic entity is becoming a primary force in the global economy. Recent work by Sassen (2007) suggests that the presence of multiple types of agglomeration economies within one regional space goes beyond “familiar scale economies and associated urbanization advantages” allowing us to reasonably expand the aforementioned ideas about regional spaces to those of the megaregion.

While regions continue to expand in economic scale and functionality, increasingly complex economic functional relationships are expanding spatially, reaching beyond and across current jurisdictional and decision-making boundaries. This expanding scope is seen in the sprawling growth patterns throughout the United States in the past few decades, as urban functions can be seen in traditionally non-urban forms such as suburbs and exurbs (Lang and Dhavale, 2005).

As these urban functions continue to spread into traditionally non-urban areas, so do the spatial ramifications of these functions. Regional planning, as a measure of regional coordination, is a factor that positively affects the economic welfare of the region (Levine, 2001). A region’s success at competing on a global scale thus must be linked to its ability to coordinate and plan for economic functionality. The increasing recognition of regions as the economic footprint of the global economy suggests the megaregion approach may be helpful in responding to the challenges outlined above.

While the case can be made for a spatial focus in planning a region’s economic function, it is not only economics driving economic functionality and dictating the spatial effect of a region. Regional transportation, land availability, economic competition, housing availability and affordability, environmental issues, natural resources management, and quality of life are all interlinked throughout the region. Porter (2001) argues that environmental and social issues are inextricably linked to a region’s economic functionality. Therefore, as a region’s economic functionality increases, so do the associated environmental and social concerns. Alleviating the many issues—including those that are environmental and social in nature—will require their integration in the economic discussions at a megaregional level (Porter, 2001). In other words, a holistic, spatially-based approach to regional planning has the potential to allow megaregions to succeed in an increasingly global marketplace.

Megaregions are more than just physical connections, economic agglomerations or heavily populated places; megaregions are connections to each other and to the people that live within them and to the places they traverse. As such, the social obligations that we assume in the global economy are also important. For economically depressed areas, impoverished populations, or places that do not have adequate service provision or access to markets, the new challenges of infrastructure and megaregions are to be an umbrella under which we meet our needs (Edgington et al., 2001).

### **3. Global Climate Change**

At this point in time it is much easier to list the current and potential impacts of transportation on rising global temperatures (often referred to simply as “climate change”) than to state clearly and definitively what actions should be taken to mitigate these impacts. This section

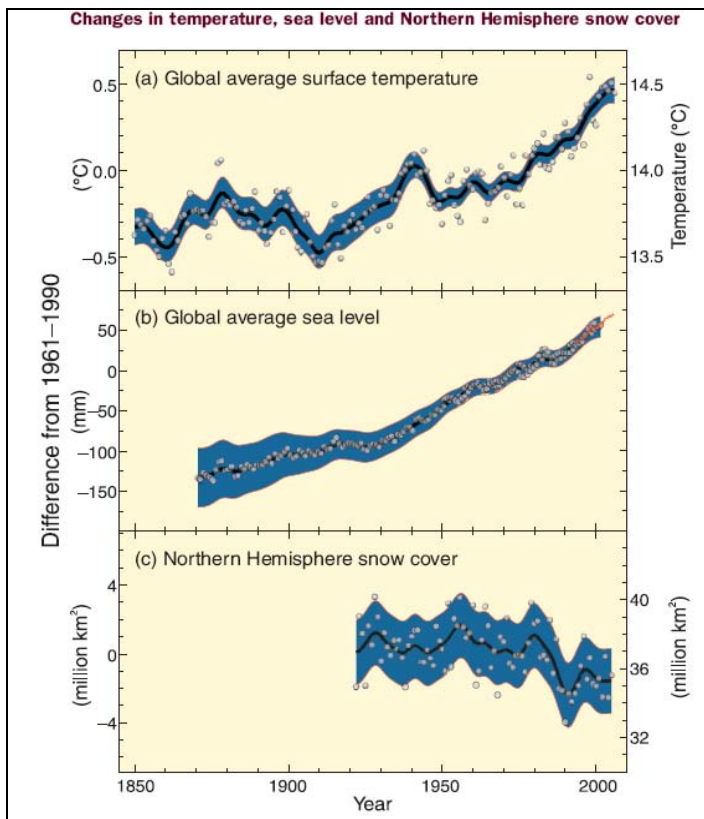
has two goals: first, to discuss how current transportation patterns in the United States contribute to the production of greenhouse gases (GHGs) and thus to rising global temperatures and their climatic effects; and second, to make some preliminary speculations on how refocusing transportation planning along megaregional lines might affect the relationship between transport and GHGs.

Rising average global temperatures are believed to have a number of consequences, including, but not limited to, melting of the polar ice caps, rises in average sea level, changes in the hospitality of habitats to plant or animal life, and increased instability of areas of permafrost (IPCC, 2007). Figure 1 shows how average surface temperature, sea level, and snow cover in the Northern Hemisphere changed between 1850 and 2000 (IPCC, 2007).

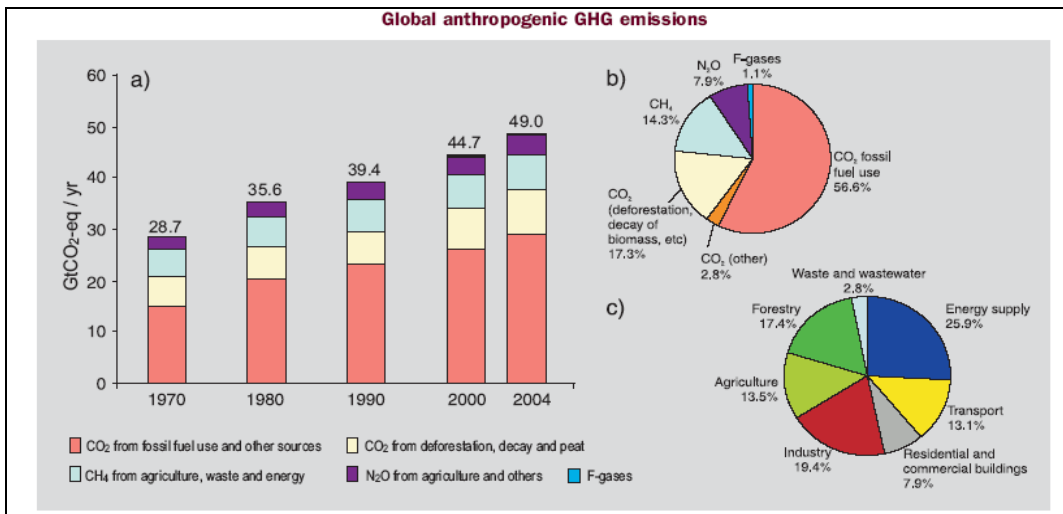
These changes are believed to be positively correlated with the increased emissions of GHGs related to human activity, particularly carbon dioxide (CO<sub>2</sub>). Between 1971 and 2001, CO<sub>2</sub> emissions worldwide rose by 60% (Banister, 2005). Figure 2 shows increases in production of CO<sub>2</sub> and three other GHGs—methane, or CH<sub>4</sub>; nitrous oxide, or N<sub>2</sub>O; and “F-gases,” or gases including fluoride, such as hydrofluorocarbons—since 1970.

Transport is one of the largest producers of GHG emissions, particularly CO<sub>2</sub> emissions. Worldwide, fuel combustion accounted for 25 billion tons of CO<sub>2</sub> emissions in 2003 (TRB,

2008). During that time U.S. emissions were 1.8 billion tons, of which 85% could be attributed to road transport (TRB, 2008). The rise in GHG emissions can be correlated with increasing globalization and increases in inter-regional and international trade (van Veen-Groot and Nijkamp, 1999). It is reasonable to expect that decisions in transport policy will have an impact on US GHG emissions, which could in turn have an impact on worldwide average temperatures. What would scaling transport to the megaregional level imply in terms of climate change? There are currently two major types of responses to climate change: “mitigation,” which consists of strategies to reduce GHG emissions



**Figure 1: Changes in Selected Global Environmental Indicators, 1850-2000 (IPCC, 2007)**



**Figure 2: GHG Emissions, Worldwide, Since 1970 (IPCC, 2007)**

and thus slow the contribution of GHG emissions to climate change, and “adaptation,” which consists of strategies in response to changes in weather patterns related to climate change. A megaregion approach has implications for both mitigation and adaptation strategies, each of which is considered in the following paragraphs.

Since approximately 80 percent of the world’s carbon emissions are produced from urbanized areas (Aitch, 2007), it is reasonable to assume that megaregions have a significant impact on the increase of carbon emissions. At the same time, this means the megaregion approach could be a solution to reduce the world’s carbon emissions. The following megaregion approaches could be considered such strategies. First of all, megaregion development, centered as it is around major urban centers, could encourage land-use patterns that in turn lead to higher-density development. One study has suggested that denser land uses could lead to a 10% reduction in urban transport activity in the United States (Grazi et al., 2008). As the “diffused metropolis” (Camagni et al., 2002) is more difficult to serve by public transport, denser development could lead to greater uses of public transport and a less predominant role of private cars. But it should be emphasized that at this point such changes in land use are the result of speculation. Currently, different megaregions have different land use policies and it is possible to speculate that different megaregions will probably continue to have different land-use patterns. However, land use planning in primary corridors in the megaregions could possibly benefit from a regional perspective on land use along those corridors linking the economic centers of these regions. Such an approach could be part of a national strategy for assuring mobility within these corridors.

A second possibility is that the megaregion could be used to coordinate transport pricing policies. England (2007) raises this possibility with his simulation of an increase in the gasoline tax of 50 cents per gallon in six New England states. The simulation compared the enacting of the increase by the six states individually, to its being enacted simultaneously. The results of the simulation suggested that the positive benefits of such a tax are increased

if the six states enact the increase simultaneously: environmental benefits increase and a higher portion of the fiscal stimulus remains within the region. England chose six states in New England for his simulation on the grounds that the region has a relatively extensive transport system, affluent travelers, and local political actors committed to reducing GHG emissions. This analysis suggests that megaregions could, given sufficient political coordination, take advantage of shared local concerns to enact mitigation policies.

Yet a third possibility is that megaregion transport planning could lead to changes in freight transport patterns. Designing transport systems with regional, rather than local, industry patterns in mind might make it easier to, first, increase efficiencies of shipping, thereby reducing congestion and related GHG emissions, and second, shift more freight shipping from truck to rail. Forkenbrock (2001) showed that the costs per ton-mile (in 1994 cents) of GHG emissions for rail freight were just 13% of those for trucks. Again, such coordination would vary depending on the resources, industrial location patterns, and specializations of the megaregion.

The megaregion could also play a role in adaptation strategies. The Transportation Research Board of the National Academies (2008) has detailed a series of predictions as to how climate change might affect transportation infrastructure:

- Higher temperature extremes may lead to the buckling of pavement and the misalignment of rail lines.
- A greater incidence of more extreme weather conditions, such as hurricanes and floods, could lead to greater damage to transport infrastructure. Approximately 60,000 miles of highway are already exposed to periodic coastal flooding.
- Intense precipitation could erode soil over pipelines.
- In general, climate change could push temperature extremes outside the ranges that infrastructure was designed to handle, leading to greater stress on infrastructure.

Climate change is associated with a variety of extreme climate events. Disaster as a result of Hurricanes Katrina and Rita and the displacement of victims along the Gulf Coast megaregion demonstrated the links between transportation infrastructure and environments in the region (RPA, 2006). A megaregion approach could play a role to efficiently meet these challenges. The Transportation Research Board report also concluded that regional coordination will be necessary to help adapt existing and new transportation infrastructure to the demands of more extreme climate events:

Adapting successfully to climate change will require forging new partnerships and organizational arrangements that better align with the impacts of climate change, which do not follow modal, jurisdictional, or corporate boundaries... The creation of regional and multistate organizational arrangements to address climate change is a formidable challenge, but could yield enormous payoffs in the ability to respond not only to climate change, but also to other natural and manmade disasters. (TRB, 2008)

In sum, megaregions could be a useful tool to in deciding both how to adapt to climate change and its impacts and how to decrease GHG emissions in order to slow the correlated increase in global temperatures. However, both the study of megaregions and the study of



climate change remain relatively young and there may be even more opportunity to achieve a more sustainable outcome.

#### **4. Economic Geography**

Concurrent with the rise and focus on the increasing significance of regions in the global economy is a resurgence of interest in economic geography. This is focused on economic activities and identifying, measuring, and locating agglomerative effects. There are cultural events, social affiliations, and racial enclaves that are also correlated with the agglomerative effects of megaregions. Therefore, the concept of the megaregion has become a topic in the expanding interest in economic geography (see Sassen (2007) and Glaeser (2007)).

Economic growth, industry organizations and global trends, transactions, and commerce underlie and give rise to the increasing focus on economic and spatial geography. As importantly, the difference between developed urban spaces that are thriving economically, and those that have less economic activity can be investigated within the context of economic geography. More importantly, in this global market there is a continued expectation of increasing revenues and growth that can be enhanced through recognition of place and its ability to attract other sectors critical to its continued development. Megaregions are places that operate at the center of a new economic geography.

The economic geography (and by extension, functionality) of regions arises in large part from agglomeration economies (Fujita et al., 1999). The economic geography of megaregions can be thought of as agglomerations of agglomeration economies. Agglomeration results in the clustering of economic activities and associated effects, but this is offset with expansion forces simultaneously spreading the activities effects of agglomeration, in a type of circular causation (Fujita et al., 1999).

#### **5. Spatial Planning**

As the concept of megaregions and an underlying framework for spatial planning is discussed and pursued in the United States, it will prove beneficial to study spatial planning undertaken in the European Union (EU). In many ways, Europe is dealing with many of the same issues facing the United States—expanding and changing urban structures outgrowing traditional jurisdictional boundaries and a rapidly globalizing marketplace where the region as a whole is becoming an economic entity (Salet et al., 2003a). These issues have intensified with the changes brought about by the creation and expansion of the EU.

Spatial planning begins with spatial policy, which is “any policy which is spatially specific or is in effect spatial in practice, whether or not it is deliberately designed to be, and any policy which is designed to influence land-use decisions, to be integrated with local planning strategies or to be implemented by local and regional authorities as part of their spatial planning responsibilities” (Williams, 1996, 7). Hence, according to the European Regional/Spatial Planning Charter, spatial planning is “conducted through a very systematic and formal hierarchy of plans from national to local level, which coordinate public sector activity across different sectors but focus more specifically on spatial coordination than economic development” (Council of Europe, 1984).

Spatial planning has long occurred in Europe. With the advent of the EU, spatial planning is becoming more defined and is taking place on a larger scale with planning often crossing

jurisdictional and sometimes even national boundaries (Jensen & Richardson, 2001; Nadin, 2001; Salet et al., 2003a). Two documents in particular provide guidance in developing governance and planning frameworks by looking at various cases of spatial planning in Europe: “Governance of Territorial and Urban Policies from EU to Local Level” (ESPON, 2006) and “A Framework for City Regions” (Harding et al., 2006), published by the British Office of the Deputy Prime Minister. Both of these documents were created to provide an evidence base for a sustainable framework for regional spatial planning. This guidance provides valuable lessons for multiple scales of spatial planning but is particularly useful when thinking of frameworks for inter-jurisdictional planning areas such as megaregions.

Although all of these planning efforts have different approaches and different spatial scales, they are based on the belief that regional performance plays a role in both the domestic and global functioning of the national economy and in the quality of life of the residents (Harding et al., 2006). The EU uses these large-scale planning frameworks to promote social equity and to strengthen regions and make them more economically competitive globally.

These planning efforts are rooted in spatial visioning, which is also seen as spatial planning strategy (Nadin, 2001; ESPON, 2006). The primary goals of this spatial planning process are to understand long-term spatial development trends, create options for the development of the territorial structure of an area, and inspire and guide the spatial planning process (Nadin, 2001). This is all done while bringing together the objectives of economic and social cohesion, conservation of natural resources and cultural heritage, and the balanced competitiveness of space (ESPON, 2006).

## **6. Governance**

Governance is the process by which society and organizations make decisions, determine representation, and render accountability. Governance is not synonymous with government, because it involves people and organizations outside governmental entities (Graham et al., 2003). It is a complex process, with many different actors playing multiple roles.

Throughout the United States the division of responsibility between federal, state, county or parish, metropolitan, and local agencies leads to the fragmentation of actions and policies. Each entity has powers and responsibilities given to it by the state. These powers and responsibilities include but are not limited to: public safety, taxation, and planning. Each state grants different powers to its counties and municipalities. The differences in state systems increase the complexity, making cooperation among layers of government and different states a challenge and decreasing incentives to develop complementary policies and regulations.

In addition to the complex layers of government, there are also multiple entities beyond those typically associated with government, which also impact planning. The spatial context of planning efforts varies, but most comprehensive planning is done at the local level, and focuses on parochial interests. There are regional planning entities, but these units of governance typically focus on a single problem, and rarely cross state boundaries.

Even within a single government entity there is often functional fragmentation. Governmental fragmentation refers to the raw numbers of government entities in any given region.

Functional fragmentation is the division of duties by discipline and by problem. The internal fragmentation of government fails to recognize the fact that problems are often related. As a result, “goals, objectives and policies are considered and administered within the confines of their specific functional areas” (Krizek & Powers, 1996, p.24).

Government fragmentation also enhances inter-jurisdictional competition. Communities compete for desirable commercial and industrial development and the accompanying perceived contribution to the tax base: “[O]ne community’s gain is likely to be another’s loss” (Orfield, 2002a, p.91). While such competition at the local level is sometimes desirable for economic development policy in that it promotes a removal of government regulations and a local control is flexible to react to local realities (Glaeser, 2007), there may be limitations for local governments to face with challenges in a global markets. In addition, state governments also compete at the federal level for transportation, education and other social welfare grants. The task for megaregional approaches is to overcome the challenges these fragmented approaches pose.

Intergovernmental relationships in the United States are characterized by interdependence, complexity and bargaining (O’Toole & Laurence, 2000). Specialists in agencies, legislative committees and pressure groups all seek to gain influence in a maze too complex for any one official or citizen to comprehend. It is “increasingly difficult for anyone, even major officials like governors or mayors or presidents, to decipher just *who* [is] causing *what* to happen” (O’Toole & Laurence, 2000, p.18, emphasis in original). Power is shared between levels of government, both vertically and horizontally, and “any change requires mutual accommodation” (O’Toole & Laurence, 2000, p.19), diluting and diffusing the original intent. The impacts of this complexity and accommodation on the future sustainability in megaregions relate to the ability of actors to take action when decisive action is needed. It is increasingly difficult to craft a unifying vision, develop a singular policy approach and “systematically execute *positive* action in a straightforwardly rational manner” (O’Toole & Laurence, 2000, p.19, emphasis in original).

## **7. Informing a Megaregion Framework**

The aforementioned literature suggests a potentially fruitful, yet challenging, path for megaregions from a policy and governance perspective. The exact nature of regional functional economic relationships is complex and not easily measured through current means, making it difficult to understand the regional economic interaction (Hoover, 1971). Inasmuch as this economic functionality and the underlying economic relationships can be understood, one could infer the existence of implicit incentives for a region to cooperate on economic grounds. To do this, it is important to understand these agglomeration economies and the need for their continued growth (Fujita et al., 2001). The previously mentioned instances of inter-jurisdictional cooperation suggested by Barnes & Ledebur (1998) could potentially allow for spatial focus and planning at the scale of economic functionality on an inter-jurisdictional level. If this were to occur, it could lead to economic decisions being made at the appropriate spatial level which could potentially offset the negative repercussions—zero- or negative-sum decisions (Levine, 2001)—of the autonomous local thinking that leads to inefficient regional economic activity and public investment.

What role do mobility and transportation infrastructure play in the development and success of megaregions in the global context? While the role of infrastructure in developing countries

is a commonplace topic, the use of infrastructure in highly developed countries and its role in expanding economic activity has not received the same amount of attention (Edgington et al., 2001). Infrastructure should be designed and created to support our global markets, as well as provide the social infrastructure to sustain our lives, families and communities. There have been numerous strategies and views put forward outlining the significance and importance of regional planning to expand economic influence and the role of infrastructure in accomplishing that effectively (Edgington et al., 2001; Isard et al., 1998; Dreier et al., 2001).

Infrastructure is the skeleton linking towns, cities, and neighborhoods to regions, regions to megaregions, and megaregions and countries together. More explicitly, transportation and mobility hubs have historically proven to be advantages to our cities and, by extension, regions (Fujita et al., 2001).

The consideration of regional economic growth sets the stage for the development of a spatial planning framework as a tool for the success of megaregions within the United States. With a multi-sectoral, place-based spatial planning approach, it is feasible to explicitly address economic prosperity as well as social and environmental issues in a megaregion framework. But this framework should go beyond merely a normative assertion. Historically, regional reform has been argued from theoretical and normative perspectives rather than from a base of empirical findings; this approach has left regional economic development detached from spatial reality (Levine, 2001). While a normative argument must be made for a holistic approach to regional planning, there must also be an empirical study of the realities of the interconnectedness of environmental, social, and economic functions and operations at the megaregion level.

Spatial planning plays a key role in coordinating policy and practice at multiple scales. But the obstacles to creating a spatial-planning framework are highly interconnected and cannot be overcome piecemeal; rather, the planning process must address all three to succeed. First, there must be a change in the understanding of megaregions and the functional and infrastructural connections between them. Second, it is necessary to develop effective, widely-supported governance arrangements that can mobilize, sensitize, and align national, megaregion, state, regional, and local actors. And third, effective spatial planning will require more coordination of public sector investment and expenditure over the long term to provide benefits and incentives for inter-jurisdictional cooperation.

The increasing importance of the region as a driver in the larger national and thus the global economy is well known. Therefore, it is important to have a national vision for how megaregions interact on an economic scale, and by extension on a functional scale. This greater understanding of the interconnectedness of megaregions, especially through transportation systems, can allow for the development of an incentive framework that jointly pushes the advancement of economic, environmental, and social goals.

The EU has seen more participation in the spatial planning process, especially from private sector and stakeholders at all levels, when benefits to those stakeholders are clearly recognizable. Many of the successful examples of increased collaboration resulting in joint spatial development plans or visions were generated through a pragmatic need for interaction in functional regions covering increasingly large geographical areas. Success in

spatial planning in the EU occurred with the development of a system of incentives capable of encouraging more cooperative and strategic relationships between local authorities and stakeholders. These relationships grew out of a pragmatic, bottom-up need to cooperate.

However, this is not to say that a fundamental change in governmental systems is necessary. Nadin (2002) and Salet et al. (2003b) both indicate that the best approach to spatial planning is to set up a framework that breaks down existing barriers to coordination and allows flexibility within the current planning system. Indeed, the change in approach to a broader vision proved effective in the EU when recognizing the particularities of the different geographic areas and then attempting to weave them into a higher order of social and economic collaboration and integration.

Experiences in the EU suggest that spatial planning success will require a governance framework that links national, regional, and local levels and is explicitly designed to build the capacity of the megaregion. This can only be done when participatory dialogue on many levels is a main component of the spatial planning process. These frameworks are ultimately derived from public sector focus and investment combined with a greater understanding of functional relationships derived from empirical study and wide ranging participation.

The global economy will give rise to new financial structures and new geographies. The evolution and transformation of our cities into megaregions and their critical role as economic centers in the global economy requires a better understanding of the role of global forces and how they affect people, places, and institutions. Additionally, we need to discern how this knowledge can be used to generate economic benefit, how to plan for it and how to measure it. Accountability and the ability to measure the outcome of certain investments and performance in megaregions are an intrinsic part of this new form of regionalism.

## **B. Megaregions & Infrastructure**

As the United States is faced with escalating global competition and the associated rapid increase in international trade and freight movement, it is becoming critical to support economic development by enhancing the capability and capacity of transportation infrastructure. (American Association of State Highway and Transportation Officials (AASHTO), 2007).

However, transportation statistics indicate that the current U.S. transportation infrastructure is not sufficient to support these trends. While the number of vehicles and vehicle-miles of travel increased by 39.8% and 81.2%, respectively, road and street mileage increased only 2.4%. The annual vehicle-miles of travel on interstate highways increased by 39.4% between 1990 and 2000, while the miles of interstate highways increased only 3.6% during the same period. In addition, as population and economic growth has concentrated on urban areas, the annual vehicle-miles of travel increased more in urban areas (30.6%) between 1990 and 2000, compared to rural areas (24.9%). Specifically, for interstate highways, the annual travel-miles increased 41.3% in urban areas and 34.5% in rural areas during the same period while the increase of travel-miles on local roads is higher in rural areas (31.0%) than in urban areas (23.5%) (Federal Highway Administration (FHWA), 2000). This identifies the failure of supply of the infrastructure to keep pace with rapid increase in demands in urban areas during the past several decades. Large metropolitan areas continuously expand from urban areas to urban area sharing transportation networks and environmental systems over

large geographic areas making transportation systems difficult to manage by one individual metro region. Such growth pressures environmental resources around transportation infrastructure as well as the fringes of metropolitan areas, calling for construction of green infrastructure as a way to preserve undeveloped land and environmental resources.

