

All Aboard

High Speed Rail Ridership in New England

Introduction

American railways are in dire need of an upgrade. America's population and highway congestion are only projected to increase, hampering our ability to travel freely and efficiently in the coming years. In particular, the Northeast Corridor between New York City and Boston is an area that will be disproportionately affected by increasing travel congestion. Plans, such as the *PlaNYC* (NYC.gov 2007) have been proposed to tackle the transportation problems but do not focus on the area between Boston and NYC.

AMTRAK has proposed a plan for a next-generation High Speed Rail [HSR] to be developed between NYC and Boston with an estimated completion date of 2040 (AMTRAK Vision 2010). The goal of this project is to determine the areas and populations that benefit from the HSR and to persuade viewers that the development of High Speed Rail is a worthy investment in our future travel.

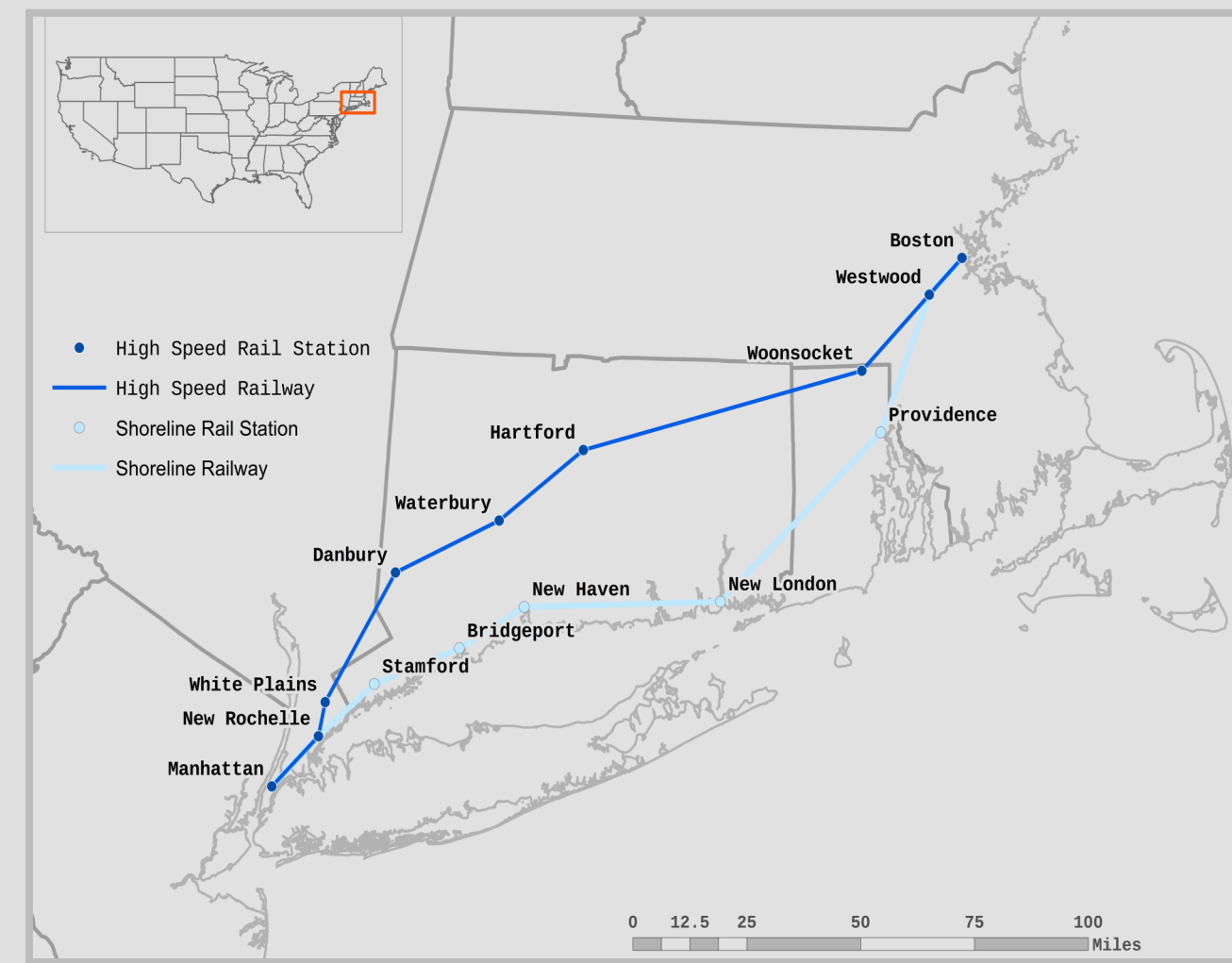


Figure 1: Shore Line and HSR. Map of current Shore Line route and proposed High Speed Rail route.

Data

US Census Data: NY, CT, NJ, MA, RI block group and town attribute data as well as vector polygons. ACS census data provided population attribute data for the block groups.

AMTRAK: Location of railway stations and railway schedules were collected to determine the geospatial position and time tables for the current Shore Line and HSR.

