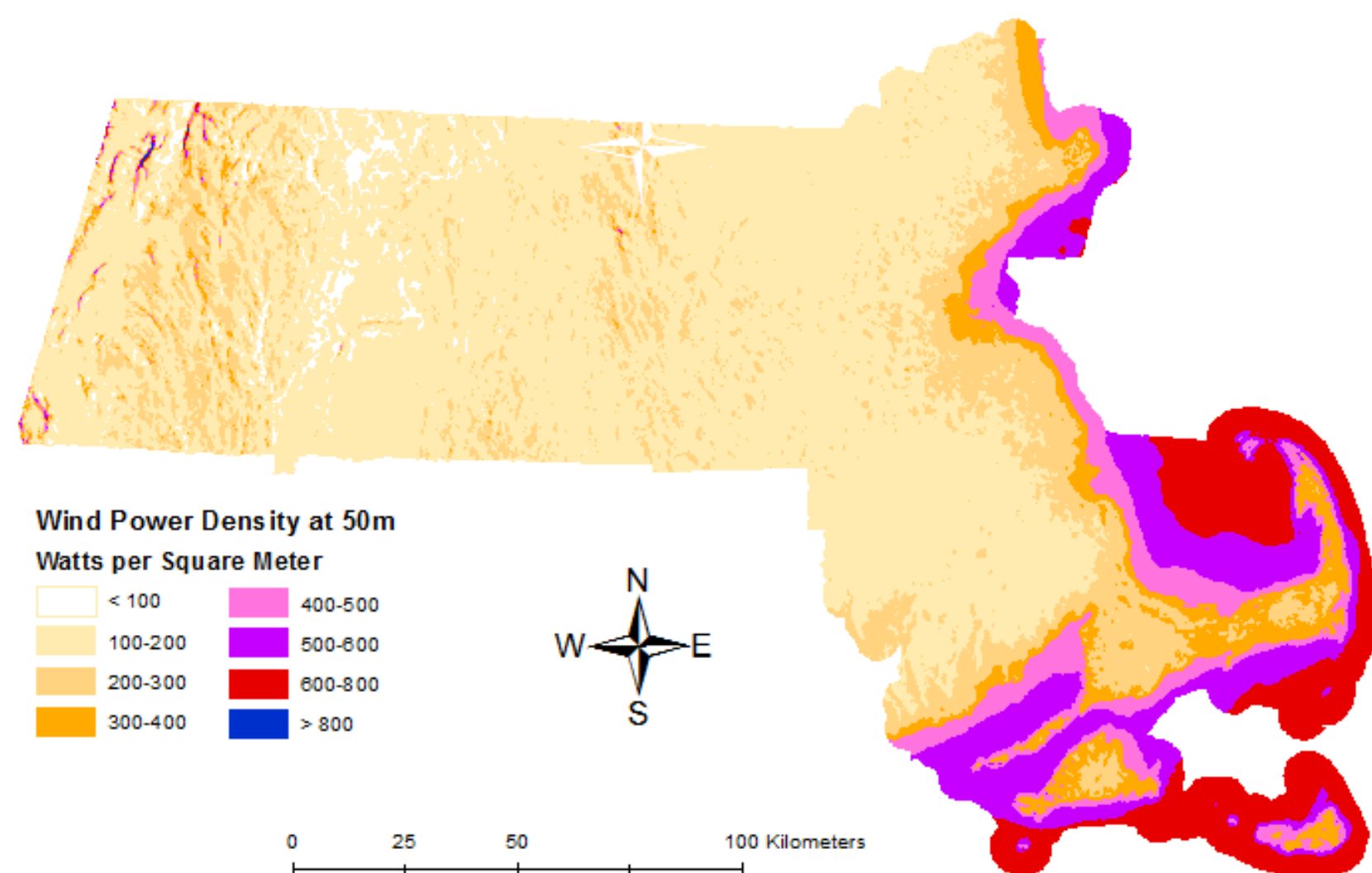# Community Wind Site Suggestions in