# Bird and Bat Studies Conducted at Proposed or Existing Windpower Facilities

## (Focused on the Northeastern/Mid-Atlantic States)

## Table of Contents

# A. MAINE

## A.1 Mars Hill Wind Farm, ME

**Land Use/Topography-** Forested ridge surrounded by farmland.

**A Spring 2006 Radar, Visual, and Acoustic Survey of Bird Migration at the Mars Hill Wind Farm in Mars Hill, Maine.** Prepared for Evergreen Windpower, LLC. Prepared by Woodlot Alternatives. September 2006.


Executive Summary

A permit has been granted to Evergreen Windpower, LLC (Evergreen) for a wind project that will include the erection of up to 33 wind turbines along the ridge top of Mars Hill in Mars Hill, Maine. During spring 2006, Woodlot Alternatives, Inc. (Woodlot) conducted field surveys of bird migration activity at Mars Hill. These field surveys were conducted to fulfill requirements under Evergreen's Maine Department of Environmental Protection Site Location of Development permit. The work included daytime surveys of migrating raptors, nighttime surveys of birds and bats using radar and bat echolocation detectors, and morning transect surveys to document birds during stopover events.

*Raptor Surveys*

The spring raptor surveys included 10 days of visual observation from April 12 to May 18, 2006. A total of 64 raptors, representing 9 species, were observed during the surveys. Osprey (*Pandion haliaetus*) were the most commonly observed species (N = 22). Turkey vultures (*Cathartes aura*) (N=11) and red-tailed hawks (*Buteo jamaicensis*) (N = 11) were the next most abundant species observed. Approximately 48 percent of the raptors observed were flying less than 120 meters (m) (394') above the ground, the approximate height of the turbines to be used at the project. Seven percent of the total raptor observations were of the federally and State Threatened bald eagle (*Haliaeetus leucocephalus*). Accipiters and falcons flew predominantly below turbine height while all other species groups flew predominantly above the turbine height. The observation rate of approximately 1.1 birds per hour was low in comparison to observation rates at other regional locations (the highest rate being 64.4 birds/hour).

Migrants observed within the project area were generally traveling south to north over the Mars Hill ridgeline or along the western slope of Mars Hill. However, most migrants did not appear to follow the entire crest of the Mars Hill ridge. Rather, flights of individual birds crossed the lower shoulders of the mountain then over the surrounding agricultural landscape. Although the survey focused on raptor movement within the project site, a few migrants were observed over the valleys directly west and directly east of the ridgeline. The overall low number of migrants observed in the project area indicated relatively low exposure of raptors to the turbines and, consequently, low risk of collision-related mortality during migration.

*Radar Surveys*

Radar surveys to collect and record video samples of the radar during horizontal and vertical operation were conducted. The purpose of the study was to document the passage rate, flight height, and flight direction of night-migrating avian species through the project area. Horizontal operation documents the abundance, flight path, and speed of targets moving through the project area and vertical operation documents the altitude of targets. A total of 15 nights were sampled between April 20 and June 4, 2006. Nightly passage rates varied from 76 ± 18 targets per kilometer per hour (t/km/hr) to 674 ± 108 t/km/hr, with the overall passage rate for the entire spring survey period was 338 ± 51 t/km/hr. Mean flight direction through the project area was 58º ± 87º.

The mean flight height of targets was 384 m ± 27 m (1,259' ± 89') above the radar site. The average nightly flight height ranged from 206 m ± 23 m (676' ± 75') to 546 m ± 82 m (1,791' ± 270'). The percent of targets observed flying below 120 m (394') also varied by night, from 4 percent to 50 percent. The seasonal average percentage of targets flying below 120 m was 16 percent. Nights with the greatest percentages of targets flying less than the maximum turbine height were typically nights that also experienced low passage rates. The overall flight patterns found at Mars Hill were generally similar to those found at other spring studies in the Northeast. Passage rate, flight height, and flight direction were within the range found at those other spring radar studies.

The mean flight direction, qualitative analysis of the surrounding topography and landscape, and mean flight altitude of targets passing over the project area indicates that avian migration in this area involves a broad front type of movement over the landscape. In general, nighttime targets were observed flying to the northeast, across the alignment of the ridge. This flight direction combined with the generally high flight height documented during the study indicates that the night migrants are not affected by the topography of Mars Hill and low-level nighttime flights across the ridge top are not common. Additionally, the flight height data indicates that the majority of migration occurs at altitudes well above the height of the wind turbines. This type of high, dispersed movement over the project area reduces the risk for potential collisions to impact populations of migrating birds passing through the project area.

Analysis of NEXRAD weather data was examined to identify the proportion of the migration season during which the radar survey at Mars Hill occurred. That analysis indicated that sampling at Mars Hill accounted for 33 percent of the spring migration season with nights of light to heavy migration.

*Morning Stopover Transect Surveys*

Morning stopover transect surveys were conducted on the mornings following the 15 nights of radar data collection. All birds seen or heard along two 0.8 km (.5 miles) transects (one along the ridge top of Mars Hill and one at the base) were recorded.

During the 15 survey periods, 935 individuals of 67 species were observed. Species composition and relative abundance of birds along transects was similar. A total of 427 individuals were documented at the low elevation transect and 508 individuals along the ridge top transect. The species composition of the birds observed during the survey was

generally as expected, with wood warblers and vireos being more common near the middle of the survey period and the sparrows being most common near the beginning of the survey period.
*(Entire Study on-file at Avatar)*

**Other Studies –** Additional studies are on-going.

## A.2 New England Wind Energy Station, ME

**Land Use/Topography** - Mountainous Terrain; forested and logged over

Northrop, Devine, & Tarbell, Inc. 1995a. **New England Wind Energy Station. Spring 1994 Nocturnal Songbird Migration Study Report**. Prepared for Kenetech Windpower, Inc. January 1995.

Northrop, Devine, & Tarbell, Inc. 1995b. **New England Wind Energy Station. Fall 1994 Nocturnal Songbird Migration Study Report**. Prepared for Kenetech Windpower, Inc. August 1995.

U.S. Windpower. 1993. **New England Wind Energy Station. Maine LURC/DEP Permit Application.**

## A.3 Redington Mountain Wind Farm, ME

**Land Use/Topography** – The entire region is generally undeveloped and dominated by a working industrial forest and mountainous landscape.

**Redington Wind Farm Land Use Regulation Commission (LURC) Permit Application, Section 7 Wildlife and Fisheries.** Prepared by Woodlot Alternatives, Inc.

Conclusions
Like any wind energy facility, the potential for collision mortality certainly exists at the Redington Wind Farm. However, data from radar and raptor surveys suggest that the topography of the region causes many birds to fly to either side of the site, rather than over the ridgelines, which reach elevations of nearly 3,700 feet. Due to the harsh conditions and limited feeding resources along these ridgelines, bats are also expected to avoid the upper elevation ridgelines during migration, and resident bat populations are expected to be small, and have low diversity. Although accurately predicting the likelihood that the proposed facility would cause bird or bat collision mortality is not possible, the topography, climate, and habitat of the site and the surrounding area would, if anything, discourage migrating birds and bats from flying over the ridgelines. Acoustic bat surveys conducted in fall 2005 documented a low occurrence near the peak of Black Nubble, which generally corroborates this conclusion.

The data presented in this report were collected during a period of more than 10 years, over which time numerous changes were made to the proposed development plan. These

changes have minimized the potential impacts of the project on wildlife, wildlife habitat, and wetlands. Like any large scale development, this project will have inevitable impacts on the landscape. However, alterations in the design plan have eliminated over 11.5 acres of wetland impacts, including impacts on ecologically significant stream resources, and have resulted in creation of buffer zones around particularly sensitive ridgeline habitats. The result of this process has been that the potential for the project to impact wildlife and habitats within the project area has been greatly reduced. While the project area does include unique habitats and species adapted to these habitats, the project will affect only a small area relative to the amount of available habitat that will remain unaltered, providing adequate habitat for displaced wildlife. As it is proposed, the project is expected to have no undue adverse impact on local wildlife and fisheries and their preferred habitats, as regulated under Natural Features by the LURC (LURC Chapter 10.25,E,2,a).
http://mainegov-images.informe.org/doc/lurc/projects/redington/Documents/Section07_Wildlife_Fisheries/Redington_Mountain_Section_7.pdf

## B. MARYLAND

## B.1 Allegheny Heights Wind Power Project, MD

**Land Use/Topography** – Appalachian Ridgetop; land use is mixture of forest and open farmland

**Environmental Analysis section of the Clipper Windpower Certificate of Public Convenience and Necessity (CPCN) filing.** August 2002.

This chapter describes the potential impacts from construction and operation of the Allegheny Heights Windpower Facility on the physical, biological, aesthetic, and cultural resources of the proposed site and vicinity. Impacts are presented and evaluated against the existing environment as well as in terms of compliance with applicable regulations and standards.
http://www.marylandwind.com/pdfs/chapter4.pdf

**Nesting Bird Surveys at the Allegheny Heights Wind Power Project Site, Garrett County, Maryland**. Prepared for Clipper Windpower, Inc. Prepared by Curry & Kerlinger, LLC. July 2002.

Executive Summary
A nesting bird survey was conducted July 15-19, 2002, to determine whether species listed by the Maryland Department of Natural Resources, Wildlife and Heritage Service were present at the Allegheny Heights Wind Power Project site. A target list of five species was identified by the Wildlife and Heritage Service as potentially present on the site including Mourning Warbler - endangered, Blackburnian Warbler – threatened, Winter Wren and Darkeyed Junco - rare, and Alder Flycatcher – in need of conservation.

In addition, the survey was conducted to determine if other listed or sensitive species were present.

A transect along the top of Backbone Mountain within the Allegheny Heights Wind Power Project (Clipper Windpower, Inc.) boundaries was established and divided into four separate survey areas corresponding to sections of the Allegheny Heights site that are separated by roads and or private property boundaries. All sections were surveyed at least twice. The transect was surveyed by walking at approximately 1 mph and noting all species seen and heard.

A total of 57 species of birds, primarily songbirds, was identified. Almost all of the species were common birds of forest, brushland, and forest edge (including residential and yard birds). A majority of birds present are species that inhabit fragmented or disturbed forests. These are considered edge species and occur where forests have been cut or even in residential neighborhoods. There were several species present that are considered forest interior species. Of the five species listed above, two were found on the transects. Three singing (male) Blackburnian Warblers were within close proximity to each other at a Norway spruce plantation within Potomac State Forest about 400 yards south of Boiling Springs Road. Approximately 14 singing (male) Dark-eyed Juncos were identified with most being located within the southernmost portion of the project site. Two hawk (Red-tailed and Broad-winged) nesting territories were also identified. The three other species listed by Wildlife and Heritage Service were not found, most likely a function of the paucity of suitable habitat on site and the fact that western Maryland is at the edge of these species' geographic distribution so even suitable habitat may not be occupied. The rarity of these species in Maryland is a function of geography and the fact that the mountainous areas of western Maryland are restricted in size.
http://www.marylandwind.com/pdfs/ALLHeightsNestRpt-7-02.pdf

**Phase I Avian Risk Assessment for the Allegheny Heights Wind Power Project, Garrett County, Maryland**. Prepared for Clipper Windpower, Inc. Prepared by Curry & Kerlinger, LLC. May 2002.

Executive Summary

This report details a Phase I Avian Risk Assessment for the Clipper Windpower, Inc. Allegheny Heights Wind Power Project, Garrett County, Maryland. The assessment includes a literature review, interviews with local and regional experts (agency staff, environmental organizations, and local birders), and site visits conducted on April 22 and 23, and July 15, 2002 by a trained wildlife biologist. Together, these sources of information provide an indication of the type and number of birds that are known or suspected to use a project site and the area surrounding that site. This information is used to assess the degree of risk to birds, if any, from wind power development at a particular site. In addition, the concerns of regulators and environmental organizations are determined and incorporated into the risk assessment.

The Allegheny Heights Wind Power Project will be a moderately sized project with

respect to electrical production and number of turbines. The total electrical output is likely to be up to about 100 megawatts of power (more than 40 turbines), or the equivalent of emission-free energy required by nearly 32,000 homes. The turbines height, including tubular tower and rotor, will be about 350 feet (105 m). A majority of electrical lines on site will be underground. Towers will be lit according to FAA recommendations.

The Allegheny Heights project site is private land, with the exception of one parcel that is part of the Potomac State Forest. The land is atop Backbone Mountain and is currently forested or used for agriculture. Logging is evident and there are some conifer plantations on site. The farmland is virtually all hay/grassy fields. Transmission lines are on the project site. Hunting cabins, homes, and roads are present along much of the ridge. Some tree removal will be required. There are electrical lines present over much of the ridge to service existing homes and cabins. There are also several communication towers on the ridge. Eagle Rock, near the northern terminus of the project site could be considered special or sensitive habitat and may be excluded from the site plan.

Nothing from the literature, site visits, or interviews with experts/agency biologists suggested that the site is important nesting or foraging areas for federally threatened or endangered birds. A letter from the U. S. Fish & Wildlife Service corroborates this assessment. According to a letter from the Maryland DNR – Wildlife and Heritage Service – listed species do occur on or immediately adjacent to the project site including Mourning Warbler, a Maryland endangered species, which might be found in brushy edge habitats there. Risk to this species is likely to be minimal because clearing of trees for turbines would actually create habitat for this species. Blackburnian Warbler (MD-threatened) may be present in or adjacent to conifer stands on Backbone Mountain (Allegheny Heights site).

The site visit did not reveal high densities or availability of prey or other habitat attributes that could attract or host large numbers of raptors to the turbine areas. Hawk migration is known to occur at the Allegheny Heights site (along Backbone Mountain), although the migrations are not large or considered significant. Risk is likely to be low because few migrants collide with wind turbines. Morning flight of night migrating songbirds undoubtedly occurs along the ridgetops at the same site, but the numbers of birds involved seems to be minimal and risk is likely to be low and not significant.

Based on what is known about avian risk factors at wind power plants in North America and Europe, the species (type and numbers of individuals) that frequent the project site, and what was learned from the literature search, site visits, and interviews, risk to most species of birds at the Allegheny Heights Wind Power Project is likely to be low and not significant. The following recommendations are made.

- Underground all electrical lines within the project site, or insulate above ground wires and substations, and configure according to APLIC (Avian Power Line Interaction Committee) guidelines.
- Meteorology towers should be free-standing and unguyed to prevent the potential for avian collisions.
- Habitat Management. Roads and turbine pads should be minimal in size so that as

few trees would be removed as possible (at sites where trees need to be removed). Brush and forest should be permitted to grow up as close to the turbines and roads as possible following construction to minimize habitat fragmentation and impact.

- Perform wetlands delineation at the project site to permit buffering of wetlands if they present. Such buffering would eliminate the potential for federal nexus (by U. S. Fish & Wildlife Service) if U. S. Army Corps of Engineer permits are required.
- FAA lighting should be white strobes at night with the longest possible off cycle permissible and lighting should be kept to a minimum number of turbines (if possible no turbines should be lit). If white strobes at night are not permitted by the FAA, red strobes or red LEDs with the longest off cycle should be used.
- Discussions with Maryland Department of Natural Resources – Wildlife and Heritage biologist(s) to determine the likelihood of Maryland listed species presence at Allegheny Heights and whether further study is needed to determine the presence of such. Surveys during the nesting season would determine whether any of these or other listed species were present.

http://www.marylandwind.com/pdfs/appendixa.pdf

**Other Studies –** Marine radar nocturnal migration study - not yet publicly released.

## B.2 Dans Mountain Wind Project, MD

**Land Use/Topography** – Appalachian ridgetop, reclaimed coal strip, grassland adjacent to forest

Roy, R.D., S.K. Pelletier, T. Peterson, and A. Gravel. 2005. **A radar and acoustical survey of bird and bat migration at the Dan's Mountain Wind Project in Frostburg, Maryland, Fall 2004.** Report to U. S. Wind Force.

# C. MINNESOTA

## C.1 Buffalo Ridge Wind Resource Area, MN

**Land Use/Topography -** Buffalo Ridge is a 62-mile-long segment of the Bemis Moraine; land uses include farmland and Conservation Reserve Program fields.

**Avian Monitoring Studies at the Buffalo Ridge, Minnesota Wind Resource Area: Results of a 4 Year Study.** Prepared for Northern States Power Company. Prepared by Western Ecosystems Technology, Inc. September 2000.

Key Findings

In 1994, Northern States Power Company (NSP) initiated a windpower development project that may eventually produce 425 megawatts (MW) of electricity. Results of a biological reconnaissance of the Buffalo Ridge Wind Resource Area (WRA) conducted prior to windpower development indicated that there was relatively low potential for avian mortality to occur on this site because Buffalo Ridge was not in a major waterfowl staging area or migration route, and that passerines usually migrate at altitudes above the

turbine blades. Radar studies of nocturnal avian migrants also showed that abundance of migrants was relatively lower on Buffalo Ridge than other areas sampled in west-central and southwestern Minnesota. Results of pilot avian monitoring studies conducted by South Dakota State University in 1994 and 1995 following construction of the first wind plant indicated that avian and bat mortality within the wind development area was relatively low. In 1996, Western EcoSystems Technology (WEST, Inc.) was contracted by Northern States Power Company (NSP) to develop an avian monitoring protocol for the Buffalo Ridge WRA and to implement the protocol beginning with the 1996 field season.

Buffalo Ridge is a 62-mile-long segment of the Bemis Moraine located in Lincoln and Pipestone Counties in southwest Minnesota and Brookings County, South Dakota. Habitats in the study area consist primarily of agricultural crops including corn, soybeans, small grains and hay; pasture; and Conservation Reserve Program (CRP) fields. So far, there are three major phases of wind development within the WRA. In addition to those study sites within the WRA, a permanent reference area not scheduled for windpower development was selected along Buffalo Ridge northwest of the WRA in Brookings County, South Dakota.

The primary goals of this study were to evaluate risk to birds from each phase of development and the cumulative risk to birds from all windpower development in the WRA. The secondary goal was to provide information that can be used to reduce the risk to birds from subsequent developments. This monitoring study used the before/after and control/impact (BACI) design. The design and analysis used a "weight of evidence" approach to assess effects of the project on species of concern.

Compared to several other wind plants in the U.S., avian mortality appears to be low on Buffalo Ridge. Our data indicate that wind plant-related avian mortality on Buffalo Ridge primarily involves nocturnal migrants. Mortality of resident breeding birds appears very low, involves primarily common species, and would not likely have any population consequences within the Buffalo Ridge WRA. Based on the estimated number of birds that migrate through Buffalo Ridge each year, the number of wind plant related avian fatalities at Buffalo Ridge is likely inconsequential from a population standpoint. Information on bat abundance, behavior or habitat use at Buffalo Ridge is currently lacking.
http://www.west-inc.com/reports/avian_buffalo_ridge.pdf

**Effects of Wind Turbines on Upland Nesting Birds in Conservation Reserve Program Grasslands.** Krecia L. Leddy, Kenneth E Higgins, and David E. Naugle. Wilson Bull., 11 l(l), 1999, pp. 100-104.

Abstract
Grassland passerines were surveyed during summer 1995 on the Buffalo Ridge Wind Resource Area in southwestern Minnesota to determine the relative influence of wind turbines on overall densities of upland nesting birds in Conservation Reserve Program (CRP) grasslands. Birds were surveyed along 40 m fixed width transects that were placed

along wind turbine strings within three CRP fields and in three CRP fields without turbines. Conservation Reserve Program grasslands without turbines and areas located 180 m from turbines supported higher densities (261.0-312.5 males/100 ha) of grassland birds than areas within 80 m of turbines (582128.0 males/l00 ha). Human disturbance, turbine noise, and physical movements of turbines during operation may have disturbed nesting birds. We recommend that wind turbines be placed within cropland habitats that support lower densities of grassland passerines than those found in CRP grasslands. Received 9 Sept. 1997, accepted 5 Oct. 1998.
http://elibrary.unm.edu/sora/Wilson/v111n01/p0100-p0104.pdf

## D. NEW HAMPSHIRE

## D.1 Lempster Mountain Wind Power Project, NH

**Land Use/Topography –**lower elevation mountains/hills; primarily forested with a few clearings.

**Pre and Post-construction Avian Survey, Monitoring, and Mitigation at the Lempster, New Hampshire Wind Power Project.** Prepared for Lempster Wind, LLC. Prepared by The Louis Berger Group, Inc. August 2006.

Executive Summary

The purpose of this white paper is to discuss the data collected as well as describe the proposed activities by Lempster Wind, LLC, project development affiliate of Community Energy, Inc. (the Project), to understand, document, and offset the potential impacts to birds and bats of the Lempster Mountain Wind Power Project, proposed for Lempster, New Hampshire ("the Project"). This white paper addresses avian and bat sampling activities completed in from the fall 2004 through the spring 2006 as well as other task and project activities at both the pre and post-construction stages of the project. The ultimate purpose of this document is to make transparent the full suite of activities that have been conducted to-date along with other activities being proposed regarding birds, bats at the Lempster site. Ultimately, the goal of this white paper is to garner collaboration, input, and support from all key stakeholders including federal, state, and not-for-profit entities.

Much of what is being proposed and carried out by the Project is a function of the considerable lessons learned over many years about the impact of utility-scale wind power projects on birds and other wildlife. These issues have been extensively studied and monitored around the U.S. and Europe. Impacts are generally partitioned into two categories: **1. direct effects** which include the chance that birds that live in or migrate through a wind power project will collide with turbine blades, nacelles, or the towers that support the blades and nacelle, and **2. indirect effects** which include the chance that that birds and other wildlife will avoid visiting or nesting in land that supports wind turbines, due to the presence of tall turbines, the sound from rotating blades and gear boxes, or from habitat fragmentation or loss due to the interconnect roads and turbine pad clearings.

As will be summarized below, wind power projects have been carefully monitored over the past decade and have been shown to not have a significant impact on birds either from direct or indirect effects. Having said that, more is known about direct effects from collision than about the indirect effects of avoidance for the simple reason that direct effects can be measured by conducting post-construction mortality surveys wherein bird carcasses are counted in the vicinity of a wind turbine, while indirect effects vis-à-vis avoidance may take several years to manifest.

Both direct and indirect effects are nicely summarized in a 2005 document by the National Wind Coordinating Committee (NWCC) entitled: *Wind Turbine Interactions with birds and bats: a summary of research results and remaining questions*. This document, generally referred to as the "avian fact sheet", reports that some impacts of wind turbines to birds and bats have been demonstrated, but that these impacts are overall very low and are not biologically significant at the population level and that they also vary from wind plant to wind plant. The fact sheet reports that **the average number of birds that die from collision with wind turbines is 2.3 bird deaths per turbine per year**.

A summary of other significant findings in the avian fact sheet are as follows:
- Two types of local impacts to birds have been demonstrated at existing wind plants: 1) **direct** mortality from collisions and 2) **indirect** impacts from avoidance, habitat disruption and displacement.

- There have been **no documented large fatality events of nocturnal migrant songbirds at wind projects**. The two largest events reported include 14 spring migrant passerines found at two adjacent turbines in Minnesota on one night and approximately 30 spring migrants in West Virginia on one night.

- Songbirds (and in some locations bats), appear to be exposed to heightened risk at wind projects as well as at communication towers during foggy weather or where flood-lights and other artificial lighting is nearby.

-While bat mortality at most wind parks is lower than bird mortality, two wind parks located in the ridge-and-valley region of Pennsylvania and West Virginia have documented annual mortality of between 2,000 – 4,000 bats per wind park for the last two years. Efforts are underway to try and determine the cause of these unique events at the two sites.

- Both migrating and resident birds and bats sometimes die in wind farms as a result of collisions with wind turbines and meteorological towers (and their supporting guy wires). For birds, the national average is between 2-4 bird deaths per turbine per year (National Wind Coordinating Committee).

-Several studies have been published or are on-going on the displacement and avoidance impacts of wind turbines and associated infrastructure/activities on

grassland breeding songbirds and other open country birds (prairie grouse, shorebirds, waterfowl, etc.). Some of these studies have documented decreased densities of and avoidance by grassland song and other birds as a function of distance to wind turbines and roads. The level of impact varies by species, and on-going research is quantifying the distance of avoidance caused by the presence of infrastructure and human activity. Some birds adapt to areas previously avoided (habituate).

With these and other data as a backdrop, the Project is focusing on both pre and postconstruction activities (described below) that will allow them to both **monitor and mitigate** the known impact of wind turbines on birds and other wildlife. Specifically, the Project is committed to undertaking the following avian/wildlife activities (described in more detail below):

**Pre-construction Activities:**

1. The Project has conducted a Phase I Avian Risk Assessment.
2. The Project made initial investigations with federal and state agencies about threatened and endangered species, and has structured its study and analysis of the site with a heightened attention paid potential threatened, endangered or species of special concern both within and near to the Lempster Project.
3. The Project has established 16 avian sampling plots (Figure 1) within the Lempster Project footprint and begun to monitor resident and migrating bird use. Sampling plots will be updated as design of Project roads and turbine areas is finalized, in order to ensure that observation areas provide a complete and representative view of potential use areas.
4. The Project has completed one fall and one spring raptor migration survey to document the distribution and abundance of birds of prey over the Lempster site.
5. The Project has completed one fall and one spring bat migration survey using "Anabat" acoustical sensor technology, and has scheduled Anabat surveys for the summer and fall of 2006, including a focus on specific areas of concern around the proposed site.
6. The Project has planned surveillance radar surveys for the fall of 2006 and spring of 2007, to provide a sampling of nocturnal migrant activity around at the Project site area.
7. The Project is working with engineers, ecologists and regulatory agencies to design sustainable project roads and turbine pad clearings that minimize habitat fragmentation and loss and thereby some of the known indirect impacts of wind facilities on wildlife.

**Post-construction Activities:**

1. The Project will conduct mortality surveys for birds and bats under its turbines to measure any direct mortality that may occur post-construction.
2. The Project will conduct both searcher efficiency studies as well as measure the rate at which scavengers remove bird and bat carcasses in order to "calibrate" the mortality surveys.
3. The Project will conduct monitoring, study and analysis of resident and migrant birds in the avian sampling plots to allow for before-and-after comparison.
4. The Project will conduct raptor migration surveys to allow for before-and-after comparison.

