

Isaac Perry
Salem State University, Salem, MA

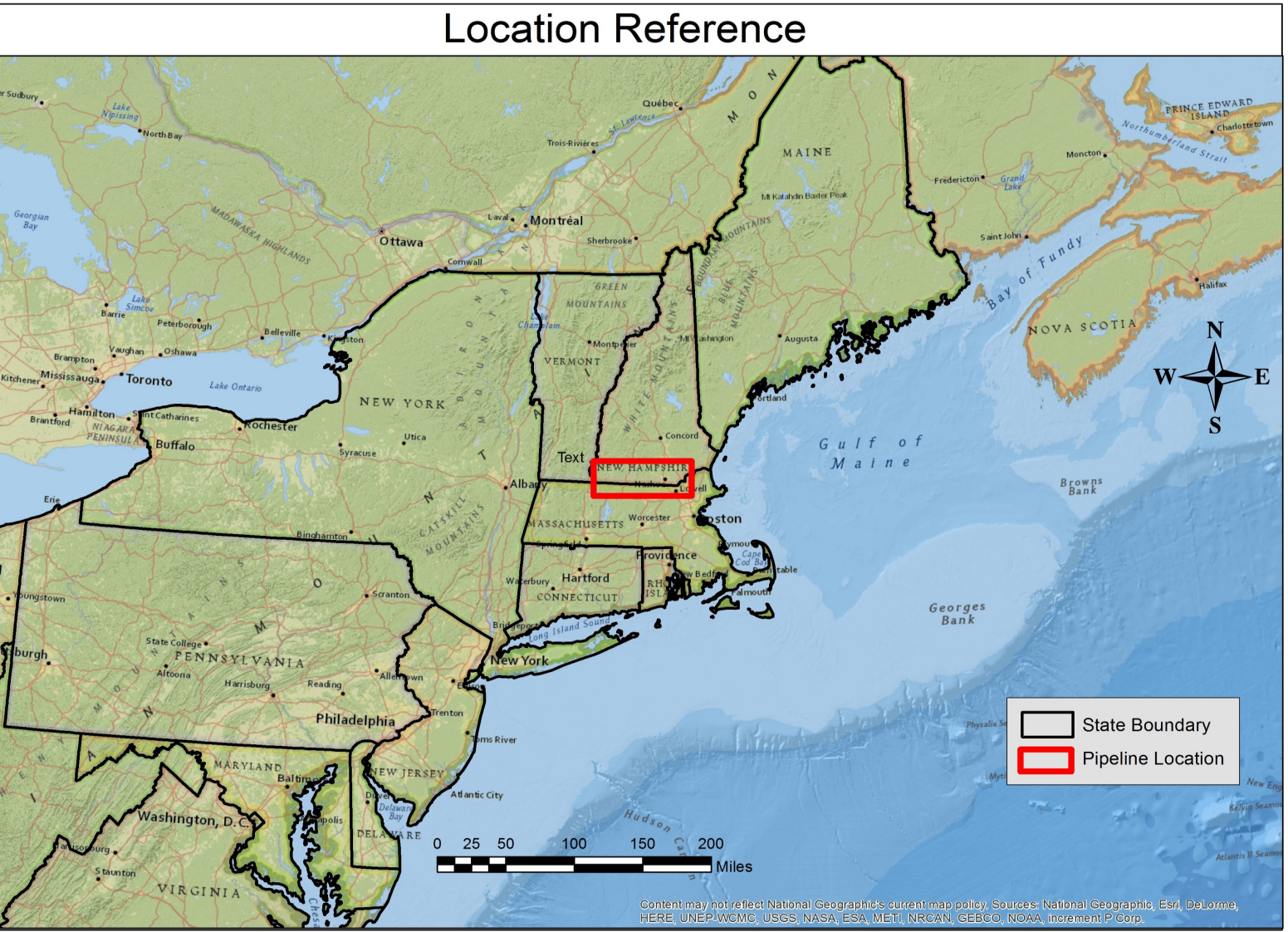
Abstract

This poster presentation concerns environmental justice within the construction and implementation of the Kinder-Morgan natural gas pipeline spanning from Wright, New York to Dracut, Massachusetts. The initial route was changed to stretch the pipeline through Southern New Hampshire, sparing roughly 15 Massachusetts towns.