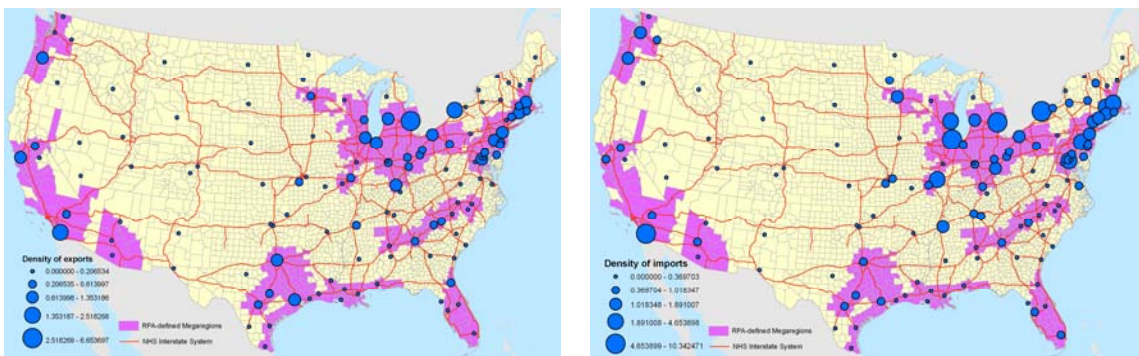
AASHTO (2007) emphasizes that the U.S. competitiveness in the global economy can be maintained by preserving the current system of interstate highways, ensuring a modern and efficient transportation system, expanding system capacities, and reducing growth in highway demand by developing alternative modes. At the same time, an effort to protect environmentally sensitive areas and ecosystems from the encroachment of this infrastructure should be made. This suggests the attractiveness of implementing a strategy that directs where and how investment in transportation infrastructure and green infrastructure should be made.

In this section the freight movement, which is not only a key factor for the national economic prosperity but also one of significant contributors to highway congestions, is reviewed within the context of megaregions. Nationwide infrastructure planning is reviewed to examine how national transportation infrastructure planning reflects the current and future necessity to foster and support economic competitiveness. In addition, the role of green infrastructure is examined all under the auspices of megaregion planning.

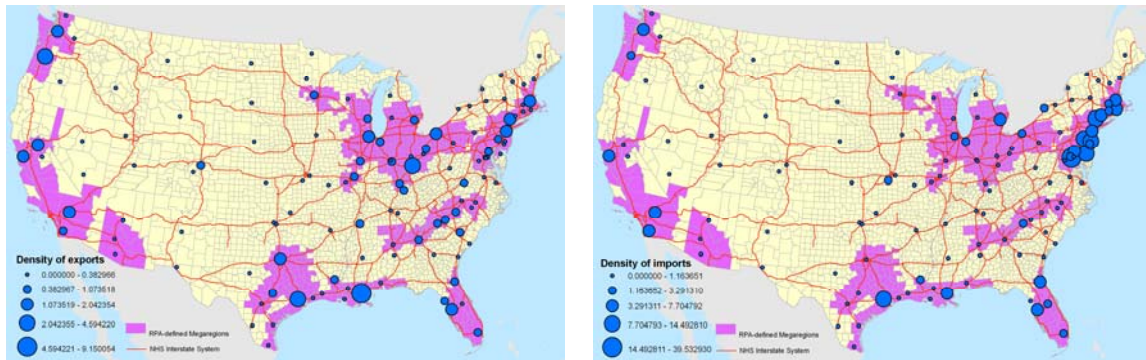
### 1. Freight Movement and Megaregions

As much as the efficient passenger travel for inter-metro areas is important in the quality of life and economic competitiveness, the efficient movement of goods via freight transportation infrastructure is essential because freight transportation may significantly affect economic productivity (Jones, 2007). In particular, the transportation infrastructure that connects metropolitan areas to move goods by truck, rail, water, air, and other modes is critical for the nation's economic competitiveness (Puentes, 2008).

A global economy and free trade will increase the demand for movements of goods and services. For example, the volume of shipments is projected to increase to 33.7 billion metric tons in 2035 from 17.5 billion metric tons in 2002 (Jones, 2007). As seen from Figure 3 and



**Figure 3: Distribution of the volume of trades with Canada and Mexico (2035)**



**Figure 4: Distribution of the volume of trades with overseas countries (2035)**

4, the trade between the United States and foreign countries are intensively taking place in most megaregions. In 2005, approximately two-thirds of the total U.S. trade took place in the 50 largest metropolitan areas (Puentes, 2008).

To accommodate these future demands, a freight transportation policy that can direct sufficient investment in appropriate areas should be prepared by identifying what kind of transportation modes will be demanded and where those movements will take place.

#### **a) Transportation modes of freight movement**

While the volume of shipments is projected to continuously increase, its effects on the transportation system may be different, depending on the transportation modes, the properties of goods, and the characteristics of geographic areas, such as origins and destinations.

The freight transportation system is a complex network of land, water, and air. The Federal Highway Administration's (FHWA) 2006 Freight Analysis Framework (FAF) provides seven modes of transportation, including air & truck<sup>2</sup>, other intermodal<sup>3</sup>, pipeline & unknown<sup>4</sup>, rail<sup>5</sup>, truck<sup>6</sup>, truck & rail<sup>7</sup>, and water<sup>8</sup>.

<sup>2</sup> 'Air & Truck' includes "shipments by air or a combination of truck and air" (FHWA, 2006c).

<sup>3</sup> 'Other Intermodal' includes "shipments typically weighing less than 100 pounds by Parcel, U.S. Postal Service, or Courier, as well as shipments of all sizes by truck-water, water-rail, and other intermodal combinations" (FHWA, 2006c).

<sup>4</sup> "Pipeline is included with unknown because region-to-region flows by pipeline are subject to large uncertainty" (FHWA, 2006c).

<sup>5</sup> 'Rail' includes "Any common carrier or private railroad" (FHWA, 2006c).

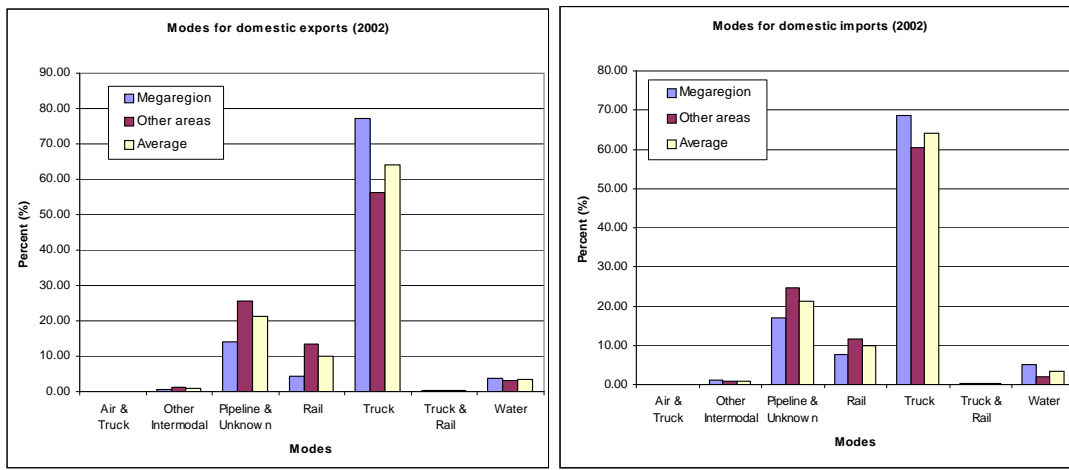
<sup>6</sup> 'Truck' includes private and for-hire truck (FHWA, 2006c).

<sup>7</sup> 'Truck & Rail' Intermodal includes "shipments by a combination of truck and rail" (FHWA, 2006c).

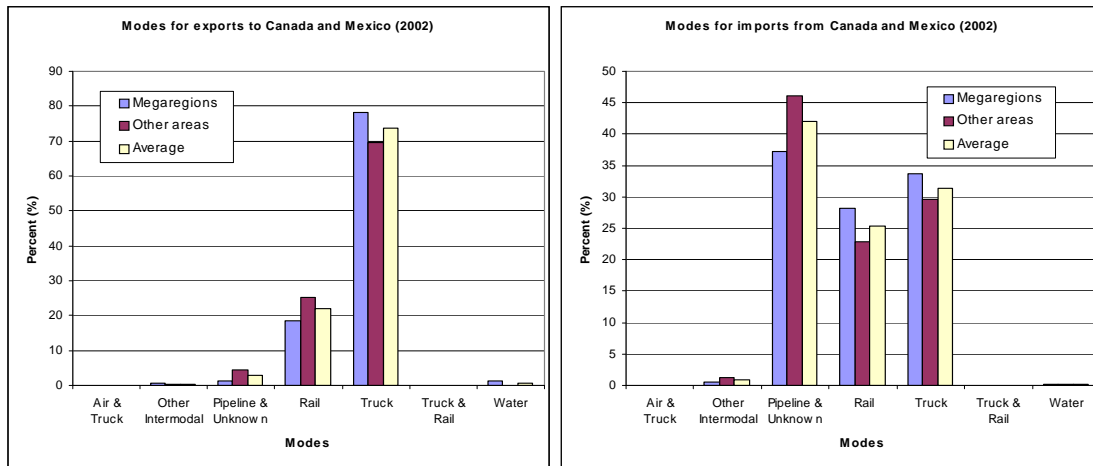
<sup>8</sup> 'Water' includes "shallow draft, deep draft, and Great Lakes shipments. Shallow draft includes barges, ships, or ferries operating primarily on rivers and canals; in harbors; the Saint Lawrence Seaway; the Intra-coastal Waterway; the Inside Passage to Alaska; major bays and inlets; or in the ocean close to the shoreline. Deep draft includes barges, ships, or ferries operating primarily in the open ocean" (FHWA, 2006c).

Figures 5-7 show that more than half of exporting goods were carried by truck to the ports of exit on the U.S. border. More than 60 percent of domestic commodity flows were moved by truck. On the other hand, the transportation modes of imported goods from foreign countries are distributed more evenly across several modes. For example, approximately 40 percent and 25 percent of imported goods from Canada and Mexico were carried by pipeline and rail, respectively, to the U.S. destinations while 30 percent were moved by truck.

The figures also show that megaregions relied more on truck than non-megaregion areas for freight movements. This issue will be discussed in the next section.

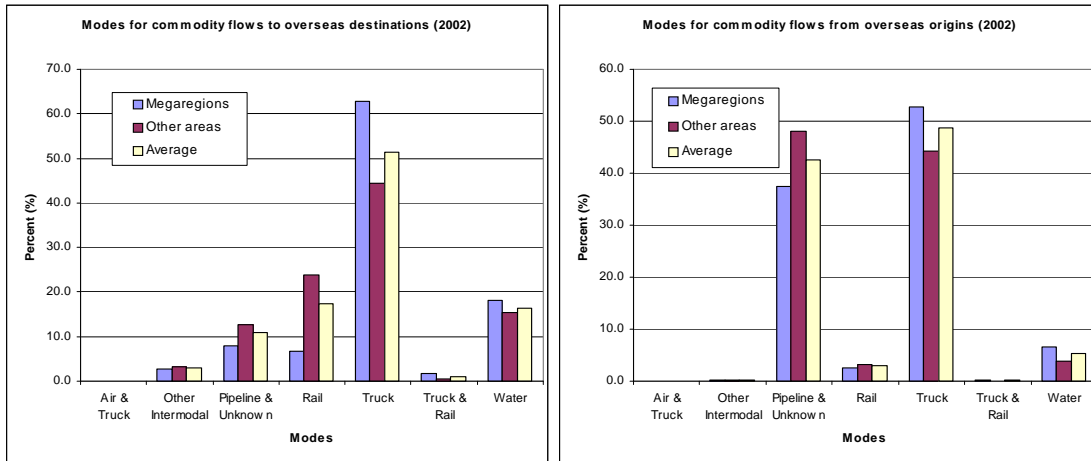


**Figure 5: Transportation modes for the domestic trade goods**



**Figure 6: Transportation modes for the international trade goods with Canada and Mexico**





**Figure 7: Transportation modes for the international trade goods with overseas countries**

**b) Domestic commodity flows**

More than half of commodities were carried by truck (64 percent) between domestic origins and destinations in 2002. Pipeline & Unknown mode contributed 21 percent, rail 10 percent, and water 3 percent (Figure 5). Specifically, more than 77 percent of commodities from megaregions were moved to domestic destinations by truck in 2002, and its portion in megaregions is projected to 80 percent in 2035, while non-megaregion areas rely less than 60 percent on truck in both 2002 and 2035 (Table 1). This means that megaregions will experience heavier freight traffic on highways than other non-megaregion areas.

Only 4-5 percent of commodities are carried by rail in megaregions, compared to 13 percent of rail usage in non-megaregion areas. Pipeline is highly used in non-megaregion areas (approximately 26 percent in 2002), compared to 4 percent in megaregions.

**Table 1. Transportation modes for exporting goods to domestic destinations between megaregions and non-megaregion areas**

Modes	Megaregion		Other areas	
	2002 (%)	2035 (%)	2002 (%)	2035 (%)
Air & Truck	0.02	0.04	0.01	0.02
Other Intermodal	0.52	0.68	1.14	0.84
Pipeline & Unknown	14.01	11.97	25.74	26.03
Rail	4.45	4.56	13.34	13.09
Truck	77.16	80.23	56.36	57.02
Truck & Rail	0.19	0.20	0.21	0.22
Water	3.63	2.31	3.20	2.77
Total	100.00	100.00	100.00	100.00

Source: reorganized from the data of Freight Analysis Framework (FHWA, 2006d)

Table 2 also shows that more increase in exporting commodity flows by truck and rail will take place in megaregions than other areas while the increase in the use of the pipeline and water modes is projected to be larger in non-megaregion areas by 2035. However, for importing goods from other domestic regions, there is no significant difference between

megaregions and non-megaregions except for the pipeline for which use will increase more in non-megaregions.

The average distance covered by truck freight is shorter (485 miles) than air (973 miles), rail (902 miles), and coastwise water (1,269 miles). Moreover, more than 65 percent of the tonnage of the freight movements by truck is estimated to move less than 100 miles (Puentes, 2008). The relatively short length of trucking implies that the freight movement policy between metropolitan areas at the megaregion level would be useful in relieving congestion caused by truck traffic on highways and to ensure just-in-time delivery of goods.

**Table 2. Comparison of growth rates of domestic commodity flows between megaregions and non-megaregion areas (% , 2002-2035)**

	Exports		Imports	
	Megaregions	Other areas	Megaregions	Other areas
Total	97.5	86.4	89.3	91.5
Pipeline & unknown	68.7	88.5	68.9	91.6
Rail	102.3	82.9	84.5	87.0
Truck	105.3	88.5	99.1	93.5
Water	25.7	61.4	47.7	45.4

Source: reorganized from the data of Freight Analysis Framework (FHWA, 2006d)

### **c) Commodity flows from and to overseas countries**

Table 3 shows how different transportation modes move export and import goods between origins or destinations and ports within the United States. For export goods, the reliance on truck in megaregions may increase from 63 to 74 percent between 2002 and 2035 while the reliance on water, rail, and pipeline may decrease. Although the freight movement by truck will increase in non-megaregions as well, other transportation modes, such as water (16 percent), rail (20 percent), and pipeline (8 percent), are expected to serve many portions of freight movements in these regions.

For import goods, 'Pipeline & Unknown' mode plays significant role next to truck in both megaregions and non-megaregion areas. For example, approximately 37 percent of commodities are moved by this mode in megaregions, and 48 percent in non-megaregion areas. This may be probably because of the characteristics of imported goods, such as oil and natural gas. However, the reliance on truck may increase to 72 percent in megaregions by 2035 while the use of the 'Pipeline & Unknown' mode may decrease from 37 to 21 percent during the same period (Table 3).

Table 4 shows that the volumes of both export and import from the trade with foreign countries will increase more in megaregions by 2035. During this period, megaregions' export goods may increase by 134 percent and import goods by 124 percent, while non-megaregion areas' export goods may increase by 85 percent and import goods by 76 percent. This implies that megaregions may play a more significant role in the nation's economic competitiveness over the next few decades.

This table also shows that the freight movement by truck will increase significantly in megaregions (almost twice the amount of increase in non-megaregions for imported goods)

between 2002 and 2035. Although trucks are responsible for the greatest share of U.S. freight movements, the freight rail network also makes important contributions. For example, the rail network is estimated to reduce 100 billion truck miles of travel over the next 20 years (Puentes, 2008).

Thus, in order to mitigate the congestion of freight movements on highways, the investments in alternative modes, such as the rail freight network in megaregions should be considered

**Table 3. Transportation modes commodity flows from and to foreign countries**

Modes	Export				Import			
	Megaregions		Other areas		Megaregions		Other areas	
	2002	2035	2002	2035	2002	2035	2002	2035
Air & Truck	0.06	0.12	0.07	0.10	0.06	0.09	0.08	0.11
Other Intermodal	2.66	2.99	3.26	2.83	0.30	0.57	0.28	0.59
Pipeline & Unknown	7.93	4.49	12.68	7.50	37.48	21.44	48.14	37.96
Rail	6.81	5.35	23.71	19.77	2.60	2.48	3.19	5.21
Truck	62.88	73.71	44.55	53.50	52.87	71.81	44.32	53.16
Truck & Rail	1.64	1.36	0.42	0.61	0.13	0.15	0.09	0.12
Water	18.03	11.98	15.30	15.69	6.57	3.47	3.90	2.85
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: reorganized from the data of Freight Analysis Framework (FHWA, 2006d)

**Table 4. Comparison of growth rates of commodity flows from and to overseas countries between megaregions and non-megaregion areas (% , 2002-2035)**

	Export		Import	
	Megaregions	Other areas	Megaregions	Other areas
Total	134.1	84.9	124.1	75.9
Pipeline & unknown	32.7	9.3	28.2	38.7
Rail	83.9	54.2	114.1	186.9
Truck	174.4	122.0	204.4	110.9
Water	55.6	89.6	18.4	28.6

#### **d) Conclusions and implications**

As a result of the global economy and free trade, many portions of international trade as well as domestic trades are taking place in megaregions. While the freight transportation system includes a complex network of roads, rail, water, and air, more than half of exporting goods were moved by trucks in 2002. This trend is estimated to be reinforced over the next few decades.

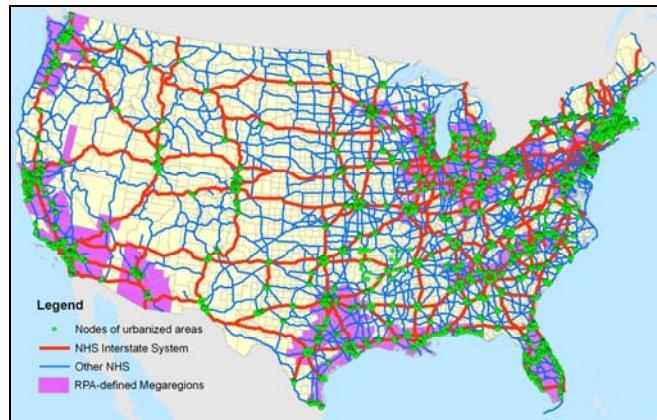
The reliance on trucking is higher in megaregions than non-megaregions. The congestion caused by truck traffic on highways may negatively affect economic productivity, increasing the costs of goods movements and generating problems for production schedules. Since these trends are estimated to continue or to be even worse in the future, a strategic approach to the freight transportation infrastructure in megaregions, focusing on highways and alternative modes, such as rail should be considered.

In order to prepare a strategy to effectively face with these challenges, the demands of freight movements, the types of infrastructure that efficiently meet those demands, and the geographic areas where those demands will increase should be studied by analyzing the characteristics (e.g. commodity groups) of goods and their possible transportation modes for each megaregion. For example, approximately 75 and 23 percent of imports/exports (in value of millions of dollars) via Detroit Combined Statistical Area in 2002 were moved by truck and rail, respectively, and 54 percent of them include motorized and other vehicles (including parts) and machinery (Yoder, 2006). Thus, many export/import goods transported via the Detroit area, which is included in the Midwest megaregion, are bulky goods, implying that the efficient highway and rail system that distribute those heavy goods from the port of entry or exit is critical in economic vitality in the region. Importantly, it begs the issue of what kind of conveyance might be more efficient in reducing emissions.

## 2. National Highway Systems (NHS)

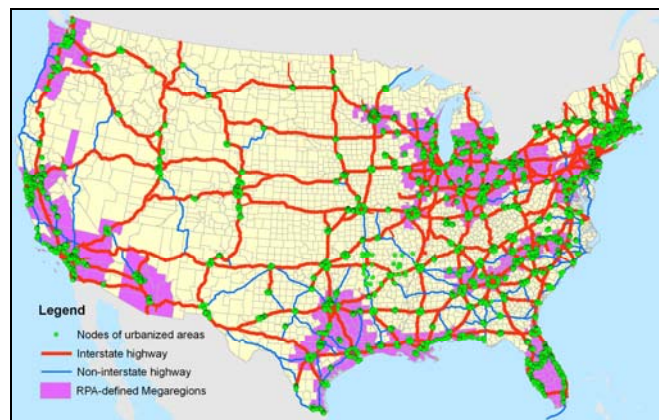
### a) The structure of NHS

The National Highway System (NHS) was required by the 1991 ISTEA. FHWA developed this system in collaboration with the states, local governments, and MPOs. The NHS was approved by Congress in 1995. The NHS consists of the Interstate System (IS) and more than 100,000 miles of arterial and other roads (FHWA, 2000). The NHS represents approximately 4% of the total public roads while it accounts for more than 44% of travel. Rural areas have more NHS miles (73.8%) than urban areas (26.2%), but more travel takes place in urban areas (59.6%) than in rural areas (40.4%) (FHWA, 2000). Modifications are frequently made to the NHS which is thus, a living system.



**Figure 8. The National Highway System** (ESRI, 2006; Bureau of Transportation Statistics (BTS), 2007)

The NHS is categorized into five parts: the interstate highway system, high-priority corridors (some of which are existing Interstates), the non-interstate portion of the Strategic Highway Corridor Network (STRAHNET), Strategic Highway Corridor Network connectors, and other arterial highways (Slater, 1996). The interstate highway system accounts for approximately 30% (more than 40,000 miles) of the NHS (Figure 8). The high-priority corridors were first identified in the Intermodal Surface Transportation

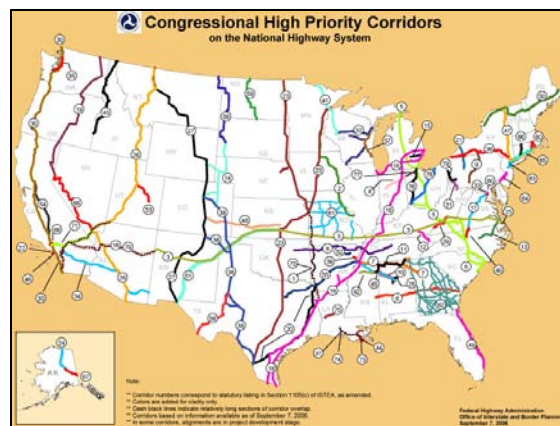


**Figure 9. The Strategic Highway Network (STRAHNET)** (ESRI, 2006; BTS, 2007)

Efficiency Act of 1991 (ISTEA), and there are 80 such corridors as of 2006 (FHWA, 2007). The Strategic Highway Network (STRAHNET) system provides access and emergency transportation of personnel and equipment in times of peace and war. It consists of over 61,000 miles of roads linking major military bases and other defense related facilities to the interstate highway. The almost 2,000 miles STRAHNET connects more than 200 important military bases and ports to STRAHNET corridors (Figure 9).

### b) NHS high-priority corridors

The Congressionally-identified high-priority corridors, one of the components of NHS, have been designated with national significance. Beginning with 21 corridors identified by ISTEA in 1991, 59 additional corridors were added in Federal transportation legislation as of 2006 (Figure 10). One of advantage of designation is that these corridors were eligible for funding from the National Corridor Planning and Development (NCPD) Program, a discretionary fund of the U.S. Secretary of Transportation, for planning, construction, and maintenance. The high-priority corridors have been funded through the “ISTEA”, “TEA-21”, and “SAFETEA-LU” multiyear surface transportation authorizations. While the first two authorizations were effective from 1992 through 1997 and from 1998 through 2003, respectively, SAFETEA-LU is currently effective (FHWA, 2007). SAFETEA-LU did not continue the NCPD. Designation of high-priority corridors may benefit economic development with the improvement of freight and vehicle movement.



