

# Uniting People, Places & Systems: **Megalopolis Unbound**

mega-region  
Vermont location  
quotient agriculture high speed rail  
territory intermodal linkages industry firms production  
reliability landscape New Hampshire ports output  
departure strategy Eurostar water supply input  
historic resources alignment mobility AVE  
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immigration mountains New York biodiversity poverty link  
trails infrastructure interconnections comparative advantage  
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reservoir network TAV station stops universities Massachusetts **Boston**  
forecast groundwater consumption Highlands public health creative economy  
migration bullet train water demand projections scale Rhode Island  
Pennsylvania institutions sense of place regulation Connecticut  
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crawl planning area fast lane outsourcing **New York City**  
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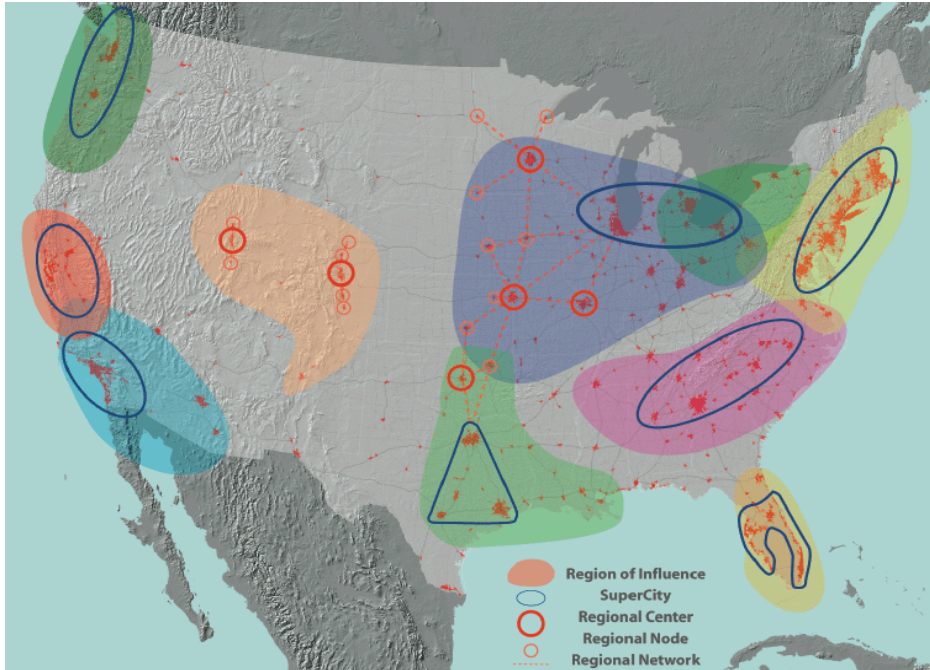
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# Executive Summary



The mega-regions identified by the 2004 University of Pennsylvania studio, with urban core areas circled in blue.

of the entire mega-region. While the region is powerful and economically competitive, clearly there is much room for improvement.

Building upon the work of previous years, the 2006 studio team focused on three target areas for improvement in the Northeast: the environment, the economy, and the transportation. These areas were selected because they are the major “bones” of a mega-region. Currently, these systems lack integration with one another, and cripple the region’s ability to maintain its economic strength and accommodate future growth.

## INTRODUCTION

In a changing world economy, the major players are no longer nation-states or individual cities, but “mega-regions” – large, connected networks of metropolitan regions that are driving an increasing share of global production and trade. Around the world, cities have grown to such proportions that they now constitute their own regions comprised of urban centers, suburban developments, and supporting hinterlands. Mega-regions are not only shaping today’s global economy at the macro-scale, but also affect everyone’s quality of life at the micro-scale. It is essential that we plan for our future at these different levels, a concept that Dutch planners call “dancing through the scales.”

The United States, vast in size and diversity, has a special role to play in the world of mega-regions. A 2004 studio from the University of Pennsylvania identified ten mega-regions spanning the country. These range from the dense urban networks of the Northeast Megalopolis mega-region to the Texas Triangle comprising Houston, Dallas-Ft. Worth, Austin and San Antonio, to Cascadia, stretching from Portland to Vancouver in the Pacific Northwest.

In 2005, a second University of Pennsylvania team zoomed in to define and evaluate the Northeast Megalopolis mega-region. Stretching from Maine to Virginia, it is the most densely populated mega-region in the nation with 48 million people (2000 census). By 2050, Megalopolis can expect to grow by another 18 million. Although the Northeast has the strongest economy of any U.S. mega-region, it is experiencing less robust growth than most of its peers. In order to examine how the Northeast can accommodate this growth, and how it can strengthen its economy it was essential to look at the current state of urban and economic development, mobility and environmental conservation in the Northeast.

The team examined the dynamics of the Northeast, and defined the area’s three zones: the urban core, the surrounding natural areas that provide the mega-region’s water supplies and other natural resources, and the remaining area of the Northeast’s 14 states. The team then mapped the Northeast’s strong and weak market cities, and proposed strategies to strengthen the synergies between these cities to improve the economy

## Northeast Megalopolis

- 14 states
- 5 major metropolitan areas
- 52 million people
- 18% of U.S. population
- 188,380 square miles
- 62,440 square miles in core area

## Environment

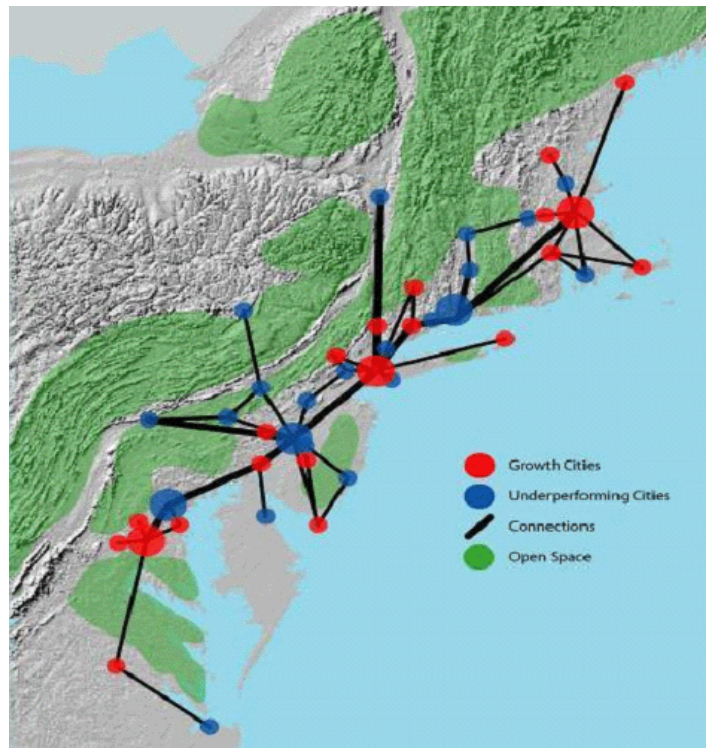
More and more regions are realizing that their environmental assets are not luxury items, but are a type of infrastructure themselves: an “eco-structure.” In the Northeast mega-region, this eco-structure consists of an extensive system of mountain ranges, forests, open spaces, and rivers that provide a high-quality water supply to cities and towns in addition to recreational opportunities and scenic viewsheds. To support a growing population and economy, the Northeast must become more sustainable both for economic purposes and to provide a high quality of life for our communities. Using the New York Highlands as a case study, the team examined the opportunities and the challenges that are part of planning for a greener, more sustainable future. Five strategies can address this goal: connect green spaces to urban places; promote compact development; tap into opportunities for renewable energy; identify and protect cultural landscapes; and enable mega-regional cooperation.

## Economy

The economy of Megalopolis has a vast \$3.2 trillion GDP, making it the third largest economy in the world, after only the U.S. and Japan. Because of its dense, well-established urban infrastructure, the Northeast has attracted the headquarters of over half of all Fortune 500 companies. Economic clusters such as pharmaceuticals and financial services have made their homes in and among Northeastern cities and are leaders in the world marketplace. However, the mega-region’s preeminence in the global economy is at risk. Because the marketplace is “flattening” due to globalization, all mega-regions must enhance their comparative advantages to remain competitive. For the Northeast, this means sustaining its technological edge, retaining the world’s most highly skilled workforce, and investing in its infrastructure. And despite the fact that the mega-region contains seven of the ten top research universities in the nation, these institutions are not leading in metrics such as the number of patents produced. The natural competitive advantages of the Northeast and its challenges are illustrated with case studies of two Connecticut cities, Hartford and Stamford. Drawing upon lessons from these two places, it is apparent that stronger and faster physical links and improved urban fabric are needed throughout the region. The economic geography of the pharmaceutical industry is analyzed, to identify the potential advantages that would result from strengthened transportation links between the Northeast’s urban centers.

## Transportation

One of the greatest competitive advantages of the Northeast mega-region is existing investment in transportation infrastructure. No other U.S. region has as much transit as the Northeast, nor does any other region reach densities that could support such a system. However, the 2005 studio team identified transportation linkages as a major weakness in the mega-region, with particular emphasis on the lack of strong connections between strong cities and under-performing cities. High Speed Rail (HSR) is the most appropriate mode to service the needs of mega-regions stretching from 200-500 miles across. An HSR system, much like those in Europe and Japan, could provide quick links between major cities, whereas regional and local systems can remain in place—with major improvements in maintenance and operations. Three



*The Northeast consists of a densely populated corridor of growth cities and under-performing cities.*

strategies are essential in realizing this vision of a tightly-linked transportation network for the mega-region. First, due to the large amounts of money involved, investments should be phased in starting with upgrading the existing infrastructure then adding a HSR demonstration line between Philadelphia and New York. Second, institutional and funding reforms must be enacted: the federal government must come to terms with the fact that public transit will never be a profit-making business, but is a public service. Public/private partnerships must be forged to provide the necessary funds to run a high-quality, reliable system. Third, and most salient to riders, there must be improved standards of service with greater rates of on-time arrivals, faster service, and more affordable tickets. Although the initial investment costs may seem staggering, the long-term pay-offs for the region as a whole are incalculably large and far-reaching.

## Why Plan for the Northeast Megalopolis?

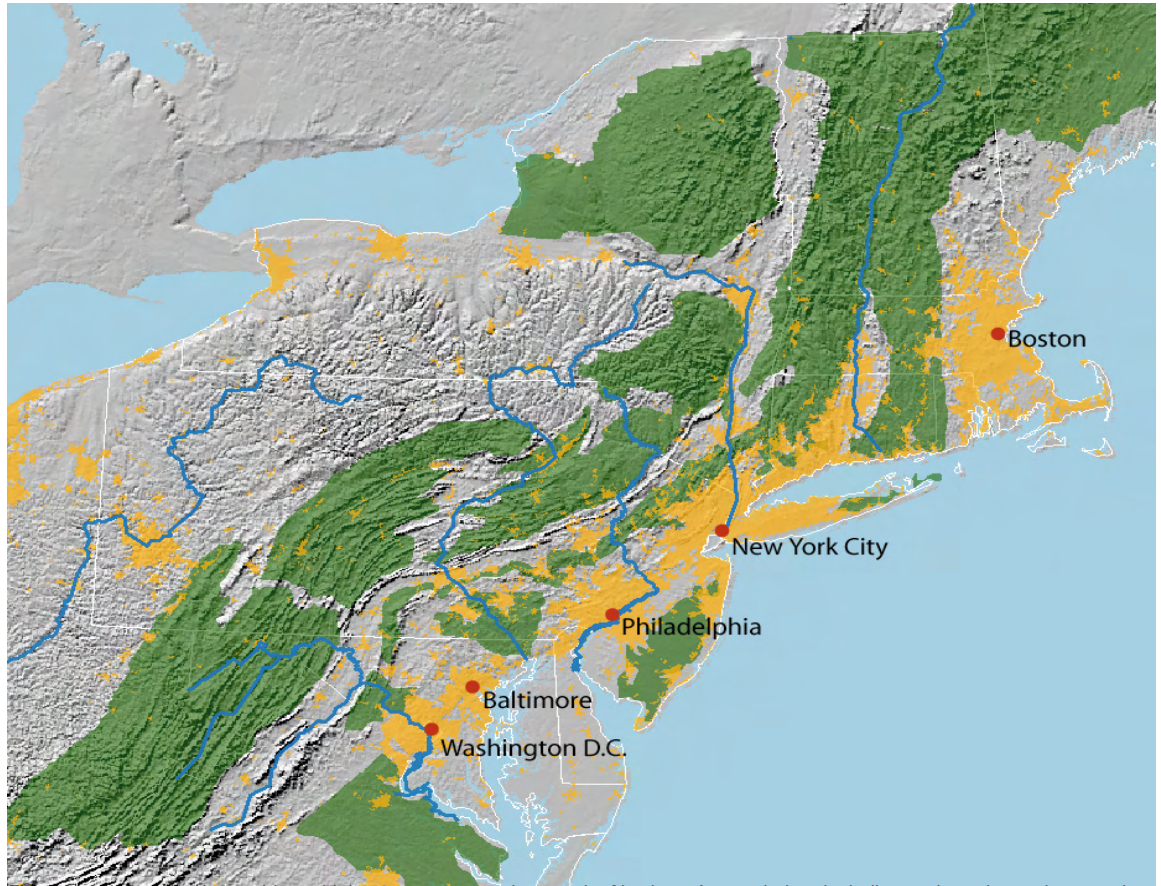
Although the United States is currently a leader in the global economy, the Northeast faces increasing competition from the growing countries of Asia and from our traditional competitors in Europe. The challenge is to not just maintain the strength of Megalopolis but to enhance them. The Northeast must sustain its competitive advantages and build upon them, while simultaneously innovate to ensure people have healthy, sustainable, and well-connected communities in which to live, work, and enjoy life.

# Environment

Most residents in the Northeast mega-region live in five major metropolitan areas that lie along its eastern seaboard, strategically positioned near river mouths or major harbors. Life in these places are underpinned by the mega-region's "eco-structure" of public water supplies, forests, farms, estuaries, and other natural resources. Its largest contiguous natural resource, the Appalachian Highlands system, lies to the north and west of the core developed areas.

These open spaces connect to the urban landscape through river corridors running to the coast. Along the coast, a network of estuaries and barrier beaches and islands represent a major asset, both as an environmental and quality of life resource.

This report provides a case study on the New York section of the Appalachian Highlands and analyzes the importance of the area's natural resources and identifies current and future threats. To protect the New York Highlands, and the rest of the Megalopolis's eco-structure, we propose a sustainability strategy that involves: 1) connecting green spaces to urban places; 2) promoting compact development; 3) investing in renewable energy sources; 4) encouraging interstate cooperation to implement renewable energy initiatives and coordinate land use, and 5) identifying and protecting the cultural landscapes that make the Northeast unique. The vision for the Northeast is to transform it into a more sustainable region.



*Forests and open lands provide multiple ecosystem services to the Northeast's population, including carbon absorption, erosion prevention, water supply, water purification, flood control, wildlife habitat, and recreation opportunities.*

## New York Highlands Case Study

The Appalachian Highlands is a key piece of the Megalopolis's eco-structure. The Highlands covers 3.5 million acres that stretch across four states, providing water to nearly 12 million people. A region

*The New York Highlands, as one component of the four-state Appalachian Highlands system, provides invaluable resources to the Megalopolis.*





The New York Highlands abounds with parks, hiking and biking trails, canoeable rivers, lakes, and scenic viewpoints, including many along the Appalachian Trail.



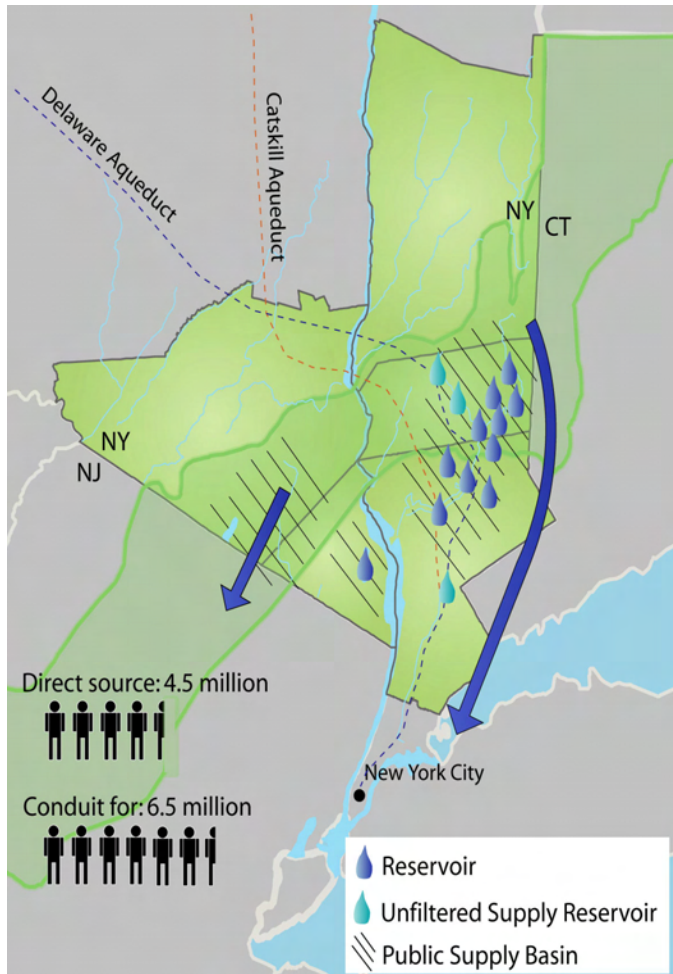
characterized by mountains, forest, streams, and lakes, the New York Highlands offers valuable recreational opportunities to the entire northeastern United States: the New York-New Jersey Highlands alone welcome 14 million visitors annually.<sup>1</sup>

Upland forests, comprising 55% of the land cover in the New York Highlands, are critical to water purification, oxygen production, and carbon

absorption. In recent years, the forest has become increasingly fragmented by development, which threatens the forest's ability to perform ecological functions.<sup>2</sup>

The New York Highlands is a landscape characterized by high elevations, abundant rainfall, and natural

Water originates in protected watersheds further north and is carried south through aqueducts and reservoirs.



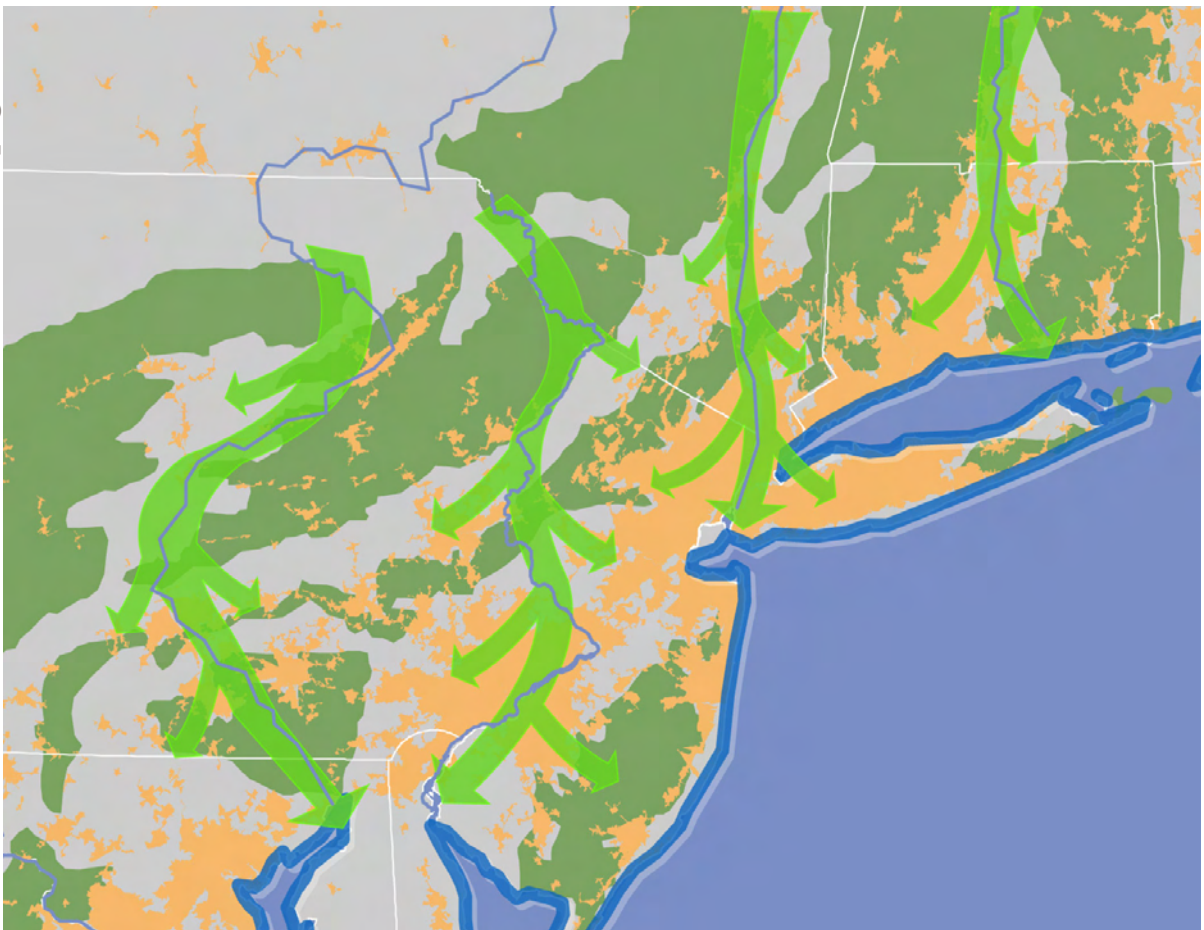
storage basins, making it an ideal source of water for the New York metropolitan region. This ecostructure serves as a conduit for water for 6.5 million people in New York City and surrounding areas. The Highlands also serves as a direct source of water for 4.5 million people in New York and New Jersey.<sup>3</sup> These water resources are at risk due to on-site septic systems and industrial storage tanks leaking into groundwater supplies, and a lack of coordination among political jurisdictions and water management entities. This has compromised the ability of some places to meet peak water demand. Moreover, the Northeast is projected to add 18-20 million additional people in the next 50 years. If current trends continue, development will spread quickly into the Highlands, threatening its natural resources and ability to provide safe, high quality drinking water to the New York metropolitan area.

The New York Highlands provides valuable habitat for 18 animal species and 92 plant species that are endangered, threatened, or "of concern".<sup>4</sup> The U.S. Forest Service has identified fragmentation and alteration of habitat to be the single greatest threat to biodiversity in the region.<sup>5</sup> Additionally, the New York Highlands lies within the path of a major intercontinental migratory flyway. The mountain ridges form a visual guideline for songbirds, and the forests and wetlands serve as resting spots along the way. Two-thirds of the bird species that use the flyway are in decline due to loss of habitat.<sup>6</sup>

In 2004, Congress designated the entire Appalachian Highlands region as an Area of National Significance. The state of New Jersey has protected its portion of the Highlands with the passage of the Highlands Water Protection and Planning Act in 2004. The Act designates certain sections of the New Jersey Highlands to be preserved, while slating other sections to accommodate higher-density, environmentally sensitive development. This act created the Highlands Council and called for the development of a regional master plan. New York, however, has no system in place. The hope is that the New Jersey Highlands Council will serve as a model for the New York Highlands and other unprotected open spaces throughout the Northeast.

