

# Commute Times and Obesity Rates in Massachusetts

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## Abstract:

This project will examine commute time, and examine whether it has an effect on health. The literature shows that it has a significant effect on chronic diseases, mental health, and injury rates (1). Commute time forces trade-offs regarding healthy behaviors (1). Traffic is one major cause of air pollution, with in turn affects health (2). This project will examine the relationship between commute time and obesity (if any) in Massachusetts. Overall, longer commutes are linked to poor physical health outcomes due to lack of physical activity and increased sedentary time, such as obesity, increased BMI, and decreased cardiovascular fitness (1). Impacts on obesity are seen starting at a daily commute time of 31 to 60 minutes (3). The commute time means more time not being physically active, and less time for healthy behaviors such as visiting the doctor, sleep, physical exercise, and healthy eating (1).

This project attempted to examine two research questions: Are longer commute times or obesity rates clustered in certain areas of Massachusetts? And are longer commute times and higher obesity rates correlated in Massachusetts?

## Methods:

First, I had to find data by town for commute time and for a chosen health indicator. I used the “Travel Time to Work” data from the US Census American Community Survey. Using Excel, I found the count and percentage of people who travelled over 45 minutes daily to work, by town. Next, I assembled data on adult obesity rates from MA Department of Health & Human Services’ Healthy People 2010 Report.

To examine the data, I created a series of maps in GIS. The Excel tables were geocoded using an attribute join. I used the Jenks natural breaks to divide the data into ranges, and kept these breaks consistent throughout the project for purposes of comparison. Next, I added a highway layer to determine whether highways might be connected to high obesity rates or commute times. I selected towns that intersected highways, and compared the statistics between the two groups.

To examine clustering and correlation, I used a series of GIS tools. I determined the Local and Global Moran’s I to determine if – and where – the data might be clustered. Next, I used GIS tools to examine the centroids and standard deviation ellipses for the two sets of data. Finally, I created a series of raster maps to try to determine where both high obesity rates and long commute times might be clustered. To do this, I converted to two preliminary vector maps into raster maps. I then reclassified both raster maps using the aforementioned ranges, and gave each range an integer between 1 (low rate or percentage) and 5 (high rate or percentage). I used the raster calculator to determine what areas of Massachusetts had a high score in both categories.

## Results:

### Are they clustered?

Figures A and B give a rough idea about where high obesity rates and long commutes might be clustered in Massachusetts. It appears that high commute times are clustered to the

