

Conservation Easement Distribution Across New England

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ABSTRACT

My project considers conservation easement distribution across New England. I answer the questions: Are conservation easements clumped in each of the New England states? How do conservation easements generally differ between states in terms of size and number? Where are conservation easements located in relation to areas of various population densities? I examine clumping of conservation easements by state using a Monte Carlo simulation. Results suggest that easements are significantly clumped in Maine, New Hampshire, Vermont, Massachusetts, and Rhode Island. There is no data for Connecticut. As far as size of easements is concerned, the average easement tract size is much larger for Maine than for the other states. Massachusetts and Rhode Island have many small easements scattered across more populated landscapes. Further research could be conducted to analyze the ecological implications of easement clumping and to try to isolate the factors causing this clumping.

INTRODUCTION

Conservation easements, also known as conservation restrictions, are legal agreements in which property owners donate or sell some or all of their property rights to conservation entities, typically land trusts or government agencies, with then become the holders (Beck et al., 2012). States began to pass statutes establishing the enforceability of easements in the 1960s, and the use of easements as a conservation tool accelerated through the 1990s and 2000s (National Conservation Easement Database, 2013). Easements allow for the conservation of more land for less money (Byers and Ponte, 2005; Eikenberg per. comm., 2012), but the ecological and social benefits of the increased use of easements have been subject to debate (Hagan et al., 2005; Rissman et al., 2007; Morris and Rissman, 2009; Richardson and Bernard, 2011). Conservation easements in New England provide an interesting case study: although the states in this region share a common, natural resource-based history, their conservation easement policies are heterogeneous. Considering differences in easement use may help characterize conservation efforts in these states. My project examines the questions: Are conservation easements clumped in each of the New England states? How do conservation easements generally differ between states in terms of size and number? Where are conservation easements located in relation to areas of various population densities?

METHODS

I conducted my analysis using ArcMap 2010. I used a Monte Carlo simulation to examine the clumping of conservation easements. First, I dissolved the conservation easement polygons for Maine, New Hampshire, Massachusetts, and Rhode Island and generated centroids of the polygons in each of these dissolved layers. The Vermont layer could not be dissolved, so I generated centroids for the easement tracts. I then ran the Monte Carlo simulation for each state. I found the average nearest neighbor distance in meters for the centroids of the actual easement polygons and also all of the average nearest neighbor distances for the centroids generated by a random process run 1,999 times per state. I obtained conserved lands data for the New England states from the Maine Office of GIS, New Hampshire Granite, MassGIS, Vermont Conserved Lands Database, and Rhode Island GIS. There is no conservation easement data for Connecticut, but Figure 1 shows conserved lands generally for Connecticut.