European cities like Stockholm have successfully integrated greenways into their urban network.



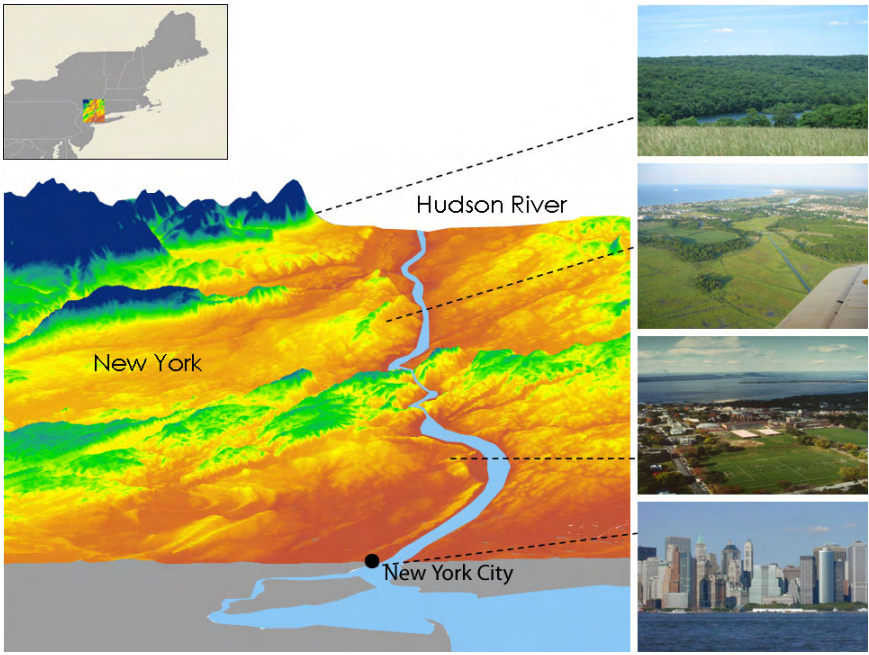


Connecting green spaces to urban places along river corridors is essential to enhancing the Northeast's quality of life.

# Sustainability Strategies for the Northeast

The Northeast can use the five strategies described below to become a greener, more sustainable region while accommodating population growth and economic development.

Land should be protected near source waters and along riparian corridors, such as the Hudson River, to protect water quality for downstream users.



# Strategy 1. Connect Green Spaces to Urban Places

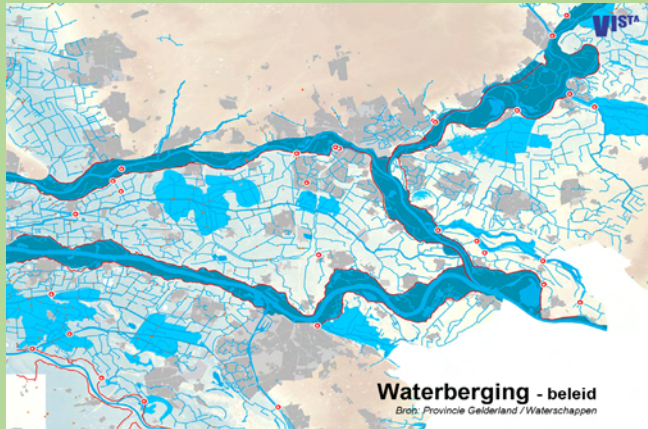
Megalopolis should adopt a new approach to the relationship between the region's eco-structure and the urban landscape. By connecting green spaces to urban places along river corridors and

### London Embraces Clean & Green Identity

Under the direction of Mayor Ken Livingstone, the Greater London Authority has launched a series of initiatives to transform the city into a model of sustainable urban life. The Mayor's Energy Strategy, 'Green Light to Clean Power,' encompasses three goals: to reduce London's contribution to climate change, to increase affordable access to energy, and to promote economic development through renewable, efficient technology. Mayor Livingstone's vision of reinventing London as the world's premier model of sustainable urban life should inspire leaders in the northeast megalopolis to think in similar visionary terms.



## The Netherlands: Creating Space for Nature and Water



Credit: Edwin Von Umm, VISTA

The Dutch Government recently approved the National Spatial Strategy, which maintains that environmental protection and quality of life are key factors in promoting economic development. The National Spatial Strategy emphasizes setting aside areas for green space and water in planning for the development of new homes, employment areas, and amenities. In addition to providing parks in urban areas, the Government also recognizes that regional open spaces around cities can provide recreational opportunities to enhance the quality of life. The Netherlands is also taking a proactive approach to planning for the environmental changes expected from global warming, such as rising sea levels and extreme weather patterns. To this end, the Government has set aside lands to allow rivers to expand without destroying the urban fabric. Moreover, the Government aims to protect and enhance the landscapes for which the Netherlands is well-known, such as the Green Heart of Randstad, which is a network of cities and regions made up of Amsterdam, Rotterdam, The Hague, and Utrecht, that enclose an agricultural “green heart.”

re-greening urban landscapes, we can increase the Megalopolis’s sustainability, competitiveness, and quality of life.

Natural lands and waterways should be considered an integral part of the urban landscape. Connecting large open space systems to urbanized areas and restoring the tree canopy will bring both ecological and economic benefits to the region.

Protecting land near source waters and along riparian corridors is essential to maintaining water quality and environmental integrity for users downstream. Estuaries, shorelines, and harbors must be safeguarded. Coastal waters can play a valuable role in providing recreational opportunities in some of the region’s largest cities.

By introducing more trees to the urban landscape, cities can reduce air pollution levels and stormwater runoff rates while enhancing the visual appeal of the streetscape. In addition, increased vegetation in urban areas will help to reduce the urban heat island effect, which occurs in areas containing few trees or shrubs and large amounts of impervious surface. The urban heat island effect increases the average air temperature in cities, which exacerbates air pollution levels and decreases energy efficiency.

### Regional Greenhouse Gas Initiative

In April 2003, Governor Pataki of New York invited eleven northeast governors to draft an action plan to develop a regional cap-and-trade program to address carbon dioxide emissions in the northeast. In December 2005, the governors of seven of these states - Connecticut, Delaware, Maine, New Hampshire, New Jersey, New York, and Vermont – signed a Memorandum of Agreement to implement the Regional Greenhouse Gas Initiative (RGGI), and Maryland joined the compact in April 2006. This initiative, the first time these states have joined together for a common cause since the Bill of Rights, aims to create a flexible, market-based, mandatory cap-and-trade program to reduce carbon dioxide emissions from northeast power plants. RGGI represents a positive move towards increased interstate cooperation to address sustainability issues in the Megalopolis.

### Strategy 2. Promote Compact Development

Land use patterns that promote compact development, coupled with increased transportation efficiency, will support sustainability initiatives in the Megalopolis. No city in the country illustrates the energy-efficient benefits of density better than New York City. New York City accommodates over eight million residents in 321 square miles, and it is more populous than 39 states. Eighty-two percent of the city’s residents commute to work via mass transit or bicycle, or on foot, which is why the city has the lowest rate of gasoline consumption in the nation.<sup>7</sup>

If the Northeast expects to accommodate an additional 18-20 million people by 2050, decision-makers in the mega-region must explore ways to limit encroachment into sensitive parts of the eco-structure, such as the Highlands, and to promote greater energy efficiency. Philadelphia, for example, contains over 31,000 vacant lots.<sup>8</sup> Urban infill coupled with densification of existing suburban areas will serve to tighten the mega-region’s development patterns while conserving critical open spaces.

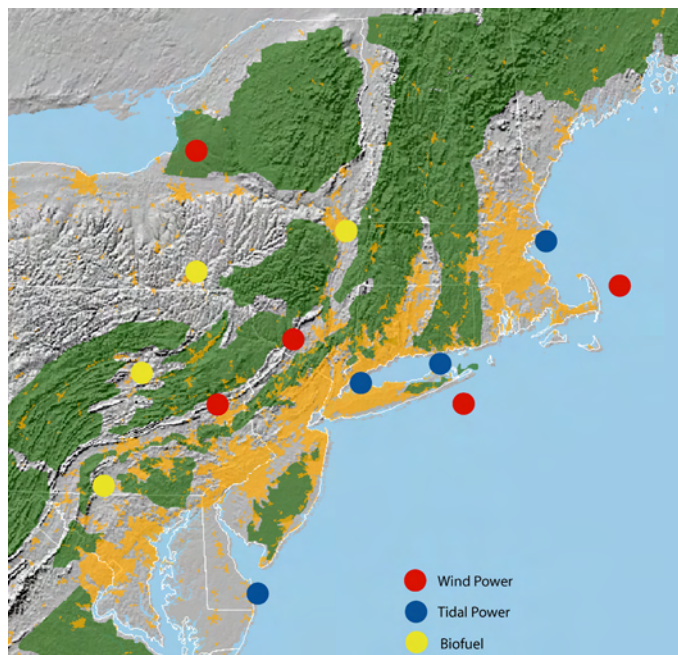
## Strategy 3. Invest in Renewable Energy

### Climate Change

In recent decades, rapid industrialization and heightened deforestation rates have hastened global warming. The burning of fossil fuels emits carbon dioxide and other greenhouse gases, which become trapped in the earth's atmosphere and result in rising global temperatures. The average global temperature rose by 1 degree Fahrenheit in the 20<sup>th</sup> century, while Arctic ice cover has been shrinking at a rate of 9% per decade since the 1970s. Global temperatures are projected to rise 3 to 10 degrees Fahrenheit by the year 2100. Experts expect sea levels to rise 4 to 35 inches by 2100, and for every 1.5 foot increase in sea level rise, coastlines will retreat by 150 feet, threatening low-lying coastal communities. <sup>(9)</sup> As diverse plant and animal species face rapid habitat changes, many will become extinct. Precipitation rates, storm surges, and extreme weather patterns are likely to increase dramatically.

### Energy in the Northeast

In the northeast mega-region, average winter temperatures are slated to rise 4 to 9 degrees Fahrenheit over the next century. These temperature changes will



The Northeast should capitalize on the growing alternative energy industry by investigating strategic locations to site wind farms and tidal turbines, and to grow grass for biofuel.

threaten fragile ecosystems and coastal areas. Winter recreation opportunities and agricultural productivity will decline. Hotter summers will create more smog in our cities, leading to more cases of asthma and heat-related illnesses and deaths. Finally, extreme weather patterns will threaten the region's transportation efficiency and reduce its economic strength.<sup>10</sup>

Twenty-two percent of U.S. greenhouse gas emissions come from the Megalopolis. By reducing the northeast's contribution to global warming and preparing the region to confront the effects of global warming, the northeast can transform itself into the most sustainable part of the nation.

### Renewable Sources: Wind, Tidal, and Biofuel

Renewable sources of energy are becoming increasingly competitive. These sources are infinitely renewable and produce zero or minimal emissions. The northeast is poised to capitalize on the production of wind power, tidal power, and biofuel. These sources of energy can be produced and consumed within the mega-region, keeping money in the local economy and reducing dependence on foreign oil.

#### Wind Power

Unlike other power sources, wind turbines do not consume water. Wind farms provide more jobs per



Credit: www.leica-geosystems.com

### 2003 Blackout



Credit: dmsp.njdc.noaa.gov

On August 14, 2003, a massive power failure spread across parts of the midwest, northeast, and eastern Canada. The largest blackout in North American history, this event affected approximately 50 million people and caused an estimated \$6.4 billion in financial losses to the U.S. alone. <sup>11</sup> Rail and air transportation stalled, financial markets and businesses closed, food spoiled, water pumps failed to operate, and additional emergency services were called. Most important, this event sparked a scrutiny of the reliability and vulnerability of the northeast's power system. According to a joint U.S.-Canadian government task force that investigated the blackout, the outage was triggered by a power failure in Ohio, and exacerbated by "inadequate situational awareness" and a lack of system monitoring. To prevent future economic losses, improvements to the energy system that powers the northeast mega-region must be explored.

dollar invested than any other energy source, more than five times the number created by coal or nuclear power development.<sup>12</sup> Local farmers and landowners can reap a profit by agreeing to host a number of wind turbines on their property.<sup>13-</sup>

Wind power holds enormous potential for local energy production throughout the northeast mega-region. Some estimate that 10% of New York State's electricity usage could safely be generated from wind farms.<sup>14</sup> A wind farm is currently under construction along 12,000 acres of the Tug Hill plateau near Lake Ontario that, when completed, will be the largest wind farm in eastern North America, producing 300 MW.<sup>15</sup> Plans are in development for an offshore wind farm off Long Island.<sup>16</sup>

Although it is a common belief that wind energy is an unreliable power source, wind farms in Denmark, Northern Germany, and parts of Spain regularly provide 20-40% of electric loads with no drop in reliability. Some opponents argue that windmills threaten migrating birds, are noisy, and are a visual blight on the landscape. Studies show, however, that wind farms harm about 1 bird per 30,000. Moreover, modern technology has significantly reduced the noise of wind farms.

If wind farms can be sited to avoid negative visual impacts, much can be gained through investment in wind technology, particularly for the Megalopolis. Wind farms have the potential to be developed along the Atlantic Continental Shelf and along ridgelines.

### Tidal Power

Also known as lunar power, tidal power harnesses the energy of the moon's gravitational pull on the ocean. Historically, hydroelectricity has posed a number of environmental challenges. Today, however, technological advances have produced tidal power



Credit: www.darvill.clara.net

turbines that are sensitive to fragile ecosystems in the new form of the tidal lagoon. These lagoons are offshore impoundments with turbines located in the

lagoon walls. As water enters and exits the lagoon with the tides, the turbines spin and produce electricity. These structures prevent shore erosion and are fish-friendly.<sup>17</sup> This type of structure has operated at La Rance, France, since 1966, and in the Bay of Fundy, off the Atlantic coast of Canada, since 1984.

One of the primary advantages of tidal power is its predictability: tides are regular, consistent,

and can be calculated centuries in advance. The turbines are invisible from the shoreline, and they can be installed in close proximity to the energy-dependent urban areas along the coast. The only concerns associated with tidal power are amassing the upfront capital required for installation costs, and ensuring the mitigation of any ecological issues.

Worldwide, few locations are suitable for tidal lagoons. The Northeast mega-region has the unique position of being one of the only two regions in the U.S. that can capitalize on this opportunity, the other region being the Pacific Northwest. The high tidal ranges found in the North Atlantic offer strong potential for significant power generation. Currently, a pilot project is underway in the East River, the tidal strait that separates Manhattan and Long Island. The New York State Energy Research & Development Authority (NYSERDA) has found that New York State has a potential capacity of 1,000 MW of tidal energy.<sup>18</sup> The best locations for the installation of tidal turbines in the northeast include the areas of strong tidal currents along the East End of Long Island, and along the Connecticut coast. Other sites that have been identified as having strong potential include the Merrimack River in Massachusetts and the Indian River in southern Delaware.

### Biofuel

Various varieties of grass hold significant untapped potential as a source of renewable energy. Grass can be converted into cellulosic ethanol, a form of biofuel derived from



Credit: www.fws.gov

non-food plant matter such as grass or wood chips. Cellulosic ethanol offers a more sustainable approach to energy than its popular counterpart, corn-based ethanol. The production of corn-based ethanol contributes to greenhouse gas emissions because farmers use nitrogen, produced with natural gas, to fertilize corn; in addition, coal and natural gas are used in the conversion process. When compared with traditional gasoline, corn-based ethanol reduces greenhouse gas emissions by only 15%, while cellulosic ethanol reduces emissions by 90 to 95%.<sup>19</sup>

Land in the northeast is well-suited to growing many varieties of grass, which is a dense, fast-growing, low-maintenance crop that does not necessarily require fertilizers, weed management, or tilling.<sup>20</sup> New York alone contains up to 2 million acres of underutilized farmland that could be used for this purpose.<sup>21</sup> Development of a market for this crop for energy production will promote rural economic development and restore

profits to local farmers in the region, while linking energy production and consumption to the local economy. Furthermore, grasslands provide multiple ecosystem services, such as erosion control, wildlife habitat, open space, and scenic views.

Landowners in New York could take advantage of state initiatives encouraging biofuel production. NYSERDA has created an incentive package offering grants to facilitate the construction of biofuel refineries.<sup>22</sup> As the market for biofuel widens in the megalopolis, more farmers in upstate New York and other rural parts of the northeast can capitalize on this resource as an important source of income.

## Strategy 4: Protect Cultural Landscapes

Recently, the field of historic preservation has expanded its scope to look beyond old buildings and museums. There is now growing interest in the resources and cultural practices that are most legible at a landscape and regional scale. This new scale of heritage preservation is commonly called the cultural landscape, which is defined as an interconnected collection of sites—historical, cultural, and natural—that express a shared heritage. Moreover, they are often “working” landscapes that are not relics of times past, but living examples of the evolution and continuity in a community’s culture.

These landscapes hold many values to the region. First, they anchor communities with a sense of place that stems from an area’s heritage. They often hold historical, religious, educational, identity, and scenic values that cannot be quantified. However, if protected and leveraged strategically, these landscapes can provide a sustainable economic base from a mixture of heritage tourism, small-scale community revitalization efforts, and a sense of local ownership through stewardship. For example, in the Hudson River

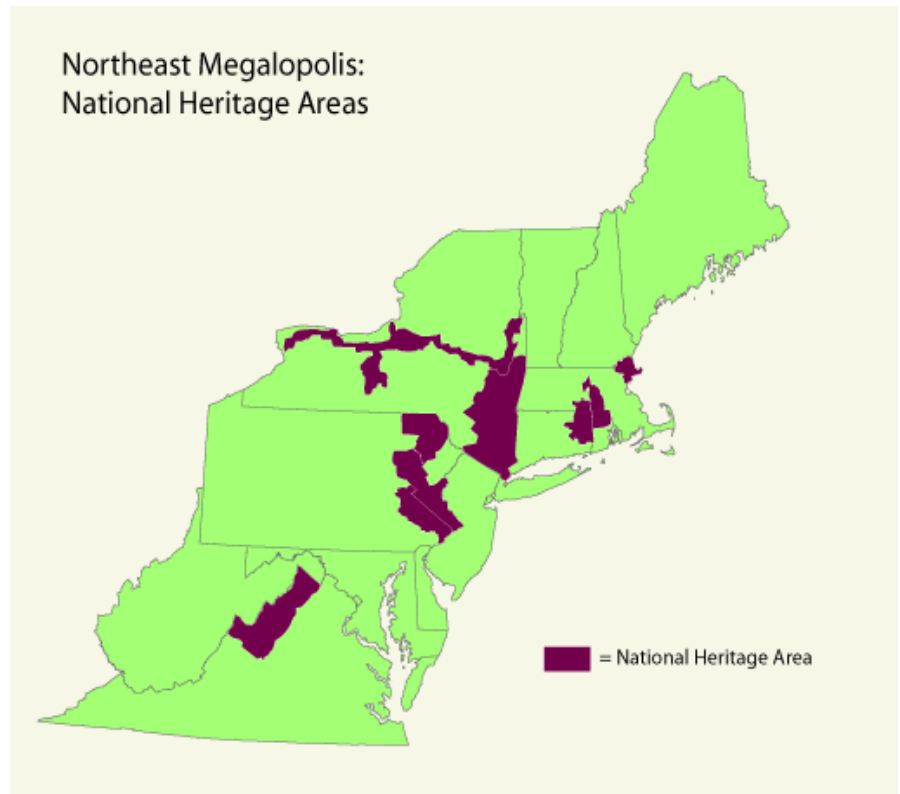
Valley National Heritage Area, visitors to 36 of its 80 official sites spent more than \$300 million in 2005, reverberating throughout the local economy to an estimated \$600 million. If these statistics are to be extrapolated to encompass all eighty sites, the economic benefit to the local communities is estimated at over \$1 billion annually.<sup>23</sup>

### *National Park Service: Heritage Areas and Corridors*

As defined by the National Park Service (NPS), a Heritage Area “is a place designated by the United States Congress where natural, cultural, historic and recreational resources combine to form a cohesive, nationally distinctive landscape arising from patterns of human activity shaped by geography.” Currently, Congress has authorized 27 National Heritage Areas—eight of which are in the Northeast mega-region.

With the National Heritage Area program, NPS created a collaborative, multi-level approach to identifying and protecting these large collections of special places. The National Park Service does not own, nor manage these areas. Instead, a “management entity” leads the planning process for both

*Since the 1990s, Congress has authorized the creation of eight National Heritage Areas in the Northeast mega-region.*



short and long-term initiatives. The goals of the areas vary from place to place, but almost all strive to use local partnerships to create economically sustainable places based on the celebration of community heritage.

