

Spatial Implications of Wind Power Buildout in Oklahoma

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Introduction

Clean, renewable energy; with the ever increasing world population, alternate methods for energy production will be needed to help meet the energy demand while not creating more greenhouse gases or the depletion of fossil fuels. Wind energy is not a new concept in the U.S. because early American settlers used wind turbines to irrigate their crops. It, however, has not been prominent on the landscape until recent times and this prominence has created enough backlash to pass Oklahoma Senate Bill 808 which spatially limits wind. The bill was created in order to keep the base of a new wind turbine 1.5 nautical miles away from public schools, hospitals, and the center lines of municipal-owned airports, public airports, and private-use airports that meet with the Federal Aviation Administration (FAA) requirements. The bill specifically affects the locations of wind turbines built after January 1, 2017.

Purpose

The purpose of this poster is to examine the geography of suitability of Oklahoma for the installation of wind farms. The placement of wind farms in Oklahoma is important so as to ascertain areas most suitable and lessen the conflicts created by these large structures. Despite the stipulations placed on wind farms by Oklahoma Senate Bill 808, the hypothesis here is that there is enough suitable area for wind farms to be installed to meet the Department of Energy 2030 vision for Oklahoma. By analyzing the locations of wind turbines, more informed decisions could be made about future locations of wind farms. For this analysis, Cimarron County will be the study area.

Methods

Raster data of the National Land Cover and Oklahoma wind power density was clipped to Cimarron County. The two clipped rasters were converted to polygons. Buffers with a distance of 1.5 nautical miles and dissolve type ALL were created for the point data from the school, hospital, and airport shapefiles. The buffers and a municipality shapefile were used to erase the areas wind farms cannot be legal established. The Oklahoma wind power densities less than 300 W/m² were exported to their own shapefile, which was then used to erase the less than ideal areas of the National Land Cover shapefile. The area for land class was expressed in hectares.

Results

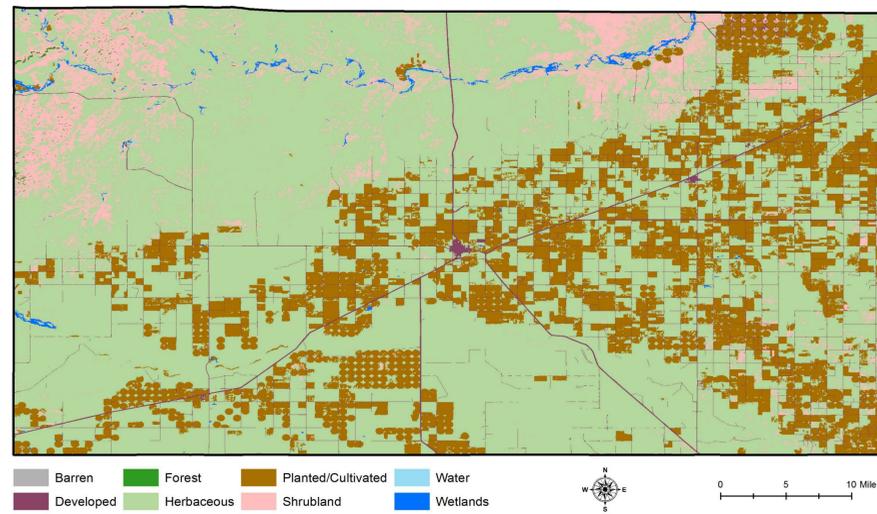
The analysis showed in Cimarron County that there are 457,395 ha suitable for wind farm development and only 15,440 ha that are unsuitable. The suitable area requirements were to have a land classification of herbaceous, planted/cultivated, or shrubland, have a wind power density greater than 300 W/m², and not be within 1.5 nautical miles of a school, hospital, or airport.

	Total Suitable Hectares (ha)
Herbaceous	323,060
Planted/Cultivated	96,506
Shrubland	37,793
Unsuitable	15,440