Residents of the towns traversed by the pipeline are deeply concerned for a number of reasons. There will be a massive loss of private property due to eminent domain. Additionally, property values are estimated to depreciate in the vicinity of the pipeline route. There is also a threat to both safety and water sources as the Kinder Morgan Company's pipelines have an extensive record of subpar safety protocol and significant accidents resulting in fatality, spills, fire and explosions. Furthermore, there is opposition from residents who do not want fossil fuel infrastructure put in place in order to prevent natural gas from reaching the coast where it can be exported.

This research seeks to answer the following question: is this shift in routing socially regressive or inequitable? It is important to understand the social effects of rerouting the pipeline to ensure the project is free from environmental injustices such as racism, wealth discrimination or environmental blackmail. By using geographic information systems and utilizing Census data, demographics of the previous route and the newly proposed route are compared to determine if there are disparities in key demographics, such as race, income, or education. Furthermore the comparative analysis will give insight to the balance of burdens and benefits from this project in a geographic context.

Figure 1.



This map highlights the area where the Kinder Morgan Company has shifted the blueprints of their natural gas pipeline.

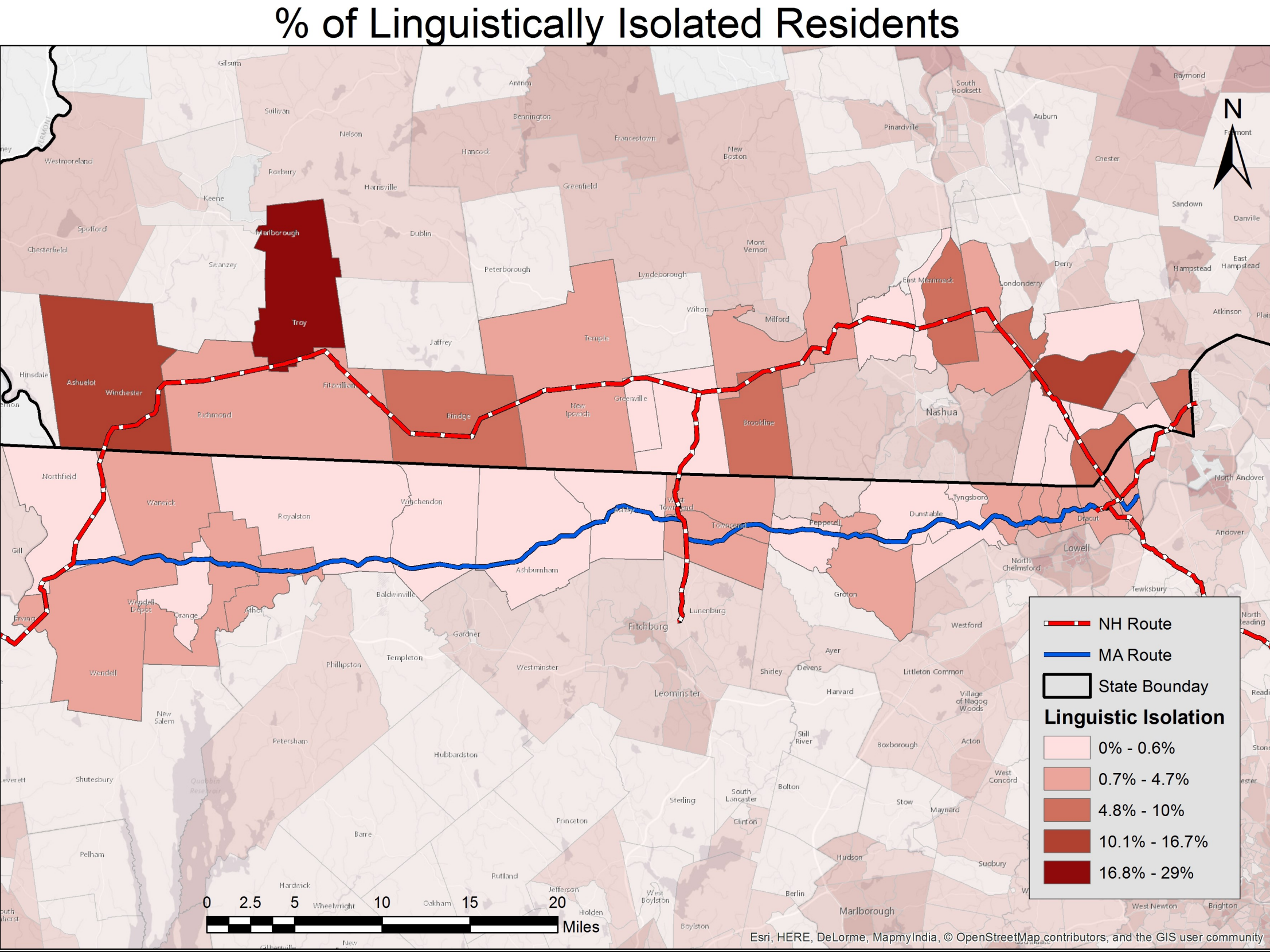
Methods of Research