**Figure 10. NHS High Priority Corridors**  
(FHWA,2006a)

### c) Highway systems and megaregions

As seen from Figure 8 and 9, an overlapping map of NHS and megaregions<sup>9</sup> (RPA, 2006), most urban areas within megaregions are served by or close to interstate highways. However, the capacity and load of roads and streets are different between megaregions and non-megaregions. For example, Table 5 shows that urbanized areas of megaregions have shorter interstate highways and local roads than non-megaregions. Specifically, miles of interstate highways and local roads per 1,000 persons are 0.0586 and 2.6949 for megaregions, but non-megaregions have 0.1075 and 3.8068 miles, respectively. This implies that interstate highways of megaregions are more congested than non-megaregions. Figures 11 and 12 also show that both passenger travel and freight movements are more congested in megaregions.

<sup>9</sup> Since RPA-defined megaregions, although their identification methods have not been released, this section uses RPA’s delineations as tentative megaregion locations. Recently, Passenger Rail Working Group (PRWG) (2007) and National Surface Transportation Policy and Revenue Study Commission (2007) used RPA’s definition.

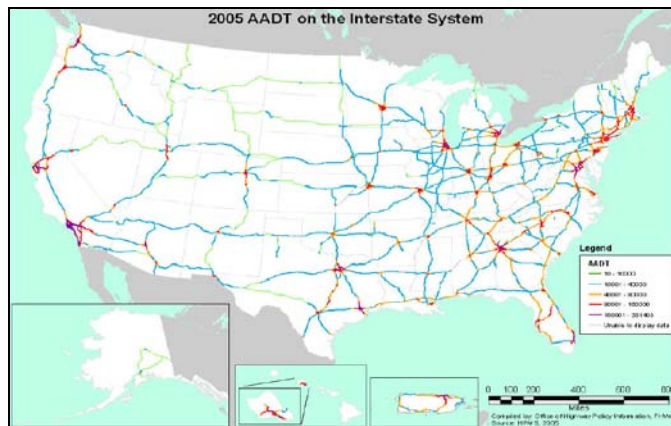
**Table 5. Miles of interstate highways and local roads of federal-aid urbanized areas<sup>10</sup>**

	Total Miles/1,000 persons	
	Interstate	Local
Urbanized areas of megaregions	0.0586	2.6949
Urbanized areas of Non-megaregions	0.1075	3.8068

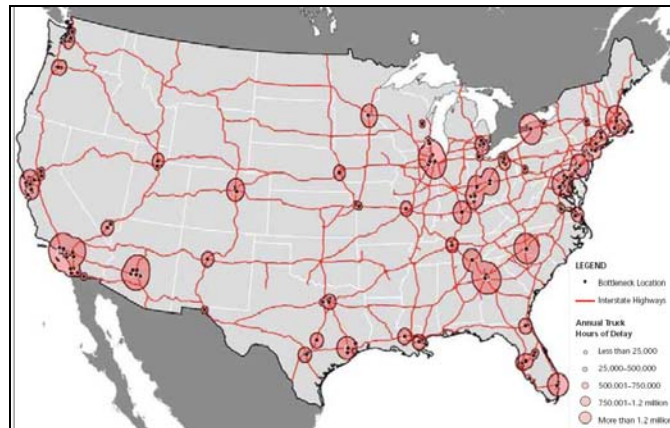
Source: reorganized from the table (miles and daily vehicle-miles of travel) of FHWA (2006)

While congressional high priority corridors have increased from 21 to 80 since 1991, some routes within megaregions have not been designated as high priority corridors. They include the routes between Dallas-Fort Worth and Houston (I-45)<sup>11</sup> and San Antonio and Houston (I-10) in the Texas Triangle, the route between Houston and New Orleans in Gulf Coast (I-10), the interstate system of central and west Florida (I-75, 4), and the route between Washington D.C. and New York (I-95). Additionally, in the Piedmont Atlantic Megaregion, any route that connects major metropolitan areas, such as Birmingham, Alabama, Atlanta, Georgia, and Raleigh, North Carolina, was excluded from the congressional high priority corridors although these areas have experienced severe congestion in both freight and passenger travel (Figure 11 and 12).

Figure 13 presents future interstates on the NHS. Within megaregions, the California Farm-to-Market Corridor, US 59 (Texas), US 90 (Louisiana), US 69 (Michigan and Indiana), and US 41 (Wisconsin) have



**Figure 11. Average daily traffic volumes** (National Surface Transportation Policy and Revenue Study Commission, 2007)



**Figure 12. Interstate Bottlenecks** (National Surface Transportation Policy and Revenue Study Commission, 2007)

<sup>10</sup> A "Federal-Aid Urbanized Area" is an area with more than 50,000 persons that encompasses the Census-defined urbanized areas (FHWA, 2001).

<sup>11</sup> There exist strong flows of Chemicals/Petroleum products via this route (Zhang et al., 2007).

been designated by Section 1105 of ISTEA as future interstate highways. To incorporate the notion of economic competitiveness in the global economy into the interstate planning and programming process, a megaregions context could be taken into account for designation of future interstates.

### 3. High-speed Railway (HSR) Systems

#### a) History of railway systems in the United States

Under the High Speed Ground Transportation (HSGT) Act of 1965, the Federal Railroad Administration (FRA) introduced Metroliner cars and the TurboTrain in the Northeast Corridor (NEC) revenue service in 1969 (FRA, 1997). With the completion of the route between Washington D.C. and New York, the National Railroad Passenger Corporation (Amtrak) led by the Rail Passenger Act of 1970, ensured HSGT options as a part of the intercity rail passenger network (FRA, 1997). With increasing involvement of states as well as federal involvement in HSGT planning during the 1980's, six states, including Florida, Ohio, Texas, California, and Nevada, formed high-speed rail entities although these proposals have not resulted in construction. The High-Speed Rail Transportation Act, of which key issues were reflected in ISTEA of 1991, and the Next Generation High-Speed Rail Technology Development Program in 1994 encouraged study of an implementation of HSGT technologies (Schwieterman & Scheidt, 2007; FRA, 1997). In 2001, Amtrak started Acela Express service, which is the only high-speed railway system that operates at speeds between 75 mph and 150 mph in the United States<sup>12</sup>. The Acela Express service connects Washington D.C., Baltimore, Philadelphia, New York, and Boston (Schwieterman & Scheidt, 2007).

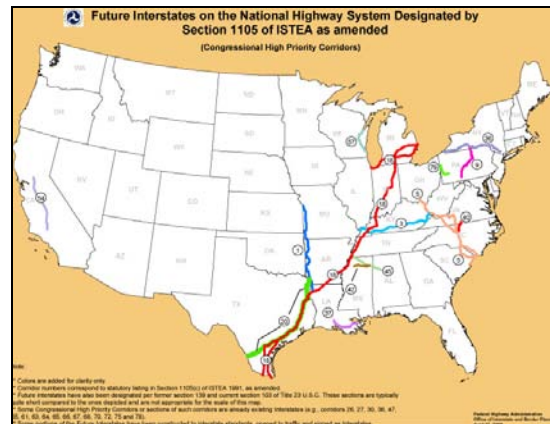


Figure 13. Future Interstates on the NHS (FHWA, 2006b)

#### b) Advantages of HSR systems

As intercity transportation by highway and aviation systems has increasingly suffered from congestion within metropolitan areas due to growing travel demand, many states have invested in intercity passenger rail service (AASHTO, 2007; FRA, 1997). As an alternative to existing surface transportation modes, high-speed rail (HSR) systems have several advantages. First, the use of a HSR system can reduce current congestion in both air ways and highways. Second, the HSR system may save energy (Schwieterman & Scheidt, 2007). National Surface Transportation Policy and Revenue Study Commission (2007) estimates that the railway mode consumes about 17% and 21% less energy per passenger mile than airplanes and vehicles, respectively. Second, HSR emits less carbon dioxide and may contribute to better air quality, compared to airplanes and automobiles. Third, when the HSR system is integrated with existing Amtrak service, it may be possible to provide direct access to downtown areas as well as reducing construction costs (National Surface Transportation

<sup>12</sup> Chicago-Detroit/Pontiac corridor is planned to serve at 110 mph within 2 years (Schwieterman & Scheidt, 2007).

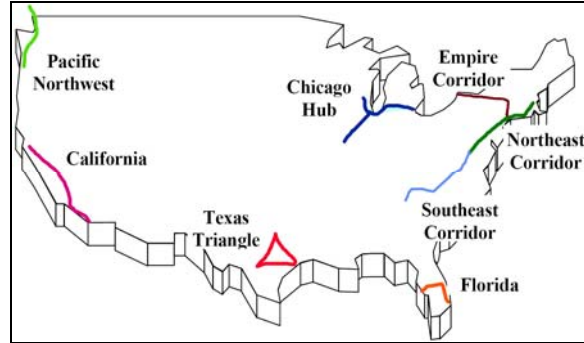
Policy and Revenue Study Commission, 2007). Finally, it may be used as a secure intercity transportation mode in the event of future disruptions to the aviation systems as experienced in the September 11 event in 2001.

**c) Existing plans for HSR systems**

The FRA (1997), conducted benefit and cost analysis of HSR for 8 corridors in the United States. As seen in Figure 14, they include existing corridors where intercity trains currently operate at speeds of more than 110 mph [Northeast Corridor (Boston—New York City—Washington) and Empire Corridor (New York City—Albany—Buffalo)], five potential HSR corridors [Pacific Northwest Corridor (Eugene-Portland-Vancouver, B.C.), California Corridor (San Diego-Los Angeles-San Francisco), Chicago Hub (Chicago to Detroit, St. Louis, Milwaukee), Florida Corridor (Tampa-Orlando-Miami), and Southeast Corridor (Washington-Richmond-Charlotte)], and the Texas Triangle (Fort Worth-Dallas-Houston-San Antonio) as a unique “nonlinear” shape. The above five potential corridors were designated under Section 1010 of the ISTEA using operational, financial, and institutional criteria and conditions that existing railroads have the capacity to run at 90 mph.

In addition to the 5 HSR corridors under ISTEA of 1991, in 1998, 6 more corridors were authorized as HSR corridors under TEA-21. Since then, the Department of Transportation has designated ten corridors and their extensions (Figure 15).

Recently, the Passenger Rail Working Group (PRWG) (2007), established by Commissioner Frank Busalacchi of the National Surface Transportation Policy and Revenue Study Commission, which was created by Congress, identified the 2050 intercity passenger rail network to estimate the future investment required for the passenger rail system. The corridors, designated by U.S. Department of



**Figure 14. FRA HSR illustrative corridors (FRA, 1997)**



**Figure 15. HSR corridor designations (FRA, 2005)**



**Figure 16. 2050 intercity passenger rail network of PRWG (PRWG, 2007)**



Transportation, and other corridors, already proposed or expressed as possible developments by states, were overlapped with megaregions (Figure 16). AASHTO (2007) estimated the costs of improvement for 21 intercity passenger rail corridors (Figure 17).



**Figure 17. Intercity passenger rail corridor development plan (AASHTO, 2007)**

Many state and regional agencies have proposed the development of HSR systems. Schwieterman & Scheidt (2007) estimate that about 60% (9991 miles) of proposed mileage in 64 intercity corridors, including corridors included in the above literature are federally designated routes.

**d) HSR systems and megaregions**

Schwieterman & Scheidt (2007) indicate that about 63% of the proposed mileage for HSR service is included in HSR corridors that cross state lines. All but one of the 43 states proposing routes on the HSR system have at least one interstate corridor slated for consideration. The location of the proposed HSR coincides with the economic core of most megaregions and would serve to provide greater mobility in a more sustainable way. In fact, some corridors, such as the Chicago-Detroit-Pontiac corridor, are divided into several segments reflecting differences in operations and in management/ownership. These segmentations may negatively affect both the development process and future operations in the long run.

Although many corridors connect existing metropolitan areas, each passenger rail route has been identified based on existing transportation patterns and infrastructure and relevant studies (National Surface Transportation Policy and Revenue Study Commission, 2007) without full consideration of future social and economic environments and the global economy. Table 6 shows that about 65.7% of the proposed mileage of 64 intercity corridors, identified by Schwieterman & Scheidt (2007), are located within megaregions and only 40.4% of them are formally designated as federal HSR routes.

**Table 6. Share of the proposed mileage of SHR within megaregions and non-megaregions (%)**

	Megaregions	Non-megaregions	Total
Federally designated routes	40.4	20.1	60.5
Others	25.3	14.2	39.5
Total	65.7	34.3	100.0

Source: reorganized from Schwieterman & Scheidt (2007)

In order to compete globally by enhancing economic competitiveness and maintaining the quality of life in the region, the designation of the HSR network should consider not only financial issues but should include social and economic considerations including complex relationships between the regions.

#### **4. Green Infrastructure**

The elements of transportation infrastructure which facilitate the movement of people, goods and information have created a network of barriers to natural systems. These barriers are in conflict with the natural landscape, impede natural processes, spatially fragment land uses, and isolate open space (Williamson, 2003). Furthermore, the issues of land consumption and environmental degradation are critical in the metropolitan areas because urban sprawl has been a trend in most metropolitan areas with constructions of highways and expanding regional growth. The establishment, planning, and implementation of a “green infrastructure” system may play an important role in offsetting these losses and systematically protecting the ecosystems. Green infrastructure is the ecological framework needed for environmental, social and economic sustainability. These natural networks provide essential ecological solutions that offset impacts created by traditional infrastructure.

##### **a) The concept of green infrastructure**

Green infrastructure is a network of open space, woodlands, wildlife habitat, parks and other natural areas that sustains clean air, water and natural ecological processes and enriches our quality of life (Benedict & McMahon, 2002). The concept of green infrastructure repositions open space protection from an amenity to a necessity (Benedict & McMahon, 2002) and encompasses a variety of natural and restored eco-systems and landscape features that make up a system of hubs and links.

Hubs anchor green infrastructure networks and provide origins and destinations for wildlife and ecological processes (McQueen & McMahon, 2003). Hubs include:

- Reserves: lands that protect significant ecological sites
- Managed Native Landscapes: large publicly-owned lands
- Working Lands: private working lands, including farmland, forests, and ranch lands.
- Parks and Open Space Areas: landscapes at the national, state, regional, county, municipal and private level that may protect natural resources and/or provide recreational opportunities.
- Recycled Lands: lands that were previously damaged by intense public or private use and that have been restored or reclaimed (Williamson, 2003).

Links are the connections between the hubs, facilitating the flow of ecological processes.

Links include:

- Conservation Corridors: linear areas, such as river and stream corridors that serve primarily as biological conduits for wildlife and may provide recreational opportunities.
- Greenbelts: protected natural lands or working landscapes that serve as a framework for development while also preserving native ecosystems and/or farms or ranchlands.
- Landscape Linkages: open spaces that connect wildlife reserves, parks, managed and working lands and provide sufficient space for native plants and animals to flourish. In addition to protecting the local ecology, these linkages may contain cultural elements, such as historic resources (Williamson, 2003).

The underlying concepts of green infrastructure include the science of conservation biology and the practice of ecosystem management (Benedict & McMahon, 2002). An analysis of the

specific types, extents and qualities of the vegetation, wildlife, topography and resources of an area should be made to determine the role that each landscape feature plays in supporting natural processes (Williamson, 2003). Linking parks and other green spaces for the benefit of communities is also an integral concept. The green infrastructure system can more easily be addressed at an appropriate scale under the megaregion planning approach.

### b) Green highway

Green highways may bridge the gap between the transportation networks and environmental systems by bringing the concept of sustainability to transportation infrastructure, and maximizing existing transportation infrastructure. Figure 18 shows the physical characteristics of green highways, including biofiltration, a preserved forest buffer, a porous pavement shoulder, wildlife crossing, stream restoration, wetland restoration, soil amendments, and environmentally friendly concrete.



**Figure 18. Virtual Green Highway** (Green Highways Partnership: [www.greenhighways.org](http://www.greenhighways.org))

Green highways are built with permeable materials to reduce imperviousness. Since green highways technology uses recycled materials, they can reduce concrete production waste and energy consumption. Using wildlife crossings, such as bridges, culverts, tunnels, and barriers, as a link reduces the risk of vehicular collision. These technologies prevent traditional highway infrastructure from interrupting critical habitats and ecosystems (Green Highways Partnership).

Building a green highway includes three steps: 'planning and preliminary design', 'final design and construction', and 'operations and maintenance'. Construction of a green highway requires an expansive scope both geographically and functionally because the sphere of influence of natural environments is broad. Also, monitoring and evaluation systems should be managed in broader areas along highway corridors (Green Highways Partnership).

### c) Green infrastructure and megaregions

Green infrastructure is intended to integrate nature back into the community in a way that facilitates various levels of human interaction with the environment based upon the resiliency of the natural resources being protected (Williamson, 2003). An effective network of green infrastructure cannot stop abruptly at the edge of the implementing jurisdiction. There are many laudatory efforts being made to develop and implement informed greenspace strategies, but to date, there is very little coordination between these local initiatives. A megaregion based green infrastructure would be more effective.

## C. Defining a Region

The act of defining and delineating the boundaries of a region can take many forms, from the accumulation of community visions and perceptions, to historical precedence, to data-driven methods based on economic and urban theories. This section provides a background on the historical methods of regional delineation in the United States and reflects on preliminary delineation methods for megaregions in the United States and abroad.

### 1. Historic Delineation Methods

Since U.S. megaregions are commonly defined as connected networks of metropolitan areas (Delgado et al., 2006a; University of Pennsylvania, 2006), we revisit the definition of metropolitan areas as a starting point of reviewing delineation methods.

According to the 1990 definition, a Metropolitan Statistical Area (MSA) consists of a city with a population of 50,000 or Census Bureau-defined “urbanized area”<sup>13</sup> with a population of at least 50,000 if the component county’s or counties’ population exceeds 100,000 (US Census Bureau). For the 2000 census, the MSA is more simply defined by including a population criterion (at least 50,000) of a central county or counties with a Census Bureau-defined “urbanized area” and commuting criteria for adjacent counties. In addition, the Micropolitan Statistical Area is newly defined in 2000 in a similar way that it includes a central county or counties of Census Bureau-defined “urban clusters”<sup>14</sup> with population size between 10,000 and 49,999, and adjacent counties that have high interaction with the central county. Both metropolitan statistical areas and micropolitan statistical areas are included in the Core Based Statistical Area (CBSA).

Similarly, the European Union uses a threshold of population to delineate the statistical areas (NUTS) of Member States. The concept inherent in this method has been used in delineating boundaries of urban centers at a metropolitan level. Giuliano & Small (1991) and McMillen & McDonald (1998) use a minimum employment and employment density procedure to delineate the boundaries of urban centers in Los Angeles and Chicago metropolitan areas. They use different “cut-off” points for different metropolitan areas. For example, Giuliano and Small (1991) use 10 employees per acre as a minimum density and a total of at least 10,000 employees in a set of contiguous areas for the Los Angeles metropolitan area. However, McMillen and McDonald (1998) use 20 employees per acre and a total of 20,000 employees as minimum “cut-off” points for the Chicago metropolitan area. This implies that it would be difficult to apply a unified minimum-value procedure for delineating boundaries in different geographic areas, particularly, in a large country like the United States.

For these reasons, researchers have developed mathematical or econometric methodologies such as graph analysis (Dietvorst & Wever, 1977; Nystuen & Dacey, 1961; Campbell, 1972; Kipnis, 1985; Puebla, 1987) and Markov chain (Brown & Holmes, 1971; Dietvorst & Wever, 1977) for identifying linkages between regions using commuting flows, telephone flows, and migration flows, and multivariate analysis methods (Kim & Woo, 2000; Clayton, 1974) and density functions (McMillen, 2001; McMillen & McDonald, 1997; Muniz et al., 2003; Lee,

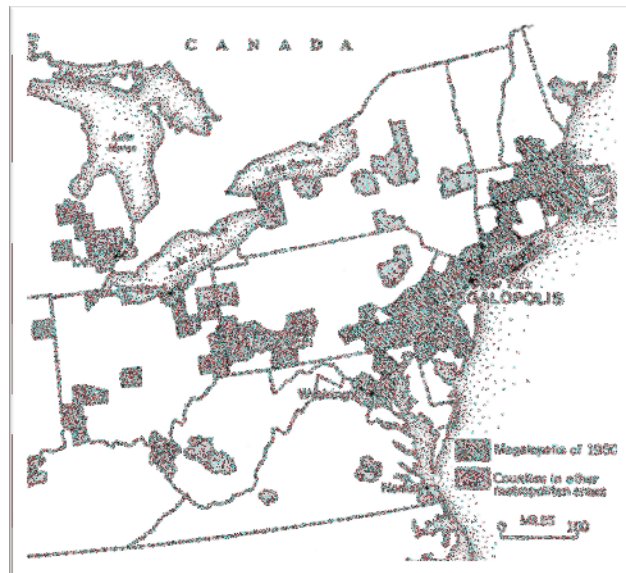
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<sup>13</sup> The U.S. Census Bureau defines an urbanized area as “densely settled territory that contains 50,000 or more people” (U.S. Census Bureau 2000).

<sup>14</sup> An urban cluster consists of densely settled territory with population between 2,500 and 50,000 (U.S. Census Bureau 2000).

2007; Woo, 2007). Different kinds of multivariate analysis, including cluster analysis, factor analysis, and principal component analysis, have been used to delineate boundaries of places with a high degree of centrality and their spheres of influences using diverse criteria, such as population, employment, commuting flows, or telephone call flows. Multivariate analysis is useful in that several criteria are simultaneously considered in the model (Kim & Woo, 2000). While it is difficult to consider several criteria in one density function, this method has been broadly used in identifying areas with high concentrations of population or economic functions. Recently, Woo (2007) and Lee (2007) used mixed procedures employing those methods above, showing two-stage procedures in delineating the boundaries of centers.

While these methods are useful to identify central regions and their relationships and to delineate the boundaries of their exurban areas, they have not been applied to megaregion analysis in the United States. These delineation methods have been used specifically in a context of polycentric spatial patterns at the metropolitan level. As European spatial planning has emphasized developing polycentricity at the interregional scales (Davoudi, 2003; Green, 2005) and each megaregion consists of hierarchical centers, these methods would provide useful information in developing delineation methods for megaregions in the United States.



**Figure 19. Gottmann's Megalopolis** (Gottmann 1957)

## 2. Preliminary Delineations of Megaregions

In 1950, the Bureau of the Census presented a map, which showed the economic continuation of metropolitan areas from Hillsborough County, NH (the north of Boston) to Fairfax County, VA (the south of Washington, D.C.), on a pamphlet of statistics on 'States Economic Areas' (Figure 19). Jean Gottmann named this continuous metropolitan economy 'Megalopolis', which he described as an economic continuation of metropolitan areas. It was reflection on Gottmann's analysis of megalopolis beginning in 2004 by University of Pennsylvania and the Lincoln Institute of Land Policy that began a national debate on a new geography for aspects of United States planning.

In recognition of the markedly varied and largely nonurban character of the United States, researchers have agreed upon new terminology, adopting "megaregion" as the descriptor of regions with a multiplicity of relationships composed of numerous political bodies, from local to state, and even national scales. A research team from the University of Pennsylvania defines megaregions as "large, connected networks of metropolitan regions that are driving an increasing share of global production and trade." The Great Lakes Megaregion plan

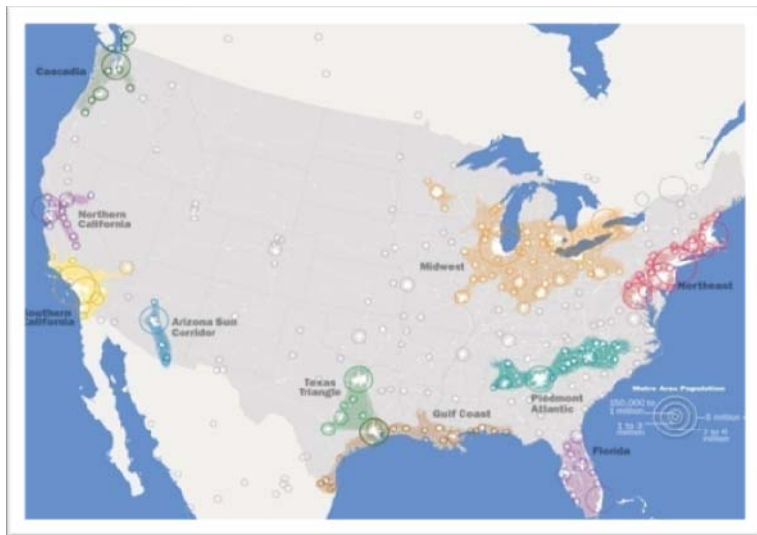
similarly defines megaregions as “a set of interconnected metropolitan areas”. While U.S. megaregions have been delineated with bounded areas, the megaregional concept in Asia and Europe has been used to address regional or transnational networks, often using high-speed rail and separated goods movement systems (Metcalf & Terplan, 2007). All of these efforts commonly argue that a large scale of analysis and planning is necessary to address economic and environmental problems that frequently take place beyond traditional political boundaries.

**a) Nationwide Delineation Approaches in the United States**

The definition and delineation of megaregions in the United States have been explored by several researchers using diverse criteria (Metcalf & Terplan, 2007; Ross et al., 2007; Zhang et al., 2007; Delgado et al., 2006a; Regional Plan Association, 2006; University of Pennsylvania, 2006; Contant et al., 2005; Lang & Dhavale, 2005; Seltzer et al., 2005). Among the attempts to delineate large scale regions, two have received the greatest attention—Virginia Tech’s Metropolitan Institute’s Megapolitans and the Regional Plan Association (RPA)’s Megaregions.