Tufts Data Lab: Nationwide vector network analysis data set was collected from the Tufts Data lab and used to determine the travel time from Boston, New York, and the railway stations.

Methods

In order to conduct the analysis, two computer programs were used: ArcMap 10.6.1 and Microsoft Excel 2016.

To plot out the paths of the Shore Line and High Speed Rail (Figure 1.), US Census TIGER/Line boundary data (US Census Bureau TIGER/Line 2018) provided the polygons and attribute data of all towns and cities in New England. The Feature to Point tool determined the approximate locations for the planned Stations by placing them in centroids of specified cities. The Points to Line tool plotted the railway line.

Shore Line travel times were collected from the AMTRAK time table (AMTRAK NORTHEAST 2019) (Figure 2.). The Measure tool was used to calculate the proportional distance of each rail segment, which was combined with time taken from the Amtrak HSR proposal (AMTRAK Vision 2010). to derive the estimated HSR travel times (Figure 3.).

Shore Line Segment	Time (min)
Boston to Westwood	16
Westwood to Providence	25
Providence to New London	61
New London to New Haven	52
New Haven to Bridgeport	27
Bridgeport to Stamford	27
Stamford to New Rochelle	21
New Rochelle to NYC	29
Total (Boston to NYC)	258

Figure 2: Shore Line travel times.