Fig. A: Percentage of Workers with 45+ Minute Daily Commute

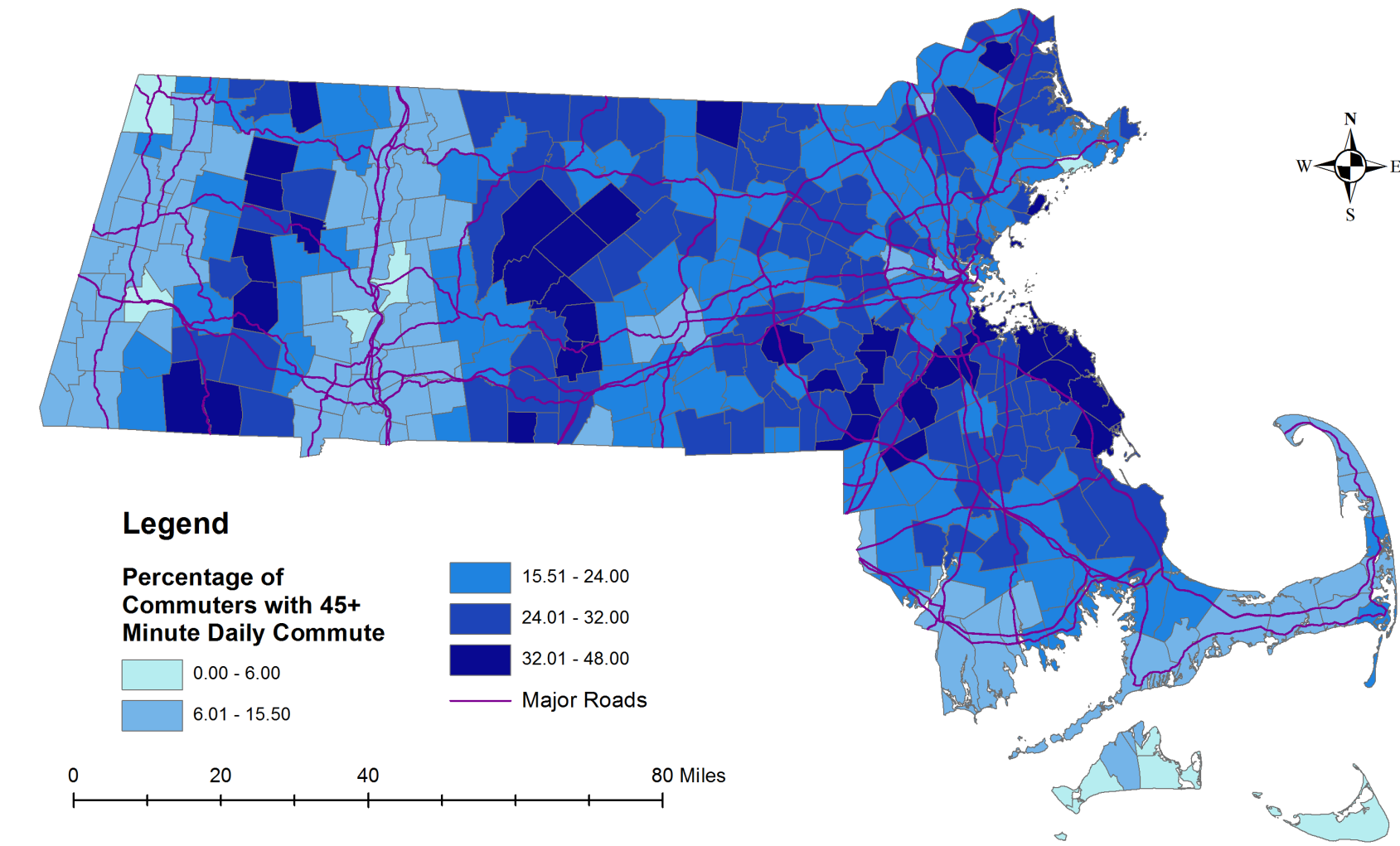


Fig. B: Obesity Rates by Town