5. The Project will continue to maintain and manage all Project roads and clearings such that they continue to provide as much ecological benefit as possible. http://www.newwindenergy.com/windfarm_lempster/pdf/SEC%20Docs/31.%20Avian%20and%20Bat%20Survey%20White%20Paper%20-%20August%202006.pdf

**Phase I Risk Assessment for the Lempster Mountain Wind Power Project, Lempster (Sullivan County), New Hampshire.** Prepared for CEI New Hampshire Wind, LLC. Prepared by Curry and Kerlinger. June 2005.

Executive Summary

This report details a Phase I Avian Risk Assessment for the proposed Lempster Mountain Wind Power Project (hereafter the "Project") in the township of Lempster, Sullivan County, New Hampshire. It includes a review of the literature and available databases, a site visit (September 13-15, 2004), and a written consultation with the U.S. Fish and Wildlife Service (New England Field Office) and the New Fish and Game Department. The literature and database review examines both the impacts to birds at wind power facilities and the avifauna that may be present at the site or in the general area. The site visit focused on evaluating habitat to determine the type and number of birds likely to nest, forage, rest, or use the project site. Together, the information gathered provided an indication of the type and number of birds that are known or suspected to use the Project. This information was then incorporated into a risk assessment to determine the degree of risk to birds from the proposed wind power development.

The Lempster Mountain Wind Power Project would be a small to moderately sized wind plant that would consist of between 12 and 20 wind turbine generators, totaling about 24 to 30 megawatts of nameplate capacity. Tower height would likely be about 80 meter (262 feet), with rotor lengths up to about 42 m (138 feet). Maximum height of the rotor tip when the rotor is in the 12 o'clock position could be up to about 122 m (400 feet) AGL. Each turbine would nameplate generation capacity of about 1.65 to 2.0 megawatts. The Project is being proposed by CEI New Hampshire Wind, LLC.

Turbines would be situated on the highest portions of Lempster Mountain, from Silver Mountain in the south to Kennedy Hill in the north. Elevations where turbines would be located range from about 1,850 feet to 2,240 feet (564-683 m) ASL. The mountain is a series of hills oriented from north-northeast to south-southwest. The site is mostly northern forest, with some boreal elements. Trees are a mixture of deciduous hardwoods mixed with some conifer, with fairly large patches of red spruce. The tops of hills are either mixed hardwood and conifer, continuous red spruce, or balds, and there are clearings here and there throughout the site. Some fields were evident, usually adjacent to residences. Land use is primarily forestry (small logging operations) and recreational. There is a road that extends through the prospective turbine area, several residences on Lempster Mountain, and there are communication towers on the mountain.

The Project site and adjacent habitats support a diverse assemblage of common and less common nesting species of forest edge, brushland, and forest interior. The habitat is not suitable for nesting by any federally or state listed (endangered and threatened) species.

A letter from New Hampshire Fish and Game stated that their records indicated "no known locations of state listed species within the boundary of the project" but the turbines could have impacts on migratory birds. A letter from the U.S. Fish and Wildlife Service reinforced the statements of the state agency in that they reported no federally-listed species or species proposed for listing at or near the project site. The letter did suggest that migrating Bald Eagles (threatened) could be present at times. The site and area surrounding the site does not appear to be suitable for nesting by eagles, although ponds within 1-2 miles from the Project site might attract these birds at times.

There are likely to be small numbers of migrating hawks that soar along the sides of Lempster Mountain, although the numbers present are unlikely to indicate a significant migration pathway. With respect to other waterfowl, waterbirds, shorebirds, and songbirds, there is no reason to suspect that a significant migration pathway or corridor occurs in the area and migration is likely to be broad front. Although the site is not suitable for stopovers by large numbers of waterbirds, waterfowl and shorebirds during migration, modest numbers of night migrating birds are likely to make stopovers on site. The diversity and numbers of birds present on site in winter is likely to be minimal because of the harsh conditions and lack of forage or open water on site.

The following recommendations are made:

- Electrical lines within the project site should be underground between the turbines and any new above ground lines from the site and substations to transmission lines, should follow APLIC (Avian Power Line Interaction Committee) guidelines to reduce the potential for electrocution.
- Permanenet meterology towers should be free-standing and unguyed to minimize the potential for avian collisions.
- Size of roads and turbine pads should be minimal to disturb as little habitat as possible. After construction, forested habitat should be permitted to regenerate as close to turbines and roads as possible to minimize habitat fragmentation and displacement impacts to nesting birds.
- Lighting of turbines and other infrastructure (turbines, substations, buildings) should be minimal to reduce the potential for attracting night migrating songbirds and similar species. FAA lighting for night use, if needed, should be red or white flashing, strobe-like or strobe lights with the longest off cycle permissible. No steady burning FAA lights should be used and sodium vapor lamps, spotlights, and other lights should not be used onsite at night except for emergency maintenance or personnel safety.
- Because the forests on site appear to be suitable for forest interior species that are sensitive to fragmentation, pre-and post- construction breeding bird studies should be done to determine the degree of displacement of nesting birds, the impacts of forest fragmentation to these birds, and whether or not interior forest nesting birds habituate to the presence of wind turbines. An impact gradient study design is recommended. That research design should be peer reviewed or reviewed by the state or federal wildlife agency to insure it is robust and will measure impacts accurately.

- A post-construction study of collision fatalities would be helpful to future wind power development in New England and New Hampshire, where there is only one utility-scale wind power facility currently operating. Such a study would provide information on the number and type of fatalities that occur, and determine the biological significance of the fatalities documented.

Collision risk to birds at the Lempster Mountain Wind Power Project is likely to be minimal and not biologically significant. With respect to interior forest nesting songbirds, clearing of forest in some places is likely to cause habitat disturbance and displacement of some species, in addition to fragmentation. Such impacts are poorly studied, so the level of impact to sensitive thrushes, warblers, and other neotropical songbirds cannot be determined, nor do we know if these birds will habituate to the presence of turbines. Although migration over the site is not likely to be concentrated in numbers that suggest high risk, the U.S. Fish and Wildlife Service may request radar or other remote sensing studies prior to construction of the Project.
http://www.newwindenergy.com/windfarm_lempster/pdf/SEC%20Docs/30.%20Phase%20I%20Avian%20Risk%20Assessment%20-%20June%202005.pdf

## E. NEW YORK

## E.1 Altona Wind Park, NY

**Land Use/Topography** – Project site is in the town of Altona, in the Northern Lowlands on NY at the edge of the Adirondack Highlands. Land use is primarily forest, with some agricultural fields and wetland areas.

**Draft Environmental Impact Statement**. April 2006.
http://www.noblepower.com/our-projects/altona/AltonaDEIS.html

**The following documents are Section F of the Draft Environmental Impact Statement:**

**Avian and Bat Risk Assessment, Clinton County Windparks - Clinton, Ellenburg, and Altona, Clinton County, New York.** Prepared for Noble Environmental Power, LLC. Prepared by Ecology and Environment Inc. January 2006.

Objectives
The objectives of this study were to:

1. Collect baseline information on flight directions, passage rates, and flight altitudes of nocturnal targets (migratory birds and bats).
2. Collect information on the occurrence and distribution of avian species in the Project Areas during migratory and breeding seasons.
3. Collect information on the occurrence of bat species in the Project Areas during migratory and breeding seasons.
4. Analyze the baseline data and other available studies and data to evaluate the potential impacts from the projects.

Due to project similarities, proximity, and the potential for cumulative impacts this avian and bat risk assessment addresses the potential impacts of all three Clinton County projects individually and collectively.
http://www.noblepower.com/our-projects/altona/documents/NEP-AltonaDEIS-SecF-Q.pdf

**A Radar and Visual Study of Nocturnal Bird and Bat Migration at the Proposed Clinton County Windparks, Spring and Fall 2005.** Prepared for Ecology and Environment, Inc. and Nobel Environmental Power, LLC. Prepared by ABR, Inc. January 2006.

Objectives and Key Findings
-This report presents the results of a radar and visual study of bird and bat migration conducted during a 45 day period in spring (15 April-29 May 2005) and during a 60 day period in fall (15 August –13 October 2005) at the proposed Clinton County Windparks, located in Clinton county, northern New York. Radar observations were conducted during all nocturnal hours (~8-9 h/night in spring, ~8-12/night in fall) and visual observations were conducted for ~4-5h/night during spring and for ~5-7h/night in fall.
- The primary goal of this study was to collect information on the migration characteristics of nocturnally migrating birds, especially passerines, during the spring-migration period and to assess the extent of use of the area by bats. Specifically, the objectives of this study were to: (1) collect baseline information on migration characteristics (i.e., flight direction, migration passage rates, flight altitudes) of nocturnally migrating birds and bats; (2) visually estimate the relative proportions of birds and bats within the potential rotor-swept area of the proposed wind turbines ; and (3) determine the number of birds and bats that may pass within the rotor-swept area of the proposed wind turbines during the migratory season.
- The key results of the study were: (1) the mean overall passage rate was 110 targets/km/h during spring and 197 targets/km/h during fall; (2) mean nightly passage rates ranged from 0 to 721 targets/km/h during spring and from 23 to 1,404 targets/km/h during fall; (3) the percentage of targets passing below 125 m agl was 19.7% during spring and 12.1% during fall; (4) the estimated turbine passage rate of nocturnal migrants passing within the airspace occupied by each proposed turbine was 1.2-8.3 migrants/turbine/d during spring and 1.6-11.1 migrants/turbine/d during fall; and (5) migrants flying below 150 m agl consisted of ~92% birds and ~8% bats during spring and ~82% birds and ~18% bats during fall.
http://www.noblepower.com/our-projects/altona/documents/NEP-AltonaDEIS-SecFAppABC-Q.pdf

## E.2 Bliss Wind Park, NY

**Land Use/Topography** – Rolling hills, farmland and forested patches

**Final Environmental Impact Statement** (Includes reports for the Centerville, Allegany County and Wethersfield, Wyoming County projects)
http://www.noblepower.com/our-projects/bliss/FEISBliss.html

**Exhibit E of Appendix C of Final Environmental Impact Statement: Workplan for Avian and Bat Post-construction studies.** Prepared for Noble Environmental Power, LLC. Prepared by Ecology and Environment, Inc. July 2006.

Objectives

Given the concern for avian and bat resources associated with wind energy facilities, quantifying the direct collisions with turbines is the key component of the studies. The studies are a compliment to pre-construction field surveys that were conducted in the spring and fall of 2005 and are designed to quantify the avian and bat collision impacts from the Bliss Windpark during migratory periods.

The proposed plan of study has the following objectives:

1. Collect collision data on birds and bats from the Bliss Windpark during migratory seasons.
2. Collect information on the occurrence of bat species in the project area during migratory seasons.
3. Evaluate the data and identify potential adaptive management strategies if the collision impacts are significant.

http://www.noblepower.com/our-projects/bliss/documents/NEPBlissFEISAppCExE-G.pdf

**Exhibit F of Appendix C of Final Environmental Impact Statement: Supplemental Radar Data: A Radar and Visual Study of Nocturnal Bird and Bat Migration at the Proposed Centerville and Wethersfield Wind Parks, Spring 2006.** Prepared for Ecology and Environment, Inc. and Noble Environmental Power, LLC. Prepared by ABR, Inc. July 2006.

Objectives and Key Findings

-This report presents the results of a radar and visual study of bird and bat migration conducted during a 45 day period in spring (16 April-30 May 2006) at the proposed Centerville and Wethersfield Windparks, located in Wyoming and Allegany counties, western New York. Radar observations were conducted during the evening crepuscular period, the entire nocturnal period (~8-9 h/night), and the morning crepuscular period. Visual observations were conducted for ~7-8h/night during nocturnal hours only.

- The primary goal of this study was to collect information on the migration characteristics of nocturnally migrating birds, especially passerines, during the spring-migration period and to assess the extent of use of the area by bats. Specifically, the objectives of this study were to: (1) collect baseline information on migration characteristics (i.e., flight direction, migration passage rates, flight altitudes) of nocturnally migrating birds and bats; (2) visually estimate the relative proportions of birds and bats within the potential rotor-swept area of the proposed wind turbines ; and (3) determine the number of birds and bats that may pass within the rotor-swept area of the proposed wind turbines during the migratory season.

- The key results of the study were: (1) the mean overall passage rate was 290 targets/km/h at Centerville and 324 targets/km/h at Wethersfield; (2) mean nightly

passage rates ranged from 25 to 1,140 targets/km/h at Centerville and from 41 to 907 targets/km/h at Wethersfield; (3) the percentage of targets passing below 125 m agl was 15.7% at Centerville and 19.4% at Wethersfield; (4) the estimated turbine passage rate of nocturnal migrants passing within the airspace occupied by each proposed turbine was 2.5-18.3 migrants/turbine/d at Centerville and 3.3-22.9 migrants/turbine/d at Wethersfield; and (5) migrants flying below 150 m agl consisted of ~84% birds and ~16% bats at Centerville and ~82% birds and ~18% bats at Wethersfield.
http://www.noblepower.com/our-projects/bliss/documents/NEPBlissFEISAppCExF-G.pdf

## E.3 Cape Vincent, NY

**Land Use/Topography** – Nearly flat, farmland near great lake shore.
**Studies –** Nocturnal migration study.
Currently trying to obtain more information.

## E.4 Chautauqua Wind Energy Facility, NY

**Land Use/Topography** – Low ridge near great lake shore, farmland and small forested patches.

**A Radar Study of Nocturnal Bird Migration at the Proposed Chautauqua Wind Energy Facility, New York, Fall 2003.** Prepared for Chautauqua Windpower, LLC. Prepared by ABR, Inc. April 2004

Executive Summary
-This report presents the results of a radar study of bird migration conducted during 2 September – 10 October 2003 at the proposed Chautauqua Wind Energy Facility, located in western New York. Radar observations were conducted for ~6 h/night during 30 nights within the 40-day study period.
- The goal of this study was to collect information that will be used to help evaluate the potential impacts of these proposed wind-energy facilities on migratory passerines during the peak fall migration period. The objectives of this study were to use radar techniques to collect baseline information on flight direction, migration intensity (i.e., passage rates), and flight altitude of nocturnal passerine migrants at the proposed Chautauqua Wind Project area during 2 September –10 October 2003.
- At night, the mean flight direction of targets observed on radar was 199° ± 58° (i.e., slightly southwest).
- In fall 2003, we recorded moderate passage rates of nocturnal songbird migrants over the Chautauqua Study Area. Fall nocturnal passage rates (mean ± SE = 238 ± 48 targets/km/h) were significantly lower than spring rates (395 ± 69 targets/km/h). Similar to spring, however, there were no dramatic within-night patterns in passage rates.
- Nocturnal passage rates were highly variable among nights in fall 2003, ranging from 10 to 905 targets/km/h. Nocturnal passage rates generally were higher after mid-September than they were during early September.
- Mean flight altitudes observed on radar (1.5-km-range) were highly variable among

nights in fall 2003. Mean nocturnal flight altitudes in fall (532 ± 3 m agl) were not significantly different from nocturnal flight altitudes in spring (528 ± 3 m agl). There were no discernable hourly patterns in flight altitude within the nocturnal hours in either fall or spring.
- The mean percentage of nocturnal targets flying 1-125 m agl was 4.0% in fall, or only slightly higher than the 3.8% in spring.
- During fall, birds were flying on both sides of the ridgeline where the proposed turbine string would be located in roughly equal proportions, unlike spring, when there was a distinctive concentration of targets along the northern and western side of the ridgeline. It is possible that the spring concentration occurred due to lake avoidance, similar to what is seen for migratory hawks (i.e., concentrations of northbound migrants tend to fly around the southern shore of Lake Erie during spring and thus avoid flying over the lake, whereas concentrations of southbound migrants tend to fly around the northern shore in fall, with a corresponding drop in numbers on the far side of the lake in both seasons).
- Based on our data sets, the largest pulses of migration often were associated with light winds; however, overall passage rates were not significantly different between days with light winds or tail winds and days with head winds.
- Flight altitudes were significantly lower during favorable (light or tail) winds (492 ± 4 m agl) than during head winds (560 ± 4 m agl).
- The Chautauqua Study Area had fall nocturnal migration passage rates that was similar to one other location that has been studied in New York (i.e., at Wethersfield [~100 km northeast of this study site]), and higher rates than at two other locations (i.e., Carthage [~20 km east of Watertown and ~300 km northeast of this study site] and Harrisburg [~30 km southeast of Watertown and ~300 km northeast of this studysite]). We estimated that ~32,000 - 33,000 nocturnal migrants (i.e., birds and bats) flew over the Chautauqua Wind Resource Area (at or below turbine height) during our 30-day fall study period.
http://www.abrinc.com/news/Publications_Newsletters/Radar%20Study%20of%20Nocturnal%20Bird%20Migration,%20Chautauqua%20Wind%20Energy%20Facility,%20NY,%20Fall%202003.pdf

**A Visual and Radar Study of 2003 Spring Bird Migration at the Proposed Chautauqua Wind Energy Facility, New York.** Prepared for Chautauqua Windpower LLC. Prepared by ABR, Inc. April 2004

Executive Summary
- This report presents the results of a radar and visual study of bird migration conducted during 15 April - 15 May 2003 at the proposed Chautauqua Wind Energy Facility, located in western New York. Concurrent radar and visual observations were conducted for ~4 h/day, and radar observations were conducted for ~5 h/night, throughout the study period.
- The goal of this study was to collect information that will be used to help evaluate the potential impacts of the proposed wind-energy facilities on migratory raptors and passerines during the peak spring migration period. The objectives of this study were to:
-use radar and visual techniques to collect baseline information on flight direction, migration intensity, and flight altitude of daytime raptor and nocturnal passerine migrants at the proposed Chautauqua Wind Project area during 15 April -15 May 2003.

- In spring 2003, we recorded 3,765 individual birds (112 waterbirds, 2,578 raptors, and 1,075 landbirds) of 43 species during 115 visual sampling sessions. The five most abundant species were (in decreasing order of abundance) Broad-winged Hawk (1,059 individuals), Turkey Vulture (899), Red-winged Blackbird (355), Red-tailed Hawk (220), and Barn Swallow (138).
- We observed 10 federal- or state-listed species during spring 2003: Common Loon (19 individuals, State Species of Special Concern), Osprey (14; State Species of Special Concern), Bald Eagle (14; State and Federal Threatened Species), Northern Harrier (31; State Threatened Species), Sharp-shinned Hawk (43; State Species of Special Concern), Cooper.s Hawk (41; State Species of Special Concern), Red-shouldered Hawk (6; State Species of Special Concern), Golden Eagle (7; State Endangered Species), Peregrine Falcon (2; State Endangered Species), and Common Nighthawk (1; State Species of Special Concern).
- During the day, the mean flight direction (± 1 angular deviation) of targets observed on radar was 040 ± 49°. At night, the mean flight direction of targets observed on radar was 029 ± 40°.
- In spring 2003, we recorded low numbers of waterfowl and landbirds and moderate-high numbers of raptors during the day. Moderate-high numbers of landbirds flew over at night in April and May; during April, waterfowl-like targets also were present at night. There was high among-day variability in movement rates for all species and times.
- Our surveillance radar observations indicated that passage rates in spring 2003 were significantly higher at night (395 ± 69 targets/km/h) than during the day (79 ± 13 targets/km/h).
- Mean daytime flight altitudes (372 ± 6 m above ground level [agl]) were significantly lower than nocturnal flight altitudes (528 ± 3 m agl). Similarly, the mean percentage of targets flying below 125 m agl was higher during the day (17.2% of all daytime targets) than at night (3.8%).
- Our vertical radar observations suggested that there was a tendency during both the day and night for birds to concentrate either over, or northwest of, the ridgeline where the proposed turbine string would be located. During the daytime, this pattern matched the pattern that we observed visually: raptors often flew over the ridgeline or the valley immediately to the north of the ridgeline and in a direction roughly parallel to the ridgeline.
- Based on our data sets, the largest pulses of migration often tended to be associated with tail winds; however, overall passage rates were not significantly different between days with tail winds and days with other winds.
- Flight altitudes during both day and night were significantly lower during periods with precipitation than without it and during periods with low ceiling heights than with high ones. Flight altitudes also were significantly lower during foggy daytime periods than during periods with no fog; in contrast, at night, birds flew significantly higher during foggy periods. Tail winds did not affect flight altitudes during the day or the night.
- This study focused on providing information on daytime raptor and nocturnal passerine migration because the Chautauqua site is located in a known spring raptor migration corridor and because little is known about nocturnal migration in the area. We found that

the Chautauqua Study Area had relatively high spring passage rates for daytime migration of raptors and for nocturnal migration of passerines. We estimated that ~5,200 -5,300 raptors during peak daylight hours and ~30,000 -31,000 nocturnal migrants passed through Chautauqua Wind Resource Area (at or below turbine height) during our 30-day study.
http://www.abrinc.com/news/Publications_Newsletters/Visual%20and%20Radar%20Study%20of%20Bird%20Migration,%20Chautauqua%20%20Wind%20Energy%20Facility,%20NY,%20Spring%202003.pdf

## E.5 Clinton Wind Park, NY

**Land Use/Topography –** Project site is located in the town of Clinton in the northern lowlands of NY at the northeastern edge of the Adirondack Highlands. Land use is primarily forest, farmland, and wetlands.

**Draft Environmental Impact Statement**. March 2006.
http://www.noblepower.com/our-projects/clinton/ClintonDEIS.html

**The following documents are Section F of the Draft Environmental Impact Statement:**

**Avian and Bat Risk Assessment, Clinton County Windparks - Clinton, Ellenburg, and Altona, Clinton County, New York.** Prepared for Noble Environmental Power, LLC. Prepared by Ecology and Environment Inc. January 2006.
*(See E.1 Altona Wind Park, NY for study objectives)*
http://www.noblepower.com/our-projects/clinton/documents/NEP-ClintonDEIS-SecF-Avian-72-Q.pdf

**A Radar and Visual Study of Nocturnal Bird and Bat Migration at the Proposed Clinton County Windparks, Spring and Fall 2005.** Prepared for Ecology and Environment, Inc. and Nobel Environmental Power, LLC. Prepared by ABR, Inc. January 2006
*(See E.1 Altona Wind Park, NY for study objectives and key findings)*
http://www.noblepower.com/our-projects/clinton/documents/NEP-ClintonDEIS-SecF-Avian-Appendices72-Q.pdf

## E.6 Cohocton Wind Project, NY

**Land Use/Topography -** The project area sits atop a plateau. Narrow, steep-sided stream valleys dissect the plateau from all directions and are heavily forested with hemlock and a mixture of hardwoods. Land use in the project area is agricultural, with open fields comprising more than two-thirds of the project area. Mature forest stands are common, as are areas of young, secondary growth, including hedgerows, wood borders, and old fields.

**Draft Environmental Impact Statement**
http://www.cohoctonwind.com/about-deis.php

**Appendix E to the Draft Environmental Impact Statement:**
**Species List and Avian/Bat Risk Assessment.** Prepared for UPC Wind Management, LLC. Prepared by Woodlot Alternatives, Inc. February 2006.

Conclusions
Wind technology is advancing quickly, and potential environmental effects seen in earlier studies may be avoided with proper siting of facilities and newer turbine and facility designs. Only recently have improved studies on the potential effects of wind energy developments on birds and bats been emerging to assist with the assessment of new proposed projects to these animals that are vulnerable to colliding with wind turbines.

Comparison of the physical setting of the proposed Cohocton project and the biological communities of the bird and bat populations in the vicinity of the project provide a reasonable expectation that potential mortality at the project could be within the range of mortality found at existing facilities. Certainly, no one characteristic of the proposed project yields any anticipation that mortality could be significantly different (either higher or lower). Consequently, it is anticipated that the overall risk of bird collisions is low, which is based on observed mortality rates at existing facilities.
However, bats may be more susceptible and thus the risk for these species is higher than for birds. While the project may not reflect the fairly low collision rates found at western and mid-western projects, neither is it expected that it will reflect the alarming rates found along forested ridgelines of the central Appalachians. In this respect, the risk of bat collisions with the proposed turbines is generally anticipated to be moderate.

Future investigations of fatality rates at modern facilities in a variety of landscapes remain the only way to definitively identify the impact of new projects on birds and bats. Additionally, future studies that combine mortality surveys with survey techniques that are typically used during pre-construction studies (i.e., radar, acoustic, thermal imaging, visual diurnal studies) may be the only way that predictive models of risk for new projects can be derived.
http://www.cohoctonwind.com/PDFs/DEIS/Appendices/Appendix%20E%20-%20Species%20List-Avian-Bat%20Risk%20Assessment.pdf

## E.7 Copenhagen, NY

**Land Use/Topography –** Gently rolling plateau, farmland and forested patches.
**Studies –** Nocturnal migration study.
Currently trying to obtain more information.

## E.8 Dairy Hills Wind Project, NY

**Land Use/Topography –**Deep valleys dissecting flat-topped upland hills. The primary land uses are agriculture, dairy farms, and residential development.

**Draft Environmental Impact Statement.** July 2006.
http://www.horizonwind.com/projects/whatweredoing/newyork/dairyhills/impactstatement.aspx

**Appendix E of the Draft Environmental Impact Statement:**
**Avian and Bat Studies for the Proposed Dairy Hills Wind Project, Wyoming County, New York.** Prepared for Horizon Wind Energy. Prepared by West, Inc. April 2006.

Goals and Objectives
A field study that addressed agency concerns and provided site specific data on resources of concern was initiated in April 2005. The principal goals of the study were:
1) Provide information on avian and bat resources and use of the study area that is useful in evaluating potential impacts from wind power development;
2) Provide information on avian and bat migration over the proposed development area that is useful in evaluating the relative risk of the proposed wind project location;
3) Provide information on avian, bat, and sensitive species use of the study area that would help in designing a wind plant that is less likely to expose species to potential collisions with turbines, and;
4) Provide recommendations for further monitoring studies and potential mitigation measures, if appropriate.

The studies included field surveys for avian species, especially spring and fall nocturnal migrants and diurnal migrants with a focus on raptors, breeding birds, fall migrant and resident bats, and state listed or sensitive species. Specific objectives of the study were to (1) describe and quantify nocturnal migration over the proposed project, (2) describe and quantify diurnal raptor migration through the proposed project, (3) describe and quantify breeding bird use in the proposed project area, (4) describe and quantify migrant bats over the proposed project, and (5) identify the presence of any special-status species (e.g., state-listed species) that may occur seasonally in the project area.