Population Density: Within One Hour of Boston and New York

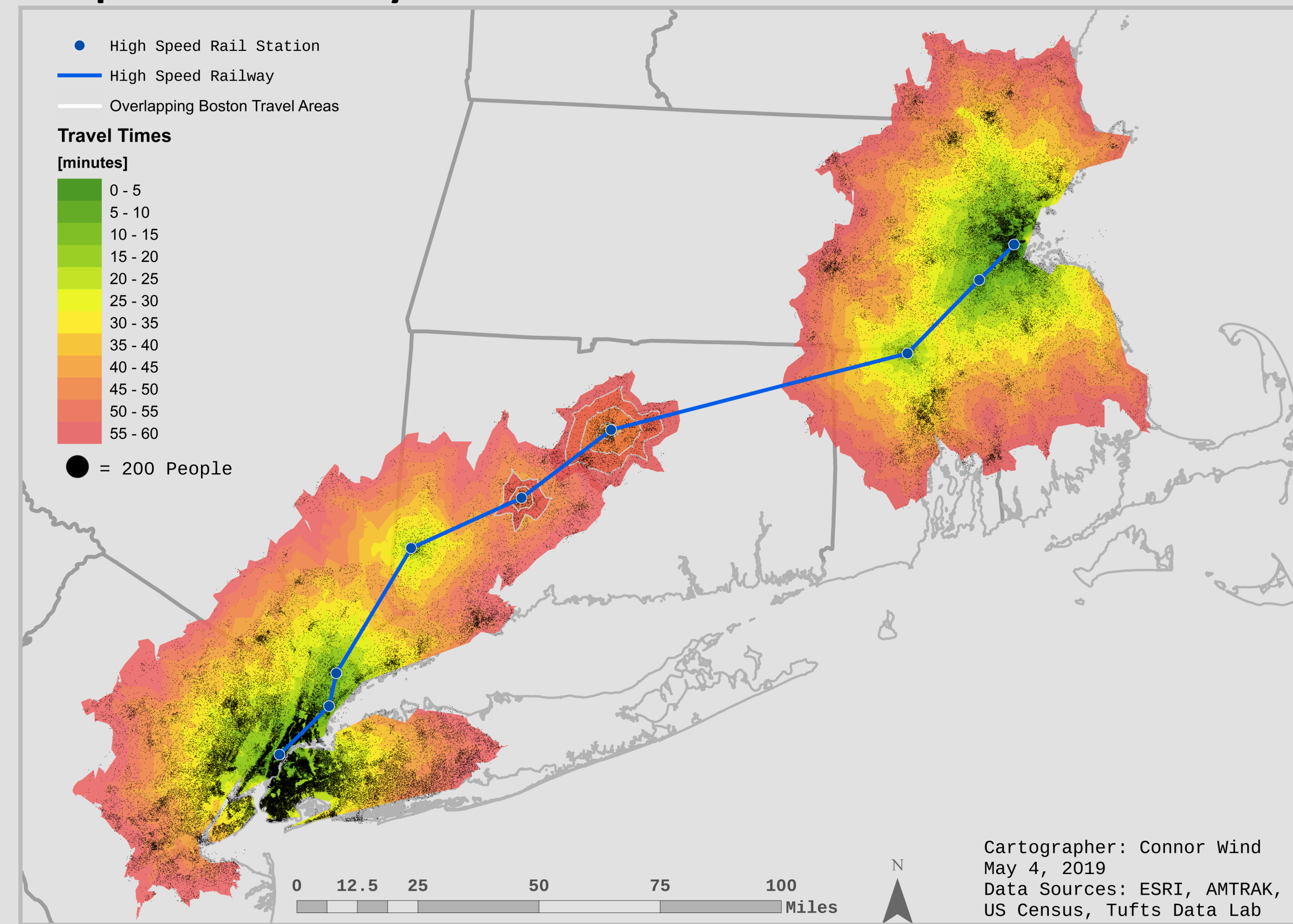


Figure 7: HSR area population density. Population density overlaid on Figure 5.

Results

We found that the High Speed Rail represents a significant increase in area covered and populations with the ability to reach New York and Boston in under an hour. This hour of travel represents a combination of car and train travel and calculates the most optimized time frame one can travel in (Figure 4.) (Figure 5.).

If the HSR was implemented today, over 25 million people would find themselves within an hour of Boston and/or New York. Nearly three million more people have access than in the current Shore Line area.

	Population	Area covered (sq mi)
High Speed Rail	25,737,513	9873.93
Shore Line	22,782,263	7205.84

Figure 6: One-hour zone data.