The following are examples of best practices from selected Heritage Areas:

**Heritage Tourism:** “Corridor Discovery System,” *South Carolina National Heritage Corridor*. The Corridor Discovery System is a multi-pronged, regional approach to tourism that promotes heritage by helping visitors navigate the resources of the region through a network of visitor centers, interpretative sites, and online travel guides. Since the development

## Iconic Landscapes of the Northeast

With the input of northeast regional National Park Service (NPS) experts, a number of important cultural landscapes for the mega-region have been identified. Because the idea of what comprises a cultural landscape is still evolving, we applied to following criteria to this preliminary selection of landscapes:

*Must still exist and survive with a good amount of integrity;*

*The value and importance of the place can be easily agreed upon by many different types of people;*

*Must be a type of place that is unique or is emblematic to the Northeast and its culture.*

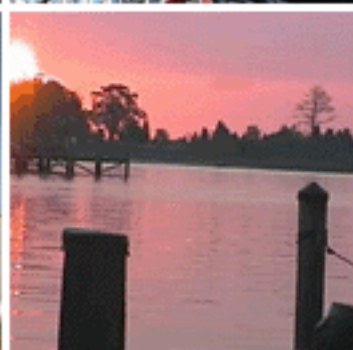


### Primeval Landscapes

- The Adirondacks
- Chesapeake Bay
- Rocky Coast of New England & Lighthouses (Thatcher Island, Great Point Lights, Seguin, Boston Lighthouse)
- Skyline Drive – Eastern Ridge of VA
- “Leaf-peeping” corridors in Massachusetts/ New Hampshire

### Pastoral/Non-urban settlement Landscapes

- Amish Country, Pennsylvania
- Maple Syrup “sugarbushes”
- Long Island North Fork
- Brandywine Valley
- Pioneer Valley
- Dairy farms of Vermont
- Battlefields: Gettysburg/Antietam/Manassas and Lexington and Concord
- Cape Cod
- “The New England Village”
- Martha’s Vineyard/Nantucket



### Urban/Industrial Landscapes

- The Jersey Shore
- Industrial Revolution: Lowell, Paterson, Hopewell Furnace
- New York Harbor: Statue of Liberty/Ellis Island
- Canals: Erie, C&O Canal
- Olmstedian Parks: Central Park, Prospect Park
- Historic Urban Parks: Boston Common and Public Garden, Emerald Necklace, Fairmount Park
- Rowhouse Districts of Boston, Brooklyn, Philadelphia, Baltimore
- Public Markets
- Coney Island
- Universities
- Times Square/Broadway District
- Wall Street
- Chinatowns
- Brooklyn’s Hassidic Jewish neighborhoods
- Harlem
- Colonial Philadelphia
- Washington DC monuments

of the Heritage Corridor Plan in 1996, visitors to the discovery sites increase by an average of 25% every year; grants administered by the Corridor have leveraged over \$30 million in funds for enhancement; and according to a 2005 survey, 89% of the sites report at least a 50% jump in the number of visitors since becoming involved in the National Heritage Corridor.<sup>24</sup>

**Economic Development:** “Progress Fund,” *Southwestern Pennsylvania Path of Progress*. The management entity set up a revolving loan fund for small business ventures related to the National Heritage Corridor that were too risky for mainstream investors. Since its inception in 1997, the program has made 152 loans totaling over \$11.3 million, has provided over 5,200 hours of business counseling, and has contributed to the regional economy by creating or retaining local jobs.<sup>25</sup>

### *A Competitive Advantage*

The Northeast mega-region has both an extensive collection of cultural landscapes and strong preservation and open space preservation movements, giving it both the opportunity and the imperative to protect cultural landscapes. The region’s diverse ethnic history has created a rich palette of areas that are unique not only amongst themselves, but together create the multi-layered heritage of Megalopolis. Because of its small size and dense transportation infrastructure, these areas are easily accessible to people throughout the region. These linkages enable the dense population of the mega-region to easily visit these places, and also to support their protection by volunteering their time and resources. An additional asset to the Northeast is a special niche in heritage tourism. Various studies have shown the strong attraction that many European tourists have to visiting sites associated with colonization from their own countries, of which the Northeast has in abundance.<sup>26</sup> This represents a unique opportunity to capitalize on the rich market of European tourism.

### *Implementation Strategy*

By taking the best aspects from the model developed under the National Park Service’s Heritage Areas program, the Northeast can begin to capitalize on its cultural resources that are currently under-utilized and not currently protected. The very backbone of a heritage area is that it is a local initiative, begun by and for the people of the affected communities.

There are several possible approaches to generating widespread interest in creating Regional Heritage Areas. The National Park Service Northeast Regional Office and the Northeast Regional Office of the National Trust for Historic Preservation could be

partners in determining criteria of regional significance and providing technical assistance. On a local level, it would be essential to gain the input and support of the State Historic Preservation Offices and environmental and recreational agencies in these initiatives. These agencies are knowledgeable at both a regional and local level, and already have relationships with communities to engage them in public meetings and dialogues. Municipal and county governments and councils could also play a part in identifying and protecting cultural landscapes. Federal and state governments could support these efforts by providing seed money, perhaps through revolving funds created for this purpose.

## **Strategy 5: Implement Sustainability Initiatives on Varying Scales**

Protecting cultural landscapes, connecting green spaces to urban places, promoting compact development, and investing in renewable energy sources are initiatives that can be implemented on varying scales within the Megalopolis. While some measures are more appropriately implemented on the Megalopolis level, others will be more effective if achieved through interstate cooperation or local control.

### *Mega-Regional Cooperation*

Although climate change is a global phenomenon and thus best addressed on a global scale, the United States’ refusal to sign the Kyoto Protocol has spurred the northeast mega-region to act. Eight states in the Megalopolis

### **New Zealand: A Dramatic Approach to Sustainability**

In the late 1980s, New Zealand began a massive overhaul of its government structure to refocus national, regional, and local policy on one goal: sustainable management of environmental resources. The reforms received unprecedented support from private business and the civic community, resulting in more public accountability, transparent government processes, and greater civic involvement in planning endeavors. Public sector reforms included the dissolution or restructuring of over 800 governmental agencies, replacing them with three central government agencies, 86 local government authorities, and 74 district or city councils. In addition, 12 regional councils were established according to watershed boundaries. The Resource Management Act of 1991, the cornerstone for New Zealand’s initiatives, replaced 55 environmental statutes and 19 sets of regulations with one piece of legislation encompassing the environment, land use, and natural resources. Broad public support has sustained momentum for environmental management despite political changes in leadership.

are members of RGGI, whose primary focus is the implementation of a cap-and-trade system to reduce emissions through market mechanisms. These states should also consider ways to invest in and promote alternative energy sources in the mega-region. If the northeastern states cooperate to support the installation of wind farms, tidal turbines, and biofuel refineries, the mega-region can transform swiftly into a model of sustainability based on sound public-private investment.

### *Tri-State Agency*

The New York Metropolitan area could become a test-bed for many of these concepts. It has a long tradition of open space, historic preservation and cultural area preservation. It also has a single-purpose, multi-state environmental regulatory planning agency, the Interstate Environmental Commission (IEC), which could seek expanded powers to coordinate environmental and alternative policies and investments across state borders. The IEC was created in 1936 to coordinate environmental clean-up processes for the New York-New Jersey-Connecticut metropolitan region. Currently, the Commission focuses on water and air pollution control, but it has little real authority. Building on this existing organization could allow the tri-state region to work together to protect sensitive ecosystems, invest in renewable energy, and implement a cap-and-trade system that realizes the goals of RGGI. This tri-state agency may also work to coordinate existing and proposed regional land use regulatory commissions in the region.

### *New York Highlands Regional Land Use Regulatory Commission*

The State of New York may choose to adopt a regional land use regulatory commission to protect the valuable resources of the New York Highlands. Various models of successful regional protection efforts stretch across the Megalopolis, ranging from the Chesapeake Bay Program to the Cape Cod Commission. New York may adopt one of two models: the 'top-down' approach, in which the state legislature creates an entity to oversee all land use decisions in the region, or the 'bottom-up' approach, in which existing civic organizations and municipal governments coordinate protection efforts in the region. New York State currently has examples of both models. The Adirondack Park Agency, for example, was created through state legislative action and imposed on local governments in the region. The Long Island Central Pine Barrens and Tug Hill Commissions, on the other hand, were created through collaborative action of municipal governments, and then sanctioned by state government.

A crucial step in protecting the New York Highlands is a thorough analysis of the landscape to identify which lands are most sensitive and which might accommodate limited development. The New Jersey Pinelands

Commission, the New Jersey Highlands Council, and Long Island's Central Pine Barrens Commission all set up a 'protection area' and 'growth area' in their regions to prioritize protection needs. This model recognizes that channeling growth to appropriate areas is essential to promoting local economic development. An incentive-based approach that encourages economic development and smart growth, modeled after the emerging regional conservation strategies of the New Jersey Highlands Council, could ensure that environmental protection does not come at the expense of growth in designated development areas in the region. A New York Highlands Commission could also implement a regional transfer of development rights (TDR) program, which would allow landowners in designated preservation areas to earn a profit from the sale of development rights to their properties. A TDR program provides the opportunity for these landowners to sell the rights to develop their land while permitting landowners in the 'growth areas' to build at a higher density by buying these development rights. Both the New Jersey Pinelands and the Long Island Pine Barrens offer successful models of TDR programs.

Land acquisition is a necessary element of any environmental protection program. A land use regulatory commission for the New York Highlands must prioritize land acquisition depending on the ecological or water resource significance of each parcel and the degree of development threat. Fee

simple acquisition, can be used to protect the most significant and threatened sites while purchase or transfers of development rights can be used to ensure permanent protection of other sensitive lands.

Finally, this commission should recognize the grassroots support that exists for protection of the Highlands. By uniting a diverse set of local interests under the umbrella of a regional entity, a regional commission for the New York Highlands could benefit from the resources of existing organizations, such as the Highlands Coalition, and ensure long-term political support for protection efforts. The Tug Hill Commission and the Finger Lakes Initiative, both located in upstate New York, exemplify successful intermunicipal cooperation for environmental protection. Ultimately, the entire four-state Highlands region should consider increased cross-border cooperation that draws on existing protection efforts throughout the region.



Over the past 350 years five large metropolitan regions and a network of smaller urban centers have emerged to provide a framework for the economic growth and development of the Northeast Mega-region. Throughout this history, new forms of transportation have shaped cities of the Megalopolis. Until the early 19th Century, there were limited options for mobility other than shoe leather or animal power, and cities were compact and dense by necessity. When trolleys and trains became a viable form of transportation, the city began to develop along fixed radial patterns along side the trolley tracks and development became concentrated around train stations. In the late 19th Century, the combination of mass transit, elevators and steel frame building construction technology made possible the emergence of some of the world's first high-rise cities in places like Lower Manhattan, Boston's Financial District and Center City Philadelphia.

The Eisenhower era ushered in the interstates through our cities altering the environment and structure. The automobile has continued to define our urban fabric as the need for parking has dominated planning and urban design decisions in many of our center cities. Due to early patterns of settlement of growth prior to World

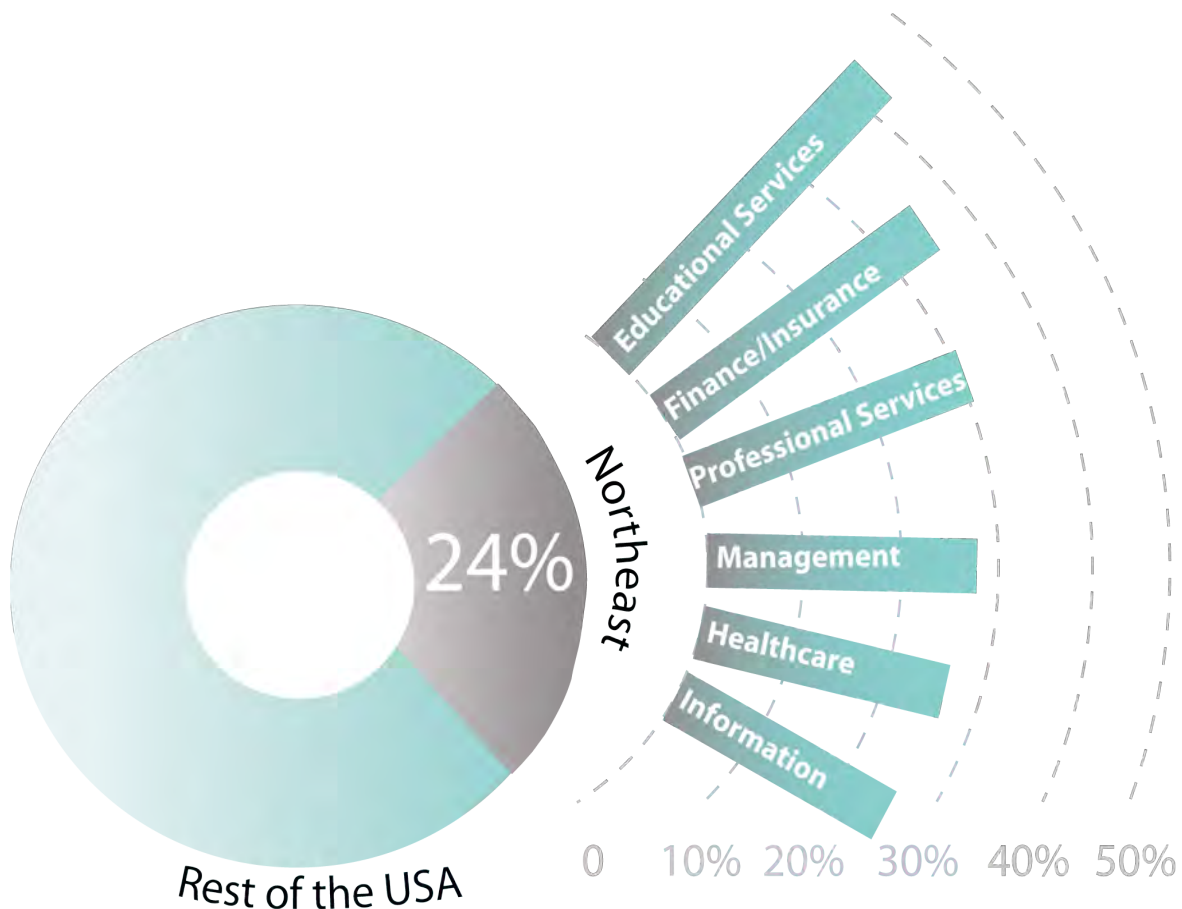
# Economy

War II, the cities of the Northeast have remained some of the nation's strongest urban centers and the richest in terms of inter-modal transportation.

The built environment of the Northeast is dense with strong transportation networks. The history of our region has shaped the patterns of growth creating a physical layout and built environment conducive for smart business. The built environment was re-shaped by the post-World War II era, altering the physical layout by the introduction of highways; much in the same way most of the Mega region will be enabled and shaped by high-speed rail.

## Current Conditions

The Northeast has long been recognized as an engine for of the United States' economy. At 3.2 trillion dollars, it comprises more than a quarter of the U.S. GDP, making it the third largest economy in the world after the US and Japan<sup>1</sup>. Even more remarkable is that it is a relatively small mega-region, taking 7% of the country's land area.<sup>2</sup> To put it in perspective, this is approximately the size of France. The result is the highest concentration of wealth and population in the United States, and in the world.

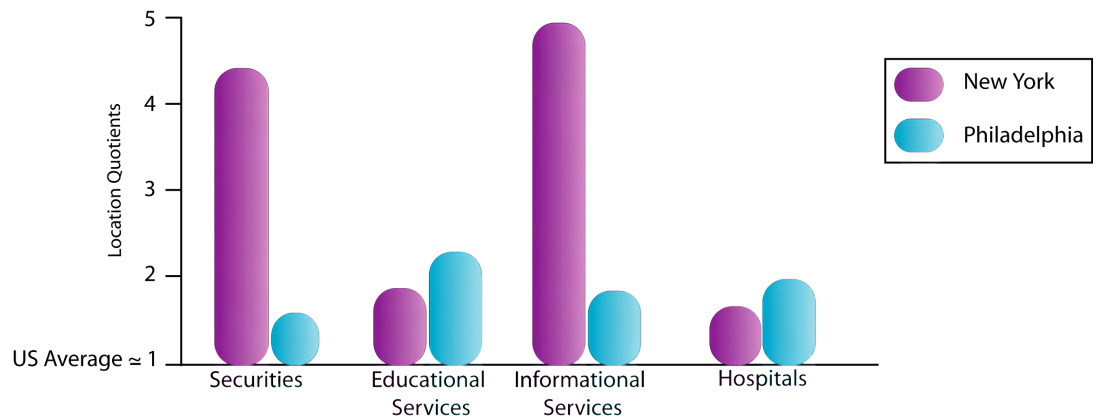




Concentration of capital and workforce creates strong central business districts, cheaper and quicker forms of transportation and greater capacity for industrial clusters to form<sup>3</sup>. This pattern of development generates a rich urban fabric and a business climate highly sought after by “smart job” sectors, businesses that require a workforce with a high level of educational attainment and deal with innovative research and the generation, dissemination and utilization of knowledge. The Northeast’s strongest job sectors fall into this category. The top industries, FIRE (finance, insurance and real estate), Health Care, Educational Services, Information and Professional/ Technical Services, are all industries grounded in the knowledge-based economy.<sup>4</sup> This poses an opportunity for the region as the U.S. economy shifts further from low-tech manufacturing and towards the knowledge-based manufacturing and service sectors.

Because of its density, transportation networks and high-profile business districts, the Northeast is capable of catering to businesses that require extensive face-to-face interactions. More than half of all Fortune 500 companies and more than 10% of Global 500 headquarters are located in the Northeast, with a disproportionate number of those located in New York, by far the densest U.S. city in terms of population and wealth. More than 90% of the top FIRE firms, for example, are headquartered in

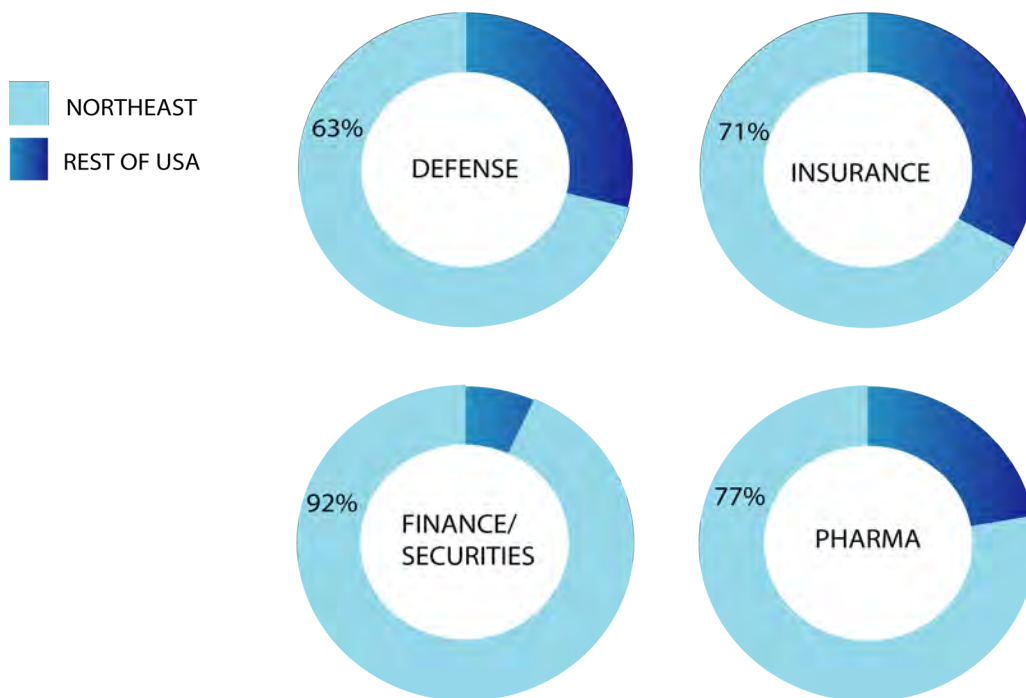
Location Quotients for Top Job Sectors



Manhattan.<sup>5</sup> This is an advantage for the region as face-time becomes increasingly important in an increasingly dispersed global market; studies have shown that physical proximity to other like-businesses and capacity to meet in-person is a critical element in fostering regional competitiveness.<sup>6</sup>

## Economic Integration

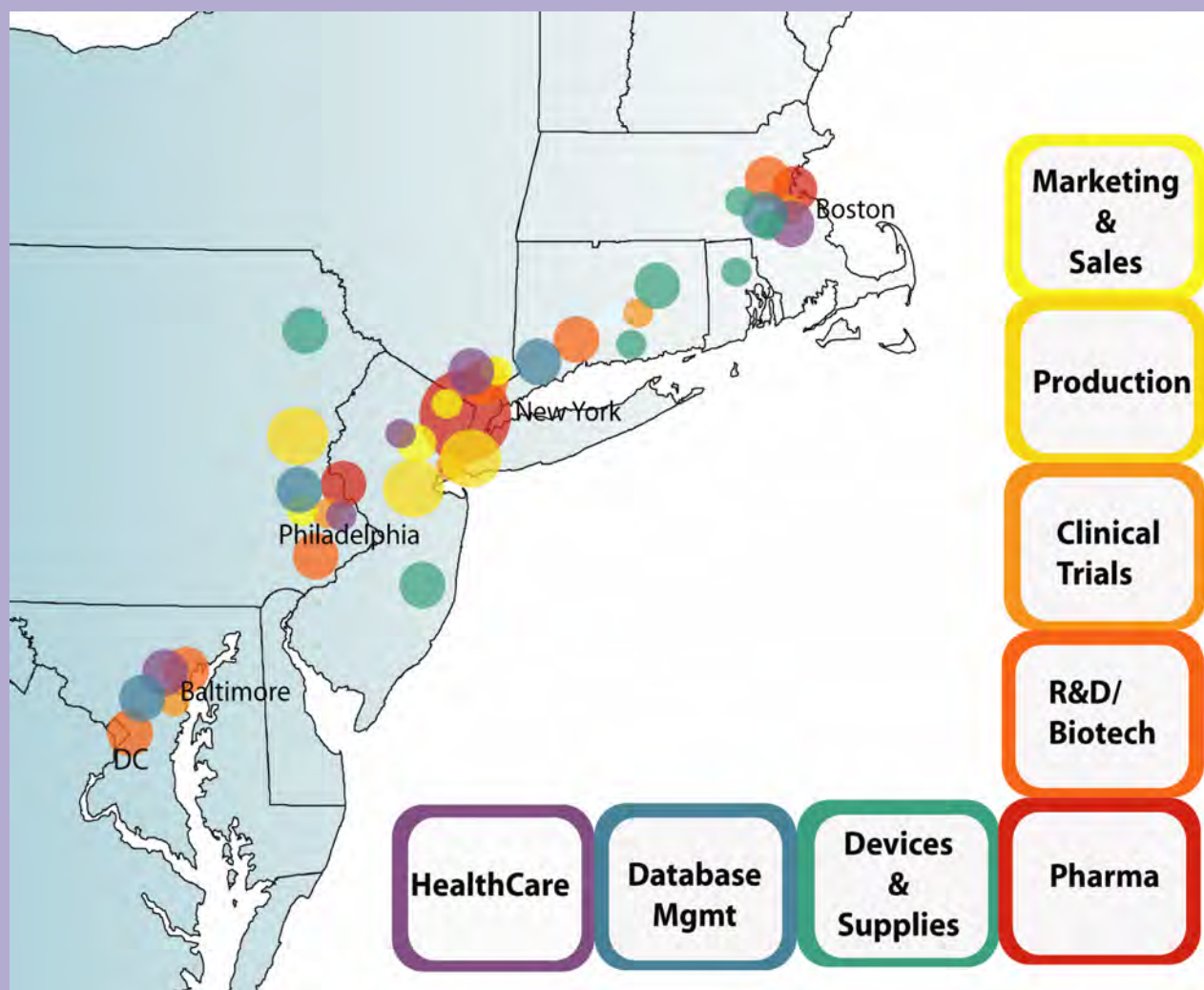
A cluster is defined as a concentration of similar companies and industries in a geographic region that is interconnected by the markets it serves, shared business channels and common suppliers, as well as common educational institutions and affiliated supportive companies.<sup>7</sup> They develop naturally as a means to increase competitiveness and innovation while lowering costs of transportation and labor. For example, the leading cluster in the Silicon Valley, information technology related services, developed around innovation in computer hardware and software companies, which attracted supportive venture capital firms and related electronics R&D companies. Fostering the growth of existing clusters is a critical enabler for economic growth, which expands the network of labor and knowledge that creates innovation.



