Harnessing Wind Power Without New Development:

Siting New Wind Farms on Developed Land with Compatible Uses

Background

Massachusetts has found itself paralyzed over wind power in recent years. While wind farms are much cleaner and more sustainable than the coal-burning plants from which the state currently generates over a quarter of its electricity, many conservationists oppose the development of greenfields or forests for turbine placement. The Cape Wind controversy has seen local communities unite to oppose wind farms being sited on previously pristine coast lines

One way to mollify both wind power advocates and those opposed to new development is to site wind farms on land that has already been developed. Wind turbines must be situated at a great distance from each other for maximal efficiency. This leaves large, open areas of space in between turbines. Some wind farms leave 95% of their total land area untouched. This leaves ample space for activities such as growing crops, mining, storing waste, and keeping livestock.

This approach has been tested in Texas and New York, and has been successful. Landowners and local communities appreciate the revenue the wind farm brings to the area, local population centers get cleaner energy, and no pristine wild areas are affected. Massachusetts could benefit from following suit.

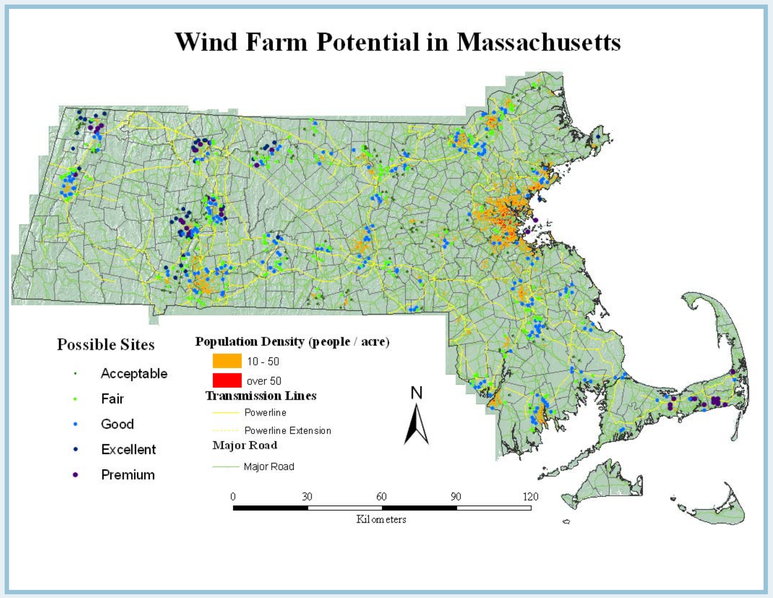
Grazing cattle appear not to notice the turbine sharing their pasture.

Objectives & Methodology

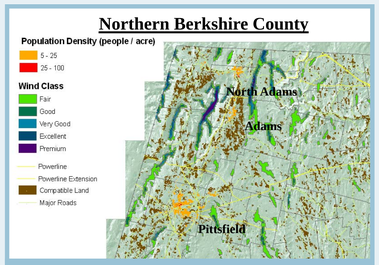
This study aims to identify specific areas that are most suitable for the construction of new wind farms according to six factors. All vector data was converted to raster format, and factors were reclassified from 1 to 5 according to their perceived suitability for wind farming. Sites entirely unsuited for wind farms were excluded from consideration by being classed as NoData. Factors were then weighted and calculated, with the most suitable sites having the highest combined total according to this model:

Factor	Weight in Final Model
Wind speed	35%
Proximity to transmission lines	25%
Proximity to urban areas	15%
Proximity to roads	15%
Proximity to low-income areas	10%
Land use classification	*

** While land use was a factor, its weighting was negligible, as incompatible uses were excluded and the model is indifferent between compatible uses.*

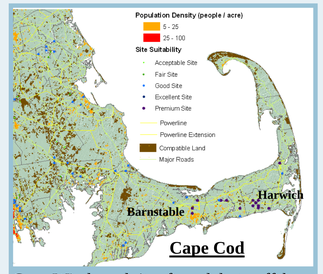


Site Highlights



The northern Berkshires have some of the best wind resources available in the northeast, a large amount of compatible agricultural land, and an existing network of roads and transmission lines. The area has the potential to generate power for hundreds of thousands of homes. In fact, state planners expect the area to be generating 1 GW, enough power for half a million homes, by 2020.

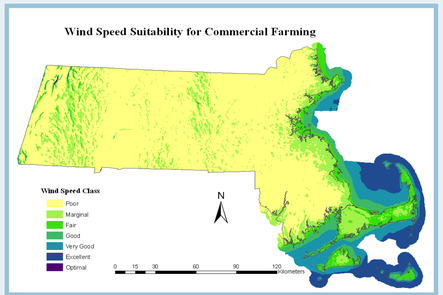
Boston could generate much of its power locally. Deer Island Waste Water Treatment Plant and nearby Moon Island's old sewage facility could together house 6 - 10 3.0 MW Vestas turbines, which, with such low transmission costs, could provide power for 10,000 - 30,000 households, depending on average operational capacity.