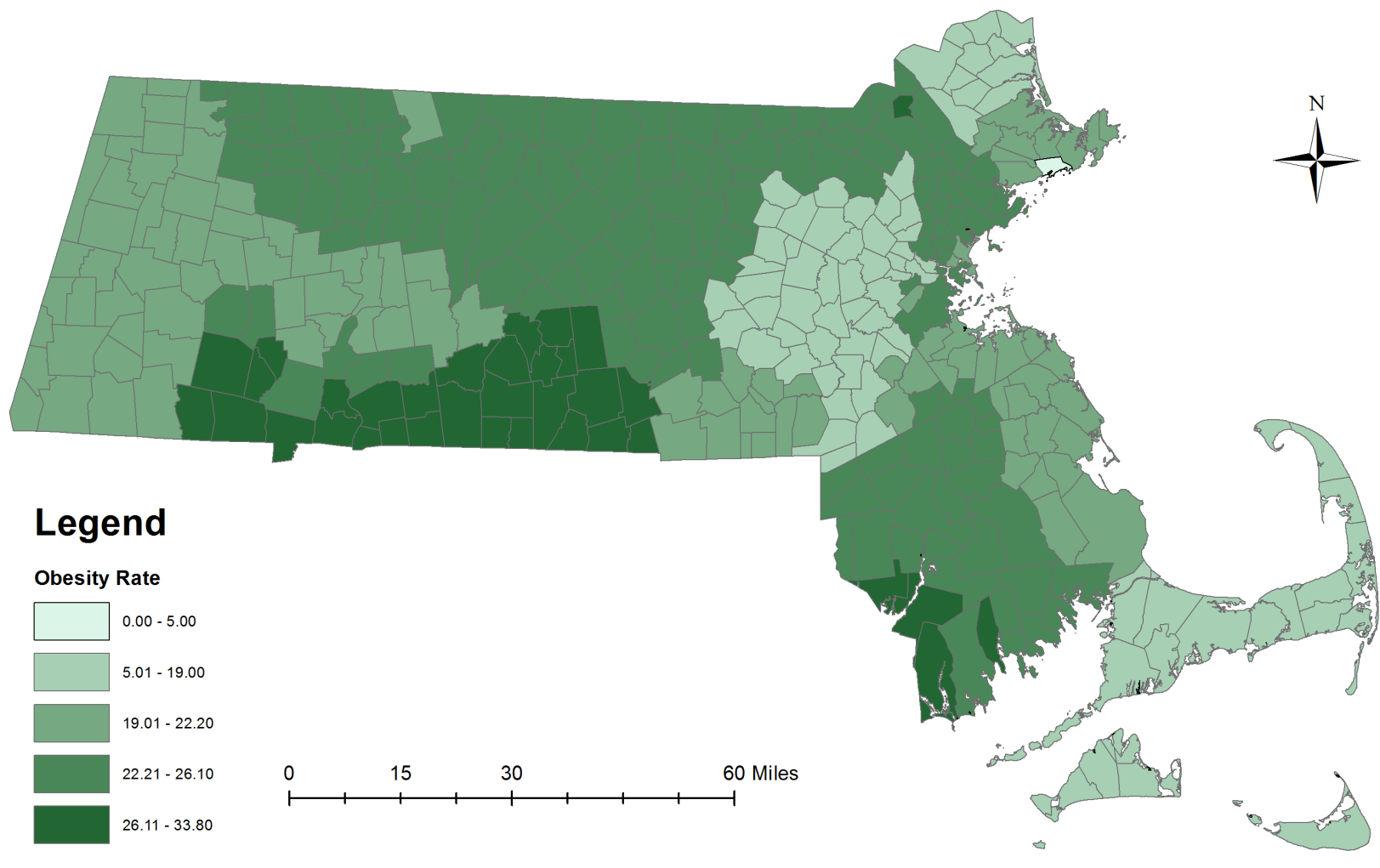


Fig. F2: Clustering of Obesity Rates

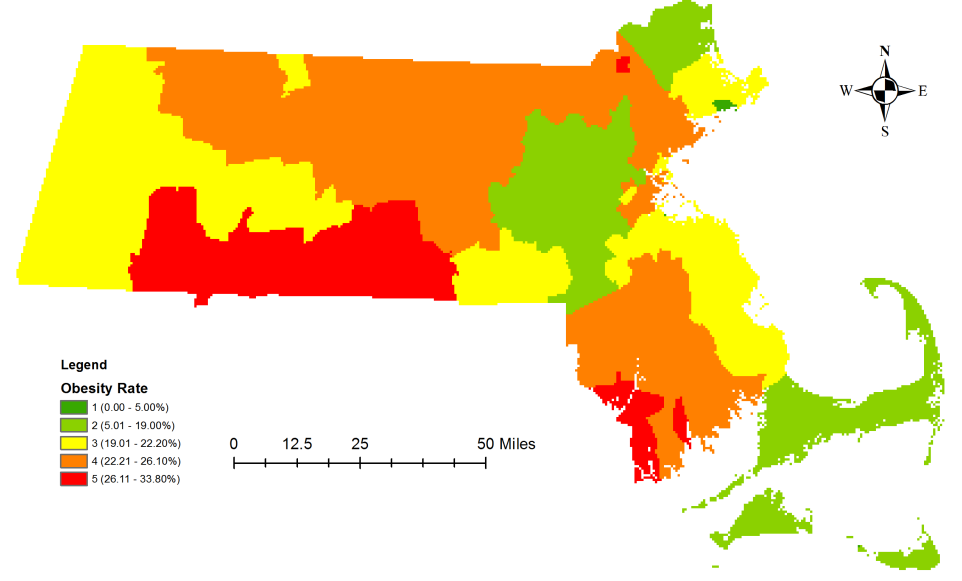