Shore Line Travel Within One Hour of Boston and New York City

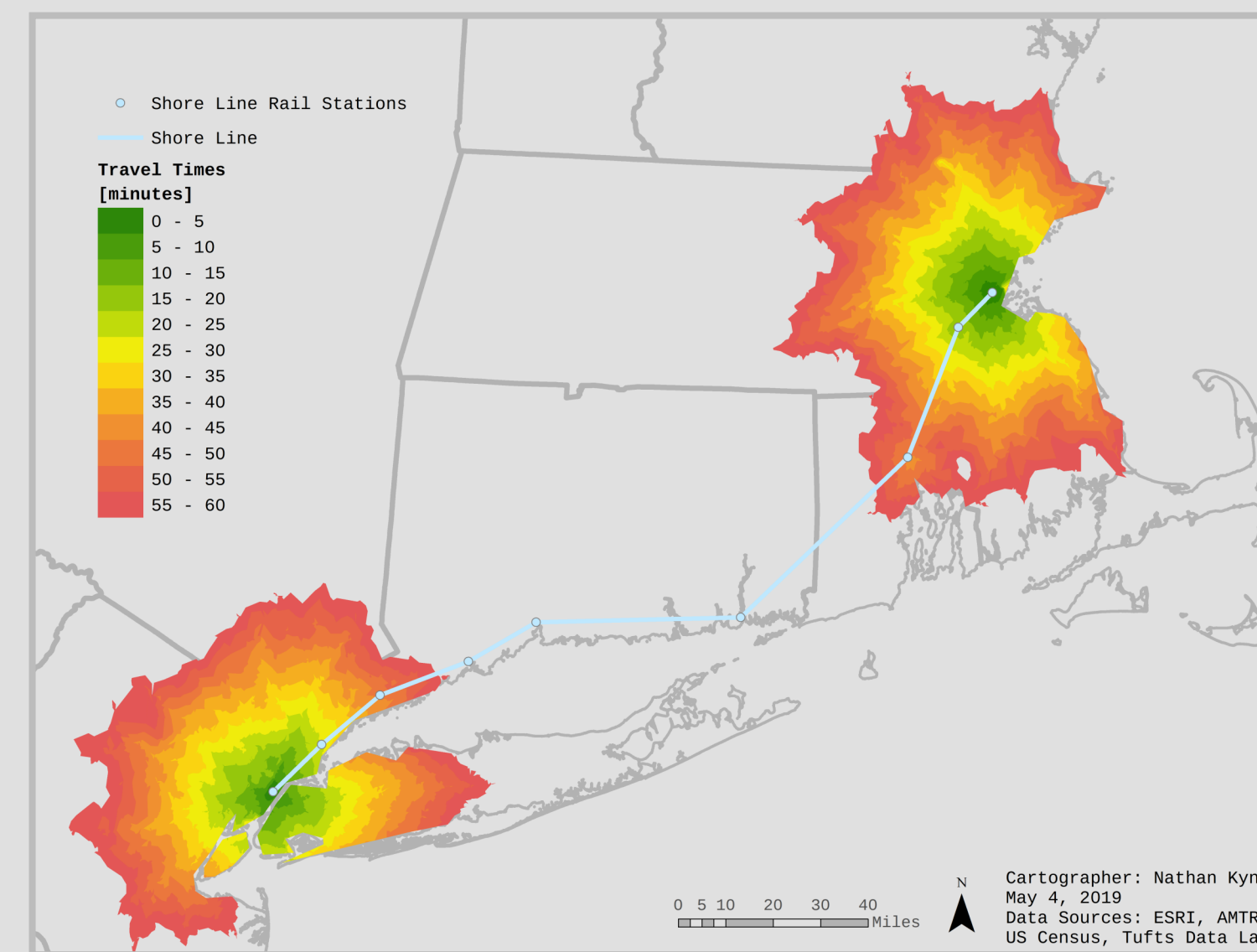


Figure 4: Shore Line travel. Map areas within one hour of Boston and NYC by car and rail using the current Shore Line.

Similarly there is an increase of over 2,500 square miles of land that would be within one hour of New York and Boston with the High Speed Rail (Figure 6.).

High Speed Rail Segment	Time (min)
Boston to Westwood	4.38
Westwood to Woonsocket	9.06
Woonsocket to Hartford	27
Hartford to Waterbury	9.92
Waterbury to Danbury	10.7
Danbury to White Plains	12.85
White Plains to New Rochelle	2.97
New Rochelle to NYC	6.12
Total (Boston to NYC)	83

Figure 3: HSR travel times.

The one-hour zones were built using Network Analyst tools and a Tufts Data Lab Network Dataset (APA). A service area was created for each station within one hour of the major cities using 5 minute increments determined by each station's excess driving time. Services area shapefiles were exported then combined using the Merge tool. A field was added to the attribute tables determining each polygon's time distance from either NYC or Boston.

The Editor toolbar Clip feature discarded all extraneous polygons with time values above the minimum of any given area. The service areas were then clipped with Tufts Data lab US State Polygons to discard areas that were covering bodies of water. Finally, a choropleth was quantified using the time data. This created four service areas, two for each city, for Shore Line and HSR analysis respectively (Figure 4.) (Figure 5.).

