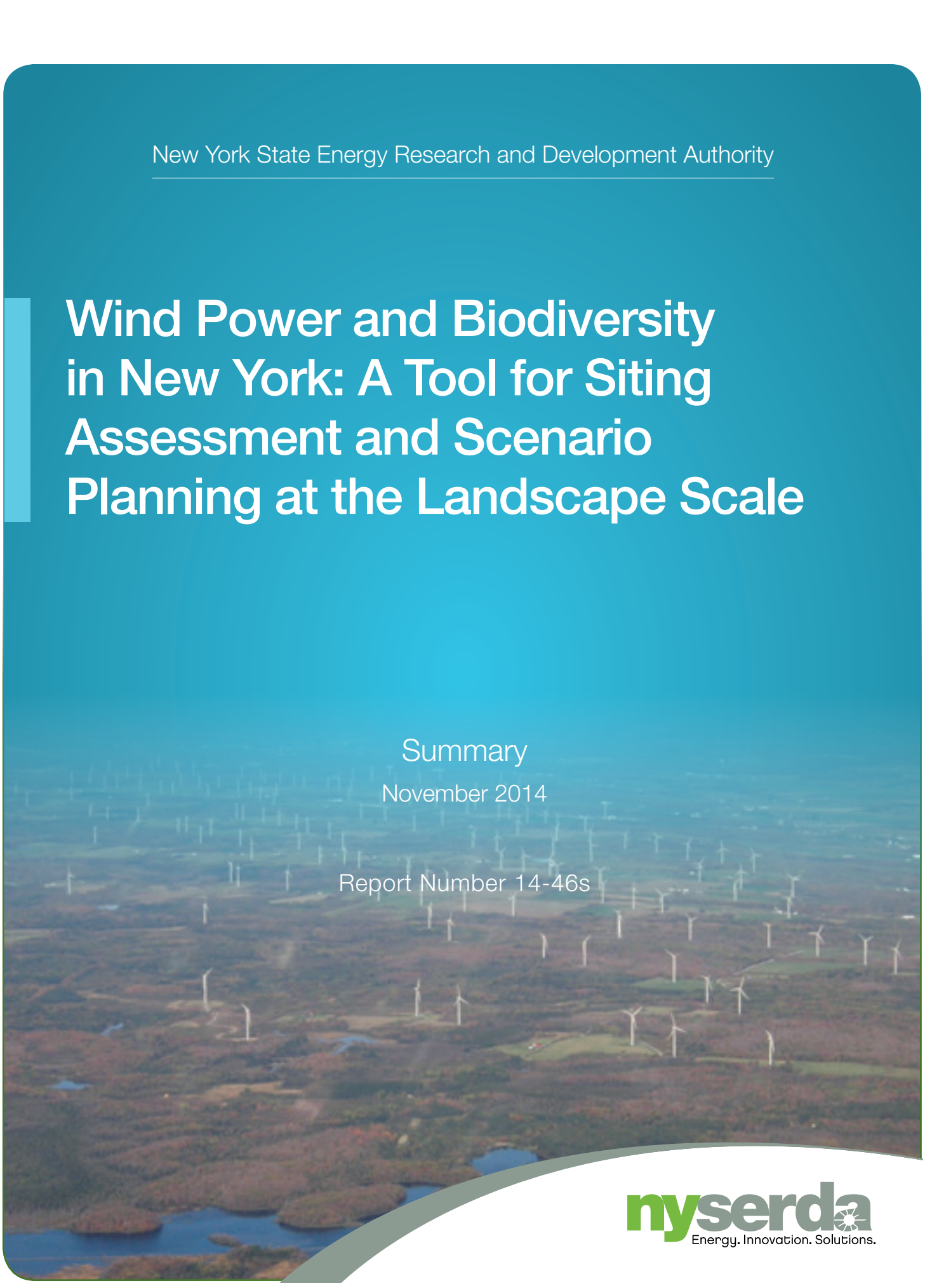
New York State Energy Research and Development Authority

Wind Power and Biodiversity in New York: A Tool for Siting Assessment and Scenario Planning at the Landscape Scale

Summary

November 2014

Report Number 14-46s



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Summary

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Preferred Citations

See Section 7.1.11 for details on how to cite the full report, summary report, and online tool