In order to begin a comparative analysis of the demographics along each pipeline route, we must first know the exact location of the prospective routes. By accessing a series of roughly 150 map images released by the Federal Energy Regulatory Commission at a scale of 17,200 , one can examine the pipeline route in increments of one mile. Each of these map images was georeferenced onto a base map using ESRI's World Imagery in ArcMap 10.3 software. Each map image was georeferenced with a route mean square error of less than one meter. The pipelines were then digitized to represent each route in its entirety. Next, information was retrieved from the American Community Survey 2014 5-year data set, at the census tract level. The vulnerability of residents along each route was measured through four demographics:

1. median household income within the past 12 months,
2. percent of minority residents, meaning those who identify as Hispanic, Latino or anything other than white
3. linguistic isolation, referring to households where occupants over 14 years old do not speak English "very well" or at all
- 4.educational attainment, referring to residents over the age of 25 with at least a bachelor's degree.

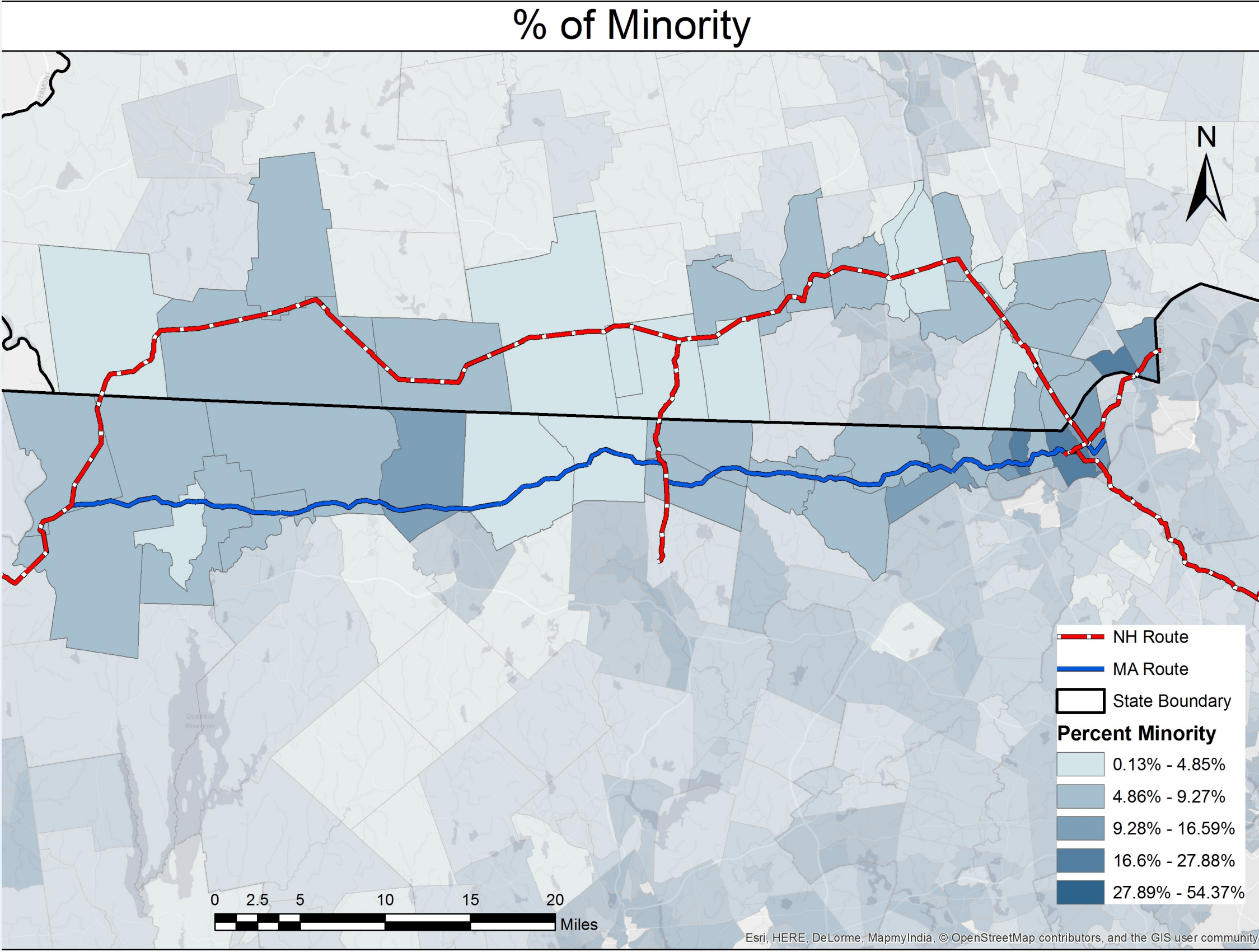
These demographic data sets for the states of Massachusetts and New Hampshire were acquired, modified and brought into ArcMap to be mapped. In order to measure and compare the demographics between the original and newly proposed pipeline routes, Census Tracts were spatially joined to each pipeline route, which identified those Census Tracts traversed by the pipelines. Summary statistics of the demographic variables were computed for the Census Tracts traversed by the initial and modified pipeline routes, and compared to the states as a whole.