The studies were designed to characterize avian (raptors, breeding residents and migrants) use of the proposed development area, summer and migrant bat use of the proposed development area, and provide data that were useful in estimating potential impacts the Dairy Hills project may have on birds and bats.
http://www.horizonwind.com/projects/whatweredoing/newyork/dairyhills/AppendixE-AvianandBatStudies.pdf.pdf

## E.9 Ellenburg Wind Park, NY

**Land Use/Topography –** Project site is located in the town of Ellenburg in the northern lowlands of NY at the northeastern edge of the Adirondack Highlands. Land use is primarily farmland and forest, with some wetlands.

**Draft Environmental Impact Statement.** April 2006.
http://www.noblepower.com/our-projects/ellenburg/EburgDEIS.html

**The following documents are Section F of the Draft Environmental Impact Statement:**

**Avian and Bat Risk Assessment, Clinton County Windparks - Clinton, Ellenburg, and Altona, Clinton County, New York.** Prepared for Noble Environmental Power, LLC. Prepared by Ecology and Environment Inc. January 2006.
*(See E.1 Altona Wind Park, NY for study objectives)*
http://www.noblepower.com/our-projects/ellenburg/documents/NEP-EburgDEIS-SecFAvian72-Q.pdf

**A Radar and Visual Study of Nocturnal Bird and Bat Migration at the Proposed Clinton County Windparks, Spring and Fall 2005.** Prepared for Ecology and Environment, Inc. and Nobel Environmental Power, LLC. Prepared by ABR, Inc. January 2006.
*(See E.1 Altona Wind Park, NY for study objectives and key findings)*
http://www.noblepower.com/our-projects/ellenburg/documents/NEP-EburgDEIS-SecFAvian-Appendices-Q.pdf

## E.10 Harrisburg, NY

**Land Use/Topography-** Gently rolling plateau, farmland and forested patches.
**Studies –** Nocturnal migration study
Currently trying to obtain more information.

## E.11 High Sheldon Wind Farm, NY

**Land Use/Topography –** Two long plateaus bisected by creek; primarily farmland, some small wooded areas.

**Final Environmental Impact Statement**. June 2006.
http://www.highsheldonwind.com/pdfs/deis/text/Final%20DEIS%20HSWF%20R2%202006-05-31.pdf

**The following documents are selected appendices of the Final Environmental Impact Statement:**

**Phase I Avian Risk Assessment for the High Sheldon Wind Farm, Wyoming County, New York.** Prepared for Invenergy Wind, LLC. Prepared by Curry & Kerlinger, LLC. November 2004

Executive Summary
A moderate to large wind farm is proposed for the town of Sheldon in Wyoming County, New York. The High Sheldon Wind Farm (hereafter the "Project") would have about 86

wind turbine generators. The turbines most likely to be used in the Project will have 80-meter towers, 41-meter rotors, and a tip height[1] of 121 meters (397 feet) above ground level. The project is being proposed by Invenergy Wind, LLC.

The Project site consists of farms, old fields, and forests. Turbines and construction will be primarily in farmland (hay, alfalfa, and corn), although some turbines would be in forest, forest edge, and brushland areas. Lands surrounding the Project site are farms, early to mid-succession deciduous woodlots of various sizes, and rural residential. There are small wetlands within the Project area, but no major water bodies are present. Habitat within the Project boundary is not sensitive habitat, nor is such habitat located adjacent to the Project. However, there are large grassy/farmed fields of the type that have become scarce in New York State and are now considered high quality nesting habitat. There are also some larger forest patches that constitute good nesting habitat.

This report details a Phase I Avian Risk Assessment for wind power development. It includes a literature and database review, requests for listed species information from federal and state wildlife agencies, and site visits (May 26-28, 2004) during which habitat and birds present were examined. Together, these sources of information provide an indication of the type and number of birds that are known or suspected to use a project site and the area surrounding that site. This information is then used to determine the degree of risk to birds, if any, from wind power development at a particular site.

A letter from the New York Natural Heritage Program (New York State Department of Environmental Conservation) suggested that three state listed species, Short-eared Owl (Endangered), Upland Sandpiper (Threatened), and Henslow's Sparrow (Threatened) had been reported from the area of the Project site. The literature and database review indicated that some state listed species may nest on parts of the Project site. A certified letter was sent to the U. S. Fish and Wildlife Service (received May 17, 2004) requesting information on listed species at or near the Project site was not answered as of November 22, 2004.

The site visit occurred at the peak of the nesting season and found no New York Endangered species. Two New York State Threatened species were observed during the site visit and are likely nesting in portions of the Project area: Northern Harrier and Upland Sandpiper. Both of these species will nest in large open fields. In addition five Species of Special Concern were found during the site visit: Sharp-shinned Hawk, Cooper's Hawk, Red-shouldered Hawk, Horned Lark, and Vesper Sparrow. The raptors likely nest within forested areas, whereas the songbirds nest in the largest hay and fallow fields. These nesting areas represent a small portion of the overall Project site. The Project site was not a nesting or foraging area for federally threatened or endangered birds, or birds proposed for federal listing.

The Project site and adjacent habitat supports an assemblage of common species of forest edge, brushland, and grassland, with the exception a few State listed species and species of special concern. There are no known hawk migration pathways or lookouts on or 25+ miles (40 km) of the project site. Small numbers of songbirds and other species

are likely to migrate over the project site, as evidenced from a one-year radar study and an acoustical study conducted several miles away. The site is not known to be a significant wintering site for birds, so relatively few birds are likely to use the site between mid-November and mid-March. Wintering raptors will be present there. In addition, there was no evidence that the project site or lands adjacent to the site would attract large or significant numbers of migrating or wintering waterfowl, shorebirds, songbirds, hawks, or other species.

The following recommendations are made:
- Electrical lines within the project site should be underground to the degree possible and all new above ground wires leading from the site and substations, should have specifications that follow APLIC (Avian Power Line Interaction Committee) guidelines.
- Permanent meteorology towers should be free-standing and unguyed to reduce the potential for avian collisions.
- Roads and turbine pads should be minimal in size so that as little habitat as possible is removed from forested areas and grassland type habitats. After construction the habitat should be permitted or encouraged to regenerate as close to the turbines and roads as possible. Such management would potentially minimize habitat fragmentation and disturbance/avoidance impacts.
- A wetland delineation should be undertaken.
- Lighting should be kept to a minimum at turbines and other facility infrastructure (substations, buildings) to minimize potential attraction of night migrating songbirds and similar species during fog, light rain or snow, and low cloud ceiling. Sodium vapor lamps and spotlights should not be used at any facility at night except when emergency night maintenance is needed. FAA lighting for night use should only be flashing lights (red or white) with the longest possible off cycle permissible and no steady burning FAA lights should be used.
- A post-construction study of collision fatalities would be helpful to future wind power development or site expansion. Such a study would provide detailed information on the number and type of fatalities that occur, including a means of determining biological significance and potential cumulative impact of turbine development in western New York and the eastern United States.
- A detailed nesting bird survey could be conducted to map nesting locations of New York State listed species or species of concern (Northern Harrier, Upland Sandpiper, Henslow's Sparrow, Grasshopper Sparrow, Vesper Sparrow, Horned Lark, Redshouldered Hawk, etc.) that are unaffected by current land uses. The results of this survey could be used to prevent or mitigate disturbance impacts and avoidance/displacement of these species.

Based on what is known about risks to birds at wind power plants in North America and Europe, and what was learned from the literature search, site visits, and interviews, there is little indication that the High Sheldon Wind Farm will result in biologically significant collision impacts to birds. Disturbance/displacement of grassland nesting birds, including some State listed species, could occur in some portions of the Project site. Such impacts could be biologically significant in the immediate vicinity of the wind turbines, but are

not likely to be significant at the regional, national, or global level. Impacts to non-listed species are not likely to be biologically significant, which is dependent on whether these birds habituate to the presence of turbines.
http://www.highsheldonwind.com/pdfs/deis/Appendices/appendix_h_1_phase_i_avian.pdf

**2005 Breeding Season Bird Survey Report, High Sheldon Wind Farm, Wyoming County, New York.** Prepared for Invenergy Wind LLC. Prepared by Tetra Tech EC Inc. January 2006.

Key Findings
This report presents results of bird surveys conducted during the breeding season at the High Sheldon Wind Farm located in the town of Sheldon in Wyoming County, New York (Site). The overall purpose of these surveys were to provide a broader understanding of birds present within the Study Area during the breeding season to enable design of a wind energy project that will avoid or minimize potential impacts to wildlife.

A survey plan was developed in consultation with and approved by the NYSDEC that included avian studies using three types of survey methods: daytime surveys for breeding season birds, daytime surveys for diurnal migratory birds, and nighttime surveys for nocturnal migratory birds and bats. This report provides results of the daytime surveys conducted for breeding season birds. It also details the field methods that were used to document the species composition and numbers of birds using Study Area habitats during the 2005 breeding season.

The objectives of the breeding season bird survey were to determine diversity of birds breeding in and around the Site and to determine the presence of state listed bird species potentially sensitive to a wind project, specifically sharp-shinned hawk, Cooper's hawk, red-shouldered hawk, northern harrier, short-eared owl, upland sandpiper, horned lark, vesper sparrow, grasshopper sparrow, sedge wren, Henslow's sparrow, and loggerhead shrike.

A total of 53 species were recorded at the 41 sample locations over the two week period based on sampling conducted during the initial 3-minute interval at each stop. Only two additional species, Eastern towhee (*Pipilo erythrophthalmus)* and northern harrier (*Circus cyaneus*), were recorded during the 3 to 5 minute interval, indicating that birds counted during the 3-minute interval accurately characterizes the bird population associated with habitats present in the Study Area.

Fifty five species of birds were recorded at the High Sheldon Wind Farm site during the spring 2005 two week sample period. Total number of species varied during sampling routes with 45 species observed during the first run of the route and 42 species observed during the second run of the route. The total number is lower than the 5-year running tally of species (2000-2004) reported on the NYS Breeding Bird Atlas website for Breeding Blocks 2173A, 2173B, 2173C, 2173D. However, the average number of individuals per species observed was similar to the average numbers of birds per route

recorded for the USGS BBS for the Hamburg – 61053 (Erie County), West Seneca – 61054 (Erie and Genesee Counties), Gainesville – 61055 (Wyoming and Genesee Counties), and East Java – 61057 (Erie and Wyoming Counties) routes, which are located close to the Site. The predominance of agricultural habitats in the Study Area influences the diversity of birds present within the Site during the breeding season, and the assemblage of birds observed reflect species adapted to open and edge habitats.

Average number of species counted per stop ranged between 7 and 17 with an average for all stops of 11.1. This is attributable to the relatively uniform habitats within the Study Area. The most abundant birds observed included red-winged blackbird (*Agelaius phoeniceus),* European starling (*Sturnus vulgaris),* American robin (*Turdus migratorius),* song sparrow (*Melospiza melodia),* common grackle (*Quiscalus quiscula),* and American crow (*Corvus brachyrhynchos),* all adapted to open habitats. The least abundant birds observed were most often species associated with forests or some specialized habitat not commonly occurring on the Site. Most of the species were observed low to the ground or at altitudes well below 30 meters. A few of the forest adapted species were observed at altitudes between 20 and 50 meters. No owl species were observed.

Only two state listed species were observed during the breeding season bird surveys, the horned lark (special concern) and the northern harrier (threatened). The horned lark was observed at four stops in agricultural habitats. The northern harrier was observed at only one stop flying over a hay field. The short-eared owl, for which there is a historic record within the Site, was not observed.
http://www.highsheldonwind.com/pdfs/deis/Appendices/appendix_h_2_breedingbird_survey.pdf

**2005 Diurnal Migrating Bird Survey Report, High Sheldon Wind Farm, Wyoming County, New York.** Prepared for Invenergy Wind, LLC. Prepared by Tetra Tech EC, Inc. January 2006.

Key Findings
This report presents results of the migratory raptor survey conducted for the High Sheldon Wind Farm located in the town of Sheldon in Wyoming County, New York (Site). The overall purpose of this survey was to provide a broader understanding of raptor migration within the Study Area[1] to enable design of a wind energy project that will avoid or minimize potential impacts to wildlife.

This report provides results of the daytime surveys conducted for spring and fall diurnal migratory birds. It also details the field methods that were used to document the species composition and numbers of birds passing over or using Study Area habitats during the 2005 spring and fall migratory seasons.

The objective of the diurnal migrating bird survey was to document the occurrence of birds, with particular emphasis on raptors, which migrate in the vicinity of the proposed wind project during daylight hours. This survey determined species composition,

numbers, and flight patterns including direction and approximate flight height. While it focuses on migratory raptors all birds observed are reported.

Total number of diurnal migrating birds observed at the High Sheldon Wind Farm during the spring surveys varied between 0 and 41 individuals per day during the seven days sampled with the number per hour ranging between 0 and 7.3. Turkey vultures were the most commonly observed bird and occurred in the highest numbers, accounting for nearly half of all the birds observed. Turkey vultures are partial migrants (e.g., some individuals migrate while others do not) in the north, and are also known to migrate in large numbers. The second most commonly observed species was the red-tailed hawk. Both these species are common in the region and have a wide distribution throughout the state.

In comparison, spring migrating birds at Braddock Bay ranged between 0 and 1,602 birds per day with a range of 0 to 133.5 birds per hour. Bird movement patterns at the High Sheldon Wind Farm during the spring migration period indicate a broad front migration pattern rather than a concentrated flight pattern. Most birds observed were at altitudes well above 328 feet (100 meters), indicating behavior typical of migrants rather than residents. However, several were foraging nearer the ground, suggesting that they may be local birds on established territories. Most of these birds foraged at altitudes between 98 and 164 feet (30 and 50 meters).

Total number of diurnal migrating birds observed at the High Sheldon Wind Farm during the fall surveys varied between 2 and 34 individuals per day over the eight days sampled with the number of birds per hour ranging between 0.3 and 5.2. As in spring, turkey vultures were the most numerous species observed accounting for more than 75 percent of the all individuals counted. Red-tailed hawks and northern harriers were the next most common species. As the Braddock Bay site is a spring migratory hawk watch, the Kestrel Haven site was used for comparison purposes in the fall. The number of fall migrants at Kestrel Haven during the same sample period ranged from 3 to 21 birds per day with birds per hour ranging from 0.3 to 1.8. As with spring survey data, the numbers of birds observed at the High Sheldon Wind Farm during fall 2005 indicate a broad front migration pattern. This appears to be a regional phenomenon for the fall migratory season as the Kestrel Haven Site suggests the same broad front pattern.

Similar to spring, several of the individuals observed were foraging or loafing in trees, suggesting that they may be local birds on territory. Individuals that were assumed to be migrating were observed at altitudes well above 328 feet (100 meters) and moved towards the south/southeast.
http://www.highsheldonwind.com/pdfs/deis/Appendices/appendix_h_3_diurnal_migrant_survey.pdf

**A Spring 2005 Radar Survey of Bird Migration at the Proposed High Sheldon Wind Project in Sheldon, New York.** Prepared for Tetra Tech EC, Inc. and Invenergy, LLC. Prepared by Woodlot Alternatives, Inc. March 2006.

Executive Summary

Woodlot Alternatives, Inc. conducted a field survey of nocturnal bird migration activity at High Sheldon in Sheldon, NY during the spring of 2005. This survey is part of the planning process by Tetra Tech EC, Inc., on behalf of Invenergy LLC for a proposed wind project, which will include the erection of up to 90 wind turbines in open farmlands, with a maximum turbine height of 120 meters (m), or 394 feet (’). This survey was conducted at night using marine radar.

The results of the spring field survey provide useful information about site-specific migration activity and patterns in the vicinity of the High Sheldon project area. This analysis is a valuable tool for the assessment of risk to birds during migration through the local area.

The migration survey included 38 nights of radar surveys during which 1-minute horizontal radar samples were collected to measure the abundance, flight path, and speed of avian targets moving through the project area. The radar unit was also operated in vertical mode to collect 10-minute samples for use in determining the altitude of targets. While 45 nights of sampling were targeted, a total of 36 were sampled due to inclement weather creating conditions in which the radar could not adequately document target passage.

A total of 2,714 one-minute horizontal radar video samples, including 18,110 targets, were analyzed to determine passage rate and flight direction. Nightly passage rates varied from 6 ± 5 targets per kilometer per hour (t/km/hr) (April 24) to 558 ± 104 t/km/hr (May 17). The mean passage rate for the entire survey period was 112 ± 20 t/km/hr. Mean flight direction through the project area was 25º ± 53º.

A total of 201 ten-minute radar video samples, including 5,995 targets, were analyzed to determine flight altitude. The mean flight height of all targets was 418 m ± 45 m (1,371’ ± 148’) above the radar site. The average nightly flight height above the radar site ranged from 202 m ± 45 m (663’ ± 148’) to 812 m ± 138 m (2,664’ ± 453’). The percent of targets observed flying below 120 m (394’) (the maximum turbine height) also varied by night, from 0 percent to 36 percent. The seasonal average percentage of targets flying below 120 m was 6 percent.

The mean flight direction, qualitative analysis of the surrounding topography and landscape, and mean flight altitude of targets passing over the project area indicate that avian migration in this area involves a broad front type of landscape movement. The flight height of targets indicates that the vast majority of bird migration in the area occurs well above the height of the proposed wind turbines. This type of broad front movement, particularly in conjunction with the high-elevation passage level and modest passage rate, suggests a limited avian mortality risk during spring migration.
http://www.highsheldonwind.com/pdfs/deis/Appendices/appendix_h_4_spring_2005_radar_survey.pdf

**A Fall 2005 Radar Survey of Bird Migration at the Proposed High Sheldon Wind Farm in Sheldon, New York.** Prepared for Invenergy, LLC. Prepared by Woodlot Alternatives, Inc. March 2006.

Executive Summary

Woodlot Alternatives, Inc. (Woodlot) conducted a field survey of bird migration activity at the High Sheldon Wind Farm (High Sheldon) in Sheldon, NY during Fall 2005. This survey is part of the planning process by Invenergy LLC (Invenergy) for a proposed wind project, which will include the erection of up to 90 wind turbines in open farmlands with a maximum turbine height of 120 meters (m) (394'). The survey included nighttime observations of birds using marine surveillance radar to document the magnitude, height, and direction of nocturnal migrants over the project area. The fall studies represent the second of two seasons of migration surveys undertaken by Invenergy at this site.

The results of the field surveys provide useful information about site-specific migration activity and patterns in the vicinity of the High Sheldon project area, especially when reviewed along with results of the spring 2005 surveys conducted in the same vicinity. This analysis is a valuable tool for the assessment of risk to birds during migration through the project area.

The survey included 36 nights of radar surveys to collect and record video samples of the radar during horizontal operation, which documents the abundance, flight path and speed of targets moving through the project area, and vertical operation, which documents the altitude of targets. While 45 nights of sampling were targeted, a total of 36 nights were sampled due to inclement weather creating conditions in which the radar could not adequately document target passage.

Nightly passage rates varied from 43 ± 10 targets/kilometer/hour (t/km/hr) on October 11 to 529 ± 115 t/km/hr on October 13, with the mean passage rate for the entire survey period at 197 ± 24 t/km/hr. Mean flight direction through the project area was 213º ± 109º.

The mean flight height of targets was 422 m ± 12 m (1,385' ± 39') above the radar site. The average nightly flight height ranged from 292 m ± 4 m (958' ± 13') to 593 m ± 26 m (1946' ± 85'). The percent of targets observed flying below 120 m (394') also varied by night, from 0 percent to 6 percent. The seasonal average percentage of targets flying below 120 m was 3 percent.

The mean flight direction, qualitative analysis of the surrounding topography and landscape, and mean flight altitude of targets passing over the project area indicates that avian migration in this area involves a broad front type of landscape movement. This type of broad front movement, particularly in conjunction with the high-elevation passage level and modest passage rate, suggests a limited avian mortality risk during fall migration. Additionally, the flight height of targets indicates that the vast majority of bird migration in the area occurs well above the height of the proposed wind turbines.

http://www.highsheldonwind.com/pdfs/deis/Appendices/appendix_h_5_fall_2005_radar_survey.pdf

**Workplan for 2005 Preconstruction Avian and Bat Studies for the High Sheldon Wind Farm, Wyoming County, New York.** Prepared for Invenergy Wind LLC. Prepared by Tetra Tech EC, Inc. April 2005.

Objectives

This report presents the proposed avian and bat studies for the High Sheldon Wind Farm site located in the Town of Sheldon in Wyoming County, New York (Site). The overall purpose of these studies is to provide a broader understanding of migrating bird and bat behavior in the Study Area and its habitats to enable design of a project that will avoid or minimize potential wildlife displacement, injury and mortality risks to the extent practical.

This work plan identifies the surveys that will be conducted and the field methods that will be used to document the species composition and numbers of bird and bat species passing over or using Study Area habitats. The work plan consists of three types of surveys: daytime surveys for breeding birds, daytime surveys for diurnal migratory birds, and nighttime surveys for nocturnal migratory birds and bats. The daytime migratory bird surveys will focus primarily on migrating raptors but will record all observed diurnal migrants. The nocturnal studies will use marine radar and acoustic equipment and methods to document the presence and assess the movement characteristics of birds and bats through and over the Study Area at night. Invenergy believes these are appropriate based on the current state of the art and the currently perceived potential impacts associated with wind farms.
http://www.highsheldonwind.com/pdfs/deis/Appendices/appendix_i_avian_and_bat_work_plan.pdf

**A Spring and Summer 2005 Radar and Acoustic Survey of Bat Migration at the Proposed High Sheldon Wind Farm in Sheldon, New York.** Prepared for Tetra Tech EC, Inc. and Invenergy, LLC. Prepared by Woodlot Alternatives, Inc. March 2006.

Executive Summary

Woodlot Alternatives, Inc. conducted field surveys of bat migration activity at High Sheldon in Sheldon, New York, during spring and summer 2005. The surveys are part of the planning process by Tetra Tech EC, Inc., on behalf of Invenergy, LLC for a proposed wind project, which will include the erection of up to 90 wind turbines in open farmlands with a maximum turbine height of 120 meters (m) (394'). Surveys included nighttime surveys of bats using radar and bat echolocation detectors.

The results of the field surveys provide useful information about site-specific migration activity and patterns in the vicinity of the High Sheldon project area. This analysis is a valuable tool for the assessment of risk to bats during migration through the local area.

*Spring 2005*
The spring field survey included deployment of an Anabat II detector for a total of 36 detector-nights. Sampling occurred from April 21 to May 31, although data was only collected between April 21 and May 26. The detector was deployed at a height of approximately 30 m (98') in a meteorological measurement tower (met tower). The detector was set to collect data from 7:00 PM to 7:00 AM, which meant that sampling occurred from before sunset to after sunrise on each night of sampling.

A total of 6 bat call sequences from 6 of the 36 nights sampled were recorded during the spring survey period, yielding a detection rate of 0.17 calls/night. Calls were detected between April 21 and May 10. Due to the low numbers of calls detected, hourly passage rates were not calculated. When possible, recorded bat calls were identified to species or genus (in the case of *Myotis*) based upon the shape of the call sequence, the slope, and the maximum and minimum frequencies. Recorded calls were compared to reference libraries of known calls created using the same equipment. Of the six calls recorded at High Sheldon, four belonged to the Genus *Myotis*; one was identified as a silver-haired bat (*Lasionycteris noctivagans*) and one as an eastern pipistrelle (*Pipistrellus subflavus*).

*Summer 2005*
The summer field survey included passive and active sampling with the use of 1 to 3 detectors on 9 separate nights (July 13 – 15, July 21 – 33 and August 1), yielding a total of 22 detector-nights and 184.1 hours of recordings. On nights when two or three detectors were used, they were deployed at heights of 15 m and 30 m (49' and 98') in a met tower; and the third detector was deployed at the edge of the met tower field at a height of 2 m (7'). A fourth detector was used for active hand held sampling.

The summer field survey included documentation of bat activity through active and passive surveys with detectors. A total of 763 bat call sequences were recorded during the summer sampling. Far more calls were recorded during active sampling (630) than during passive sampling (133) despite the fact that the detectors in the met tower were operating for twice as long as the hand-held detector (average of 10 – 12 hours a night versus 4 – 6 hours). There was a peak in number of call sequences recorded on July 31at the field edge bat detector. The overall bat detection rate over the course of the entire summer study was only .8 bat calls/hour for passive sample, but 39 calls/hour for active sampling periods. There was no activity on July 15 at passive detectors.

When possible, recorded bat calls were identified to species, genus (in the case of *Myotis*), or as "unknown," based upon the shape of the call sequence, the slope, and the maximum and minimum frequencies. Of the 763 calls recorded, 505 were identified as *Myotis* spp., 161 were identified as big brown bat *(Eptesicus fuscus*), 21 as hoary bat (*Lasiurus cinereus*), 11 as eastern red bat (*Lasiurus borealis*), and 2 as silver-haired bat.

Active sampling was conducted in a variety of habitats throughout the project area. Field edges, barns, creek drainages and ponds yielded the highest number of bat call sequences. Active sampling resulted in a high diversity of detected species (four species and the

genus *Myotis*), while passive sampling only detected one species and members of the genus *Myotis.*
http://www.highsheldonwind.com/pdfs/deis/Appendices/appendix_j_1_spring2005_bat_report.pdf

**A Spring and Summer 2005 Radar and Acoustic Survey of Bat Migration at the Proposed High Sheldon Wind Farm in Sheldon, New York.** Prepared for Tetra Tech EC, Inc. and Invenergy, LLC. Prepared by Woodlot Alternatives, Inc. March 2006.

Executive Summary

Woodlot Alternatives, Inc. conducted field surveys of bat migration activity at High Sheldon in Sheldon, New York, during spring and summer 2005. The surveys are part of the planning process by Tetra Tech EC, Inc., on behalf of Invenergy, LLC for a proposed wind project, which will include the erection of up to 90 wind turbines in open farmlands with a maximum turbine height of 120 meters (m) (394'). Surveys included nighttime surveys of bats using radar and bat echolocation detectors.

The results of the field surveys provide useful information about site-specific migration activity and patterns in the vicinity of the High Sheldon project area. This analysis is a valuable tool for the assessment of risk to bats during migration through the local area.

*Spring 2005*

The spring field survey included deployment of an Anabat II detector for a total of 36 detector-nights. Sampling occurred from April 21 to May 31, although data was only collected between April 21 and May 26. The detector was deployed at a height of approximately 30 m (98') in a meteorological measurement tower (met tower). The detector was set to collect data from 7:00 PM to 7:00 AM, which meant that sampling occurred from before sunset to after sunrise on each night of sampling.