Eastern Massachusetts
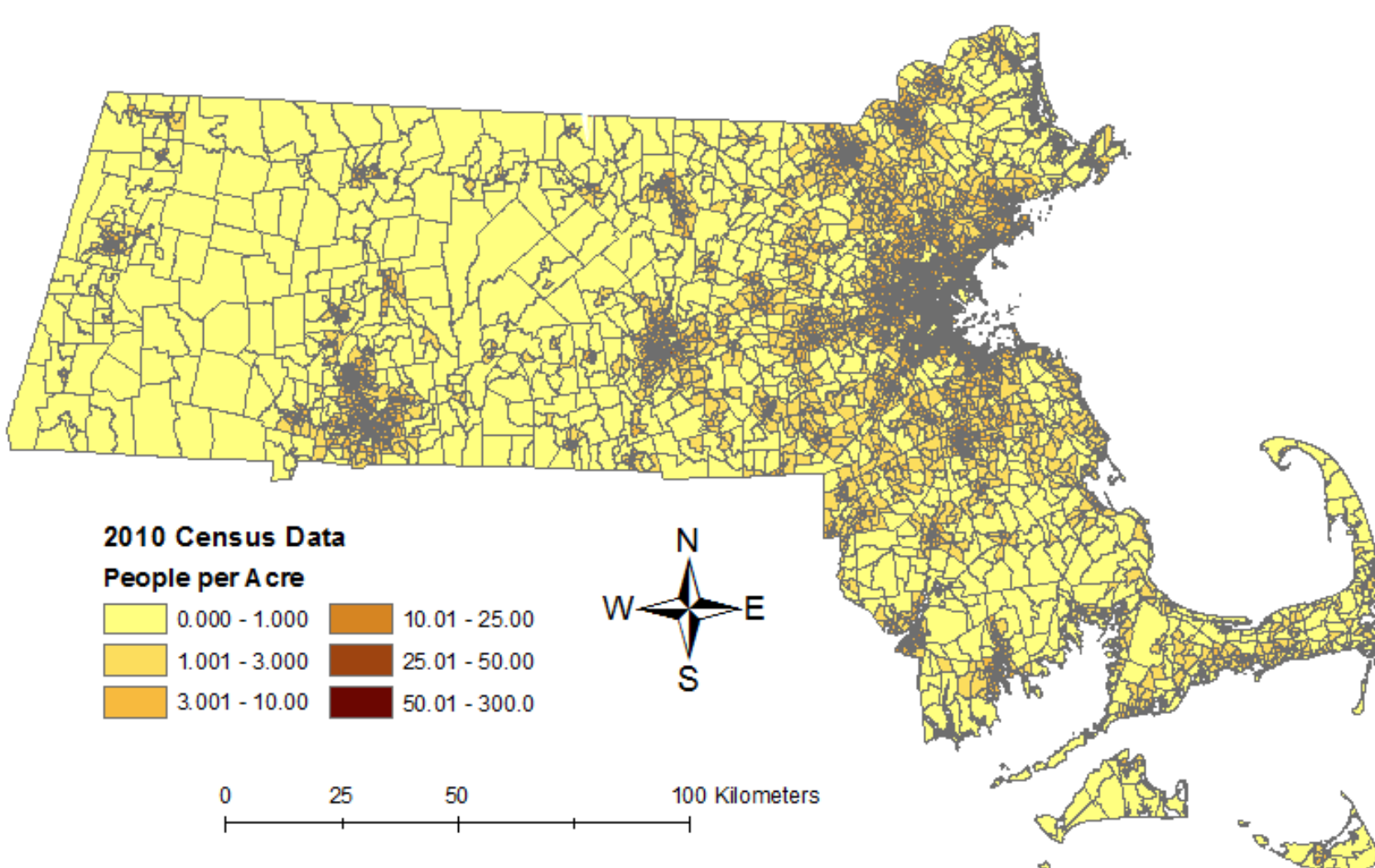
Question / Purpose