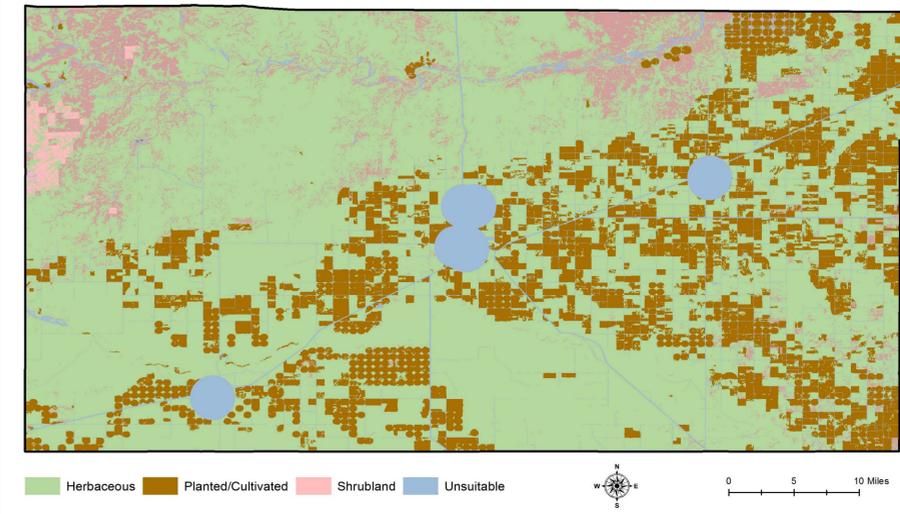
Cimarron County, Oklahoma



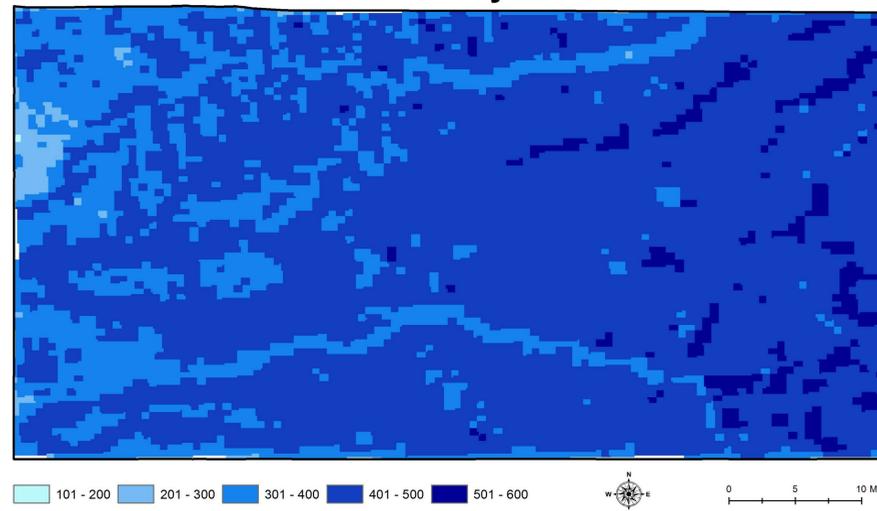
Land Cover



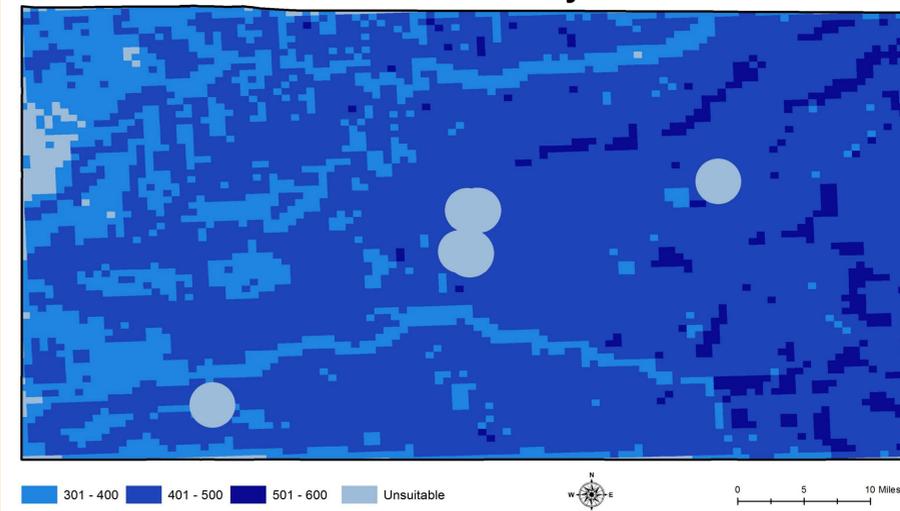
Suitable Land Cover



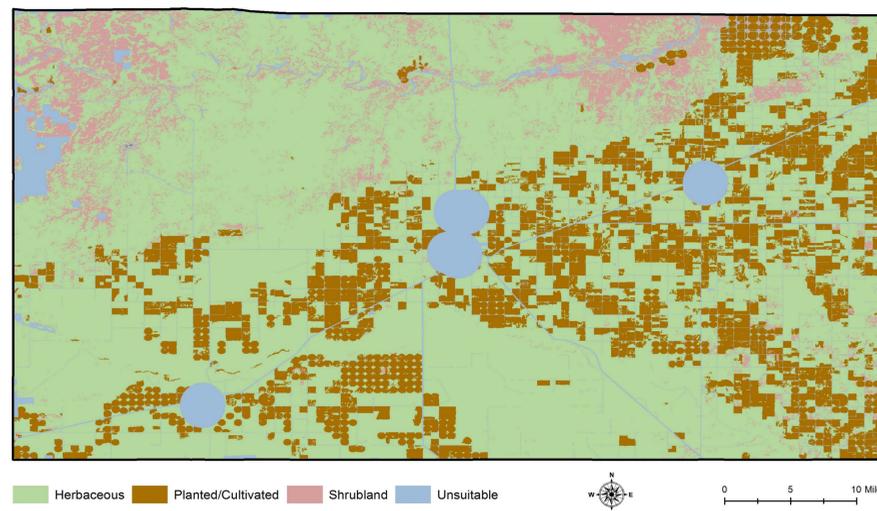
Wind Power Density at 100m W/m²



Suitable Wind Power Density at 100m W/m²



Suitable Areas for Wind Power Buildout



Conclusion

The methods used to find the suitable areas for wind power buildout in Cimarron County can be extended to the entire state of Oklahoma. The results showed that there was suitable land in Cimarron County. In this county, Senate Bill 808's stipulations did not greatly affect the amount of suitable land for wind farms. With further analysis, these methods can be implemented in future wind power buildout research.

Sources

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- Wind Density Data courtesy of the Oklahoma Wind Power Initiative.