Figure 2.



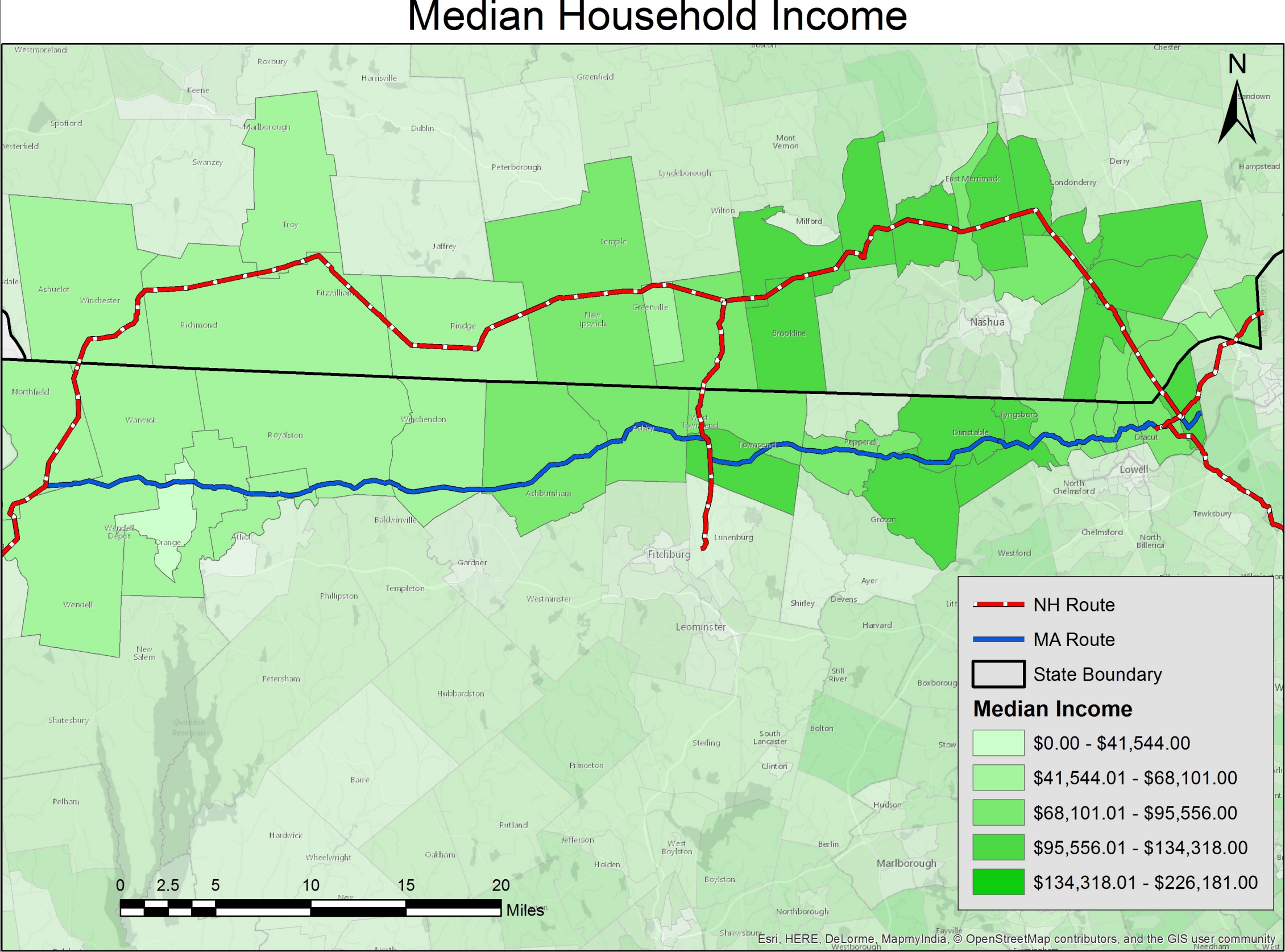
This figure shows the percentage of the population along each pipeline route who are above the age of 14 years old, and do not speak English at all or very well.