Although the titles are different, they are both intended to recognize large-scale economic centers.

The RPA (2006) has identified five criteria that define 10 emerging or existing megaregions (Figure 20). The criteria include “environmental systems and topography, infrastructure systems, economic linkages, settlement patterns and land use, and shared culture and history” (Regional Plan Association, 2006). The RPA assumes that an area that shares many of these criteria will be a cohesive megaregion.



**Figure 20. The RPA’s megaregions (RPA, 2006)**



**Figure 21. Metropolitan Institute’s Megapolitan Areas (Lang and Dhavale, 2005)**

Similarly, Virginia Tech’s Metropolitan Institute identifies 10 “megapolitans” using a different set of criteria and procedures (Figure 21). They define megapolitans as clusters of counties that combine at least two metropolitan areas and have a total of more than 10 million residents by 2040. Based on Lang and Dhavale (2005), the following process and criteria are used to identify megapolitans:

- Map the counties in U.S. Census defined micropolitan and metropolitan statistical areas. Any string of contiguous metropolitan and micropolitan areas is a candidate for a megapolitan.
- Non-metropolitan counties that are completely encircled by metropolitan or micropolitan counties are included in the megapolitan.
- The type of connectedness is examined for all candidate counties. For example, the “CSA-to-CSA” relationship has the highest priority, followed by “metro-to-CSA”, “metro-to-metro”, “metro-to-micro”, and “micro-to-micro” link.
- The candidate megapolitans are tested by population maps to check if they are consistent with urban development patterns.
- Boundaries are smoothed by other criteria, such as transportation networks, development trends, topographic elements, etc.
- Finally, those clusters of counties with at least two metropolitan areas and a total of 10 million of projected residents by 2040 are defined as megapolitans.

Table 7 documents the differences between the RPA and Metropolitan Institute approaches to define large-scale regions in the United States.

**Table 7. Comparison of delineating criteria of megaregions in the United States**

	<b>Metropolitan Institute</b>	<b>Regional Plan Association</b>
<b>Analysis Unit</b>	County	County
<b>Requirements of megaregions</b>	More than 2 metropolitan areas & 10 million population by 2040	N/A
<b>Analysis Criteria</b>	<ul style="list-style-type: none"> <li>- Population size</li> <li>- Contiguity</li> <li>- Cultural and historical geography</li> <li>- Physical environment</li> <li>- Links of large centers</li> <li>- Growth projections</li> <li>- Goods and service flows</li> </ul>	<ul style="list-style-type: none"> <li>- Environmental systems and topography</li> <li>- Infrastructure system</li> <li>- Economic linkage</li> <li>- Settlement patterns and land use</li> <li>- Shared culture and history</li> </ul>

As the RPA megaregion and Metropolitan Institute megapolitans maps show, these different approaches produce similar, yet not identical, definitions of the regions. Both the Metropolitan Institute and RPA identify 10 megaregions across the country. The Metropolitan Institute includes Oklahoma City and Tulsa (OK) as megapolitans, focusing on the Interstate 35 corridor and including Houston in the Gulf Coast Megapolitan. However, RPA excludes those Oklahoma metropolitan areas from megaregions, identifying a triangular form of metropolitan areas within Texas. The Metropolitan Institute identifies a broader area as the Northeast Megapolitan, including Richmond, while RPA’s region stretches south by Washington D.C. metropolitan area. However, the Metropolitan Institute delineates a smaller

area for the Midwest Megapolitan while RPA identifies a broader area including Minneapolis (MN) and Buffalo (NY). In addition, RPA excludes Knoxville (TN) from the Piedmont Atlantic Megaregion and the Metropolitan Institute excludes Jacksonville (FL) from the Florida Megapolitan.

Table 8 compares the results of the megapolitan versus megaregion approaches by describing which metropolitan areas are contained in each.

**Table 8. Comparison of identified megaregions/megapolitans across the country**

<b>Metropolitan Institute (10 Megapolitan Areas)</b>	<b>Regional Plan Association (10 Megaregions)</b>
1. Northeast (Including Richmond (VA))	1. Northeast (Excluding Richmond and Virginia Beach (VA) of Chesapeake)
2. Midwest (Including Chicago (IL), Detroit (MI), Indianapolis (IN), Cincinnati (OH), Columbus (OH), Pittsburgh (PA), Cleveland (OH))	2. Great Lakes (Including Minneapolis (MN), Chicago (IL), St. Louis (MO), Indianapolis (IN), Louisville (KY), Cincinnati (OH), Columbus (OH), Cleveland (OH), Detroit (MI), Pittsburgh (PA), Buffalo (NY))
3. Piedmont (Including Knoxville (TN))	3. Piedmont Atlantic (Excluding Knoxville (TN))
4. Peninsula (Excluding Jacksonville, FL)	4. Florida (Including Jacksonville, FL)
5. Gulf Coast (Including coast areas of LA, MS, AL, TX, and FL)	5. Gulf Coast (Including coast areas of LA, MS, AL, TX, and FL)
6. I-35 Corridor (Including Tulsa (OK), Oklahoma City (OK), Dallas-Fort Worth (TX), San Antonio (TX), Austin (TX))	6. Texas Triangle (Including Dallas-Fort Worth, Houston, San Antonio, Austin)
7. Valley of the Sun	7. Arizona Sun Corridor
8. Cascadia	8. Cascadia
9. NorCal	9. Northern California
10. Southland	10. Southern California

### **b) Regional Delineation Approaches in the United States**

While somewhat different criteria are used in delineating megaregions based on their own regional characteristics, most institutions use counties and MSAs as the analysis units, and the data of those criteria are incorporated by a mapping method with Geographic Information System (GIS) and a descriptive analysis. Table 9 presents the different types of analysis used in identifying megaregions in different parts of the United States.

In the Piedmont Atlantic Megaregion (PAM), researchers identify urban cores and their surrounding regions, considering watersheds, geography, ecologically sensitive areas, commuting patterns, and freight movement. The urban cores are verified by the analysis of settlement patterns and transportation flows. The boundaries are smoothed by some factors including commodity flows (western boundaries), cultural factors (northeastern and southern boundaries), and natural features (eastern and northwestern boundaries) along the county lines (Contant et al., 2005).

The researchers examining the Northeast Megaregion use two components to define the region: urban core and support zones (Dewar & Epstein, 2007). The urban core is defined as contiguous MSAs and adjacent counties that have more than 15 percent of Employment



Interchange Measure (EIM). The support zone, an outer boundary to the urban core, includes adjoining counties that have large preserved open spaces, water and recreational resources, environmentally sensitive areas, and river basins that are related to the developments from the urban core (University of Pennsylvania, 2005). In addition, Vicino et al. (2007) have recently delineated the Northeast Megaregion using only two criteria: population density and contiguity of metropolitan areas.

The Northern California study identifies a core area and its sphere of influence by overlapping four feature maps, including travel times, population growth and land consumption, environmental features, and “government-defined” regional groupings, such as multi-county regional councils. The urban core of the Northern California region is defined by commuting sheds of greater Sacramento (Metcalf & Terplan, 2007).

The Great Lakes Megaregion selects the largest metropolitan areas, which have common industrial histories and large population size within states bordering Great Lakes, as megaregions. Although some researchers include Minneapolis and St. Paul (MN) in the Midwest megaregion, they were excluded in the Great Lakes Megaregion because of the dissimilar industrial histories and challenges. Adjacent counties that have greater than 8 percent of population growth rate are added to the region to consider issues of land consumption and environment degradation in the future. Also, other counties adjacent to one of the Great Lakes and those surrounded on more than two sides by megaregion counties are included (Delgado et al., 2006a).

Zhang et al. (2007) have verified the Texas Triangle Megaregion of the Regional Plan Association mostly based on maps of transportation networks, industrial flows, and eco-zones of four metropolitan areas, including Dallas-Fort Worth, Houston, San Antonio, and Austin.

However, while there have been efforts to understand the challenges and opportunities for other megaregions, including Southern California, Southern Florida, the Gulf Coast, Cascadia, and the Arizona Sun Corridor, specific methodologies to identify their boundaries have not been detailed at the regional level.

**Table 9. Comparison of delineating methods of selected megaregions in the United States**

	<b>Piedmont Atlantic</b>	<b>Northeast</b>	<b>Northern California</b>	<b>Great Lakes</b>	<b>Texas Triangle</b>
<b>Institution</b>	Georgia Institute of Technology	University of Pennsylvania	San Francisco Planning & Urban Research	University of Michigan	University of Texas, Austin
<b>Source</b>	Contant, Ross et al. (2005)	University of Pennsylvania (2005)	Metcalf & Terplan (2007)	Delgado et al. (2006a)	Zhang et al. (2007)
<b>Analysis Unit</b>	County, MSA	County, MSA	County	County, MSA	County, MSA
<b>Structure</b>	Urban core & surrounding regions	Urban core & support zone	Core area & sphere of influence	Major MSAs & adjoining areas	Major MSAs & counties within the triangle area
<b>Analysis Criteria</b>	<ul style="list-style-type: none"> <li>- Population growth</li> <li>- Settlement patterns</li> <li>- Watersheds</li> <li>- Geography</li> <li>- Ecologically sensitive areas</li> <li>- Linkage of highways</li> <li>- Commuting patterns</li> <li>- Freight movement</li> </ul> <p>*Urban cores are verified by the analysis of settlement patterns and transportation flow.</p>	<p>Urban core:</p> <ul style="list-style-type: none"> <li>- Contiguous MSAs</li> <li>- EIM (Employment Interchange Measure)</li> </ul> <p>Support zone:</p> <ul style="list-style-type: none"> <li>- preserved open space</li> <li>- water &amp; recreational resources,</li> <li>- environmentally sensitive area</li> <li>- river basin</li> </ul>	<ul style="list-style-type: none"> <li>- Travel times</li> <li>- Population growth</li> <li>- Land consumption</li> <li>- Environmental features</li> <li>- Regional groupings (e.g. multi county councils)</li> </ul> <p>* Core area is defined by commute sheds of greater Sacramento</p>	<p>Major MSAs:</p> <ul style="list-style-type: none"> <li>- Industrial history</li> <li>- Population size</li> </ul> <p>Support areas:</p> <ul style="list-style-type: none"> <li>- Population growth (8%)</li> <li>- Adjacency to the Great Lakes</li> </ul>	<ul style="list-style-type: none"> <li>- Transportation Networks</li> <li>- Industrial flows</li> <li>- eco-zones</li> </ul>
<b>Smoothing Boundaries</b>	Consider commodity flows, cultural factors, and natural features			Include counties surrounded on two or more sides by Megaregion counties	
<b>Incorporating Data</b>	Descriptive analysis & Mapping				

Several studies (including those of the Piedmont Atlantic, Northeast, Northern California, and Great Lakes megaregions) divide the megaregion into two parts: core areas (or major MSAs) and areas of influence (areas that play a role in the economic activity of the core and are affected, both positively and negatively, by the core). There exist outer areas of metropolitan areas on the maps of the Texas Triangle studies. However, authors did not explicitly characterize these areas. On the other hand, Lang and Dhavale (2005) assert that “Megapolitan Areas should have discrete boundaries, as do metropolitan and micropolitan areas.” However, the identification of areas of influence is important as Sassen (2007) mentions that “rural enterprise zones” require megaregional investment to provide low-wage jobs as one strategy to play a more complete role in the global economy.

The criteria used in the previous research can be categorized by “essentialist” criteria and “relational” criteria, as Healey (2004) presents. As seen in Table 10, essentialist geography is a traditional approach where the relationship between places is hierarchically determined by their activities, and proximity and contiguity are important factors that characterize their relationship. On the other hand, the relational approach emphasizes that spatial effects cannot be determined by physical proximities because the effects may occur from a distance as well as nearby. In addition, a place is not necessarily bounded by specific territories, and the nodes and borders are continually changing according to their relationship with others.

Specifically, in the megaregion studies, several criteria, including proximity, contiguity, population growth, settlement patterns, land consumption, and political boundaries, expressed as essentialist criteria, were overlaid to identify candidate megaregions. In addition, relational criteria, such as commuting patterns, industrial flows (goods and service flows), historical characteristics, and international passenger traffic and labor migration, have been analyzed to examine interactions between regions. In a spatial context, the relational approach is important to understanding broad economic issues in a national and global economy. However, it should be noted that the traditional (essentialist) approach is useful in policy implementation. For example, specific boundaries of regions are needed for effective physical infrastructure planning and implementation. In addition, such boundaries and distance criteria are useful to designate and protect environmentally sensitive areas. Thus, a strategic approach that may incorporate the advantages of both essentialist and relational approaches should be explored.

**Table 10. Essentialist and relational geography in spatial planning (reorganized from Healey, 2004)**

	<b>Essentialist Geography</b>	<b>Relational Geography</b>
<b>Spatial Effect</b>	Physical proximity is an important factor. Connections are governed by transport routes with simple distance-decay characteristics.	Spatial effects cannot be analyzed only by physical proximities. Instead, they may occur from a distance as well as nearby.
<b>Place</b>	The boundaries of distinct regions or settlements are identified.	Nodes and borders are continually emergent, not derived by specific model of “socio-spatial organization”.
<b>Relationship between places</b>	Places are divided into several zones based on their activities (e.g. core & periphery).	Place is seen as a social construct, where “meanings” are given to particular places, areas, or nodes. Places are located in particular relational networks, and the distance between places and nodal points in relevant networks is important.
<b>Development</b>	Development is treated in a linear way from “less-developed” to “more-developed” areas.	Different places have different potentials because of the interactions between their histories and relationships with others.

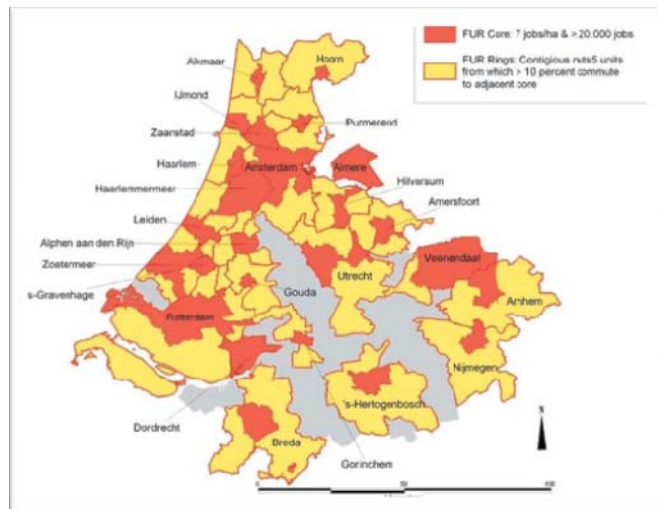
### **c) Delineation Approaches from Abroad**

The methods of delineating megaregions in foreign countries are not directly applicable to the proposed American megaregions because their political systems and administrative units differ from those in the United States. However, useful information can be drawn from the decision criteria used in delineating or identifying megaregions in those countries (see Table 11 for a comparison for methodologies). Since European and East Asian countries (except China) are relatively small, some megaregions appear to be transnational. As a result, these megaregions are more focused on the connectivity between major cities and countries via infrastructure, such as high-speed railway system and under-sea canal, rather than the delineation of boundaries of hinterlands.

**Table 11. The criteria of delineating megaregions in foreign countries**

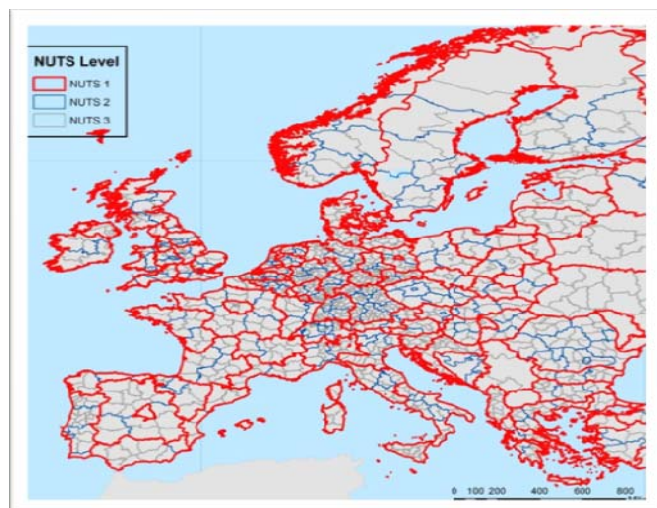
	<b>Randstad (Netherlands)</b>	<b>NUTS (European Union)</b>	<b>Zhujiang Delta (China)</b>	<b>North-East Asian Megaregions</b>
<b>Analysis Unit</b>	City	City	-	City
<b>Analysis Criteria</b>	Core: - Employment density - Population size  Hinterlands: - Commuting flows	NUTS: - Population size  Non-administrative units: - Continuity - Geography - Socio-economics - History - Culture - Environment	Physical Geography: - Flood zones - Coastal lines - River basins	International interaction: - Air passenger traffic - Flow of information - International labor migration

The “Functional Urban Regions” (FURs) of the Randstad, in the Netherlands, include a core and a hinterland. A core area consists of municipalities that have a total of at least 20,000 jobs and a job density of 7 jobs per hectare (17.29 jobs per acre). Commuting data are used to identify hinterland areas. Similar to the concept of Employment Interchange Measure (EIM) of the U.S. Census, municipalities that send more than 10 percent of commuters to the core areas are assigned to the hinterlands. As seen from Figure 22, 25 functional urban regions are identified in the Randstad area (Randstad, 2005).



**Figure 22. Randstad Mega City Region** (The Randstad, 2005)

The European Union (EU) divides the Member States into three regions. The Nomenclature of Territorial Units for Statistics (NUTS) is used to designate administrative divisions of the Member States for statistical purposes. The NUTS is a hierarchical classification of areas because it subdivides the Member States into NUTS 1, NUTS 2, and NUTS 3. The NUTS 2 and NUTS 3 regions are subdivisions of the NUTS 1 and the NUTS 2, respectively (Figure 23). The EU defines territorial units using



**Figure 23. NUTS level of the European Union** (ESRI, 2006)

normative criteria: population size and geographical areas (existing administrative units). Table 12 presents the thresholds of the average population size to divide the regions into NUTS 1, NUTS 2, and NUTS 3.

However, if there are no administrative units in these population scales in a Member State, a new geographical units (“non-administrative units”), which constitutes existing small administrative units, can be aggregated considering such relevant characteristics as contiguity, geography, socio-economy, history, culture, or environment (The European Parliament and the Council of the European Union, 2003).

**Table 12. The minimum and maximum thresholds for the average population size of the NUTS regions.**

	Minimum	Maximum
<b>NUTS 1</b>	3,000,000	7,000,000
<b>NUTS 2</b>	800,000	3,000,000
<b>NUTS 3</b>	150,000	800,000

Source: Article 2 of the Regulation (EC) No 1059/2003 of the European Parliament and of the Council of 26 May 2003 on the establishment of a common classification of territorial units for statistics (NUTS)

In the study of South-East Asia, Macleod & McGee (1996) divide urban regions into three regions: urban core, metropolitan areas, and extended metropolitan regions (EMRs), which are later called mega-urban regions (MURs). The EMRs are similar to hinterlands of the U.S. megaregions. While authors do not specify the boundaries of the region, they observe that urban cores are filled with globally linked finance and producer service functions (Douglass, 2000). Chu (1996) describes one of Chinese megaregion, the Hong Kong-Zhujiang Delta, in a framework of the world city system. The region is defined by physical characteristics, such as flood zones, coastal lines, and river basins, and includes 7 municipalities and 21 xians with a total area of 42,600 km<sup>2</sup> (16,448 mi<sup>2</sup>).

After the Cold War era, policy makers in China, Japan, and Korea have increasingly emphasized the three countries’ mutual political and economic relationships. Choe (1996) presents two emerging North-East Asian megaregions: the Yellow Sea Rim and the East Sea Rim regions (Figure 24). Without the issue of specific boundaries of the megaregions, he identifies transnational interactions between major cities using several criteria, such as air passenger traffic, the flow of information (the volume of international telephone calls), and international labor migration.



**Figure 24. The Yellow Sea Rim and the East Sea Rim in North-East Asia (Choe, 1996)**

## SECTION III.

### A HISTORICAL AND CONTEMPORARY PERSPECTIVE

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Attempts to explain and plan for the United States from a regional perspective have a long history. The earliest attempt to divide the United States into administrative “regions” took place within the 1850 census, in which educational statistics were presented for five geographical divisions (Barnes & Ledebur, 1998). In the 1960s, Rexford Tugwell, one of the preeminent national planners of Franklin Roosevelt’s administration, proposed splitting the country into twelve regions for federal administrative purposes (Barnes & Ledebur, 1998). And in 1981 Joel Garreau argued that North America was actually “nine nations”, with differing economic, political, and cultural emphases, and that thinking in terms of these nine regions would lead to better public-policy choice (Garreau, 1981).

Although regional delineation is thus not an uncommon endeavor in the United States, it is frequently alleged that attempts at regional governance or regional planning have not prospered. The late 1970s to early 1990s, in particular, saw a sharp decrease in interest in regionalism (Weitz & Seltzer, 1998). Ekbladh (2002) sums up the case against regional organizations in the United States:

They regularly do not deliver on their grand promises and can have unintended and drastic social, environmental, and economic impacts. Too often, detractors assert, the imposition of these vast undertakings hurt the people in their path as the grand, “high-modernist” visions at the core of these programs ignore people’s needs, values, experiences, and knowledge.

Any new regional planning effort must overcome the distrust of regional approaches that has resulted from past endeavors. In contrast to popular skepticism, Swanstrom (2001) argues that regionalism can help promote and strengthen three political virtues central to American democracy—political equality, civic tolerance, and local liberty. Regionalism, he suggests, can help ameliorate the substantial differences in economic and political power between wealthy suburbanites and poor urban residents: “If Americans are going to be persuaded to embrace the new regionalism and create more civic metropolises, it will... be because regional reforms enhance deeply-held political values.” In this Swanstrom lays down, one could say, a challenge for future regionalist initiatives to work within the existing shared political values.

The following are overviews of previous regional planning efforts as they relate to transportation. We first discuss what issues in planning have been most often addressed by regionalism. We then proceed to review the history of several regional organizations—the Regional Plan Association, the Appalachian Regional Commission, the Tennessee Valley Authority, and metropolitan planning organizations—to examine “regionalism” and how it works in practice in each case. In addition, we review federal highway planning, which was not initially conceived as a distinct regional effort, to better understand the degree to which regional concerns were incorporated into the planning process.

## **A. History of Regional Planning in the United States**

Historically regional planning efforts have either emerged as the result of interstate compacts or have begun at the federal level. Some of the examples of federal regional planning—the Tennessee Valley Authority (TVA), the Appalachian Regional Commission, and the highway system—will be covered later in this review. These regional efforts are well known nationally; yet it is still worthwhile to examine less famous cases of multi-state collaboration.

Economic development remains one of the more popular spurs to regional activity (Weitz & Seltzer, 1998). Cisneros (1996) distinguished between “things-regionalism,” which he identified as special districts charged with specific public-works projects, and what he called “people-regionalism,” which focused on equity issues and regional development. “Everybody wins as regions become global competitors,” he asserted. An example of a regional body focused on economic development is the Southern Growth Policies Board, which was formed in 1971 and has 13 states<sup>15</sup> as members; among its regional goals are encouraging entrepreneurship, increasing knowledge creation, and sustaining a quality of life “that is attractive to globally competitive businesses and employees” (Southern Growth Policies Board, n.d.). But while such organizations as the Southern Growth Policies Board may be able to produce useful research, their influence on economic-development policies is unclear.

Another frequent source of cooperation between states is environmental issues, especially water. To be sure, water can be a source of inter-state conflict (most recently among Georgia, Florida, and Alabama), but the boundary-crossing nature of water management has been acknowledged multiple times. Lepawsky (1950) observed, “Few functions of the American Federal system seem less suited physically to state boundaries than the management of our water resources.” In 1961, the Delaware River Basin Commission (DRBC) was formed by four states (New York, New Jersey, Pennsylvania, and Delaware) and the federal government. Although Derthick (1974) charged that “[t]he DRBC’s actual functions have fallen far short of its formal powers,” the DRBC has been influential in settling water-related disputes between the participating states (Collier, 2007).

Finally, transportation can spur interstate cooperation. Grant (1955) called the creation of the Holland Tunnel “an amazing example of stop-and-go driving through the obstacle course of interstate metropolitan co-operation.” The commission to study transport connections between New York City and New Jersey was proposed by the New York state legislature in 1906; construction on the tunnel did not begin until 1919 (Grant, 1955). The tunnel was actually governed by two different state commissions simultaneously until 1931, when it was placed under the governance of the Port Authority of New York and New Jersey (Grant, 1955). However, such examples as the ongoing New York-New Jersey cooperation are rare in American policy-making.