Fig. F3: Clustering of Commute Percentages

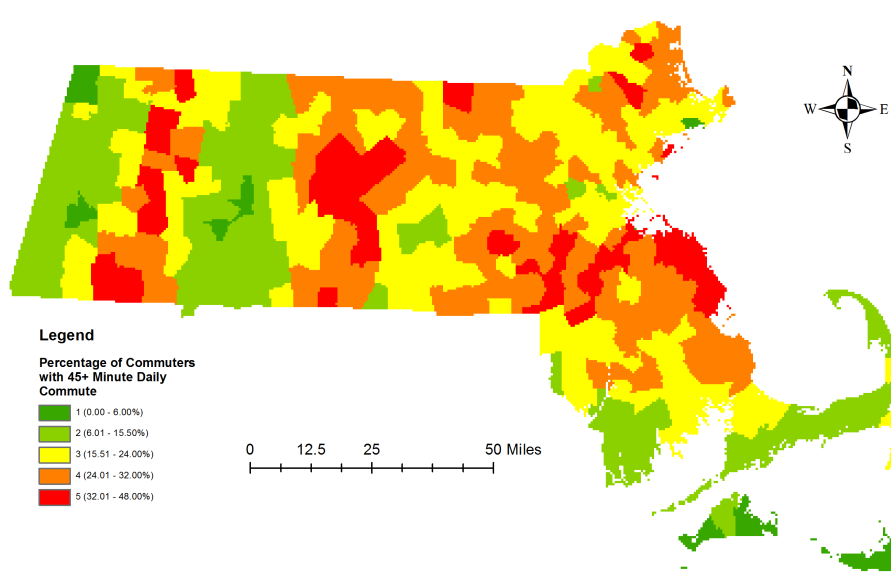
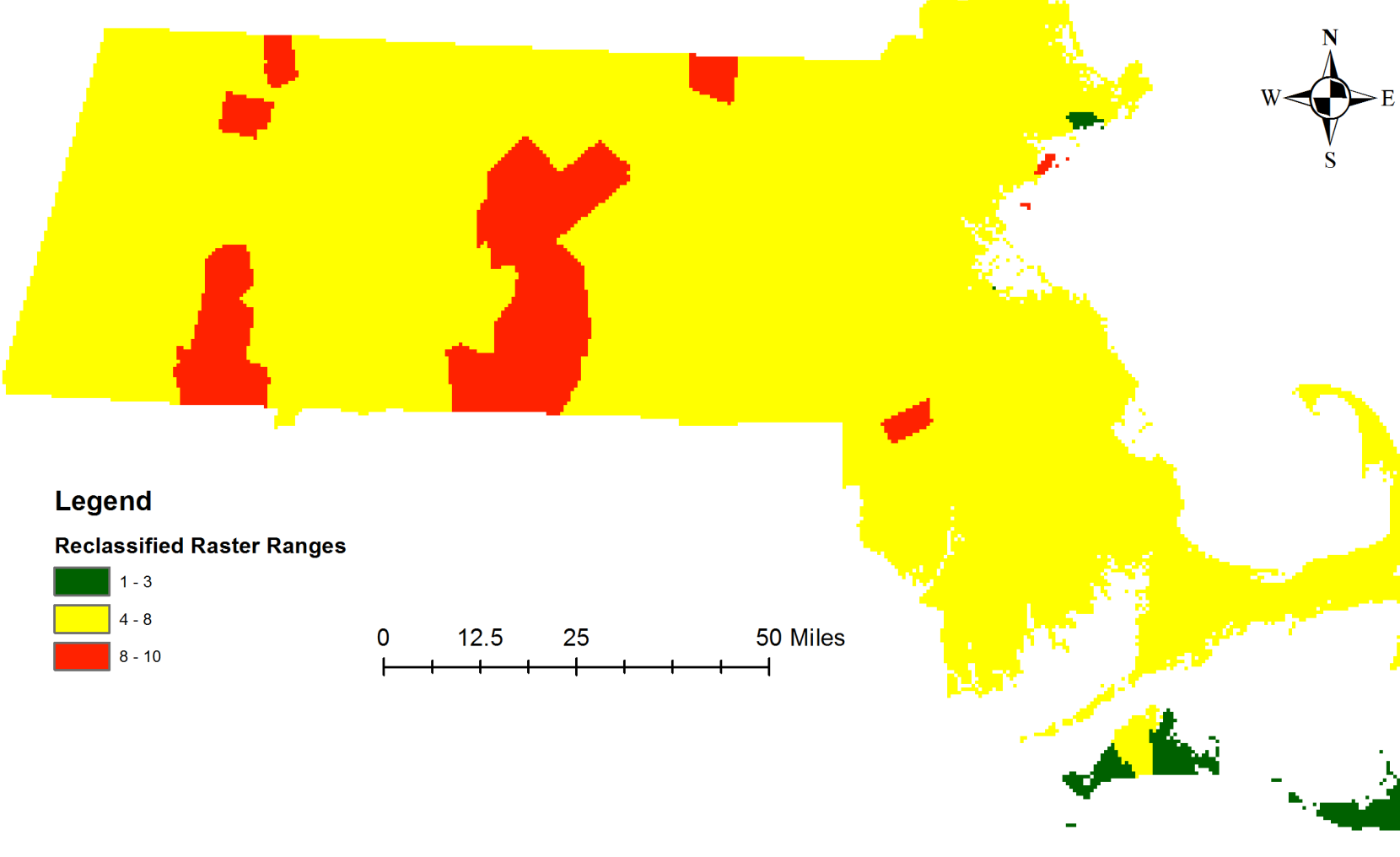