A total of 6 bat call sequences from 6 of the 36 nights sampled were recorded during the spring survey period, yielding a detection rate of 0.17 calls/night. Calls were detected between April 21 and May 10. Due to the low numbers of calls detected, hourly passage rates were not calculated. When possible, recorded bat calls were identified to species or genus (in the case of *Myotis*) based upon the shape of the call sequence, the slope, and the maximum and minimum frequencies. Recorded calls were compared to reference libraries of known calls created using the same equipment. Of the six calls recorded at High Sheldon, four belonged to the Genus *Myotis*; one was identified as a silver-haired bat (*Lasionycteris noctivagans*) and one as an eastern pipistrelle (*Pipistrellus subflavus*).

*Summer 2005*

The summer field survey included passive and active sampling with the use of 1 to 3 detectors on 9 separate nights (July 13 – 15, July 21 – 33 and August 1), yielding a total of 22 detector-nights and 184.1 hours of recordings. On nights when two or three detectors were used, they were deployed at heights of 15 m and 30 m (49' and 98') in a met tower; and the third detector was deployed at the edge of the met tower field at a height of 2 m (7'). A fourth detector was used for active hand held sampling.

The summer field survey included documentation of bat activity through active and passive surveys with detectors. A total of 763 bat call sequences were recorded during the summer sampling. Far more calls were recorded during active sampling (630) than during passive sampling (133) despite the fact that the detectors in the met tower were operating for twice as long as the hand-held detector (average of 10 – 12 hours a night versus 4 – 6 hours). There was a peak in number of call sequences recorded on July 31at the field edge bat detector. The overall bat detection rate over the course of the entire summer study was only .8 bat calls/hour for passive sample, but 39 calls/hour for active sampling periods. There was no activity on July 15 at passive detectors.

When possible, recorded bat calls were identified to species, genus (in the case of *Myotis*), or as "unknown," based upon the shape of the call sequence, the slope, and the maximum and minimum frequencies. Of the 763 calls recorded, 505 were identified as *Myotis* spp., 161 were identified as big brown bat *(Eptesicus fuscus*), 21 as hoary bat (*Lasiurus cinereus*), 11 as eastern red bat (*Lasiurus borealis*), and 2 as silver-haired bat.

Active sampling was conducted in a variety of habitats throughout the project area. Field edges, barns, creek drainages and ponds yielded the highest number of bat call sequences. Active sampling resulted in a high diversity of detected species (four species and the genus *Myotis*), while passive sampling only detected one species and members of the genus *Myotis.*
http://www.highsheldonwind.com/pdfs/deis/Appendices/appendix_j_1_spring2005_bat_report.pdf

## E.12 Jordanville Wind Power Project, NY

**Land Use/Topography –** Rolling, elevated plateaus that drop in elevation towards the Mohawk River Valley located to the north and towards the Susquehanna River Valley to the south. The majority of the area consists of open crop fields (primarily hay and corn) and pastures, with forested areas generally confined to small woodlots and steep slopes that descend into adjacent valleys.

**Draft Environmental Impact Statement.** May 2006.
http://www.newwindenergy.com/windfarm_jordanville/pdf/DEIS_05-31-06.pdf

**Supplement to the Draft Environmental Impact Statement.** November 2006.
http://www.newwindenergy.com/windfarm_jordanville/pdf/SDEIS/1-Text/Supplement_DEIS_11-06.pdf

**Supplemental Draft Environmental Impact Statement, Appendix E: Raptor Migration Workplan.** Prepared for Community Energy. Prepared by Curry & Kerlinger. November 2006.

Workplan Summary

This proposal outlines a raptor migration study that is designed to answer questions posed by the New York Department of Environmental Conservation and others who are concerned that the Jordanville Wind Power Project site is a concentration area for migrating raptors.
http://www.newwindenergy.com/windfarm_jordanville/pdf/SDEIS/3-Appendices/E-Raptor%20Migration%20Work%20Plan/1-Work%20Plan/DEC%20Approved%20Version%2011-09-06_Final.pdf

**The following documents are from Appendix E of the Draft Environmental Impact Statement:**

**Avian Risk Assessment for the Jordanville Wind Project, Herkimer County, New York.** Prepared for Jordanville Wind. Prepared by Curry & Kerlinger. January 2006.

Overall Risk Assessment and Conclusions

From the Phase I avian risk assessment report, the breeding bird study, and the spring and fall radar studies conducted for the Jordanville project, an overall assessment of risk can be made. The following sections address risk to nesting, migrating and wintering birds. Within each section, different taxonomic groups are examined. For a more complete literature review and explanation of the risk associated with wind turbines and at the Project site, the reader is referred to the original reports cited herein.

Nesting Birds. Because the nesting bird study revealed the presence of many grassland nesting birds, including some that are species of concern (Vesper Sparrow and Horned Lark) and one that is a New York State threatened species (Northern Harrier), it is possible that some impacts to those species will occur. It is also possible that some common nesting species, from grassland and forest habitats, may be impacted.

Of the nesting species, few are likely to collide with turbines, although Horned Lark has been demonstrated to collide with wind turbines more often than all other species. For this bird, collisions are believed to be associated with courtship flight during which preoccupied birds fly within the rotor swept area. Other species that are nesting within the Project boundary that have been demonstrated to collide with turbines include American Kestrel and Red-tailed Hawk. The latter two species are present in moderate numbers on site.

With respect to disturbance and potential displacement of nesting birds, grassland nesting birds may be impacted to some extent. Common species such as meadowlark, Bobolink, and Savannah Sparrow, some individuals/pairs may be displaced outwards of 50 m to about 200 m from turbines. Similarly, such displacement may occur among species of concern such as Vesper Sparrow and Horned Lark, although the latter does not seem to be less susceptible to disturbance from wind turbines. Displacement is less likely or unlikely among forest nesting birds, although some displacement of raptors may occur. Overall, the displacements will be minimal and not biologically significant from a county

or regional perspective. It is likely that some species will habituate to the presence of turbines over time, because some species have previously been shown to do so.

It is unlikely that waterbirds will be displaced greatly because few waterbirds nest at or near turbine locations.

*Migrating Birds*. The Phase I avian risk assessment concluded that migration over the Project site was likely to be broad front and that there was not likely to be a concentration of any type of migrant over the site. This conclusion was made for various types of birds including raptors, night migrating songbirds, and waterbirds (shorebirds, waterfowl, and other waterbirds).

The literature and habitat on site do not suggest that the site has the appropriate habitat or other ecological magnets that would attract birds to the site during migration or funnel birds through a narrow area where turbines would be located. Therefore, collision fatalities of raptors and waterbirds during migration are not expected to be numerous. These birds have almost never been shown to be collision susceptible during daylight hours. Waterfowl and shorebirds are also not collision susceptible during night migration.

The radar studies confirmed the conclusions of the Phase I avian risk assessment and other studies that night migrating songbirds and other night migrants proceed through central New York over a broad front. Migration direction was no different from migration direction at many other sites in the northeastern United States and altitude of flight averaged well above rotor swept height. In addition, numbers of targets per kilometer per hour were within the range of other studies conducted in the northeastern United States and well below studies conducted in the southeastern United States The results of the Jordanville radar study and the comparison with other radar studies suggest that risk to night migrants, mostly songbirds, at the Jordanville site, is likely to be similar to other wind turbine sites in the eastern and Midwestern United States.

Perhaps the best means of assessing risk is to examine fatality rates of night migrants at the other wind power sites. For example, the numbers of night migrants that collide with turbines at the Mountaineer wind power site in West Virginia amounted to 3 birds per turbine per year. At the Madison Wind Power Project in Madison County, just to the west of Jordanville, the numbers of night migrant fatalities were very small and it is likely that fewer birds are killed by those turbines (on a per turbine basis) than those at Mountaineer. The Mountaineer site reported one of the highest rates of night migrant fatalities at any site in the United States, although that rate, in absolute numbers, is relatively low and not believed to be biologically significant. It is important to note that the Mountaineer site is more than 500 miles south of the Jordanville site where there are presumably more migrants. The Mountaineer site is also in the Appalachian Mountains, where many more birds are supposed to migrate because populations from the Midwest and east converge. Thus, the numbers of fatalities at Jordanville are likely to be the same as those at Madison.

Based on the weight of evidence, it is not likely that biologically significant numbers of

night migrants will collide with the turbines at Jordanville. A one year post-construction study should be done to determine the actual numbers and to help determine risk at future wind power facilities in New York State.

*Wintering Birds*. Risk to wintering birds at the Jordanville project site was described in the Phase I report. Relatively few birds will be found at the site during winter because of the cold temperatures, strong winds, and deep snow that is found in most years from December through mid-March. The relatively small numbers of birds will be found either in the forested patches where few turbines will be situated or moving from farm field to farm field. Thus, the turbines are not likely to seriously displace birds or displace large numbers of birds from the site. Furthermore, collision fatalities are likely to be minimal in winter because use of the site by birds is greatly reduced during this season.

In conclusion, minor impacts including some displacement of grassland nesting birds and small numbers of collision fatalities can be expected at the Jordanville wind project. However, those impacts are not likely to present a biologically significant risk to birds.

**A Fall 2005 Radar and Acoustic Survey of Bird and Bat Migration at the Proposed Jordanville Wind Project in Stark and Warren, NY.** Prepared for Community Energy, Inc. Prepared by Woodlot Alternatives, Inc. December 2005.

Executive Summary
During summer and fall 2005, Woodlot Alternatives, Inc. (Woodlot) conducted field surveys of bird and bat activity in Stark and Warren, New York. The surveys focused primarily on the bird and bat migration period, although some summer bat detector surveys were also conducted. The surveys are part of the planning process by Community Energy, Inc. (CEI) for a proposed wind project. The project, known as the Jordanville Wind Project, will include the erection of up to 75 wind turbines located primarily in open agricultural lands and will generate up to 150 megawatts (MW) of wind energy, annually. Surveys included nighttime surveys of birds and bats using radar and bat echolocation detectors. These studies represent the second of two seasons of migration surveys undertaken by CEI at this site.

The results of the field surveys provide useful information about site-specific migration activity and patterns in the vicinity of the Jordanville project area. The results are especially significant when reviewed along with results of the spring 2005 surveys conducted in the same vicinity. This analysis is a valuable tool for the assessment of risk to birds and bats during migration through the area.

*Radar Survey*
The fall field survey targeted 45 nights from September 1 to October 15, 2005, to collect and record video samples of the radar during horizontal and vertical operation. Horizontal documents the abundance, flight path and speed of targets moving through the project area and vertical documents the altitude of targets. While 45 nights of sampling were targeted, a total of 38 were sampled due to inclement weather creating conditions in which the radar could not adequately document bird movements.

Nightly passage rates (reported as the number of targets per kilometer per hour of operation, or t/km/hr) varied from 26 ± 5 t/km/hr to 1,019 ± 171 t/km/hr, with the overall passage rate for the entire survey period at 380 ± 41 t/km/hr. Mean flight direction through the project area was 208º ± 82º. The mean flight height of targets was 440 m ± 7 m (1,444' ± 23') above the radar site. The average nightly flight height ranged from 275 m ± 12 m (902' ± 39') to 722 m ± 76 m (2,533' ± 249'). The percent of targets observed flying below 125 m (410'), the approximate maximum height of the proposed turbines, also varied by night from 1 percent to 26 percent. The seasonal average percentage of targets flying below 125 m was 6 percent.

The flight patterns seen in the fall 2005 surveys are generally consistent with patterns seen in the spring 2005 surveys. Nightly and mean passage rates between the fall and spring surveys are comparable, as are nightly flight heights. However, the fall survey mean flight heights are slightly higher than the spring survey flight heights and a smaller percentage of targets were documented below the maximum height of the proposed turbines.

The mean flight direction, qualitative analysis of the surrounding topography and landscape, and mean flight altitude of targets passing over the project area indicates that avian migration in this area involves a broad front type of landscape movement. This type of broad front movement, particularly in conjunction with the high-elevation passage levels, indicates that most night-migrating birds may have a limited risk of colliding with the turbines.

*Summer Bat Survey*

The summer field survey included documentation of summer bat activity through active and passive surveys with detectors during a single three-night sampling period. Passive detectors were placed in an on-site meteorological measurement tower (met tower) at a height of approximately 30 m (100'). Active sampling included hand carrying a detector during the first four hours of the night along various landscape features in the project area, such as field edges, field hedgerows, roadsides, streams, and wet areas. A total of 10 hours and 45 minutes of recordings were collected in this manner.

A total of 71 bat call sequences were recorded during the summer sampling. More calls were recorded during active sampling (40) than during the passive sampling (31) despite the fact that the detector in the met tower was operating for twice as long as the hand-held detector.

Recorded bat call sequences were identified to species, when possible. In the case of the genus *Myotis*, call sequences were identified only to genus. However, these calls were reviewed closely for the likelihood of any recorded sequences being of the Indiana bat (*Myotis sodalis*). Characteristics used for this included the shape of the call sequence, the slope of the calls, and the maximum and minimum frequencies, which are parameters used by some national experts in attempts to identify Indiana bats from recorded calls. Calls without suitable characteristics for identification were classified as unknown.

Of the 71 calls recorded, 27 were identified as big brown bat (*Eptesicus fuscus*), 42 as *Myotis* spp., 1 was identified as eastern red bat (*Lasiurus borealis*), and 1 was categorized as unknown. The calls identified as *Myotis* had very high and very steep call signatures, particularly during the feeding buzz portion of the call sequences. These characteristics are most common of the little brown bat (*Myotis lucifugus*) suggesting that call sequences from the Indiana bat were not recorded. Additionally, these calls were reviewed by the leading national expert on the identification of this species using Anabat recordings, which confirmed that calls of the Indiana bat were not recorded.

*Fall Bat Detector Surveys*
The fall bat detector survey included deployment of 1 or 3 detectors on 41 separate nights. On nights when two detectors were used, they were deployed at heights of 15 m and 30 m (50' and 100') in the guy wire array of a met tower; otherwise, one detector was deployed at 30 m. A total of 522 bat call sequences were recorded. A peak in the detection of bat calls occurred in mid to late August. When possible, recorded bat calls were identified to species, genus (in the case of *Myotis*), or as "unknown," based upon the shape of the call sequence, the slope, and the maximum and minimum frequencies. Of the 522 calls recorded, 471 were able to be determined as to species and/or genus. Of the total recorded calls, 298 (57%) were *Myotis* spp., 60 (12%) were big brown bat, 47 (9%) were eastern red bat, and 50 (10%) were unknown.
http://www.newwindenergy.com/windfarm_jordanville/pdf/DEIS%20Appendices/Appendix%20E/Jordanville%20FALL%202005%20WIND%20REPORT%20Final%201-10-06.pdf

**A Spring 2005 Radar and Acoustic Survey of Bird and Bat Migration at the Proposed Jordanville Wind Project in Jordanville, New York.** Prepared for Community Energy, Inc. Prepared by Woodlot Alternatives, Inc. October 2005.

Executive Summary
During spring 2005, Woodlot Alternatives, Inc. conducted field surveys of bird and bat migration activity in Jordanville, New York. The surveys are part of the planning process by Community Energy, Inc. for a proposed wind project, which will include the erection of up to 75 wind turbines located primarily in open farmlands that would produce 112-150 megawatts of wind energy, annually. Surveys included nighttime counts of birds and bats using radar and bat echolocation detectors.

The results of the field surveys provide useful information about site-specific migration activity and patterns in the vicinity of the Jordanville project area. This information is valuable for the assessment of risk to birds and bats during migration through the area.

*Radar Survey*
The spring field survey included radar surveys on 40 of 45 targeted nights between April 15 and May 30, 2005 to collect video samples in horizontal operation, which documents the abundance, flight path, and speed of avian targets moving through the project area, and in vertical operation, which documents the altitude of targets.

Nightly passage rates varied from 26 ± 5 targets/kilometer/hour (t/km/hr) (May 22) to 1,410 ± 159 t/km/hr (May 27), and the mean passage rate for the entire survey period was 409 ± 59 t/km/hr. Although the overall passage rate is slightly higher, nightly passage rates are within the range of other surveys conducted in the region. Mean flight direction through the project area was 40º ± 55º. For both the observed passage rates and flight directions, there was considerable night-to-night variation but little variation within individual nights.

The mean flight height of all targets was 371 meters (m) ± 47 m (1,217' ± 154') above the radar site. The average nightly flight height ranged from 161 m ± 20 m (528' ± 65') to 670 m ± 65 m (2,198' ± 213'). The percent of targets observed flying less than 125 m (410') above the radar elevation also varied by night, from 2 percent to 50 percent. The seasonal average percentage of targets flying below 125 m was 21 percent.

The mean flight direction, qualitative analysis of the surrounding topography and landscape, and mean flight altitude of targets passing over the project area indicates that avian migration in this area involves a broad front type of movement. This type of broad front movement, particularly in conjunction with the high-elevation passage of migrants, demonstrates a limited avian mortality risk during spring migration.

*Bat Survey*
Field surveys also included the deployment of an Anabat bat detector at the site on 29 nights from April 14 to May 13. The detector recorded from 7:00 pm to 7:00 am each night and was deployed at a height of 30 m (100') in a meteorological measurement tower (met tower).

A total of 15 bat call sequences were recorded. Calls were detected throughout the sampling period, with the greatest number of calls per night (four calls) occurring on April 18. Due to the low numbers of calls detected, hourly passage rates were not calculated. The overall detection rate for the month of survey was 0.5 detections/night.

When possible, recorded bat calls were identified to species. When that was not possible, calls were identified to the lowest possible taxonomic category (Genus in the case of *Myotis*), or as "unknown." Recorded calls were compared to reference libraries of known calls created using the same equipment. Of the 15 calls recorded at Jordanville, 8 were identified as *Myotis* sp., 1 as a big brown bat (*Eptesicus fuscus*), 1 as a hoary bat (*Lasiurus cinereus*), and 5 were classified as unknown due to lack of sufficient material on which to base an identification.
http://www.newwindenergy.com/windfarm_jordanville/pdf/DEIS%20Appendices/Appendix%20E/Jordanville%20Spring%202005%20Final%20Report%2001-26-06.pdf

**Breeding Bird Survey for the Jordanville Wind Power Project, Herkimer County, New York.** Prepared for Jordanville Wind. Prepared by Curry and Kerlinger, LLC. August 2005.

Executive Summary

To determine the type and number of nesting bird species present at the Jordanville Wind Power Project (hereafter, the "Project") site in Herkimer County, New York, a study of birds breeding within the Project boundary was conducted. The study was conducted after an avian risk assessment demonstrated suitable habitat was present on site for New York State endangered, threatened, and, or species of concern. In addition, the New York State Department of Environmental Conservation recommended a nesting bird study to determine the status of listed species and, or species of concern that might be present. That agency also wished to establish a baseline data set with respect to the numbers and types of birds present at the site. Two objectives of the study were: (i) to determine the status of federal or New York State listed species or species of special concern that may be nesting on site and if they were present, determine the locations of those nesting areas; and (ii) to identify the approximate the numbers of individuals/territories, and distribution of all bird species within the proposed turbine areas. The habitats identified in the avian risk assessment as being suitable for listed species and, or species of concern and having important avian resources were farm fields that resemble natural grasslands. These grassland nesting species are thought to be most at risk of disturbance and displacement from wind turbine construction and presence. The species of focus in this study included Upland Sandpiper, Henslow's Sparrow, Northern Harrier, Grasshopper Sparrow, among others that are listed or species of special concern in New York State.

A total of 30 point counts were established within the Project site. Point count locations were selected in the highest quality grassland nesting bird habitats present on the Jordanville site. The points were generally spaced by at least 300 m. Point count surveys and focused searches for listed species were conducted on June 2, 3, 6, 25, and 26, 2005. Incidental observations were also made on a daily basis, when traveling between point count locations and other activities on site. Two complete rounds of point counts were conducted approximately three weeks apart. Each point count location was surveyed daily for 3 minutes during which time birds seen or heard were recorded. Also recorded were the distance and compass direction of each bird from the point count location.

A total of 1,462 individuals of 74 species was detected at the 30 point counts and another 14 species were observed incidental to establishing the point count locations and traveling around the site during the study (but not during the actual 3-minute point count observations). All 88 of these species likely nest within the Project boundary or nearby. The assemblage of species nesting on the Jordanville site is a diverse assemblage of species found in forest, forest edge, brush, and grassland habitats. Songbirds accounted for majority of species (with few raptors, waterfowl, or shorebirds. Five species (Bobolink, Song Sparrow, Savannah Sparrow, Common Yellowthroat, and Red-winged Blackbird) accounted for 44.7%. These birds are songbirds that nest mostly in brush and forest edge, as well as dissected grasslands. The grassland nesting bird community was only a partial representation of the community that is found in larger contiguous prairies or unfragmented grasslands. Also present were a very few forest interior birds, obligate grassland nesting species, raptors, waterfowl, and gamebirds.

No federally endangered or threatened species or New York State endangered species were observed or likely to nest at the Jordanville site. Northern Harrier, a New York State threatened species was the only state listed species present during the nesting surveys. This species was observed mostly in one area northeast of Jordanville, although individuals were seen in several other locations, a few miles from this core area. There was strong evidence that this species is nesting and at least one nest is likely on site.

Four New York State species of concern, American Bittern, Cooper's Hawk, Horned Lark and Vesper Sparrow, were observed during point count observations and, or among the incidental sightings. In addition, an immature Red-shouldered Hawk was observed flying on site incidental to regular point count observations. The Cooper's Hawk and American Bittern were both observed flying over point count locations and both were observed only one time during the five days on site. The habitats on parts of the Project site are suitable for these species, although the individuals seen could have been from nesting areas many miles removed from the Jordanville site.

There were two point count locations at which Horned Larks likely nest, with at least 1 pair at each point count site. Vesper Sparrow territories were located at 3 point count locations, with three individuals being heard or seen at one of these three point count locations. This means that about 5 pairs were likely present and it is probable that several more pairs were present on site.

Biologically significant collision fatalities of nesting birds at the Jordanville project are not likely. The species that nest in forest, brush, and grassland on or immediately adjacent to the site seldom fly above the forest canopy at heights that would bring them near turbine rotors, with the exception of Horned Lark, swallows, American Kestrel, Red-tailed Hawk, Turkey Vulture, and perhaps others. Horned Larks, however, do have a propensity for colliding with turbines during aerial courtship displays. Also, Red-tailed Hawk and American Kestrels have shown a slight propensity for collisions while hunting.

Disturbance and displacement from project operations, turbines, and roads may result in impacts to grassland nesting species such as Vesper Sparrow, Eastern Meadowlark, Bobolink, Savannah Sparrow, and others. Immediately following construction of the turbines, some grassland nesting species will likely be displaced from the areas surrounding turbines out to distances of 50 to more than 200 m. This will mean reduced nesting densities of these species in these portions of the wind farm, but will not likely result in complete extirpation of individual species. The impacts will be local and not biologically significant from a county or regional perspective.

Based on the findings of the breeding bird study and impacts known from other wind power project sites, the following recommendations are made.

- To reduce habitat disturbance and impacts, habitat restoration surrounding the turbines, meteorology towers, roads, and other infrastructure should be done following construction.

- A long-term post-construction grassland nesting bird study, focusing on displacement distances of particular species, would be very helpful for assessing the areal nature of these impacts and whether or not habituation occurs among grassland nesting species. http://www.newwindenergy.com/windfarm_jordanville/pdf/DEIS%20Appendices/Appendix%20E/Jordanville%20Breeding%20Bird%20Study%20Final.pdf

**Phase I Avian Risk Assessment, Jordanville Wind Project, Herkimer County, New York.** Prepared for Jordanville Wind. Prepared by Curry and Kerlinger, LLC. April 2005.

Executive Summary

This report details the results of a Phase I Avian Risk assessment for the proposed Jordanville Wind Power Project (hereafter the "Project"), Herkimer County, New York. This assessment includes: 1) a site visit conducted on December 16-17, 2004, 2) a review of the literature and available databases, and 3) written consultations with the US Fish and Wildlife Service (USFWS; pending) and New York State Department of Environmental Conservation (NYSDEC; pending). The site visit evaluated habitat to determine the type and number of birds likely to nest, forage, roost, or otherwise use the site. The literature and database review examined the avifauna most likely to be present at or surrounding the site and what is known about the impact to birds at existing wind power facilities. The written consultations with wildlife agencies sought to clarify bird species of concern in the Project vicinity. Together, this information indicates the type and number of birds that are known or suspected to use the Project site. When incorporated into the risk assessment, this information helps determine the degree of risk to birds from the proposed wind power development.

The project, proposed by Jordanville Wind, would be a large-scale wind farm by eastern standards. The Project plan calls for about 65-75 wind turbines distributed over an area of about 6 miles long and 3 miles wide. Each of the wind turbines would have a nameplate generating capacity of 1.5 to 2.0 MW (megawatts), yielding a total nameplate generating capacity of roughly 100 and 150 MW. The towers of the wind turbines would be about 78 meters (262 feet) tall and have blades of about 38.5-43.5 m (126-142.7 feet) long. With the rotor tip in the twelve o-clock position, the wind turbines would reach a maximum height of about 122 m (400 feet) above ground level (AGL). At the six o-clock position, the rotor tip would be roughly 34.5 meters (113 feet) AGL (if 43.5 m rotors are used).

Predominant land-use at the Project site is agricultural, including hay, alfalfa, cover crops, and corn, as well as some pasture. There are extensive fallow, grassy fields, as well as shrubby thickets that have taken over abandoned farm fields. Less than about 10% of the site is northern hardwood forest, mostly in small patches or fragments. Small, isolated wetlands (cattail and wooded) and some small streams are present. There are minimal wetlands and only small, isolated open bodies of water within the Project boundary. Wind turbines and new roads would be located primarily in farmed fields, with a few being located within forest patches or at the edges of forests. There are rural

residences and farm structures along a network of roads within the Project area. Two transmission lines extend slightly to the east and north of the turbine areas.