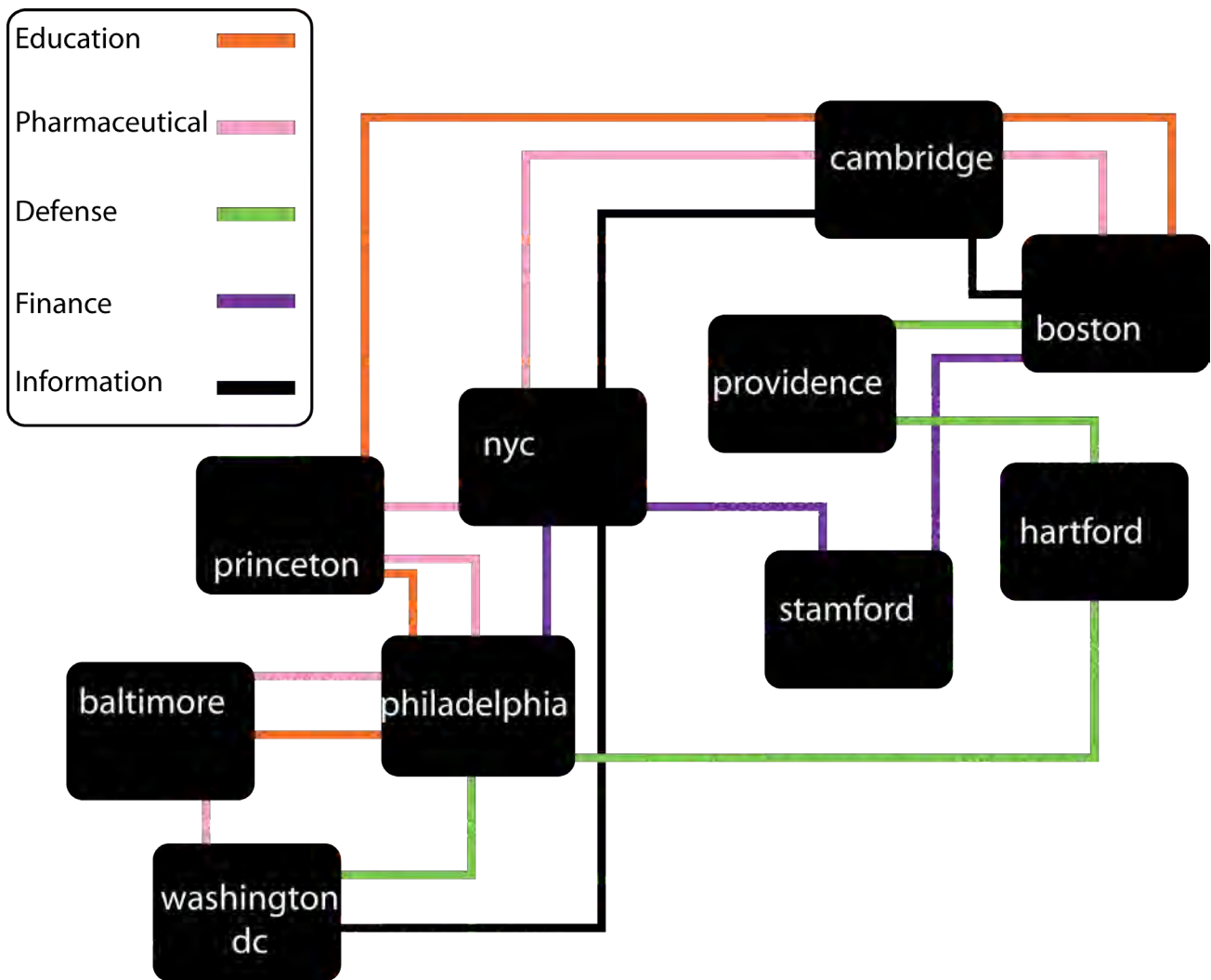
Despite their varying degrees of economic performance, the five largest cities in the Northeast – Boston, New York, Philadelphia, Baltimore and Washington D.C. – have remarkably similar industry strengths that can be built upon to form mega-regional clusters. The region shares a common infrastructure, economic history, financial markets and educational institutions. Most notably, the Northeast has a shared geography, stretching more than 500

## Northeast Pharmaceutical Cluster

The pharmaceutical and medical cluster is one of several leading economic sectors with the potential to take advantage of mega-regional scale. It has the unique advantage of having the largest agglomeration of pharmaceutical firms in the world, four of the top ten biotechnology clusters in the country, access to the necessary venture capital and strong clusters of chemical manufacturing, insurance, medical device manufacturing, hospitals and research institutions.<sup>8</sup> In addition, the industry has the added advantage of reorganizing its vertical and horizontal structure in such a way as to promote greater diversification across a larger geographic area. Where previously large pharmaceutical firms held a majority of their operations in close proximity to headquarters, now certain functions are located in areas that have improved access to resources, workforce and lower cost. For example, independent biotechnology firms are now generators of new drug patents. Successful biotechnology clusters tend to locate near strong universities and venture capital markets, not pharmaceutical headquarters. Other trends include the outsourcing of drug marketing and clinical trials. As a result of these trends, a new economic geography has emerged, in which this whole industry and its network of interconnected firms and job sectors are distributed over the Megalopolis. This geographic dispersal has an underlying connection based on shared infrastructure, resources and labor force that bind it to the region.



*The vertical and horizontal intergration of the pharmaceutical and medical industry cluster.*



miles along the Atlantic Coast, bounded by the Ocean to the east and the Appalachian Range to the west, and linked by the Interstate-95 and the Amtrak Northeast Corridor rail network. Common economic history and geography has led to a common set of opportunities and challenges determining the economic fate of the region.

While until now there have been no coordinated efforts to address economic development at this scale, the Northeast as a whole is in a position to coordinate its economic similarities and join together to nurture its strengths. Many of the necessary ingredients to forge synergies between metropolitan areas exist and provide an unbounded opportunity for growth. The region has the capacity to foster interconnectedness of firms through its specialized labor markets, shared educational institutions and common transportation systems. By combining markets, the region can reach a greater potential in terms of its position in the global economy.

## Economic Challenges and Opportunities

Despite the strength of pharmaceuticals and its other key industry clusters, the Northeast faces increasing competition from regions both in the United States and around the world. The Northeast's economic growth rate since 1997 is slower than several other U.S. mega-regions, particularly the fast growing areas of Southern California, the Bay Area, Cascadia and the Sun Corridor. The Northeast's growth is also much slower than that of several of its international competitors. China's GDP is growing twice as fast as the U.S. and is now the 6<sup>th</sup> largest global economy, with its growth driven by the Yangtze and Pearl River mega-regions. Europe poses another threat. Although the European Union's growth rate is still significantly lower than the U.S. at 2.2%, with further integration of the member state's economies and a high level of investment capital available, growth rates may jump over the next decade.<sup>11</sup>

In his bestseller *The World is Flat* (2005), Thomas Friedman argues that the advent of the digital age and the subsequent expansion of global markets have begun to level the playing field. Despite the balancing



\*www.sauer-thomson.com

out of comparative advantage, however, the Northeast and other prosperous mega-regions retain a number of important economic assets that make these “mountain ranges” in a “flatter” world. The Northeast has some of the world’s largest urban centers, which provide its concentration of executive, professional, and knowledge-based job sectors with valuable face-to-face interactions. It is home to some of the best educational and research institutions in the world, which attract, train and help retain a highly skilled workforce. The mega-region is further enhanced by being home to many of the best in America and an unrivaled ethnic diversity.

However, the Northeast has to take steps to prevent erosion of these assets. A number of both first and second-tier Northeast cities are continuing to lose population and jobs to their sprawling suburbs and to other regions in the U.S. and overseas. This decline is further aggravated by concentrations of poverty, racial divisions and competition among municipalities for tax base, all of which leave many of these cities under-funded and unable to provide basic services. Housing prices are escalating and existing transportation networks are becoming outdated and congested. With a predicted population increase of 18 million people and a lagging economic growth rate compared with other US mega-regions, more proactive strategies are

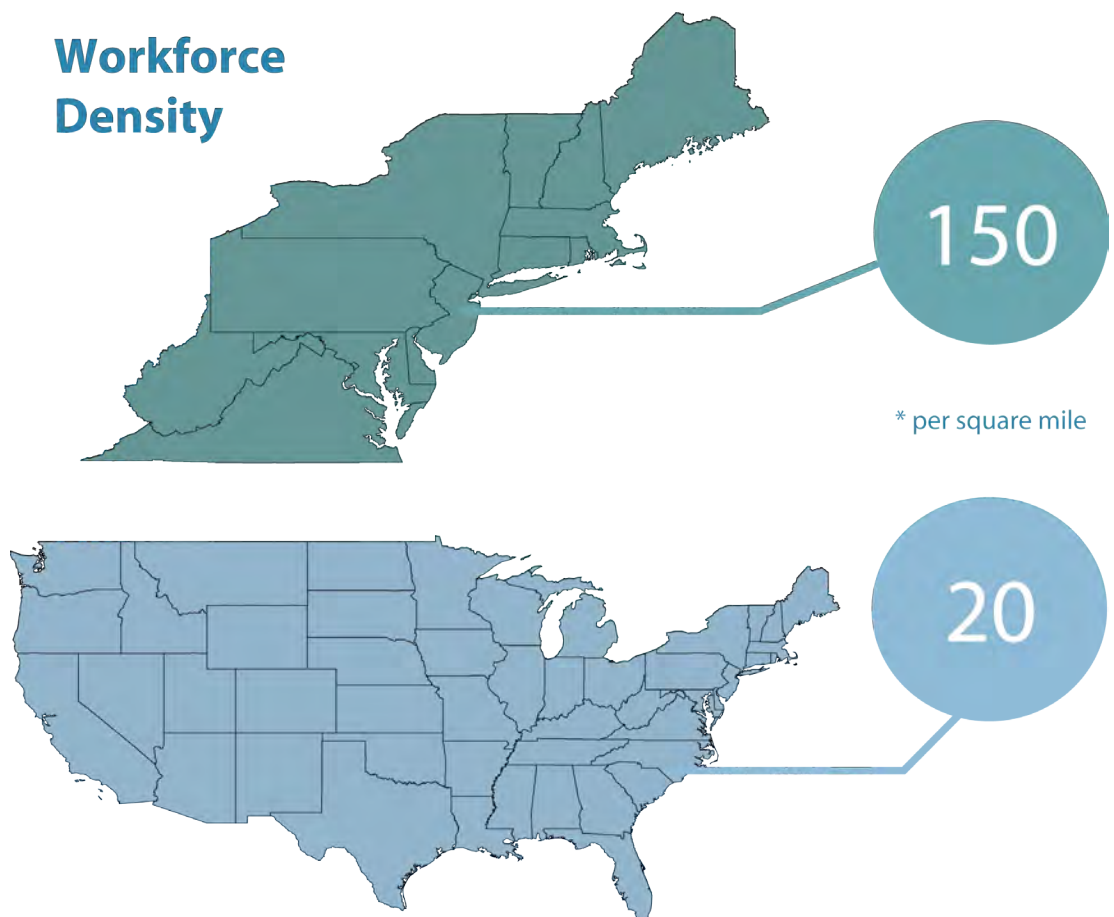
needed to secure the region’s long-term success in an increasingly competitive global economy.

## Business

Businesses perform well in the Northeast because of its extensive transportation networks, agglomeration of companies, the strength of its research universities and highly educated workforce. The population density in the Northeast provides an immense pool of labor. The Northeast Mega-region has 150 people in the labor force per square mile, compared to a United States average of 20 people per square mile.<sup>10</sup> Businesses are attracted to access to labor. The population density allows businesses to reach broader markets and they can therefore attract higher-skilled and better-trained workers.

Despite these advantages, however, a recent national business location survey assessed costs of labor, energy, taxes and office space, and found that of the top ten “Best Places” only one, Washington D.C., is located in the Northeast Mega-region<sup>11</sup>. The top ranked metro areas have significantly lower costs for businesses than most metro areas in the northeast. For example, Atlanta, Georgia has the lowest business costs for a metro area with a population above 4 million.

While headquarters continue to agglomerate in the Northeast, production plants, research facilities and back office operations have become more dispersed.<sup>12</sup>





Credit: <http://e-commerce.nsta.org>

## Hartford, Connecticut

Historically, Hartford was known as a major industrial outpost of the Northeast. While in post-industrial decline, Hartford reworked itself by attracting a cluster of insurance firms, and other Fortune 500 companies. Hartford Financial Services, the Phoenix Company, and United Technologies (UTC) are all Fortune 500 companies headquartered in Hartford. United Technology is the second largest aerospace and defense company in the United States. According to Forbes Magazine (2004), Hartford is listed in the “Best Places for Business and Careers.” However, in recent years, Hartford lost 11.5% of its job base while its suburbs increased by 3.3%, as many insurance and other firms relocated outside the city.<sup>13</sup>

Hartford serves as an example of a cold city in the Northeast mega-region. In addition to its job loss, Hartford faces population loss, racial tensions, low housing values, high crime, and high concentrations of poverty. The wealthy suburban areas surrounding Hartford reveal the exodus of wealthy residents. The people that work and run the Fortune 500 companies located in Hartford do not live in Hartford but in its suburbs. Hartford’s population decreased by 14% between the years 1990 and 2000, which is the largest population decrease of any city in Connecticut. In the year 2000, almost 30% of Hartford’s population was below the poverty line, making it the second poorest city in the country.<sup>14</sup>

Hartford is taking steps to rebuild the amenities and livability of its downtown and neighborhoods, after many unsuccessful previous efforts. A new convention center and downtown housing loft conversions are bringing 24-hour activity and new middle-class residents to downtown. In addition, a number of “stranded institutions” including Trinity College, Hartford Hospital and others are working together to rebuild the City’s South End and Frog Hollow neighborhoods. These important first steps should be matched with additional regional and state efforts to stabilize Hartford’s tax base and failing public schools if Hartford is to return to economic health.

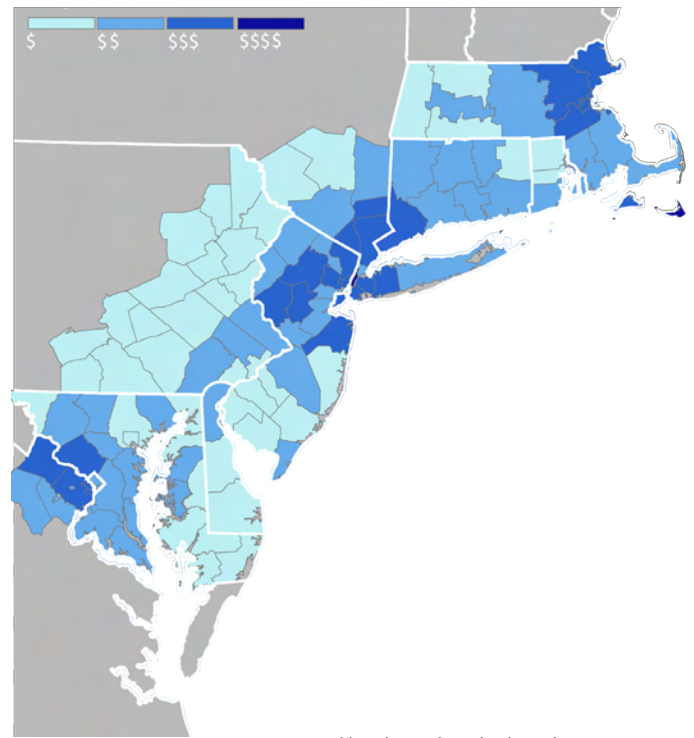
Hartford has a unique opportunity because it is located equidistant from both New York City and Boston. At the moment, however, with trips to these places by rail and automobile taking more than two hours, daily commuting travel to both of these places is inconvenient. The State of Connecticut is now proposing to extend commuter rail service from New Haven north to Hartford and Springfield, MA. This service would permit more frequent, lower cost one-seat-ride trips to the employment centers of Fairfield County and Manhattan. If the Northeast had high-speed rail services similar to those in Europe and Asia, Hartford would be pulled into the economic orbit of New York and Boston, which could transform its economic prospects.

Lower skilled jobs continue to move to the South or overseas simply because production costs less, and therefore allows the firm to increase competitiveness. Rival firms continue to follow suit to remain in the game, and the search for cheaper means of production becomes cyclical.<sup>15</sup> Companies that require a highly skilled workforce are attracted to areas where the workforce want to live, in more affordable and/or warmer climates that offer a high standard of living. Because of this tradeoff, firms can often attract this highly sought-after labor pool for a lower salary. Additionally, businesses in the Northeast face high taxes, high real estate prices, congested outdated infrastructure and expensive labor, while metro areas in the southwest boast low taxes, modern infrastructure, cheap land, growing populations, and low costs of living and labor.

Despite these obstacles, the Northeast continues to attract and retain highly skilled managerial, executive and professional workers and the industries that depend on them. In order to continue business growth, the challenge is to break down these barriers and attract an even greater share of these highly skilled jobs and their accompanying industries.

### Housing

The Northeast Mega-region has a diverse housing stock, ranging from the nation's densest urban neighborhoods in Boston, New York, Philadelphia and Washington to inner ring suburban areas to sprawling exurbs. The Northeast's center cities provide an array of housing styles from historic row-house districts to high-rise modern apartments. Suburban and exurban areas surrounding these urban cores provide a variety of housing opportunities, including large-lot subdivisions and Main Street-style apartments.

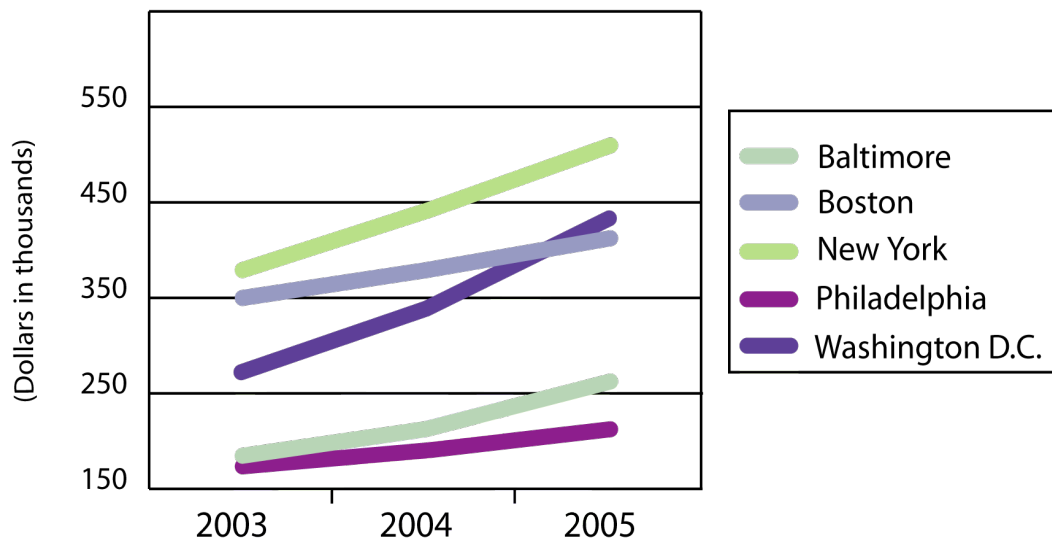


Housing values in the urban core area.

Housing costs in some parts of the Northeast Mega-region are becoming increasingly unaffordable, particularly in strong market cities and suburbs. Housing prices vary widely between the Northeast's metropolitan regions. For example, prices in Philadelphia are much lower than Washington D.C. Better integration among housing markets, for example, through High Speed Rail links that shorten travel times between urban centers could enable more equity and housing options for all income levels.

Often, affordable homes are located in areas considered undesirable due to high crime, concentration of poverty, and racial segregation. However, areas in close proximity to many of the Northeast's high priced markets, for example, Central Brooklyn, West Philadelphia or Southeast Washington, are becoming gentrified and losing their affordability.

### Median Single Family Housing Prices

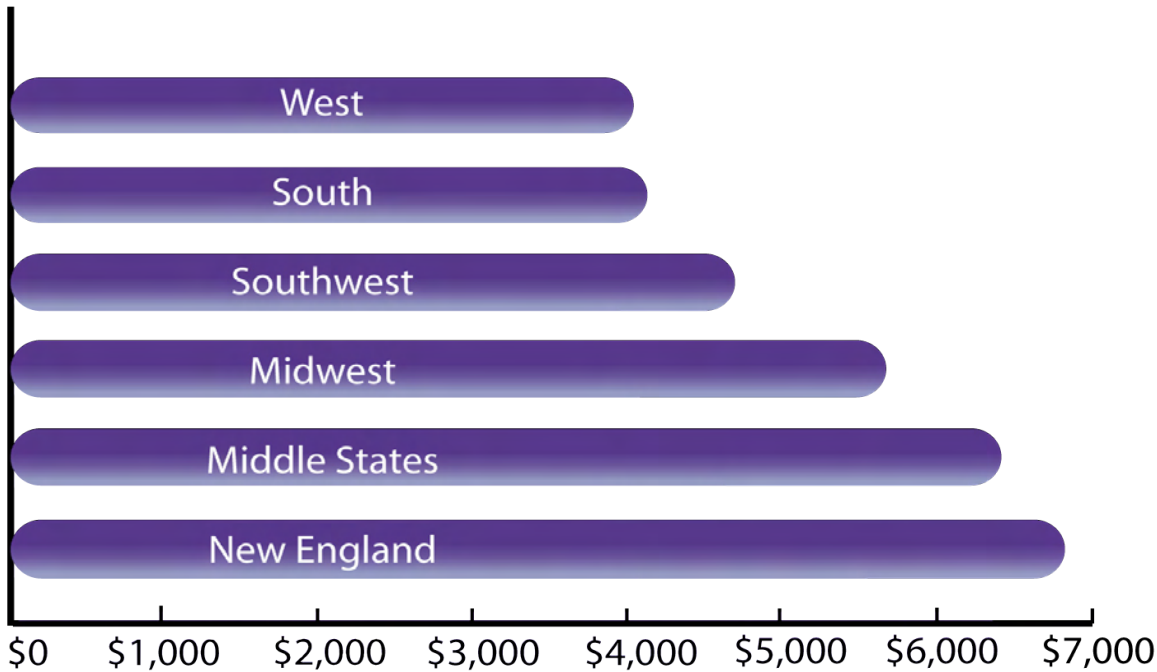


Source: National Association of Realtors, 2005

### Education

The northeast's top universities attract some of the brightest students in the world, many of whom chose to remain in the mega-region following graduation. According to the annual survey by US News and World Report (2006), eight of the top ten universities are located in the Northeast Mega-region. These institutions have achieved

## Public College & Universities: Average Cost of Tuition and Fees by Region



\*Middle States are defined as NY, NJ, PA, DE, MD

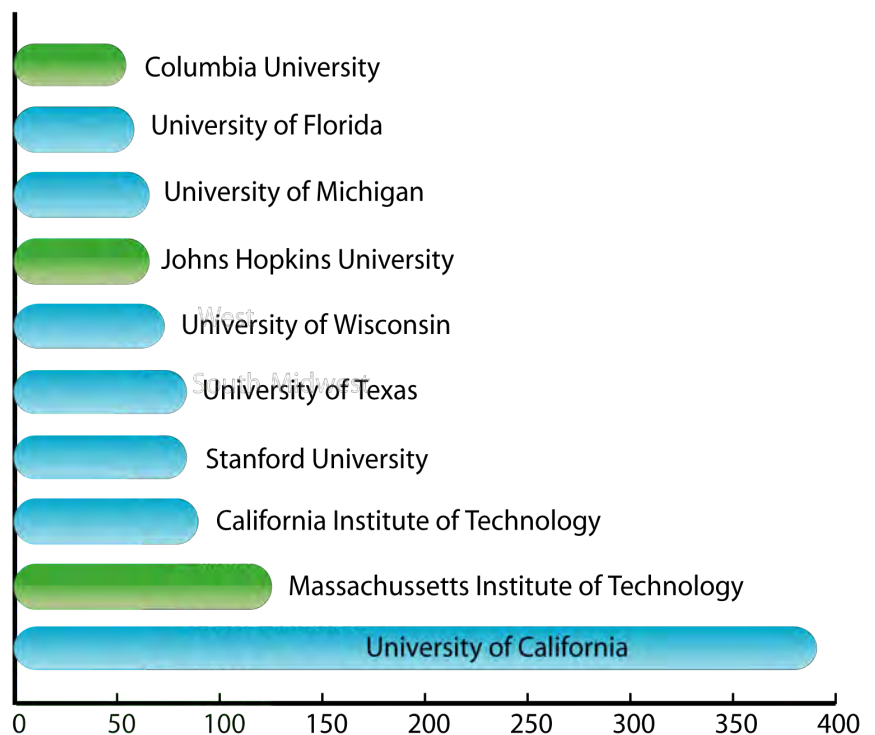
Source: The College Board, 2004-2005

international acclaim as well: 7 of the top 20 research universities in the world are in the Northeast according to a study performed by Shanghai Jiao Tong University.<sup>16</sup> As a result of this remarkable strength, about 40% of all U.S. research and development funding is awarded to northeast universities.<sup>17</sup> This is an important element to creating interactions between education and the workforce, which helps maintain students in the northeast after graduation.