Fig. F1: Clustering of High, Medium, and Low Commute Percentages and Obesity Rates



south of Boston, and in two bands running north and south to the east of Boston. The highest obesity rates appear to be clustered in the central-southern region of Massachusetts near Springfield, while the outer Boston suburbs and Cape Cod appear to have lower obesity rates.

The Global Moran’s I results show that the clustering of both high commute times and obesity rates are statistically significant, and very unlikely to be due to random chance. Commute times have a stronger positive autocorrelation than obesity rates, with a Global Moran’s I of 0.857 versus 0.447.

Finally, I wanted to determine if high commute times or obesity rates might be connected to highway systems. Populations in just outside of the highways systems were more likely to have a commute time of over 45 minutes (20.97% vs. 21.98%). High obesity rates did not appear to be related to highway locations.

### Are they correlated?

Figure C shows the centroids and first two standard deviation ellipses for obesity rates and for percentages of high commute times. The centroids and ellipses of both sets of data are similar, though the obesity data skews slightly to the south. The standard deviation ellipses for the commute percentage data are slightly smaller, meaning that more data – and higher percentages – are clustered around the centroid.

Figure D, which shows clustering of high commute time percentages using Local Moran’s I, confirms that high commute times are clustered to the south of Boston and in two bands to the east of Boston, as well as the northeastern section of Massachusetts. Figure E, which shows clustering of obesity, confirms that high obesity rates are clustered in the southern-central region of Massachusetts, as well as the southeast corner of the state. There appears to be some amount of overlap in this clustering.