Cover Photo

Maple Ridge wind farm in Lewis County, NY .
Credit: Dennis Wischman, NYS Department of Environmental Conservation

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1 Background and Introduction

Renewable energy is key to mitigating climate change and its effects on biodiversity, and wind energy projects have proliferated nationwide as examples of one of its most sustainable forms. However, the growth of wind energy projects in New York State has led to increased concern about wind projects' effects on biodiversity. Wind energy projects have two primary short-term impacts on biodiversity: 1) direct impacts—resulting from collisions of aerial wildlife, particularly birds and bats, with turbine blades, and 2) indirect impacts—resulting from the footprint of the turbines and associated infrastructure like roads and transmission lines.

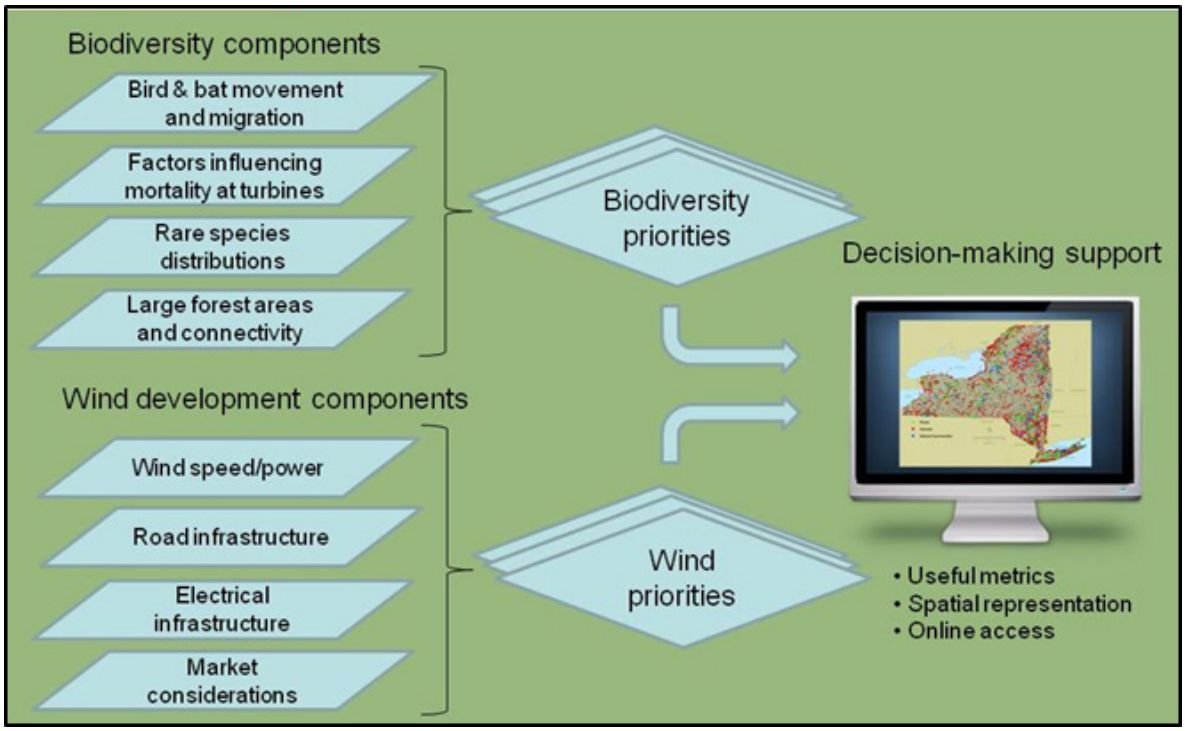
Avoidance of known and suspected impacts has been hampered by the lack of biodiversity information assembled in an easy and digestible manner, the lack of a synthesis of this information to guide siting of wind energy projects, and the absence of a comprehensive statewide strategy for siting wind projects with input from regulatory agencies, conservation groups, and the wind industry.