Conclusion

Transit upgrades are necessary to alleviate increasing population density and travel congestion problems. The proposed High speed rail would provide an enormous boon to travel in the Northeast and serve as an integral part of the Northeast's travel needs. The Dot Density map alone reveals large populations in Connecticut, Rhode Island and Massachusetts that will experience improved access to New York and Boston. If the High Speed Rail proposal receives support from congress and local governments, vast swaths of people will be given greater access to the Boston and New York, the two major economic hotspots of the Northeast. Thousands of square miles of land would be ripe for development due to their newfound proximity to key economic areas, especially areas of Connecticut and Rhode Island that have seen their economic development falter in recent years. We hope that our data and analysis can help garner support for the High Speed Rail and its future of the Northeast.

HSR Travel Within One Hour of Boston and New York City

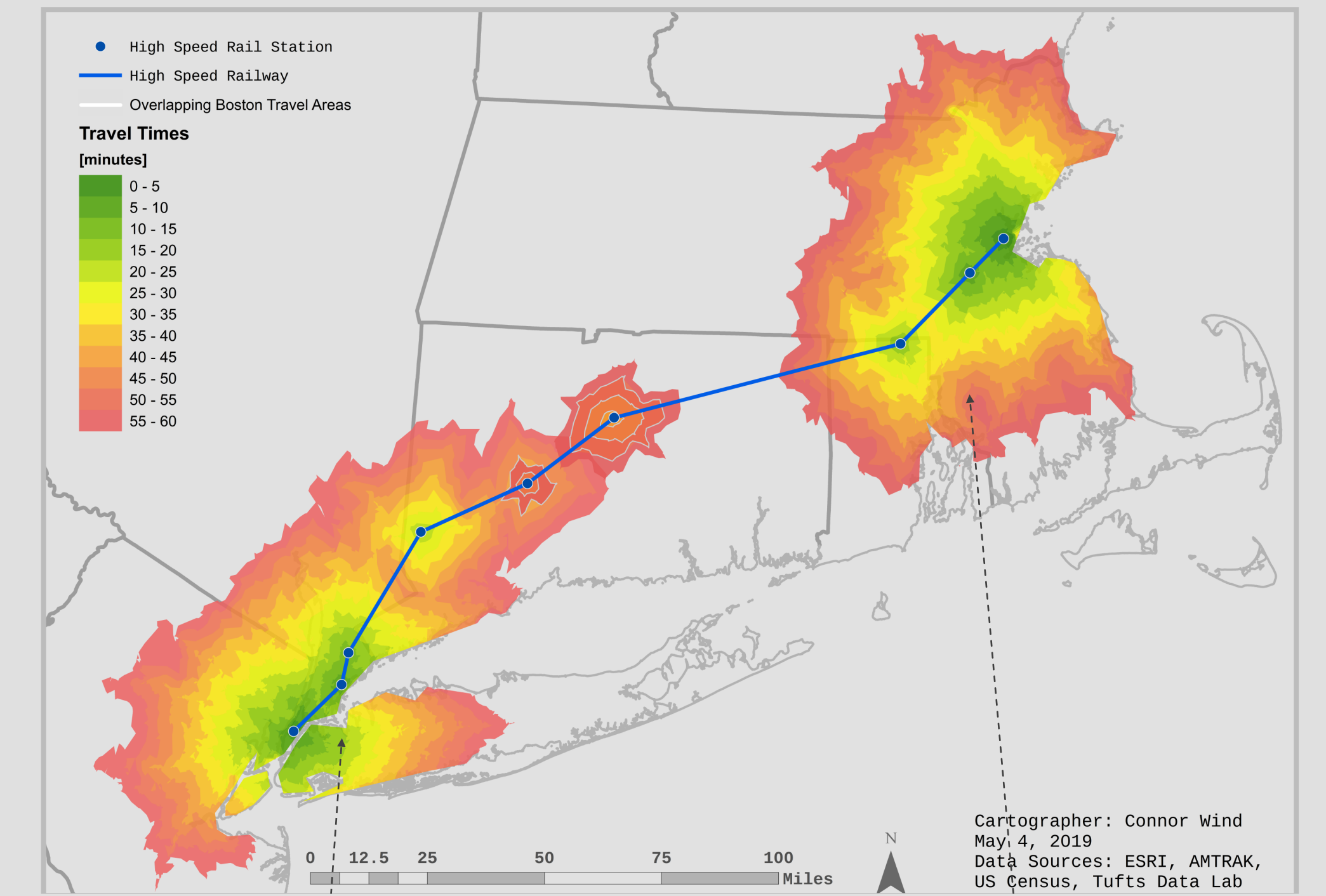


Figure 5: HSR travel. Map areas within one hour of Boston and NYC by car and rail using High Speed Rail.