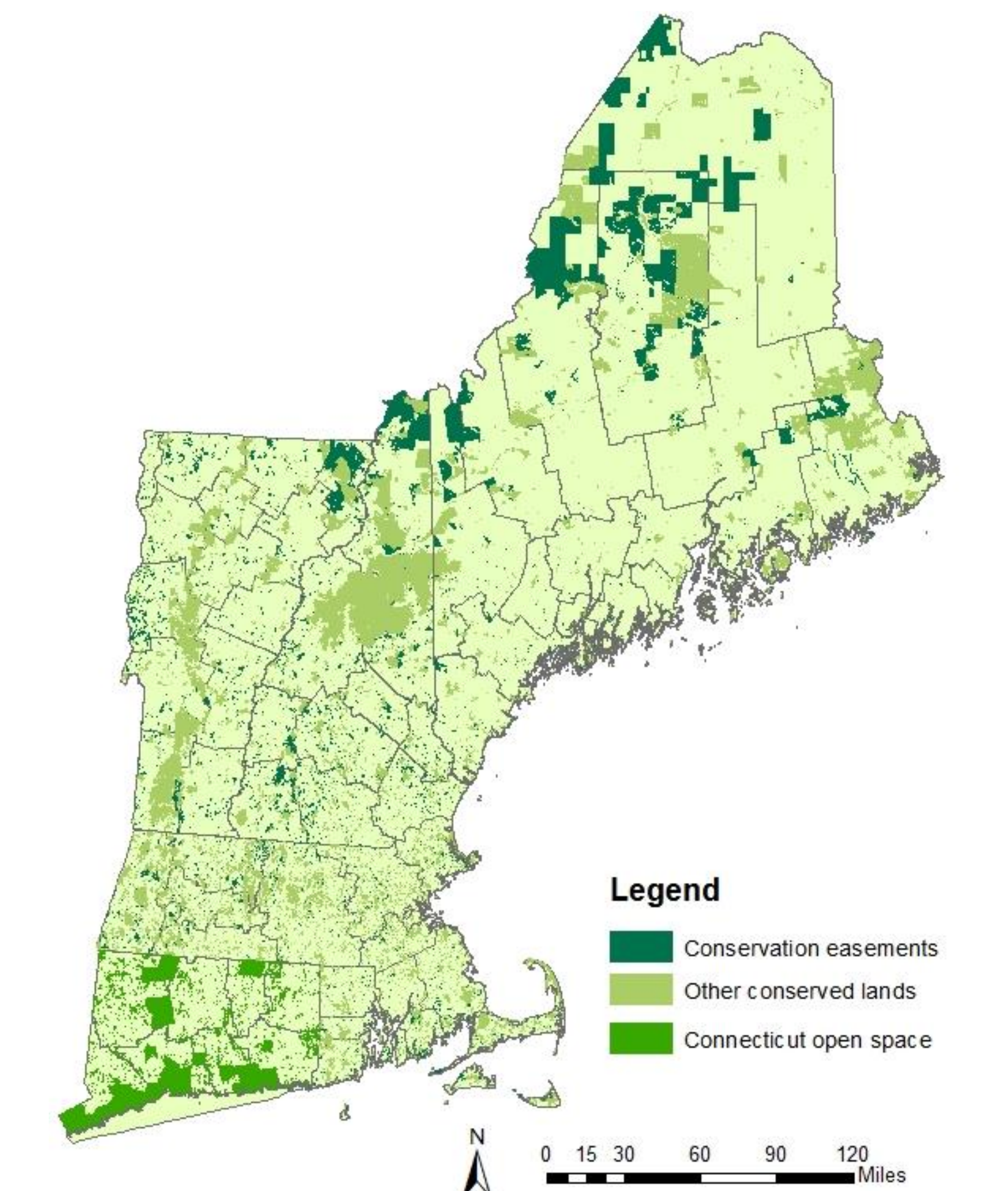


Figure 1: Conservation easements and other conserved lands across New England

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METHODS

To find the average size of easement tracts by state, I used the summarize tool. To illustrate the positions of easements relative to population density, I used population density data from American Community Survey (ACS) 2006-2010.

All data were projected to North American Equal Area Conic with a central meridian set to 71 degrees west and parallels set to 42.8 and 45.4 degrees north.