Sidestepping these impacts rests largely on appropriate siting of projects in areas less sensitive to habitat loss and fragmentation, and in areas less frequented by migrating, breeding, and wintering birds and bats. While some relevant data for making siting decisions are readily available through tools such as the Great Lakes Wind Collaborative (GLWC) Great Lakes Wind Atlas, New York Nature Explorer, and the American Wind and Wildlife Institute (AWWI), no publicly available synthesis of this information exists to identify areas most sensitive to loss of biodiversity. In addition, much of the available data on bird migration routes in New York have great potential to inform the proper siting of wind energy project, but have remained unanalyzed at appropriate spatial scales. This comprehensive spatial mapping tool represents the first of its kind specific to New York.

Planning for energy infrastructure is best done at a landscape scale to minimize impacts on important habitats and natural systems. Looking at impacts at the scale of individual projects is insufficient to account for the impacts to resource values of a given landscape or region. Implementing landscape-scale planning and mitigation approaches can reduce impacts, meet conservation needs, and increase agency efficiency and development costs by reducing the time and complexity of project reviews, environmental analysis, and permitting.

To address these needs, The Nature Conservancy (TNC) and the New York Natural Heritage Program (NYNHP), with funding support from NYSERDA, developed a spatial mapping tool to identify statewide biodiversity priorities using the most comprehensive biodiversity data available. The tool brings together multiple data layers representing wind project suitability, and combines these in a set of example scenarios for using a custom mapping tool. This document represents an abridged version of the final report. It describes the project structure, an overview of what was produced, and guidance for using the online Wind Siting and Biodiversity Mapping Tool.

Figure 1. Project Conceptual Model



2 Project Advisory Committee

This project benefited greatly from the involvement of a Project Advisory Committee (PAC). PAC members were recruited individually and consisted of 23 representatives of 19 industry, government, and nonprofit groups (Table 1).

The project team conducted a series of webinars for the PAC. Each series consisted of a presentation updating the committee on progress (7 webinars) or describing the technical details of the approach (four webinars), followed by discussion.

PAC members had varying levels of involvement throughout the project; some PAC members participated in every webinar, while others rarely participated. Note that PAC membership and participation do not necessarily indicate endorsement of our products.

Table 1. Project Advisory Committee Members

- Adirondack North Country Association
- Adirondack Park Agency
- Alliance for Clean Energy New York
- American Wind and Wildlife Institute
- Audubon New York
- Bat Conservation International
- Cardno-Entrix
- Ecology & Environment
- EDPR
- EverPower
- Hawk Migration Association of North America
- Iberdrola Renewables
- Invenergy
- NYS Department of Environmental Conservation
- NYS Department of Public Service
- Old Bird, Inc.
- Tug Hill Commission
- US Fish and Wildlife Service
- Wildlife Conservation Society

3 Data Layers

The online tool includes 31 layers that represent pre-existing biodiversity data and models, newly available biodiversity data and models, and energy data (Table 2).