The goal of this project is to identify the best potential locations for community wind energy projects. I used population density and wind speed data to determine what places in Massachusetts would be good spots to consider putting wind turbines. Ideal locations would be in areas where electricity demand is high (a high concentration of people) and where wind speeds are high enough for a wind turbine to be an economically smart choice.

Massachusetts Wind Map

Wind Power Density at 50m
Watts per Square Meter
- < 100
- 100-200
- 200-300
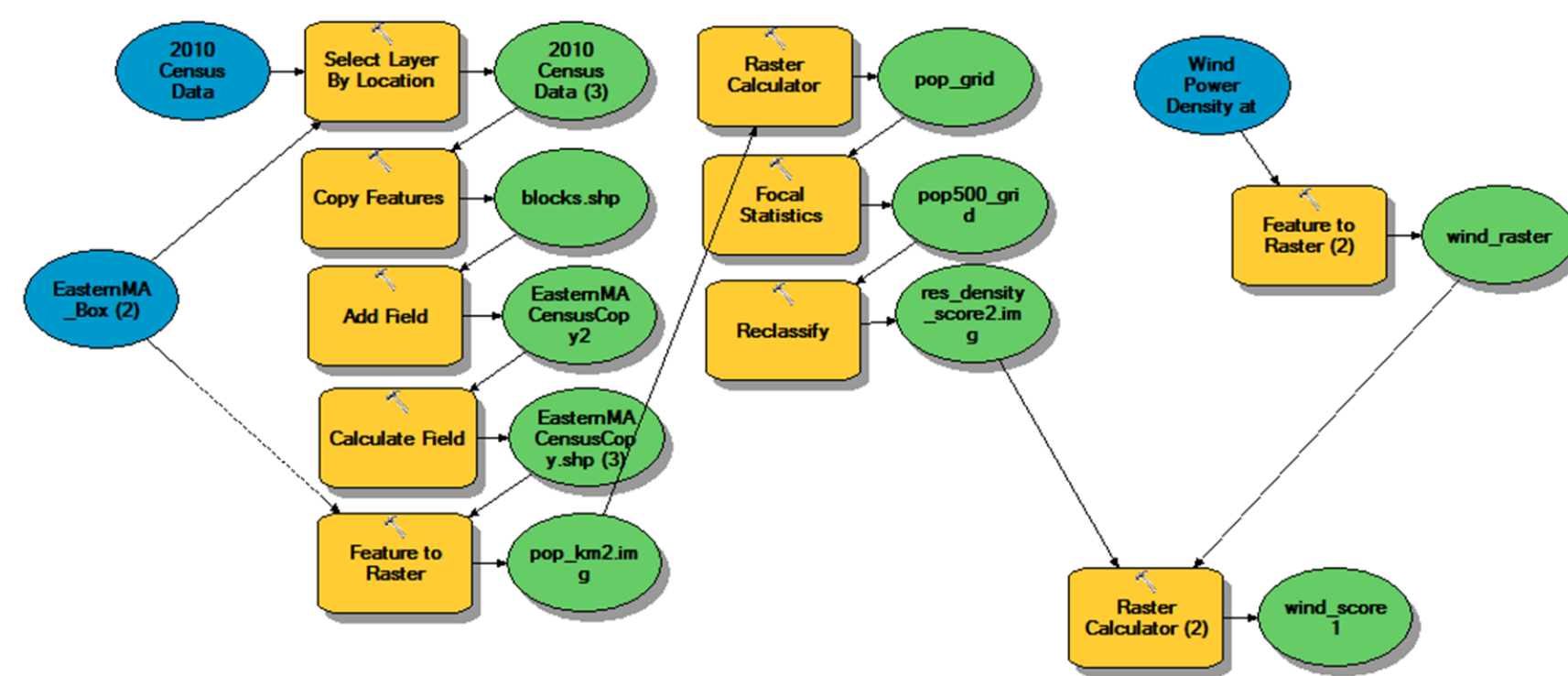- 300-400
- 400-500
- 500-600
- 600-800
- > 800

This was one of my input layers, showing wind speeds at a height of 50 meters across the state of Massachusetts and the nearby offshore areas. From this map, it becomes clear that the highest wind speeds are in the costal region of the state.

