Green Energy in the Green Mountain State: Possible Solar Energy Sites in Vermont

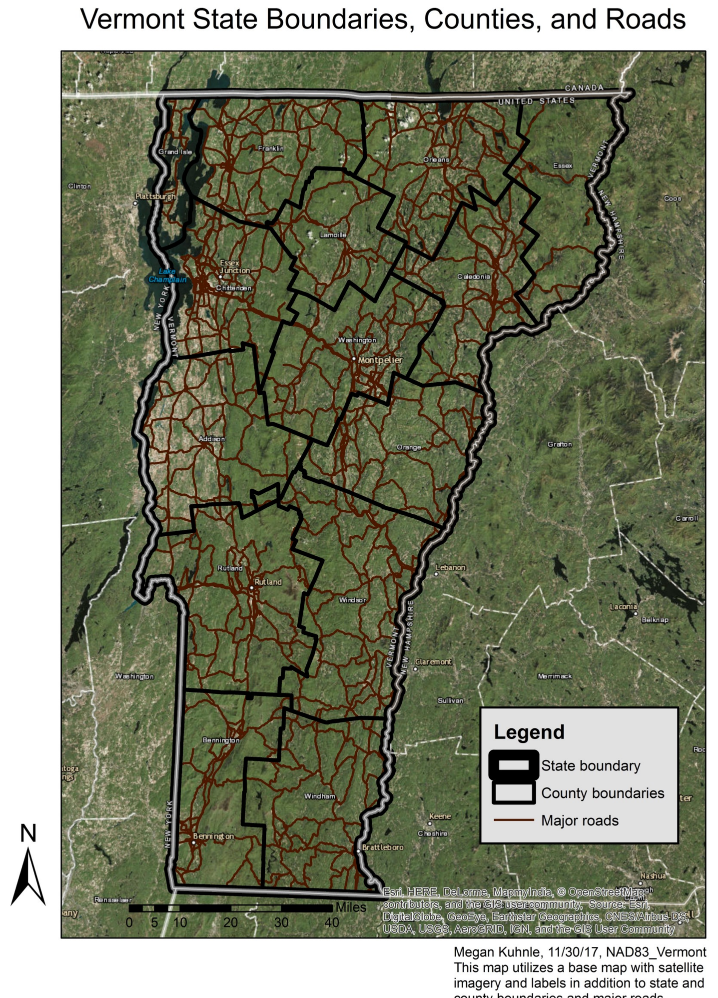
INTRODUCTION

When we think about Vermont, we usually think of maple syrup, rolling green hills, and Ben & Jerry's. Vermont is known for being a progressive state where people care about the environment, but 90% of Vermont's energy comes from nonrenewable sources and 50% of Vermont's electricity comes from out-of-state sources. In order to transition to using renewable energy sources, Vermont needs to consider the possibilities of solar power, wind power, and hydropower in order to supply electricity. Locally-based energy plants help towns become energy-independent and provide economic opportunities, in addition to lowering the cost of energy over time. My project focuses on identifying potential sites for construction of a solar plant. The requirements for a location to be considered an ideal site are that it 1) have an elevation of 3,000 feet or higher, 2) be on a southward-facing slope, and 3) be within 20 miles of an electric substation. My analysis showed that there are several potential sites that can be used as solar plants throughout the Green Mountain range. The maps displayed on this poster demonstrate the process I used to figure out the ideal location for the solar plants, and the last map shows potential sites for solar plant construction. Since most of Vermont is considered rural, solar energy has a lot of potential for the state.