Table 2. Data and Model Categories Included in the Online Tool

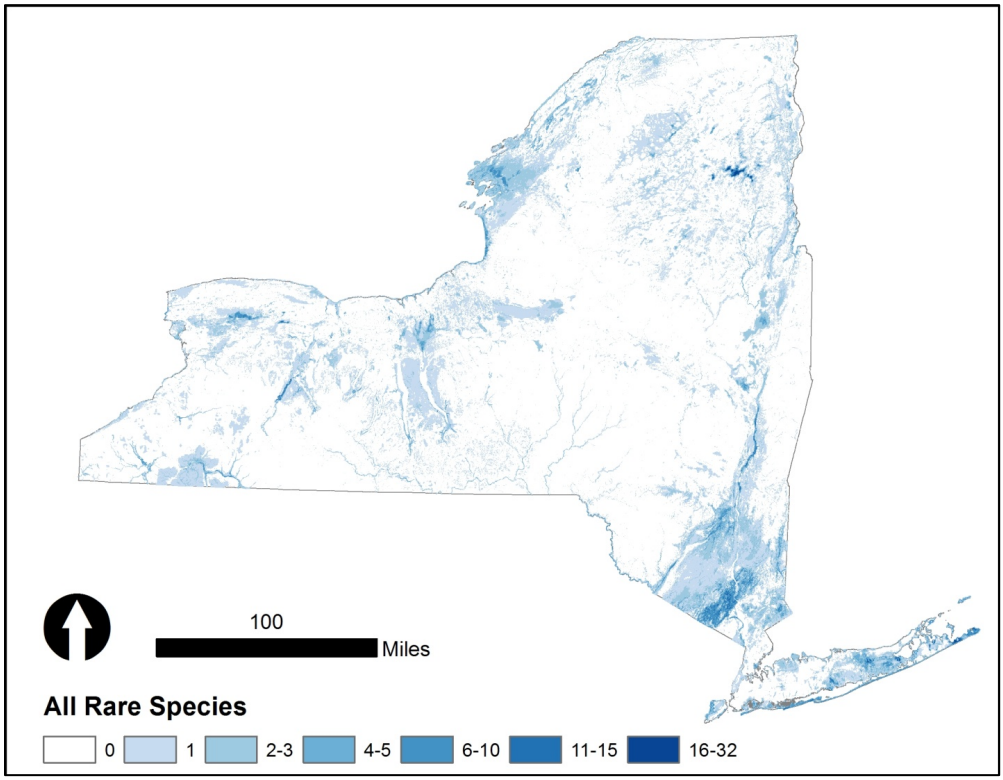
Data and Models	Includes
Pre-existing biodiversity data and models	• Resilient stream networks, floodplain complexes, predicted mussel richness, and predicted aquatic macroinvertebrate richness from TNC's and NYNHP's 2011 "Freshwater Blueprint" project • Terrestrial landscape resilience from TNC's 2011 "Resilient Sites for Species Conservation in the Northeast and Mid-Atlantic Region" • Percent forest in the landscape from the National Land Cover Database • Conservation lands from the NY Protected Areas Database
New biodiversity data and models (See Section 3.1 for details.)	• Habitats necessary for the survival of at-risk species • Bat distribution and migration • Large unbroken expanses of natural land critical for the persistence of intact ecosystems • Connectivity through corridors, stepping stones, travel routes, and stopover sites.
Energy data	• Existing and proposed wind turbine locations from the Federal Aviation Administration • Wind power class at 50 m, as modeled by AWS Truepower • Elevation • Distance to major power transmission lines Marcellus Shale thickness and depth to base Utica Shale thickness and depth to base

3.1 New Biodiversity Data and Models

3.1.1 Habitats necessary for the survival of at-risk species

To best assess where the most important habitat for the highest priority species occurs, a series of statewide distribution models were built for 371 rare and at-risk plants and animals tracked in the NYNHP database. These models identified areas of New York State with habitat conditions similar to those where the species are known to exist. Assessment and validation metrics were calculated on every model, and models failing such assessment were not included in any final products. These models were then stacked to yield the predicted richness of at-risk plants and animals (Figure 2).

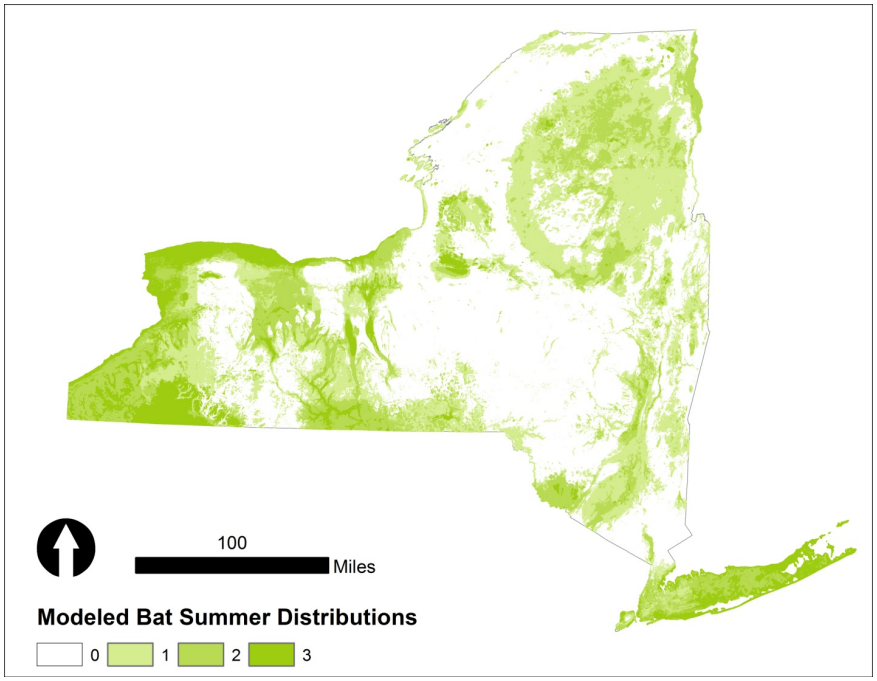
Figure 2. Stacked Distribution Models for 330 At-Risk Animals and Plants