However, university education is becoming increasingly expensive in the United States. Public universities in the Northeast mega-region are more expensive than other regions, which indicate that other regions give more state support to their public college systems than the Northeast. California, for example has an excellent public university system that has the lowest average cost of tuition and fees in the United States.<sup>18</sup> In addition to their low cost, they are becoming increasingly competitive by attracting more investments and grants. The California public university system obtained significantly more patents than any other state University system in the country.<sup>19</sup>

Only three of the top ten universities receiving patents for inventions during the 2003 calendar year are located in the Northeast Mega-region.<sup>20</sup> Patents represent the collaboration between universities and the market.

### Universities Receiving Most Patents



Source: United States Patent and Trademark Office, 2005

They translate the research and knowledge acquired at universities into an economically viable or wealth-generating product that brings innovation and creativity to the market.

page **Infrastructure**

**Economy** Major investments should be made to improve infrastructure and existing amenities in the Northeast's center cities in order to strengthen their economies and reduce over-concentrations of poverty. Investing in faster and more efficient transportation connections to move people and goods between these cities will enhance business development in weak-market cities. Strong cities stand to benefit as well, with these links better enabling their businesses to take advantage of lower cost rents and pay scales in these underutilized locations.

**Beyond Borders**

Global advances in transportation and the speed of exchanging information have expanded and broken through boundaries, allowing new communications and connections to be forged. In Europe and Asia, regions are working across long established national borders on joint transportation and economic development strategies, and the Northeast must take similar measures. New York and New Jersey, for example, have the opportunity to collaborate on key infrastructure and economic development investments, such as the proposed new trans-Hudson passenger rail tunnels and rebuilding of the World Trade Center site. The entire region must work collectively to compete, drawing upon our unique strengths, in order to retain our comparative advantages in a fast evolving global market.

New collaborations across borders could be led by different sectors. Governors, for example, or state transportation commissioners, could lead efforts to reform Amtrak's Northeast Corridor, or promote high-speed rail service. Members of Congress from the mega-region's 14 states could do likewise. With 28 U.S. Senators, the Northeast has the potential for enormous political influence if its states and congressional delegations can find common ground. Business and civic leaders could also collaborate across political borders on transportation and economic development concerns, as they are starting to do in the Southeast's Piedmont Atlantic Mega-region.

**Education**

In the changing global market, there is an increasing gap between the skills the workforce possesses and the skills required and demanded by growing job sectors. Integrating the job demands of growing sectors with education and workforce development will serve to plug the gap. Businesses should take direct action to determine exactly what skills they require and then invest in training programs for those skills. In Southwestern Connecticut, for example, CTWorks Centers provide services to the under- and unemployed, as well as customized services for businesses that include matching jobseeker skills to business needs. Universities should expedite the transfer of new technologies to the marketplace. Yale, for example, has entered into joint ventures with companies to deploy new technology developed at the University, attracting \$1.5 billion in new investments and creating 29 start-up companies.<sup>21</sup> Another model is MIT's Draper Labs in Cambridge, Massachusetts, a research and development lab specializing in defense systems. Draper runs educational programs for students at Massachusetts Institute of Technology, which not only advances technology but also creates new highly skilled potential future employees.<sup>22</sup>

Credit: <http://www.yale.edu>





## Second Tier, Not Second-Class: The Success Story of Stamford, Connecticut



Credit: <http://www.views.com>

In addition to the large metropolitan areas that are the principal focus of this report, the Northeast also includes dozens of second-tier cities, the success of which will be critical to the success of the larger megalopolis. The experience of one of these smaller cities, Stamford, Connecticut, illustrates the kinds of strategies and investments that might be used to improve the competitiveness and livability of second-tier cities across the Northeast.

Stamford, Connecticut experienced the same Post World War II de-industrialization that has affected virtually all of the Northeast's second-tier cities. But Stamford succeeded in reinventing itself as a post-industrial center, first as a major corporate headquarters center and then as a major financial services center. Today, Stamford is home to the headquarters of Pitney Bowes, Xerox, UBS Warburg, GE Capital and recently, Royal Bank of Scotland's US Headquarters. Stamford achieved this success through a combination of geography, good business and political leadership and strategic investments in transportation and downtown redevelopment. It attracted these companies with a large and successful downtown redevelopment plan and a major and continuing major investment by the State of Connecticut in its Metro-North Commuter Rail service to Manhattan. Stamford has been helped by its location in Fairfield County, one of the wealthiest counties in America. As housing prices have risen in surrounding suburbs, Stamford's attractive residential neighborhoods have also increased in value. And suburban restrictions on multi-family housing have also pushed large segments of the County's middle and upper-middle income households into Stamford.

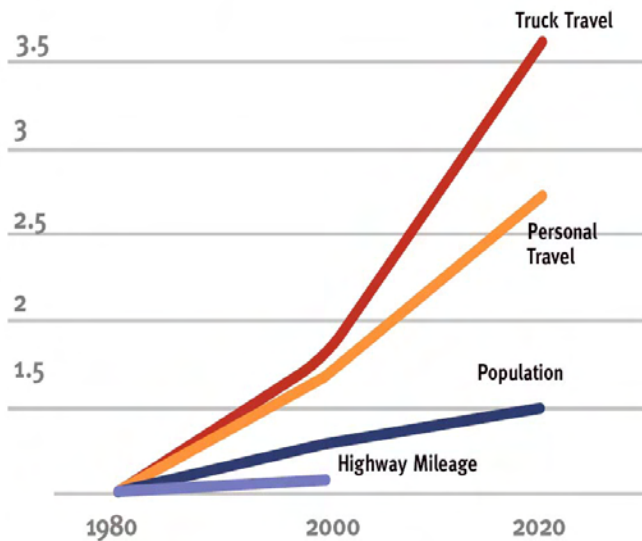
Stamford capitalizes on its proximity to New York City, and its 45-minute Metro-North commute to Midtown Manhattan, which contains the nation's largest concentration of managerial, executive and professional jobs and workers. This convenient service brings tens of thousands of Stamford residents to work in the city, and also brings employees from New York to Stamford's growing downtown business district – an important factor in the decision by many employers to locate there in the first place.

# Transportation

## Current Conditions

The transportation system of the Megalopolis links its disparate metropolitan areas into a larger whole, yet this system is not designed to function as an integrated, intermodal network. As the region and its economy have grown, this system has become increasingly congested and unreliable. Projected rapid increases in traffic volumes in the Interstate Highway corridors and airports will further compromise the ability of this system to meet the Northeast's accessibility and mobility needs.<sup>1</sup> This report focuses on one critical component of a broader Megalopolis transportation strategy: improving rail service in Amtrak's Northeast Corridor leading to phased development of High Speed Rail (HSR) service between Boston and Washington, DC.

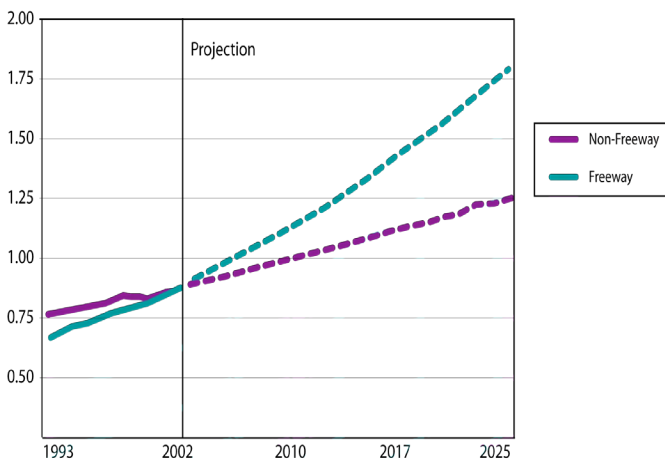
### Travel Projections, 1980-2020



Source: US Department of Transportation

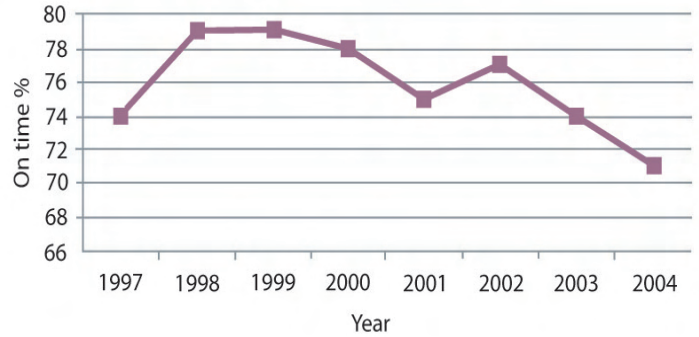
Traffic congestion and vehicle miles traveled (VMT) are projected to increase.

### Growth of VMT in NE Region Mega-Region (Index, 2002 = 1.0)



Source: Estimated from Highway Stats, FHWA

### Amtrak Systemwide On-Time Performance



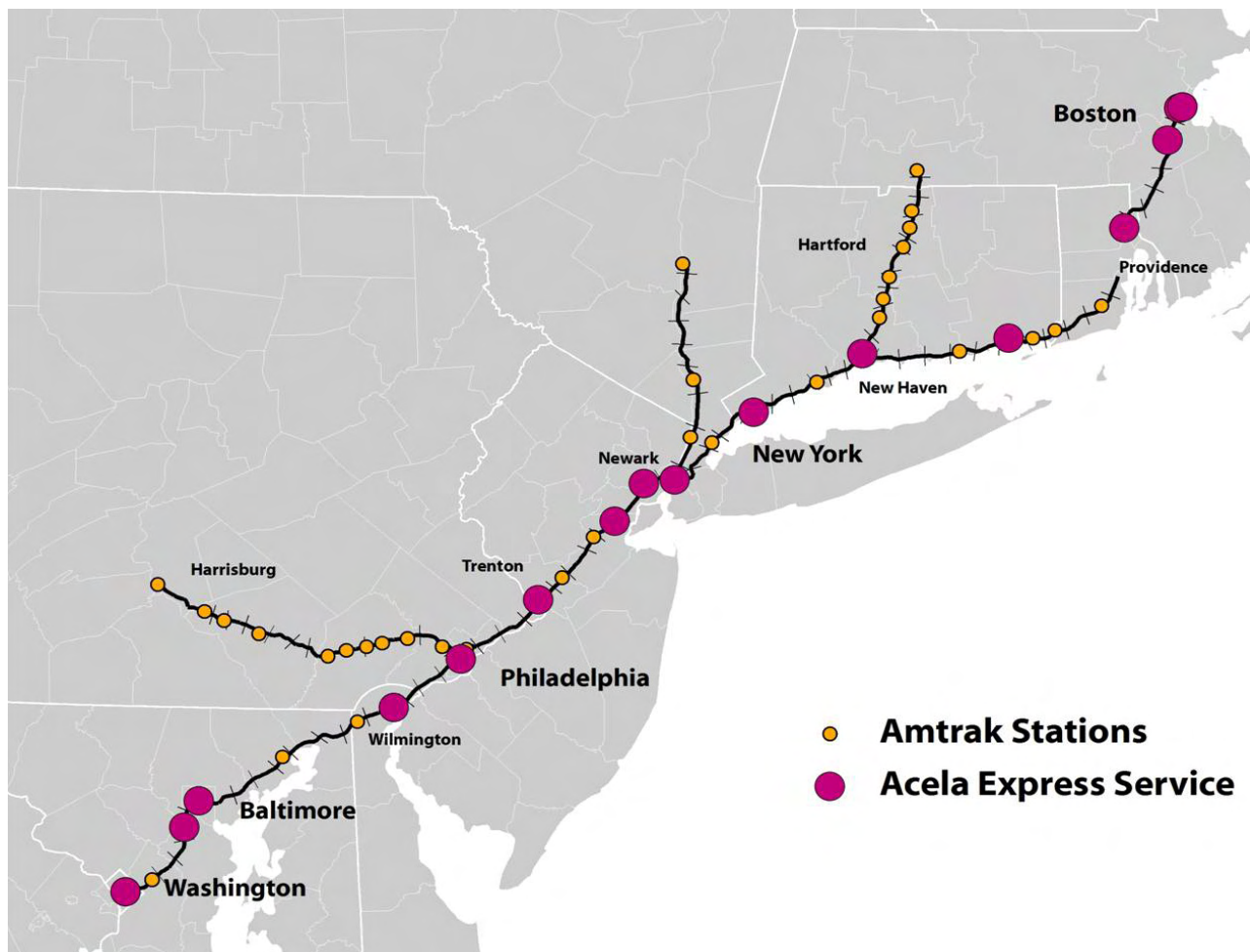
Decreased reliability is one effect of the lack of investment in Amtrak

The 2005 University of Pennsylvania studio found that one of the greatest impediments to the Megalopolis's prosperity is its failure to capitalize on its dense growth patterns by not investing in efficient, well-planned transportation system.

The Interstate System has enabled metropolitan regions to sprawl to a radius of 30 to even 60 miles across. Many prominent planners, including the executive director of the Rhode Island Economic Policy Council Kip Bergstrom, believe that HSR systems could play a comparable role in facilitating future development of mega-regions, which stretch from 200 to 500 miles across. The Megalopolis's transportation system is an elaborate network of roads, airports, and rail lines; this interconnected system has grown increasingly congested, yet does not operate at its full multi-modal potential. Each mode plays a unique role for inter-city transportation needs at certain distances; for example, rail is most effective for trips ranging from 100 to 500 miles.<sup>2</sup>

The Amtrak Northeast Corridor has one main line that runs from Washington, DC in the south to Boston in the north. There are three lines that spur from the main line to the north and west – The Keystone runs between New York and Harrisburg; the Empire Service runs between New York and Albany, continuing to Buffalo; and the Springfield branch of the Regional Service splits from the Northeast Corridor at New Haven, proceeding north through Hartford. The Northeast Corridor also provides a higher-speed service, Acela Express, from Washington, DC to Boston.<sup>3</sup>

Currently the Regional and Acela Express services are in a state of decline, with deteriorating reliability. On-time performance is unacceptably low at 71% and can be expected to decline further as Amtrak's financial situation deteriorates as a result of anticipated budget cuts.<sup>4</sup> A lack of funding has created an excessive debt that has led to deferred maintenance of tracks and vehicles, and the existing infrastructure cannot fully accommodate the speed



Existing Amtrak Regional and Acela Express route and stations.

capabilities of Acela Express trains, nor are train operators fully trained to use Acela’s technology.<sup>5</sup>

## Existing Network and Ridership

The Northeast megalopolis is reaching capacity on its roadways and in the air. According to the Texas Transportation Institute<sup>6</sup>, congestion has grown significantly in the largest urban areas of the megalopolis. The highway network has expanded, but latent demand and a growing population and economy have used up the additional capacity. There is little ability to effectively add capacity to the highway network without invading environmentally sensitive areas and exacerbating sprawl and pollution.

The Megalopolis has some of the busiest airports in the United States and the world. Most of the major airports have limited capacity to expand and are surrounded by development on all sides. The air shuttles that run along the Northeast corridor are one of the major causes of air congestion, both in the air and on the ground<sup>7</sup>. A HSR system that is well connected to cities and their centers can reduce the number of shuttles necessary within the Northeast, which will open up capacity within the existing airport infrastructure for longer-distance domestic flights and international flights.

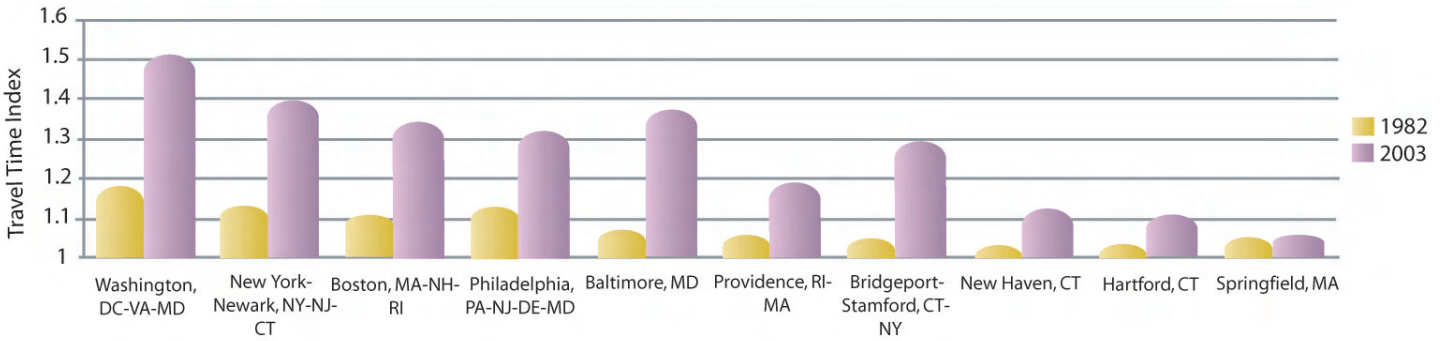
The limited ability of the highway and air networks to expand in the Megalopolis, combined with the under-performance and under-utilization of the passenger rail network, makes a compelling case for rail as the solution to mega-regional transportation issues. Along much of the Northeast Corridor there is room for an additional rail alignment in areas that are either undeveloped or that adjoin abandoned, derelict or underutilized former industrial properties. Where developed land encroaches, the possibility exists for constructing tunnels, bridges, and new alignments that bypass developed areas, as is commonly done with HSR corridors in the densely developed areas of Europe and Asia.

The Northeast is home to a strong passenger rail and mass transit culture. Compared to the rest of the country, the Northeast has substantially higher rail ridership<sup>8</sup>. Improvements to the existing system and a HSR system can easily be integrated into the multi-modal system, making it stronger in the future.

## Vision

One goal of this megalopolis study is to enhance those elements of the Northeast that give it an economic advantage over other regions. A key component of

Growth in Peak Traffic Congestion, 1982-2003



Traffic congestion in the major metropolitan areas of the Megalopolis is a significant problem. Source: Texas Transportation Institute

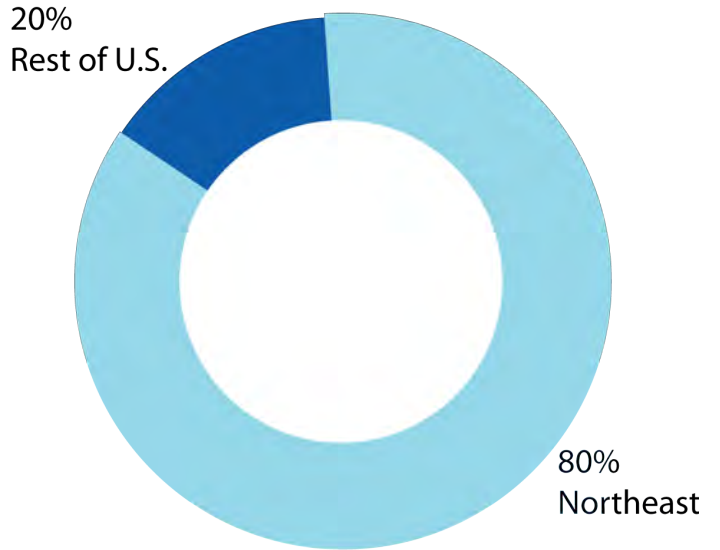
this strategy is improving the transportation linkages between these markets, focusing on better rail connections. The Northeast should create a fast, safe, reliable, convenient and competitively priced high-speed rail line connecting the metropolitan areas of the megalopolis. The HSR should accompany improved Amtrak Regional and Acela Express services, each operating with better reliability, speed, and lower cost to the rider. The rail network should receive secure, dedicated funding that would ensure proper maintenance, capital improvements, and capacity expansions. These investments in the passenger rail network would slow the growth in congestion on the Megalopolis's highway and air networks.