### **1. The Regional Plan Association (RPA)**

The Regional Plan Association (RPA), the oldest American regional body, was founded in 1922 and produced its first plan for the greater New York City metropolitan area in 1929. Since then it has produced two other plans, in 1968 and 1996. The first two plans had a

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<sup>15</sup> Alabama, Arkansas, Georgia, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, Virginia, and West Virginia.



strong influence on the shape of the affected region, which now includes New York City and 26 additional counties in New York, New Jersey, and Connecticut (Bressi, 1991). In addition to producing regional plans, which include recommendations on transportation, housing, community space, and economic activity, the RPA facilitates planning projects in the area and conducts relevant research. Recently the RPA has convened the Civic Alliance to Rebuild Downtown New York, which is dedicated to an open and fair planning process for lower Manhattan in the wake of the 2001 attacks on the World Trade Center (Civic Alliance, n.d.) Of all the non-profit planning organizations in the United States, the RPA is almost certainly the most powerful.

The RPA currently has projects in five policy areas: housing; community design; open space; workforce and the economy; and transportation. While its main office is in New York City, it keeps offices in Connecticut and New Jersey and a representative on Long Island. Its governance is led by a 60-member board, assisted by advisory Long Island, New Jersey, and Connecticut committees (RPA, n.d.). The RPA's annual Regional Assembly offers community members the chance to participate in workshops related to the main policy areas. In this way the RPA is able to form and strengthen relationships with local stakeholders.

The RPA is able to have an influence on policy by creating and sustaining a planning process with a high level of stakeholder involvement. Bressi (1991) describes the process that began the development of the RPA's third plan:

The project was launched officially at a regional assembly in April. The day-long event drew some 1,000 participants, who met in workshops and small-group discussions. To oversee the plan, [then-president Richard] Anderson and [chief planner Robert] Yaro have corralled more than 120 business, civic, foundation, and labor leaders in a group called the Council for the Region Tomorrow. For technical advice, the RPA is convening 20 to 25 "round tables" of experts in such fields as housing, open space, and communications technology.

At the time, Bressi (1991) also noted that "federal interest in urban projects has waned" and Yaro was, at the time, having difficulty raising the \$10 million needed to complete the planning process (Bressi, 1991). Since then, political leaders have shown a greater interest in regionalism. The RPA served on the advisory board for PlaNYC, the plan released by New York City's mayor, Michael Bloomberg, in June 2007 (RPA, 2007). It also finished the fiscal year with net assets of more than \$2 million (RPA, 2007). Finally, the agency was able to boast that "The past twelve months may well have been the most impressive year to date for realizing the ambitious transportation agenda laid out in RPA's 1996 Third Regional Plan" (RPA, 2007). The RPA does not have the financial influence wielded by metropolitan planning organizations (MPOs). Yet its influence seems to be increasing, not decreasing, as a result in changes in regional political thinking.

It is worth asking why the RPA has been successful where regional efforts elsewhere in the country have not been able to last as long, or accomplish as much. The RPA has the advantage of having been founded more than 80 years ago, at a time when the interstate nature of traffic and economic flows into and out of New York City were already being recognized (Baker, 1927). The RPA also probably benefited from having been established before the Depression, thus spending the 1930s under a president who had previously been governor of New York and who took an interest in planning unmatched until Lyndon

Johnson's administration. The RPA is a private sector organization with a relatively greater amount of independence than what has been afforded other regional planning entities in the public sector. Moreover, the RPA's independent nature may have helped it to weather the collapse in federal funding for planning programs in the late 1970s and 1980s. Finally, the RPA covers a region in which political actors have historically been more willing to act regionally, possibly due to historic development patterns and the fact that surrounding areas have had centuries to acknowledge and come to terms with the dominance of New York City. Thus the region has produced not only the RPA but the Port Authority and the Delaware River Basin Commission, of which both New York and New Jersey are members. This is not to diminish the RPA's accomplishments, but to suggest that it would be difficult to create a similarly influential organization elsewhere in the country.

## **2. The Tennessee Valley Authority**

Probably the best-known American regional project is the Tennessee Valley Authority (TVA). As of late 2007 TVA was managing 293,000 acres of public land and providing power, by selling power to local distributors, to 8.7 million people in seven states (TVA, 2007).

The TVA was created by the federal government in 1933 to improve navigability and flood control of the Tennessee River. It was a "top-down" creation, put forward by Franklin Roosevelt soon after his taking office as president. Derthick (1974) argues that the creation of the TVA succeeded while similar proposals of regional governing failed because of unique circumstances: the federal government's ownership of two nitrate plants near Muscle Shoals, Alabama; the decision to form a public corporation to operate those plants; and Roosevelt's personal interest in the project.

In its creation, the TVA was charged with regional economic development responsibilities. The Tennessee Valley Act, the legislation that created the TVA, specified six general purposes: flood control, development of the Tennessee River, generation of electric power, use of marginal lands, reforestation, and maintaining or promoting the economic and social well-being of residents of the river basin (Taylor, 1938). The TVA's economic development branch offers loans to entrepreneurs via its Economic Development Loan Fund, hosts conferences on rural development, keeps a separate \$16 million fund for loans to the area's most economically distressed counties, and offers technical and economic development analysis services to firms thinking of locating within the TVA's service area (TVA, n.d.).

As of 2003 the agency carried \$25 billion in debt and many of its coal plants needed further upgrading (The Economist, 2003). Nonetheless, the TVA can be judged a relative success in terms of power provision. How it has fared as a regional body is a more open question. David Lilienthal, one of the TVA's original board members, initially championed a "grass-roots" approach to management, which called for the utilization of local institutions, put a high value on public participation in the decision-making process, and allowed for employees in the field to make decisions (Derthick, 1974; Ekbladh, 2002). Lilienthal saw the TVA as a shining example of inclusive development (Ekbladh, 2002). Yet the agency actually acted in a relatively autonomous fashion (Derthick, 1974) and the "grass-roots" rhetoric did not match operations (Ekbladh, 2002).

In short, judging the TVA as a regional body requires considering the goals of regionalism. While the TVA has been efficient at long-term power provision and land management, and

continues to play an economic-development role in the region, it cannot be considered a truly “regional” body, if regionalism implies multiple actors, local and regional, participating in regional decision-making.

### 3. The Appalachian Regional Commission

The Appalachian Regional Commission (ARC) was originally convened in 1965. It grew out of fortuitous political alliances, both at the state level—the Conference of Appalachian Governors had issued an appeal for political help in 1960—and at the federal level: John F. Kennedy’s presidential bid had included a crucial early primary win in West Virginia, augmenting his interest in the region (Derthick, 1974). But the ARC was not established by Congress until the Democratic Party had won control of both the House of Representatives and the Senate, two years after Kennedy’s death (Derthick, 1974). Unlike other agencies, the ARC has functioned more as a multi-state economic development, transportation and social-service funding agency than as an organization concerned primarily with planning. Planning functions have been left largely in the individual states’ hands.

At present the ARC has 14 members: the governors of each of the 13 states<sup>16</sup> and one federal co-chair, appointed by the president and subject to Senate confirmation (ARC, n.d.(a)). State program managers are appointed by the governors. The 410 counties covered by the ARC are grouped into 72 Local Development Districts (LDDs), which do multi-county planning and development (ARC, n.d.(b)). The ARC currently defines its role as having four primary components:

- **advocate** for the entire region;
- **knowledge builder** through regional forums, advisory councils, and community meetings;
- **investor** in the region, by making its own funds available and by recruiting other investors; and
- **partner** with state, federal, and local governments. (ARC, n.d. (c)).

Thus it could be said that, while not a transportation planning agency in and of itself, the ARC helps member states and localities with their planning projects.

Isserman and Rephann (1995) used a matched-county study to evaluate the long-run economic effects of the ARC-funded investments. They found that between 1965 and 1991, the growth rates of the Appalachian counties were greater than that of their non-Appalachian matches; the total income growth differences, in 1991, added up to \$8.4 billion. The difference held even after the authors controlled for racial composition. Isserman and Rephann (1995) specified that they were not examining the ARC “as a political innovation or a planning institution” and did not speculate as to how the ARC might have contributed to the growth of member counties. Nevertheless, they found significant enough differences in economic growth to conclude that the ARC has helped to improve economic growth in member counties.

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<sup>16</sup> Alabama, Georgia, Kentucky, Maryland, Mississippi, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Virginia, and West Virginia.

Thus while the ARC has accomplished its objectives, and can be counted as one of the few success stories in the history of American regionalism, it is not, and has never been, a locus for regional transport planning. Gauthier (1973) criticized ARC-funded highway construction as lacking a regional basis for coordinated development. “The Appalachian Development Highway System,” Gauthier wrote, “is neither a highway network nor a regional system.” Derthick thought similarly: “In sum, the commission has generally been able to arrive at adjustments of the states’ separate interests... It has not sought to achieve subordination of the states’ interests to the common good of the region” (Derthick, 1974).

#### **4. National Highway Planning**

An examination of the creation of the national highway system is worthwhile to better understand how the different goals of the federal government, states, and cities were incorporated into the process. This is in fact a major consideration for megaregion planning. Few transportation projects have matched the ambition and scale of the national highway system, first mulled over by Roosevelt in 1935. Highway planning was not conceived as a regional effort—transportation planning was largely left to the states because transportation facilities and services were managed by state and local agencies (Weiner, 1997), until the idea of a federal “superhighway” system was introduced under Roosevelt’s administration (Mertz, 2006). Under Roosevelt, the highway program was briefly designed as “interregional,” but Congressional members who heartily disliked Roosevelt insisted that the word “interregional” be removed before the 1944 bill on highways could be brought before Congress (Weingroff, 2000).

Under the Roosevelt administration, highway spending was framed not only as an employment-creation program or an economic stimulant, but as a solution to particularly urban problems. In 1937 the National Resources Planning Committee presented a report to Roosevelt, “Our Cities,” which identified fourteen emerging urban problems, including a deterioration of the urban housing stock, public-health threats, and “drastic inequalities of income and wealth” (Mertz, 2005). The report included an assertion that new forms of transportation—the passenger car, the truck, and the airplane—would “affect the national distribution of our urban centers and even the local pattern of our cities” (Mertz, 2005). The report recommended the establishment of a national planning board, a federal public-works authority, and a new national transport policy in the service of urban development (Mertz, 2005).

Thomas H. MacDonald, chief of the Bureau of Public Roads from 1919 to 1953, was the driving force behind two reports, one produced in 1939 and a second in 1944, which conceived of federal highway transportation in terms of regional and urban needs. It was MacDonald who originally coined the term “interregional” after a national data-collection effort led him to conclude that most automotive traffic in the United States was regional, not transcontinental (Weingroff, 2000). The 1944 report, *Interregional Highways*, called for coordinating highway planning with other urban interests, including housing authorities, city planners, airport officials, and other agencies with a vested interest in the shape of the city (Weingroff, 2000; Weiner, 1997). It would be a mistake to call MacDonald a participatory planner, or a transportation planner not subject to the prejudices of his time: one of his goals was to coordinate highway building with federal slum clearance. But he envisioned the highway system in a way that integrated it more deeply with urban needs than has been the case since 1956.

Other advocates of a national highway system also supported greater planning integration. In 1954, speaking before AASHO (later AASHTO), Representative George Dondero, in calling for AASHO to support President Eisenhower's newly proposed highway-funding plan, said:

It's not only the city folk who will benefit from improved urban highways. They will help the farmer in getting his produce to market, and facilitate the social and cultural pursuits of his family. The whole business is a two-way street, economically and every other way, for every segment of our people.

All this emphasizes the need for cooperative thinking and planning—for a close working partnership between all levels of government. (Mertz, 2006)

But the political battles over the proposed highway funding led to a shift in highway planning, away from its ties with urban revitalization. In 1957 Lewis Mumford gave a blistering criticism of the new Federal Highway Administration: "We are faced, it is fairly obvious to me, with the blunders of one-dimensional thinking... and forgetting the realities that surround us" (Weingroff, 2000). Mumford was especially incensed that the new head of what is now the Federal Highway Administration (FHWA) and the Federal Housing Administrator had not met until September 1957, more than a year after Eisenhower signed the Federal-Aid Highway Act (Weingroff, 2000). That same act had included no provisions for urban highways and some have called attention to the omission of urban highways in the legislation. Subsequently, the national highway system moved away from "one-dimensional thinking" in planning transportation to incorporate the impacts of the federal highway system on urban life or local environments. Currently, the Federal Register requires State Departments of Transportation, MPOs and other public transportation operators to conduct comprehensive and coordinated transportation planning in metropolitan areas and States (Federal Register, 2007).

## **5. Metropolitan Planning Organizations**

Metropolitan planning organizations (MPOs) have existed in the United States since the 1950s (Sanchez & Wolf, 2005), but have become increasingly important in transportation planning since the 1973 Surface Transportation Assistance Act specified that urbanized areas with populations of 50,000 or greater create MPOs to facilitate the transportation-planning process. There are now 384 MPOs and could be more than 400 after the 2010 census (TRB, 2006). While the size and scope of MPOs vary—the Charlotte metropolitan area has five MPOs, while the Atlanta Regional Commission does transportation planning for as many as 22 counties within the metropolitan area—each MPO has the same broad mandate: to ensure that the local use of federal transportation funds was determined by a planning process that was continuing, cooperative, and comprehensive (known as the "three Cs") (Glassman, n.d.). As such, MPOs are the closest the transportation-planning process in the United States to implement "regional" decision-making.

The Intermodal Surface Transportation and Equity Act (ISTEA), enacted in 1991, substantially increased the responsibilities, and power, of MPOs. ISTEA provided transportation funds directly to MPOs, but required them to prepare 20-year regional transportation plans and three-year Transportation Improvement Plans (TIPs). The act also made some changes to the structure of MPOs, requiring that representatives of local governments and state officials be included on the boards of MPOs governing large areas,

requiring greater citizen involvement, and establishing criteria for the MPOs to use in reviewing transportation programs (Sanchez & Wolf, 2005).

Nonetheless, the structure and composition of MPOs vary widely. A survey by Sanchez & Wolf (2005) found the number of board members on an MPO could be as low as seven, for the Greater Buffalo-Niagara Regional Transportation Council, and as high as 92, for the Miami Valley Regional Planning Commission in Ohio. Sanchez and Wolf also found that the rule of “one area, one vote” led to overrepresentation of suburban areas on many MPO boards, and noted that previous research has suggested that more suburban votes on MPO boards leads to less money being allocated for transit. The priorities of an MPO, as well as its board structure, are often influenced by jurisdiction patterns and local politics.

Goldman & Deakin (2000) suggest that “[t]he lack of representativeness of MPO boards may pose a real obstacle to their ability to acquire strong powers for regional government.” Only one MPO in the country that of Portland, Oregon, has its board members directly elected. Some MPOs have been able to balance the new demands under ISTEA with their lack of direct power by forming partnerships with state transportation agencies, other MPOs (especially in cases where several different MPOs served one larger metropolitan region) and non-governmental organizations (Goldman & Deakin, 2000). Certain MPOs, such as the Metropolitan Council of Minneapolis and St. Paul, have been able to achieve higher levels of citizen involvement and inter-agency cooperation. However, partnerships are often reluctant, and “in a number of regions key actors, public and private, remain opposed to a strong MPO role” (Goldman & Deakin, 2000).

A 2006 conference on MPOs concluded with a sort of “wish list” for future MPO actions. It called for MPOs with:

- Legal authority commensurate with their responsibilities;
- Flexibility in transportation funding;
- The ability to provide leadership on regional issues, develop partnerships to promote entrepreneurial leadership, and facilitate agreement on regional priorities;
- Have roles that vary by the characteristics of the region and boundaries that vary by issue or topic (e.g. different boundaries for water/sewer and for transportation planning);
- A multi-disciplinary, well-trained, “multimodal in perspective” staff (TRB, 2006).

This list highlights both the potential and the limitations of the MPO. A well-managed, well-funded, and well-regarded MPO can incorporate regional needs into local transportation planning. Yet most MPOs must still answer to local political forces which may not be willing or able to advocate regional policies. For the moment, the MPO is confined to the funding of one metropolitan area, although inter-MPO partnerships may encourage polycentric regional planning.

## **6. Conclusions**

As we have seen, regional planning initiatives in the United States have traditionally come in one of two ways: created at the federal level and imposed upon the affected states, or

agreed to by the states themselves. Generally, the former have tended to be more far-reaching, more ambitious, and more successful than the latter. Yet creating regional initiatives at the federal level begs questions of local representation. The TVA does not answer to the affected states. The Appalachian Regional Commission, by contrast, devolves planning power to the states, and thus, while it functions well as an economic-development facilitator, has had more trouble achieving goals to help the region as a whole. Meanwhile, inter-state compacts have traditionally been relatively limited in their scope and influence. The exception to this dichotomy, the Regional Plan Association, has been able to influence planning and policy making in its area, in part because of fortunate social, political, and historical forces.

The major challenge for future regional efforts will be to combine the effectiveness of federally-proposed initiatives with the cooperative nature of interstate compacts. In this the MPOs, which receive (and, perhaps more importantly, control) federal funding yet must be attentive to local concerns, may be the best model for future regional efforts. It must be noted, however, that MPOs struggle with issues of scale. A large MPO, such as the Atlanta Regional Commission, may have more local clout but may struggle with its ability to speak for a multiplicity of groups. A smaller MPO, such as those in the Charlotte metropolitan area, will be able to work more easily with local groups, yet will have difficulty exerting much influence over larger issues. The questions of governance and representations are tricky ones which must be part of any regional-planning discussion.

## **B. From Regions to Megaregions**

### **1. Impetus for Megaregions for Transportation Planning**

Why do we need planning at this larger scale? Economic and social interactions are taking place at the megaregion scale beyond the boundaries of either individual municipalities or metropolitan areas (Zhang et al., 2007). The megaregion presents a new perspective on defining regionalism that captures the economic, political and spatial level at which planning should be conducted in order to respond to the challenges of agglomerations of economic activity and population. It also recognizes the new context in which large-scale regions exist—one of global economic and environmental issues taking place on a larger scale. Megaregions provide a strategy to act globally, while addressing local quality-of-life issues. This expanded regional footprint is a vehicle for accommodating growth and economic development through collaborative megaregional transportation planning, policy, implementation, and operations. Similar cooperative initiatives in infrastructure investment and economic development are beginning both Asia and Europe.

The megaregions will experience key challenges in the coming decades, including: rapid population growth, expansion of suburban landscapes, aging infrastructure, social equity challenges, strained ecosystems, and uneven inter- and intra-regional growth patterns. Many megaregion areas in the United States are already faced with issues stemming from sprawling development patterns, escalating land consumption, and increased traffic congestion. It is expected that these areas will continue to grow in population and the potential addition of millions of residents will only exacerbate existing problems in metropolitan and regional planning for these regions (National Surface Transportation Policy and Revenue Study Commission, 2007). These issues have several things in common: they

are spatial; they are not confined by existing political boundaries; they affect future generations; and they are interrelated (Ross et al., 2007).

As United States megaregions grow, will they remain competitive in the changing global marketplace? Will they be places in which residents can enjoy stable and comfortable lives? Will there be sufficient transportation choices? Can continued growth and development occur in a sustainable manner? If these areas continue to form without planning, will this create a nation whose global competitiveness is threatened by social and environmental problems? These challenges reach across traditional jurisdictional boundaries, making the current planning strategies inadequate and demanding a new planning perspective (Contant, Ross et al., 2005).

Current economic development planning tends to ignore the spatial distribution of impacts caused by investments and programs. Local comprehensive planning is spatial in focus and concept, but is also shaped by parochial interests, ignoring the cumulative effects of many individual decisions on the surrounding region. Transportation planning connects regions, but fails to address adequately the land use and environmental impacts of infrastructure decisions. Other single-function planning efforts, such as watershed planning or energy development planning, are also incapable of fully addressing the issues that affect the entire region. Most importantly, current planning, whether it is guided by an issue or by proximity, lacks a common vision. Although researchers, planners, politicians, and decision-makers each appreciate the interconnectedness of issues by content and by space, they currently have no guiding vision of what the future should hold, and no plan to get there. A megaregional approach, integrating an understanding of these systems, could provide a more effective strategy.

The section overviews four of the key issues driving the need for a new regional strategy: transportation, natural environment, land use, and economic competitiveness.

#### **a. Transportation**

The trend of global economic markets and increasing international trade puts new pressures on national transportation systems. The significant growth of international trade since 1980 has strained the capacities of the United States' ports and the transportation networks that serve them. Over the next 30 years, the increase of international trade via ports is expected to be much higher than before. Most major ports in the nation are located in megaregions, such as Southern California, Gulf Coast, and Northeast, identified by Lang and Dhavale (2005) and RPA (2006). In addition, many goods from international trade may be moved to other megaregions as consumption and production centers as well as those coastal megaregions, implying that the increasing movement of freight will not only affect internal transportation networks of the coastal megaregions, but also major interstate highways that connect to other megaregions.

However, recent federal transportation investments have been mostly concentrated on the maintenance of existing infrastructure in metropolitan areas. The 2005 SAFTEA-LU transportation act is targeted at local transportation projects without appropriate coordination to enhance the connectivity at the regional level, although much of the existing infrastructure in metropolitan areas was constructed more than 50 years ago and will require increasing maintenance investment or infusions of new capital (Regional Plan Association, 2006). As



mentioned earlier, more than 70 percent of the nation's population and employment growth will be accommodated within megaregions by 2050 (Amekudzi et al., 2007; Ross et al., 2007; Regional Plan Association, 2006), meaning that the future economic success of the United States is directly related to the economic activities of these regions. Therefore, the investment in transportation connectivity and other improvements within and between megaregions is important to support their economic activity and roles as gateways to other parts of the nation (Meyer, 2007).

### **b. Environmental**

It has long been recognized that environmental issues transcend current political boundaries and governance mechanisms. Ecological integrity, energy sources, pollution, solid and hazardous wastes, water supply, air quality, habitat preservation, management of flood plains, and natural resource use do not follow politically drawn boundaries. The impacts of these problems have yet to be seriously considered in spatial planning at the megaregional level.

Specifically, as people and functions are continuously concentrated in metropolitan areas, a possible impact of the growth of megaregions on environment should be taken into account. A recent conflict between three states, Georgia, Alabama, and Florida, over water supply, reminds us that regional efforts beyond standard political boundaries will be increasingly necessary to solve and prevent environmental problems. Meanwhile, the energy use of most metropolitan areas is growing rapidly, reflecting population growth. Heavy reliance on fossil-fuel power plants will continue to cause environmental problems, including emissions of particulate matter and greenhouse gases (Center for Quality Growth and Regional Development, 2006).

In addition, environmental issues will affect investment decisions for future transportation planning: the consideration of global warming and reduction of carbon emission will be the continuing public concern (Meyer, 2007).

Thus, what is important, and is currently missing, is a sustainable model which would permit regions to continue to grow and overcome obstacles that will not be able to be solved within traditional jurisdictions.

### **c. Land Use**

Most of the United States' population and economic growth has been concentrated in large metropolitan regions since 1970 (Regional Plan Association, 2006). The boundaries of American urban areas have expanded much faster than have their population in recent decades (Cox, 2000). This geographic expansion, known as urban sprawl, has been criticized for producing increased traffic congestion, higher air pollution and energy consumption from longer commutes, excessive encroachment on agricultural land, and development on ecologically sensitive lands, such as wetlands and wildlife habitats (Woo, 2007). At the same time, inequities have emerged across the region as spatial segregation divides the haves from the have-nots. Fiscal inequities occur as local governments struggle to gain tax revenue, while their underserved populations stress the region as a whole (Orfield, 2002). Sprawling development patterns are both a cause and a result of these economic and development forces. There has been a loss of some simple and basic urban-design principles and livability has suffered (Calthorpe & Fulton, 2001). Quality of life issues

threatened by contemporary urban development patterns have traditionally been addressed at the local level, but in a megaregion these issues transcend current political boundaries and governance mechanisms. Community designs, educational systems, parks, and cultural amenities are often proposed without consideration of the regional context. Megaregions must ensure a continued high quality of life if they hope to attract and retain future residents. They must address current disparities and inequities in education and economic opportunity in order to enhance the success of the entire region over the long run.

#### **d. Global Economic Competitiveness**

Glaeser (2007) argues that an economic development policy should be controlled at the local level for the diversity and competition. This argument is partly correct in that local control is efficient to make a place more attractive to business and workers and to remove governmental regulations. However, a large-scale planning approach may also be useful for addressing economic competitiveness in a context of global economy (See Jensen and Richardson, 2001; Levine, 2001; Salet *et al*, 2003a). For example, the decline of manufacturing in the Midwest region cannot be controlled or mitigated at the local level. While there are many factors playing a role in the decline of manufacturing in the region, this partly resulted from the global economy driven by transnational enterprises. In a global context, the new environment of technology and free trade made it possible to transfer financial capital quickly to anywhere in the world and to move production functions of manufacturing to foreign countries, creating an international division of labor (Sassen, 1994). Specifically, due to high labor wages in the Midwest region, many manufacturing companies have moved their factories to foreign countries and southern states of the United States (Delgado, 2006b).