3.1.2 Bat distribution and migration

Three unique data sets are available to help us understand bat migrations and summer bat habitat. First, identity and location data were extracted for six bat species from acoustical survey data obtained from NYSDEC plus other mist-net data, and built distribution models using similar methods as previously described. Second, existing data on Indiana bat and little brown bat movements from hibernacula were used to display the patterns of short-distance migration for these species. Third, landscape characteristics were analyzed in relation to bat mortality at wind turbine facilities to provide insights into what landscape features may result in increased mortality of bats at turbine sites (Figure 3).

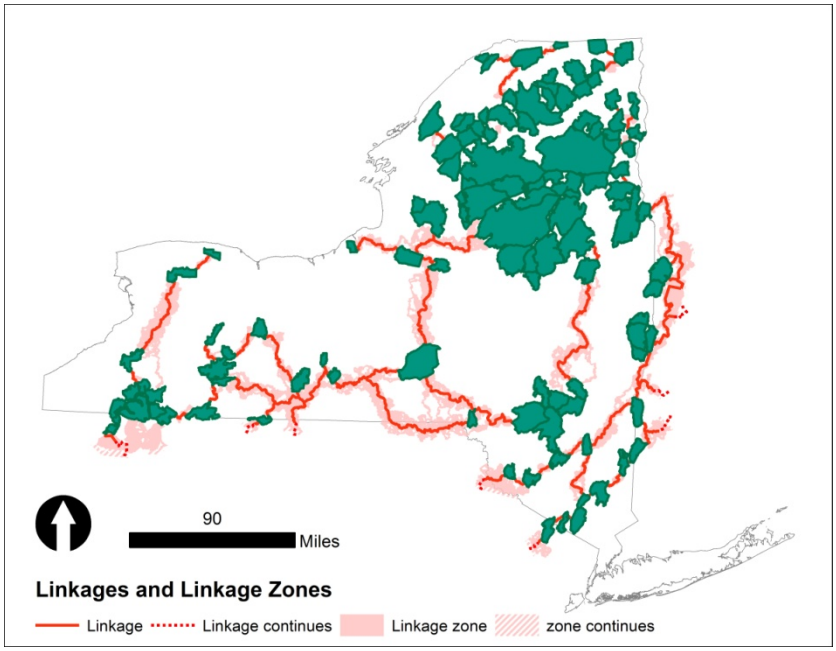
Figure 3. Stacked Summer Distribution Models for Three Species of Bats



3.1.3 Large, unbroken expanses of natural land critical for the persistence of intact ecosystems

Prioritizing large chunks of unfragmented habitat (usually larger than 10,000 acres) has been a focus of conservation efforts for years. As forests are the dominant ecosystems of Eastern North America, assessments from this region identified areas of large, unfragmented forest ("matrix forest blocks") as critical for conservation. The tool displays all of New York's matrix forest blocks, including in the Great Lakes Ecoregion, which had not previously been analyzed (Figure 4).