With secure funding, the first goal should be to make incremental improvements to the existing rail system that

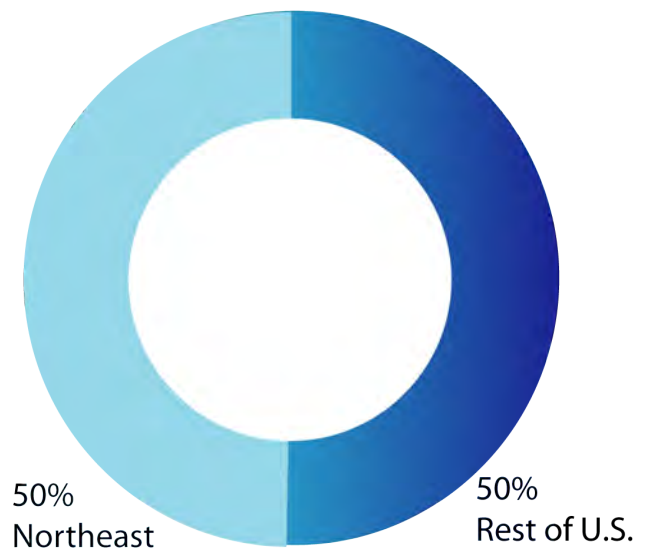
Aerial photograph of the dense development and current rail alignment near the Newark Liberty International Airport



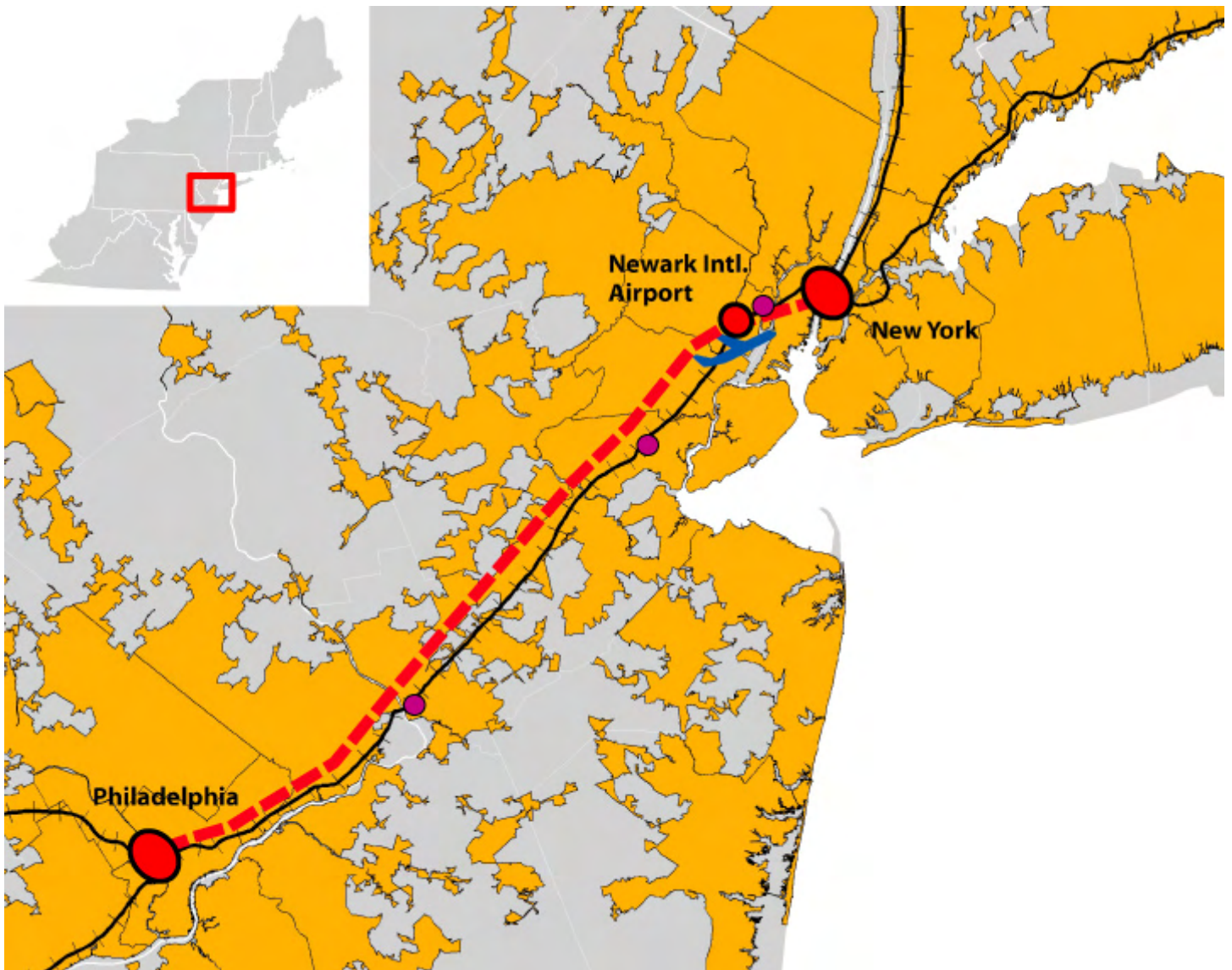
### U.S. COMMUTER RAIL PASSENGERS



### TOTAL AMTRAK RIDERSHIP



The Megalopolis has a higher rail ridership than in the rest of the U.S., as well as a stronger commuter rail ridership.



would improve service and create better connections to other transportation modes, thereby increasing the viability of rail as a competitive transportation option, and allowing the system to reach its full potential.

During these incremental improvements, or following their completion, a demonstration project for high-speed rail between Philadelphia and New York should be constructed to show how HSR can drastically improve market connections and alter the relationship between the cities in the Megalopolis. This is the beginning of a larger vision: building a high-speed rail system connecting Washington, DC to Boston with stops in Baltimore, Philadelphia, Newark Airport, New York, New Haven, Providence and Boston, with a second branch north from New York though Hartford, and on to Boston.

## Strategies

### Strategy 1: Upgrade in Phases

Upgrading the transportation linkages in the Megalopolis is a key component of a broader strategy for the Megalopolis's economic future. Introducing a high-speed

rail line will improve the accessibility of the Megalopolis's markets, and take considerable pressure off of the air travel system. These upgrades will require a significant public investment, and cannot be completed all at once. Rather, a phased approach will give investment priority to the most urgent projects, with the long-term objective of a comprehensive inter-city transportation system that is fast, reliable, accessible, and affordable. These phases include shoring-up the existing passenger rail network, followed by a HSR demonstration project between Philadelphia and New York, with eventual extensions, first to Washington, DC, and then to Boston via two branches through Providence and Hartford.

#### Phase I

The existing system should be upgraded before any long-term capital investments in HSR. Secure public investment must be targeted toward repairing and maintaining aging infrastructure, rolling stock, and proper crew training so that all of the available technology on the Acela Express can be utilized.



Credit: <http://www.ebbc.org/rail/tra.html>



## Amtrak: Facts & Figures

National Railroad Passenger Corporation (aka Amtrak) was created in 1970 as a spin-off from the freight railroads' passenger services. This agency is under the jurisdiction of the Federal Railroad Administration (and therefore, the US DOT), but it is technically a private for-profit corporation.

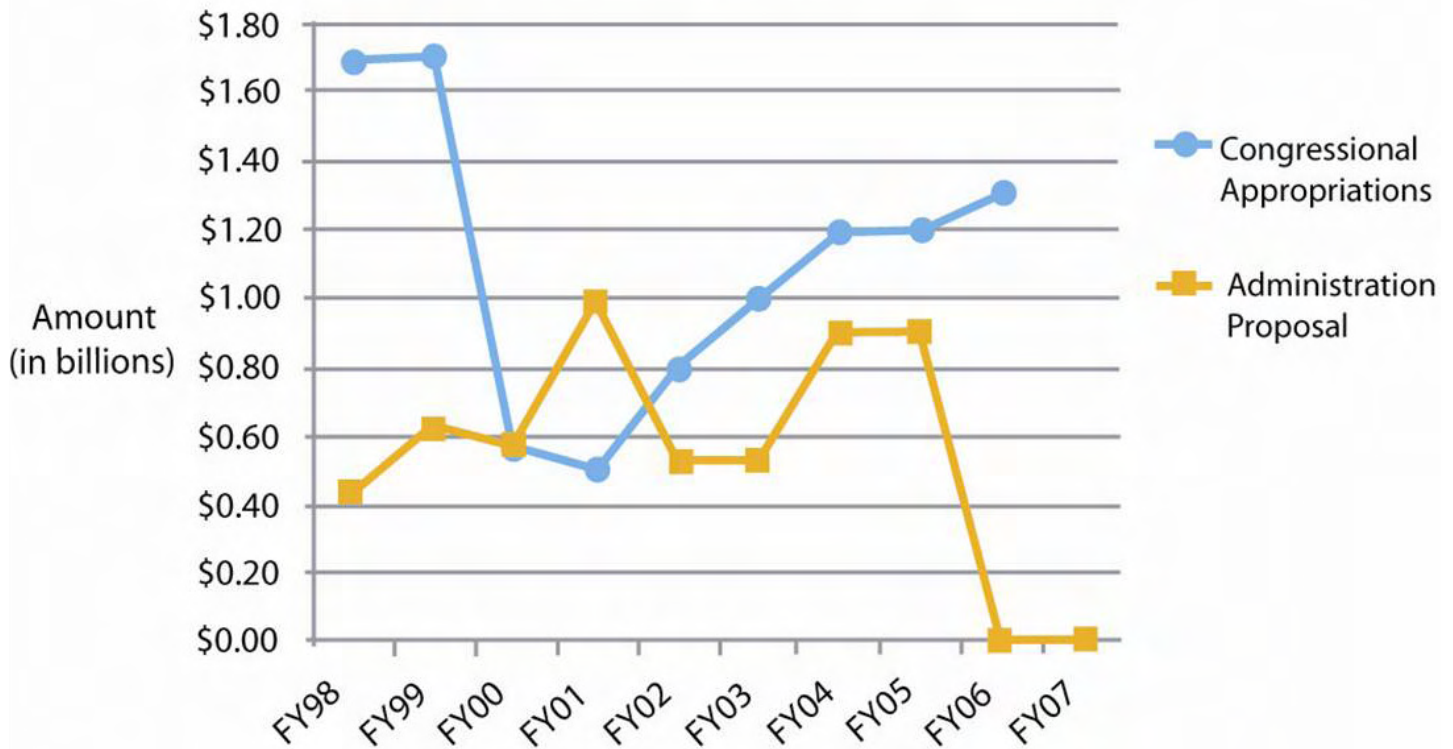
- Revenues derive from:
  - 45% Passengers
  - 32% Federal payments
  - 14% Other
  - 9% Commuter Rail Agency Payments
  
- Domestic intercity travel:
  - Amtrak 1%
  - Air 92%
  - Buses 7%
  
- Outstanding debt (2004): \$4.6 billion<sup>9</sup>

Proposed demonstration project and the vision of HSR in the Megalopolis



# Federal Funding for Amtrak

Sources: Senate Committee on Commerce, Science, and Transportation Report on S. 1516; Budget of the United States Government



For several years, Clinton and Bush Administration budget proposals have supported disinvestment in Amtrak, while Congress has appropriated nominal amounts of funding to keep Amtrak running.

a confusing variety of possibilities for institutional reform. There are several common elements however, that suggest an approach that the federal government and other HSR stakeholders can pursue.

## Federal

The federal government's philosophy about Amtrak revolves around the expectation that Amtrak, even though it is a public service, should perform like a private service and make a profit. Unfortunately, there are no transportation systems in the world that earn at a profit. This misguided philosophy needs revision, which may be possible through policy changes.

The U.S. Department of Transportation (US DOT) could retain ownership of Amtrak's current assets (e.g. the Northeast Corridor infrastructure), and institute a different operating structure. Amtrak would not need to be dissolved, but could be reinvented as a specialized rail transportation provider.

There are several ways that the US DOT and Amtrak can approach this:

- Amtrak could continue as the Northeast's rail provider but with increased financial and institutional support from the US DOT;

- Amtrak and US DOT could contract with a private company to provide operations services within certain limits specified by both agencies, or services without any limits.

Providing additional financial support for Amtrak and the future HSR system is imperative. No rail system in the world operates without public investment, and it is unrealistic for the US DOT or other federal agencies to expect its rail system to operate without such investment, let alone become a profitable business. The federal government could consider fully funding all Amtrak and HSR infrastructure needs. Perhaps the responsibility for capital costs can be shared between the federal government and a private rail operator, while also receiving increased support from local and state governments. The stress on public budgets could be mitigated by better balancing funding for rail, highways, and airports, and perhaps even cross-subsidizing between these modes.

Many Amtrak critics point to the Federal Railroad Administration's rolling stock regulations as problematic to Amtrak's improvement. These regulations relate to the requirements for passenger rail rolling stock, and are based on crashworthiness standards that have not been updated since the 1940s. The outdated crashworthiness standards are intended to protect

## Do's and Don'ts of Rail Reform: British Rail Lessons

In 1996, the United Kingdom's rail system, known as British Rail, became a partially privatized entity. Railtrack, a private company supported by the government, owned and operated the tracks, stations, and railyards. More than 70 other private companies assumed responsibility for train operations, took over ownership and maintenance of the rolling stock, and performed track renewal and maintenance, as well as heavy maintenance on the rolling stock. These three separate categories of companies with operations and infrastructure management and ownership responsibilities created a complicated web of rail reform. Many critics blamed the two major train collisions in the first 4 years of the new system on the convoluted nature of this reform effort.<sup>10</sup> The British Government recently re-nationalized Railtrack and is making heavy investments in its rail infrastructure, belatedly recognizing the necessity for government financing of these improvements.



Credit: <http://www.britrail.net>

### Phase II

The next phase begins with the HSR demonstration project between Philadelphia and New York. This 90-mile corridor has the highest rail-passenger volumes in the United States, and has the potential to generate a dramatic increase in ridership as the economies and transportation systems of Greater New York and Greater Philadelphia become further integrated. Granted, this is the minimum length that can provide significant transportation and economic benefits. The ultimate goal should be a HSR system that extends from Boston to Washington, DC.

The new right-of-way would mostly parallel the existing Northeast Corridor rail alignment, with approximately 30 miles of tunnels underneath densely built-up areas in North Philadelphia in Pennsylvania, and Trenton, New Brunswick, Rahway, Elizabeth, and Newark in New Jersey. Newark Liberty International Airport would serve as an intermediate stop between Philadelphia and New York, to fulfill the goal of maintaining and improving intermodal connections between air and rail. Since this portion of the HSR line would be underground, there is potential to have a station directly at the air passenger terminals, unlike the existing rail station that is connected to the terminals by monorail.

The HSR would take advantage of the new capacity under the Hudson River that will be created by the proposed new passenger rail tunnels, as part of the Access to the Region's Core project, which is already in project phase.<sup>11</sup> HSR trains would utilize the existing Penn Station tunnels after some of the current service is diverted into the new tunnels. At the same time, the improved Acela Express service would be extended

from New Haven north to Hartford, Connecticut, and Springfield and Worcester in Massachusetts as part of a northern branch service to Boston. This service would greatly increase the accessibility of these economically stagnant cities to larger, stronger markets.

The complete project would bring HSR extensions south of Philadelphia to Washington, DC through Baltimore, as well as north of New York to New Haven, Hartford, Providence, and Boston.

An initial step toward a complete HSR system would be to conduct a land survey to establish a possible right-of-way based on an examination of existing infrastructure, existing development, and geographic physical features. After such a study is completed, the next step would be to secure this right-of-way for the future HSR alignment.

## Strategy 2. Institutional & Funding Reforms

In order to create an improved Acela Express system and a true HSR network, the current institutional arrangement must be reformed. Discussions concerning Amtrak reform have been ongoing for decades among many different stakeholders. Multiple reform proposals have come from disparate sources, including the Bush Administration, Congress, and the National Association of Railroad Passengers.

Another possibility would be to examine successful HSR systems throughout the world. Countries that currently operate high speed rail systems have approached the management and financing of these systems in many different ways. All of these options appear to present



# Global High-Speed Rail Comparisons

Credit: [http://www.pref.aichi.jp/kotsu/rinia/index\\_e.html](http://www.pref.aichi.jp/kotsu/rinia/index_e.html)

## Japan: Shinkansen



The Japanese high speed rail system is admired around the world. It is managed by the Japan National Railway (JNR), although its level of involvement in everyday operations varies depending on the type of service and region in which it runs. The passenger rail system is divided between service on the main island, and service on Japan's three smaller islands. While rail on the main island is mostly privately owned, rail on the three smaller islands is 100% publicly owned.<sup>12</sup>

- Operating speed: 300 km/hr
- 10 lines
- At least 6 trains/hr between Tokyo and Osaka, the largest cities with the busiest stations

Credit: [http://www.raglanroad.org/weblog/archives/2005\\_06.html](http://www.raglanroad.org/weblog/archives/2005_06.html)

Credit: <http://www.bombardier.com>

## Spain: AVE



Spain will have invested about €41 billion by 2007 in the construction of rail infrastructure. This large scale project includes 450 miles of HSR along 5 corridors. The first link of 259 miles, between Madrid and Seville, has already been built. This link has reduced a 6 hour trip on conventional passenger rail to 2.5 hours. Spain has also invested a significant sum in the AVE system's rolling stock. For example, the Madrid to Barcelona route will use 32 train sets, at a cost of €741 million. Most recently, Spain has invested €4 billion in a new order of train sets from Bombardier and Siemens.<sup>13</sup>

Credit: <http://www.eurogroups.com/images/images/ave.jpg>

the passenger rolling stock from collisions with freight rolling stock, a scenario that is unlikely on the Northeast Corridor. The Federal Railroad Administration should reexamine the rolling stock regulations, in order to make them consistent with global engineering practices.

### Private Sector

Opportunities for the private sector to enter the rail transportation market are currently lacking. The Bush Administration advocates for a complex operating structure that would allow private businesses to control infrastructure maintenance and operations, much like the British Rail reforms that have proved to be disastrous (see “Do’s and Don’ts of Rail Reform: British Rail Lessons). However, the uncertainty of allowing multiple private entities to run train operations and infrastructure maintenance could compromise security, efficiency, safety, and quality. For the sake of these issues, the option of pursuing privatization of passenger rail must be undertaken very cautiously.

Although many rail experts agree that complete privatization of Amtrak would bring an end to its operation, a case can be made for privatization of the Northeast Corridor. While it is not a profitable operation, the demand for rail service in the megalopolis is high and is projected to grow.<sup>14</sup>

### Private-Public Partnership

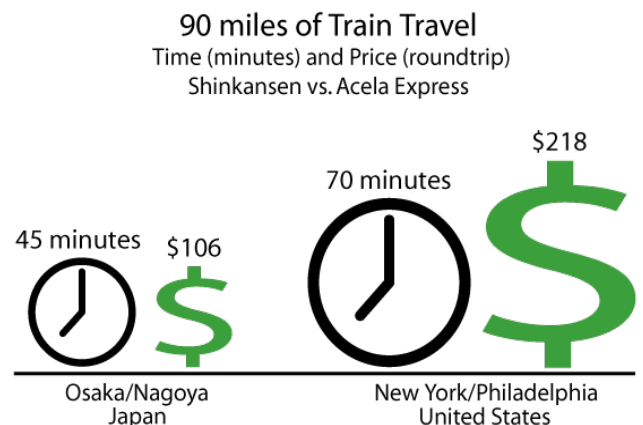
Some combination of governmental support and private sector involvement is the best solution for passenger rail in the Northeast. Federal and state government cooperation is vital to the growth and future success of passenger rail, especially to the construction and operation of the HSR demonstration project. Even though freight rail companies pushed the federal government to separate passenger rail operations from freight—hence the creation of Amtrak in the 1970s—the Northeast Corridor could provide profitable opportunities for private companies.

One scenario for such an arrangement would be to pursue government and private sector funded settlement of Amtrak’s debt, government and private sector investment in capital costs, and private sector operation of high speed rail services and stations with added incentives for transit oriented development. While the private sector would operate the Northeast Corridor, it would have the federal government’s support for safety, some funding, and other specific needs. This is just one way in which government at all levels could work with the private sector to reinforce passenger rail’s position as the most practical mode of intercity transportation in the Megalopolis.

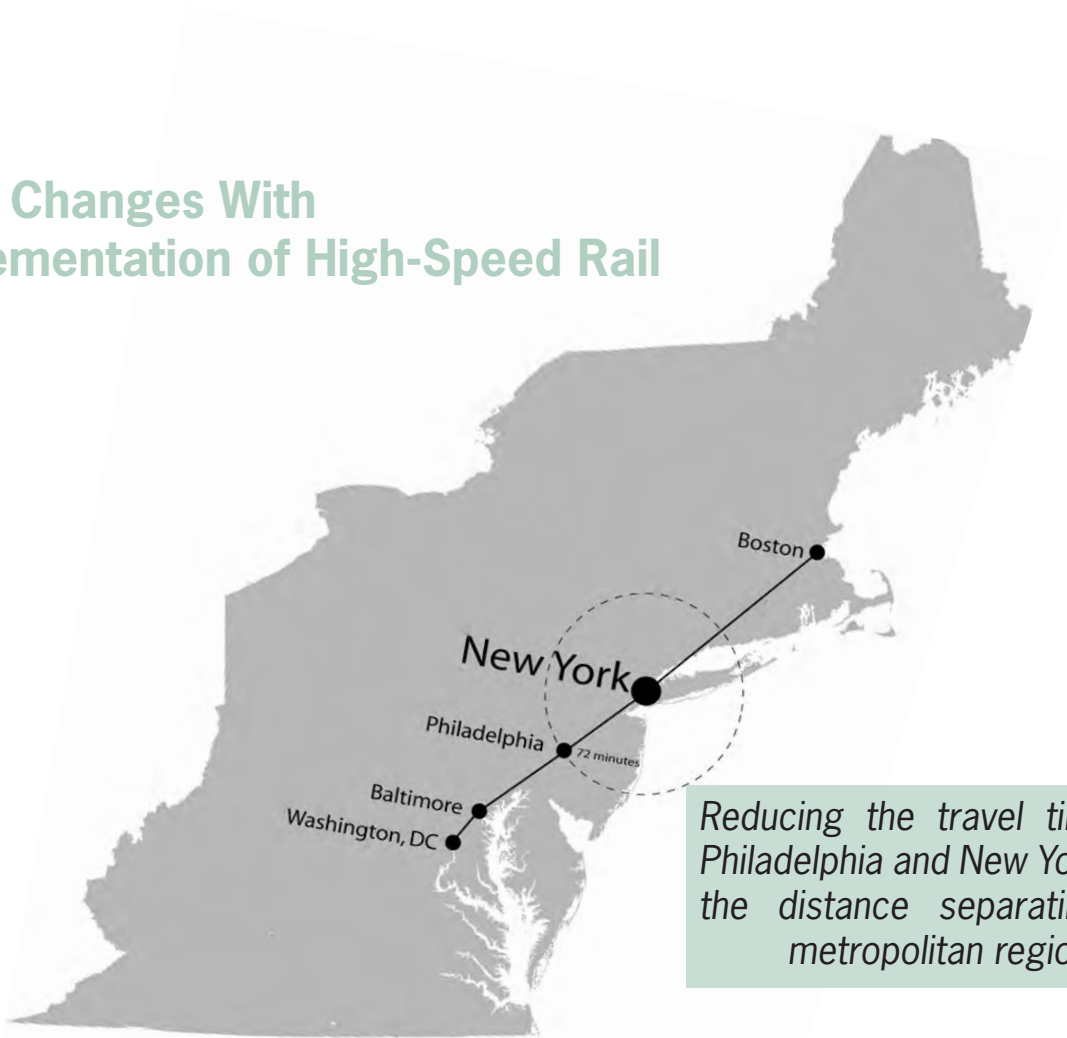
## Strategy 3: Improved Standards of Service

Currently, the average operating speed of the Acela Express between Boston and Washington, DC is 68 miles per hour. The system can not reach its maximum speed of 150 miles per hour for significant periods of time because of incompatibility with the existing infrastructure and the insufficient distance between station stops. With upgrades to the existing system, this speed would increase and reduce travel times from New York to Washington, DC from nearly 3 hours to just over 2 hours. The travel time from New York to Boston would be reduced from nearly 4 hours to about 3 hours. A high-speed rail system would provide even faster service, with speeds of up to 186 miles per hour. Allowing for enough distance between stations, actual operating speeds can approach 150 miles per hour as trains cruise at high speeds for significantly longer periods, bringing travel time between New York and Philadelphia down to less than one hour. With the completed system, travel times from Washington, DC, to New York would improve to less than 2 hours, and New York to Boston would improve to less than 2 hours.