Figure 4.



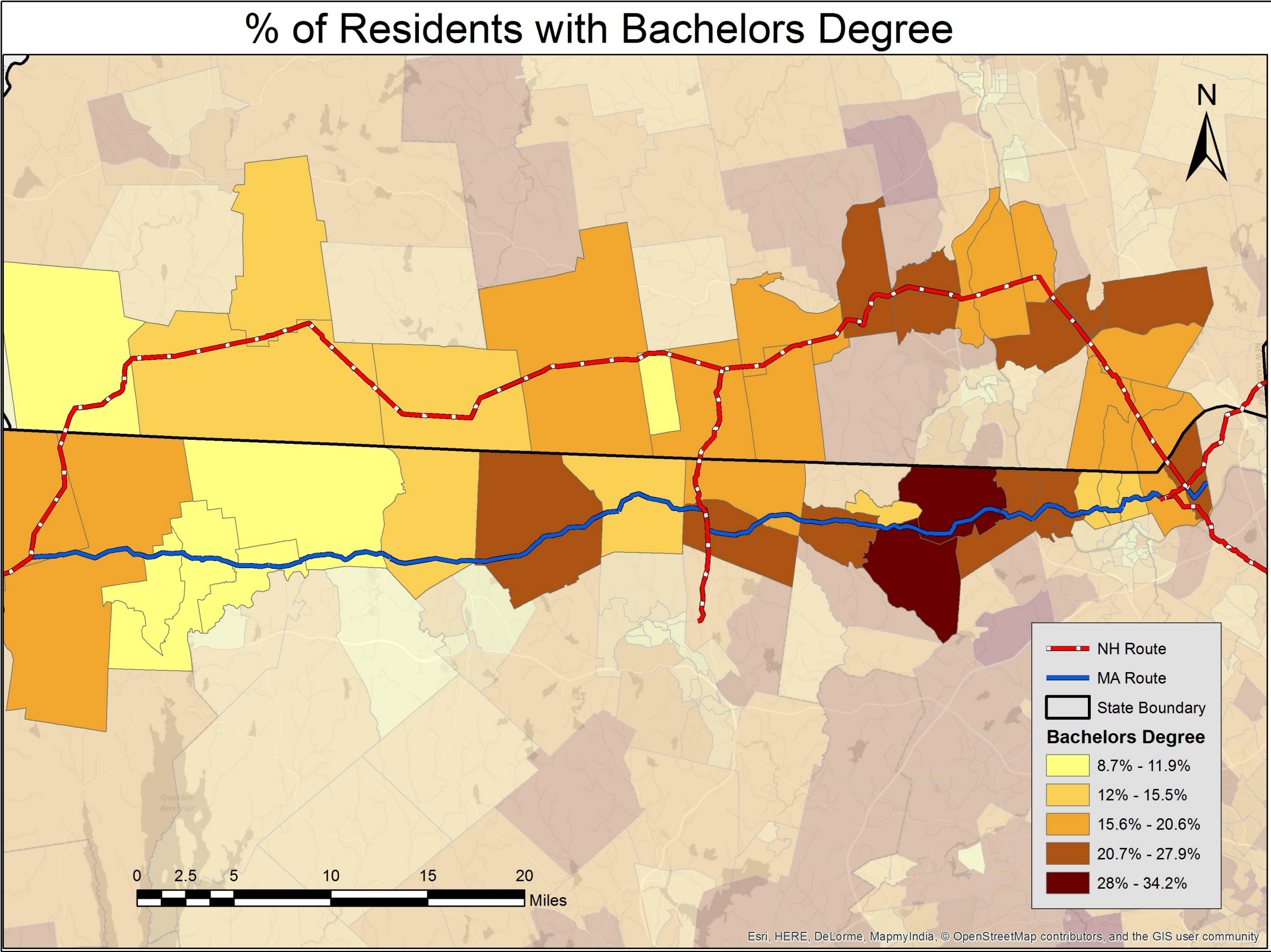
This figure illustrates the percentage of the population who are considered minorities. This represents people along the original and newly proposed pipeline routes who identify their ethnicity as anything other than white.

