BREEDING BIRD INVENTORY AND ASSESSMENT FOR THE PROPOSED GEORGIA MOUNTAIN COMMUNITY WIND PROJECT CHITTENDEN AND FRANKLIN COUNTIES, VERMONT

Georgia Mountain as viewed from Madonna Peak, Morristown, VT Photo by Steven D. Faccio

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December 2008

VERMONT CENTER FOR ECOSTUDIES
UNITING PEOPLE & SCIENCE FOR CONSERVATION

Executive Summary

We conducted a breeding bird inventory and evaluated the potential impacts of the proposed Georgia Mountain Community Wind Project (Chittenden and Franklin Counties, Vermont) on the breeding bird community. This initiative isa, 3 to 5-wind turbine generation project. Field studies were conducted during June 2008. Our report provides the findings and interpretations from a single field season before construction, evaluating the potential impacts on breeding birds. We also make recommendations to minimize impacts if the project moves forward. Our objectives were to (1) document any state or federally endangered or threatened species, or species of concern; (2) determine species composition, richness, and abundance on the site, and 3) determine whether a more rigorous assessment is necessary before construction is initiated.

We carried out a combination of transect and point count surveys, to obtain breeding bird species diversity, relative abundance, and evenness within the Georgia Mountain study area. Point counts were established along the ¾ -mile ridgeline where turbine locations are proposed, and transects were established along the proposed access road and transmission line corridor. A total of 15 point counts were conducted at 11 survey points during 2 separate visits; four points were sampled on both visits.

At the proposed site, avian species diversity and density paralleled that of other forested regions in the state. We detected a total of 36 bird species during field work. Twenty-six species were detected at point counts, and 10 during transect surveys or between point count stations. Six species commonly associated with northern hardwood forests (Red-eyed Vireo, Veery, Ovenbird, Black-throated Blue Warbler, Eastern Wood Pewee, and Rose-breasted Grosbeak) comprised 52% of the 141 individuals detected during point counts. Most of the species detected on point count surveys nest primarily in mature forest habitat, and 15% of those detected were edge species.

We found a singing male Cerulean Warbler, a species of Special Concern in Vermont, along the proposed access road near the existing cell tower road. On transects and point counts, we detected nine species with a conservation concern status (Bird Conservation Region status and/or Vermont Species of Greatest Conservation Need) including a pair of soaring Red-shouldered Hawks. We did not find federal or Vermont endangered or threatened species in the study area. Because the elevation at Georgia Mountain reaches only 1440ft., it does not harbor montane spruce-fir habitat that would support Bicknell's Thrush (listed as Special Concern in VT) or other species of that habitat guild.

Habitat loss and fragmentation is a potential concern for any proposed wind power facility. However, the long-term impact of this proposed wind facility on breeding birds due to fragmentation is likely to be relatively low because: 1) the forest on the proposed site is already moderately fragmented due to the cell tower and access road, logging activities, and ATV trails, 2) significant portions of the proposed access road and transmission line follow existing roads and trails.

The project poses a low risk of collision to raptors outside of migration season. Raptors documented breeding or hunting at or near the site occur at low densities. Furthermore, they are

diurnal, visual predators that are at greater risk of collisions with powerlines or guy-wires that are difficult to see.

Although impacts of the proposed project to the breeding bird community are expected to be low, we recommend measures be taken to minimize them. Specifically, we recommend that temporarily disturbed areas be reclaimed, and infrastructure be sited on areas already disturbed or developed whenever possible. We do not believe that additional study is needed pre-construction to evaluate impacts on the local breeding bird community.

Introduction

Wind technology has firmly established its place at the table among viable, alternative sources of energy. Despite ever-changing short-term economic and political constraints, investors have made a substantial commitment to the exploration and proliferation of wind power. New investments in wind power have required a concomitant responsibility to examine the potential environmental impacts of wind power projects. Although it is beyond the scope of this particular assessment, it may be important to place potential negative impacts of wind projects in the context of their environmental benefits.

The unique geography, climatic conditions, prior land use, landscape matrix, and natural community composition of each proposed site location makes it challenging to extrapolate impact assessment results from one project site to another. The scientific community is still on a steep learning curve regarding the potential impacts of wind power, and documenting the actual impacts is still in its infancy in some regions, including the northeastern U.S., where most large-scale projects are relatively new. To date, a separate assessment for each project has generally been required, and arguably, necessary.