For maximum convenience, headways between trains along the HSR system would be approximately every ten minutes during peak periods, and no more than 20 minutes during off-peak times. Proper and timely maintenance of infrastructure and rolling stock will mean far greater reliability for travelers. Tickets must be priced more competitively. Acela fares between New York and Philadelphia (Amtrak’s highest volume service) are, for example, currently twice those of comparable Shinkansen services in Japan, with far lower levels of speed, reliability, comfort and frequency of service on Acela than on Shinkansen trains. Prices should be reduced across all levels of rail service, with significant discounts for frequent commuters, as well as competitive business travel packages. Ticket prices between cities on the HSR system should cost less than the current too-high price of the conventional Regional and Acela Express trains.



## Time Changes With Implementation of High-Speed Rail



Reducing the travel time between Philadelphia and New York, will make the distance separating the two metropolitan regions shorter.<sup>15</sup>



Similar mega-regions in Europe and Asia, including most of the Northeast's global economic competitors, are developing integrated, intermodal mobility strategies. These countries are making multi-billion dollar investments in these systems, with the goal of strengthening the transportation and economic connections between their component metropolitan regions. Critical components of these strategies are HSR networks now being completed or planned in Europe and Asia. The oldest of these is Japan Railways' Shinkansen Bullet Train system opened in 1964, with a first route linking Tokyo with Nagoya and Osaka.<sup>1</sup>

It is also important to note that the Shinkansen in Japan is much more competitively priced than even the existing Acela system, which is slower and much less reliable. Osaka and Nagoya are the third and fourth largest cities by population in Japan, with a combined total of 5 million people, and are the same distance apart as New York and Philadelphia, which are the first and fifth largest cities, respectively, with a combined population of approximately 22 million people<sup>2</sup>; however, Osaka and Nagoya are much better connected to each other by the Shinkansen than New York and Philadelphia by the Acela Express.

Based on previous projects and existing systems, it can be estimated that the 90-mile demonstration project between Philadelphia and New York would cost between \$7 billion and \$11 billion to build. This range is derived from an assumption that there will be approximately 30 miles of track running through tunnels and 60 miles of track running either at-grade, on bridges, and overpasses, and includes land acquisition and construction costs. Tunneling was chosen over the options of bridging and building around densely developed areas because tunneling is more aesthetically pleasing and less disruptive to communities than aerial structures; bypassing densely developed areas that surround New York, primarily, would require a substantial amount of additional alignment,

# Cost Benefit Analysis

thereby requiring more land to be acquired, which would greatly increase the cost. The tunneling portion of the HSR would cost somewhere between \$220 million per mile, the cost of the AVE Tunnel that runs between Madrid and France, and \$350 million per mile, the cost of the tunnel that runs between Hokkaido and Honshu Islands in Japan.<sup>3</sup> The at-grade costs are estimated to be between \$7.5 million per mile, the average cost for the TGV system in France, and \$9 million per mile, the average cost per mile for Taiwan's HSR system.<sup>4</sup>

In addition to less disruption and reducing overall alignment length, tunneling also reduces the number of overpass and bridge projects. According to the UK Commission for Integrated Transport, the construction costs of a new HSR segment through tunnels or over aerial structures is approximately 4-6 times the cost of at-grade construction. Within the existing right-of-way between Philadelphia and New York, there are approximately 190 overpasses, underpasses, bridges, and flyovers. To upgrade or construct a single such project ranges in cost from \$1.5 million to \$11.5 million, bringing costs for just this portion of the HSR to between \$160 million and \$1.2 billion. With tunneling under densely developed urban areas, the number of overpasses, underpasses, and flyovers to construct and upgrade is reduced to less than 90, further reducing costs for this portion of the HSR to

## Commuting Between New York City and Philadelphia

Currently, only a small number of people commute between New York City and Philadelphia, the nation's largest and fifth largest metropolitan centers. Although these two city centers are only 90 miles apart, the current highway commute is very congested and subject to delay and uncertainty. Although Amtrak provides Acela and regional rail service between the two cities, these services are relatively slow, expensive, unreliable and infrequent. As a result, in 2000, only 7,538 people lived in the Philadelphia metro region and commuted to work in the New York City metro region. And 1,656 who lived in the New York metro region commuted to work in the Philadelphia metro region.<sup>5</sup>

between \$130 million and \$1 billion, not including land acquisition costs and use of eminent domain through densely urbanized areas.<sup>6</sup>

Assuming that the capital cost for the entire 460 mile HSR line would mirror the cost structure of the demonstration project between New York and Philadelphia, the capital cost for the entire system would range between \$37.5 billion and \$55 billion.

Additionally, the rolling stock should cost approximately \$28 million per train or \$2 million per car, similar to the cars and trains used by the TGV system in France and the ICE system in Germany.<sup>7</sup>

## Benefits

Implementing a high-speed rail between New York City and Philadelphia will create a number of economic benefits for these cities, their surrounding suburbs and the entire Megalopolis. The connection will spur economic growth by allowing the two cities to share a workforce and real estate market. Increasing transportation efficiency will allow businesses to expand and network over a larger region. And the resulting developments around transit hubs will encourage investment back into the urban centers. This will lead to a decrease in sprawl, cleaner air, less road congestion, greater opportunities for jobs and living and, overall, an increased economic productivity.

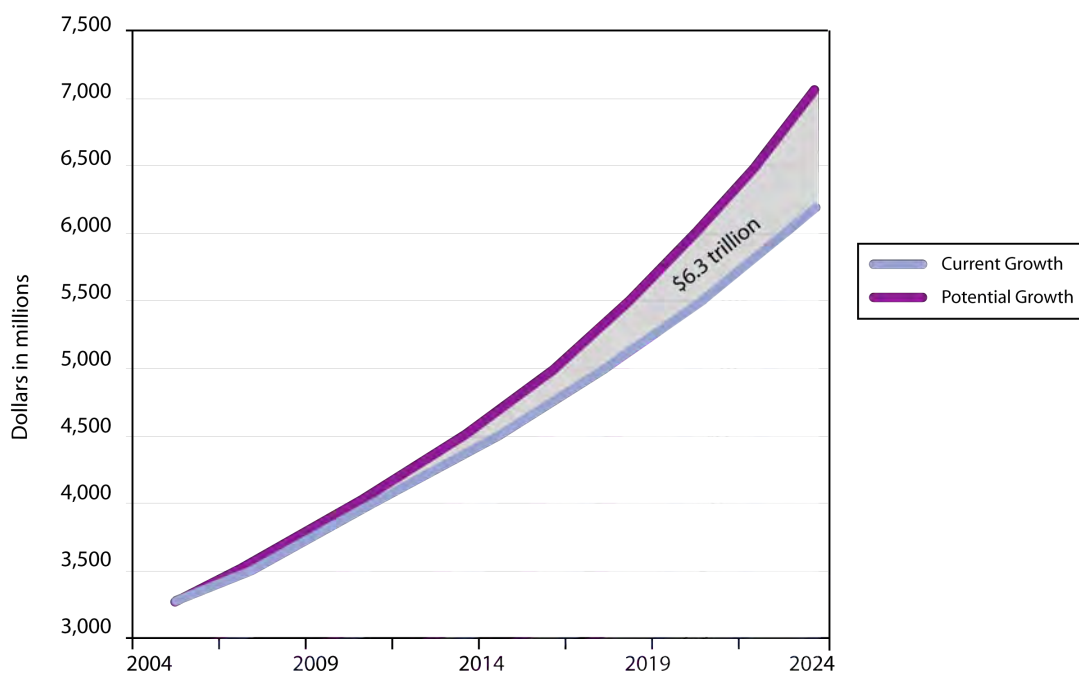
## Jobs and the Economy

Currently the Northeast's economic growth rate is modest compared to the growth rates of other more western U.S. mega-regions. Cascadia, the Sun Corridor and the two California mega-regions (the Bay Area and Southern California) have growth rates around 4% compared to the Northeast's 3%.<sup>8</sup> This is largely due to the limited supply of land, higher costs and outdated infrastructure in the Northeast. But with a high-speed rail line linking Philadelphia and New York,

and eventually stretching from Boston to Washington and beyond, the Megalopolis has the opportunity to address some of these problems. When the travel time between New York and Philadelphia is reduced to 45 minutes, the two cities have the potential of functioning as a single economic unit. Comparable travel time's savings between Boston and New York and Philadelphia and DC could have additional benefits. This means greater options for business location, more efficient transportation options and the potential to integrate and expand business clusters across the Megalopolis.

A high-speed rail line linking the major centers in the Northeast Corridor will have positive effects for the mega-regional economy as a whole. Assuming that the economy of the Northeast were to grow by only one twentieth of one percent, this would create more than \$6.3 trillion of additional economic activity over a 25 year period. Building a high-speed rail system for the

**Gross Regional Product Projections**  
(based on an increase of 0.05% per year)



Source: US Bureau of Economic Analysis (calculations done by author)

Northeast would clearly be a very expensive undertaking. However, even if it were to cost the higher end estimate of \$55 billion dollars for the corridor between Boston and Washington DC, this would still only represent 12% of the potential growth of the economic output of the Mega-region over a 25 year period.

Investing in a NY-Philadelphia high-speed rail link increases the capacity of New York while providing job opportunities to Philadelphia, a city that has been left out of the region's economic prosperity for decades. Linking the two cities will increase efficiency in terms of land use and employment. Employers will have

access to a workforce of 12 million. People will have greater choice as to where to live and work. And Philadelphia will no longer have to endure the “brain-drain”, with more than 75% of its recent graduates moving to areas with greater job opportunities.<sup>9</sup>

## Real Estate Markets

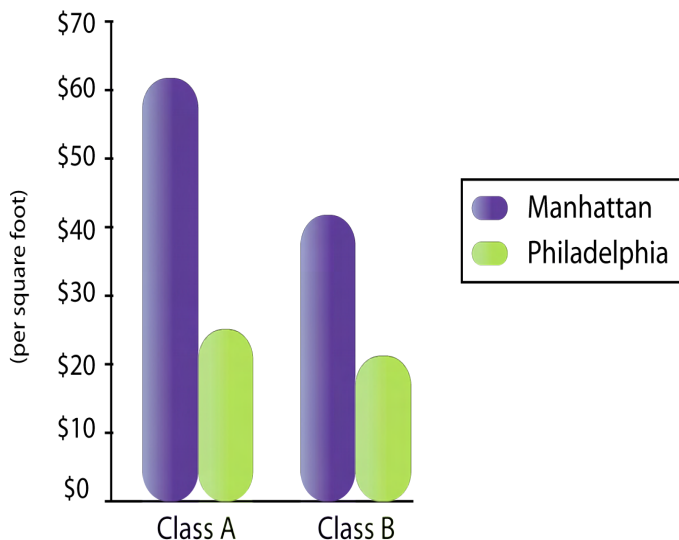
### Commercial Real Estate

New York City’s commercial class A office rent asking price is at a four year high, exceeding \$60 per square foot. While the first quarter results from Philadelphia have only increased modestly for class B office rent and a slight decline in class A rents.<sup>10</sup> Although both cities have experienced growth, New York City class A office space rents for nearly two and a half times more than in Philadelphia. Class B office space is also twice as expensive in New York City than in Philadelphia. Historically, as the Manhattan commercial market has become tight at the top of each business cycle, rapidly escalating rents have choked off additional business activity in New York’s core, limiting New York’s potential economic growth. By connecting Manhattan with Center City Philadelphia’s office market, some of this potential growth could be decanted to Philadelphia, lessening these spikes and expanding the economies of both cities.

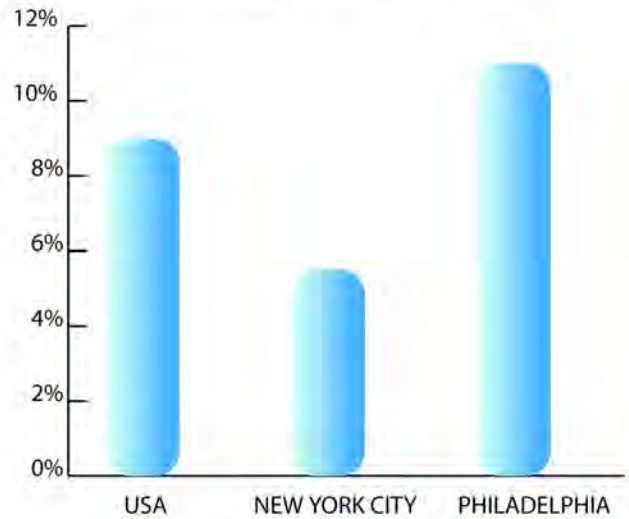
### Residential Real Estate

The median housing cost in the New York MSA is \$403,600.<sup>11</sup> The median housing cost in the Philadelphia MSA is \$198,500.<sup>12</sup> The vacancy rate in the New York City MSA is 5.82%. Less than 6% vacancy rates constitutes a housing emergency, meaning the region has insufficient housing to meet its current needs, contributing to a sustained run up in housing prices across the region. The vacancy rate for the Philadelphia MSA is 8.63% vacancy.<sup>13</sup> The disparity in

Median Rent for Office Space



Percentage of Vacant Housing



housing prices and vacancy rates between these two cities suggests that there could be advantages to both places if their housing markets were to be integrated through improved transportation links. It is assumed that by bringing these two metropolitan regions closer together, the vacancy rate in the Philadelphia region would decrease while alleviating the pressure on the New York City market.

The pre-tax median household income in New York City is \$41,509.<sup>14</sup> If a homeowner spends an average of 30% of their household income on housing, a household making the average household income in New York City must spend \$1037 a month on housing. However, a household making the median income purchases a home at the median housing cost, \$403,600, would spend 71% of their income on housing. By strengthening the ties between housing markets in New York City and Philadelphia, it could alleviate the pressure of affordable housing in New York by allowing a spillover into Philadelphia’s more affordable market.

## Compact Development

A high-speed rail link between New York City and Philadelphia will concentrate population growth and density around transit hubs in the center cities. Increasing land use density has positive affects on agglomeration and productivity levels. One study found that doubling a county’s density results in a 6% state-level gain in productivity.<sup>15</sup> The Philadelphia metro area’s population is expected to grow by almost 600,000 people by 2025.<sup>16</sup> If this were concentrated into Philadelphia County, the State of Pennsylvania’s gross state product may increase about \$500 million per year.<sup>17</sup> Over the course of twenty years, this is approximately \$2 billion in tax revenue.<sup>18</sup>

Furthermore, automobile expenditures contribute

significantly less to the regional economy than rail because the majority of expenditures are foreign products. One study found that for each \$1 million shifted from automobile expenditures to rail provides an additional 8.6 jobs and \$219,000 to the regional economy.<sup>19</sup>

Concentrating growth around transit hubs will reduce the amount of land consumed by urbanization and reduces the amount of typical infrastructure and other public investments associated with sprawl. Scenarios relating to land and roads, and water and sewer are described below and how their implementation will impact the Megalopolis. Rutgers University has developed two alternatives of land development scenarios, the first a “controlled” model in which development is concentrated in defined urban areas. A second scenario depicts lower density, “uncontrolled” development, involving greater land consumption and automobile use. These scenarios and their typical impacts are described in the next page.<sup>20</sup>

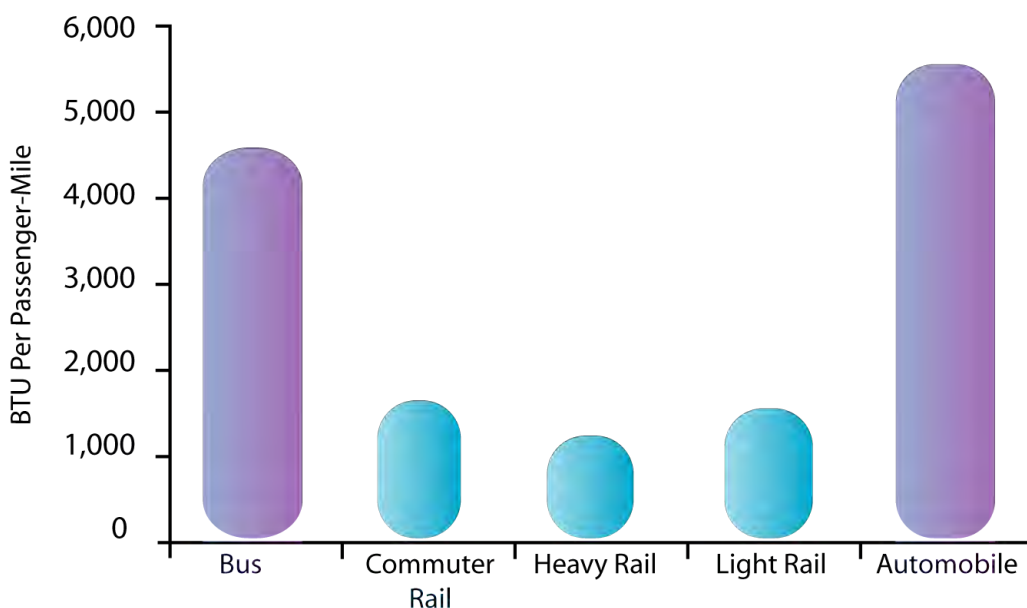
## Policies Promoting Rail

European and Japanese HSR links have utilized discounted weekly and monthly fares to promote ridership and commutation between cities in High Speed Rail Corridors. Similar fare policies in the Northeast could promote increased commuting between cities within Megalopolis. Coordinated fare policies between commercial aviation and HSR networks could further increase rail ridership and reduce congestion at the Northeast’s major airports. Rather than adopting fare policies designed to promote commuting in the Northeast Corridor, last year Amtrak doubled the price of monthly commutation passes.

## Environmental Benefits

In addition to reducing congestion, rail transit provides a more sustainable use of energy and reduces emissions into the environment, especially in highly populated areas. The automobile uses five times more energy per passenger mile than rail.<sup>21</sup> Travel by rail is more environmentally friendly than the automobile due to its efficient mechanical systems and ability to carry large loads. Furthermore, increasing oil prices are making it less affordable to drive automobiles resulting in increased preference for travel by rail.

## Transit Energy Consumption




Source: Shapiro, Hassett, and Arnold, 2005

# Cost of Sprawl

## Land

<p><b>Controlled</b> 282,853 acres of land saved</p>	<p>Nearly 80% of lands will be saved in a controlled growth scenario including the protection of farmland and environmentally sensitive landscapes.</p>
<p><b>Uncontrolled</b> 1,460,868 acres of land converted</p>	<p>Sprawling landscapes are detrimental to our agricultural production and environmentally sensitive landscapes, resulting in a considerably larger amount of money being spent as seen below.</p>

## Road

<p><b>Controlled</b> 6.2 Billion Dollars Saved</p>	<p>In a controlled growth scenario, only 281,000 miles of road will need to be added over the next 25 years in the Northeast region. The United States will save 109.00 Billion Dollars under tighter regulations.</p>
<p><b>Uncontrolled</b> 135.77 Billion Dollars Spent</p>  <p><small>Credit: Unknown</small></p>	<p>Over 288,000 miles of road will be required in an uncontrolled growth scenario in the Northeast region. To avoid spending an extra \$6.2 Billion, simple measures can be implemented to avoid the need for driving and sprawled development.</p> <p><b>Cost Per Mile</b></p> <ul style="list-style-type: none"> <li>- six lane freeway \$8,800,000</li> <li>- two to four lanes \$3,200,000</li> <li>- patching &amp; rehabilitation \$650,000</li> <li>- surfacing \$450,000</li> <li>- new interchange to existing interchange \$6,500,000</li> <li>- new signal \$115,000</li> </ul>

## Water and Sewer

<p><b>Controlled</b> 1,264 Millions of Dollars Saved</p>	<p>The controlled growth scenario will save an estimated 7 million gallons of water per day, and 3,068 miles of lateral infrastructure will need to be installed costing just over \$14 Million.</p>
<p><b>Uncontrolled</b> 16,015 Millions of Dollars Spent</p>	<p>The uncontrolled growth scenario will spend over \$16.01 million dollars and will demand 1,415 millions of gallons of water per day. This will require 3,406 total water and sewer laterals.</p>

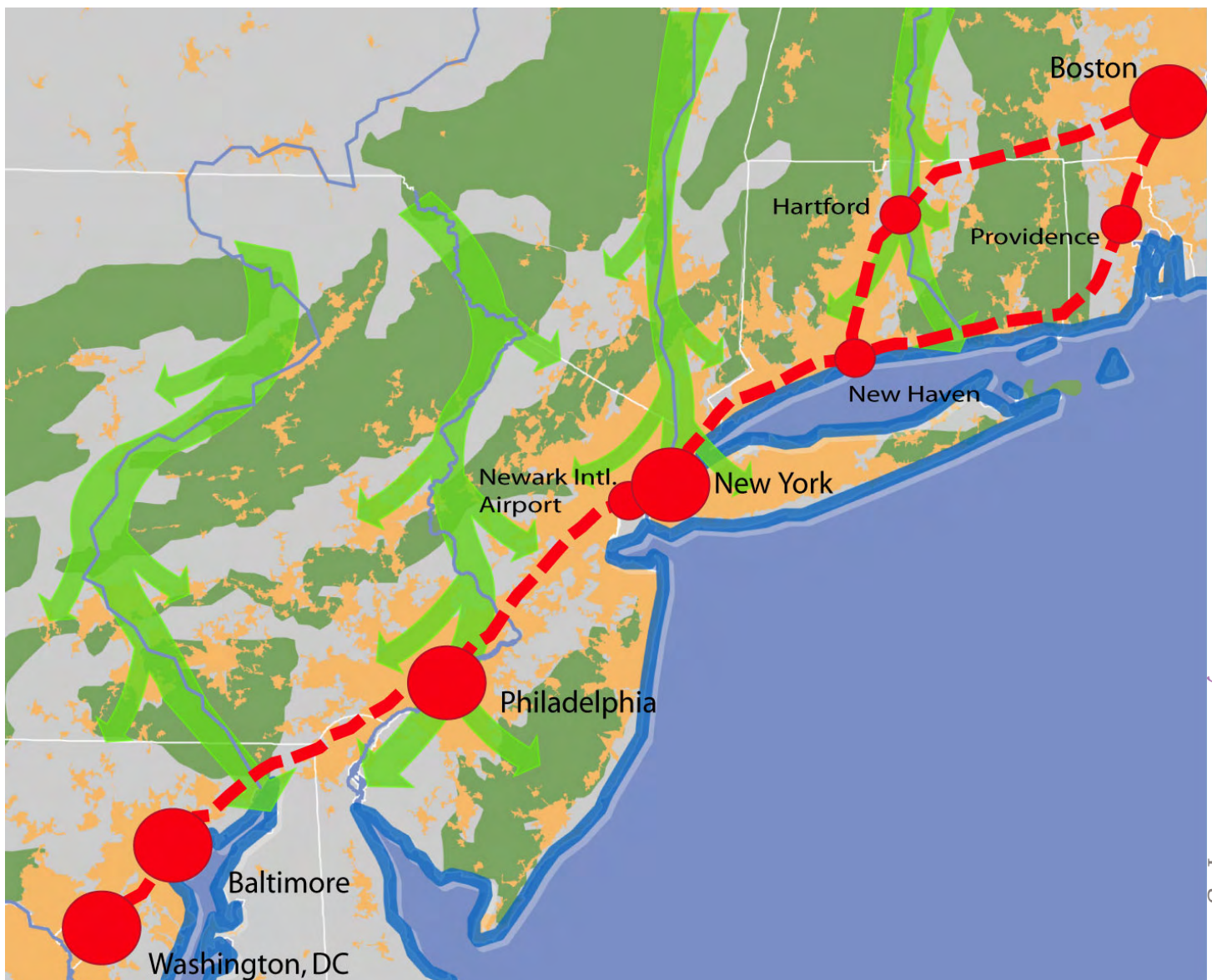


# Conclusion

The Northeast Megalopolis is one of the biggest players in the global marketplace. With the highest population density in the nation, the world's largest concentration of top rated research universities, the ability to attract robust economic clusters, and extraordinary quality of life, Megalopolis has many competitive advantages. However, without greater innovation and regional cooperation, the Northeast is poised to slip behind not only global competitors, but also faster-growing regions in the United States.