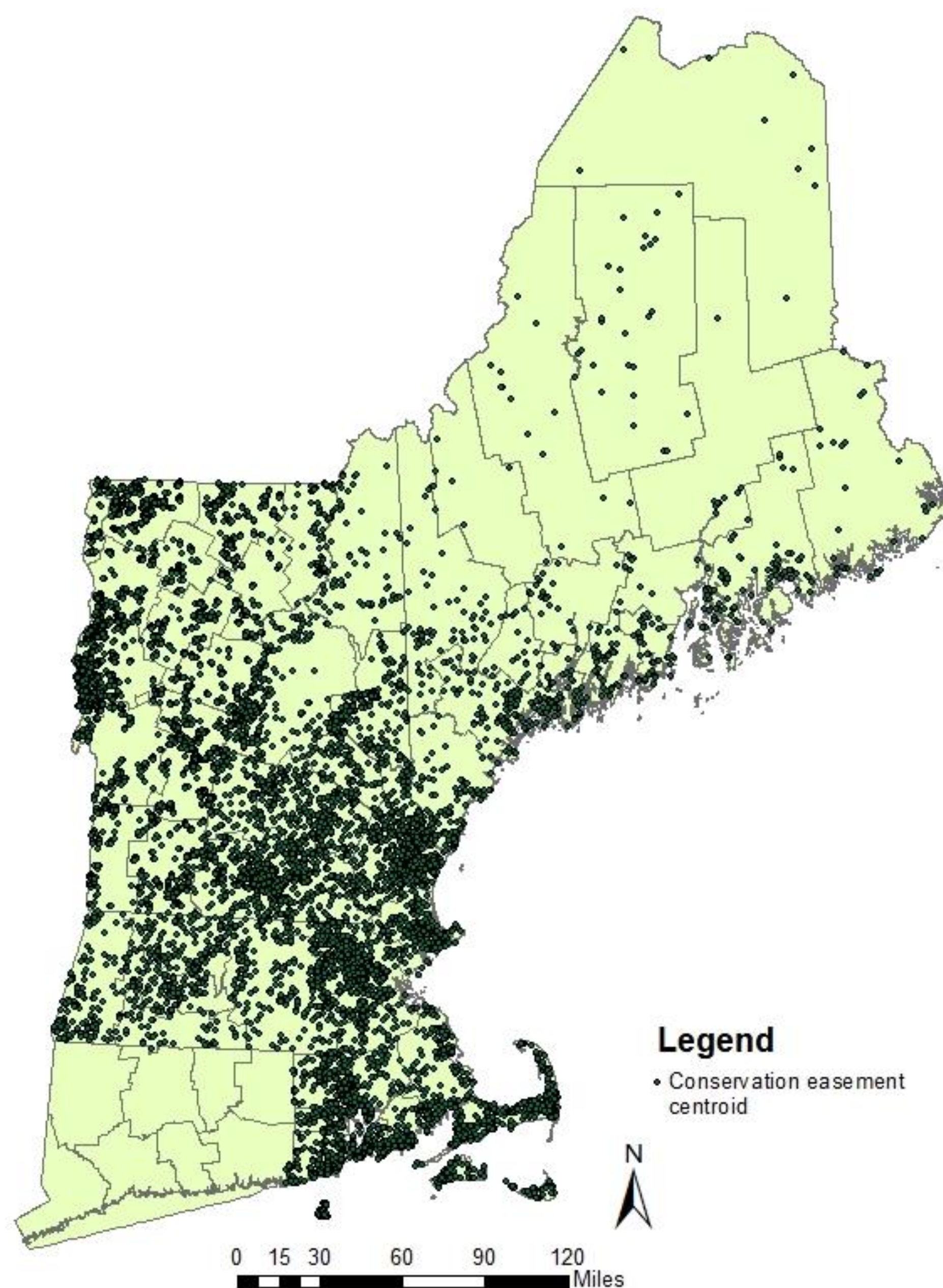


Figure 2: Centroids of conservation easements across New England

RESULTS

Monte Carlo simulations indicated that conservation easements are significantly clumped in Maine, New Hampshire, Vermont, Massachusetts, and Rhode Island. The average nearest neighbor values in meters for each state are listed in Table 1. Figures 3 illustrates that in each state, the average nearest neighbor value for the actual centroids is less than all of the average nearest neighbor values calculated for the centroids from the 1,999 random processes. P-value=0 for each of the states, indicating that clumping is significant for each of the states.

The average tract size and number of tracts for each state are listed in Table 2.