The Georgia Mountain Community Wind project is currently proposed with only 3 to 5 wind turbines and towers along the peak ridgeline. Despite the size of this project, the possible environmental impacts must still be assessed. Given the scale of the project, it is appropriate that an initial evaluation be carried out to determine whether a full-scale assessment, similar to the process for larger projects, is needed.

Assessing the potential impacts of the Georgia Mountain Community Wind Project on the breeding bird community requires gathering baseline, pre-construction information on the bird community that is currently using the site. Few assessments and even fewer controlled studies have examined the impacts of wind turbines on breeding birds, and results have been equivocal (e.g., Leddy et al. 1999, Delucas et al. 2005). Other wind project assessments in Vermont have found potential impacts on some forest bird species (e.g., Kerlinger 2002), including on state threatened species for projects at higher elevations (Rimmer and Faccio 2004). Studies specifically on wind projects have not demonstrated a threat to the breeding bird community in general. However, habitat loss and fragmentation from timber management and development have caused local breeding bird population changes (Villard et al. 1999) that can be used as a proxy for wind power projects that disturb, remove, or fragment similar amounts of forest cover.

Possible impacts of wind power development on breeding birds include 1) direct mortality from collisions with turbines, 2) direct loss of habitat, either temporary or permanent, 3) direct loss of nests or disturbance resulting in lower productivity during construction, 4) changes in the habitat that indirectly reduce productivity (e.g., changes in predator community or movements), 5) disturbance during construction or operation that interrupts behavioral cues or movements essential to successful breeding (e.g., territorial or courtship displays, pair formation, pair bonding, feeding of chicks), and 6) changes in habitat quality from the creation of edge habitat and reduction of contiguous forested areas (habitat fragmentation), resulting in avoidance of the project area and reduced density of some species. Foraging raptors are at risk of direct collision, but other breeding birds generally do not fly above the canopy and do not risk collision with turbines. Impacts 2 through 5 are potential threats to most breeding bird species, including raptors. Impact 6 is of greatest concern for forest-interior breeding bird species.

The purpose of our study was to carry out an initial assessment breeding bird inventory along the ridgeline area of the proposed Georgia Mountain Wind Project on the local breeding bird community. Our objectives were to: 1) determine whether endangered bird species, threatened bird species, or bird species of concern (federal or state) were present at the site, 2) develop a list of bird species using the site, 3) collect baseline quantitative data on bird species abundance and diversity in areas that would be directly impacted by the project, and 4) determine whether there is potential impact of the project on the breeding bird community

Study Area and Methods

The Georgia Mountain Community Wind Project study area consists of a roughly ¾ -mile long, northwest-southeast ridgeline lying just east of Arrowhead Mountain Lake and south of the Lamoille River. The twin summits of Georgia Mountain are primarily located in the Chittenden County town of Milton, but the northern summit is bisected by the county line, and is partially located in the Franklin County town of Georgia. This small ridge attains a maximum elevation of approximately 440m (1,440 ft). Habitat consists primarily of a rich northern hardwood forest matrix, embedded with some pockets of rich limy transitional hardwood forest, and dry-mesic red oak-red maple-beech forest on the shallow-soiled, broadly rounded summits. All three of these natural communities have been judged to be of statewide ecological significance (Engstrom and Lapin 1998). Although the forest was largely contiguous throughout the study area, small areas that were logged in the last 2-15 years, and a network of logging roads and ATV trails were present. The study area is located in the Champlain Lowlands bioregion, and in the Lower Great Lakes/Saint Lawrence Plain Bird Conservation Region (BCR), also known as BCR 13 (NABCI 2000).

Point Count and Transect Surveys

We used a combination of transect and point count surveys were used to obtain quantitative information on the breeding birds within the Georgia Mountain study area. We established sampling points around the proposed turbine locations at the south summit area in ArcGIS 9.2 (ESRI 2006) by overlaying point counts at 250-meter intervals along, and on either side of, the summit ridge on the Harrison property. We also placed one point on the north summit on land owned by the Green Crow Company (Fig. 1). To survey the proposed access road and

transmission line corridor, we conducted a transect survey primarily along existing ATV trails, along with point counts spaced approximately 300m apart.

We conducted a total of 15 point counts at 11 survey points during two separate visits. Four points (#s 8, 9, 13, and 14) were sampled on both visits (Fig. 1). During the first visit on 10 June, 10 we conducted point counts between 0430 and 0900. During the second visit on 19 June, between 0430 and 0930, we conducted five point counts, along with a transect survey of the proposed access road and transmission corridor areas. We surveyed each point count for five minutes, with observations divided into 1-minute intervals using a digital timer. We placed bird detections into 4 distance bands; 0 – 10m, 10 – 25m, 25 – 50m, and >50m; we recorded birds flying over the study site above the forest canopy as "flyovers." During the transect survey, we recorded all birds seen and heard, but we did not estimate distance and did not attempt to quantify relative abundance of species detected. We also recorded bird species seen or heard between point count stations, to include in an overall species list. All surveys were conducted by S. Faccio.