Through the improvement of information technology and open trade markets, the United States is competing with approximately 3 billion educated citizens of developing countries (Bullard, 2007). Specifically, real-time interactions and distribution of electronic information realized by information technologies have changed traditional space and time constraints (U.S. Congress, 1995). Based on the principle of “comparative advantage”, these conditions along with lower labor costs in foreign countries have contributed to the direct investment of U.S. companies in these countries, and such conditions facilitated U.S. employers to manage foreign branches and their employees (e.g. routine clerical work). These global competitors have already created more constructive strategies at the megaregional level than have cities and metropolitan areas in the United States. As mentioned in Section 2, in line with such international labor division, Sassen (2007) suggests that some activities (e.g. low-cost manufacturing and back office functions), currently outsourced to foreign countries, could be accommodated in megaregions' hinterlands, because the urban cores of megaregions are not competitive to such functions due to higher land values and such labor forces are not available in rural areas far from megaregions.

Globalization is erasing traditional boundaries between economies, a process referred to as “debordering”. At the same time, there is an increasing tendency for industries to cluster to gain competitive advantage in a global system that places a premium on knowledge and innovation. As these changes develop, it has been evident that a larger spatial unit of regional networks is more useable than the city (Scott *et al.*, 2001). Some urban areas in the United States already benefit from these tightly linked and spatially concentrated clusters,

but future economic development must enhance their growth and connections in order to ensure continued success.

Thus, it is critical to develop a megaregional economic development framework with the necessary infrastructure supporting the system, in the face of international competitions in the world economy.

## **2. Profiles of Megaregions in the United States**

Throughout the country, large-scale regional efforts are underway to examine the relationships, challenges, and opportunities that unite people across jurisdictional boundaries. One of these is a new initiative which has been launched to address America's anticipated growth before the year 2050 and the challenges and opportunities associated with the emergence of megaregions. This initiative, "America 2050: Towards a National Strategy for Prosperity, Equity and Sustainability" was coordinated by the Regional Plan Association, the Lincoln Institute of Land Policy, and the Southern California Association of Governments and was comprised of ground-up megaregion research, planning, and coordination efforts taking place in ten of the emerging megaregions across the country.

Annual Roundtables for Megaregional Development since 2005 have brought together leading urban and regional planners, academics, metropolitan planning directors, and business and civic leaders to share progress reports, research methods, and strategies on megaregion coordination as well as to discuss nation-wide policies that can underpin these efforts. The Roundtables set goals for America 2050 for each year and discussed the leadership and strategic path of the initiative.

The Center for Quality Growth and Regional Development (CQGRD) at the Georgia Institute of Technology convened federal and state legislators, mayors, public- and private-sector representatives, academics, and other community leaders, hosting a symposium in 2006, in order to provide a broad initial overview of the concepts of megaregions and megaregion planning. In 2007, CQGRD hosted the second symposium, an assembly of academics, to discuss and examine the theoretical constructs surrounding megaregions.

Following are descriptions of several megaregions which are currently being defined and researched through different initiatives within the United States. They include the Piedmont Atlantic Megaregion (PAM), the Northeast Megaregions, Northern California, Southern California, the Great Lakes Megaregion, and the Texas Triangle Megaregion (CQGRD, 2006).

## a) Piedmont Atlantic Megaregion

### LOCATION

The Piedmont Atlantic Megaregion (PAM) is anchored by the Atlanta, Georgia metropolitan region, but stretches to Raleigh, North Carolina to the east and Birmingham, Alabama to the west. See Figure 25.

### CHARACTERISTICS

The southeastern United States has built upon its rich history to become a dynamic and ethnically diverse region that is now home to Fortune 500 companies, the busiest airport in the world,

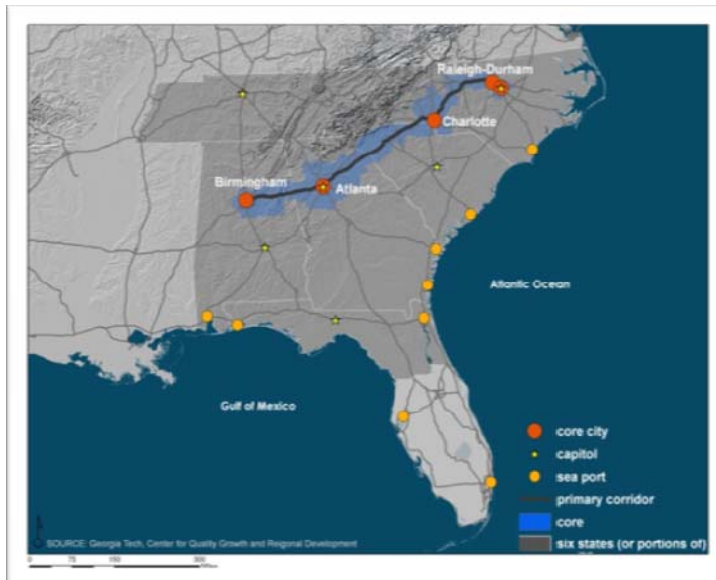
critically acclaimed art galleries and museums, national banks, and media powerhouses. Charlotte, NC, began to boom with a gold rush in 1799, but most cities developed later. Atlanta, GA, named for the Western and Atlantic Railroad, which terminated in the city, incorporated in 1847. Birmingham, AL, at the junction of two rail lines, incorporated in 1871. Today, Amtrak's Crescent, one of a handful of intercity passenger routes still running in the southeast, passes through all these cities.

After World War II, the comprehensive national highway network dramatically changed mobility, economic growth, and transportation effectiveness in the southeast. It reinforced already existing transportation links and promoted even faster growth and economic development in the cities along the Piedmont plateau. Ultimately automotive transportation became the primary mode for almost all of the passenger traffic and much of the freight movement in the region.

### CHALLENGES AND OPPORTUNITIES

Working in cooperation with one another, the metropolitan areas along these corridors can strengthen their own competitive advantage while contributing to the economic capacity of the extended region. Atlanta ranked eighth in the United States in Gross Metropolitan Product in 2001 and houses more than four-fifths of the nation's largest business branch offices. Charlotte is also a booming city, home to the second-largest financial center in the United States. Raleigh-Durham is one of the top five biotech and life science regions in the world (Contant, Ross et al., 2005).

PAM is also experiencing tremendous population growth, driven primarily by domestic in-migration. Regarding domestic in-migration rates, all of the MSAs in PAM's urban core (with the exception of Birmingham) are in the top fifteen MSAs in the country. The low cost of



**Figure 25. The Piedmont Atlantic Megaregion** (Contant, Ross et al., 2005)

living and the high quality of life in PAM are two of the reasons for a projected population growth rate of over 65 percent between 2000 and 2050, reaching more than 57 million people by 2050. However, unfortunately, PAM also boasts some of the highest increases in commuting times in 1990-2000 (U.S. Census Bureau, 2000). The rapid rate of growth and the accompanying increase in industrial and transportation activity have generated air pollution and created air quality issues for the Southeast. Most of the major metropolitan areas in the region (e.g., Atlanta, Birmingham, Charlotte) experience periods of non-attainment under Environmental Protection Agency air quality standards. Four major metropolitan areas in PAM are among the 25 worst in the country for ozone air pollution (American Lung Association, 2004; Contant, Ross et al., 2005).

Furthermore, because of PAM's historical focus on the automobile when making infrastructure investment decisions, travelers within PAM are almost completely dependent on personal cars for access to work, shopping and other destinations. The region is also heavily reliant on trucking for freight transportation, further increasing both congestion and the economic costs of congestion. In addition, the economic benefits of the region will be jeopardized if energy costs, environmental concerns, or other problems make auto travel and truck shipping less feasible with no ready alternative at hand. If long-distance travel and shipping continue to grow as rapidly as they have, environmental pressures from air travel and waterborne shipping will grow correspondingly.

Research is underway at the Georgia Institute of Technology's (Georgia Tech) Center for Quality Growth and Regional Development (CQGRD) to confront issues of growth, land consumption, infrastructure, and political fragmentation in order to develop sustainable solutions through a multi-state dialogue. A graduate planning studio was taught at Georgia Tech in spring 2005, which produced a preliminary study on PAM. The study was informed by a planning charrette in Madrid, Spain, where European and American planning and policy practitioners worked with students on issues of equity, economic development, transportation, and the natural environment.

## b) Northeast Megaregion

### LOCATION

The existing Northeastern megaregion is the largest agglomeration of people and economic activities in North America. As seen in Figure 26, it stretches from Maine to Virginia, and includes Boston, New York, Philadelphia, Baltimore, and Washington, D.C. (Regional Plan Association, 2007).



Figure 26. The Northeast Megaregion (RPA, 2007)

## **CHARACTERISTICS**

The unique network of metropolitan areas that stretches from Washington, D.C. to Boston was first recognized by French geographer Jean Gottmann in his 1957 study, "Megalopolis or the Urbanization of the Northeastern Seaboard." For decades, no other area of the United States came close to matching the concentration of population, power and wealth that characterized the Northeast, which today accounts for 18 percent of the nation's population, 20 percent of the nation's Gross Domestic Product and only 2 percent of the nation's land area. Each metropolitan area has its own strength New York City is the financial, commercial, and media center, Washington, D.C. the political and administrative center, Boston the intellectual center, and Philadelphia and Baltimore act as academic, cultural, and commercial centers.

The region has many natural amenities including 500 miles of coastline and 12 million acres of protected open space and parkland. More than 50 percent of all U.S. public transit riders and 77 percent of commuter rail riders live in the Northeast region.

## **CHALLENGES AND OPPORTUNITIES**

Although the Northeast region is known as the largest agglomeration of population and economy in the world, it faces several challenges. The Northeast region is losing its economic competitiveness with declining GDP and employment share (particularly in manufacturing). At the same time, tax burdens for families in major cities of the region have increased over time. The region has abundant natural amenities. However, it suffers from the deterioration of the environment from urban sprawl and faces major water, land, and air pollution problems. Much of the infrastructure of the region is old and overcrowded, and needs to be replaced or repaired. In the next forty-five years, the Northeast Megaregion is projected to add eighteen million residents to its population. The cost from congestion in the Northeast region is estimated to \$13.8 billion in time and 1.3 billion gallons of gas per year. Although rail transit is very important to the megaregion, insufficient funds have been allocated for maintenance, leading to degradation of service in the Northeast's rail networks (University of Pennsylvania, 2005). Furthermore, the improvement of intercity transportation networks could bring synergies among the specializations of the Northeast regions (Regional Plan Association, 2007).

In spring 2006, a graduate planning studio at the University of Pennsylvania focused on the Northeast Megaregion, building on research completed by students the previous year. Recent efforts to protect the Appalachian Highlands and reduce greenhouse gas production could provide a foundation for further action on key issues facing the Northeast Megaregion, including efforts to sustain and improve Amtrak's Northeast Corridor rail service (Center for Quality Growth and Regional Development, 2006).

## c) Northern California Megaregion

### LOCATION

Based on the three economic centers of San Francisco, Silicon Valley and Sacramento, the region extends from Monterey in the south up to Sonoma in the north, and to the high-growth Central Valley in the east, through Sacramento, and up into the foothills of the Sierra Nevada. The urban core includes San Francisco Bay area, Sacramento, and their commuting counties in the Central Valley, and the sphere of influence extends north to Yuba County, east to Reno, and south to Fresno (Metcalf & Terplan, 2007) (Figure 27).

### CHARACTERISTICS

The Northern California megaregion is relatively wealthier and more liberal than the state as a whole. According to San Francisco Planning & Urban Research (SPUR) the average median household income in the megaregion area was \$53,800 in 1999 and \$47,500 for the state. The poverty rate is smaller in the Northern megaregion (12.1 percent) than in the state (14.2 percent). Dominant industries in the region include information technology, Software, communication equipment and services, biotechnology, electronics, and semiconductors (Bullard, 2007).

The growth of the traditional nine-county Bay Area, including Sonoma, Marin, San Francisco, San Mateo, Santa Clara, Alameda, Contra Costa, Solano, and Napa, has expanded to north, south, and east (Sacramento and its suburbs), resulting in the addition of surrounding counties to the megaregion. The biotech and biomedical industries in the Bay Area and other technology industries in Silicon Valley have moved or expanded to Sacramento and its suburbs (Metcalf & Terplan, 2007).

### CHALLENGES AND OPPORTUNITIES

The Bay Area, with nine counties will grow to 8.7 million by 2030. In the surrounding 12 counties, 3.6 million will be added during the same period. The rate of population growth is exceeding the rate of housing growth, resulting in high housing prices in this region, and contributes to increasing congestion in the main transportation corridors. During the past two decades, commuters from the surrounding 12 counties to the Bay Area increased from 30,000 to more than 117,000 daily. Also, it is estimated that 1 million acres of natural land will be converted to urban uses in the San Joaquin Valley by 2040 (Metcalf & Terplan, 2007). Urban sprawl, fueled by economic growth in the Bay Area, will take place beyond the Central Valley.



Figure 27. The Northern California Megaregion (SPUR, 2007)

Residents in the region are highly educated; its economic base is diverse, and it has numerous natural amenities. However, the region has experienced income disparities, generating very high-wage and very low-wage jobs without opportunities for middle-class stability. As the studio project of University of Pennsylvania School of Design suggested, a possible strategy may be derived from the enhancement of transportation network between those areas (Metcalf & Terplan, 2007).

Given the current problems, such as urban sprawl and long commutes, there have been many discussions with regard to high-speed rail system in California. Although the planned high-speed rail system runs between San Francisco and Los Angeles, it may have big impacts on travel patterns within the Northern California Megaregion.

#### d) Southern California Megaregion

##### LOCATION

The Southern California megaregion encompasses Los Angeles, Kern, Orange, Riverside, and San Diego counties in California, as well as the northern portion of Baja California, including Mexicali, Tijuana, and Ensenada (Center for Quality Growth and Regional Development, 2006). The Pacific Ocean is the region's western boundary; the region has 250 miles of coastline (Figure 28).



Figure 28. The Southern California Megaregion (SCAG, 2006)

##### CHARACTERISTICS

The Southern California megaregion contains 1.5 percent of the land area of the United States, more than 7 percent of the U.S. population, and more than 7 percent of the nation's total Gross Domestic Product (GDP). The region is ranked as the world's 10<sup>th</sup> largest economy (Kern County Council of Governments et al., 2005). In addition, the region is well known as a tourist destination and entertainment capital. Major industries in the region include aerospace and defense, communication equipment, electronics, and mass media (Bullard, 2007).



## CHALLENGES AND OPPORTUNITIES

The California Department of Finance projects the region's population to be 27.7 million by 2030 (a 35 percent increase between 2000 and 2030). Specifically, international immigration is expected to contribute significantly to the increase in population: Hispanics will be the majority by 2030, contributing 55 percent of the region's total population (Kern County Council of Governments et al., 2005).

Traffic congestion, continuing growth away from transportation hubs and urban centers, rising housing and land prices, and poor air quality have threatened the region's competitiveness in the global markets. The California Department of Transportation indicates that growth in truck travel is much faster than population growth (Kern County Council of Governments et al., 2005). The high density contributes to the viability of the transit system in the region, which has one of the nation's largest bus riderships.

The Southern California places a heavy emphasis on goods movement and logistics because this region has the second largest port in the nation and the fifth busiest port complex in the world, and these industries are very important to its economy (Regional Plan Association, 2006). As a result, building infrastructure to enhance a role as a global gateway is a critical issue for the Southern California region.

The Southern California Association of Governments (SCAG), the San Diego Association of Governments (SANDAG), and the Kern County Council of Governments have begun collaborating on a planned growth strategy for the region, outlined in a 2005 report.

### e) Great Lakes Megaregion

#### LOCATION

The Great Lakes megaregion is anchored by Chicago, Illinois, stretching north to Milwaukee, Wisconsin; south to Cincinnati, Ohio; and east to Pittsburgh, Pennsylvania (Delgado et al., 2006a) (Figure 29).

#### CHARACTERISTICS

The region is home to more than 20 percent of Fortune 500 companies' headquarters. The region still has a concentration of manufacturing (over 1.3 of LQ), with employment accounting for more than 17 percent of total jobs in the region (Delgado et al.,

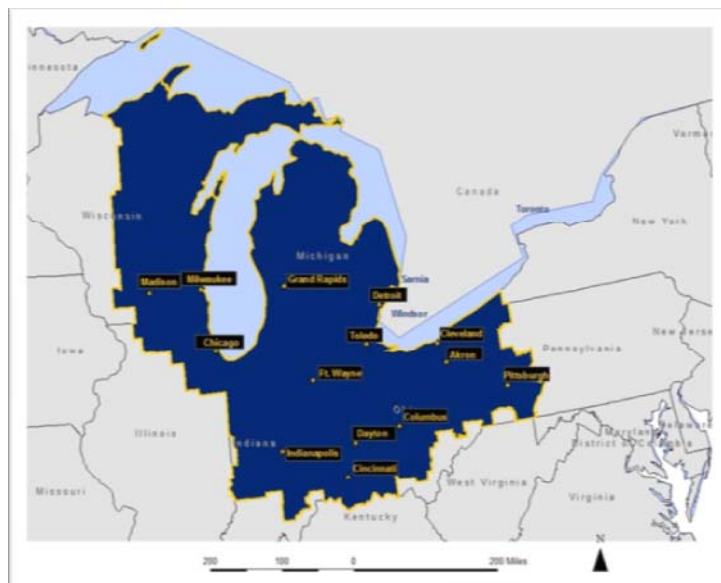


Figure 29. The Great Lakes Megaregion (Delgado et al., 2006b)

2006b). The region consists of several industrial metropolitan areas that have similar histories of industrial activities.

An extensive transportation system of highways, airports, ports, and railways in the region plays an important role for both domestic and international trade. For example, \$102 billion in trade (18 percent of the value of imports and exports over land in the US) passed through the bridge and tunnel of Detroit in 2003. Also, in the same year, 85 million tons of domestic goods moved over the Great Lakes and O'Hare international airport in Chicago, the second busiest airport in the country (Delgado et al., 2006b).

## **CHALLENGES AND OPPORTUNITIES**

The Great Lakes megaregion shares 4.9 percent of the land area of the United States, 15.3 percent of the U.S. population, and 15.7 percent of the nation's total Gross Domestic Product (GDP). While the population of the United States is projected to grow by 40 percent by 2050, the region's population will grow to 53.5 million, a 25 percent increase during the same period (Delgado et al., 2006b).

The landscape of the Midwest has changed dramatically. Many industries in this region have migrated to the Sun Belt and countries such as India and China. Dayton, OH has lost 40 percent of its population from its peak; Cleveland, OH 48 percent; Detroit, MI 49 percent; St. Louis, MO 60 percent; and Chicago 24 percent (Longworth, 2008).

With the decline of manufacturing, industries such as transportation and warehousing and professional, scientific, and technical services are growing in the region. In particular, about 20 percent of top 40 largest warehousing and storage companies in the United States have their home in the region, implying that freight demand will continue to increase in the region (Smith, 2002).

Due to future freight demand, controlling peak hour congestion is another important challenge. The loss due to congestion delays in the largest Great Lakes megaregion cities was estimated equal to 304 million gallons of gas in 2003. Another statistic shows that the congestion cost was estimated at \$8.5 billion, 75 percent of which is attributed to congestion in metropolitan Chicago and Detroit (Delgado et al., 2006b).

One of advantages of this megaregion compared with other megaregions is the abundance of water resources, including the Great Lakes, inland lakes, and watersheds. This natural resource provides not only drinking water and industrial water, but also the opportunities of recreation and tourism that contribute to economic growth. Agricultural land occupies 25 percent (48,175 mi<sup>2</sup>) of the region, providing the nation with a significant amount of its domestic food supply (Delgado et al., 2006b).

The region has, on average, higher educational attainment than the U.S. average and some of the largest research universities in the world, such as The Ohio State University, the University of Michigan, and the University of Wisconsin (Regional Plan Association, 2006; Delgado et al., 2006b). Collaboration has emerged between the University of Michigan, Youngstown State University of Ohio, the Northeastern Illinois Planning Commission, and the Great Cities Institute in Chicago on a joint project to define the megaregion, share data

methods, and identify strategies to strengthen the Midwest's position in the national and global economy (Center for Quality Growth and Regional Development, 2006).

## f) Texas Triangle

### LOCATION

The Texas Triangle Megaregion includes the Dallas/Fort Worth, Houston, San Antonio and Austin metropolitan areas (Regional Plan Association, 2006; Zhang et al., 2007) (Figure 30).

### CHARACTERISTICS

The Texas Triangle Megaregion includes 66 counties (57,430 square miles) with a total population of 15 million in 2000 (Zhang et al., 2007).

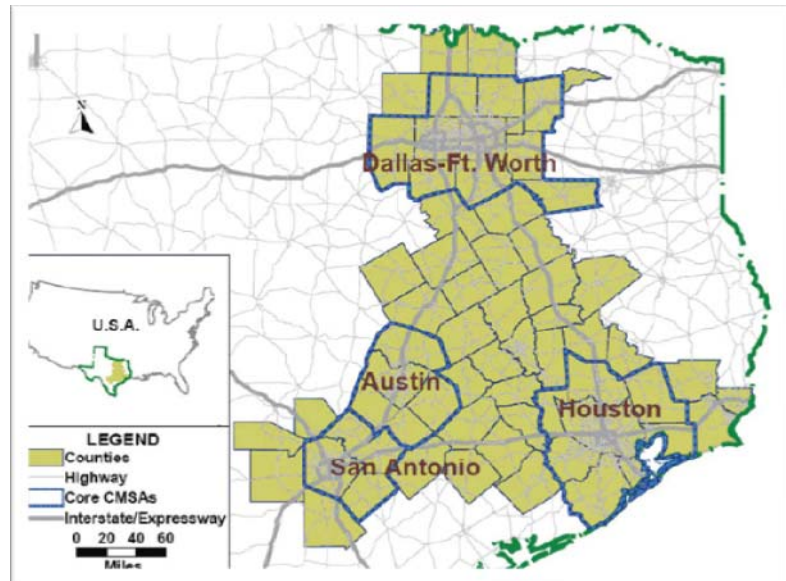


Figure 30. The Texas Triangle Megaregion (Zhang et al., 2007)

Four metropolitan areas in the region are closely tied to each other economically. For example, Zhang et al. (2007) examine county to county goods movements, showing that Houston has the central distributional role for chemicals/petroleum products and Dallas-Fort Worth has the same role for machinery products. The movement of miscellaneous products, including mixed freight, waste, and scrap, clearly shows the interconnectedness among the four metropolitan areas. Also, a strong flow of information in business has been identified from high-capacity internet connections between Houston and Dallas-Fort Worth. Major industries in the Texas Triangle Megaregion include energy and natural Resources, construction, semiconductors, and software and information technology.

### CHALLENGES AND OPPORTUNITIES

By 2050 about 35 million people or 70 percent of the population of Texas will live in these four metropolitan areas that comprise the Texas Triangle (Zhang et al., 2007). If the rates of land consumption continue unchanged, the metropolitan areas have the potential to merge into a relatively continuous stretch of urbanization. Such a scenario increases the potential for economic collaboration between the metropolitan areas, but also raises serious environmental concerns. This convergence allows for strategic coordination for competing and complementary industrial sectors to enhance economic competitiveness in the region.

The total travel for bus and auto will almost double by 2050. The region already has frequent flights between metropolitan areas, and therefore the expansion of airline services may be restricted due to the current congestion of airport and airspace (Zhang et al., 2007). As an

alternative mode of travel, a research team of the University of Texas, Austin emphasizes constructing a high-speed rail system to accommodate future travel demand. In this context, the Texas Triangle has been broadly recognized by business leaders and policy makers in the state, as high-speed rail connections have been proposed to supplement the thriving air travel between the major cities.

The Trans-Texas Corridor (TTC) has been developed by Texas to meet future transportation demand. The key features of the plan include toll lanes, freight railways, high-speed commute railways, and infrastructure for utilities. While the plan faces political resistance due to the costs of construction, its success will be able to provide multimodal transportation services in the region (Zhang et al., 2007).

## g) Southern Florida Megaregion

### LOCATION

The Southern Florida Megaregion includes the southern portion of the Florida peninsula, including the metro regions of Orlando, Tampa, West Palm Beach, Fort Lauderdale, and Miami, and potential connections to neighboring island nations (Center for Quality Growth and Regional Development, 2006) (Figure 31).