Population Density Map

2010 Census Data
People per Acre
- 0.000 - 1.000
- 1.001 - 3.000
- 3.001 - 10.000
- 10.01 - 25.00
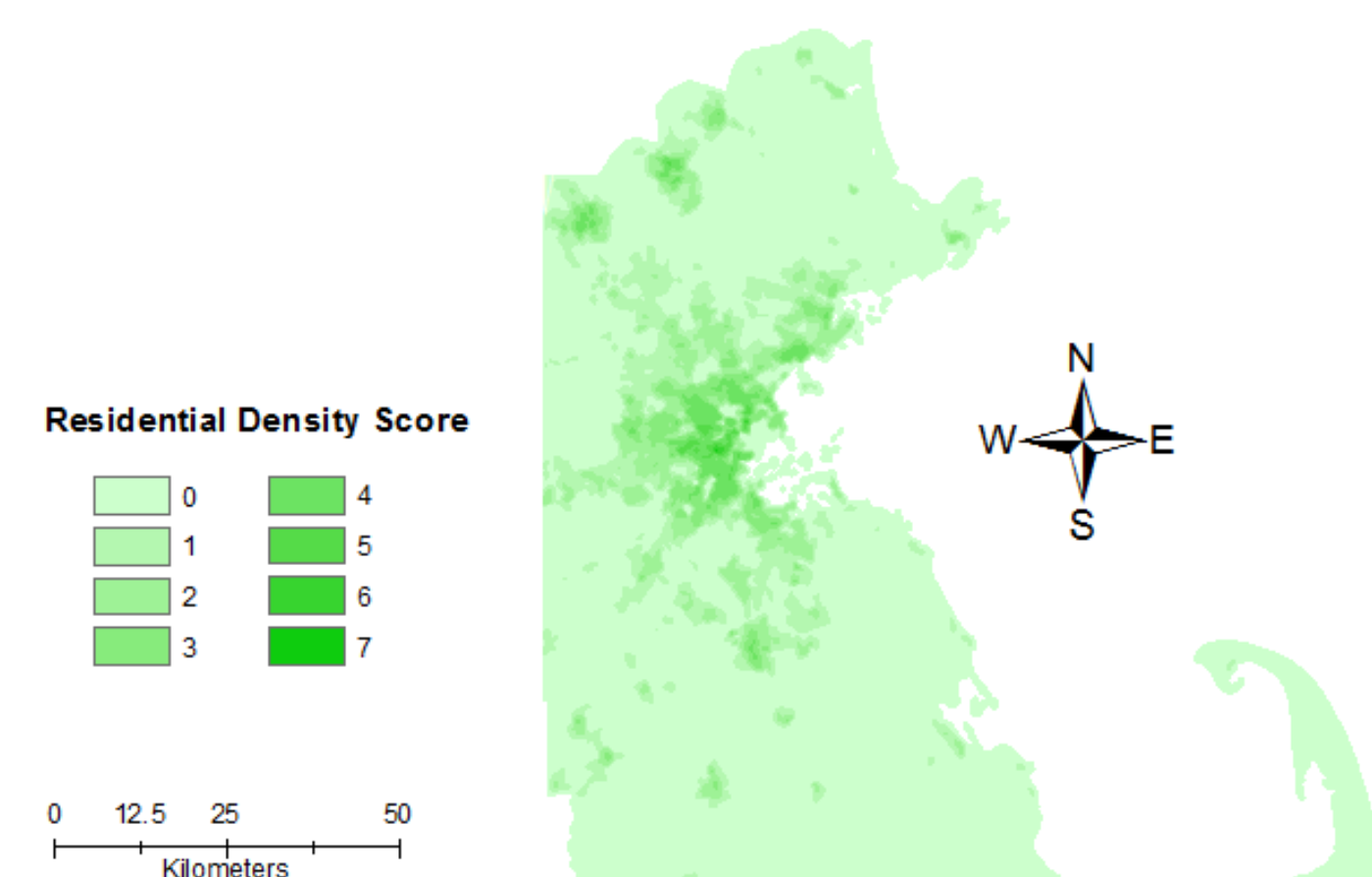- 25.01 - 50.00
- 50.01 - 300.0