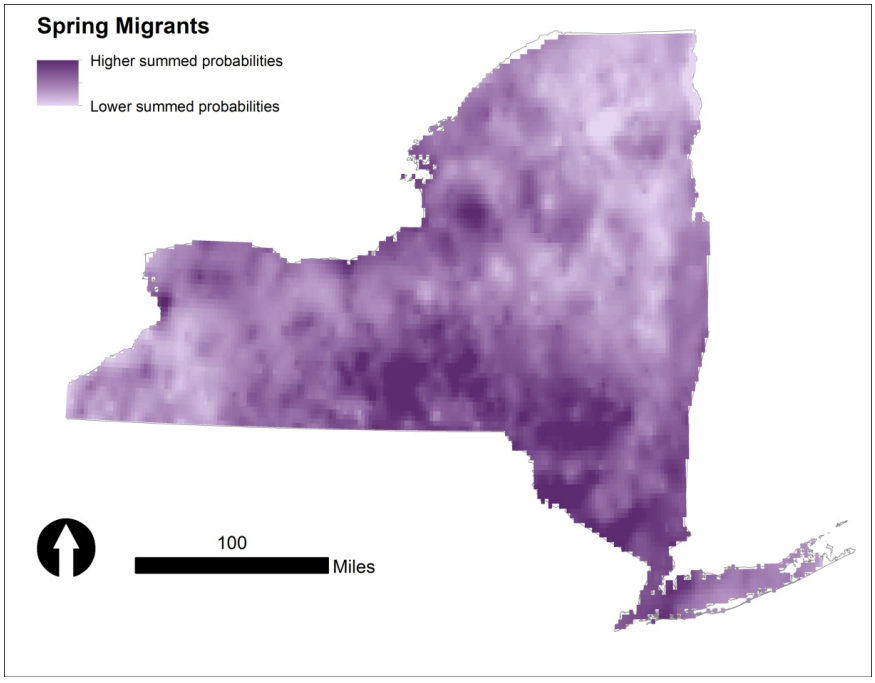
Figure 4. Matrix Forest Blocks with Modeled Connection Zones



3.1.4 Connectivity through corridors, stepping stones, travel routes, and stopover sites

Populations in isolation have a much lower probability of persisting over time. Sustaining adequate gene flow among populations as well as among habitats large enough to support dynamic responses to outside stimuli (such as weather and climate) also requires functional biological connections. In addition to the bat movement data described earlier, connections and corridors were evaluated in three ways. First, forest connectivity was evaluated using a graph theory approach to assess connections among matrix forest blocks and their relative contributions to larger scale conservation planning. Second, collaboration with the Cornell Lab of Ornithology helped to identify important stopover habitat in spring and fall for 28 migratory birds, using data available from the Avian Knowledge Network (and the eBird database within) in a rigorous modeling framework. Individual species were stacked to yield predicted richness of migratory birds statewide (Figure 5). Finally, the Cornell Lab of Ornithology deployed recording units near existing and potential wind farms to detect flight calls of migrating birds and report on the timing and spatial pattern of migration.

Figure 5. Stacked Models of Stopover Habitat for 28 Species of Migratory Birds in Spring



4 Data Syntheses and Finding a Balance

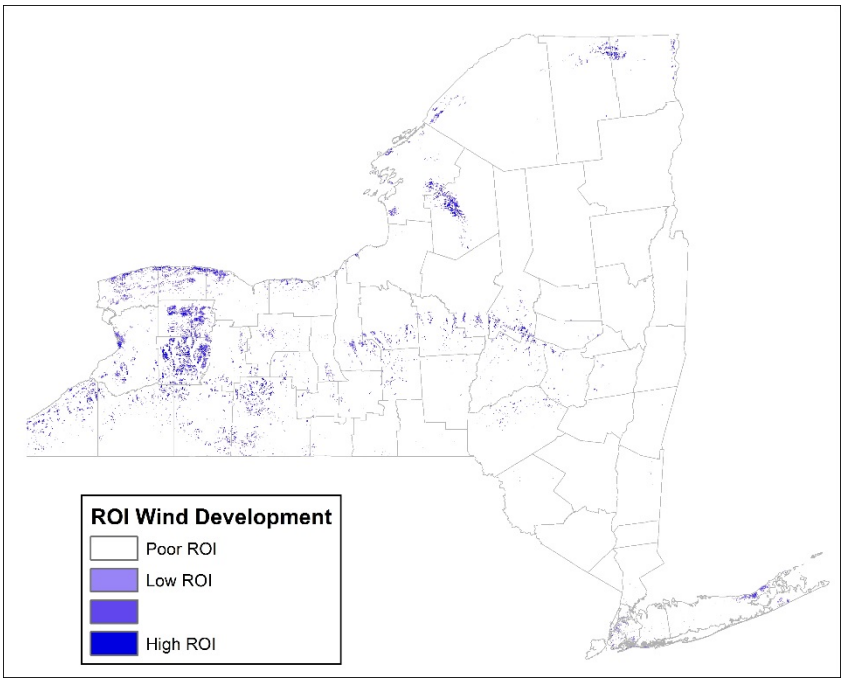
In addition to developing and providing access to these data layers, a method was built for synthesizing these layers to prioritize development and biodiversity needs and then balance these needs to identify locations with the least conflict between energy development and biodiversity conservation. The return-on-investment (ROI) method is an approach for synthesizing and balancing biodiversity protection and wind siting. This synthesis depends on weighting a variety of components that might be weighted or prioritized differently depending on the user. This approach was used to address the question of how much more on-land wind development is feasible in New York while avoiding sensitive habitats and wildlife. The data and the methods presented in this report allow users with geographic information system (GIS) expertise to recreate these synthesis analyses for their own needs.