In order to maintain its prime position, the Northeast must enhance its competitive advantages and invest in under-utilized resources. Given the expected population increases, the region must become more sustainable. To do so, it must link natural spaces to urban places, promote compact development, invest in renewable energy, and leverage the resources of cultural landscapes. These measures will not only improve the environmental health of the Northeast, but will also support a growing economy. To remain competitive, the region must also provide more affordable housing, create greater opportunities for education to all socio-economic classes, and better integrate its strong cities and its under-performing cities into a single system. This integration can be accomplished primarily through investing in the transportation system. Specifically, existing infrastructure must be upgraded and bolstered by the creation of a high speed rail line that links the major metropolitan areas together and effectively “shrinks” distances between cities, both strong and weak.

These strategies will be difficult—if not impossible—to achieve if the region does not work cooperatively as a unit. Environmental, economic, and transportation systems, all cross boundaries, yet this is not reflected in current management or planning for the future. In the rapidly changing global marketplace, the regions that stand to gain the most are those who understand the new role of the mega-region and have proactively planned for their continued economic health and quality of life.



# Endnotes

## Environment

1. USDA Forest Service 2002 Highlands Study p. 68
2. Highlands Regional Information System
3. USDA Forest Service 2002 Highlands Study p. 14-15
4. *ibid.* p. 69
5. *ibid.* p. 59
6. U.S. Fish & Wildlife Service
7. Owen
8. Pennsylvania Horticultural Society
9. Handwerk
10. Environmental Defense
11. Anderson Economic Group

## Economy

1. Based on U.S. Bureau of Economic Analysis 2004 data of gross domestic product. The Northeast gross regional product is the sum of the gross state products of the thirteen states and Washington D.C.
2. University of Pennsylvania, 2005
3. Glaeser, 2005
4. Based on location quotients of top five metropolitan areas. Location quotients calculated from reported NAICS industry codes, 1997-2003, U.S. Bureau of Labor Statistics.
5. Fortune Magazine ranking for 2005.
6. Doeringer and Terkla, 1995
7. Rosenfeld, 1997, p.10
8. The top pharmaceutical firms are determined by the PharmExec's Top 50 Report, 2005. Biotechnology clusters are ranked in the Brookings Institution's Biotechnology Report, 2002. Organizational trends in the pharmaceutical industry are outlined in the Arthur D. Little Global Management Consulting Report, 2003.
9. Based on the 2010 Lisbon Strategy outlined in the European Economy Review, Directorate General for Economic and Social Affairs, 2004
10. Land area's are taken from US Census and workforce taken from BEA, 2005
11. Survey conducted by Moody's Economy.com on "The Best Places for Business and Careers." published by Forbes Magazine, 2004.
12. Hoffmann and Markusen, 2005
13. Weber, 1929
14. Ranking for top universities compiled by Shanghai Jiao Tong University are based on research performance and academic quality. Biased against humanities and social sciences. The Economist, September 2, 2004
15. Cortwright and Mayer, 2002, p. 16 Based on 2001 National Institute of Health Research Funding for Medical Schools and Research Institutions.
16. United States Patents and Trademark Office, 2006
17. The College Board, 2005
18. *ibid.*
19. Katz, 2001
20. US Census, 1990 and 2000
21. Yale University, 2006
22. Massachusetts Institute of Technology, 2006

## Transportation

1. Penn 2005 Studio, p. 12
2. Penn 2004 Studio, p. 87
3. Amtrak
4. Interview with Jeff Zupan, Regional Plan Association, 2/14/06; Statement of US DOT Inspector General Kenneth Mead before the House of Representatives Committee of Transportation and Infrastructure, 21 September 2005
5. Interview with Peter Cohen, Amtrak, 2/14/06
6. Texas Transportation Institute Urban Mobility Study
7. Interview with Jeff Zupan, Regional Plan Association, 2/14/06
8. *ibid.*
9. Statement of US DOT Inspector General Kenneth Mead before the House of Representatives Committee of Transportation and Infrastructure, 21 September 2005; and Amtrak
10. Guardian Unlimited, "Key Dates in Britain's Railway History"
11. Regional Plan Association's plan for a new passenger rail tunnel under the Hudson River
12. Interview with Jeff Zupan, Regional Plan Association, 2/14/06
13. Frittelli
14. Railwaytechnology.com
15. This cartogram visually displays the time savings of a HSR line in the Megalopolis. It is based on an assumption of 45 minutes of travel time between New York and Philadelphia, comparable to the time and distance between Osaka and Nagoya, Japan, which is currently achievable on that country's Shinkansen HSR.

## Cost Benefit

1. Wikipedia, "Shinkansen"
2. Brinkhoff
3. Railwaytechnology.com; Engineering.com
4. These costs were estimated by using precedents outlined in the following sources, and accounting for inflation. See Levinson, David, and Jean Michel Mathieu, David Gillen, Adib Kanafani.
5. U.S. Census, 2000
6. UK Commission for Integrated Transport  
Railwaytechnology.com
7. Penn 2005 Studio
8. U.S. Bureau of Economic Analysis, based on gross state product growth rates 1997-2003
9. U.S. Bureau of Labor Statistics, 2005.

12. Long Island Offshore
13. U.S. Department of Energy, Energy Efficiency, and Renewable Energy
14. Burkhardt
15. MW: A watt is a unit of power of equal to one joule per second. A megawatt is 1,000 watts.
16. Long Island Offshore
17. Holloway
18. Verdant Power
19. Griscom
20. Cornell University
21. "NY Adopts Biofuel Initiative"
22. *ibid.*
23. Aldrich
24. National Park Service
25. *ibid.*
26. Aldrich

10. Grubb & Ellis, Q1Report, 2006
11. Based on a projected increase in growth rate by 1/20<sup>th</sup> of a percent over 20 years for the 13 states and Washington D.C.
12. *ibid.*
13. American Community Survey, US Census, 2005
14. National Association of REALTORS, 2005
15. Litman, 2005, p.30.
16. Woods and Pooley, 2004
17. Based on GSP Projections by US Bureau of Economic Analysis. Calculated by author
18. Calculations done by author
19. Miller, Robison and Lahr, 1999.
20. Center for Urban Policy and Research, Rutgers University
21. Litman, 2005
22. *ibid.*

**General**

"Towards an American Spatial Development Perspective." University of Pennsylvania, Department of City and Regional Planning, 2004 Studio.  
 "Reinventing Megalopolis." University of Pennsylvania, Department of City and Regional Planning, 2005 Studio.

**Environment**

Aldrich, J. Winthrop. "HERITAGE SITES: A Report to the Management Committee of the Hudson River Valley National Heritage Area." Online: [http://www.hudsonrivervalley.com/images/uploaded\\_images/HERITAGE%20SITES.%202004.htm](http://www.hudsonrivervalley.com/images/uploaded_images/HERITAGE%20SITES.%202004.htm) October, 2005.  
 Anderson Economic Group: Economic Impact of the 2003 Blackout [http://www.andersoneconomicgroup.com/modules.php?name=Content&pa=display\\_aeg&doc\\_ID=834](http://www.andersoneconomicgroup.com/modules.php?name=Content&pa=display_aeg&doc_ID=834)  
 "Annual Industry Rankings Demonstrate Continued Growth of Wind Energy in the United States." March 15, 2006. American Wind Energy Association website. [http://www.awea.org/news/Annual\\_Industry\\_Rankings\\_Continued\\_Growth\\_031506.html](http://www.awea.org/news/Annual_Industry_Rankings_Continued_Growth_031506.html)  
 Barrett, Brenda. "National Heritage Areas: Places on the Land, Places in the Mind." The George Wright Forum. Volume 22, Number 1. 2005  
 Beresford, Michael and Phillips, Adrian. Protected Landscapes: A Conservation Model for the 21<sup>st</sup> Century." The George Wright Forum. Volume 14, Number 1. 2000  
 Burkhardt, Paul. "Wind Power Gains Force in New York State." [Metropolismag.com](http://www.metropolismag.com/html/sustainable/case/WindPowerGainsForce.html). 2004.  
 DePalma, Anthony. "It Never Sleeps, but It's Learned to Douse the Lights," [The New York Times](http://www.nytimes.com), December 11, 2005.  
 Environmental Defense. "Global Warming: Undo It" [http://www.undoit.org/what\\_is\\_gb.cfm](http://www.undoit.org/what_is_gb.cfm)  
 Eugster, J. Glenn. "Evolution of the Heritage Areas Movement." The George Wright Forum. Volume 20, Number 2, 2003.  
 "Grass Bioenergy in the Northeast US: Information Sheet." Cornell University, College of Agriculture and Life Sciences. February 10, 2006. [http://www.grassbioenergy.org/downloads/Bioenergy\\_Info\\_Sheet\\_1.pdf](http://www.grassbioenergy.org/downloads/Bioenergy_Info_Sheet_1.pdf)  
 "Green Plans," <http://greenplans.rrri.org/inaction/newzealand.html>

Handwerk, Brian. "Global Warming Fast Facts" [National Geographic News](http://www.nationalgeographic.com/news/2004/12/1206_041206_global_warming.html) December 6, 2004  
[http://news.nationalgeographic.com/news/2004/12/1206\\_041206\\_global\\_warming.html](http://news.nationalgeographic.com/news/2004/12/1206_041206_global_warming.html)

Harmon, David. "Intangible Values of Protected Areas: What Are They? Why Do They Matter?"

The George Wright Forum. Volume 21, Number 2. 2004  
 Highlands Regional Information System <http://crssa.rutgers.edu/projects/hiris/index.htm>  
 Holloway, Nigel. "The Power of the Moon," [Forbes Magazine](http://www.forbes.com). July 21, 2003.  
 Kempton, Willett, Jeremy Firestone, Jonathan Lilley, Tracy Rouleau, and Phillip Whitaker. "The Offshore Wind Power Debate: Views from Cape Cod." [Coastal Management](http://www.ocean.udel.edu/windpower/docs/KempEtAl-OffshoreWindDebate05.pdf), 33: 119-149, 2005. <http://www.ocean.udel.edu/windpower/docs/KempEtAl-OffshoreWindDebate05.pdf>  
 Little, Amanda Griscom. "Mikey Likes It: Bush's pick to head the USDA is a big ethanol booster," [Grist Magazine](http://www.grist.org/news/muck/2004/12/09/little-johanns/?source=daily). December 9, 2004. <http://www.grist.org/news/muck/2004/12/09/little-johanns/?source=daily>  
 London: The Environment <http://www.london.gov.uk/gla/environment.jsp>  
 Long Island Offshore Wind Initiative. <http://lioffshorewindenergy.org/>  
 National Park Service. "Best Practices in Heritage Development from the National Heritage Areas." Spring 2005. Online: <http://www.cr.nps.gov/heritageareas/REP/10BP2006.pdf>  
 "New York Adopts Biofuel Initiative," [Renewable Energy Access](http://www.renewableenergyaccess.com/rea/news/story?id=39629). November 22, 2005. <http://www.renewableenergyaccess.com/rea/news/story?id=39629>  
 "New York State: Wind Energy Development." American Wind Energy Association. 2005. <http://www.awea.org/projects/newyork.html>  
 New Zealand Department of Conservation Website, <http://www.doc.govt.nz/index.html>  
 New Zealand Ministry for the Environment Website, <http://www.mfe.govt.nz/state/>  
 Owen, David. "Green Manhattan," [The New Yorker](http://www.nytimes.com). October 18, 2004, pp. 111-123.  
 Philadelphia Horticultural Society: Reclaiming Vacant Lots [http://www.pennsylvaniahorticulturalsociety.org/phlgreen/ui\\_reclaimvacantlots.html](http://www.pennsylvaniahorticulturalsociety.org/phlgreen/ui_reclaimvacantlots.html)  
 Regional Greenhouse Gas Initiative <http://www.rggi.org/>  
 Samuelson, J.D. "Harnessing the Tides to Make Electricity," [The New York Times](http://www.nytimes.com), July 25, 2004.  
 Sumits, Andrea P. and Jason I Morrison, Creating a Framework for Sustainability in California: Lessons from New Zealand, December 2001. The Pacific Institute for Studies in Development, Environment and Security. [www.pacinst.org/reports/sustainable\\_california/sustainable\\_california\\_summary.pdf](http://www.pacinst.org/reports/sustainable_california/sustainable_california_summary.pdf)  
 The Trust for Public Land. "The Economic Benefits of Parks and Open Space: How Land Conservation Helps Communities Grow Smart and Protect the Bottom Line." 1999. [http://www.tpl.org/tier3\\_cdl.cfm?content\\_item\\_id=1152&folder\\_id=727](http://www.tpl.org/tier3_cdl.cfm?content_item_id=1152&folder_id=727)  
 United States Department of Agriculture: Forest Service: Northeastern Area State and Private Forestry 2002 New York-New Jersey Highlands Regional Study Update. <http://www.na.fs.fed.us/highlands/>  
 U.S.-Canada Power System Outage Task Force: Final Report on the August 14th Blackout in the United States and Canada <https://reports.energy.gov/>  
 U.S. Department of Energy: Energy Efficiency and Renewable Energy: Tidal Power [http://www.eere.energy.gov/RE/ocean\\_tidal.html](http://www.eere.energy.gov/RE/ocean_tidal.html)  
 U.S. Department of Energy, Energy Efficiency and Renewable Energy. "Wind Energy Benefits Factsheet." April 2005. [http://www.eere.energy.gov/windandhydro/windpoweringamerica/pdfs/wpa/wpa\\_factsheet\\_series.pdf](http://www.eere.energy.gov/windandhydro/windpoweringamerica/pdfs/wpa/wpa_factsheet_series.pdf)  
 U.S. Department of Energy, Energy Efficiency and Renewable Energy. "Wind Energy Myths Factsheet." May 2005. [http://www.eere.energy.gov/windandhydro/windpoweringamerica/pdfs/wpa/wpa\\_factsheet\\_myths.pdf](http://www.eere.energy.gov/windandhydro/windpoweringamerica/pdfs/wpa/wpa_factsheet_myths.pdf)  
 U.S. Fish and Wildlife Service: Significant Habitats and Habitat Complexes of the New York Bight Watershed. [http://training.fws.gov/library/pubs5/web\\_link/text/ny\\_njh.htm](http://training.fws.gov/library/pubs5/web_link/text/ny_njh.htm)  
 Verdant Power <http://www.verdantpower.com/initiatives/currentinit.html>  
 VROM International, Netherlands Ministry of Housing, Spatial Planning, and the Environment. "The National Spatial Strategy," <http://www2.vrom.nl/pagina.html?id=7348>  
<http://www.netherlands.info/Geography.html>  
 "Winds of Change." Volume 1, issue 1. Spring 2005. <http://www.lioffshorewindenergy.org/Volume1Issue1.pdf>  
 World Energy Council: Tidal Energy. <http://www.worldenergy.org/wec-geis/publications/reports/ser/tide/tide.asp>

**Economy**

Arthur D. Little Global Management Consulting. "Unraveling the Pharmaceutical Industry." Report, 2003.  
 Badenhausen, Kurt. "Closer to Home." [Forbes Magazine](http://www.forbes.com). 2004  
 "Best Colleges and Universities." [US News & World Report](http://www.usnews.com). 2006.  
 Cortwright, Joseph and Heike Mayer. "Signs of Life: The Growth of Biotechnology Clusters in the U.S." The Brookings Institution Center on Urban and Metropolitan Policy, 2002.  
 Directorate General for Economic and Social Affairs, European Commission. [European Economy](http://www.europa.eu.int) 6, 2004.  
 Doeringer, P.B., and D.G. Terkla. "Business strategy and cross-industry clusters." [Economic Development Quarterly](http://www.economicdevelopmentquarterly.com) 9: 225-37. 1995.  
 Environmental Law & Policy Center. High Speed Rail Benefits. 2006. ([www.elpc.org](http://www.elpc.org))  
 Glaeser, Edward. "Urban Colossus: Why is New York America's Largest City?" Discussion Paper Number 2073, Harvard Institute of Economic Research. Harvard University: Cambridge, June 2005.  
 Hoffmann, Anders N. and James R. Markusen. "Investment Liberalization and the Geography of Firm Location." University of Colorado: Boulder, 2005.  
 Gray, Nicole. "Pharm Exec Top 50." [Pharmaceutical Executive](http://www.pharmexec.com). July 8, 2005. <http://www.pharmexec.com>  
 Katz, Bruce. "Escape from Connecticut's Cities." [The Hartford Courant](http://www.hartfordcourant.com). April 8, 2001.  
 O'Neil, James. "Brain Drain? Not So Fast." [The Philadelphia Inquirer](http://www.philadelphia.com), June 11, 2004.  
 Paugh, Jon and Dr. John C. LaFrance. "U.S. Industry Faces the 20<sup>th</sup> Century: The U.S. Biotechnology Industry." U.S. Department of Commerce, Office of Technology Report, 1997.  
 Porter, Michael. [The Competitive Advantage of Nations](http://www.competitiveness.com). New York: Basic Books. 1990.  
 Rosenfeld, Stuart A. "Bringing Business Clusters into the Mainstream of Economic Development." [European Planning Studies](http://www.europeanplanningstudies.com) 5(1): 3-23. 1997.  
 "Top Universities." [The Economist](http://www.economist.com). 2006  
 United States Bureau of Labor Statistics, 2006.  
 United States Bureau of Economic Analysis, 2006  
 United States Census Bureau, 1990-2006  
 United States Patent & Trademark Office, 2006. <http://www.uspto.gov>

**Transportation**

Amtrak.com. "Amtrak Routes Northeast." [http://www.amtrak.com/servlet/ContentServlet?pa=Amtrak/am2Route/Vertical\\_Route\\_Page&c=am2Route&cid=1080772074490&ssid=134](http://www.amtrak.com/servlet/ContentServlet?pa=Amtrak/am2Route/Vertical_Route_Page&c=am2Route&cid=1080772074490&ssid=134)  
 Amtrak.com "Amtrak: Background and Facts." <http://www.amtrak.com/pdf/AmtrakBackgroundInformation.pdf>  
 Cohen, Peter. Personal interview. 14 Feb. 2006.  
 Frittelli, John. "Foreign Intercity Passenger Rail: Lessons for Amtrak?" Congressional Research Service, 7 June 2002.  
 Guardian Unlimited. "Key Dates in Britain's Railway History." <http://www.guardian.co.uk/transport/Story/0,,633951,00.html>  
 House of Representatives Committee of Transportation and Infrastructure, Statement of US DOT Inspector General Kenneth Mead. 21 September 2005  
 Railwaytechnology.com. "AVE High Speed Rail Network." <http://www.railway-technology.com/projects/spain/>  
 Texas Transportation Institute Urban Mobility Study. <http://mobility.tamu.edu/ums/>  
 Zupan, Jeff. Personal interview. 14 Feb. 2006.

**Cost-Benefit Analysis**

Brinkhoff, Thomas. "Japan, City Population." <http://www.citypopulation.de/Japan-Cities.html>  
 Burchell, Robert W.; Dolphin, William R.; Galley, Catherine C.; Lowenstein, George; "TCRP Report 74 - Cost of Sprawl 2000". National Academy Press, Washington, D.C. 2002.  
 Engineering.com. "The Channel Tunnel." <http://www.engineering.com/content/ContentDisplay?contentId=41007025>  
 Institution of Civil Engineers, "The Missing Link," December 2005.  
 Lahr, Michael, Jon Miller and Henry Robison. "Estimating Important Transportation-Related Regional Economic Relationships in Bexar County, Texas." VIA Transit <http://www.viainfo.net>, 1999.  
 Levinson, David, and Jean Michel Mathieu, David Gillen, Adib Kanafani. "The full cost of high-speed rail: an engineering approach." [The Annals of Regional Science](http://www.annals.org) 1997, 31: 189-215.  
 Litman, Todd. "Rail Transit in America: A Comprehensive Evaluation of Benefits." Victoria Transport Policy Institute: Victoria, BC. 2005.  
 National Association of Realtors, 2006. <http://www.realtor.org>  
 Persichetti, Richard. "Office Market Trends New York City". Grubb & Ellis Research First Quarter: 2006.  
 Steer Davies Gleave (Prepared for Commission for Integrated Transport), High Speed Rail: International Comparisons. London. 2004.  
 Woods & Poole Economics, Inc. "Population Projections." 2002.  
 Wright, Matthew. "Office Market Trends Philadelphia: CBD & Suburbs." Grubb & Ellis Research First Quarter: 2006.  
 Railwaytechnology.com, "AVE High Speed Rail Network." <http://www.railway-technology.com/projects/spain/>  
 UK Commission for Integrated Transport. "High Speed Rail: International Comparisons." <http://www.cift.gov.uk/docs/2004/hsr/research/04.htm>  
 U.S. Census Bureau. "Metropolitan Areas Ranked by Population," <http://www.census.gov/population/cen2000/phc-t3/tab03.pdf>  
 Wikipedia, "Shinkansen," <http://en.wikipedia.org/wiki/Shinkansen>.

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