For all species detected at point counts, we calculated frequency of occurrence (the proportion of points at which a given species was detected), frequency of detection (the proportion of detections that were of a given species), and relative abundance (mean number of individuals per point). To help assess the overall diversity of the bird community, we also calculated species richness (total number of species detected), diversity, and evenness. We used Shannon's diversity index (H), which accounts for species richness, abundance, and evenness. In the formula below, *s* represents richness, and *p* is the proportionate representation of species *i* among the total number of species.

$$H = -\sum_{i=1}^{S} p_i \log p_i$$

Evenness was calculated by dividing H by the log of *s*.

To supplement the data we gathered in the field, we compiled Breeding Bird Atlas data that overlap with the proposed study site and with Arrowhead Lake.

Results

Point Count and Transect Surveys

We conducted point counts on 2 separate mornings; 10 and 19 June 2008. We detected 141 individual birds of 26 species, averaging 9.7 individuals per point (min. = 7, max. = 11) (Table 1, Appendix 2). Six species (Red-eyed Vireo, Veery, Ovenbird, Black-throated Blue Warbler, Eastern Wood Pewee, and Rose-breasted Grosbeak) made up the majority (52%) of observations during point counts (Table 1). The two most abundant species, Red-eyed Vireo and Veery, accounted for nearly a quarter of all observations (22%), and along with Black-throated Blue

Warbler, were the most widely distributed species, with Red-eyed Vireo and Black-throated Blue occurring on 91% of all point count stations and Veery on 82% (Table 1).

Mean species richness was 6.3 species per point (min. = 5, max. = 11) (Appendix 2). Shannon diversity index was 2.93 and the evenness index was 0.90 (Table 1). Ten species that were not detected during point count surveys were encountered incidentally between point count stations or during the transect survey, including a single male Cerulean Warbler (Table 2). This species is of conservation concern in the region (Rich et al. 2004), and the Nongame and Natural Heritage Program of the Vermont Fish and Wildlife Department (VFWD) lists its state rank as "S1" (very rare) and its status as "Special Concern" (VFWD 2008). We detected the Cerulean Warbler on 19 June at 0620 hours along a logging road at the start of the transect survey, approximately 30 m NW of the first hairpin turn on the cell tower road (Fig. 1, Appendix 1). It was first heard singing, then observed through binoculars for approximately one minute, and photographed from 25-35 m away before flying off (Fig. 1). Efforts to relocate the bird following the transect survey between 0845 and 0930 were unsuccessful. Additionally, a colleague returned to the site on 29 June specifically to search for Cerulean Warbler, but did not locate the species (T. Murin, personal communication).

Most (85%) of the species detected on point count surveys nest primarily in mature forest habitat, including 6 of the 7 species of conservation concern (Table 2). Two species (8%), Chestnut-sided Warbler and Grey Catbird, nest primarily in early-successional forest or along shrubby forest edges. Most observations of edge species were from points located in or near regenerating timber harvests. In addition, four Brown-headed Cowbirds, a brood parasite, were encountered at point count station 6, near a recently harvested timber stand.

Of the 36 species detected on point counts, transect surveys, or incidentally, 10 (28%) are listed as species of conservation concern in Vermont and/or within BCR 13 (Tables 1 and 2). All of these species are forest-dependant birds, and nine of these species primarily use mature forest habitat for nesting. Among the six most abundant species on point count surveys, four (67%) were listed as species of conservation concern: Veery, Black-throated Blue Warbler, Eastern Wood Pewee, and Rose-breasted Grosbeak (Table 1). No federal or Vermont endangered or threatened species were detected in the study area.

