Modeling and Evaluating Potential Constraints Between Siting of Commercial Wind Power and Ecological and Social Values in the Mountains of the Northern Forest

Principal Investigator(s): Dr. David Publicover and Dr. Kenneth Kimball
Affiliations/Institutions: Appalachian Mountain Club
Email: dpublicover@outdoors.org
Mailing address: P.O. Box 298, Gorham, NH 03581
Completion date: Project is on-going

Primary project objectives/outcomes:

1. The application of a GIS-based analytical model to assessing the relative level of natural resource conflicts present at potential ridgeline windpower development sites across the region.
2. Use of this information to stimulate discussion and promote development of state-based windpower siting guidelines or policies.

Funding support for this project was provided by the Northeastern States Research Cooperative (NSRC), a partnership of Northern Forest states (New Hampshire, Vermont, Maine, and New York), in coordination with the USDA Forest Service.
<http://www.uvm.edu/envnr/nsrc/>

Project Summary

Rationale

In recent years windpower has emerged as one of New England's most important resources for the generation of renewable energy. The primary focus of commercial windpower proposals has been higher-elevation terrestrial ridgelines - the least developed and most natural part of the regional landscape and areas of high ecological, recreational and scenic value. The siting of windpower in undeveloped higher elevation areas has generated significant controversy across the region. In addition, state regulatory agencies have struggled with review of development proposals under regulatory standards that do not adequately address the unique impacts of this technology.

This project was undertaken to: 1) provide stakeholders with information on the nature and distribution of natural resource values that may be impacted by ridgeline windpower development, and 2) promote the development of state-based windpower siting policies that balance windpower development with the protection of important high-elevation areas.

Methods

Three approaches were used, with a focus on Maine and New Hampshire:

1) *Research*: GIS-based analysis to delineate potential ridgeline development sites and identify their spatial overlap with natural resources of state, regional or national significance.

2) *Outreach*: Education of stakeholders about the analytical approach and the need for windpower siting guidance policies.

3) *Advocacy and policy development*: Promotion of state-based policies that guide windpower development to appropriate sites.

Project Summary (continued)

Major outcomes

1) Conducted comprehensive analysis of potential conflicts between ridgeline windpower development and natural resource values for the mountains of Maine (final report October 2007).

2) Compiled data and conducted preliminary analysis for ridgelines in New Hampshire (analysis on-going).

3) Convened and led multi-stakeholder working group that developed windpower siting guidance document for New Hampshire; results submitted to legislatively-established Energy Policy Study Commission (May 2007).

4) Serving as alternate member of Governor's Task Force on Windpower Development in Maine (on-going).