Fig. C: Centroids and Standard Deviation Ellipses

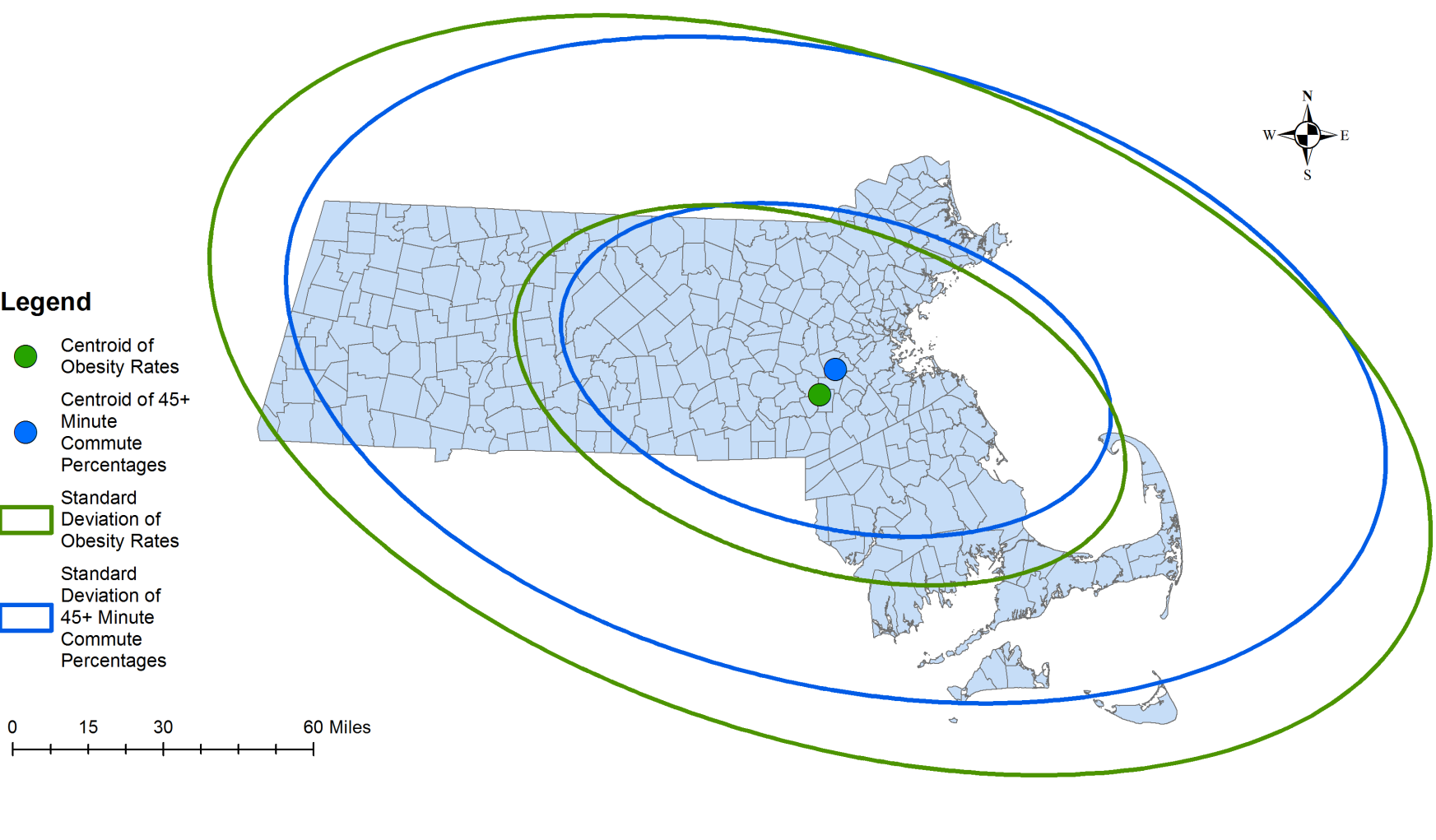


Fig. D: Local Moran’s I Clustering, Commute Percentages

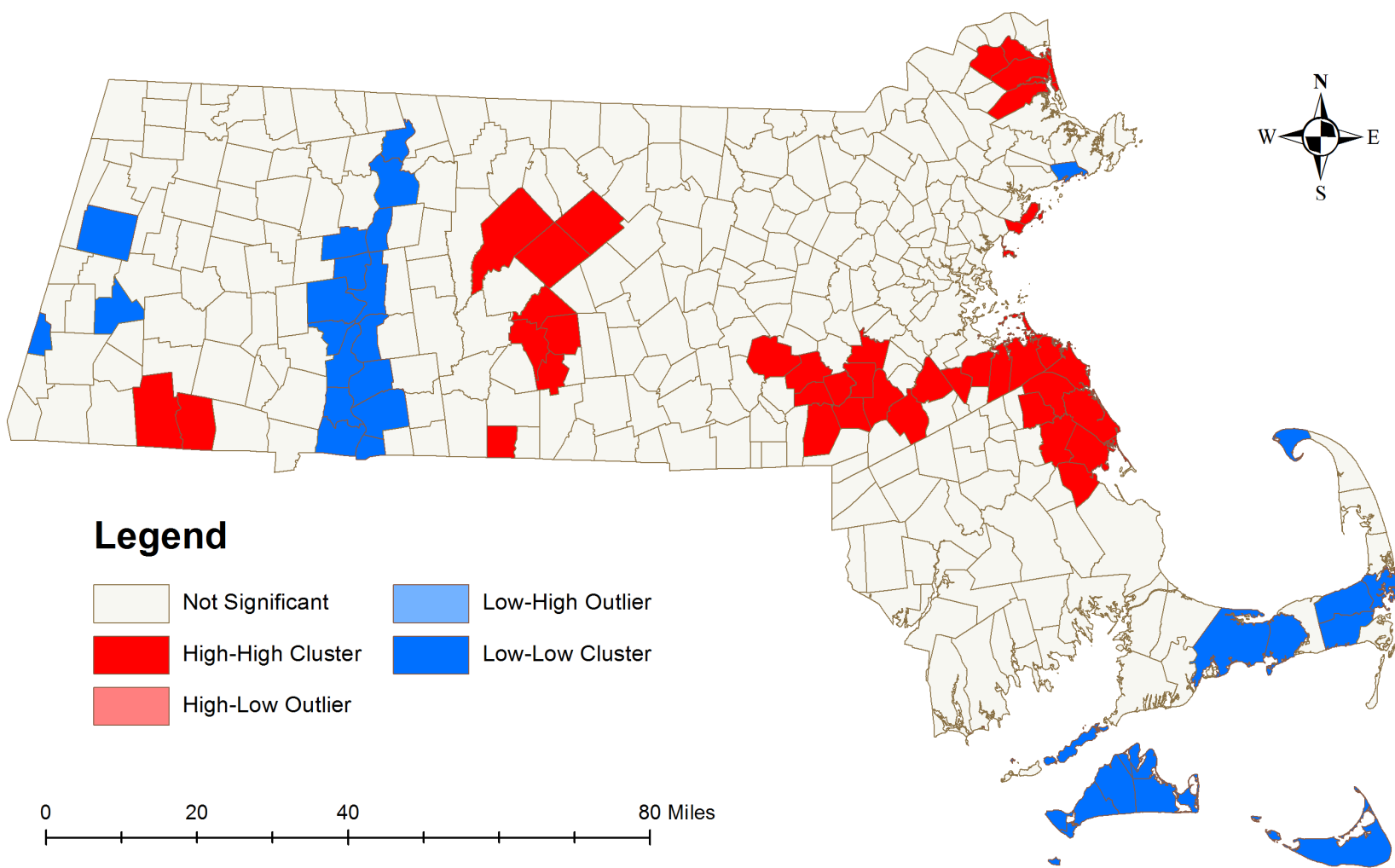
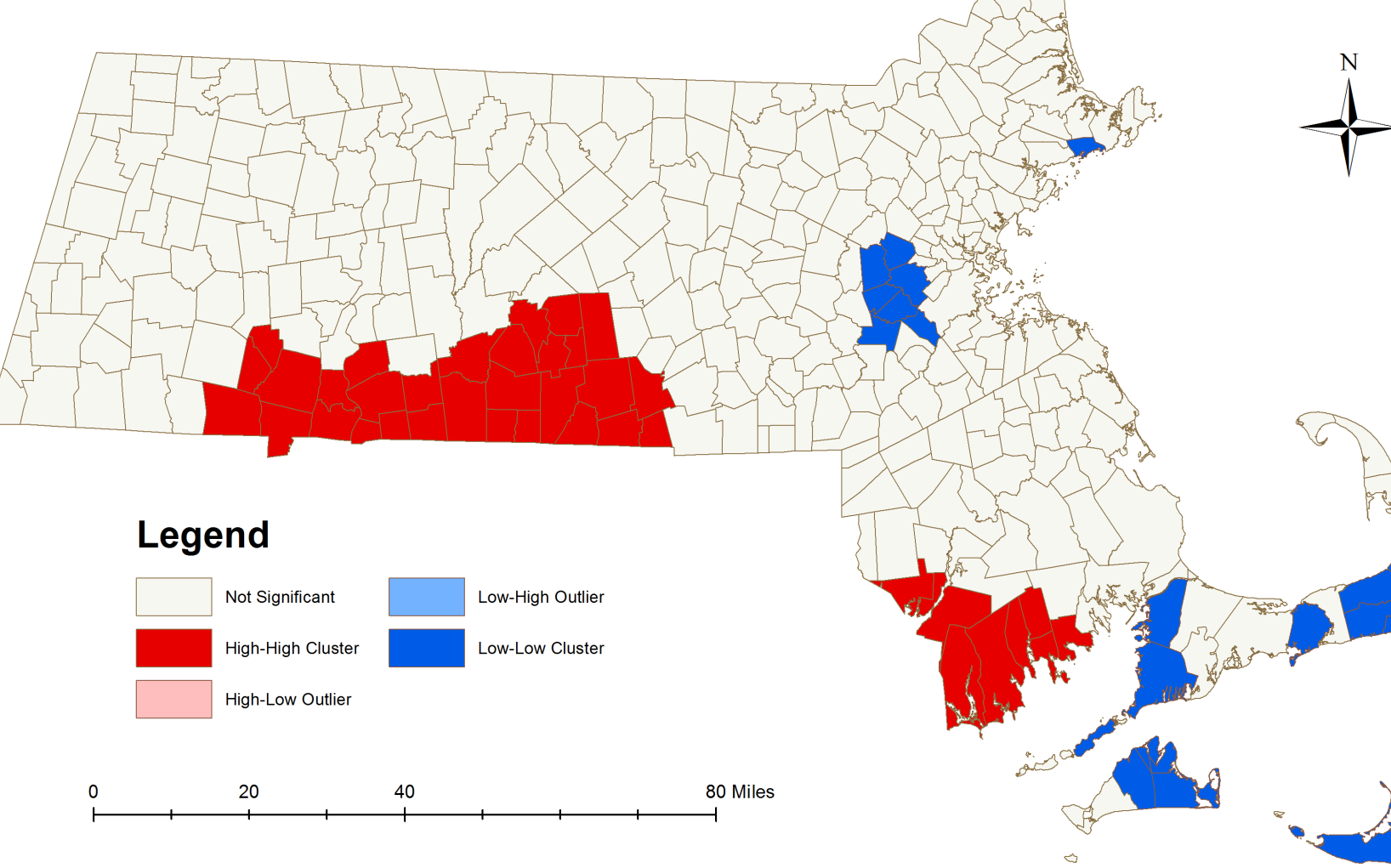


Fig. E: Local Moran’s I Clustering, Obesity Rates



Finally, Figure F shows where high obesity rates and high commute times might be clustered. Both obesity rates & high commute time percentages were reclassified into integers between 1 and 5, and these values were added together and reclassified into three groups to create this map. I chose to use conservative ranges to see where high commute times and high obesity rates might truly be correlated. If the area had a score of 3 or below, both the commute time percentages and obesity rates had to be low. If the score was between 4 and 7, both the commute time percentages and obesity rates could be moderate, or one could be high and one could be low. If the score was between 8 and 10, both the commute time percentages & obesity rates had to be high. Scores between 8 and 10 appeared to be clustered in two bands in central Massachusetts.

## Conclusions

These results suggest that both obesity rates and high commute times percentages are clustered. They also show that there are some areas where this clustering overlaps, and suggests that they may be correlated. However, there could be several confounding variables. Many factors influence obesity rates, and these factors are often connected and cluster in similar areas. In the future, the clustering of other variables related to obesity (such as housing, income, and education) should be investigated.

## Sources & References:

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