Discussion

General Observations

Results from Georgia Mountain point counts indicate that measures of avian diversity, including species richness, and the Shannon diversity and evenness indices, were typical for northern hardwood forests in Vermont. A 2007 inventory of the breeding bird community at Grandpa's Knob in Rutland County, Vermont (an 8-mile long, north-south ridgeline with elevations ranging from 800 to 2,000 feet) produced a comparable Shannon and evenness index (3.307 and 0.798 respectively, Renfrew and Faccio 2007). An earlier study at the Marsh-Billings-Rockefeller National Historical Park (500 acres, elevation 700-1400 ft)in Woodstock, Vermont also produced similar results (Faccio 2003). Although we detected half of the number of species (26 species) compared to Grandpa's Knob (63 species), this was primarily a function of differences in the size of the projects and respective study areas and habitat diversity. At Grandpa's Knob,

4.6 times more point counts were conducted compared to this study, and the habitat surveyed included a hayfield and several large clearcuts, in addition to extensive forested habitat. A standardized comparison is provided by mean species richness per point (6.3 species/point at both study sites), mean abundance (9.7 and 10.6 birds/point at Georgia Mt. and Grandpa's Knob, respectively), and the overall breeding bird community diversity as measured by the Shannon Index (similar at both sites, see above).

Displacement and Habitat Loss

The displacement of birds from areas within and surrounding wind farms due to visual intrusion and disturbance can result in the effective loss of suitable breeding habitat (Drewitt and Langston 2006). Few studies have considered the possibility of displacement for forest passerines, although Leddy et al. (1999) found higher densities of breeding grassland passerines with increasing distance from wind turbines, and higher densities in a control plot than within 80 m of the turbines, indicating that displacement did occur. Unfortunately, most studies of displacement due to disturbance are inconclusive, often because of the lack of before-and-after and control-impact (BACI) assessments (Drewitt and Langston 2006).

Habitat fragmentation is a relatively minor concern regarding birds breeding on Georgia Mountain. There is an enormous volume of peer-reviewed literature regarding the impacts of habitat fragmentation on forest bird species that we will not attempt to review here. In general, roads, turbines, and other infrastructure will cause a direct loss of habitat, create edge habitat, and reduce the size of contiguous forest patches. Each of these alterations results in decreased productivity for some breeding bird species. New roads and openings can provide travel lanes for predators, brood parasites, and invasive species, causing an increase in nest predation rates and lower productivity.

The Georgia Mountain proposed site is already fragmented by a cell tower, access road, and a network of logging roads and ATV trails. Permanent, new clearings will be required for 3 to 5 turbines, approximately 3100ft of 17-ft wide access road, and 1700' of 25-ft wide overhead transmission line, most of which will be located alongside an existing road. The remaining clearings will entail upgrading existing roads. Because of the extensive use of existing roads, new clearings, effects on the breeding bird community will be limited. Likely impacts include minor changes in bird species composition and abundance in favor of edge species and against some forest interior species. Despite the widely documented negative impacts of fragmentation, small-scale natural or human-induced vegetated forest openings can provide important habitat for recently-fledged individuals of some species that nest in forest interiors (e.g., Vitz and Rodewald 2006).

Raptors

During the transect survey, a pair of Red-shouldered Hawks was heard calling and observed soaring above the forest canopy about 200 m east of Point Count 12. Listed by VFWD as a species of Greatest Conservation Need (Kart et al. 2005), this raptor of swamps and lowland forest is widely distributed in the state at low densities relative to elsewhere in its range and relative to other widely distributed Buteos, particularly in the Champlain Valley. In the second Vermont Breeding Bird Atlas the species was detected in 36% fewer survey blocks in the Champlain Valley compared to the first atlas project conducted during the late-1970s (Vermont

Breeding Bird Atlas 1976-1981, 2003-2007). That trend was mirrored statewide, with atlas detections down by 37% across all bioregions between the first and second atlas. Although we found no evidence of a nest within the Georgia Mountain Wind Project study area, suitable breeding habitat for Red-shouldered Hawk exists, particularly on the lower slopes of Georgia Mountain adjacent to wetlands.

Arrowhead Lake provides important nesting and/or foraging habitat for several other raptor species, which could result in increased raptor activity near the proposed turbines. In 2008, four pairs of Osprey nested on Lake Arrowhead, and Bald Eagle use of the lake has been observed during migration (T. Scharf, pers. comm.). Osprey and Bald Eagles hunt for fish in large water bodies, while Peregrine Falcons (nesting approximately two miles east of Georgia Mt. at Arrowhead Mountain) and Merlins both hunt for small birds in open areas, including over open water (Sodhi et al. 1993, White et al. 2002). However, a review by Madders and Whitfield (2006) found that sensitivity of foraging raptors to displacement from wind turbine construction or operation was generally low. Although we did not survey raptors intensively or make specific attempts to document nest sites, we detected only two raptors during our surveys and expect impacts on breeding raptors to be extremely low.