Figure 3.



This map displays the median household income for each of the census tracts along the prospective pipeline routes within the past 12 months.

Figure 5.



This map shows the percentage of residents along each of the pipeline routes who are over the age of 25 and have attained a bachelors degree.

Results

In reviewing the prospective routes for the Kinder Morgan Pipeline, the differences in the impact of each route can be measured. The original pipeline route would have traversed 15 Massachusetts towns. The modified route is now set to traverse 17 New Hampshire towns. The original in route would have extended 68.88 miles across Massachusetts land. The new route creates a 70.59 mile long route in Southern New Hampshire. The original route would have traversed Massachusetts communities with 108,163 residents. The current route through New Hampshire traverses the neighborhoods of 109,280 residents. The summary of demographics for each of the routes and the states are exhibited in Table 2.

Table 2. Cumulative Demographic Statistics

	New Hampshire Average	New Hampshire Route	Massachusetts Average	Massachusetts Route
Median Income	\$67,274	\$85,443	\$70,832	\$78,313
Percent minority	8.34%	6.49%	26.9%	8.45%
Linguistic Isolation	5.54%	5.77%	6.2%	4.83%
% with bachelors Degree	21.12%	23.22%	21.96%	19.30%
Towns Traversed	-	17	-	15
Route Length	-	70.59 miles	-	68.88 miles
# of Residents Affected	-	109,280	-	108,163

Within Table 1, the figures in red show potential areas of vulnerability when compared to the state average. These figures show that communities along the New Hampshire route have a slight increase in linguistically isolated residents. Additionally, residents along the former Massachusetts route have less educational attainment than the state as a whole. The figure in yellow shows that the pipeline route in Massachusetts has 4.83% less linguistically isolated residents than the New Hampshire route.

Conclusion

This analysis compares the impacts of the prospective routes for the Kinder Morgan, New England Energy Direct natural gas pipeline project. The results show that the newly proposed route would affect more people, yet a generally less vulnerable population. This analysis is based on the same demographics used to identify Environmental Justice populations under the Massachusetts Environmental Justice policy. The results of this analysis do not show an inherent injustice among the more vulnerable population. However, implications derived from this analysis are the result of only four factors. In order to asses a broader scope of potential social inequity, additional demographics could be analyzed.

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Contact Information

Isaac B. Perry, Student
Department of Geography
Salem State University
352 Lafayette St, Salem, MA 01970
i_perry@salemstate.edu

Table 1.