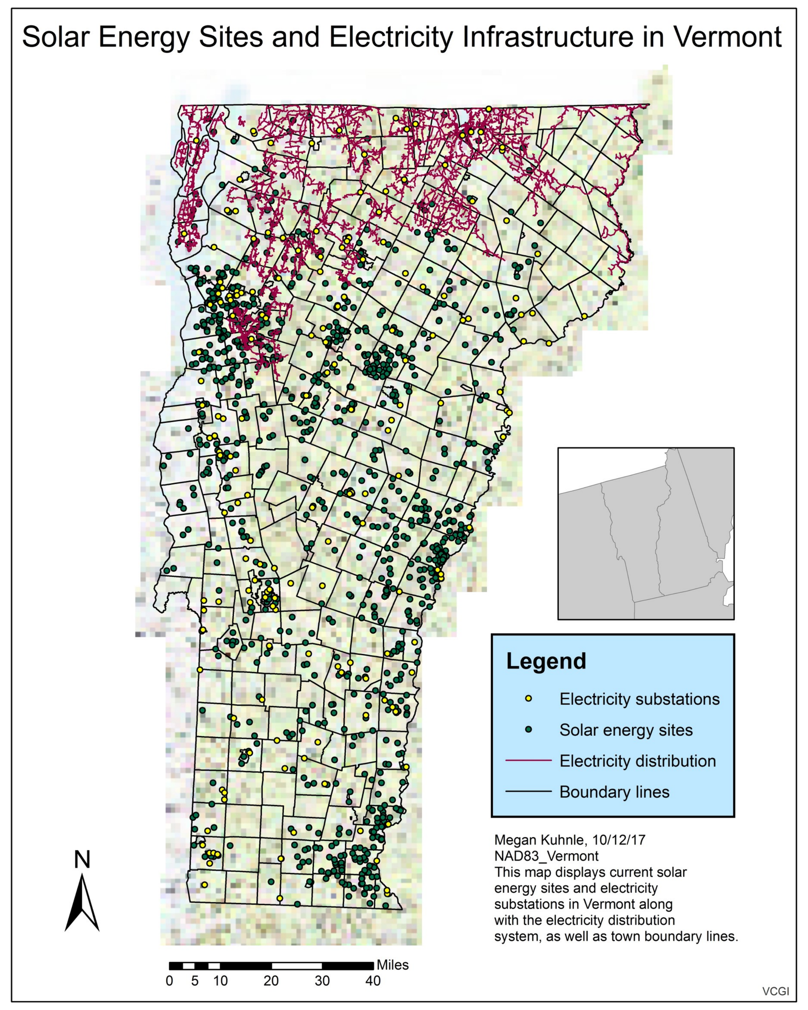
INITIAL MAPPING

My first two maps were created so I could familiarize myself with Vermont's geography and existing solar and electricity infrastructure. Vermont has 14 counties and as of 2016 is home to 624,594 people. There are many existing solar energy sites in Vermont, but most of the sites are small and aren't ideally located. There are, however, plenty of substations that can be used to transport solar power from any new sites.