Cerulean Warbler

Cerulean Warbler is of high conservation concern in the eastern U.S. due to its small population size and significant declines documented throughout its breeding range (Hamel 2000). In Vermont, the species is listed as Special Concern, a status used internally by the Vermont Endangered Species Committee for the purpose of monitoring species that could become state threatened. Considered an extremely rare breeder in Vermont, Cerulean Warbler has only been documented nesting in the northern Champlain Valley, most recently during the Vermont Breeding Bird Atlas (BBA) project at a location about 10 miles south of Georgia Mountain.

Because the singing male Cerulean Warbler observed at Georgia Mountain could not be relocated later the same morning or during a colleague's follow-up visit 10 days later, it seems likely that the individual observed was a "floating" male (an unpaired individual that may wander widely in search of a mate and/or suitable breeding habitat, and does not actively defend a territory). Observations of floating males are relatively common in the Northeast, which is at the eastern periphery of the species breeding range (R. Dettmers, U.S. Fish and Wildlife Service, personal communication). Therefore, we have little concern that the Georgia Mountain Community Wind Project would negatively impact the species.

We do not expect the proposed project to impact Cerulean Warblers regionally, including the pair located 10 miles south of Georgia Mountain. Loss of breeding habitat has been identified as a factor contributing to Cerulean Warbler population declines, along with loss of winter habitat and poor reproductive success due to weather and predation (Hamel 2000). In predominantly forested landscapes, however, breeding populations appear to coexist with forest management activities (Oliarnyk 1996). Although more research is needed, the threat of habitat destruction may be related to the proportion of the landscape that is forested. Oliarnyk (1996) reported that in landscapes which exceed 60-70% forested, small-scale habitat loss appear not to affect Cerulean Warblers. In landscapes dominated by agriculture, however, forest clearing may present a more serious threat to the species (Hamel et al. in press). The species is of particular

concern for wind power facilities in the mid-Atlantic states, which is at the core of Cerulean Warbler's breeding range and has suffered substantial habitat loss to development (National Research Council 2007).

Breeding Bird Atlas Data

The Vermont Breeding Bird Atlas is carried out every 25 years, and entails 5 years of surveys throughout the state on randomly selected 5 X 5 km blocks of land. The second generation Atlas for Vermont was recently completed, and field work was carried out in 2003-2007. Atlas participants record the bird species they detect by sight or sound as they traverse the various habitats within a block, until they find at least 75 species. They also obtain evidence of breeding for at least 35 of the species they find. Although these data are species lists for an entire 5 X 5km area and are not necessarily exhaustive, they give us some insight into the avian community found in the general area.

The Milton-2 and Milton-3 Atlas blocks include Arrowhead Lake and Georgia Mountain (Fig. 2). The Milton 3 block in particular includes the proposed wind project site. The Milton 2 block was surveyed in both the first (1976 – 1981) and second generation Atlases, whereas the Milton 3 block was surveyed only in the second Atlas. In the Milton 2 block, Osprey were found breeding on Arrowhead Lake, and Peregrine Falcons breed at Arrowhead Mt, approximately 2 miles east of Georgia Mt. Bald Eagles (threatened) and Least Bittern (Special Concern) were also found on this block, although evidence of breeding was not obtained. Both blocks show an array of species associated with northern hardwood forests, grasslands, wetlands, and shrub-dependent species (Table 3). Threatened or endangered species were not found in the Milton 3 block. Northern Harrier is the only Special Concern species found on this block, but this species forages and nests low to the ground and on the ground, respectively, in grassland habitat, and would not be at risk from the project during the breeding season.

Risk of Collision

We do not expect direct collision to be a significant risk for the suite of breeding birds we found at the proposed site or for species breeding nearby. The risk of collision during the breeding season varies among species depending on the behavior of the species (Smallwood and Thelander 2004). We detected two species that routinely fly above treeline during the breeding season: Common Raven and Red-shouldered Hawk. Ravens have been found to rarely collide with turbines in a California carcass study (Smallwood and Thelander 2004), but we could not find data on the potential risk to Red-shouldered Hawks.

The level of collision risk to raptors varies depending on site characteristics (topography and wind), tower construction, the species, and bird density (Erickson et al. 2001, Barrios and Rodriguez 2004). Although raptor collisions have been high in some regions (Smallwood and Thelander 2004, DeLucas et al 2005), the level of risk has been low to non-existent at sites in the eastern U.S. (See Erickson et al. 2001 for a review). The potential for displacement of local, foraging raptors by wind farms is considered low, but more research is needed on the effects that topography and weather have on local movements (Madders and Whitfield 2006). Howell and Noone (1992) found similar numbers of raptor nests before and after construction of Phase 1 of

the Montezuma Hills, California wind-energy facility, and a Swainson's Hawk nested within 800m of a small wind-energy plant in Oregon (Johnson et al. 2003).