Implications for the Northern Forest

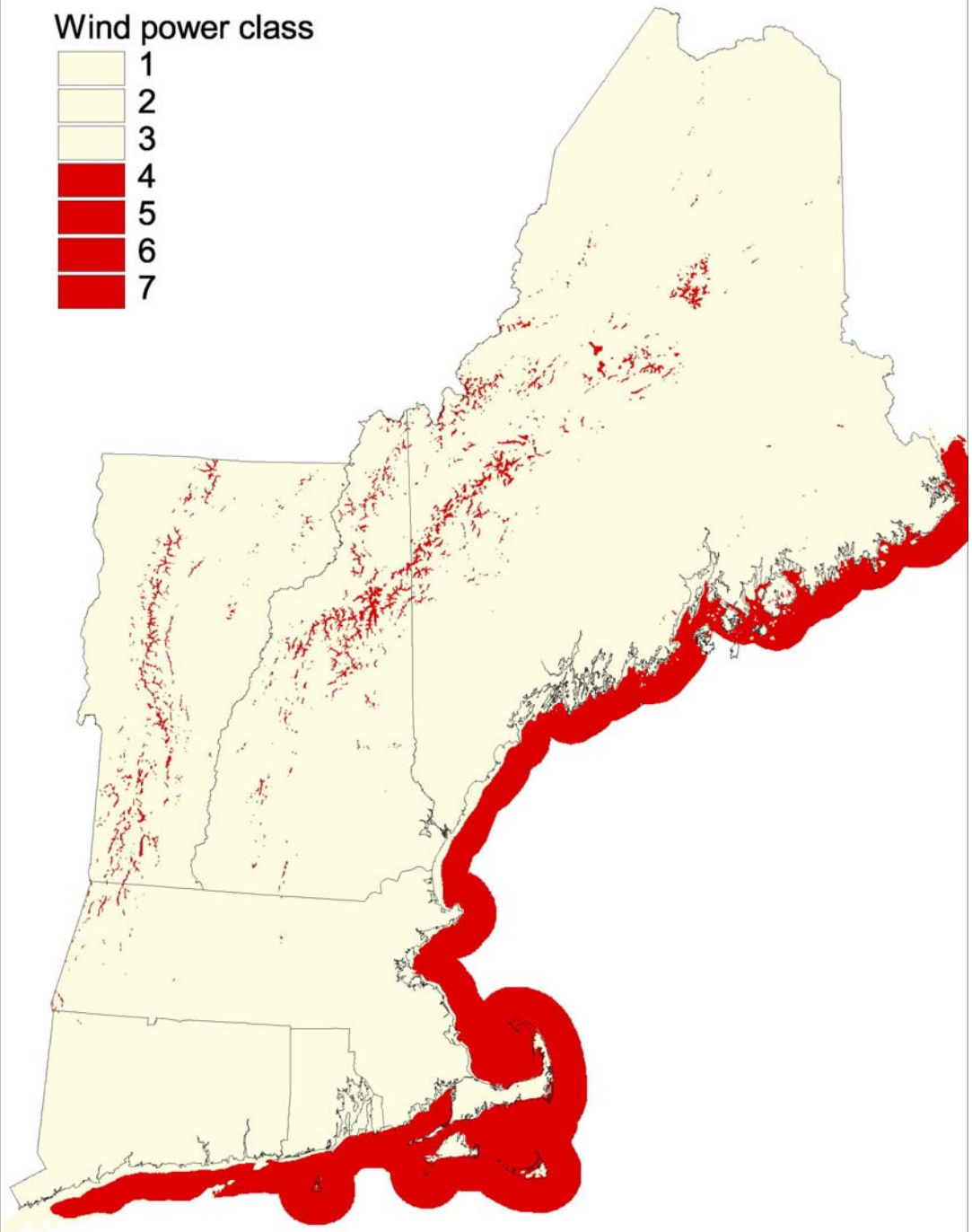
Much of the strongest terrestrial wind resource in New England is located in the Northern Forest. Several commercial windpower projects have been proposed for the region and others are in the planning stage. If appropriately sited, these projects can make a significant contribution to the renewable energy supply in the region. However, if inappropriately sited they will have a significant adverse impact on the natural and cultural values of the undeveloped Northern Forest landscape. The work conducted for this project is providing important information as to how best to reconcile the dual goals of renewable energy development and natural resource conservation.

Background and justification

In recent years, numerous state and federal policies have been enacted promoting the development of renewable energy. In New England, wind is one of the primary indigenous resources available for the generation of renewable energy. However, the strongest wind resource is located on higher-elevation ridgelines and in coastal and off-shore regions – areas of potentially high ecological, recreational and scenic value (see Map 1). Higher elevation areas are generally the least developed and most natural parts of the regional landscape.

To date, about a dozen commercial windpower projects have been proposed for New England, the majority of them on terrestrial ridgelines, and many of them within the Northern Forest region. Many of these projects have generated significant public controversy, as stakeholders debate the appropriate balance between renewable energy development and the conservation of undeveloped high-elevation forest lands. In addition, regulatory agencies have struggled with permitting these projects under regulatory standards that were developed without consideration of the unique impacts of windpower development (including concerns about impacts on undeveloped wildlife habitat and preservation of natural scenic landscapes).

This project was undertaken to provide all parties with analytical information on potential conflicts between windpower development at a wide range of ridgeline sites and significant natural resource values, and to use this information to promote development of state-based windpower policies that guide development to sites of lower natural resource value.