Habitats in and around the Project site support common species associated with grassland/farmland, brushy, and forest edge. There are few contiguous forests within the Project boundary that could support interior forest nesting species. Habitat on site appears suitable for nesting of a few or several state-listed species, particularly those of grassland/farm field communities, including the threatened Northern Harrier, Upland Sandpiper, Sedge Wren, Henslow's Sparrow, and special-concern Horned Lark, Vesper Sparrow, and Grasshopper Sparrow. A letter from the NYSDEC Natural Heritage Inventory dated February 15, 2005, confirmed the potential presence of Upland Sandpiper within the Project boundary, along with the potential presence of Least Bittern (state threatened) in the general Project Area. Wooded areas on site also appear suitable for nesting for the following raptors that nest in forest and forest edge: Sharp-shinned Hawk (special concern), Cooper's Hawk (special concern), Red-tailed Hawk, and American Kestrel. Other species of concern may nest within the Project boundary including Golden-winged Warbler and American Bittern. Many of these species were found on nearby Breeding Bird Atlas and Breeding Bird Survey databases. Habitat on site for federally threatened Bald Eagles is unsuitable, although a nest of this species is located 7 miles (11.2) km to the south of the Project site. The Project site contains little suitable nesting habitat for waterbirds, although the small isolated wetlands could support some of these birds in modest numbers.

A letter from the US Fish and Wildlife Service dated May 16, 2005, stated that "except for transient individuals, no Federally-listed or proposed endangered or threatened species under our jurisdiction are known to exist in the project impact area." That letter also provided concerns regarding migratory birds.

The Project site and surrounding habitats are not likely to be ecological magnets for migrating birds and it is unlikely that significant migration concentrations occur over the Project site. No major hawk migration pathways or lookouts are known or suspected to occur within or near the site. Songbirds and other species are likely to migrate over the Project site, although not in numbers, patterns, or altitudes that are significantly different from most other areas in central New York. The site itself is unlikely to be a significant wintering site for birds, although wintering raptors – mostly Red-tailed Hawk, Rough-legged Hawk, Northern Harrier, Short-eared Owl, and possibly American Kestrel – will likely be present at the Project site in winter in small numbers.

Within 5-10 miles of the Project site there were no Important Bird Areas, federal wildlife areas, state wildlife management areas, or other publicly held lands that support a high diversity of species.

The avian risk assessment makes the following recommendations:

- Permanent meteorology towers should be free-standing structures (i.e., without guy wires) to prevent the potential for avian collisions.

- Electrical lines within the project site should be underground between the turbines and any new above ground lines from the site and substations to transmission lines should follow Avian Power Line Interaction Committee (APLIC) guidelines for insulation and line spacing.
- The footprint of roads and turbine pads should be minimal and after construction natural habitat that is disturbed should be restored or encouraged to regenerate as close to the turbines and roads as possible to minimize habitat fragmentation.
- Lighting of turbines and other infrastructure (turbines, substations, buildings) should be minimal to reduce the potential for attraction of night migrating songbirds and similar species. Federal Aviation Administration (FAA) lighting for night use should be flashing lights (red strobe-like or white strobes) with the longest permissible off cycle. No steady burning FAA lights should be used. Sodium vapor lamps and spotlights should not be used at any facility at night except when emergency maintenance is needed.
- A nesting bird survey should be undertaken to determine the distribution and densities of grassland birds that may nest in suitable habitat on site. These include listed species and species of concern such as threatened Northern Harrier, Upland Sandpiper, Sedge Wren, and Henslow's Sparrow, and the special-concern Horned Lark, Vesper Sparrow, and Grasshopper Sparrow. The special-concern Cooper's Hawk and possibly other rare species may occur in wooded habitats on site. The results of this survey may be used to prevent or mitigate disturbance impacts and displacement of these species. Should a nesting survey be conducted, its design should involve consultation with NYSDEC biologists prior to implementation.
- Radar studies may be conducted at the site in order to determine flight patterns of night migrants (direction, altitude, and number of birds) passing over the wind farm site. Should such a survey be conducted, its design should involve consultation with NYSDEC biologists prior to implementation.
- A post-construction study of collision fatalities is recommended. Such a study would be helpful to guide future wind power development in New York State by providing information on the number and type of fatalities that occur, as well as potential biological significance and cumulative impacts of turbine development in New York State.

With respect to grassland nesting songbirds and raptors, some may be displaced to varying degrees from current nesting areas by construction of turbines. The degree of this displacement cannot be predicted, nor is it known if these birds will eventually habituate to the turbines, because detailed studies have not yet been conducted in similar habitat in New York State. The level of impact to these birds could be significant at the local level, but it is unlikely to be significant at the global level. As a result, the Project will not threaten or jeopardize the overall populations and stability of these species.

Collision risk to birds at the Jordanville Wind Power Project is likely to be minimal, although the potential presence of state listed species is of concern. From what was learned from the site visit and literature search, as well as a documented lack of significant avian fatalities at modern wind power facilities, there in no indication that the

Jordanville Wind Power Project will result in biologically significant collision impacts to birds.
http://www.newwindenergy.com/windfarm_jordanville/pdf/DEIS%20Appendices/Appendix%20E/JordanvilleAvianPhaseI-Final1.pdf

**Jordanville Wind Farm Avian and Bat Work Plan.** Prepared for New York State Department of Environmental Conservation. Prepared by Community Energy, Inc. April 2005.

Workplan Summary
Community Energy plans to conduct the following bird and bat studies and surveys at the proposed wind farm site in Warren, NY:
- Phase I Avian Risk Assessment
- Bird Radar Survey: 45 nights in the Spring and 45 nights in the Fall 2005
- Bat Acoustics Survey: 1 period of three nights during June or July, 30 nights in the Spring and Fall 2005
- Radar Assessment Report
- Breeding Bird Study

These surveys are intended to be compiled in a Draft Environmental Impact Statement.
http://www.newwindenergy.com/windfarm_jordanville/pdf/DEIS%20Appendices/Appendix%20E/CEI%20Bird%20and%20Bat%20Work%20Plan%204-6-05.pdf

## E.13 Madison Wind Power Project, NY

Kerlinger, P. 2002**. Avian Fatality Study at the Madison Wind Power Project, Madison, New York.** Report prepared for PG&E Generating.

## E.14 Maple Ridge Wind Farm, NY
**(formerly called Flat Rock Wind Power Project)**

**Land Use/Topography –** Farmland on plateau, forested patches

**Final Environmental Impact Statement**

**A Radar and Visual Study of Nocturnal Bird and Bat Migration at the Proposed Flat Rock Wind Power Project, New York, Fall 2004.** Prepared for Atlantic Renewable Energy Corporation. Prepared by ABR, Inc. March 2005.

Executive Summary
• This report presents the results of a radar and visual study of bird and bat migration conducted during 5 August–3 October 2004 at the proposed Flat Rock Wind Power project, located in the Tug-Hill Plateau of northern New York, in Lewis County. Radar and visual observations were conducted for ~6.5 h/night during 60 nights during the fall.
• The primary goal of this study was to collect information on the migration characteristics of nocturnally migrating birds, (especially passerines) and bats during the fall-migration period to provide an overall assessment of potential project-related impacts

to birds and bats. Specifically, the objectives of this study were to: (1) collect baseline information on migration characteristics (i.e., flight direction, migration passage rates, flight altitudes) of nocturnally migrating birds and bats; (2) visually estimate the number and relative proportions of birds and bats within the potential rotor-swept area of the proposed wind turbines; and (3) determine the number of birds and bats that would pass within the rotor-swept area of the proposed wind turbines during the migratory season.
• In the fall, the mean flight direction of targets observed on radar was 184°.
• The mean nocturnal passage rate for the fall season was 158 ± 21 targets/km/h and ranged among nights between 5 and 704 targets/km/h. Fall passage rates varied among hours of the night, with lowest mean rates occurring during the earliest hour of the evening.
• The mean nocturnal flight altitude for the entire fall season was 415 ± 2 m agl. Mean flight altitudes observed on vertical radar were highly variable among nights and ranged from 194 to 691 m agl. Eight percent of all targets during fall 2004 were below the maximal height of the proposed wind turbines (125 m).
• Migration passage rates increased with tailwinds, crosswinds, and date. Flight altitudes increased with tailwinds, crosswinds, and date and decreased with wind speed.
• Assuming an average of 10 nocturnal h/d and 60 d in the fall study, we estimated a seasonal turbine passage rate index of 39–275 nocturnal songbird/bat migrants passing within the area occupied by each proposed turbine during fall 2004.
• We used visual sampling methods of night vision goggles and two, 2,000,000-Cp spotlights with red lenses to investigate low-altitude migration of birds and bats, and were able to identify ~81% of all targets as either birds or bats. During nocturnal hours, we observed a total of 1,383 birds (mainly passerines) and 179 bats (mainly small bats) at both sites. The proportions of birds and bats flying <~150 m agl (i.e., our effective sampling distance with the night-vision goggles and spotlights) were 91% birds and 9% bats ($n$ = 865 identifiable targets) at the North site and 85% birds and 15% bats ($n$ = 697 identifiable targets) at the South site.
• The key results of our of fall passerine and bat migration study were: (1) the mean overall passage rate (i.e., 158 targets/km/h) was comparable to other sites in New York; (2) mean nightly passage rates ranged from 5 to 704 targets/km/h; (3) the percentage of targets passing below 125 m agl (~8%) was similar to that for a small number of comparable studies; (4) an estimated turbine passage rate index of 39–275 nocturnal migrants passing within the airspace occupied by each proposed turbine during the 45-d fall migration season (equivalent to ~0.7–4.6 nocturnal migrants/turbine/d); and (5) migrants composed of ~85–91% birds and ~9–15% bats during this study.
http://www.abrinc.com/news/Publications_Newsletters/Flat%20Rock%20Fall%20Migration%20Study_Fall%202004.pdf

Kerlinger, P. and J. Dowdell. 2003**. Breeding bird survey for the Flat Rock Wind Power Project, Lewis County, New York.** Prepared for: Atlantic Renewable Energy Corporation.

Kerlinger, P. 2002. **Phase I Avian Risk Assessment for the Flat Rock Wind Power Project, Lewis County, New York.** February 2002. Report prepared for Atlantic Renewable Energy, Corporation.

**Other Studies –** currently conducting post-construction studies (results not yet available).

## E.15 Marble River Wind Farm, NY

**Land Use –** Primarily forest and agricultural use, but also includes significant wetland acreage. Farms and rural residences occur along the public roads within the Project area.

**Draft Environmental Impact Statement** - March 30, 2006
http://www.marbleriverwindfarm.com/deis/DEISNarrative.pdf

**Appendix F of the Draft Environmental Impact Statement:**
**A Spring 2005 Radar, Visual, and Acoustic Survey of Bird and Bat Migration**
**A Fall 2005 Radar, Visual, and Acoustic Survey of Bird and Bat Migration**
**Avian Risk Assessment**
*(to be added to the website soon)*

## E.16 Martinsburg, NY

**Land use/Topography –** Gently rolling plateau, farmland and forested patches

**Studies –** Nocturnal migration study
Currently trying to obtain more information.

## E.17 Munnsville Wind Farm, NY

Kerlinger, P. 2005. **Phase I Avian Risk Assessment for the Munnsville Wind Farm, Madison and Oneida Counties, New York, January 2005.** Report prepared for Citizens Airtricity Energy.

## E.18 Prattsburgh Wind Farm, NY

**Land Use/Topography -** Mature, eroded plateau with gently rolling uplands,dissected by steeply cut ravines; predominately farmland and forested areas

**Draft Environmental Impact Statement.** June 2006.
http://www.prattsburghwind.com/DEIS/WindFarm%20Prattsburgh/DEIS%20Text/DEIS_Final-06-22-06.pdf

**The following documents are Appendix E of the Draft Environmental Impact Statement:**

**Windfarm Prattsburgh Ecological Survey, Towns of Prattsburgh and Italy, Steuben and Yates Counties, New York.** Prepared for Windfarm Prattsburgh, LLC. Prepared by Environmental Design and Research, PC. May 2006.

Purpose

Environmental Design & Research, Landscape Architecture, Environmental Services, Engineering and Surveying, P.C. (EDR) was retained by Windfarm Prattsburgh, LLC to conduct a survey of the flora and fauna within an approximately 2,285-acre Project Area, located in the Town of Prattsburgh, Steuben County and the Town of Italy, Yates County, New York. This report describes the methods and results of the on-site ecological survey conducted by EDR. It also provides an assessment of impacts to on-site flora and fauna that may result from construction and operation of the proposed project and a discussion of potential mitigation measures. Reconnaissance of areas proposed for development (i.e. wind turbine locations, access roads, electrical interconnect lines, substation) were performed by EDR personnel during the spring and summer of 2005, and detailed ecological field investigations were conducted during the fall of 2005 and the spring of 2006.
http://www.prattsburghwind.com/DEIS/WindFarm%20Prattsburgh/DEIS%20Appendicies/Appendix%20E%20Ecological/1%20Ecological%20Report/Ecological%20Report_5-23-06.pdf

**A Fall 2004 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed WindFarm Prattsburgh Project in Prattsburgh, New York.** Prepared for Windfarm Prattsburg, LLC. Prepared by Woodlot Alternatives Inc. March 2005.

Executive Summary

Field surveys of bird and bat migration activity were conducted by Woodlot Alternatives, Inc. near Prattsburgh, New York, at the site of the proposed WindFarm Prattsburgh Project. The Project will include the erection of approximately 50 wind turbines in agricultural fields and would produce approximately 75 MW of wind energy. Surveys included daytime surveys of migrating raptors and nighttime surveys of birds and bats using a radar and bat echolocation detectors.

Thirteen days of raptor surveys were completed in the project area. The results of the field surveys indicate that fall raptor migration in the WindFarm Prattsburgh project area is low relative to other sites in the region. Most raptors observed were believed to be resident birds, rather than migrants, based on a number of factors. Only approximately 40% of the raptors observed were believed to be undertaking long range migratory movements. Even when all of these birds were included as potential migrants and included within the calculated observation rates, these rates were very low compared to other regional sites.

Resident birds were observed flying at lower heights than migrants, as they were typically undertaking small-scale movements while foraging. Many residents, however, were observed flying exclusively below the blade-swept area of the proposed turbines. Migrants were observed taking advantage of thermals and crosswinds flowing up hillsides and were consistently observed gaining altitude in these areas before following

straight flight paths south and southwest. Based on the observed flight paths of migrants, it is likely that the wider valleys and sideslopes of valleys are receiving high use by migrating raptors because of the suitable atmospheric conditions that develop in those areas.

Thirty nights of radar surveys were conducted. Radar surveys included the collection and analysis of 1-minute video samples of the radar in surveillance (horizontal) operation, which documents the abundance and flight paths of migrants, and 10-minute samples of the radar in vertical operation, which documents the altitude of migrants.

Nightly passage rates varied from 12 ± 5 to 474 ± 90 targets/km/hr (t/km/hr), and the overall passage rate for the entire survey period was 193 ± 21 t/km/hr. These passage rates are similar to other recent radar surveys using similar methods and equipment that have been conducted in the northeast and are lower than those found from the southeastern United States. Night-to-night variation is a common phenomenon with bird migration, with birds typically waiting out periods of inclement or non-conducive migration weather for periods when wind and other atmospheric conditions are more suitable for migration. Passage rates were generally highest when winds were from the north. The timing of nightly peaks in passage rates suggests that, at least on some nights, a large number of birds could leave the shores of Lake Ontario and pass over the project area in two distinct pulses.

The mean flight direction through the project area was 188º ± 66º. There was considerable night-to-night variation in mean direction, although within each night there was less variation. The average nightly flight direction was typically southwest to southeast on 20 of the 30 nights sampled. No correlation between flight direction and wind direction was observed. While not statistically significant, a relationship between flight direction and a combination of wind direction and speed was observed. On nights when wind speeds were high (above 15 km/h) targets were generally flying downwind or within 30º of the wind direction.

The mean flight altitude of all targets was 516 ± 17 m (1,692') above ground level and the average nightly flight altitude ranged from 190 m to 727 m (623' to 2,385'). The percent of targets observed flying below 125 m (400') also varied by night, from 0% to 50%. The seasonal average percentage of targets flying below 125 m was 2.6%.

No significant barriers to nocturnal bird movement are suspected to occur in the area. The mean flight direction, analysis of the surrounding, and mean flight altitude of targets passing over the project area indicates that bird migration in this area is broad front. Additionally, the flight height of targets indicates that the vast majority of bird migration in the area occurs well above the height of the proposed wind turbines.

One to two detectors were operated on 30 separate nights, yielding a total of 43 detector-nights and 481.5 hours of recordings. A total of 269 bat call sequences were recorded. The majority of these calls were recorded during the first week of sampling when the detectors were hand-held or placed on at ground level. Detectors placed near the ground

in mid-August yielded 22 hours of recordings. Those located in forest edge habitats had detection rates of 16.8 bat passes/hour while those in fields had detection rates of 2.5 bat passes/hour. Detectors placed in similar locations near the end of October yielded only 1 bat recording in over 28 hours of surveys.

Detectors were placed in the meteorological measurement towers (met towers) on 23 nights, yielding 430.2 hours of recordings and an overall passage rate of 0.1 bat passes per hour. The highest bat passage rates detected in the tower was 0.8 bat passes/hour, from a detector placed 15 m (50') above the ground. The detection rate from a detector at 30 m (100') was less than half of that. Based on the location of the detectors, it is anticipated that bat activity in the area is greatest near the ground at forest edges and lowest at greater heights in the middle of fields. Bat passage rates exhibited a steady seasonal decline, as would be expected, and hardly any bats were detected after September.

When possible, recorded bat calls were identified to species, Genus, or as unknown. Of the 269 calls recorded, 136 (51%) were assigned to a species, and 133 (49%) were too short to be identified. Species detected, in decreasing order of abundance, were *Myotis* spp. (76), big brown bat (34), silver-haired bat (10), eastern pipistrelle (9), hoary bat (6), and eastern red bat (1).

Big brown bats were present only during the first round of sampling in August and were detected only near the ground. Silver-haired bats were detected only in the met towers, and only during September. Bats of the Genus *Myotis* were present throughout August and September.

The collected data provide useful information on site-specific migration activity and patterns in the vicinity of the WindFarm Prattsburgh project area. The information should prove useful in the assessment of risk to birds and bats migrating during the day and at night through the area.
http://www.prattsburghwind.com/DEIS/WindFarm%20Prattsburgh/DEIS%20Appendicies/Appendix%20E%20Ecological/2%20Fall%202004/WFP%20Fall%2004%20Avian%20Report.pdf

**A Spring 2005 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed WindFarm Prattsburgh Project in Prattsburgh, New York.** Prepared for Windfarm Prattsburg, LLC. Prepared by Woodlot Alternatives, Inc. September 2005.

Executive Summary
During the spring of 2005, Woodlot Alternatives, Inc. conducted field surveys of bird and bat migration activity in Prattsburgh, New York. The surveys are part of the planning process by WindFarm Prattsburgh for a proposed wind project, which will include the erection of up to 50 wind turbines in agricultural fields and secondary growth woodlots. At maximum build-out, the facility would produce approximately 75 megawatts of wind energy. Surveys included daytime surveys of migrating raptors and nighttime surveys of birds and bats using radar and bat echolocation detectors. The Spring surveys were the

second part of a two-season migration study that included data collection during the Fall of 2004.

The results of the field surveys provide useful information about site-specific migration activity and patterns in the vicinity of Wind Farm Prattsburgh. This analysis is a valuable tool for the assessment of risk to birds and bats during migration through the area.

The spring field surveys included 10 days of visual raptor migration observation between March 22 and May 7, 2005. A total of 314 raptors, representing 15 species, were observed during the surveys. Approximately 83 percent of the raptors observed were flying less than 125 meters (m) above the ground. Two state-listed endangered species [peregrine falcon (*Falco peregrinus*), golden eagle (*Aquila chrysaetos*)], 2 state-listed threatened species [bald eagle (*Haliaeetus leucocephalus*), northern harrier (*Circus cyaneus*)], and 5 species of concern [osprey (*Pandion haliaetus*), sharp-shinned hawk (*Accipiter striatus*), Cooper's hawk (*Accipiter cooperii*), northern goshawk (*Accipiter gentilis*), and red-shouldered hawk (*Buteo lineatus*)] were observed migrating through the project area. While these species are listed as species of conservation concern, the individuals observed are unlikely to be resident to the project area. In fact, most, if not all, of the individuals observed were transient, occurring only during the migration season.

The results of the spring raptor migration surveys are fairly similar to the fall 2004 surveys. Relatively few raptors were observed relative to other hawk watch sites in NY and the surrounding region. The Appalachian ridgelines to the south of the study area and the Great Lakes north of the study area receive much more use by migrating raptors than the interior NY setting of the study area.

The spring nocturnal bird migration field survey included 20 nights of radar surveys to collect 1-minute video samples in horizontal operation, which documents the abundance and flight path of migrants, and 10-minute samples in vertical operation, which documents the altitude of migrants. Nightly passage rates varied from 70 ± 15 targets/kilometers/hour (t/km/hr) to 621 ± 94 t/km/hr. The overall passage rate for the entire survey period was 277 ± 52 t/km/hr. These rates are higher than those observed during the previous fall (range of 12 ± 5 to 474 ± 90 t/km/hr, with an overall rate of 193 t/km/hr) but still similar to rates observed during other available regional studies. Mean flight direction through the project area was 22º ± 52º, which is approximately 166º different than the previous fall (mean flight direction of 188º ± 66º). Flight direction varied between nights and was probably due to variation in the weather (particularly wind direction and speed). Flight direction was weakly correlated with flight height ($r=0.406$, $p<0.059$). In general, flight directions to the northeast were associated with higher flight altitudes, and flight directions to the south were associated with lower flight altitudes.

Flight direction was not correlated with wind speed ($r=0.083$, $p<0.889$). Wind speed throughout the season was relatively mild with max winds only reaching 32 km/hr (20 miles per hour). Other weather factors may have influenced flight direction as well.

The mean flight height of all targets was 370 m ± 41 m (1214' ± 135') above the radar site. The average nightly flight height ranged from 225 m ± 17 m (738' ± 56') to 667 m ± 29 m (2188' ± 95'). The percent of targets observed flying below 125 m (410'), the approximate maximum height of the proposed wind turbines, also varied by night, from 1 percent to 41 percent. The seasonal average percentage of targets flying below 125 m was 16 percent. These average flight height data are lower than the observed fall flight characteristics (mean flight height of 516 ± 17 m [1,692']) with nightly means of 190 m to 727 m (623' to 2,385'). Also during the fall, 0 percent to 50 percent of nightly targets were observed below 125 m with a seasonal average of 2.6 percent.

No significant barriers to nocturnal bird movement are suspected to occur in the area. The mean flight direction, qualitative analysis of the surrounding landscape, and mean flight altitude of targets passing over the project area indicates that bird migration in this area involves broad front movement. Additionally, the flight height of targets indicates that the majority of bird migration in the area occurs well above the height of the proposed wind turbines.

The spring bat field survey included deployment of 1 to 2 detectors on 37 separate nights, yielding a total of 57 detector nights. On nights when two detectors were used, they were deployed at heights of 15 m and 30 m (50' and 100') in a meteorological measurement tower; otherwise, one detector was deployed at 30 m.

A total of 16 bat call sequences were recorded. The overall bat detection rate over the course of the entire study was only 0.28 calls per night. Detection rates at the high detector (0.22 calls per night) were approximately half of that observed at the low detector (0.40 calls per night). The number of calls recorded was significantly lower than the fall 2004 survey (269 calls during 43 detector-nights).

When possible, recorded bat calls were identified to species using certain call characteristics such as shape of the call sequence, the slope, and the maximum and minimum frequencies. Species identification analysis was based on comparison of call sequences to known reference calls. Most calls were identifiable to species, but some were only identifiable to Genus. Of the 16 calls recorded, 2 species and 1 Genus were documented. These were the big brown bat (*Eptesicus fuscus*), hoary bat (*Lasiurus cinereus*), and *Myotis* spp. The hoary bat calls were recorded only during the very last nights of the survey period, while the other two species were recorded throughout the survey period.
http://www.prattsburghwind.com/DEIS/WindFarm%20Prattsburgh/DEIS%20Appendicies/Appendix%20E%20Ecological/3%20Spring%202005/WFP%20Spring%2005%20Avian%20Report.pdf

**Avian and Bat Information Summary and Risk Assessment for the Proposed WindFarm Prattsburgh Project in Prattsburgh, New York.** Prepared for Windfarm Prattsburgh, LLC. Prepared by Woodlot Alternatives, Inc. January 2006.

Conclusions
Wind technology is advancing quickly, and potential environmental effects seen in earlier studies may be avoided with proper siting of facilities and newer turbine and facility designs. Only recently have improved studies on the potential effects of wind energy developments on birds and bats been emerging to assist with the assessment of new proposed projects to these animals that are vulnerable to colliding with wind turbines.

Comparison of the physical setting of the proposed WindFarm Prattsburgh project and the biological communities of the bird and bat populations in the vicinity of the project provide a reasonable expectation that potential mortality at the project could be within the range of mortality found at existing facilities. Certainly, no one characteristic of the proposed project yields any anticipation that mortality could be significantly different (either higher or lower). Consequently, it is anticipated that the overall risk of bird collisions is low.

However, bats may be more susceptible and thus the risk for these species is higher than for birds. While the project may not reflect the fairly low collision rates found at western and mid-western projects, neither is it expected that it will reflect the alarming rates found along forested ridgelines of the central Appalachians. In this respect, the risk of bat collisions with the proposed turbines is generally anticipated to be low to moderate.

Future investigations of fatality rates at modern facilities in a variety of landscapes remain the only way to definitively identify the impact of new projects on birds and bats. Additionally, future studies that combine mortality surveys with survey techniques that are typically used during pre-construction studies (i.e., radar, acoustic, thermal imaging, visual diurnal studies) may be the only way that predictive models of risk for new projects can be derived.
http://www.prattsburghwind.com/DEIS/WindFarm%20Prattsburgh/DEIS%20Appendicies/Appendix%20E%20Ecological/4%20Risk/105027%20Prattsburgh%20Windfarm%20Risk%20Assessment%20FINAL%203-2-06_Cumulative.pdf

## E.19 Top Notch Wind Project, NY

**Land Use –** Rolling, elevated plateaus that drop in elevation towards the West Canada Creek and Mohawk River valleys to the west and south and the Black Creek Valley to the north. The majority of the area consists of open crop fields (primarily hay and corn) and pastures, with forested areas generally confined to small woodlots and slopes that descend into adjacent valleys.

**Draft Environmental Impact Statement.** June 2006.
http://www.ppmenergy.com/pdf/DEIS/Text/DEIS_06-13-06.pdf

**The following documents are from Appendix D of the Draft Environmental Impact Statement:**

**Phase I Avian Risk Assessment, Herkimer Wind Farm, Herkimer County, New York.** Prepared for PPM Atlantic Renewable. Prepared by Curry and Kerlinger, LLC. April 2005.