Species such as Red-tailed Hawk, Osprey, and Peregrine Falcon nest within a few miles of the ridgeline and could pass over the site or actively hunt over the site during forays for prey. However, these raptors are all visual-oriented, diurnal predators that are at much greater risk of collisions with difficult-to-see powerlines and guy-wires, than they are with turbines and towers. Furthermore, raptors occur at low densities during the breeding season. Some risk of collision or displacement to raptors outside of migration season by a wind farm at Georgia Mountain exists, but it is likely quite low.

Recommendations for Construction and Siting of Turbines and Related Infrastructure

- Disturbed roadsides that will not be used after construction and turbine sites (up to the turbine base) should be reclaimed by replacing topsoil, which will allow for forest regeneration close to turbines, roads and other infrastructure, and reduce the extent of forest fragmentation and its impacts to forest nesting birds.

- To minimize forest fragmentation, turbines, roads, and other infrastructure should be sited in, or adjacent to existing natural or human-induced forest gaps (e.g., from previous logging), disturbed areas, and roads/trails whenever possible. The proposed plan appears to already follow this protocol.

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Table 1. Relative abundance, frequency of detection, frequency of occurrence, species richness, Shannon diversity index, evenness, and conservation status of birds detected during point count surveys at Georgia Mountain Wind Project, Vermont, June 2008. Species listed in descending order by relative abundance. Species in boldface are those of conservation concern in the state or Bird Conservation Region (BCR) 13.

Species	Relative abundance (birds/point)	Frequency of detection	Frequency of occurrence	Conservation Status[1]
Red-eyed Vireo	1.200	0.121	0.909	
Veery	**1.050**	**0.099**	**0.818**	**GCN**
Ovenbird	0.950	0.092	0.636	
Black-throated Blue Warbler	**0.900**	**0.092**	**0.909**	**GCN**
Eastern Wood Pewee	**0.550**	**0.064**	**0.545**	**RC**
Rose-breasted Grosbeak	**0.550**	**0.057**	**0.455**	**RS**
Blue Jay	0.500	0.050	0.273	
Scarlet Tanager	0.450	0.050	0.455	
Yellow-bellied Sapsucker	0.450	0.050	0.545	
American Redstart	0.300	0.035	0.455	
Dark-eyed Junco	0.300	0.035	0.273	
Black-throated Green Warbler	0.300	0.028	0.273	
Wood Thrush	**0.300**	**0.028**	**0.182**	**CC, RC**
Common Raven	0.300	0.021	0.091	
Brown-headed Cowbird	0.200	0.028	0.091	
Canada Warbler	**0.200**	**0.021**	**0.091**	**CC, RC**
Chestnut-sided Warbler	**0.200**	**0.021**	**0.182**	**GCN**
Blackburnian Warbler	0.200	0.014	0.273	
Hairy Woodpecker	0.150	0.014	0.182	
Black-and-White Warbler	0.150	0.021	0.273	
American Robin	0.100	0.014	0.182	
Downy Woodpecker	0.100	0.014	0.091	
Hermit Thrush	0.100	0.007	0.091	
Gray Catbird	0.050	0.007	0.091	
Pileated Woodpecker	0.050	0.007	0.091	
White-breasted Nuthatch	0.050	0.007	0.091	
Mean Relative Abundance	**9.650**			
Species Richness	**26**			
Shannon Diversity Index	**2.931**			
Evenness	**0.900**			

[1] GCN* – Vermont Species of Greatest Conservation Need as listed in the Vermont Wildlife Action Plan;
SC** – Vermont Species of Special Concern;
CC*** – Continental Concern Watch List Species are those which are most vulnerable at the continental scale;
RC*** – Regional Concern Species are those which are vulnerable within the region or BCR;
RS*** – Regional Stewardship Species are those for which a given BCR has a high responsibility.
*(see Kart et. al. 2005)
**(see Vermont Fish and Wildlife Department 2008)
***(see Rich et al. 2004)

Table 2. Species, observation date, locations of observation, and conservation status of birds detected during transect survey or incidentally between point count stations at Georgia Mountain Wind Project, Milton/Georgia, Vermont, 2008. Only species not detected during point count surveys are included. Species in boldface are those of conservation concern in the state or Bird Conservation Region (BCR) 13.