Map 1

Class 4 and above wind resource in New England. (Class 4 is considered the minimum wind resource necessary for commercial development given current technology and economics.) The primary location of high wind resource is higher elevation ridgelines and coastal and off-shore areas – locations of potentially high ecological, scenic and recreational value.

Wind resource data was developed by AWS Scientific, Inc. (AWS TrueWind) as part of a project jointly funded by the Connecticut Clean Energy Fund, the Massachusetts Technology Collaborative, and Northeast Utilities System. Wind resource class, which uses values from 1 (lowest) to 7 (highest) is a measure of the energy that can be extracted from wind and is based primarily on average wind speed.

Methods (Maine ridgeline siting analysis)

- Analysis was adapted from methodology developed during a pilot study of the Berkshires region of Massachusetts (see www.outdoors.org/pdf/upload/Windpower-Siting-Project-Report.pdf).

- Analysis involved three basic steps:

1) Delineation of potential ridgeline development sites. Contour line data was overlaid on wind resource data and primary ridgelines at least 1 mile in length were delineated by on-screen digitizing (see Map 2).

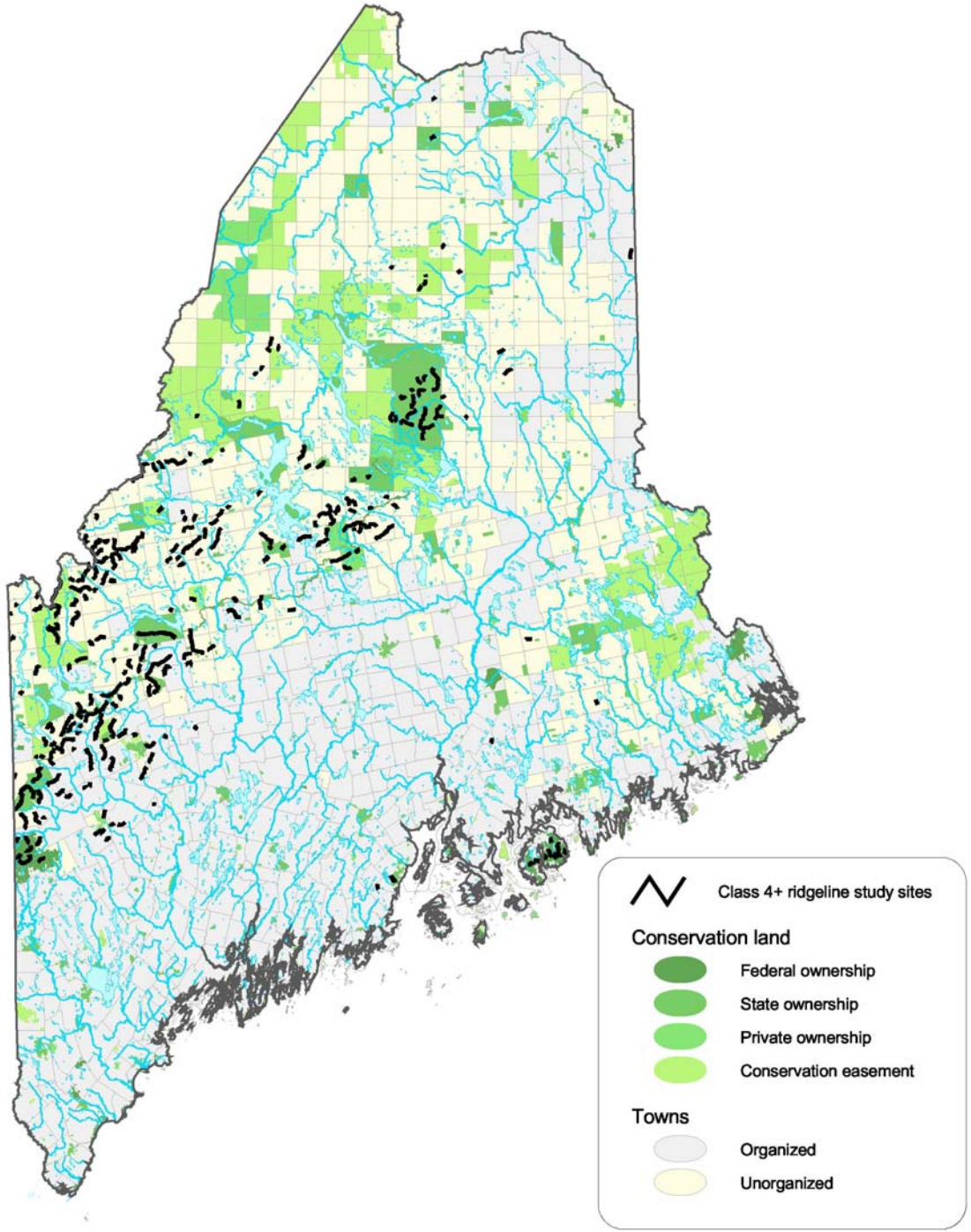
2) Compilation of available digital data on natural resource values of state, regional or national significance that could potentially conflict with development (see next page).