Executive Summary

This report details the results of a Phase I Avian Risk Assessment for the proposed Herkimer Wind Farm ("Project") in the towns of Fairfield and Norway in Herkimer County, New York. This assessment includes: 1) a site visit conducted on November 10, 2004, 2) a review of the literature and available databases, and 3) written consultations with the US Fish and Wildlife Service (USFWS) and the New York State Department of Environmental Conservation (NYSDEC). The site visit evaluated habitat in order to estimate the type and number of birds likely to nest, forage, rest, or otherwise use the site. The literature and database review examined the avifauna most likely to be present at or surrounding the site and information relevant to potential impacts to birds at comparable wind power facilities. The written consultations with wildlife agencies sought to clarify bird species of concern in the Project vicinity. Together, this information indicates the type and approximate numbers of birds that are known or suspected to use the Project site. When incorporated into the risk assessment, this information helps determine the degree of risk to birds from the proposed wind power development.

The Herkimer Wind Farm is proposed by the Atlantic Renewable Energy Corporation, a division of PPM. A conceptual layout for the Project shows 61 wind turbines distributed over an area 9 miles long and 2 miles wide…….. The predominant habitats on the Project site are tilled farmland (corn, hay, cover crops), pasture, old field, and, dispersed, mainly deciduous forest patches and woodlots. Wetlands are not well represented, consisting of several small ponds and cattail marshes. According to the conceptual layout, the wind turbines would mainly be constructed in existing open areas, but some limited areas with trees would be affected by road and turbine construction. Land use in and around the proposed wind farm is mainly agricultural, with a significant number of rural residences along a network of roads.

Habitats in and around the Project site support typical bird communities, composed mainly of common species associated with grassland, brushy areas, woodland edge, and woodland. But, given these habitats, some state-listed species may breed at or near the site. Some of the potential state-listed species are classified as *threatened* and include Northern Harrier, Upland Sandpiper, and Henslow's Sparrow. The extensive combination of fallow fields, pastures, and hay fields may support them. One of these birds – the harrier – was recently confirmed as a breeder in one of the Breeding Bird Atlas (BBA) blocks that overlaps the Project site.

There is also the potential for several breeding birds classified as *of special concern,* including Sharp-shinned Hawk, Cooper's Hawk, Northern Goshawk, Red-shouldered Hawk, Red-headed Woodpecker, Horned Lark, Golden-winged Warbler, Vesper Sparrow, and Grasshopper Sparrow. One of these birds – the Cooper's Hawk – was recently confirmed as a breeder in one of the BBA blocks that overlaps the Project site. The habitats on site, and for more than five miles surrounding the site, however, are not

suitable for any federally listed species, but the threatened Bald Eagle may fly over the site at times.

Letters from the USFWS and NYSDEC did not suggest the presence of federally endangered or threatened species at the Project site or nearby. However, the USFWS did mention the potential for impacts to birds protected by the Migratory Bird Treaty Act. The NYSDEC letter did suggest that New York State threatened Upland Sandpiper and endangered Loggerhead Shrike were known to nest at one time near the Project site, and state species of special concern, Common Loon, also was known to nest nearby.

There are no known major hawk migration pathways or lookouts at or near the site. Songbirds and other species are likely to migrate over the Project site, although not in numbers, patterns, or altitudes that are significantly different from most other areas in central New York. The site is not known to be a significant wintering site for birds, so relatively few birds are likely to use the site between mid-November and mid-March. Wintering raptors – mostly Red-tailed Hawk, Rough-legged Hawk, Northern Harrier, and American Kestrel – will likely be present at the Project site in winter in small to moderate numbers. In addition, there was no evidence that the Project site or lands adjacent to the site would attract large or significant numbers of migration or wintering waterfowl, shorebirds, songbirds, hawks, or other species.

The avian risk assessment makes the following recommendations:

- Electrical lines within the project site should be underground between the turbines, and any new above ground lines from the site and substations to transmission lines should follow Avian Power Line Interaction Committee (APLIC) guidelines for insulation and spacing.
- Permanent meteorology towers should be free-standing (i.e., without guy wires) to prevent the potential for avian collisions.
- Size of roads and turbine pads should be minimal to disturb as little habitat as possible. After construction, any natural habitat should be permitted or encouraged to regenerate as close to the turbines and roads as possible to minimize habitat fragmentation and disturbance/displacement impacts.
- Lighting of turbines and other infrastructure (turbines, substations, buildings) should be minimal to reduce the potential for attraction of night migrating songbirds and similar species. FAA lighting for night use should be flashing lights (red or white) with the longest permissible off cycle. No steady burning FAA lights should be used. Sodium vapor lamps and spotlights should not be used at any facility at night except when emergency maintenance is needed.
- A post-construction study of collision fatalities would be helpful to guide future wind power development in New York State. Such a study would provide information on the number and type of fatalities that occur, and determine the biological significance and potential cumulative impact of turbine development in New York and in the eastern United States.
- Because the habitat on site appears to be suitable or marginally suitable for species classified by NYSDEC as threatened and of special concern, a nesting bird survey is advised to determine the extent to which the threatened Northern Harrier, Upland Sandpiper, and Henslow's Sparrow, and the special-concern

Horned Lark, Vesper Sparrow, and Grasshopper Sparrow, use the site's grassland habitats. Additionally, two other special-concern species that might breed in the site's woodland-type habitats should also be checked. They are the Red-headed Woodpecker and Golden-winged Warbler. The site-specific breeding bird survey should map the areas where these birds nest in relation to the proposed turbine and road locations. The results of this survey would be useful in preventing or mitigating the disturbance or displacement of these species. Should a site-specific breeding bird survey be conducted, its design should involve consultation with NYSDEC biologists prior to implementation.

With respect to grassland nesting songbirds and perhaps some raptors, some of these species will likely be displaced from current nesting areas. The degree of this displacement cannot be predicted, nor is it known if these birds will eventually habituate to the turbines, because detailed studies have not yet been conducted in similar habitat in New York State. The level of impact to these birds could be significant at the local level, but it is highly unlikely to be significant at the regional or global level. As a result, the Project will not threaten or jeopardize the overall populations and stability of these species.

Collision risk to birds at the Herkimer Wind Farm is likely to be minimal. From what was learned from the site visit and literature search, as well as a documented lack of significant fatalities at the nearby Madison and Fenner wind power facilities (30 and 45 miles distant, respectively), there is no indication that the Herkimer Wind Farm will result in biologically significant collision impacts to birds. But, based on other wind power projects, it is likely that USFWS and NYSDEC will request pre and post-construction studies in order to minimize and mitigate potential impacts from the proposed project and to help guide future wind power development in New York State. http://www.ppmenergy.com/pdf/DEIS/Appendicies/Appendix_D_Avian_and_Bat/2_-_Phase_I_Avian_Risk_Assessment/HerkimerPhaseI-Final-4-22-06_revisedfinal.pdf

**Summer 2005 Breeding Birds Surveys at the Proposed Top Notch Wind Project in Fairfield and Norway, New York.** Prepared for PPM Atlantic Renewable. Prepared by Woodlot Alternatives, Inc. December 2005.

Conclusions

Yellow warblers, American robins, American redstarts, and black-capped chickadees were the most abundant species at the forest points. The yellow warbler, least flycatcher, common yellowthroat, and American robin were the most abundant birds at forest edge points. Species dependent upon or tolerant of open habitats (cropland and fields) were preponderant in the breeding bird surveys (bobolink, red-winged blackbird, and savannah sparrow).

The project area consists of upland grasslands, croplands, forests, and forest edge. The forested habitat had the greatest species richness and highest number of unique species. Forested parcels and grasslands within the study area contained good bird diversity. These results may indicate that breeding birds in forested patches in the project area may be from populations from Adirondack Park.

http://www.ppmenergy.com/pdf/DEIS/Appendicies/Appendix_D_Avian_and_Bat/3_-_Breeding_Bird_Survey/Breeding_Bird_Survey.pdf

**A Spring 2005 Radar Survey of Bird and Bat Migration at the Proposed Top Notch Wind Project in Fairfield, New York.** Prepared for PPM Atlantic Renewable. Prepared by Woodlot Alternatives, Inc. November 2005.

Executive Summary

During spring 2005, Woodlot Alternatives, Inc. conducted field surveys of bird and bat migration activity at the proposed Top Notch Wind Project area in Fairfield and Norway, NY. The surveys are part of the planning process by PPM Atlantic Renewable for a proposed wind project, which will include the erection of up to 42 wind turbines located predominantly in agricultural croplands and hay fields. Surveys included nighttime surveys of birds and bats using radar and bat echolocation detectors.

The results of the field surveys provide useful information about site-specific migration activity and patterns in the vicinity of the proposed Top Notch project area. This analysis is a valuable tool for the assessment of potential risk to birds and bats during migration through the project area.

The spring field survey included radar surveys on 40 of 45 targeted nights to collect video samples in horizontal operation, which documents the abundance, flight path, and speed of avian targets moving through the project area, and in vertical operation, which documents the altitude of targets.

A total of 2,475 horizontal radar video samples, including 60,647 targets, were analyzed to determine passage rate and flight direction. Nightly passage rates varied from 80 ± 19 target/kilometer/hour (t/km/hr) to 1,175 ± 228 t/km/hr, with the overall passage rate for the entire survey period at 509 ± 77 t/km/hr. Mean flight direction through the project area was to the northeast, at 44º ± 77º.

A total of 328 vertical radar video samples, including 17,544 targets, were analyzed to determine flight altitude. The mean flight height of all targets was 419 meters (m) ± 46 m (1374’ ± 150’) above the radar site. The average nightly flight height ranged from 160 m ± 36 m (524’ ± 118’) to 833 m ± 64 m (2,732’ ± 209’). The percent of targets observed flying below 125 m (410’) also varied by night, from 0 percent to 71 percent. The seasonal average percentage of targets flying below 125 m was 20 percent.

The mean flight direction, qualitative analysis of the surrounding topography and landscape, and mean flight altitude of targets passing over the project area indicates that avian migration in this area involves a broad front type of movement. This type of broad front movement, particularly in conjunction with the high-elevation passage of migrants, demonstrates a limited avian mortality risk during spring migration. Additionally, the flight height of targets indicates that the vast majority of bird migration in the area occurs well above the height of the proposed wind turbines.
http://www.ppmenergy.com/pdf/DEIS/Appendicies/Appendix_D_Avian_and_Bat/4_-_Spring_2005_Radar/Spring_2005_Raday_Survey.pdf

**Summer and Fall 2005 Radar and Acoustic Surveys of Bird and Bat Activity at the Proposed Top Notch Wind Project in Fairfield and Norway, New York.** Prepared for PPM Atlantic Renewable. Prepared by Woodlot Alternatives, Inc. November 2005.


Executive Summary

During summer and fall 2005, Woodlot Alternatives, Inc. (Woodlot) conducted field surveys of bird and bat activity at Top Notch Wind Project in Fairfield and Norway, New York. The surveys are part of the planning process by PPM Atlantic Renewable (PPM) for a proposed wind project, which will include the erection of up to 42 wind turbines on predominately open agricultural land. Surveys included nighttime surveys of birds and bats using radar and bat echolocation detectors. The fall studies represent the second of two seasons of migration surveys undertaken by PPM at this site. The summer survey included detector surveys in various habitats throughout the project area to document general bat activity and species presence during that time of year.

The results of the field surveys provide useful information about site-specific migration activity and patterns in the vicinity of the Top Notch project area, especially when reviewed along with the results of the spring 2005 survey conducted at the same location. This analysis is a valuable tool for the assessment of risk to birds and bats during migration through the area.

*Radar Survey*

The fall field survey targeted 45 nights of radar surveys from September 1 to October 15, 2005. Nightly passage rates varied from 116 ± 19 targets per kilometer per hour (t/km/hr) to 1,351 ± 195 t/km/hr, with the overall passage rate for the entire survey period at 691 ± 51 t/km/hr. Mean flight direction through the project area was 198º ± 85º. The mean flight height of targets was 516 meters (m) ± 18 m (1,692' ± 59') above the radar site. The average nightly flight height ranged from 303 m ± 24 m (994' ± 79') to 800 m ± 40 m (2625' ± 131'). The percentage of targets flying below 125 m (410'), the approximate maximum height of the turbines that might be used at the project, each night ranged from less than 1 percent to 13 percent, with a seasonal average of 4 percent. In general, during nights when the highest percentage of birds was flying below 125 m, the wind speed was greater than on nights with fewer targets below 125 m.

Results from the fall survey vary slightly from the spring results. Both the mean fall seasonal passage rate (691 ± 51 t/km/hr) and flight height (516 ±18 or 1,692' ±59') were higher than the mean spring passage rate (509 ± 77 t/km/hr) and flight height (419 m ± 46 m or 1,375' ± 151') above the radar.

The mean flight direction, qualitative analysis of the surrounding topography and landscape, and mean flight altitude of targets passing over the project area indicates that avian migration in this area involves a broad front type of movement over the landscape. This type of broad front movement, particularly in conjunction with the high flight heights, demonstrates a limited avian mortality risk during fall migration. Additionally, the flight height of targets indicates that the vast majority of bird migration in the area occurs well above the height of the proposed wind turbines.

*Summer Bat Survey*

The summer field survey included documentation of summer bat activity through active and passive surveys with detectors during several three-night sampling periods. Passive sampling was conducted by placing a detector in an on-site meteorological measurement tower (met tower) at a height of approximately 30 m (100'). Active sampling included hand carrying a detector during the first four hours of the night along various landscape features in the project area, such as field edges, field hedgerows, roadsides, streams, and wet areas.

Passive sampling time totaled 72 hours and active sampling included approximately 13.5 hours of sampling. A total of 149 bat call sequences were recorded during the summer survey: 54 during the passive sampling and 95 during the active sampling. Active sampling detected bats at nearly 10 times the rate of active sampling. An average of 7 calls/hour were recorded during the active sampling while only 0.75 calls/hour were recorded at the passive detector located in the met tower guy wire array.

Recorded bat call sequences were identified to species, when possible. In the case of the genus *Myotis*, call sequences were identified only to genus. However, these calls were reviewed closely for the likelihood of any recorded sequences possibly being of the Indiana bat (*Myotis sodalis*). Characteristics used for this included the shape of the call sequence, the slope of the calls, and the maximum and minimum frequencies, which are parameters used by some national experts in attempts to identify Indiana bats from recorded calls. Calls without suitable characteristics for identification were classified as unknown.

Calls from the genus *Myotis* were the most commonly recorded calls (90) followed by those of the big brown bat (*Eptesicus fuscus*) (40). Of the *Myotis* calls, nearly all had characteristics most similar to the little brown bat (*Myotis lucifugus*), though several calls more closely resembled those of long-eared bat (*Myotis septentrionalis*).

*Fall Bat Survey*

The fall bat detector survey included deployment of 3 detectors for 34 continuous nights from August 19 to September 21, 2005. Two detectors were deployed at heights of approximately 15 m and 30 m (50' and 100') in the guy wire array of a met tower and one detector was placed 2 m (6') above the ground at the base of the tower.

At total of 173 bat call sequences were recorded during the fall sampling. The total number of calls detected on any given night ranged from 0 (September 10, 11, 21) to 24 (September 17), with corresponding detection rates of 0 to 8 calls/detector-night. The overall average number of calls recorded per detector-night was 1.7.

Of the 173 calls recorded, 137 were identified to species and/or genus. Big brown bats were the most common species documented (47), followed by silver-haired bats (*Lasionycteris noctivagans*) (44), hoary bat (*Lasiurus cinereus*) and *Myotis* (17 each), and eastern red bat (*Lasiurus borealis*) (11). Only 1 eastern pipistrelle (*Pipistrellus subflavus*) was documented and 36 calls were unidentifiable.

http://www.ppmenergy.com/pdf/DEIS/Appendicies/Appendix_D_Avian_and_Bat/5_-_Summer_and_Fall_2005_Radar/Fall_2005_Radar_Survey.pdf

# F. PENNSYLVANIA

## F.1 Casselman Wind Farm, PA

**Land Use/Topography –** Appalachian top, grassland adjacent to forest.

**Patterns of Pre-construction Bat Activity at a Proposed Wind Facility in South-Central Pennsylvania**. 2005 Annual Report. Prepared for Bats and Wind Energy Cooperative. Prepared by Edward Arnett, Bat Conservation International, John Hayes, Oregon State University, and Manuela Huso, Statistical Consulting. August 2006.

Executive Summary
A 5-year study was initiated in mid-summer 2005 to determine patterns of bat activity and evaluate the use of acoustic monitoring to predict fatality of bats at a proposed wind energy facility in south-central Pennsylvania. The primary objectives of this study are to 1) determine level and patterns of activity of different species groups of bats using the proposed wind facility prior to and after construction of turbines; 2) correlate bat activity with weather and other environmental variables; and 3) determine if indices of pre-construction bat activity can be used to predict post-construction bat fatalities at proposed wind facilities.

We recorded echolocation calls of bats with Anabat zero-crossing ultrasonic detectors programmed to record calls each day from one half-hour before sunset to one half-hour after sunrise each day of the study from 1 August to 1 November 2005. We used meteorlogical (met) towers and 22 m tall, portable, telescoping towers to vertically array detectors for acoustic sampling during this study. We recorded calls at proposed turbine locations from detectors deployed on 3 met towers (one detector at 1.5, 22, and 44 m high at each tower) and from 6 locations using portable towers (one detector at 1.5 and 22 m high at each tower) from a forested ridge and from 2 met towers and 4 portable tower locations on an open strip-mined ridge.

We recorded a total of 9,162 bat calls from all detectors and tower locations combined from 1 August through 1 November 2005. Bat activity was highly variable throughout the study period, but generally highest from mid-August through mid-September with brief peaks of high activity in October. Bat activity generally was highest immediately after sunset and declined through the night until just before sunrise the following morning. High (>35 kHz, e.g., Myotis species) and l w (<35 kHz, e.g., Lasiurus spp.) frequency-emitting echolocating bats tended to fly at different heights on the study area. While the two species groups had approximately equal activity levels at 22 m, activity rate of high frequency-emitting bats was estimated t be 9–59% higher than that of low frequency bats at 1.5 m. This trend was reversed at 44 m where it was estimated that activity rate of low frequency-emitting bats was 17–210% higher than that of high frequency bats. The height at which either species group tended to fly differed in the two

habitats. Although activity rates for either species group at 44 m were approximately equal in forest and open habitats, it was estimated that activity rate in the forest habitat was 9–61% higher than in open habitat at 1.5 m. This trend was most extreme at 22 m, where it was estimated that activity rate in forest habitat was 99–229% higher than in open habitat.

The best model and eleven other models in the 95% candidate set all included linear effects of temperature and wind speed, quadratic effect of temperature and the interaction of temperature with height. Total bat activity increased with increasing temperature up to about 19–21º C, after which activity began to decline. While bat activity was positively related to temperature, the effect differed at different heights. For every 1º C increase in temperature, bat activity increased 7–13% at 1.5 m, 0–7% at 22 m, but was unaffected by temperature at 44 m. The optimum temperature for maximum activity was similar for the two species groups in both habitats. Wind speed was less than 6.5 m/s (23.4 km/h) on 80% of the nights and the highest wind speed recorded was 15.7 m/s (56.5 km/h); even at wind speeds above 6.5 m/s, there was still some bat activity in both species groups. The effect of wind speed was the same for both species groups in both habitats and at all three heights. For each 1 m/s (3.6 km/h) increase in wind speed, activity rate was estimated to decrease by 11–39%. Activity patterns of the two species groups were similar in both open and forest habitats at 44 m, but at 22 m was between 2 and 3 times higher over forests than in the open habitat.

This study was conducted at one proposed wind energy facility located on a forested ridge and an open, reclaimed ridge that had been previously strip-mined, so statistical inferences are limited to this site. However, we believe that our findings likely reflect patterns of bat activity on similar forested and open ridges with comparable vegetation composition and topography in this region. We caution that our study only encompasses the late summer-fall period and does not represent a full period when bats are known to be active (generally April through November). Analyses presented in this report are exploratory, in part because so little data exist upon which to develop a priori, confirmatory hypotheses and associated candidate models. The current analysis only estimates activity rates and differences in activity patterns of two species groups (high and low frequency), in forested and open habitat, and at three heights.

We began a second year of pre-construction acoustic monitoring in mid-April 2006 that will continue through the end of October 2006. Turbine construction for this site is tentatively scheduled for summer-fall 2007, after which we will gather two years of post-construction activity and fatality data from April through October in 2008 and 2009. http://www.batcon.org/wind/BWEC%202005%20Annual%20Report.pdf

Plissner, J.H., T.J. Mabee, and B.A. Cooper. 2005. **A radar and visual study of bird and bat migration at the proposed Casselman and Martindale Wind Power Projects, Pennsylvania, Fall 2004**. Draft Report to Atlantic Renewable Energy Corporation.

## F.2 Martindale Wind Power Project, PA

**Land Use/Topography** – Appalachian ridgetop, forested

Plissner, J.H., T.J. Mabee, and B.A. Cooper. 2005. **A radar and visual study of bird and bat migration at the proposed Casselman and Martindale Wind Power Projects, Pennsylvania, Fall 2004**. Draft Report to Atlantic Renewable Energy Corporation.

## F.3 Meyersdale Wind Energy Center, PA

**Land use/Topography –** Appalachian ridgetop; forested

**Relationships between Bats and Wind Turbines in Pennsylvania and West Virginia: An Assessment of Fatality Search Protocols, Patterns of Fatality, and Behavioral Interactions with Wind Turbines.** Prepared for Bats and Wind Energy Cooperative. Prepared by Edward Arnett, Bat Conservation International, Wallace Erickson, Western Ecosystems Technology, Jessica Kerns, University of Maryland, and Jason Horn, Boston University. June 2005.

Key Findings

The relationships between bats and wind turbines were investigated at the Mountaineer Wind Energy Center in Tucker County, near Thomas, West Virginia, and at the Meyersdale Wind Energy Center in Somerset County near Meyersdale, Pennsylvania. The primary objectives were to compare results of daily versus weekly carcass searches, quantify bias corrections needed to more accurately estimate fatality, and recommend improved search protocols for bats. Assessments included correlating bat fatalities detected during daily searches with the previous nights' weather and turbine conditions, observing and quantifying behavior of bats encountering moving and non-moving blades at turbines with and without FAA lights, and evaluating the use of trained dogs to detect bat fatalities beneath turbines. Fatality searches were conducted at both sites between 31 July and 13 September 2004 with half of the turbines at each site searched daily and the other half weekly. Thermal imaging cameras were used to assess bat, bird, and insect activity at turbines only at Mountaineer from 2–27 August 2004.

Estimates of bat fatality are among the highest ever reported and support the contention that forested ridges are locations of especially high risk for bat fatality at wind facilities. This study only covered 6 weeks (31 July to September 13) in just one year and is not a measure of full season bat activity, behavior, or fatality. Estimated fatality rates from the 6-week period appeared to be as high during the first site visits in mid-July suggesting a significant number of fatalities may ha e occurred prior to the study, and the fatality rates likely continued at least through September and early October, as is reported by other studies.

Weekly searches at Mountaineer underestimated the fatality rate by nearly a factor of 3. A primary reason for this is that the timing of the weekly fatality searches at Mountaineer tended to occur before the larger fatality events. A better design would ha e been to search a portion of the turbines each day for 4 days rather than all turbines on one day,

thus balancing variation in timing of fatalities. Estimates for daily and weekly searches were similar at Meyersdale primarily because scavenging was very low. Mountaineer began operation one-year earlier than Meyersdale, and we hypothesize that scavenging could change through time at the Meyersdale facility as scavengers learn of a new food source, exhibiting a temporal influence on fatality search protocols. Also, differences in scavenging rates could be a function of species composition of bird and mammal scavengers at the different sites.

There are many possible sources of attraction that may explain bat fatalities. Ultrasound emissions may attract the curiosity of bats, although this hypothesis remains untested. Light sources have been shown to attract insects and therefore bats, but our fatality searches and thermal imaging data indicated no difference in bat fatality or activity at turbines with and without FAA recommended lighting. Bats may be investigating wind turbines to evaluate their potential as roosting sites. We observed bats making several check passes at turbine masts and landing on both the mast and a non-moving blade, lending support for this cause for attraction. This curiosity and investigation behavior would likely increase the probability of a collision with a moving blade over random chance alone. If there are ephemeral, abundant food resources at wind turbine sites, an increase in bats aloft may represent an attempt by both local and transient, migrating bats to take advantage of these resources. The high variation in numbers of both bats and insects that we observed on a nightly basis seems to support this hypothesis. We could not confirm if observed bats were local or migrants, but we often saw bats feeding and foraging around and in the rotor-swept zone of the turbine blades. Additionally, modifications to the landscape to construct the wind farm, including creating open space around turbines and the access road, may create favorable foraging habitats for both local and migratory bats.

Another significant finding of this research is that the distribution of bat activity throughout the night is uneven. We found that higher bat activity occurs in the first two hours after sunset. This observation combined with our findings that weather patterns appear to be predictors of bat activity and fatality, suggests that windows of high risk for collisions may be clearly identifiable with additional longer-term studies. If so, collisions and fatality could be greatly reduced by focusing mitigation efforts on these high-risk times.
http://www.batcon.org/wind/BWEC2004finalreport.pdf

## F.4 Swallow Farm, PA

**Land Use/Topography –** Off Appalachian ridge, reclaimed coal strip, grassland adjacent to forest.
**Studies –** Nocturnal migration study
Currently trying to obtain more information.

# G. VERMONT

## G.1 East Haven Wind Farm, VT

**Land use/Topography –** forested mountaintop dominated by red spruce and balsam fir; mountains are disjunct and not oriented in distinct ridges; little existing development.

**Breeding Bird Survey for the East Haven Windfarm, East Mountain Demonstration Project, Essex County, Vermont.** Prepared for East Haven Windfarm. Prepared by Curry & Kerlinger, LLC. October 2003.