Species	Date Observed	Location Observed	Conservation Status[1]
Ruffed Grouse	**10 June 19 June**	**Near cell tower; Family group observed during transect survey**	**GCN**
Ruby-throated Hummingbird	10 June	Near cell tower	
Least Flycatcher	10 June	Near cell tower	
Great Crested Flycatcher	10 June 19 June	E of summit near point 6; During transect survey	
Black-capped Chickadee	19 June	During transect survey	
Cedar Waxwing	19 June	During transect survey	
Mourning Warbler	19 June	During transect survey	
Cerulean Warbler	**19 June**	**At start of transect survey, 30m from cell tower road**	**GCN, SC, CC, RC**
Indigo Bunting	10 June	E of summit near point 6	
Red-shouldered Hawk	**19 June**	**Pair soaring and calling above canopy during transect survey**	**GCN**

[1] See Table 1 for conservation status ranks

Table 3. Species found in Milton2 and Milton3 blocks (Fig. 2, Vermont Breeding Bird Atlas 1976-1981, 2003-2007). Milton3 includes the Georgia Mountain Community Wind Project site; Milton2 is adjacent and directly north of Milton3, and includes Arrowhead Lake. OB = Observed (no breeding), PO = possible breeding, PR=probable breeding, CO = confirmed breeding.

	Milton2 Block			Milton3 Block
Species	**2003-2007**	**1976-1981**		**2003-2007**
Canada Goose	CO	PO		CO
Wood Duck	CO			PR
American Black Duck	PO	PO		
Mallard	CO			CO
Blue-winged Teal		PO		
Lesser Scaup				OB
Hooded Merganser	CO			PO
Common Merganser	CO			PO
Ruffed Grouse	CO	CO		CO
Pied-billed Grebe	PR			
American Bittern	PO			
Least Bittern	PO			
Great Blue Heron	PO	PO		
Green Heron		CO		
Wild Turkey				CO

Species	Milton2 Block			Milton3 Block
	2003-2007	1976-1981		2003-2007
Double-crested Cormorant				OB
American Bittern				PR
Black-crowned Night-Heron				OB
Turkey Vulture	PO	PO		PO
Osprey	CO			PR
Bald Eagle				PO
Northern Harrier				CO
Sharp-shinned Hawk	PO			PO
Red-shouldered Hawk				PR
Broad-winged Hawk				PR
Cooper's Hawk	PO			
Red-tailed Hawk	PO	CO		PR
American Kestrel	PR	PO		PR
Peregrine Falcon	CO			
Virginia Rail	PR			PR
Killdeer	CO	PO		CO
Spotted Sandpiper	PR	PO		
Wilson's Snipe	PR	PO		PR
American Woodcock		PO		PR
Ring-billed Gull	OB			OB
Herring Gull	OB			
Caspian Tern	OB			
Rock Pigeon	CO	CO		CO
Mourning Dove	CO	PR		CO
Black-billed Cuckoo	PO	PO		PR
Yellow-billed Cuckoo				PR
Great Horned Owl		PO		
Barred Owl				CO
Common Nighthawk				PO
Chimney Swift		PO		PR
Ruby-throated Hummingbird	PR	PR		PR
Belted Kingfisher	CO	CO		PR
Yellow-bellied Sapsucker	CO	CO		PR
Downy Woodpecker	CO	CO		CO
Hairy Woodpecker	CO	CO		PR
Northern Flicker	PR	CO		PR
Pileated Woodpecker	CO	PO		PR
Eastern Wood-Pewee	PR	PR		CO
Alder Flycatcher	PR			CO
Willow Flycatcher	PR			PR
Least Flycatcher	PR	PR		PO