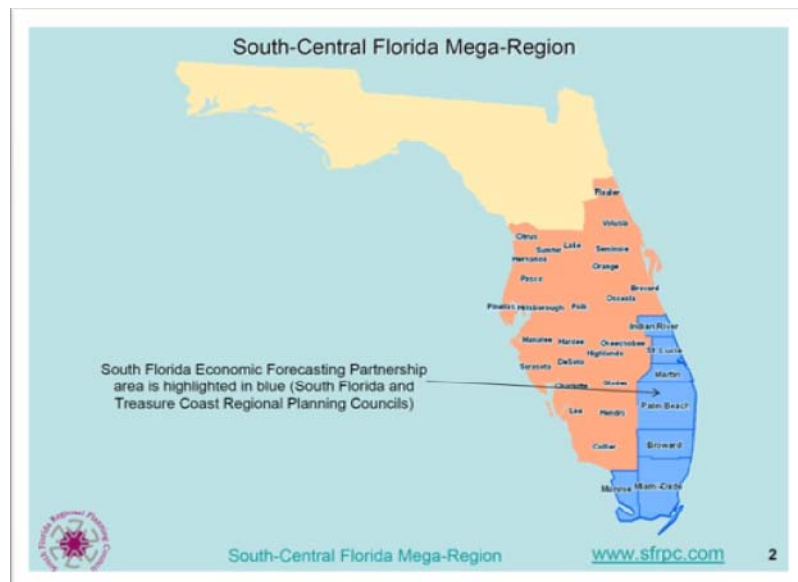


Figure 31. The Southern Florida Megaregion (SFRPC, 2006)

### CHALLENGES AND OPPORTUNITIES

The Florida megaregion is one of the fastest growing and most diverse areas in the United States; about 60 percent of new residents in the last decade came from foreign countries (Regional Plan Association, 2006). Specifically, the Hispanic population is projected to grow to over 6 million, a 25 percent of the total population in the region, by 2030. The total population of the region is projected to increase to 21.3 million by 2030, a 66 percent increase from 2000 to 2030. Most counties are included in metropolitan areas with the exception of Glades County (South Florida Regional Planning Council, 2006).

Dominant industrial sectors in the region include hotels and entertainment, financial services, professional services, and logistics and distribution (Bullard, 2007).

The South Florida Regional Planning Council (SFRPC) and the Center for Urban and Environmental Solutions (CUES) at Florida Atlantic University are initiating discussions with other regional organizations in the megaregion. Outreach efforts include contacting leaders

in Puerto Rico, the Bahamas, and the Dominican Republic, and other island nations with cultural and economic ties to South Florida (Center for Quality Growth and Regional Development, 2006).

## h) Gulf Coast Megaregion

### LOCATION

The Gulf Coast Megaregion encompasses parts of Florida, Alabama, Mississippi, Louisiana, and Texas (Figure 32).

### CHALLENGES AND OPPORTUNITIES

Despite its strong cultural traditions, the Gulf Coast as a continuous megaregion lacks the political cohesion of the nearby Texas



Figure 32. The Gulf Coast Megaregion (RPA, 2006)

Triangle. However, the 2005 devastation from Hurricanes Katrina and Rita and the resulting displacement of hurricane victims along the I-10 corridor highlighted the environmental, transportation and economic links of the Gulf Coast (Regional Plan Association, 2006). The environmental vulnerability of this region underscored the need for a region-wide environmental assessment to guide redevelopment and protect the coast from future disasters. This assessment was completed by a consortium of planners and landscape architects led by EDAW, Inc, in partnership with the University of Texas and the Regional Plan Association.

Additionally, the severe racial and economic inequities that were laid bare by the disaster called for a region-wide economic strategy to address long-standing challenges and decline. Despite the hurricanes and their devastation, the region is expected to continue to grow due to the continued in-migration of retirees from the Midwest (Regional Plan Association, 2006).

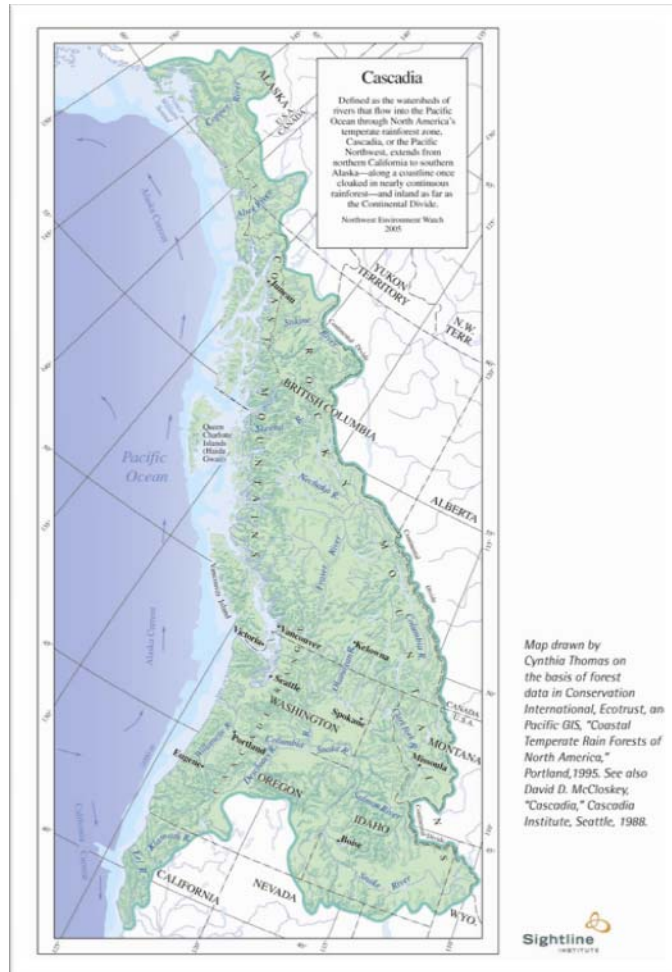
## i) Cascadia

### LOCATION

The Cascadia Megaregion contains the metro regions of Seattle, Washington and Portland, Oregon, and stretches north to Vancouver, British Columbia in Canada (Seltzer et al., 2005; Center for Quality Growth and Regional Development, 2006) (Figure 33).

### CHALLENGES AND OPPORTUNITIES

Dominant industrial sectors in the region include information technology; communication services; higher Education and research; and computer equipment (Bullard, 2007). The Portland State University research team (Seltzer et al., 2005) has proposed strategies to strengthen ties between these cities using high-speed rail and highlighting their shared hi-tech competencies, commitment to environmental sustainability, and presence of creative clusters in film and music (Center for Quality Growth and Regional Development, 2006). Research indicates that there are strong travel demands between major cities within the Cascadia region. For example, in 2004 the second most frequent destination of flights from Seattle-Tacoma International Airport (Sea-Tac) was Portland, OR. In addition, Seattle was the third most popular destination of recreation trips from Canada in 2000.



**Figure 33. The Cascadia Megaregion** (Northwest Environment Watch Sight Line, 2004)

Cascadia differs from other megaregions in that it is known as a Bioregion<sup>17</sup>. The Cascadia Bioregion consists of several smaller bioregions, including the Georgia Basin Bioregion, the Puget Sound Bioregion, the Columbia River/Columbian Bioregion, and the Poulouse Bioregion. These areas provide abundant tourism resources that can contribute to economic growth. There was an effort to unite Cascadia for tourism in 1996. However, this was not successful partly because each state has its own marketing plans and budgets. Instead, the

<sup>17</sup> A bioregion can be defined as "a geographic area having common characteristics of soil, watershed, climate, native plants and animals that exist within the whole planetary biosphere as unique and contributive parts", containing 20 out of 40 North America's largest rivers (Seltzer et al., 2005).

initiative of Cultural Cascades<sup>18</sup> coordinates cultural activities of the region and provides information for the Amtrak routes that connect the cities of Vancouver, B.C., Seattle, Tacoma, Portland, and Eugene (Seltzer et al., 2005; www.culturalcascades.com).

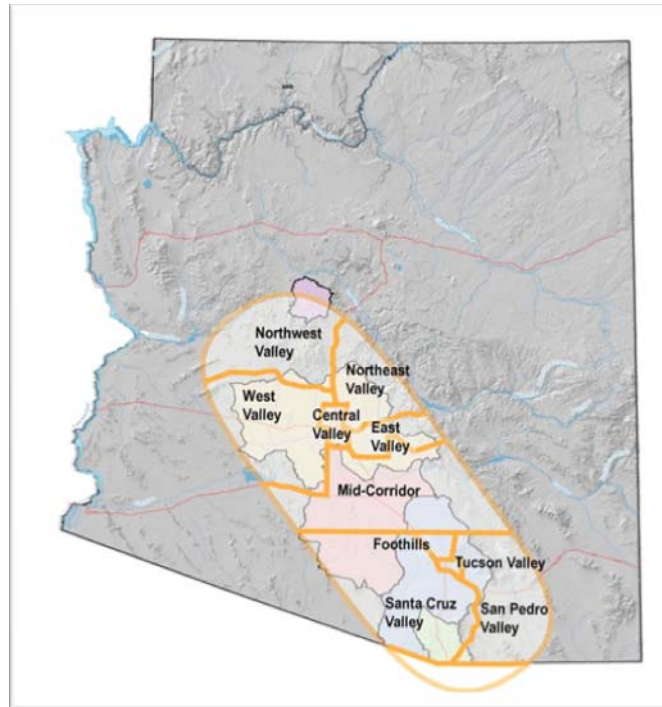
## j) Arizona Sun Corridor

### LOCATION

The Arizona Sun Corridor megaregion encompasses parts of six counties, including the three metro areas of Phoenix, Tucson, and Prescott, Arizona, and the Sierra Vista micropolitan area (Regional Plan Association, 2006) (Figure 34).

### CHALLENGES AND OPPORTUNITIES

The Arizona Sun Corridor megaregion is estimated to double in population size by 2040 (Regional Plan Association, 2006). The Bureau of the U.S. Census indicates that the average annualized rate of domestic net migration of the region would be approximately 10 to 20 percent over that time period. Other demographic characteristics include a high proportion of college-educated people (the share of those over 25 with a bachelor's degree is above the national average) and a large Hispanic population (Spanish is the primary home language of 20 percent of K-12 students in the region; the national average is 10 percent) (Arizona State University, 2006).



**Figure 34. The Arizona Sun Corridor Megaregion** (Arizona State University, 2006)

Given current water conservation requirements, the region's biggest metropolitan areas, Phoenix and Tucson, have enough water for approximately up to twenty million people, preparing the Sun Corridor for current and future growth (Regional Plan Association, 2006).

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<sup>18</sup> The Cultural Cascades is a cooperative partnership of five cities, including Vancouver BC, Seattle, Tacoma, Portland and Eugene, formed to coordinate cultural activities in those cities for residents and visitors.

### **3. Profiles of Megaregional Activities Abroad**

#### **a. The Trans-European Transport Networks (TENs-T)**

Having grown out of an economic pact between six countries to share certain resources in the 1950s, the European Union is now a super-governmental structure which imposes common law, regulates commerce, and acts as the foreign-policy representative for 27 countries. It would not be entirely accurate to regard the relationship between the EU and its member countries as identical to the relationship between the U.S. federal government and the states. Moreover, in EU parlance “region” has a specific meaning: all territory under the jurisdiction of EU members is divided into administrative regions that are eligible for financial and employment assistance. Nevertheless, recent developments in European transport policy suggest what it might be like to think about transport on a megaregion scale.

Americans mostly familiar with western European cities, with their greater reliance on light rail to travel within the city and heavy rail to travel outside it, may be surprised to learn how dominant the car has become in European transport. While the number of passenger-kilometers traveled on western Europe’s rail networks increased by more than 50 percent between 1970 and 2003, during that same time period passenger-kilometers traveled by private car increased by more than 150 percent (European Conference of Ministers of Transport (ECMT), 2005). Between 1950 and 1985, the rate of car ownership in western Europe rose from 22 per 1,000 population to 353 per 1,000 population (Ross, 1998). The EU-15 (the 15 countries, mostly in western Europe, who joined the EU between 1957 and 2004) saw their road network increase from 15,935 km (9,901 mi) in 1970 to 49,024 km (30,642 mi) by 1995. This has led to concerns on the part of the EU about increasing modal imbalance, with potential negative social, environmental, and economic consequences (Ross, 1998).

In the last decade, the EU has become more assertive in advancing a common transport policy. This is in part due to the growing awareness of the disproportionate environmental harm of certain transport modes. 28 percent of the EU’s carbon dioxide (CO<sub>2</sub>) emissions in 2000 could be attributed to transport; of that, 84 percent could be attributed to road transport (European Commission, 2001). At that time, road transport accounted for 44 percent of the EU’s goods transport market and 79 percent of its passenger transport market (European Commission, 2001). Moreover, air pollution, in the form of particulate matter, is blamed for an estimated 350,000 annual premature deaths in Europe (Commission of the European Communities (CEC), 2006). The 2001 White Paper on European transport policy describes sustainable development as a “lever” towards a common transport policy (European Commission, 2001).

The EU regards transport policy, economic growth, and sustainability as interlinked: more growth will mean more demands on transport infrastructure, which could in turn mean more environmental harm if the environment is not taken into consideration well in advance of growth. The European Spatial Development Perspective (ESDP), formulated in 1999, expresses a hope that greater accessibility will allow for greater economic competitiveness and thus more opportunity for economic growth. Thus transport planning is linked with two of the three fundamental EU goals: economic competitiveness and environmental preservation.



So far the most ambitious EU initiative towards a common transport policy has been the Trans-European Transport Networks (TENs-T). The TENs-T are a series of transport infrastructure projects proposed by the EU to facilitate the movement of people and goods within the EU. The TENs-T are considered a crucial factor in enhancing the growth and economic competitiveness within Europe (European Commission, 2005). Moreover, the TENs-T are expected to help “ensure sustainable transport” (European Commission, 2005) by increasing options within the transport network, decreasing congestion as well as the dependence of both freight and passenger travel on Europe’s roads.

The original TENs-T proposal, in 1994, included 14 projects. The current list (in Figure 35) is 30 projects, of which four have been completed. The total cost of completing all 30 projects was estimated in 2004 to be €225 billion (\$319 billion at 2007 exchange rates) (European Commission, 2005). By 2020, if the TENs-T were to be completed, it would include 89,500 km (55,613 mi) of roads and 94,000 km (58,409 mi) of railway, including 20,000 km (12,427 mi) of high-speed rail (European Commission, 2005).

Perhaps the most noteworthy characteristic of the TENs-T initiative is the emphasis on rail. Of the 30 projects, 18 are rail-only, while another three are multi-modal with rail as a component. Only three of the 30 projects are devoted exclusively to auto-based transport. Many of the rail projects, meanwhile, cross national borders: Project 6, for example, would connect southeast France to Slovenia by rail. This shows the extent to which the EU is hoping to restore modal balance and move travel away from what is seen as less environmentally friendly modes, such as auto. It should be noted that the TENs-T include both freight-directed and passenger-directed projects; for example, the Betuwe line (Project 5) strengthens rail links between the port of Rotterdam and the German border.

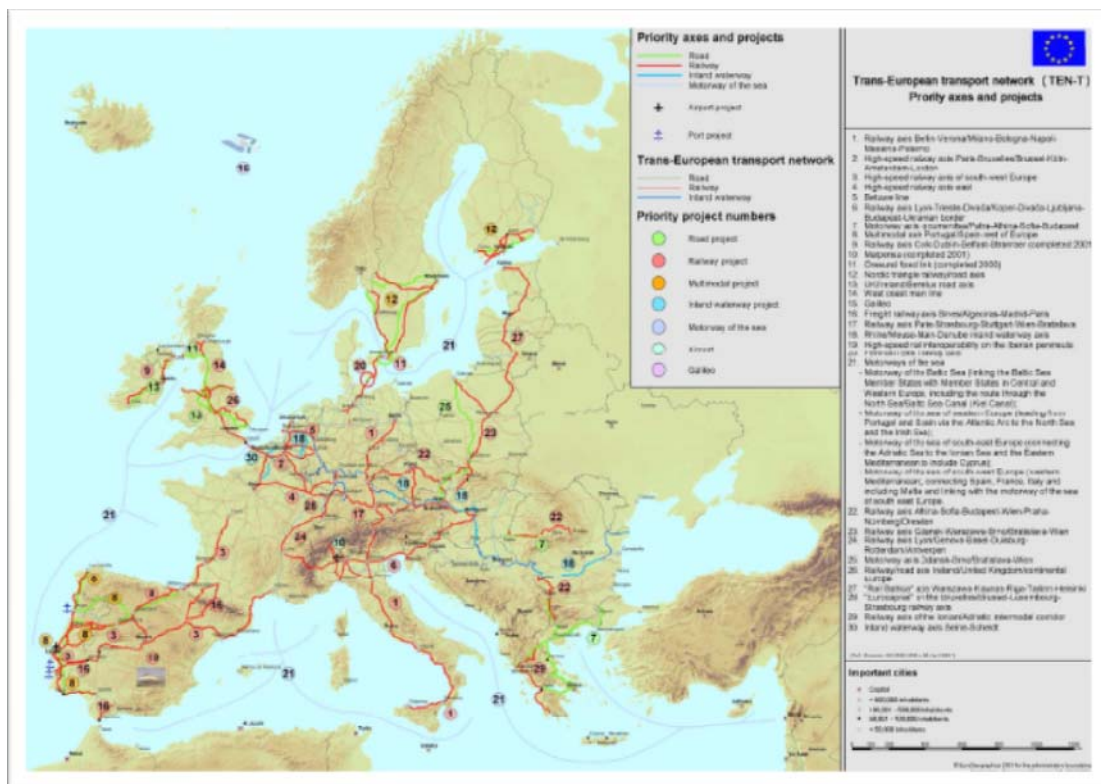


Figure 35. Trans-European transport network (TENs-T) (European Commission, 2005)

There have been some detailed, independent studies of individual TENs-T projects. Schade (2006) studied the potential economic benefits of the improvements to the corridor between Lyon, France, and Torino (Turin), Italy, which is part of Project 6. Implementing all the suggested improvements, including one 52-km (32.3-mi) tunnel, would decrease passenger travel between the two cities by two hours and 15 minutes. Schade's models found that, with all the improvements in place, by 2020 the corridor would see the following differences from a no-improvements scenario:

- Road freight between France and Italy would fall by 10 percent.
- Rail freight in both directions between France and Italy would increase by 23 percent.
- Between France and Austria, road freight would fall by 3.5 percent and rail freight would increase by 8 percent.
- Rail passenger transport between France and Italy could increase by as much as 11 percent.

Based on the model's findings, Schade estimated an aggregate gain in GDP for the EU-15 of €61 billion (Schade, 2006). The EU's estimates for completing the three parts—between Lyon and St. Jean de Maurienne on the French-Italian border, the Mont Cenis tunnel, and between Bussoleno and Torino—put total costs at about €15.3 billion (European Commission, 2005).

Schade's findings would suggest, then, that the Lyon-Torino corridor would confer a net economic benefit. In fact, Schade's modeling might possibly underestimate the economic benefits: if the entire Project 6 were to be completed, countries outside Italy, Austria, and France, namely Slovenia, would gain additional economic benefits from the improved Lyon-Torino connection.

The greatest obstacle in the development of the TENs-T is financing. The EU, whose budget comes mostly from value-added taxes imposed by member states, does not have the funding by itself to make the TENs-T happen: €225 billion is the equivalent of roughly two years of the EU's budget. Introducing the 30 projects in 2005, the European Commission, the domestic-policy arm of the EU, warned, "EU funding can act as a catalyst to get projects going, but Member States must find the majority of funding" (European Commission, 2005). Road-pricing was originally proposed as one way to fund the TENs-T (Ross, 1998) but has been implemented only in isolated cases in the EU. National governments may be reluctant to contribute their scarce transportation dollars to multi-state projects, even if the benefits are expected to be significantly higher than the costs. The general director of Romania's National Company for Motorways and National Roads told *The Diplomat*, a Bucharest-based magazine, "Our priorities are first the areas of heavy traffic and then the Trans-European Transport Network" (Nitoi & Ilie, 2008). Since transport policy has traditionally been set at the national level among EU members, the EU will have to convince member states to cede some financial and decision-making power to realize the vision of the TENs-T.

Nonetheless, the TENs-T, if achieved, will substantially increase transport options for millions of Europeans, establish better connections between European cities, better integrate outlying

areas into the greater transport network, and increase the EU's freight and passenger capacity. In short, the TENs-T has the power to make the EU and its cities a more attractive place for investment. Global cities within the EU, including London, Paris, Berlin, and Barcelona, will be able to parlay more extensive rail networks into firmer positions in the global economy. The TENs-T, like the American highway system, gives some idea of the potential of transport planning on such a large spatial scale.

#### **b. Metropolitan Shanghai/Yangtze River Delta, China**

China's rapid development since 1979 has led to intense growth in its major cities, particularly Beijing, Shanghai, and Guangzhou. In 2000, Shanghai's GDP was 16 to 17 percent of that of all of China, and its GDP per capita was three times that of China (Wang & Slack, 2004). Together, the Pearl River Delta (Guangzhou/Hong Kong/Macau), the Yangtze River Delta (Shanghai), and the Beijing-Tianjin-Tangshan regions contributed 34 percent of China's 2004 GDP (Zhang, 2006).

Prior to the "opening up" of 1978–79, centralized decision-making concentrated transportation investment on improving rail access to heavy industry, mostly concentrated in northern China, and expanding the network rather than upgrading existing routes (Démurger, 2001). Metropolitan areas generally featured dense manufacturing compounds, with relative balances between residential and commercial areas and moderate investment in road transportation (Yang, 2006). New transportation challenges arose as China moved toward a market economy. Between 1978 and 2003, motor vehicle fleet grew over 20% per year on average (China Automotive Industry Yearbook, 1985-2003). In Shanghai alone, traffic volume of motorized vehicles on the main streets increased by 40 percent between 1986 and 1991; and the number of private cars rose from just 60 in 1985 to more than 4,000 (Shen, 1997). By 2003 Shanghai was believed to have 200,000 private cars (Luard, 2003). Thus transportation demand has become a challenging issue for the largest Chinese cities.

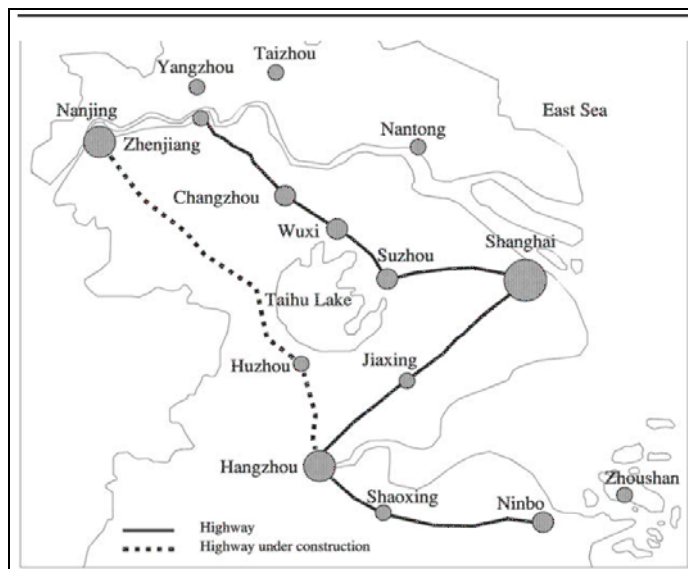
Moreover, the economic agglomerations of the economies of the largest cities have spread geographically. The building of a bridge over the Ruoxi River in 1988 led to nearby towns, such as Panyu and Dashi, being transformed into satellite towns of Guangzhou (Lin, 1999b). Panyu was annexed outright by Guangzhou in 2000 (Wu & Zhang, 2007). As Shanghai's municipal population increased from 12.2 million in 1985 to 13.6 million in 1994, its urbanized area also increased (Shen, 1997). Regional solutions to infrastructure problems thus have become more crucial, as the "reach" of China's most economically successful cities spreads, creating new suburbs and increasing the economic linkages between the central city and nearby cities or towns.

Finally, the link between transportation infrastructure and economic development can be said to be more visible in China, which has seen spatial inequities increase in the opening-up period, than in other countries. Démurger (2001) found that China's poorest provinces, such as Guangxi, Sichuan, and Guizhou in the southwest, also happened to be relatively isolated in terms of transportation access; she called them "forgotten provinces". The northwest provinces—Inner Mongolia, Gansu, and Xinjiang—also suffered limits to economic growth as a result of lack of transportation access (Démurger, 2001). The larger cities, on the other hand, could boast higher levels of mobility even after factoring in congestion. As China continues to grow, transportation infrastructure provision will continue to remain a significant policy issue.

The major question in the cases of Chinese cities is who proposes regional solutions. China's city governments, which are usually equivalent to metropolitan governments in American contexts, have a significant amount of autonomy over land-use decisions, and the final decision-maker on large projects is often the mayor of a city (Xu & Yeh, 2005; Yang et al., 2007). It was the city of Guangzhou, for example, that built major ring roads, highways, and railways (and projects such as the Ruoxi bridge) to increase its economic importance in the region (Xu & Yeh, 2005). Eighty-six different Chinese cities have created plans to develop themselves into "international metropolitan cities" (Xu & Yeh 2005). Lin (1999) argues that the Chinese central government has devolved some control to local governments: "the process of spatial restructuring in China since the reforms has been essentially a result of state disarticulation rather than increased state intervention."