Key Findings
A breeding bird study was conducted at the proposed East Mountain Demonstration Project (Project) site on East Mountain in Essex County, Vermont. The study was conducted after an avian risk assessment recommended that this type of study be conducted to determine whether endangered, threatened, or species of concern were present and to determine whether there were likely to be impacts to listed or common species that nest on the site resulting from construction of a small, 4 turbine wind power project. The object of the study was to identify the species, number of individuals, and distribution of those birds in the area where turbines are proposed. The study showed that the species observed are typical of northern forest and, to a lesser extent boreal forests. None of the species observed are listed either federally or by the state of Vermont and none are listed as Vermont species of concern. The study also showed that the potential for biologically significant numbers of collision fatalities involving nesting birds at the project site is minimal, and the displacement of nesting birds is likely to be minimal.
http://www.easthavenwindfarm.com/filing/high/ehwf-pk-3.pdf

**Avian Risk Assessment for the East Haven Windfarm, East Mountain Demonstration Project, Essex County, Vermont.** Prepared for East Haven Windfarm. Prepared by Curry and Kerlinger, LLC. July 2003.

Key Findings
This report details an Avian Risk Assessment for the proposed East Mountain Demonstration Project of the East Haven Windfarm, in East Haven, Essex County, Vermont (Project). The assessment includes a literature review, interviews with local and regional experts, and site visits conducted by an avian biologist. Together, these sources of information provide an indication of the type and number of birds that are known or suspected to use the project site. The information is then used to assess the degree of risk to birds from wind power development at that particular site. In addition, the concerns of regulators and environmental organizations are determined and incorporated into the risk assessment.

Based on the analysis, federally or state threatened or endangered species are not expected. Some Vermont species of concern may nest on or adjacent to the site, or frequent the site. East Mountain is unlikely to be a concentration site or important

stopover area for any type of migrant. During winter, few birds are likely to be present on site.

During the project's operational phase, collision impacts are not likely to be biologically significant. During the construction phase, construction activities could result in some disturbance and displacement of songbirds. However, such impacts are likely to be very small and not biologically significant. The risk to wintering and migrating birds during construction and operation is also not likely to be biologically significant.

The following recommendations were made to reduce the potential risk to birds.

- Electrical lines between wind turbines should be underground. FAA lighting for turbines would ideally be the lowest intensity red strobes (no constant-on beacons) possible with the longest time-off cycle allowable to reduce the probability of attracting night migrating songbirds. All other forms of lighting should be extinguished at night at or adjacent to the project site to avoid attracting night migrants to the vicinity of the turbines.
- Natural forestation should be allowed to proceed around turbines and along new roads to reduce the potential for forest fragmentation and subsequent impacts to forest nesting birds.
- A breeding bird study of the project site was recommended for determining if Vermont listed species or species of concern – particularly Bicknell's Thrush – are present, and for establishing baseline data on these and other birds. Baseline data would be used to assess the types of disturbances and fragmentation impacts that might occur as a result of the project and determine potential mitigation strategies. [This survey was subsequently performed in June and July of 2003].

http://www.easthavenwindfarm.com/filing/high/ehwf-pk-2.pdf

**Supplement to Avian Risk Assessment and Breeding Bird Survey, East Haven Windfarm – East Mountain Demonstration Project** (Response to Comments). November 2003.
http://www.easthavenwindfarm.com/filing/high/ehwf-pk-4.pdf

## G.2 Searsburg Wind Project, VT

**Land use/topography** – Mountain ridgeline; forested

Roy, R.D., S.K. Pelletier, and T. Peterson. 2005. **A radar survey of bird migration at the proposed Searsburg Wind Project in Searsburg, Vermont, Fall 2004.** Draft of Report to enXco.

**An Assessment of the Impacts of Green Mountain Power Corporation's Wind Power Facility on Breeding and Migrating Birds in Searsburg, Vermont. July 1996 – July 1998.** Prepared for the Vermont Department of Public Service. Prepared by Curry & Kerlinger. March 2002.

Executive Summary

A 6 megawatt, 11 turbine wind power development was constructed by Green Mountain Power Corporation in Searsburg, southern Vermont, in 1996. The turbines are Zond Z-40 turbines that stand 197 feet (about 60 m) above the ground (to the rotor tip) on tubular towers. To determine whether birds were impacted, a series of modified BA (Before, After) studies was conducted before construction (1993-1996), during (1996), and after (1997) construction on the project site. The studies were designed to monitor changes in breeding bird community (species composition and abundance) on the site, examine the behavior and numbers of songbirds migrating at night over the site and hawks migrating over the site in daylight, and search for carcasses of birds that might have collided with the turbines. Findings of the study are as follows.

- A literature search was conducted to determine the extent and diversity of bird fatalities associated with tall structures (wind turbines, towers, stacks, and buildings) in the eastern United States and Canada. In addition, the literature search examined the impact of ceilometers and other types of lights on avian behavior and fatalities at tall structures. The survey revealed an abundance of tower kill studies with few being conducted recently. There were only two studies that reported carcass searches at wind power facilities in the eastern United States and Canada.

- Breeding bird surveys (point counts taken at 21 points) were conducted in 1994 before construction of the turbines, 1996 during construction, and 1997 after construction. Although no major changes in species composition were found, the numbers of several interior forest breeding birds were lower after construction than before construction and several edge species were more numerous after construction. It is possible that the songs of some of these species could not be heard because of turbine noise during some surveys. Such effects may be the result of forest fragmentation. Further study could determine if interior forest species recover as roadsides and areas around turbines are reforested and to determine if at the same time edge species decline.

- Searches for nesting diurnal raptors, particularly Northern Goshawk, conducted in spring of 1994 revealed no raptors nesting on or adjacent to the turbine site. No evidence of raptors nesting on the site was found during breeding bird surveys in 1996 and 1997, although two sightings of Sharp-shinned Hawks within 4 km of the site suggest that this species nests nearby.

- Nocturnal migration of songbirds through the wind power facility during spring 1994 and 1997 and autumn 1996 and 1997 suggested that the site is not a predominant migratory pathway. The numbers of birds flying over the site were the same as, or less than, the numbers reported from other inland locations in New England and many fewer than reported from studies done farther south. Fewer migrants were counted after construction of the turbines, perhaps indicating avoidance of the immediate turbine area by migrants.

- Hawk migration counts taken in 1993, 1994, 1996, and 1997 revealed small numbers of these migrants. Numbers of hawks counted were lower or the same as most sites in New England and two orders of magnitude lower than the counts taken at such concentration locations as Cape May, New Jersey, Lighthouse Point, Connecticut, and Hawk Mountain, Pennsylvania. A small proportion of the hawks observed prior to construction flew near enough to the turbine area to be at risk. Fewer hawks were counted in the year after the turbines were constructed than in the years prior to construction, perhaps indicating avoidance behavior.

- Searches for dead birds were conducted adjacent to turbines during the period June through October. No carcasses were recovered. Scavenging was rare with some songbird carcasses (from road and window kills) remaining on the ground for two or more months. Two tests of observer efficiency revealed that the two observers found about 50% of songbird carcasses placed out at random.

Overall, results of the studies reported herein suggest that the Searsburg, Vermont wind power facility does not pose a major threat to avian populations that breed on the site or migrate through the site. However, fewer interior forest breeding songbirds were heard singing in the area immediately surrounding the turbines. This effect may be transitory in that these birds may habituate and recolonize as the sites are partially reforested. However, until this is demonstrated, this disturbance should be recognized as a potential impact of this type of development, especially in northeastern forests.
http://www.nrel.gov/docs/fy02osti/28591.pdf

## G.3 Sheffield Wind Farm, VT

**Land Use/Topography –** Mountain ridgelines; forested

**UPC Vermont Wind LLC – Sheffield Wind Farm Proposed Avian/Bat Mitigation Plan.** September 25, 2006.

Mitigation Plan Summary
If post-construction monitoring demonstrates that the Project is having an undue adverse impact on birds or bats, as determined in consultation with ANR, UPC will work with ANR to identify and implement appropriate and practical mitigation measures. Measures to be considered will take into account the available research information regarding the likely cause(s) of the impacts, as well as the likely costs/benefits of various mitigation alternatives. Examples of possible mitigation measures may include, but are not limited to: modified lighting, modified operations, installation of repellant devices, on-site habitat management, and habitat protection.
http://www.sheffieldwind.com/PDFs/Docket%207156%20-%20UPC%20Rebuttal%20Filing%20Sept%2025%202006/Roy/Exhibits/UPC-RR-Reb4_Proposed%20Avian%20Bat%20Mitigation%20Plan.pdf

**Summer-early fall 2006 bat detector surveys at the Sheffield Wind Farm project.** Memorandum to Dave Cowan, UPC from Bob Roy, Woodlot, Alternatives Inc. September 22, 2006.

This memo is being provided as an interim reporting method, as detector surveys are still ongoing. The results presented here are preliminary because we have not yet implemented our full QA/QC measures that we use when enumerating and identifying recorded echolocation data. Included will be nightly tallies of bat calls only, as identification analysis has not yet been conducted on the data set. The data presented will be only for the period from June 14 to September 11.

Bat detector surveys were implemented in the Sheffield Wind Farm project area on April 24, 2006. At that time, four bat detectors were deployed along the ridgeline of the northern turbine array (i.e., the ridgeline that includes Granby, Barrett, and Norris Mountains). The locations of those detectors were described in a July 16, 2006, memo.

On June 14, the detectors were rearranged and a fifth detector was added. The deployment of the detectors was as follows:
• One detector was deployed with its microphone approximately 100 feet above the ground at the Barrett Mountain met tower ("Barrett" detector);
• One detector was deployed in a dead yellow birch located along the northern side of the beaver wetland located just north of Libby Hill ("Yellow Birch" detector). The detector's microphone was located approximately 25 feet above the water surface;
• One detector was located at the lowest active beaver dam within the beaver wetland. The detector's microphone was placed approximately 5 feet above the water at the most open area of water surface on the impoundment ("Beaver Dam" detector);
• One detector was deployed with its microphone approximately 30 feet above the ground and pointed at an upward angle near the proposed Turbine 12 location, which is very near the peak of Libby Hill ("Turbine 12" detector). This detector was at the edge of a log landing located uphill and south of the beaver wetland on this ridge; and
• One detector was located at the opposite end of the Turbine 12 log landing, approximately 150 feet south of the other detector with its microphone located 20 feet above the ground and oriented across the opening of a small skid road ("Turbine 12b" detector). ***This detector was then moved*** to the Hardscrabble Mountain met tower ("Hardscrabble" detector) on June 29, 2006, and its microphone was located approximately 100 feet above the ground after a VANR request for some comparison detector data from the (at the time) southern part of the project area.

The detectors were checked periodically to download data and ensure proper operation. Due to the sensitivity of these electronic devices to harsh weather conditions and the long deployment periods between visits, the detectors occasionally operated intermittently. Additionally, the design of the storage ZCAIM device necessary for long-term deployment occasionally results in periods of powering down, even if the battery and battery recharge systems are operating correctly. There were also occasions when animals damaged the equipment, either by chewing the microphone cables or getting caught in the cables and breaking the cables loose. Finally, vandalism of a vehicle resulted in approximately two weeks of data from each detector being permanently lost.

A total of approximately 7,215 bat call sequence files were recorded by the five detectors during the June 14-September 11 deployment period (see following table). No calls were

recorded at the Barrett Mountain met tower, while nearly 3,900 call sequences were recorded at the Turbine 12 detector. Interestingly, calls from the beaver wetland represented only approximately 25 percent of the calls.
http://www.sheffieldwind.com/PDFs/Docket%207156%20-%20UPC%20Rebuttal%20Filing%20Sept%2025%202006/Roy/Exhibits/UPC-RR-Reb1d_Supplement%20Bat%20Memo%20Sept%2022%202006.pdf

**Sheffield Spring Avian Acoustic Survey.** Memorandum to Dave Cowan, UPC from Bob Roy, Woodlot Alternatives, Inc. August 16, 2006

Key Findings
Two avian acoustic monitoring systems were deployed at the proposed Sheffield Wind project area during the spring migration period. The two systems that were deployed were located at the upper Hardscrabble Mountain met tower and at the Barrett Mountain met tower. Each system consisted of a directional microphone and a digital audio recorder. Each detector was oriented straight up and it's detection cone was approximately 80-90º. Reported detection distances for these types of microphones are in the order of 1,000'. The recorders cannot be programmed to begin and end sampling so they operated continuously throughout the survey period from May 16 to June 10. Following the survey period, the recorded data were sorted to include only those that were recorded at night. Calls were analyzed and identified to species, when possible. Otherwise, they were identified to groups of species with similar calls, or identified as unknown

In 26 nights of sampling with both systems (a total of 52 recorder-nights) a total of only 33 calls were recorded, including 32 calls recorded at the Barrett Mountain station and one call at the Hardscrabble station. Although the number of calls recorded at the two stations differed, the total number of calls recorded overall was quite low, and therefore probably too small a sample size on which to base a comparison between the two stations.

As you know, we've always cautioned the interpretation and use of acoustic survey data. We've had varying levels of effectiveness during these types of surveys due to weather effects on electronic equipment and variation in the quality of the components of these systems. We have examined some of the daytime recordings to verify that each recording system was working but that does not provide a quantitative assessment of the audible detection and recording quality of each system. Consequently, I don't feel that the ratio of recorded flight calls accurately depicts the ratio of night migrants over the sites. This is, of course, in light of the on-site radar survey data and my experience at other northeastern ridgeline and mountaintop survey locations. Additionally, I feel that the chance events that this method documents – intermittently emitted flight calls – may play a considerable role in results from different sites, which is only magnified by small sample sizes.
http://www.sheffieldwind.com/PDFs/Docket%207156%20-%20UPC%20Rebuttal%20Filing%20Sept%2025%202006/Roy/Exhibits/UPC-RR-Reb1c_Supplement%20Bird%20Memo%20August%2016%202006.pdf

**June bat detector surveys for small-footed bats at the Duck Pond cliff in Sheffield.** Memorandum to Scott Darling,VANR from Bob Roy, Woodlot Alternatives, Inc. July 12, 2006.

Key Findings

Woodlot conducted bat detector surveys at a small cliff near Duck Pond in Sheffield on the night of June 14, 2006. This is the cliff area identified during the small-footed bat habitat assessment conducted for UPC's Sheffield Wind Farm project in (add month and year) as being wholly within the study area for that work. A subsequent field visit in fall 2005 verified the presence of suitable habitat.

The cliff faces south-southeast and Duck Pond is located just east of the eastern end of the cliff. The vertical portions of the cliff are relatively short, only approximately 10 meters high at most. The face of the cliff is highly fractured, with abundant cracks and loose boulders and ledge sections. Ledges with accumulated soil and small to medium-sized trees are abundant and break up any clear exposure of all but the top rim of the cliff (see photo). A thin to moderately wide band of talus is common along the bottom of the cliff, although at the western end of the cliff this talus is wider and extends up beyond the western end of the cliff area.

Weather during the night of data collection included clear skies, little wind, and temperatures starting in the low 70's and decreasing to the 50's. The data collection on June 14th included four Anabat detectors located along the face of the cliff and a fourth located at the east end of Duck Pond, approximately 30 m west of the outlet of the pond.

Bat detectors were deployed in two fashions. Three of the detectors were placed at a fixed location prior to sunset and set to begin recording at 8:00 pm and end at 6:00 am. These three detectors were the 'west end' detector, the 'east end' detector, and the 'pond' detector. The 'west end' and 'east end' detectors were suspended 2 to 5 meters below the upper rim of the cliff, depending on how high the open, vertical faces of the cliff were in those locations.

The 'center' detector was staffed for the first couple hours of the night. It was hand-held and moved in response to bats that were observed during that time. Once it got too dark to observe bats, it was left hanging in place and left out for the remainder of the night. The approximate locations of the three cliff detectors are marked on Photo 1, although the center detector can actually be seen on the photo. Photo 2 is a shot taken near the center detector.

Included with this memo are the downloaded files from each of the four detectors. In general, bat calls were recorded at all the detectors beginning from about ten minutes after 9:00 pm and ending 5 to 30 minutes after 4:00 am. The number of call files downloaded at each detector was as follows:

| Detector | Number of Files |
|---|---|
| West Detector | 159 |
| Center Detector | 474 |
| East Detector | 145 |
| Pond Detector | 141 |
| ***Total 919*** | |

Please note that not all of the call files are actual bat calls, although it is only a very small proportion of the files (anywhere from about 5 to 15 per site) that appear to be non-bat noises. There are also a number of calls that appear to be coming from two or more bats, sometimes by more than one species. However, because the weather conditions that night were optimal for bat activity a large number of high quality call files appear to be included within the attached data set.
http://www.sheffieldwind.com/PDFs/Docket%207156%20-%20UPC%20Rebuttal%20Filing%20Sept%2025%202006/Roy/Exhibits/UPC-RR-Reb1a_Supplement%20Bat%20Memo%20July%2012%202006.pdf

**Spring 2006 bat detector surveys at the Sheffield Wind Farm project.** Memorandum to Dave Cowan, UPC from Bob Roy, Woodlot, Alternatives Inc. July 16, 2006.

This memo is being provided as an interim reporting method, as detector surveys are still ongoing. The results presented here are preliminary, as we have not yet implemented our full QA/QC measures that we use when enumerating and identifying recorded echolocation data. Included will be nightly tallies of bat calls only as identification analysis has not yet been conducted on the data set. The data presented will be only for the period up to June 14th .

Bat detector surveys were implemented in the Sheffield Wind Farm project area on April 24, 2006. Four bat detectors were deployed along the ridgeline of the northern turbine array (i.e. the ridgeline that includes Granby, Barrett, and Norris Mountains). The detectors were deployed as follows:

•One detector was deployed with its microphone approximately 25’ above the ground and pointed at an upward angle near the peak of Granby Mountain. This detector was located at the edge of a heavy selection cut;
•One detector was deployed with its microphone approximately 30’ above the ground and pointed at an upward angle near the proposed Turbine 12 location, which is very near the peak of Libby Hill. This detector was at the edge of a log landing located uphill and south of the beaver wetland on this ridge;
•One detector was deployed with its microphone approximately 100’ above the ground at the Barrett Mountain met tower; and
•One detector was deployed with its microphone approximately 25’ above the ground and pointed at an upward angle just south of the saddle between Barrett and Norris Mountains. The detector site was at the edge of a selection cut and the microphone sat approximately 5’ above the shrub and sapling canopy developing in the cut.

The detectors were checked periodically to download data and ensure proper operation. There were several occasions when animals damaged the equipment, either by chewing

the microphone cables or getting caught in the cables and breaking the cables loose. Additionally, problems occurred with some of the solar battery recharging units after leaf-out.

A total of approximately 1,113 bat call sequence files were recorded by the four detectors during the April 24-June 13 deployment period (see attached table). Only 5 call sequences were recorded at the Barrett Mountain met tower while approximately 840 call sequences were recorded at the Granby Mountain detector. The vast majority of call sequences were recorded in the last two weeks of the deployment period. Interestingly, this corresponds with the emergence of leaves and flying insects. That time period may very well mark the end of the spring migration period and beginning of the summer bat activity period, although relatively little information on seasonal variation in bat activity using detectors exists.

The bat detectors were redeployed on June 14th and a fifth detector was added to the sampling program. Those detectors are still in place and are anticipated to stay in the project area until approximately October 15th.
http://www.sheffieldwind.com/PDFs/Docket%207156%20-%20UPC%20Rebuttal%20Filing%20Sept%2025%202006/Roy/Exhibits/UPC-RR-Reb1b_Supplement%20Bat%20Memo%20July%2016%202006.pdf

**A Spring 2005 Radar and Visual Survey of Bird Migration at the Proposed Sheffield Wind Farm in Sheffield and Sutton, Vermont.** Prepared for UPC Wind Management, LLC. Prepared by Woodlot Alternatives, Inc. January 2006.

Executive Summary

During spring 2005, field surveys of bird migration activity were conducted by Woodlot Alternatives, Inc. on Hardscrabble Mountain in Sheffield and Sutton, Vermont. The surveys are part of the planning process by UPC Wind Management, LLC for a proposed wind project, which will include the erection of up to 26 wind turbines on Hardscrabble and Norris mountaintops and ridgelines and would produce 35 to 45 megawatts of wind energy. Surveys included daytime surveys of migrating raptors and nighttime surveys of birds using marine radar. These surveys represent the second half of a two-season study of bird migration activity in the vicinity of the proposed project.

The results of the field surveys provide useful information about site-specific migration activity and patterns in the vicinity of the Sheffield Wind Farm project area, especially when reviewed along with results of the surveys conducted in fall 2004. These surveys provide valuable information for the assessment of risk to birds during migration through the area.

The spring field surveys also included 10 days of visual observation in April and May 2005. A total of 98 raptors, representing 10 species, were observed during the surveys, with an overall observation rate of 1.63 birds per hour of survey. Approximately 69 percent of the raptors observed were flying less than 125 meters (m) (410') above the ground, the approximate maximum height of the proposed turbines. These results are low relative to the previous fall. During the10 raptor survey days conducted in fall 2004, the

total number of raptors seen was 193, the total number of species was 10, the observation rate was 3.22 birds per hour, and percent observed flying lower than 125 m was 69. These observations (both in total number and observation rate and for both seasons) are considerably lower than other regional hawk migration count data.

The spring field survey included 20 nights of radar surveys to document the abundance, flight path, and flight height of migrants. Nightly passage rates varied from 12 ± 3 target/kilometer/hour (t/km/hr) to 440 ± 71 t/km/hr, and the overall passage rate for the entire survey period was 166 ± 31 t/km/hr. However, due to the physical setting of the radar location, passage rates are approximately 20 percent to 25 percent greater (overall rate of 199 to 208 t/km/hr). The mean flight direction through the project area was 40º ± 52º.

The mean flight height of all targets was 522 m ± 96 m (1,713' ± 315') above the radar site. The average nightly flight height ranged from 235 m ± 60 m (771' ± 197') to 820 m ± 147 m (2,690' ± 482'). The percent of targets observed flying below 125 m (410') also varied by night, from 0 percent to 31 percent. The seasonal average percentage of targets flying below this height was 6 percent.

Passage rates documented during radar studies in the fall of 2004 were only approximately half of those documented during the spring 2005 study, with a mean of 91 ± 18 t/km/hr (109 to 114 t/km/hr when the same 20 – 25 percent correction factor is used). The mean flight direction in the fall was 200º ± 63º. Interestingly, the mean flight height above the radar was very similar between the two seasons, with a mean flight height of 566 m ± 31 m (1,857' ± 164'). There was more variation in flight height in the spring, however, and the percent of targets flying below the maximum height of the proposed turbines in the spring (6%) was greater than in the fall (1%).

The flight characteristics documented with radar at the Sheffield Wind Farm are generally comparable to other studies conducted in the northeast and mid-Atlantic states using similar methods. In general, the passage rates at the Sheffield Wind Farm project area are low relative to other available studies (mean passage rates from other fall studies range from 193 to 661 t/km/hr and spring studies from 41 to 277 t/km/hr). With respect to flight height the results from these studies are consistent with those other studies in both the mean flight height being anywhere from 300 m (984') to 700 m (2,296') above the ground and the percent of targets flying below the height of wind turbines being from 1 to 6 percent.

No significant barriers to nocturnal bird movement are suspected to occur in the area. The mean flight direction, qualitative analysis of the surrounding landscape, and mean flight altitude of targets passing over the project area indicates that bird migration in this area is broad front. Additionally, the flight height of targets indicates that the vast majority of bird migration in the area occurs well above the height of the proposed wind turbines. http://www.sheffieldwind.com/PDFs/RR-3%20-%20Spring%202005%20Bird-Bat%20Migration%20Survey.pdf

**Bat Survey Summary Report for the Proposed Sheffield Wind Project in Sheffield and Sutton, Vermont.** Prepared for UPC Wind Management, LLC. Prepared by Woodlot Alternatives, Inc. January 2006.

Key Findings

Bat detector surveys were conducted during three migration seasons as part of assessment surveys for the proposed Sheffield Wind Farm in Sheffield and Sutton, Vermont. The surveys were conducted during the fall 2004, spring 2005, and fall 2005 migration seasons and used Anabat II® detectors to document the occurrence of bats on Hardscrabble Mountain and Barrett Mountain1 within the proposed wind farm development area. This report was prepared to present the results of all three seasons of bat surveys together in one document, focuses solely on the results of field investigations.

A total of 322 detector-nights of bat surveys have been conducted at the proposed Sheffield Wind Farm project. Detector surveys can and do provide useful information on bat communities in an area. The detector surveys conducted at Hardscrabble and Barrett mountains provide insight on the bat population present in the area during the spring and fall migration surveys. This is a particularly useful survey method for wind energy developments as impacts to bats, in the form collision-related mortality, has been identified as a potential concern at some existing facilities.

Survey results in the project area indicate that bat populations in the vicinity of the project include a number of common species in the Northeast (i.e., big brown bat and *myotids*) and others that are generally believed to be uncommon (eastern pipistrelle, hoary bat). Additionally, non-migratory species known to winter within Vermont were identified, as were the migratory tree-roosting bats that have been identified during fatality surveys at other wind facilities as possibly more susceptible to collisions with turbines.

Calls emitted by bats of the genus *Myotis* are generally difficult to reliably differentiate between using Anabat detectors. Consequently, the ability to definitively identify if the eastern small-footed bat (*Myotis leibii*), a Threatened species in Vermont, is limited. However, some trends within the *myotid* group do occur. In particular, the calls of little brown bat (*M. lucifugus*) and the northern long-eared bat (*M. septentrionalis*), the two most abundant species in the northeast, tend to have consistent characteristics with respect to the slope and frequency range of their calls (Appendix B Figures 1 and 2). Additionally, the eastern small-footed bat typically has a unique call shape at the lowest end of its call frequency. The calls recorded in the project area were most characteristic of the two common northeast species – little brown bat and northern long-eared bat – and it is believed that no eastern small-footed bats were detected.
http://www.sheffieldwind.com/PDFs/RR-4%20-%20Bat%20Survey%20Summary%20Report.pdf

**Assessment of potential small-footed bat habitat in the vicinity of the proposed Sheffield Wind Farm, Sheffield and Sutton, Vermont.** Prepared for UPC Wind Management, LLC. Prepared by Woodlot Alternatives, Inc. December 2005.

Key Findings

Woodlot Alternatives Inc. (Woodlot) was contracted by UPC Wind Management, LLC (UPC) to conduct a small-footed bat (*Myotis leibii*) habitat assessment for the Sheffield Wind Farm, located in Sheffield and Sutton, Vermont. The project will include 26 wind turbines with a capacity of 52 megawatts (MW). These turbines would be located predominantly on Hardscrabble and Norris mountains, as well as on some of the ridgelines and lower peaks around these two mountains.