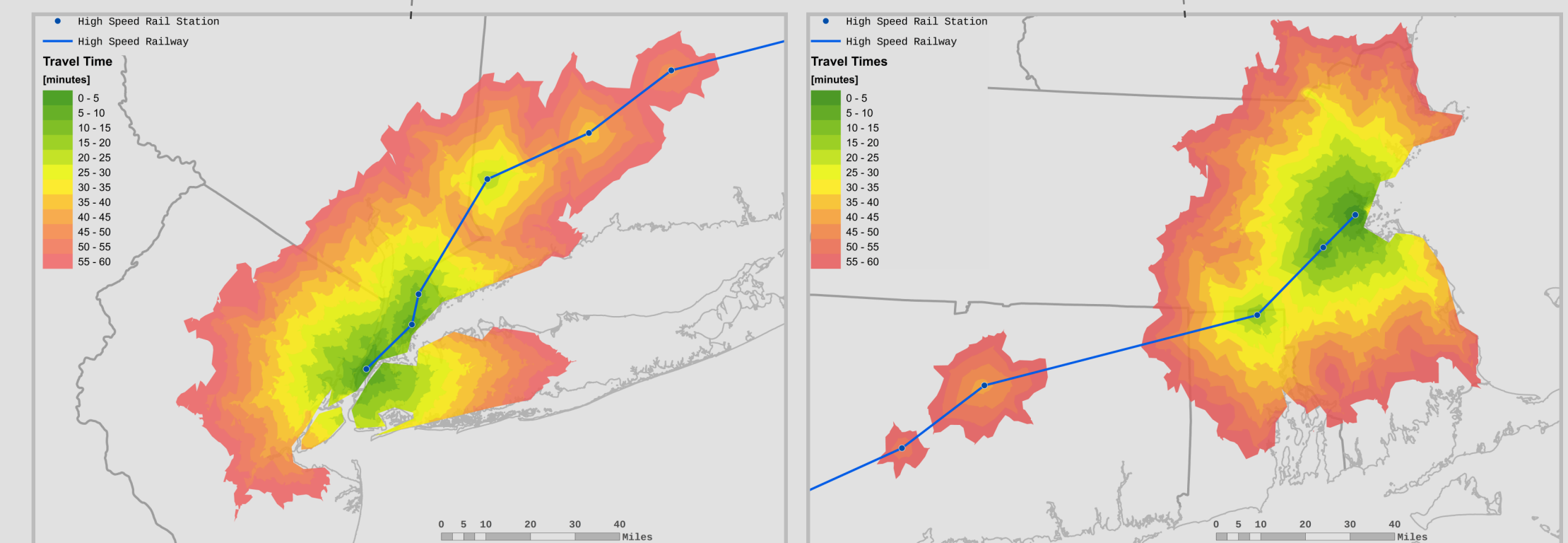


Figure 8: New York inset map.

Figure 8: Boston and Connecticut inset map.

To create the dot density map for the High Speed Rail service areas, block group data from the Northeast was joined with 2017 population attribute data downloaded from the US Census' American Community Survey (US Census Bureau ACS 2017). Then a spatial selection was used to discard all block groups that did not have their centroid within the HSR service areas. The remaining block groups were converted into a dot density layer using ArcMap's symbology tools and overlaid onto the existing HSR service areas (Figure 8.). This same population data was used to determine the total population within both HSR and Shore Line regions. The calculate geometry tool was used to determine the total coverage area (Figure 7.)

Cartographers: Connor Wind & Nathan Kyn

Projection: NAD 1983 2011 State Plane Massachusetts Mainland FIPS 2001

Date: May 6, 2019

References:

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