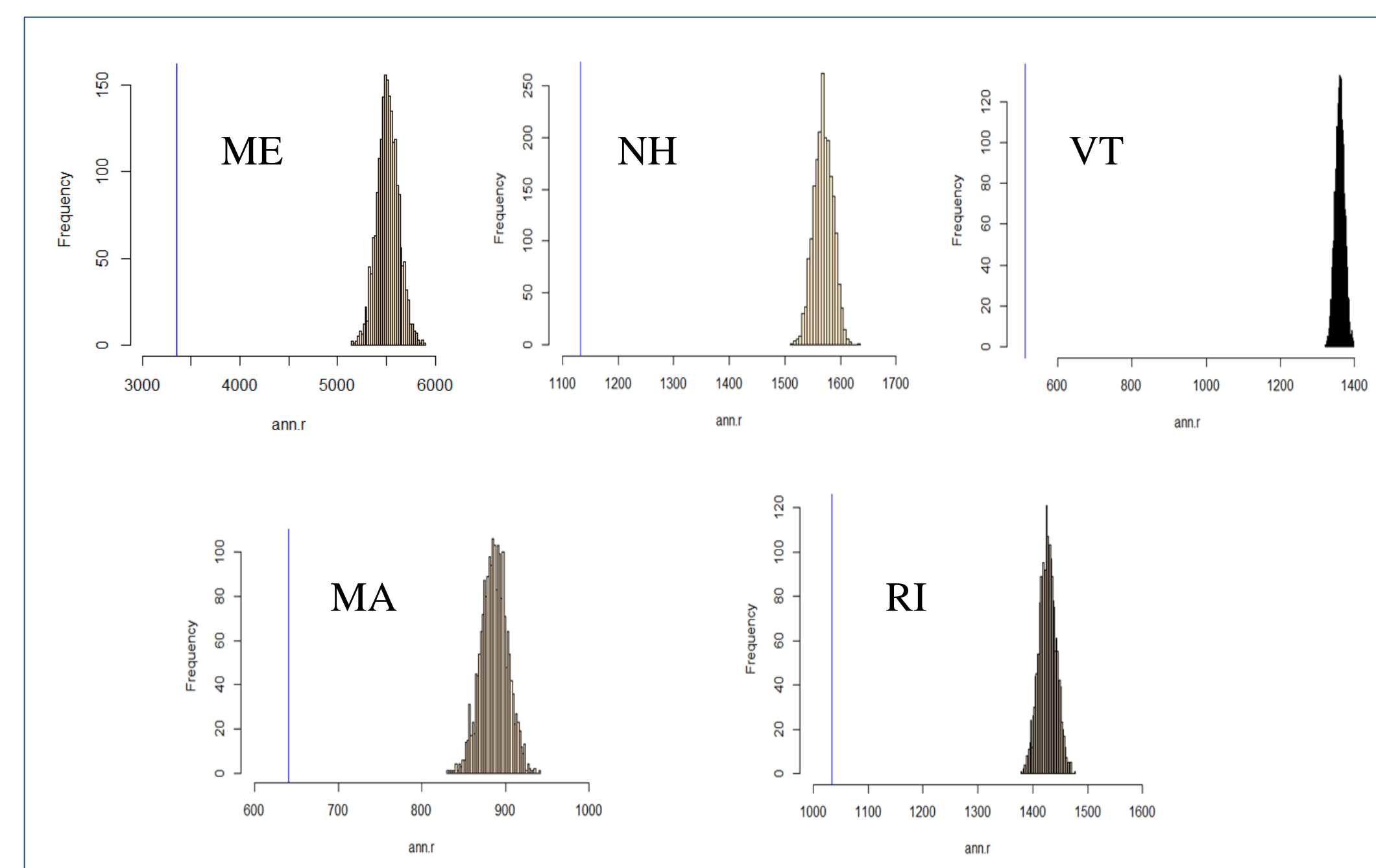


Figure 3: Histograms of average nearest neighbor values for randomly generated points, with average nearest neighbor values for the actual centroids indicated by the blue lines

| State | Ann.p |
|-------|-------|
| ME | 3,353 |
| NH | 1,133 |
| VT | 513 |
| MA | 1,034 |
| RI | 6,40 |

Table 1: Average nearest neighbor distance between easement centroids by state

| State | Average tract size (acres) | Number of tracts |
|-------|----------------------------|------------------|
| ME | 1,322 | 1,210 |
| NH | 117 | 3,909 |
| VT | 105 | 3,425 |
| MA | 27 | 6,567 |
| RI | 21 | 1,319 |
| CT | No data | No data |

Table 2: Average easement tract size and number of easement tracts by state

DISCUSSION

The Monte Carlo simulation indicates that conservation easements are significantly clumped in Maine, New Hampshire, Vermont, Massachusetts, and Rhode Island. Clumping may have positive ecological implications. It may create networks of conserved lands, providing habitat corridors. On the other hand, if the clumping is primarily occurring with small easements in suburbanized areas, the ecological payoffs may not be very high. Additional research could be conducted to further characterize easement clumping, to examine clumping in a way that takes the relative sizes of the easements into account, and also to isolate the variables that are leading to clumping. A number of prominent conservation bodies, such as The Nature Conservancy Vermont Chapter and the Trustees of Reservations, consider locations of properties relative to other conserved lands in selecting easement tracts, but there may be other variables at play that are leading to clumping.

The northern New England states contain larger conservation easement tracts, while the southern New England states contain many small easements. The average tract size for conservation easements is much larger in Maine than in the other states. This distribution of easement sizes makes sense given relative population densities: the easements in Massachusetts and Rhode Island are dispersed within and between high population density areas (Figure 3). Any easements in Connecticut would also be located within and between relatively high population density areas. It is notable that the states with smaller tracts still contain many easements. Massachusetts stands out with more than 6,000 tracts.

There are a number of caveats to keep in mind when considering this data. Some of the layers for the various states are out-of-date. The Vermont conserved lands layer has not been fully updated since 2004, although some additions were made in 2009. The Rhode Island conserved lands layers were updated in 2011. The New Hampshire conserved lands layer was updated in 2012. The Maine and Massachusetts layers was updated in 2013. Maine has by far the best data accuracy because it is the only state that legally mandates submission of conservation easement data to the government. Even so, there are over 2 million acres of land under conservation easement listed in Maine's Conservation Easement Registry, yet the conserved lands layer includes only about 1.5 million acres. The data examined here is the best data that was available to me but should be considered as generally illustrative, not necessarily complete or accurate. It is also notable that different states have different definitions of conservation easements (or conservation restrictions).