Vermont State Boundaries, Counties, and Roads

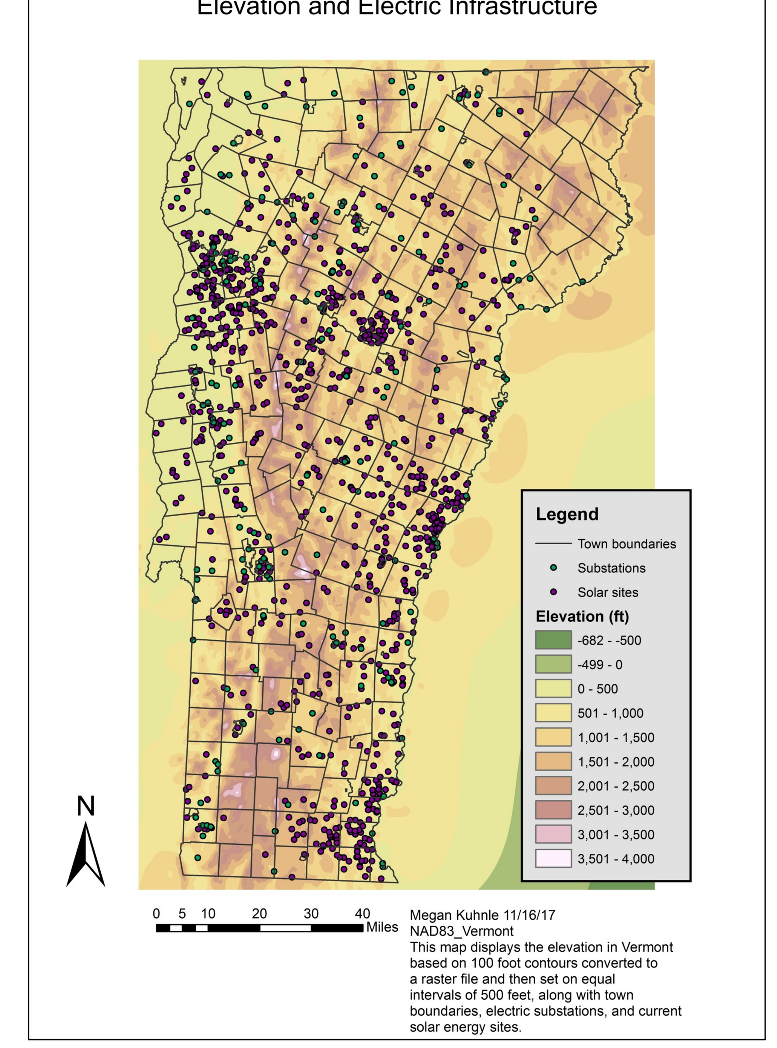


Solar Energy Sites and Electricity Infrastructure in Vermont



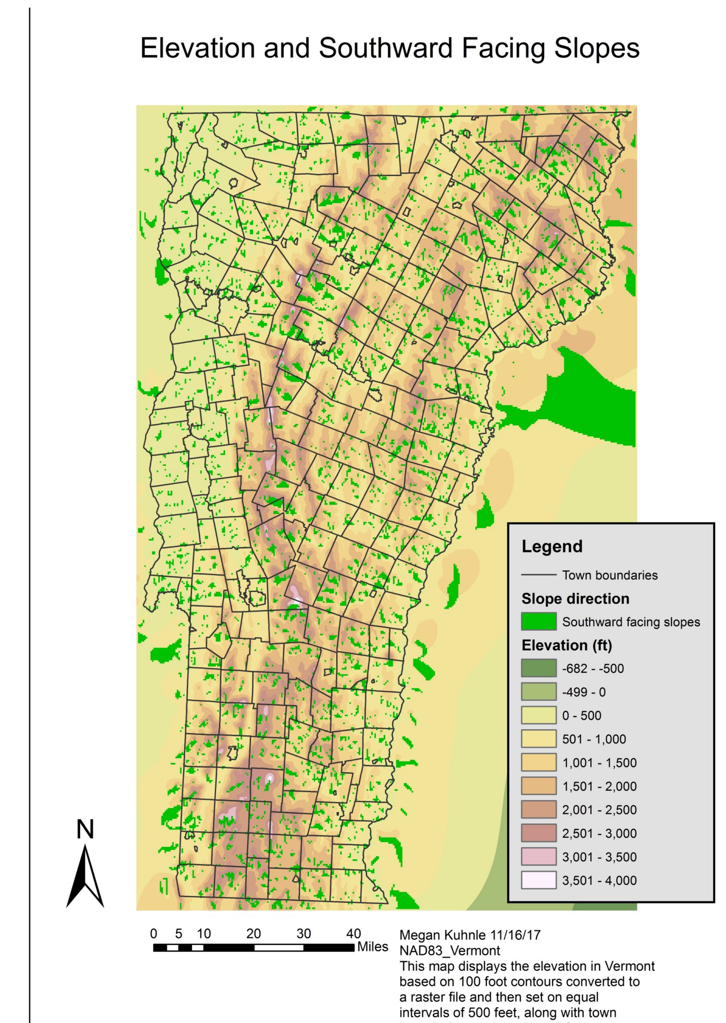
ELEVATION ANALYSIS

I converted a contour file into a raster file to analyze the elevation, which is shown on the map below. I then had a better idea of which areas would have an elevation above 3,000 feet that would meet the first requirement for an ideally located solar plant. Most of the existing solar infrastructure exists at low elevations, and the plants are clustered near areas that are relatively urban. No solar energy sites currently exist at elevations over 3,000 feet, so this is something to consider as more solar plants are constructed. Solar panels are able to convert more of the sun's rays into electricity at higher elevations, which is why it's recommended that the plants be located at such elevations. This is because at higher altitudes there is less of the earth's atmosphere to block the sunlight. After I analyzed the initial elevation data, I needed to figure out which slopes faced south in order narrow down the ideal locations for solar plants.