3) Resource data was overlaid on ridgeline data and the extent of spatial overlap for each site was determined.

Methods (continued)

- Resource data included in the analysis:
  - Conservation status/land ownership
  - Regulatory jurisdiction.
  - Extent of ridgeline above 2700'.
  - Extent of ridgeline above 3500'.
  - Known occurrences of rare plants.
  - Known occurrences of rare or exemplary natural communities.
  - Known occurrences of rare, threatened or endangered animal species.
  - Extent of steep slopes (>25%).
  - Ridgelines identified as critical summit ecosystems in The Nature Conservancy's Northern Appalachian – Acadian Ecoregional Analysis.
  - Proportion of ridgeline laying within large (>5,000 acres) roadless areas previously delineated by AMC.
  - Proportion of ridgeline mapped as potential habitat for Bicknell's thrush by the Vermont Institute of Natural Science.
  - Presence of ridgeline pond.
  - Presence of hiking trail.
  - Potential visibility from the Appalachian Trail (adapted from viewshed analysis developed by Appalachian Trail Conservancy.

- Results and discussion includes: 1) Distribution of sites by conservation status, land ownership, and regulatory jurisdiction, 2) extent to which each resource may potentially conflict with windpower development, 3) identification of sites and regions of particularly high or resource value, and 4) categorization of sites as to overall level of concern regarding development.



Map 2

Ridgelines included in Maine wind siting analysis. Delineated ridgelines are at least 1 mile in length and underlain by Class 4 or greater wind resource.

Results (Maine wind siting analysis)

- These results are preliminary and incomplete; final results will be available in the analysis report that will be completed in October 2007 and posted on AMC website (www.outdoors.org/conservation/wind).
- A total of 267 sites encompassing 670 miles of ridgeline were delineated for the analysis.
- About 30% of the sites lie on public or private conservation land, the great majority of which would be unavailable for development. About half lie on private land and the remainder on mixed public/private land.
- About 28% of the ridgeline lies above 2700'.
- Most sites overlay at least one resource, but only a minority have significant overlap with multiple resources. These sites are the ones for which development would present the greatest potential conflict. These higher-resource sites are for the most part concentrated in a limited number of larger mountain areas.
- Sites on private land generally overlay a smaller number of resources than those on conservation land.
- There are recognized limits associated with this analysis, as many factors are important to windpower siting (such as access to roads or transmission capacity, topographic suitability, and local support) are not considered. However, it provides a starting point for discussion of what sites or types of sites may be most suitable (and most unsuitable) for windpower development.

Results (policy development)

AMC has been involved in two major policy initiatives that seek to provide guidance toward appropriate windpower siting:

- The legislatively-established New Hampshire Energy Policy Commission (established June 2006) is charged with studying (among other things) "The regulatory process for siting commercial wind energy facilities in the state…". AMC (in partnership with the Audubon Society of New Hampshire) convened and led a multi-stakeholder working group that developed proposed windpower siting guidelines for the state. This document has been presented to the Study Commission, whose final report to the legislature will be presented by December 2007.