Recent surveys at two existing wind facilities in West Virginia and Pennsylvania have documented relatively high collision mortality rates (Arnett *et al.* 2005). The species of bats identified in the study included big brown bat (*Eptesicus fuscus*), hoary bat (*Lasiurus cinereus*), little brown bat (*Myotis lucifugus*), northern long-eared bat (*M. septentrionalis*), silver-haired bat (*Lasionycteris noctivagans*), eastern pipistrelle (*Pipistrellus subflavus*), red bat (*Lasiurus borealis*), unknown *Myotis*, and other unknown bats. The small-footed bat, which is listed as Threatened in Vermont, was not found during mortality surveys at those facilities.

Given the status of the small-footed bat, UPC, in consultation with the Vermont Fish and Wildlife Department (FWD), initiated an assessment of habitat for this species, specifically naturally occurring summer maternity colony habitat, in the vicinity of the project. Natural maternity colony habitats include crack systems on cliffs and steep talus areas, although buildings and other human-made structures are also occasionally used (Whitaker and Hamilton 1998, Wilson and Ruff 1999, DeGraaf and Yamasaki 2001). This habitat assessment focused on identifying areas of naturally occurring potential maternity colony habitat, including cliff and talus habitat. The assessment was largely a desktop habitat assessment conducted using aerial photography and a 10-meter digital elevation model (DEM) of the project and surrounding area.

Results show that potential small-footed bat habitat does occur in the vicinity of the proposed Sheffield Wind Farm. This habitat, however, is limited in both the number of suitable sites and the overall extent of this habitat within the study area. The analysis indicated that much more potential habitat for maternity roosts occurs just outside of the 3-mile study area that was used for the assessment. The 3-mile nightly dispersal distance used was based on available information for a similar species, and not the small-footed bat. Though the likelihood is low, the potential for any smallfooted bats using these nearby sites occurring within the project area does exist. Consequently, those sites were included in this assessment.

Of six areas with potential maternity colony roost habitat, only two occurred either wholly or partly in the study area. Air photo verification was definitive for one site and field surveys in the area for other purposes confirm that the habitat at that site is suitable maternity colony habitat. However, the other appeared to consist of broken rock bands with some degree of canopy closure over part of the area.

As discussed and agreed upon with FWD, this study provided an assessment of areas with potential to be suitable small-footed bat maternity roost habitat. No field surveys to

confirm habitat conditions at these areas occurred as FWD agreed to undertake that work themselves. Field investigations by FWD should be conducted during the summer to confirm and characterize the conditions at these sites and determine whether further study is needed at any sites. These additional field studies could include detector or capturing techniques to confirm the use of these areas by bats and, specifically, by eastern small-footed bats.
http://www.sheffieldwind.com/PDFs/RR-5%20-%20Small-footed%20Bat%20Assessment.pdf

**A Fall 2004 Radar, Visual, and Acoustic Survey of Bird and Bat Migration at the Proposed Hardscrabble Mountain Wind Project in Sheffield, Vermont.** Prepared for UPC Wind Partners, LLC. Prepared by Woodlot Alternatives, Inc. July 2005.

Executive Summary

Field surveys of bird and bat migration activity were conducted by Woodlot Alternatives, Inc. on Hardscrabble Mountain in Sheffield and Sutton, Vermont. The project will include the erection of up to 35 wind turbines on mountaintops and ridgelines and would produce approximately 60 megawatts of wind energy. Surveys included daytime surveys of migrating raptors and nighttime surveys of birds and bats using a radar and bat echolocation detectors.

Raptor surveys were conducted on 10 days from September 11 to October 14, 2004. The results of the field surveys indicate that fall raptor migration in the Hardscrabble Mountain project area is low relative to other sites in the region. A total of 193 raptors, representing 10 species, were observed during the surveys. Approximately 31% of the raptors observed were flying less than 125 m above the ground. Differences in flight altitudes between species were observed, with small species, such as the accipiters and falcons, consistently flying lower than larger species.

Eighteen nights of migration radar surveys were conducted. Radar surveys included the collection and analysis of 1-minute video samples of the radar in surveillance (horizontal) operation, which documents the abundance and flight paths of migrants, and 10-minute samples of the radar in vertical operation, which documents the altitude of migrants. Nightly passage rates varied from 19 ± 5 t/km/hr to 320 ± 39 t/km/hr, and the overall passage rate for the entire survey period was 91 ± 18 t/km/hr. However, due to the physical setting of the radar location, passage rates are approximately 20% to 25% greater (overall rate of 109 to 114 targets/km/hr). A weak correlation between passage rate and wind direction was observed, with proportionally more migration occurring on nights with winds to the south.

Mean flight direction through the project area was 200º ± 63º. There was considerable night to night variation in mean direction, although within each night there was less variation. Flight direction was correlated with flight height, with migrants flying higher when flying south or southwest and lower when traveling in directions contrary to typical south-bound fall migration.

Flight direction was also correlated with wind speed ($r=0.742$, $p<0.01$). On nights when the wind speeds were greatest, flight direction was downwind even when that direction was contrary to typical fall migration flight directions. Alternatively, on nights with light winds, flight direction was typically southward, regardless of the wind direction, as migrants could easily fly into light headwinds.

The mean flight height of all targets was 566 m ± 31 m (1,857' ± 102') above the radar site. The average nightly flight height ranged from 331 m ± 50 m (1,020' ± 164') to 775 m ± 32 m (2,543' ± 105'). The percent of targets observed flying below 125 m (400') also varied by night, from 0% to 14%. The seasonal average percentage of targets flying below 125 m was 1%. As mentioned above, flight height was correlated with flight direction. Flight height was negatively correlated with wind speed and migrants flew at lower heights when the wind speeds were greatest.

No significant barriers to nocturnal bird movement are suspected to occur in the area. The mean flight direction, analysis of the surrounding, and mean flight altitude of targets passing over the project area indicates that bird migration in this area is broad front. Additionally, the flight height of targets indicates that the vast majority of bird migration in the area occurs well above the height of the proposed wind turbines.

One to 2 detectors were operated on 11 separate nights, yielding a total of 17 detector-nights and 206 hours of recordings. When two detectors were used, they were deployed at heights of 15 m and 30 m (50' and 100') in a meteorological measurement tower (met tower) and when only one was used it was deployed at 30 m. A total of 30 bat call sequences were recorded. The majority of these calls were recorded during the first 2 nights of sampling, when mean detection rates reached a maximum of 1.38 bat calls/hour at the lower detector. The overall bat detection rate over the course of the entire study was only 0.23 bat calls/hour. No bats were detected after September 14, 2004.

When possible, recorded bat calls were identified to species, Genus (in the case of *Myotis*), or as "unknown," based upon the shape of the call sequence, the slope, and the maximum and minimum frequencies. Of the 30 calls recorded, 28 were identified as *Myotis* spp. and 2 were identified as big brown bat (*Eptesicus fuscus*). The big brown bat calls were recorded by the lower detector on September 12 and the upper detector on September 14.

The collected data provides useful information on site-specific migration activity and patterns in the vicinity of the Hardscrabble Mountain project area. The information should prove useful in the assessment of risk to birds and bats migrating during the day and at night through the area.
http://www.sheffieldwind.com/PDFs/RR-2%20-%20Fall%202004%20Bird-Bat%20Migration%20Survey.pdf

# H. VIRGINIA

## H.1 Highland New Wind Development Project, VA

**Land Use/Topography** –Appalachian ridgetops; forest and farmland

**A Radar and Visual Study of Nocturnal Bird and Bat Migration at the Proposed Highland New Wind Development Project, Virginia, Fall 2005.** Prepared for Highland New Wind Development, LLC. Prepared by ABR, Inc. January 2006.

Executive Summary
This report presents the results of radar and visual studies of bird and bat migration conducted during 16 August-14 October 2005 at the proposed Highland New Wind Development area, located in the Allegheny Mountains of western Virginia. Radar and visual observations were conducted at two sites within the project area for ~7 h/night during 58 nights.

The primary goal of the study was to collect information on the migration characteristics of nocturnal birds (particularly passerines) during the fall migration period and secondarily to assess the extent of bat use to provide an overall assessment of the potential impacts to birds and bats from the proposed McBride Wind Project. Specifically, the objectives are to: (1) collect baseline information on migration characteristics (i.e., flight direction, migration passage rates, flight altitudes) of nocturnal targets (i.e., migratory birds and bats); (2) visually estimate the relative proportions of birds and bats within the rotor-swept area of the proposed wind turbines; and (3) estimate the number of birds and bats that would pass within the rotor swept area of the proposed wind turbines during the migratory season.

No differences in passage rates, flight altitudes, or observed proportions of birds and bats were found between the two survey sites.

Mean flight direction of targets observed on radar was 204°.

The mean nocturnal passage rate was 385 ± 55 targets/km/h and ranged among nights between 9 and 2,762 targets/km/h. Passage rates varied among hours of the night, with lowest mean rates occurring during the first hour after sunset.

The mean nocturnal flight altitude for the entire fall season was 442 ± 3 m agl. Mean flight altitudes observed on vertical radar were variable among nights, ranging from 211 to 721 m agl. Overall, 11.5% of targets flew ≤125 m agl.

Migration passage rates increased later in the fall season, were lower under conditions of low cloud layers and fog, and varied with lunar phases. Flight altitudes varied inversely with wind speeds during this study.

Using night-vision sampling methods to identify the taxa of low-altitude nocturnal migrants and other potential radar targets, we calculated the proportions of birds and bats

below maximal turbine height to be 88% birds and 12% bats between 16 August and 29 September.

Assuming an average of 10 nocturnal h/d, we calculated a turbine passage rate index of 3.4-24.7 avian migrants and bats passing within the area occupied by each proposed turbine each night at the project sites during fall 2005.
http://esm.versar.com/pprp/windpower/Highland-VA-Radar-Study2006.pdf

# I. WEST VIRGINIA

## I.1. Liberty Gap Wind Project, WV

**Land Use/Topography –** Appalachian ridgetop, forested.

Roy, R.D., S.K. Pelletier, and T. Peterson. 2005. **A radar and acoustic survey of bird and bat migration at the proposed Liberty Gap Wind Project in Franklin, West Virginia, Fall 2004.** Report to U. S. Wind Force.

## I.2. Mount Storm Wind Power Project, WV

**Land use/Topography** – Appalachian ridgeline; reclaimed coal strip, forest

**Nocturnal Bird Migration Over an Appalachian Ridge at a Proposed Wind Power Project.** Todd Mabee, Brian Cooper, Jonathan Plissner, ABR Inc., David Young, Western EcoSystem Technology Inc. 2006.

Abstract
Characteristics of nocturnal bird migration are poorly understood for many regions of the United States. This information will be critical in areas where wind power projects are proposed. We used portable marine radar to conduct a nocturnal bird migration study at multiple sites along the Allegheny Front, West Virginia, on 45 nights during fall 2003, to document migration characteristics at a proposed wind power project. Nocturnal passage rates were highly variable among nights, ranging from 8 to 852 targets/km/hour, with a seasonal mean of 241 ± 33 targets/km/hour at the primary (central) study site and 199 targets/km/hour for the entire proposed development. Mean flight altitudes also were highly variable among nights, ranging from 214 to 769 m above ground level (agl), with a mean flight altitude of 410 ± 2 m agl. Flight directions indicated that most migrants crossed, rather than followed, the Allegheny Front ridgeline. We believe portable marine radars, when coupled with a rigorous study design, can collect important baseline information on avian migration and address site specific questions posed at proposed developments. Concurrent collection of low-altitude migration and avian fatality data could help elucidate which metrics are most useful for predicting avian fatalities at wind power developments. (WILDLIFE SOCIETY BULLETIN 34(3):000-000;2006)
http://www.west-inc.com/reports/mabee_migration_manuscript.pdf

**Baseline Avian Studies, Mount Storm Wind Power Project, Grant County, West Virginia Final Report**. Prepared for NedPower Mount Storm LLC. Prepared by Western Ecosystems Technology Inc., Concord College, and ABR Inc. April 2004.

Key Findings

NedPower Mount Storm LLC is developing a wind farm, of up to 300 MW capacity, in Grant County, West Virginia. The *Mount Storm Wind Projec*t, is located approximately one mile east of Bismarck, West Virginia, along the primary ridgeline of the Allegheny Front and east of Mount Storm Lake. The avian baseline studies conducted at the site consisted of diurnal avian use surveys during the spring and fall migration; a nocturnal radar study during the fall migration; surveys of golden-winged warbler habitat during the spring and summer; a survey for breeding raptors and their nests during the late spring; roadside surveys for wintering bald eagles and other raptors; and surveys of common snipe and American woodcock habitat during the spring. The principal goals of the studies were to (1) provide baseline information on activity of avian species in the proposed development area useful in evaluating the impact to birds from the wind power development and (2) to provide information that would help in designing a wind plant that is less likely to expose avian species to potential collisions with turbines.

By comparing the overall diurnal bird use results from the study with other nearby studies (e.g. Mountaineer Wind Energy Center, Canaan Valley National Wildlife Refuge) and by assessing on-site bird use, diversity, and vegetation, the project area does not appear to contain any unique features or habitat types which concentrate spring or fall migrants and which receive far greater bird use than other sites. Due to the variety of vegetation types the project area contains substantial "edge" habitat resulting in increased avian diversity over vegetatively monotypic areas. Analysis of spatial and temporal avian use of the site did not indicate that any location, day, time of day, or season received substantially greater bird use and therefore may result in greater exposure or risk to birds.

Analysis of the nocturnal radar from within the proposed development area and adjacent areas indicates that nocturnal migrants do not concentrate their migratory flight paths along the Allegheny Front. Nocturnal target flight direction was variable and did not correlate between radar sampling sites or with the prevailing direction of the Allegheny Front. Greater than 50% of targets investigated for changes in flight direction passed over the ridgeline and continued south. Flight altitude data suggested that targets did not change their altitude in response to the ground below. Target altitude was significantly different between the central station on the Allegheny Front and the valley station to the east but was not different between stations along the primary ridgeline or the station west of the Allegheny Front. Passage rates were variable over time, date, and location supporting the general knowledge about fall migration occurring in pulses over time and space. Passage rates varied between the sampling stations along the Allegheny Front and were significantly different between the central station and the southern station. Passage rates were also significantly different between the central station and the stations to the west and east. Overall the risk to avian species from the wind plant on spring or fall migrants is not expected to be substantially different than results from other wind plants in the east.

Based on surveys for species of interest that could occur within the project area – golden-winged warbler, wintering bald eagle, American woodcock, and common snipe – the project is not expected to pose any extraordinary risk. No breeding golden-winged warblers were documented in the study area. Winter bald eagle use appears to be relatively low, variable over the winter season, and concentrated around Mount Storm Lake and Stony River Reservoir. American woodcock were documented in the project area and there may be some displacement affects if turbines are constructed in habitat suitable for American woodcocks. Common snipe was also observed in the project area, however, observations were within wetland areas which will be avoided by the project. Potential impacts to these species of interest from the project are expected to be low. http://www.west-inc.com/reports/mount_storm_final.pdf

**An Assessment of Potential Collision Mortality of Migrating Indiana Bats *(Myotis sodalis*) and Virginia Big-eared Bats *(Corynorhinus townsendii virginianus*) Traversing Between Caves. Supplement to: Biological Assessment for the Federally Endangered Indiana Bat *(Myotis sodalis*) and Virginia Big-eared Bat *(Corynorhinus townsendii virginianus*) NedPower Mount Storm Wind Project, Grant County, West Virginia** Prepared for NedPower Mount Storm LLC. Prepared by Western Ecosystems Technology, Inc. April 2004.

Key Findings

NedPower Mount Storm is proposing an approximately 300 megawatt (MW) wind farm in Grant County, West Virginia. Because the NedPower Mount Storm Wind Project is within the range of two federally endangered bat species, the Indiana bat *(Myotis sodalis*) and the Virginia big-eared bat *(Corynorhinus townsendii virginianus*), a Biological Assessment (BA) was prepared to address potential impacts of the project on these bats (see Johnson and Strickland 2003). Based on results of a habitat survey, information obtained on the ecology and habitat of the two endangered species, data on bat use of the project area, and current information on bat interactions with wind turbines, the BA concluded that construction and operation of the project would not likely affect either species.

The purpose of this report was to further assess the potential for the NedPower Mount Storm Project to impact Indiana bats migrating between summer breeding areas and hibernacula and Virginia big-eared bats moving between caves in the region. This report includes an analysis of the entire mortality data set from the Mountaineer Site, provides data on bat use of the Mount Storm Project area gleaned from the avian radar study conducted in the Fall of 2003, provides additional information on location of regional caves used by Indiana and Virginia big-eared bats, and further summarizes bat mortality data from other eastern wind plants built near Indiana bat hibernacula.

Based on this review it was concluded that construction and operation of the wind plant would not likely result in collision mortality of either migrating Indiana bats or Virginia big-eared bats traversing between caves.
http://www.west-inc.com/reports/finalbatsupplement.pdf

**A Radar Study of Nocturnal Bird Migration at the Proposed Mount Storm Wind Power Development, West Virginia, Fall 2003**. Prepared for Western Ecosystems Technology, Inc. and NedPower US LLC. Prepared by ABR, Inc. March 2004.

Executive Summary

- This report presents the results of a radar study of bird migration conducted during 3 September -17 October 2003 at the proposed Mt. Storm wind power development, located in northeastern West Virginia. Radar observations were conducted for ~6 h/night on 45 nights.
- The primary objectives of this study were to (1) collect baseline information on flight directions, migration passage rates, and flight altitudes of nocturnal passerine migrants at the proposed project area during fall 2003; (2) determine if nocturnal migrants concentrate along the proposed Allegheny Front within the project area; and (3) determine if there is variation in the amount or altitude of migrants at up to three locations along the ridge at a 1,500 m radius scale.
- At night, the mean flight direction of targets observed on radar was 184° ± 1°.
- Nocturnal passage rates were highly variable among nights during fall 2003, ranging from 8 to 852 targets/km/h. The mean nocturnal passage rate for the season was 241 ± 33 targets/km/h at the primary (central) study site and was estimated to be 199 targets/km/h for the entire proposed development area. Passage rates varied among hours of the night during fall 2003.
- Mean flight altitudes observed on radar were highly variable among nights during fall 2003. The mean nocturnal flight altitude was 410 ± 2 m agl. There were hourly differences in flight altitude among hours of the night in fall 2003, with lower altitudes occurring later in the evening. Overall, we estimated that 13% of nocturnal targets flew below 125 m agl across the length of the ridge encompassing the proposed development area.
- We calculated a mean passage rate of 36.3 targets/km/h flying below 125 m agl (or 2.91 × 10-4 targets/m2/h) at the proposed development, for the fall passerine migration season.
- We found no strong correlations between NEXRAD reflectivity values (representing bird densities) and radar migration passage rates during 25 nights with comparable data. Mean flight directions of radar targets, however, were correlated with the direction of migration.
- The key results of our study include the following: (1) relatively high mean passage rates (i.e., 199 targets/km/h ridge-wide); (2) approximately 20% of nights with passage rates much higher than the mean rate for the fall season; (3) variation in passage rates among some ridge sites (central:southern) and between ridge and off-ridge sites (central:western); (4) the weight of evidence suggesting that migrants did not concentrate along the Allegheny Front in fall 2003; (5) similar mean flight altitudes among sites (excluding valley); and (6) 13% of targets < 125 m agl ridge-wide, which is higher than the small number of comparable studies.
http://www.abrinc.com/news/Publications_Newsletters/Mt.%20Storm%20Radar%20Study%20of%20Nocturnal%20Bird%20Migration,%20WV,%20Fall%202003.pdf

**Biological Assessment for the Federally Endangered Indiana Bat *(Myotis sodalis)* and Virginia Big-eared Bat *(Corynorhinus townsendii virginianus)* NedPower Mount**

**Storm Wind Project, Grant County, West Virginia.** Prepared for NedPower Mount Storm LLC. Prepared by Western Ecosystems Technology, Inc. October 2003.

Key Findings
NedPower Mount Storm is proposing an approximately 300 megawatt (MW) wind farm in Grant County, West Virginia. The project area is within an area potentially used by two federally endangered bat species, the Indiana bat *(Myotis sodalis*) and the Virginia big-eared bat *(Corynorhinus townsendii virginianus*). The U.S. Fish and Wildlife Service expressed concern that the wind plant could impact these bats in two ways, direct mortality through collision with wind turbines and indirectly through loss or degradation of habitat. The results of this review show that construction and operation of the wind plant would not likely result in the "take" of either Indiana bats or Virginia big-eared bats. The Endangered Species Act defines "take" as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct". For this reason, the recommendation is that construction and operation of the Mount Storm wind project is not likely to adversely affect Indiana bat and Virginia big-eared bat.
http://www.west-inc.com/reports/final_ned_power_bat_ba.pdf

## I.3 Mountaineer Wind Energy Center, WV

**Land use/Topography –** Appalachian ridgetop; forested

**Relationships between Bats and Wind Turbines in Pennsylvania and West Virginia: An Assessment of Fatality Search Protocols, Patterns of Fatality, and Behavioral Interactions with Wind Turbines.** June 2005. *(See study under Meyersdale Wind Energy Center, Pennsylvania)*

**A Study of Bird and Bat Collision Fatalities at the Mountaineer Wind Energy Center, Tucker County, West Virginia: Annual Report for 2003.** Prepared for FPL Energy and Mountaineer Wind Energy Center Technical Review Committee. Prepared by Curry and Kerlinger, LLC. February 2004.

Executive Summary
A post-construction bird and bat collision fatality study was conducted between April 4 and November 11, 2003, at the Mountaineer Wind Energy Center (MWEC), Tucker County, West Virginia. Searches were conducted at the 44 turbines and 2 meteorology towers (1 guyed, 1 freestanding). Twenty-two rounds of surveys (8 in spring [26 days], 1 in summer [2 days], and 13 in fall [33 days]) were conducted at all turbines, amounting to 954 individual turbine searches. Turbines were searched for approximately 30 minutes each, to 60 m from the turbine base using a concentric circle-searching pattern. Two days (or more partial days) were required to search all turbines and the two meteorology towers at the Mountaineer Wind Energy Center. A carcass removal and searcher efficiency study was conducted in October.

A total of 69 avian carcasses representing 24 known species were found beneath turbines and at an electrical substation adjacent to turbine number 23. The majority of the carcasses (17 of 24 species, 70.8%) were nocturnal migrant songbirds or songbird-like

species. The remainder of the carcasses were represented by 8 individuals and included larger species (Red-tailed Hawk, Turkey Vulture, Wood Duck, and Ruffed Grouse), as well as 3 species not protected by the Migratory Bird Treaty Act. Nine carcasses were not identifiable to species. Most species were represented by 1-5 individuals, although 21 Red-eyed Vireos were found (30.4% of 69). The majority of the carcasses were found during the spring and fall searches; only one bird carcass was found during summer searches. No searches were conducted during the winter.

Of the 69 fatalities, 33 (47.8%) were found on May 23, 2003 at turbines number 22, 23, and 24, as well as the substation. This multiple fatality event was determined to have been caused by the combination of heavy fog and the presence of several sodium vapor lights at a substation located near turbine 23. Attraction by this type of lights has been reported repeatedly from sites in West Virginia and elsewhere. No multiple avian fatality events occurred at the site after the sodium vapor lights were extinguished.

Estimated of total avian fatalities were calculated excluding the fatalities from the May event. Mean carcass removal rate was 6.7 days and the detection probability for carcasses was 0.276. The estimated total number of fatalities for all types of birds at the MWEC during the search period was 178 birds (4.04 birds/turbine) + 33 birds found on May 23, 2003, with nocturnal migrant songbirds accounting for a majority of this estimate. This estimate is greater than the reported average of 2 birds/turbine/year at most wind energy facilities, but lower than the mortality estimate reported at another eastern US wind energy facility (Buffalo Mountain, TN).

A total of 475 bat carcasses representing 7 species were detected, mostly between August 18 and September 30 (92.5%). Red bats were most numerous, accounting for 42.1% of all carcasses found, with hoary (18.5%), eastern pipistrelle (18.3%), little brown (12.6%), silver-haired (5.9%), northern long-eared (1.3%), big brown (0.4%), and unidentified (0.8%) bats accounting for the remainder.

Estimates of total bat fatalities were calculated in a similar fashion to avian estimates. The estimated total number of bats killed at the site during the study period was 2092 bats (47.53 bats/turbine). Strict interpretation of these estimates is tentative, as the rates of detection and scavenging for bat carcasses may not be the same as rates for bird carcasses. The unique coloration of bats and their location closer to the turbine base may increase their likelihood of detection by searchers. Based on the observed patterns of decomposition and decay of carcasses at this study site, we believe that bats are not scavenged as quickly as birds.

Correlations between weather during fall migration, and freshly killed bat fatalities reveal no strong relation between wind speed, wind direction, temperature, or fog/precipitation at the site and bat fatalities. Increases in bat fatalities did not occur during inclement weather conditions. The highest numbers of freshly killed carcasses were found during periods of calm winds, high temperatures, and no precipitation.

No difference in numbers of birds or bat fatalities was found at lit versus unlit turbines. This suggest that FAA lighting (L-864 red strobes) did not attract nocturnal migrants,

unlike the lighting on communication towers (which include steady burning red, L-810 lights). Conversely, the multiple-fatality event on May 23, 2003 suggests that sodium vapor lighting attracts nocturnal migrants and should never be used at or near wind power facilities or other structures where collisions could result. The location of these lights and their use should be considered before beginning operation of wind power facilities.

We recommend that searches at wind facilities in the eastern United States be conducted on a weekly basis, particularly during avian migration. The larger numbers of bat fatalities at the MWEC suggest that searches should be conducted weekly during fall bat migration, commencing in mid-July. Ideally, daily searches of all turbines or a random subset of turbines during fall migration should be conducted to examine correlations between weather conditions and bat fatalities. Searches should be increased adaptively when searchers suspect large numbers of migrant bats are moving through the study site. This will increase the likelihood of recovering bats on the ground that were not killed after colliding with the turbines, thus decreasing the number of available carcasses. Additionally, we suggest that carcass removal and searcher efficiency studies using birds and bats be conducted several times during spring, summer, and fall to increase sample size and allow for seasonal comparisons.
http://www.wvhighlands.org/Birds/MountaineerFinalAvianRpt-%203-15-04PKJK.pdf