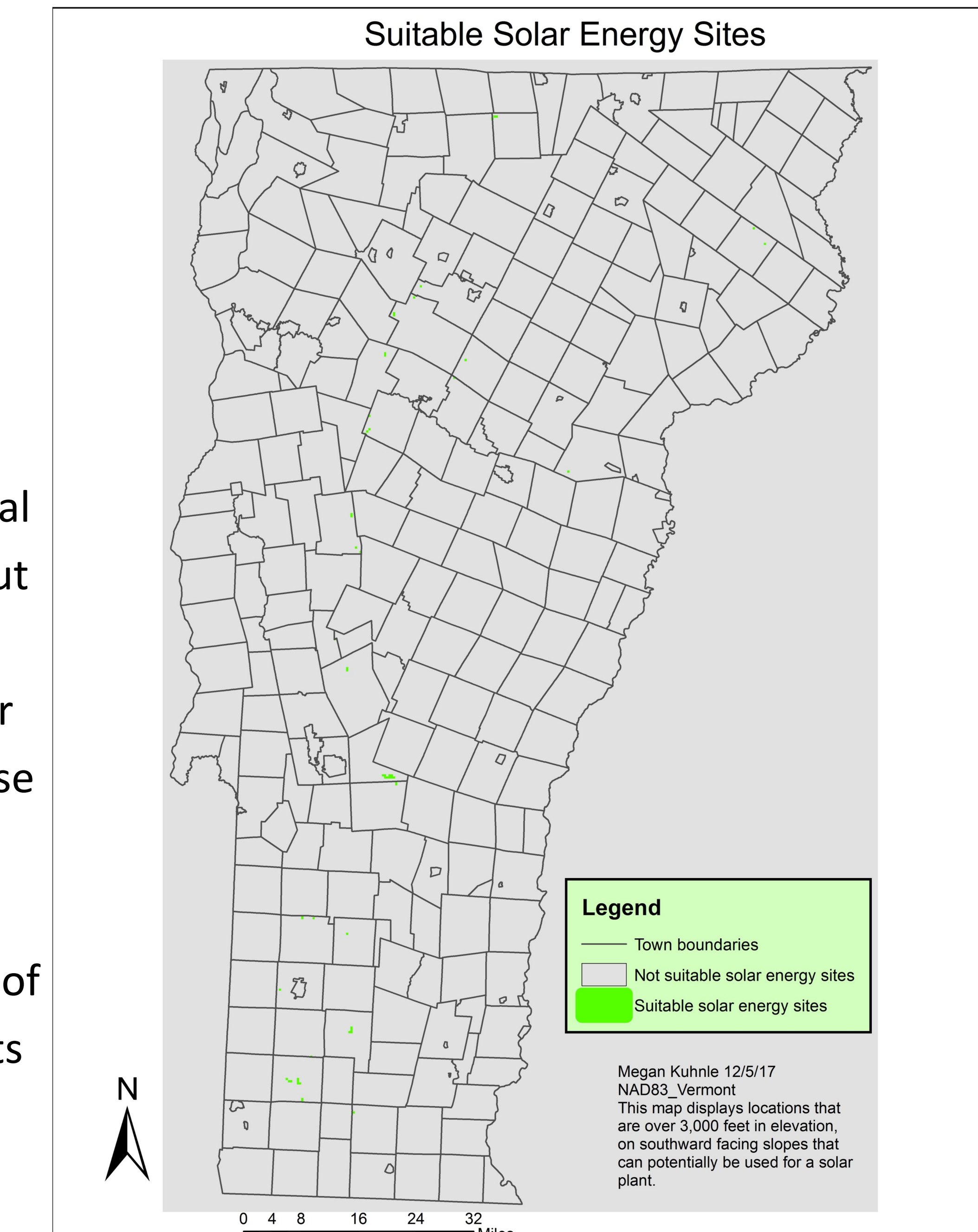
SLOPE ANALYSIS

Since Vermont is located in the Northern Hemisphere, solar panels will absorb more of the sun's rays when they are positioned on a southward facing slope. I used the aspect tool to identify the directionality of all of the sloped surfaces in Vermont, which were drawn from the elevation raster then eliminated all of the directions except for south in the Slope direction layer. From looking at the map, I could tell that there was some overlap between the southward facing slopes and the mountains with elevations of 3,000 feet or above, which I analyzed next.



RESULTS

The final step of my analysis was figuring out exactly where there were southward facing slopes at 3,000 feet or above. The green sections of the map below display those sites. I then used a buffer with a 20 mile radius around the substations to figure out which of the identified sites were close enough to a substation, and they all fell within a 20 mile radius of a substation. The biggest site is located in the town of Mendon, which could be a good site to start with to see if large-scale solar energy usage is feasible in Vermont. Further research on this topic could include comparisons with wind energy and hydropower, and also see if a combination of the three could make Vermont a state that uses 100% renewable energy. I could also further analyze the ideal slope angle to figure out if certain identified slopes are too steep for solar plants. While these sites are considered to be ideal by one definition, the process of building the solar plants in the locations I've identified will be more difficult than just finding possible sites. Going forward, Vermont should tap into solar energy as an electricity source.



REFERENCES

Van Hoesen, J., & Letendre, S. (2010). Evaluating potential renewable energy resources in Poultney , Vermont : A GIS-based approach to supporting rural community energy planning. *Renewable Energy, 35(9), 2114–2122.*

Vermont Open Geodata Portal (geodata.vermont.gov)

Cartographer: Megan Kuhnle

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Projection: NAD83_Vermont

Tufts