- AMC is serving as an alternate member of the Governor's Task Force on Wind Power Development in Maine. Among other things, the Task Force has been charged with "Creat[ing] guidelines and related information that would assist wind power developers in identifying areas in the State of Maine that are more appropriate for wind power development, and avoiding areas that are not appropriate for wind power development, due to legal, natural resource or public value constraints." AMC has made presentations to the Task Force on both its siting analysis work (1) and the proposed New Hampshire siting guidelines (2). The Task Force shall complete its work by January 2008.

1) www.maine.gov/doc/mfs/windpower/meeting_summaries/092607_summary_files/Publicover 9.26.07.ppt

2) http://www.maine.gov/doc/mfs/windpower/meeting_summaries/080307_summary_files/AMC_ Presentation_ME Wind TF 8.3.2007.pdf

Results (public outreach)

AMC has presented its approach to both windpower siting analysis and siting policy development in a range of venues, including:

- Invited presenter for panel discussion on windpower for the Maine Land Use Regulation Commission (December 2005).
- Poster presented at American Wind Energy Association annual conference (Pittsburg, PA, June 2006)
- Presentation at 2nd Maine Mountain Conference (October 2006) (see http://www.matlt.org/Includes/Publicover%20Windpower.pdf).
- Invited presenter at Western Maine Legislative Caucus breakfast forum (August 2007).
- Multiple presentations at AMC organizational events including annual membership meeting, Maine Chapter meeting, and public educational workshops.

Implications and applications in the Northern Forest region

Windpower development in higher-elevation areas of the Northern Forest (and other areas in the Northeast) presents both regulatory agencies and stakeholders with a potential conflict between two worthy goals: promoting renewable energy development and conserving undeveloped open space for its ecological, recreational and scenic values. While renewable energy development will have important benefits for both the ecosystems and communities of the Northern Forest region, inappropriately sited projects may have a significant adverse effect on important natural resource values that give the region its special character.

The desire to provide greater guidance to both windpower developers and regulatory agencies as to how this conflict may best be resolved is an important component of the work of both the New Hampshire Energy Study Commission and the Governor's Task Force in Maine. The analytical, policy development and educational outreach activities undertaken as part of this project are contributing to these efforts.

Future directions

AMC will continue the work undertaken as part of this project in several areas:

- Continuing our participation in work of both the New Hampshire Energy Policy Commission and the Governor's Task Force on Wind Power Development in Maine to promote the development of official state policies that guide development to sites of lower natural resource impact.
- Seeking other venues to influence windpower siting policy. For example, the on-going revision of the Comprehensive Land Use Plan for the unorganized territories in Maine (which encompasses much of the Northern Forest in that state) will have a significant influence on how windpower development will be balanced with protection of important natural resource values of high-elevation areas.
- Continuing analytical work for ridgelines in New Hampshire.

List of products

- Publicover, David. *Ridgeline Windpower Development in Maine: An Analysis of Potential Natural Resource Conflicts* (AMC Technical Report in preparation; completion expected October 2007; will be posted to AMC web site at www.outdoors.org/conservation/wind).

- New Hampshire Wind Energy Facility Siting Guidelines Working Group. *Proposed Windpower Siting Guidelines*. (Document presented to New Hampshire Energy Policy Commission, May 2007).

- Publicover, David, Kenneth Kimball, Catherine Poppenwimer and Larry Garland. *Balancing Windpower Development and Open Space Conservation: An Analytical Approach to Evaluating Potential Conflicts and Promoting Appropriate Siting*. (Poster presented at American Wind Energy Association annual conference, Pittsburg, PA, June 2006.)

- *The Air Up There: AMC Creates a Model for Wind-power Siting*. (Article in organizational magazine *AMC Outdoors*, January 2006; see http://www.outdoors.org/publications/outdoors/2006/windpower.cfm.)

- Additional funding for this work was provided by the John Merck Fund and the Harold Whitworth Pierce Charitable Fund.