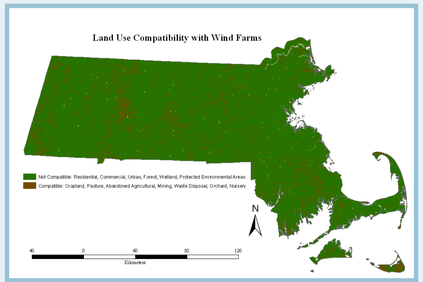
Cape Wind needn't refer solely to offshore sites. While true that the best winds in Massachusetts are in coastal waters, siting doesn't need to be a zero-sum game: the strong winds, proximity to power lines, and abundant agricultural land of Cape Cod are ideal for *additional* wind farms.

Brodie Mountain, New Ashford

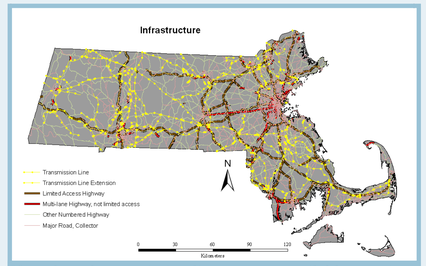
One site the model labeled as "excellent" is Brodie Mountain, a ski resort in New Ashford, abandoned several years ago. The land was reclassed in 2005 from "recreational" to "open". In the real world, Brodie is the site of the first proposed wind farm in the Berkshires. Developers are installing 10 relatively small 1.5 MW GE turbines on the ridge, using the power lines and access roads that were first built for the ski area to minimize new development. The forested slopes, originally cleared of vegetation for skiing, will be allowed to re-grow. The turbines are expected to generate power for 6,000 homes by 2010. A simulation (pictured) of the visual impact of the project suggests that the turbines should be barely visible against the sky.



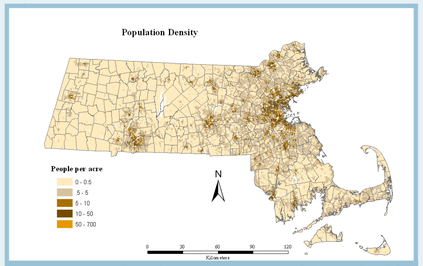
Average wind speeds of at least 10 mph are necessary to generate enough wind power density for commercial wind farming. AWS Truewind, a wind consultancy firm, has used measurements of wind speed to create seven classes of wind power potential. All "poor" sites and most "marginal" sites do not meet the 10 mph threshold, and so have been excluded from consideration entirely. For the remaining classes, sites with better winds were given greater weight.



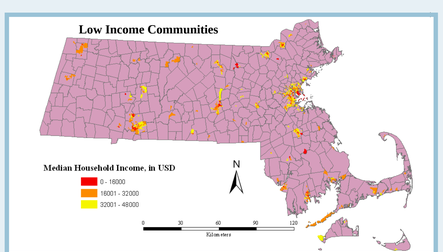
True to the purpose of the study, undeveloped land like wetlands, forests, and park areas were not considered as candidates for wind farm sites. Residential, commercial, and urban areas were also considered incompatible with wind farms: while it is technologically possible to site turbines on top of buildings, it is not politically viable. This model was indifferent to the various uses of land so long as they were compatible with wind farming.



If roads and transmission lines are not available at a site, new ones must be developed, often on the very same classes of land this study aims to avoid developing. So, sites nearer to this infrastructure received higher scores. As transmission lines lower property values significantly, their construction is usually opposed by local communities: it is highly unusual for permits to be granted for more than 30 km of new lines. Thus, sites farther from transmissions lines were excluded from the study.



Due to noise and aesthetic concerns, wind farms should not be sited in well-populated areas. Therefore, areas with over 2 people per acre were not considered viable sites. However, the closer thatenergy is produced to where it will be consumed, the lower the costs of transmission and the higher the overall efficiency. As more densely populated areas use more energy, the closer a site was located to dense population centers (without being in them, of course) the higher it scored.



Many new jobs are created during turbine construction, new maintenance jobs will be permanent, and the wind farm itself brings a new stream of revenue to the host community. All else being equal, it is good policy to site wind farms near poorer areas for two reasons: first, their economic impact to the region will be greater, and second, appreciation for new jobs will more likely outweigh aesthetic opposition. The closer a site was to poor areas, the higher it scored.

The small footprint of turbines and access roads leaves most land available for farming or other purposes.

Tufts UNIVERSITY

Cartographer: Daniel Ferry
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CEE 194: Introduction to GIS
Projection: NAD 1983
Resources: 2000 U.S. Census, MassGIS, AWS Truewind