Using the ROI model, the project team found:

- 5,430 square kilometers (1.3 million acres) of land in New York that are both suitable for wind power development and avoid areas that are likely to have high biodiversity value. Using an estimate of 3.0 MW/square kilometers, this translates to a megawatt capacity estimate of 16,300 MW (± 9,000 MW) for New York's terrestrial landscape (Figure 6).
- New York State has the on-land capacity to develop at least three times the existing wind power in the State while avoiding areas that are likely to be sensitive habitat areas. It should be noted, however, that these estimates do not consider other wind energy development constraints such as proximity to homes and roads.

While the wind mapping tools make it possible to evaluate where turbines could be sited to avoid adverse impacts to habitat and wildlife, they do not eliminate the need for site-by-site analysis to examine the impacts of a particular wind development project.

Figure 6. Return on Investment Analysis Results for Wind Development Priorities While Considering Biodiversity Constraints and Land Protection Status



5 Federal Voluntary Wind Energy Guidelines and Use of Wind Siting Tool

In 2012, the Department of the Interior released guidelines designed to help wind energy project developers avoid and minimize impacts of land-based wind projects on wildlife and their habitats. The voluntary guidelines are designed to help shape the smart siting, design, and operation of the nation's growing wind energy economy (http://www.fws.gov/windenergy/docs/WEG_final.pdf).

The federal voluntary guidelines provide a structured, scientific process for addressing wildlife conservation concerns at all stages of land-based wind energy development, and can assist developers in identifying species of concern that may potentially be affected by their proposed project, including migratory birds; bats; birds of prey; prairie and sage grouse; and listed, proposed, or candidate endangered and threatened species. These impacts may include direct impacts such as collisions with wind turbines, fragmentation of habitat and other indirect impacts.

The federal guidelines use a tiered approach for assessing potential adverse effects to species of concern and their habitats. The pre-construction tiers (1, 2 and 3) are the time to identify, avoid, and minimize risks to species by conducting landscape scale screening of possible project sites, and broad site characterization. Tier 3 involves conducting field studies. The wind sting tool described in this report is particularly appropriate for making Tier 1 and Tier 2 assessments. The US Fish and Wildlife Service recommends using tools like this one that have been developed for specific states or regions for carrying out Tier 1 and Tier 2 assessments. Using this tool early in the process of designing a project in New York offers the greatest opportunity to avoid areas where wildlife impacts are likely to be high and difficult or costly to remediate, and makes it possible to incorporate appropriate conservation measures and monitoring into siting, design, and operation.

6 Conclusion

Biodiversity protection, one of many factors in the complex process of siting energy infrastructure, must be a consideration in the suitability of an area for wind development. The Biodiversity and Wind Siting Mapping Tool is intended to help New York meet its renewable energy goals while avoiding and minimizing impacts on sensitive biodiversity resources and to enable decision makers to balance environmental concerns with siting wind power. Using the tool to evaluate sites can save time and money on permit reviews and can result in a more expedited review process. Although initially intended to address wind power siting, the tool presented in this report is relevant to many types of energy and infrastructure development decisions.