Beyond the metropolitan scale, even when China's central government desires a regional solution to an infrastructure problem, it is not necessarily guaranteed to be able to bring about regional cooperation. Wang & Slack (2004) examined port governance in the greater Shanghai metropolitan area for evidence of regional cooperation. In 1996 the central government set up the Shanghai International Shipping Center (SISC) to coordinate port development among ten ports in three adjacent provinces (Jiangsu, Zhejiang, and Shanghai). The center was tasked with creating an internationally competitive container hub centered at Shanghai (Wang & Slack, 2004). But the SISC was unable to dictate changes at individual ports. Another regional body created by the central government, the Shanghai Ports Group, was also created in 1996, but by 2004 had stopped holding regular meetings, as the body was unable to resolve differences between members (Wang & Slack, 2004). Eventually, the Shanghai city government, which runs Shanghai's port, began promoting the SISC, leading the authors to predict that the Shanghai city government will use the SISC to direct port development in the region (Wang & Slack, 2004). So far, if megaregion infrastructure planning has emerged in China, it could be said to be because the largest and most economically powerful cities, rather than the central government, decided that regional infrastructure planning would be beneficial.

And indeed, some hints of regional cooperation have emerged. Mayors of 15 cities in the Yangtze River Delta, including Shanghai, had a meeting to agree to regional cooperation in March 2003 (Zhang, 2006). This regional cooperation has resulted in cross-provincial support for an expressway between Nanjing and Hangzhou, a Shanghai-Ningbo Bay bridge, and regional plans for harbors and railroad projects (Zhang, 2006). Figure 36 shows new highway construction in the Yangtze River delta.



**Figure 36: Highways in the Yangtze River Delta** (Zhang, 2006)

Indications of greater region-wide planning can also be seen in the Pearl River Delta. Guangzhou's Urban Development Concept Plan, developed in 2000, included in its goals shifting the urban structure from monocentric to polycentric, which would include constructing a new central business district in Panyu. The plan also called for faster expansion of the transportation network (Wu & Zhang, 2007). Nearby Hangzhou developed its own plan, in 2001, which included building a "Hangzhou metropolis" through cooperation with two newly annexed cities (Wu & Zhang, 2007). Unlike in the Yangtze River Delta, however, where Shanghai's dominance is evident, the Pearl River Delta has multiple cities competing for dominance, and this competition influences local choices for development projects (Xu & Yeh, 2005). Regional cooperation seems more likely in the Yangtze River Delta than in the Pearl River Delta.

In short, the devolving of power to local governments, specifically the ability to make land-use decisions and finance infrastructure projects, means that the city governments are capable of dealing with changes at the metropolitan scale. Beyond the metropolitan scale, cities such as Shanghai and its neighbors are beginning to move towards a more regional approach, in recognition that each metropolitan area might benefit from regional cooperation and joint planning. Regional efforts towards transportation and infrastructure planning in China are expected to increase as its metropolitan areas continue to grow both economically and spatially. China's central government has also signaled its intention to promote more regional planning by initiating more comprehensive plans for the Yangtze River Delta and for the Greater Capital Region.

### c. The Randstad, Netherlands

The Randstad, sometimes called "Randstad Holland," is the name given to an area of the Netherlands, consisting of parts of four provinces (North Holland, South Holland, Utrecht, and Flevoland). No official boundaries exist (OECD, 2007), but the general outlines of the Randstad can be seen in Figure 37. The geographic territory under the concept of "The Randstad" is only about 16 percent of the Netherlands' territory, yet about 6.7 million people, or 41 percent of the country's population, live within the Randstad (Regio Randstad, 2007). In 2005 it had a gross regional product of €235 billion (\$278 billion), greater than that of Madrid, Rome, Berlin, or the Frankfurt or Brussels metropolitan regions (Regio Randstad, 2007). It includes seven universities, one of Europe's largest airports (Amsterdam Schiphol), one of Europe's largest ports in Rotterdam, and a central



Figure 37. The Randstad (Regio Randstad, 2007)

rural area known as the “Green Heart”. Since the late 1990s local policy-makers have led an effort to have the Randstad recognized as “Deltametropolis,” a poly-centric urban region which, in structure and aims, resembles the proposed American megaregions.

Ironically enough, given the American concept of “edge cities,” *Randstad* translates directly as “edge city” or “rim city”. The area was so named in 1937 by a Dutch aviation pioneer who noticed, high above Amsterdam, that the edges (*rand*) of several then-cities seemed to grow together in a circle and suggest a spot for a future city (*stad*) (Storm, 2004).

Unlike the TENs-T and some of the American regional efforts we have seen, such as the TVA and the highway system, the concept of the Randstad as an economically productive region did not originate with the federal government. Indeed, the Dutch government did not begin promoting centralized planning until after World War II; it was the first such use of central planning in the country’s history (Storm, 2004). Both Lambregts (2002) and Storm (2004) argue that, instead of privileging the Randstad, the Dutch government has traditionally encouraged a more even distribution of growth, sending resources to economically less productive areas. The attempts to turn the Randstad into “Deltametropolis” have not been imposed from above by the Dutch federal government or the EU, but rather was first proposed in 1998 by a coalition of representatives of the Randstad’s four major cities, Amsterdam, Utrecht, Rotterdam, and The Hague (Den Haag) (Lambregts, 2002).

Since then the idea of the “Deltametropolis” has gained momentum. In 2001 the Queen’s Commissioners of the four provinces and the mayors of the four major cities described the Deltametropolis as a “spatial unity with the potential to... improve the quality of living and mobility” (*NL/EU* 2001). This spatial unity was to be achieved by strengthening cooperation between local governing bodies (*NL/EU* 2001), identifying projects with region-wide benefits.

The Randstad resembles an American megaregion in several ways. First, it is an economic engine for the entire country. In 1998 it produced 49 percent of the Netherlands’s GDP and 45 percent of its total employment (Petit, 2002). The major economic sectors of the Randstad were market services (of which business services accounted for 30 percent), industry, and non-market services, such as the health sector, government, and education (Petit, 2002). During the 1990s business services found access to Schiphol Airport, in particular, a reason to locate to the area (Regio Randstad, 2004). Moreover, the Randstad’s poly-urban quality allows for economic diversification. Amsterdam functions as a center for services, Rotterdam for logistics, and The Hague for national and international government functions (Regio Randstad, 2004). Quality of life and environmental concerns are emphasized in regional planning, as the 2001 statement identified the Randstad as a potential “blue-green delta” (*NL/EU*, 2001). The Dutch national spatial planning program has identified the Green Heart as a landscape park (*NL/EU*, 2001). Finally, as with American megaregions, the idea of the “Deltametropolis” has been created and promoted as a tool for economic competitiveness. A 2006 survey ranked Amsterdam the sixth-best European city in which to locate a business, but it had been ranked fifth in 1990 (Regio Randstad, 2007). Regio Randstad, an organization devoted to studying regional questions, put it this way: “It is obvious that the large international metropolitan areas have an advantage...over the individual Dutch urban agglomerations. Only at the level of the Randstad as a whole can we compete with cities like Paris and London” (Regio Randstad, 2004).

Transport capacity, however, remains a potential block to continued growth in the Randstad/Deltametropolis. Eighty-one percent of traffic jams in the Netherlands in 2005 occurred in the Randstad (OECD, 2007). The 2001 statement called for guaranteeing “good and fast connections” to the Randstad’s air and sea ports, and called for a temporary intensification of planning focus on the region’s two major highways (NL/EU, 2001). While incremental changes have been made to the region’s road network, such as widening emergency lanes, a more ambitious, country-wide road-pricing plan is not scheduled to go into effect until 2012 (OECD, 2007). Moreover, with the European Union having committed to ambitious carbon-dioxide emissions reductions, transport planners in the Randstad, as in elsewhere in Holland, will be under pressure to reduce growth in automotive use.

That leaves public-transit service, also historically uncoordinated in the Randstad. A 2005 thesis that compared the Randstad to several other metropolitan areas in western Europe, such as Stockholm and the “Flemish rhombus” around Brussels, suggested that the share of mobility by public transport was much lower in the Randstad. Based on interviews with local companies, the author speculated that local public transport was not efficient enough; many companies provided their employees with company cars (van Dijk, 2005). The public-transport system has also been described as fragmented and unreliable (Regio Randstad, 2004). Evidence of a new commitment towards improving transit options can be seen in Rapidrandstad, a proposed magnetic-levitation rail system serving the region. Figure 38 is the proposed map for Rapidrandstad service, which would link the major cities in the Randstad with Schiphol.

In short, the transformation of the Randstad into “Deltametropolis” is an effort to increase regional competitiveness while preserving local quality of life. Considering the economic attractiveness and the transport challenges of the Randstad as a whole, rather than of the individual cities, has allowed local policy-makers to propose more ambitious initiatives. It is hard to imagine that any one municipality or province on its own would be able to implement a Randstad-wide rail transport network, or preserve the whole of the Green Heart. The Randstad is thus at the forefront in terms of innovative governance and planning efforts by cities and city-networks to make themselves more attractive to economic investment, while still providing a safe and welcome place to live.



**Figure 38. Proposed Rapidrandstad Rail System**  
(Transrapid Nederland, n.d.)

#### **d. Nascent Megaregional Efforts**

There are also tentative efforts in other parts of the world to encourage transportation and infrastructure development within a regional context. Two such cases are the “super region” project in the Philippines and the spatial-development efforts recently led by NEPAD in Africa.

##### *The Philippines*

In the Philippines, Gloria Macapagal Arroyo, president since 2001, proposed dividing the country into five “super-regions” in her 2006 State of the Nation Address. Four of the regions are geographically based: the North Luzon Agribusiness Quadrangle (NLAQ), in the northern part of the country; the Metro Luzon Urban Beltway, which includes Manila, the capital; central Philippines; and the Mindanao Super Region, in the southern part of the country. The fifth super region, a “Cyber Corridor,” is designed to connect cities in other super regions, and “boost technology, telecommunications, and education” (Arroyo, 2006). The “super regions” were formalized by Executive Order 561, issued in August 2006 (Government of the Philippines, 2006). The “super regions” are meant to function as a guide for federal investment in infrastructure and social programs, and lead to sustainable development (Presidential Management Staff, 2007).

Each of the five super regions is designed around a particular competitive advantage (Presidential Management Staff, 2007). The NLAQ and Mindanao are meant to specialize in agribusiness. The Luzon Urban Beltway is to be positioned as a “globally competitive industrial and service sector” (Presidential Management Staff, 2007). Development in Central Philippines will be aimed at promoting tourism. The Cyber Corridor is intended to draw investment in information and communication technology. The Philippine government hopes that defining such economic specializations will help it target infrastructure investment in each super region. For example, in the summer of 2007 a total of P18.6 billion (US \$403 million) was committed to irrigation projects in the NLAQ (Presidential Management Staff 2007). The Luzon Urban Beltway, which as of 2007 housed 35 percent of the Philippines’s population and 55.7 percent of its GDP, was scheduled for seven road projects totaling P51.1 billion (\$1.1 billion) and the Northrail Project, a P61.9 billion (\$1.3 billion) transit system intended to spur development in the northern part of the super region.

The super regions project may also lead to some political decentralization. In January 2007, President Arroyo asked that the central offices of the Department for Agrarian Reform, the Department of Transportation and Communications, and the Department of Agriculture be transferred out of Manila to locations in the super-regions (Office of the President of the Philippines, 2007). In her 2007 State of the Nation Address, President Arroyo explicitly discussed the creation of the super regions as a way to ease inequitable development between Manila and the rest of the nation (Arroyo, 2007). It is not yet clear, however, whether the super regions will lead to changes in political structure. The Philippine super regions project seems to be led by the federal government, in particular President Arroyo.

As such, the success of the Philippine super region project, still in its infancy, will depend largely on the success of President Arroyo, whose tenure has been marked by a series of scandals, including one which the chairman of the national elections commission (and a political ally) stepped down over bribery charges (Economist.com, 2007) and three separate



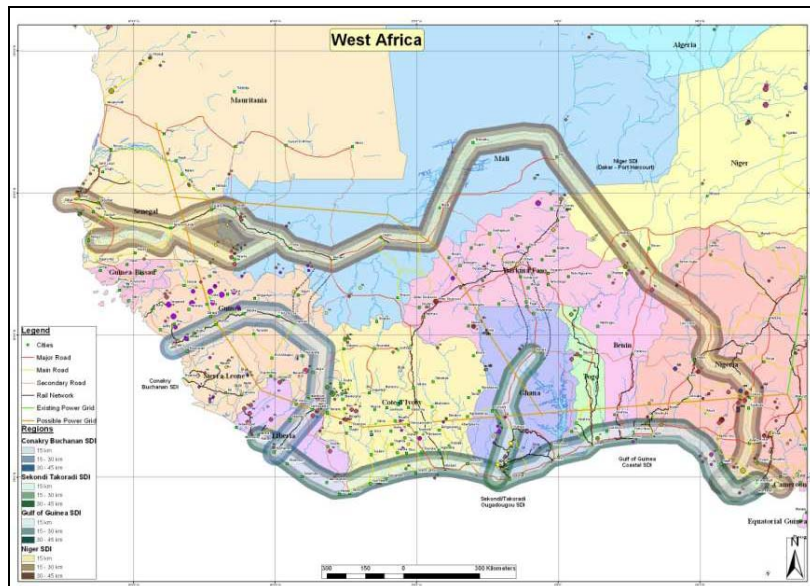
attempts at impeachment. The public may regard the super regions project as corrupt as well. The Philippine Center for Investigative Journalism has reported that as many as 200,000 people, many of them poor, may be evicted from as a result of the Northrail Project construction (Pabico, 2005). It is difficult to assess, from a distance, how much popular support the super regions project has in the Philippines, and whether it is regarded as a legitimate tool that will spur beneficial infrastructure investment and economic development.

#### *New Partnership for Africa's Development*

Another effort towards regional infrastructure development is being led by the New Partnership for Africa's Development (NEPAD), which was created in 2001 by the Organization for African Unity (OAU). NEPAD lists among its chief principles "acceleration of regional and continental integration" and building and improving infrastructure among its chief priorities (NEPAD, 2006). It should be said that NEPAD is defined as a "vision and strategic framework" (NEPAD, 2006) and thus should not be considered as having binding power on African governments' spending decisions.

In recent years NEPAD has been moving closer towards a spatial development strategy. In 2006 it published profiles of twelve potential "spatial development initiatives" (SDIs), some of which, such as the Maghreb Coastal SDI, which would include Morocco, Algeria, Tunisia, Libya, and Egypt (Mintek, 2006). Each SDI profile included an inventory of the area's infrastructure, economic, and energy assets (Mintek, 2006). NEPAD has suggested that defining SDIs could be helpful for identifying related infrastructure and investment projects. The SDI idea was inspired by programs begun by the South African government in 1996 to facilitate investment-led growth on South African development corridors (NEPAD, 2006b). Figure 39 shows a map of possible SDIs in West Africa (NEPAD, 2006b). As can be seen, the SDIs are primarily corridors linking major cities and, in some cases, existing infrastructure networks.

Unlike the Philippine super-region project, the NEPAD SDIs would not receive funding from the proposing body. Rather, the countries involved would have to agree that using the SDIs to guide infrastructure investment would be mutually beneficial. The original adoption of the SDI idea by South Africa, one of Africa's most successful and influential countries, could help its adoption throughout the continent. However, as with the European Union, transportation



**Figure 39. Possible Spatial Development Initiatives (SDIs) in West Africa (NEPAD, 2006b)**

funding decisions in NEPAD's member countries are made nationally, and so cross-national infrastructure projects would be difficult to fund if not encouraged by a separate funder, such as the World Bank or other investors. A recent occurrence is the rise of public sector lending by China. Recently state-owned banks in China are offering funding for projects, which are then awarded to Chinese contractors (Synge, 2007). As a result, in Ethiopia 60 percent of all road projects are being constructed by Chinese firms (Synge, 2007). This new development may change the funding landscape in substantive ways by introducing alternatives and thus creating more opportunities for critical thought on project development.

#### **e. Interpreting Lessons from Abroad**

The cases examined in this literature review suggest that interest in regional approaches to infrastructure and transportation planning is not limited to the North American megaregions. Regional coordination of infrastructure investments is increasingly regarded as a way to enhance the productivity of the entire region while preserving elements that would lead to greater quality of life, such as the Randstad's Green Heart. In the Philippines and Africa, regional coordination and cooperation are seen as a way to improve economic returns on infrastructure investment, while in China, regionalism is a tool to respond to rapidly increasing transportation demands. The European Union hopes that the EU-wide Trans-European Transport Networks will promote economic growth throughout while limiting the negative environmental impacts of transportation.

What is most striking about the cases outside the United States, when compared to the cases within the United States, is the difference between those projects that originate at the federal level or higher and those that originate at the local level. The EU has the scope to propose a transportation network far more ambitious than any one of its member states could suggest, but control of funding remains with the member states. It is difficult to predict at this stage whether the NEPAD Spatial Development Initiatives and the Philippine super regions will be implemented as proposed, but NEPAD would not be able to control the direction of infrastructure investments in its member countries, and the Philippine super-region project may suffer from its association with an unpopular president. The most successful cases appear to be those where local actors take the lead, as in the Yangtze River Delta and the Randstad. Since China's state government has empowered cities to make decisions on finance of major infrastructure investments, further regional efforts in China will probably originate from actors within the metropolitan areas, especially dominant actors such as Shanghai's city government, rather than be imposed by the state government.

In the United States, as we have seen, the locally-originated regional associations have tended to be weaker than those that originated at the federal level. Yet the federal programs—the TVA, the highway system, and to a lesser extent the ARC—have been accused of not being sufficiently sensitive to regional needs. Has the time come for empowered regional planning from the bottom up in the United States? It may be that megaregions can be the first (North) American example of regionally cooperative approaches with enough local buy-in to be able to act decisively. The MPOs, a case of a federal creation and empowerment of regional organizations, could possibly become actors within a megaregional framework. The international examples show how local actors can recognize common needs and coordinate infrastructure planning in hopes of bettering the region.

## SECTION IV. CONCLUSION

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The megaregion is a new perspective on defining regionalism, creating a new spatial strategy for those areas hosting a significant portion of the country's population and economic activities and thus confronting intense traffic congestion and a constrained environment. At the same time, the idea of the megaregion also represents a new and potentially fruitful context for American transportation planning. These regions are characterized as networks of urban centers and their surrounding areas, connected by existing economic, social, and infrastructure relationships. With the expanding global economy, more economic and social interactions will be taking place beyond political boundaries.

In order to frame the next steps for transportation and infrastructure planning at the megaregional scale in the United States, this report summarizes previous and current literature relevant to the planning perspective of megaregions, focusing on regionalism, globalization, global climate changes, economic geography, spatial planning, governance, infrastructure planning, and regional boundary delineation methods. The report also analyzes regional planning efforts and infrastructure provision beyond the metropolitan scale both inside and outside the United States.

Historically, while there have been numerous strategies put forward outlining the importance of regional planning in infrastructure investment planning, it has been difficult to accomplish multi-jurisdictional and multi-state transportation and infrastructure planning. Transportation, shared environmental resources, and economic development have spurred inter-state cooperation, but the most influential attempts at regional planning in the United States have originated at the federal level. The major challenge for future regional efforts will be to combine the effectiveness of federally-proposed initiatives with the cooperative nature of interstate compacts driven or undergirded by local support.

The effective transportation infrastructure, which links towns, cities, and neighborhoods to regions, regions to megaregions, and megaregions and countries together, is essential to economic growth in a global economy. In contrast to current planning, which is either nationally directed or limited to individual metropolitan areas, megaregional planning for infrastructure to support economic functionality is critical in ensuring regional competitiveness in a global context. Within a megaregion, metropolitan areas linked by transportation corridors can work together to strengthen their own competitive advantage while contributing to the economic capacity of the extended region. Thus the megaregion approach may provide a more effective strategy for spatially-based development, taking into account key regional issues: transportation, natural environment, land use, and economic competitiveness.

Although the support of transportation infrastructure is essential to maintain and enhance the economic competitiveness of the United States, past efforts have not met the increasing demand, in particular, of fast growing metropolitan areas. Megaregions, emerging agglomerated areas of population and economic activities, have not been sufficiently considered in infrastructure planning. In fact, many portions of international trade as well as domestic trade is taking place in megaregions. More than half of exporting goods were moved by trucks in 2002. The reliance on trucking is higher in megaregions than non-megaregions. The congestions caused by truck traffic on highways may negatively affect the

economic productivity, increasing the costs of goods movements and generating problems of production schedules. Since these trends are estimated to continue or to be even worse in the future, a strategic approach to incorporate the freight transportation infrastructure in megaregions into the infrastructure planning should be considered.

The national high-priority corridors (which are eligible for the National Corridor Planning and Development (NCPD) Program with a discretionary fund for planning, construction, and maintenance) have been designated in significant areas across the country. However, these exclude several strategic areas in megaregions. While proposed HSR networks are mostly crossing state lines, the appropriate governance to coordinate and lead them is absent. In addition, even though there is consensus on the necessity of developing a high-speed railway system to relieve increasing congestion in existing highways and to reduce energy consumptions and negative environmental effects of fossil fueled transportation modes, the proposed networks have been determined by existing corridor related plans or financial criteria focused on the demand side. However, the nationwide transportation infrastructure planning should consider future changing environments in social and economic aspects of the regional and global economy as well as the past trends of transportation patterns.

The United States has started to explore the megaregion approach as a strategy to face the challenges inherent in a global economy. Efforts to define and plan for megaregions are taking place throughout the United States. Since Gottmann (1957) offered the idea of a “Megalopolis” in the northeast region from the north of Boston to the south of Washington, D.C., researchers have identified megaregions across the country. Some of these regions have already begun research and outreach efforts to examine the relationships, challenges, and opportunities and understand their role in an evolving national framework for planning and public investment. While megaregions differ in size, demographics, and competitive advantages, they are similar in that they are defined by agglomerations of similar economic activity, transportation links, and cultural similarities. The power of a megaregions framework is that it can be adapted to various places so that they may pursue different strategies to address current challenges and enhance future competitiveness.

Outside the United States, regional coordination of infrastructure investments is increasingly regarded as a way to enhance the productivity of the entire region while preserving elements that would lead to greater quality of life. This is occurring in places with vastly different economic and political systems, suggesting that the appeal of regionalism is greater than any one particular economic or political set of ideas. Many European and Asian countries have already established strategies in terms of transportation and infrastructure investment at a megaregional level to respond to rapidly increasing transportation demands and to promote economic growth while preserving “green” environments. The European Union (EU) is investing in a transport policy that includes all members because it regards transport policy, economic growth, and sustainability as interlinked. As a result, EU member countries are engaged in much more extensive investment in infrastructure and economic development than they might pursue under their own auspices. In China, cities such as Shanghai and its neighbors are beginning to move towards a more regional approach in recognition that each metropolitan area might benefit from regional cooperation and planning. These cases show that actors and funding sources of megaregional planning and its implementation vary depending on the political, institutional, and geographical environment.

Thus it is critical to delineate megaregions, since each megaregion will have its own advantages and particular challenges. Spatial planning can play a key role in coordinating policy and practice at multiple scales by addressing a change in the understanding of megaregions; developing effective, widely-supported governance arrangements; and requiring more coordination of public-sector investment and expenditure over the long term to provide benefits and incentives for inter-jurisdictional cooperation. The criteria used to date in delineating the boundaries have been categorized with “essentialist” factors, such as population size, proximity, contiguity, growth, settlement patterns, land consumption, and political boundaries, and “relational” factors, such as commuting patterns, industrial flows, international passenger traffic and information flows to examine the interactions between regions.

In a broader context, future infrastructure planning should pursue both expanding the current system and reducing the growth of demand in highways (AASHTO, 2007), in fast growing metropolitan regions, which make up many of the megaregions, by improving transit and high-speed railway systems. Since these goals may not be achieved by only transportation infrastructure planning itself and each state or regional agency, future efforts need to be in line with quality growth principles which address economic competitiveness, desirable land use pattern, quality of life, environments, and global climate change. These issues are already taking place in areas beyond traditional political boundaries and should be planned for and managed in an appropriate geographical scope, megaregions. Thus, future infrastructure planning and investments could be targeted toward these metropolitan regions, while green infrastructure in and around the regions should be considered in a broader scope.

For these reasons, many researchers embrace the megaregion concept and divide it into two parts: core urban corridors and larger spheres of influences. They have used diverse criteria to identify both components of the megaregions. However, the methodologies used to delineate these boundaries need to be improved. In particular, the procedure to effectively identify the spheres of influence of core areas should be developed because these areas form the boundaries of megaregions and could be the setting for future population and economic growth.

*Megaregions: Literature Review of the Implications for U.S. Infrastructure Investment and Transportation Planning* shows how the megaregion has been used or conceived of to spatially shape and encourage quality growth. By exploring historic and current efforts, as well as United States and international examples of regional infrastructure planning and investment, this report provides a foundation for continued research to make the megaregion more useful to planners and policy-makers.

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