My second input layer is of census data from 2010, and shows the trend of higher levels of population density in the eastern part of the state. Since both the wind speeds and the population density are more favorable in the east, this is where I focused my analysis.
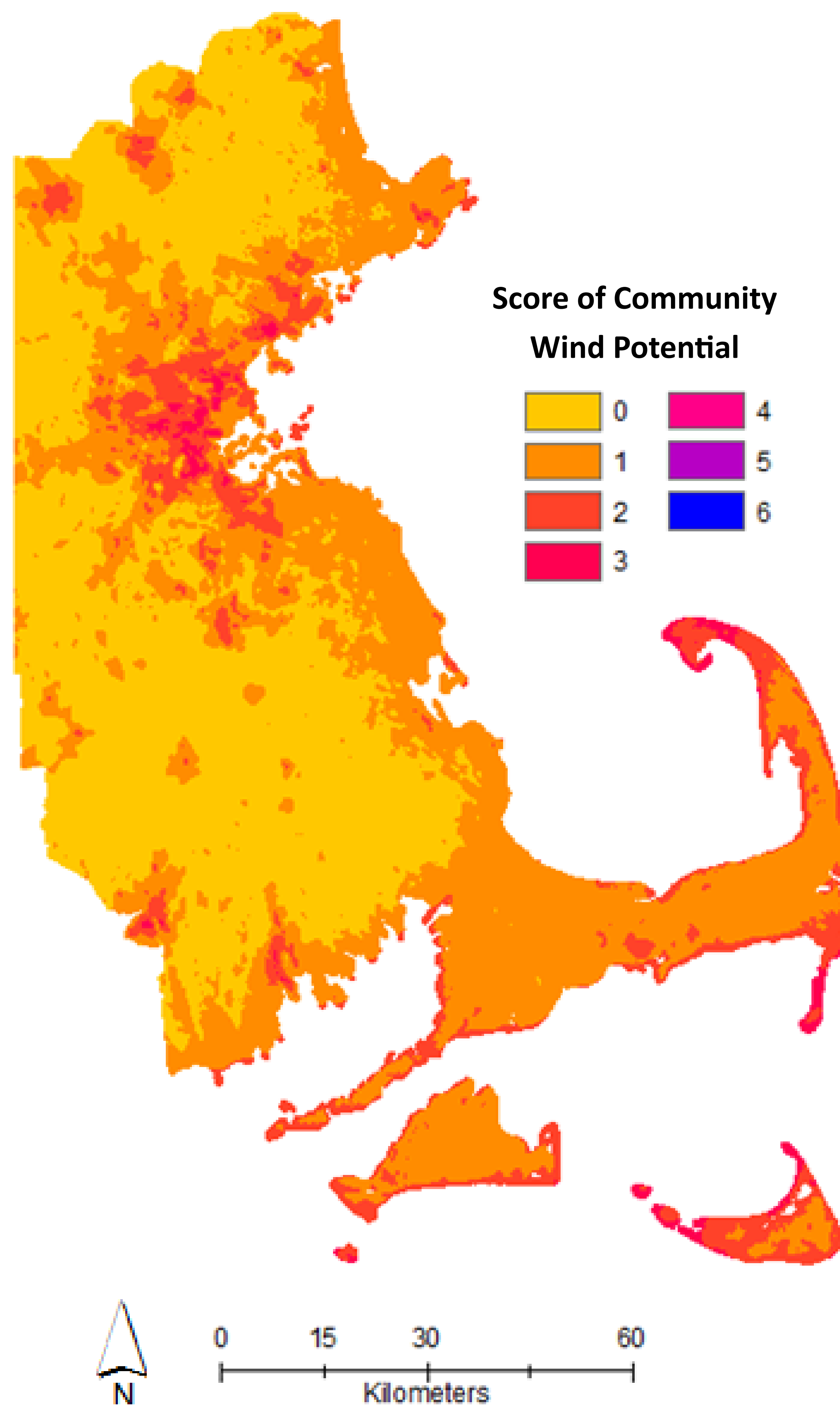
Geoprocessing Procedures

The purpose of the model is to identify locations that have both high population density and high wind speeds. First, the model creates a new layer of the block groups in Eastern Massachusetts (where the wind speeds and populations are generally higher) and turns this layer into a raster displaying the population within 500m of each point. The model then calculates a "Residential Density Score" for each location based on this density.
Next, the model creates a wind raster layer, and assigns scores to each wind speed class.
Finally, the model combines the wind score with the population score to calculate an overall score for how suitable areas are for community wind projects.

Residential Density Scores

Residential Density Score
- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7

This map shows one of the intermediate stages of my model output. The scores given to these areas represent how densely populated they are, based on how a calculation of how many people live within 500 meters from each point. These scores were combined with the wind data to create the final map.

Community Wind Potential

Score of Community Wind Potential
- 0
- 1
- 2
- 3
- 4
- 5
- 6

Results

The map to the left is the result of the geoprocessing model, showing the calculated score of how suitable different areas would be for community wind projects. The scores were calculated by giving equal weight to the two considerations, wind speed and population density.

The results show that the Boston area has plenty of good candidate spots, and some of the windier areas on Cape Cod could be well suited to turbines as well, by these metrics. Areas on Martha's Vineyard and Nantucket also show some promise, as well as a few inland pockets with high population densities.

Considerations

One flaw of the model is that it was unable to take advantage of the more favorable offshore wind speeds, since matching onshore with offshore areas was too challenging. In real life, there are many more factors to consider when planning a community wind turbine project. Other factors that could be included in the model would include location of wetlands and other important habitats, electric grid infrastructure, zoning laws, and current land uses. Taking these into account would show many fewer desirable locations for wind turbines. Additionally, you would want to place the turbine nearby, but not in, a densely populated neighborhood, potentially outside of the densest area in a place that is less populated and not very developed, or in an open space near a school or other community building.

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