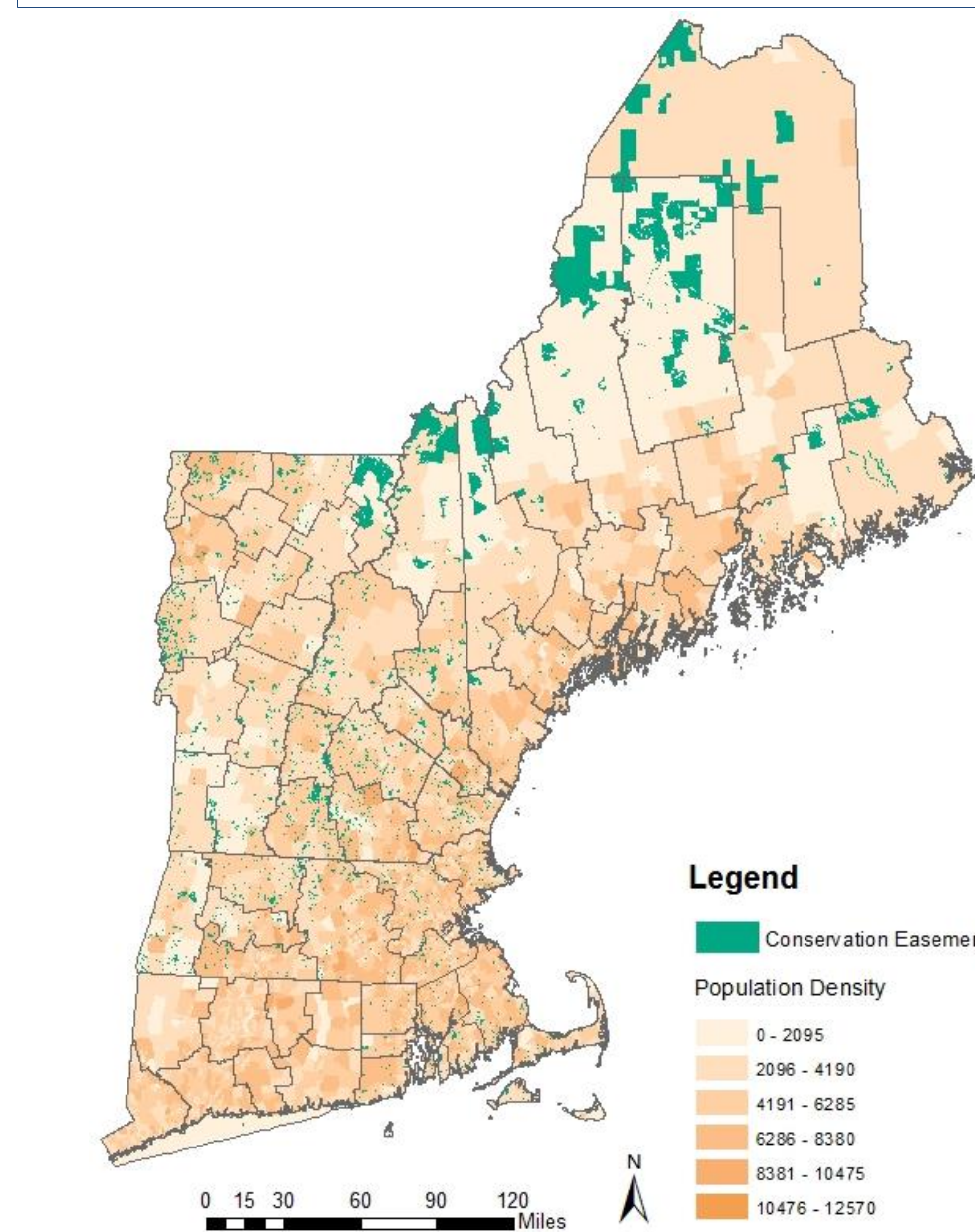


Figure 4: Conservation easements and population density across New England

CONCLUSIONS

A Monte Carlo simulation indicates that conservation easements are significantly clumped in Maine, New Hampshire, Vermont, Massachusetts, and Rhode Island. The northern New England states, and particularly Maine, are characterized by relatively large tracts under easement. The southern New England states contain many small easements across their more fragmented landscapes. Additional research could be conducted to further characterize easement clumping.

SOURCES: Conserved lands layer, Maine Office of GIS (2012); Conserved lands layer, MassGIS (2013); National Conservation Easement Database (2013); Conserved lands layer, New Hampshire Granite (2012); RIGIS (2011); Concept layer, Vermont Conserved Lands Database, Vermont Center for Geographic Information (2009); Connecticut DEEP (1997).
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