7 Using the Online Mapping Tool

The online mapping tool is available at www.ebd.mapny.info. Modern versions of most browsers should be suitable for satisfactory display and use. When visiting the site, all users first encounter a disclaimer that emphasizes the intended and appropriate uses for the tool and the data contained within. These details are discussed throughout the report, but it is important to emphasize the two key points contained in the disclaimer:

1. The tool is intended as one source of information for decision making and other information sources must be queried to ensure a full understanding of the questions being asked.
2. The data layers vary in quality, and although some may appear very fine scale in some contexts, they are intended to be used at broader, landscape scales, not necessarily for determining where individual turbines might be placed, for example.

All users must understand that GIS data and GIS models can be very useful. However, users must exercise caution in applying them beyond the use for which they were intended. And always, data collected onsite is critical for informing any decision-making.

7.1 How to Perform Common Tasks with the Online Tool

7.1.1 What are the best sites for wind development in NYS?

Although this tool does provide information that can support questions about the best remaining turbine sites in the state, there are many other components that play a role in such a decision. Because there is no single best answer, this tool is designed to provide information to support decision making but not to depict various scenarios balancing different siting priorities.

7.1.2 How do I find out how a layer was created or where it came from?

Additional information about each layer is available as metadata in a separate PDF. After turning on the layer in the Table of Contents, choose the layer name from the "Visible Layer Properties" window in the upper right corner. Then click on the "Metadata" hotlink at the bottom of that properties box. A new tab in your browser should open with the information about the chosen layer. A shorter layer description is also available.

7.1.3 How can I quickly navigate around the map?

Hold down the SHIFT key and drag a box with your mouse to zoom in. Hold down SHIFT+CTRL and drag a box to zoom out. Other quick navigation tips are available with the "Navigation" button at the top of the map.

7.1.4 How can I see a layer hidden underneath another layer?

Change the transparency of the top layer(s). In the "Visible Layer Properties" box at the upper right of the map window, select the layer that is obscuring other layers. Slide the Set Transparency slider to the right (toward "Clear") until you see the layers underneath.

7.1.5 Could this information be used for other purposes, such as road or other infrastructure planning purposes?

These data may have appropriate uses outside the expressed intent of the current tool. It is very important, however, that all users recognize the appropriate scales for use and inherent limitations in use. For scale, each layer is rendered at relatively fine scales (e.g., 30-meter pixels), but use and interpretation should not occur at the pixel-by pixel level. Rather, the overall pattern of pixels should be used to inform projects more broadly.

Users must also recognize that much of the information incorporated into the tool shows, for example, potential habitat and potential wind power. On-the-ground site survey and monitoring is crucial to inform final decision making.

7.1.6 How do I download data for use in modeling on my computer?

If the data layer came directly from another source, follow the links to that source on the Metadata page. If the data were developed as part of this project, links for direct download for each layer are available at http://nynhp.org/data.

7.1.7 What is the format of the GIS files?

All raster data are provided as geoTIFF files. Polygon data are provided in ESRI Shapefile format.

7.1.8 Won't the data be out-of-date in a few years? Do you plan to update the data regularly?

All information goes out of date with time, and these data are no exception. Each layer incorporated into this tool is unique and all layers will remain "current" for different lengths of time. It is up to the user to note the date the information was developed and decide for themselves the current value and utility. Note, however, that models depicting predicted suitable habitat are less likely to go out of date than known species locations as habitats are likely to change a bit more slowly than species populations. There are no current plans to update the data.

7.1.9 Have the models that produced many of the data layers been ground truthed?

In the sense that each model was tested with data held out from the model (validation data), yes, each model was carefully validated and poor-performing models were excluded from this tool. On-site fieldwork after model development has not been completed, emphasizing the need for site-level data collection and monitoring prior to project initiation.

7.1.10 What is the scale of the data? Does the scale vary by data layer?

Although presented at a relatively fine resolution, scale does vary by data layer. Users should consider these layers as appropriate for use at landscape scales rather than at scales for siting individual turbines, for example.

7.1.11 How should I cite the tool if I am using it in support of a publication?

Full report citation:

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New York Natural Heritage Program and The Nature Conservancy. 2014. Wind Power and Biodiversity in New York: A Tool for Siting Assessment and Scenario Planning at the Landscape Scale Interactive Mapping Tool www.ebd.mapny.info

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