Species	Milton2 Block			Milton3 Block
	2003-2007	1976-1981		2003-2007
Eastern Phoebe	CO	CO		CO
Great Crested Flycatcher	PR	PR		PR
Eastern Kingbird	PR	CO		CO
Yellow-throated Vireo		PR		PO
Blue-headed Vireo	PO			PR
Warbling Vireo	PR	PR		CO
Red-eyed Vireo	CO	CO		PR
Blue Jay	CO	CO		CO
American Crow	CO	PO		CO
Common Raven	PO	PO		CO
Purple Martin		PO		
Tree Swallow	CO	CO		CO
Northern Rough-winged Swallow	CO	PR		
Bank Swallow	CO	PO		
Barn Swallow	CO	CO		CO
Black-capped Chickadee	CO	CO		CO
Tufted Titmouse	CO			PR
Red-breasted Nuthatch	CO	CO		PR
White-breasted Nuthatch	CO	PR		CO
Brown Creeper	PR	PR		CO
House Wren	CO	CO		CO
Winter Wren	PO	CO		PR
Marsh Wren	PR			PR
Golden-crowned Kinglet				PO
Eastern Bluebird	CO			
Veery	CO	PR		CO
Hermit Thrush	CO	CO		PR
Wood Thrush	PR	CO		PR
American Robin	CO	CO		CO
Gray Catbird	CO	CO		CO
Northern Mockingbird	PO	PR		
Brown Thrasher	PR	CO		CO
European Starling	CO	CO		CO
Cedar Waxwing	PR	PO		PR
Blue-winged Warbler				CO
Golden-winged Warbler				CO
Nashville Warbler	PR	CO		PO
Northern Parula				PO
Yellow Warbler	CO	CO		CO
Chestnut-sided Warbler	CO	CO		CO
Black-throated Blue Warbler	CO	PR		CO

Species	Milton2 Block			Milton3 Block
	2003-2007	1976-1981		2003-2007
Yellow-rumped Warbler	PR	PR		
Black-throated Green Warbler	PR	PR		PR
Blackburnian Warbler		CO		PR
Pine Warbler	CO	PR		PR
Black-and-white Warbler	PR	PR		PR
American Redstart	CO	CO		PR
Ovenbird	CO	PR		PR
Northern Waterthrush	PR			PO
Mourning Warbler	PR	CO		PR
Common Yellowthroat	PR	CO		CO
Canada Warbler		PR		
Scarlet Tanager	PR	CO		PR
Eastern Towhee	CO	CO		
Chipping Sparrow	CO	CO		CO
Field Sparrow		CO		
Savannah Sparrow	PR			CO
Song Sparrow	CO	CO		CO
Swamp Sparrow	PR			CO
White-throated Sparrow	PR	CO		PR
Dark-eyed Junco		CO		PO
Northern Cardinal	CO			CO
Rose-breasted Grosbeak	CO	CO		CO
Indigo Bunting	PR	CO		CO
Bobolink	PR	PR		CO
Red-winged Blackbird	CO	CO		CO
Eastern Meadowlark	PR	PR		PR
Common Grackle	CO	CO		CO
Brown-headed Cowbird	CO	CO		PO
Baltimore Oriole	CO	CO		CO
Purple Finch	PO			
House Finch	PR			
American Goldfinch	PR	PR		CO
Evening Grosbeak				PR
House Sparrow	CO	CO		CO

Appendix 1. Coordinates (Decimal Degrees, NAD 83) of 11 point count stations surveyed and location of Cerulean Warbler observation at Georgia Mountain Wind Project, Vermont, June 2008.

Point Identification	**Latitude**	**Longitude**
Point Count 1	44.65913993	-73.07161993
Point Count 2	44.65721000	-73.06987993
Point Count 4	44.65725996	-73.06658995
Point Count 6	44.66098999	-73.06601998
Point Count 7	44.66286996	-73.06792997
Point Count 8	44.66106995	-73.06990994
Point Count 9	44.65903994	-73.06847999
Point Count 12	44.65349531	-73.07817165
Point Count 13	44.65459845	-73.07117787
Point Count 14	44.66488992	-73.07124996
Point Count 15	44.65696525	-73.07160552
Cerulean Warbler Location	44.65247902	-73.07068501

Appendix 2. Total number of individuals and species detected at each point count station, Georgia Mountain Wind Project, Milton/Georgia, Vermont, June 2008. Species listed in descending order of abundance. All points surveyed once, except points 8, 9, 13, and 14 which were sampled twice. Species in boldface are those of conservation concern in the state or Bird Conservation Region 13 (see Table 1 for specific ranks).

Species	Total # of Points	Point Count Station Number											Grand Total
		1	2	4	6	7	8	9	12	13	14	15	
Red-eyed Vireo	10	1	1	1	1	2	1		1	3	4	2	17
Black-throated Blue Warbler	**10**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**1**	**1**		**13**
Veery	**9**	**1**		**1**	**1**	**2**	**1**	**3**	**2**	**2**		**1**	**14**
Ovenbird	7		2		1		2	3	1	3	1		13
Eastern Wood Pewee	**6**	**1**			**1**		**1**	**2**			**2**	**2**	**9**
Yellow-bellied Sapsucker	6		1		1				1	1	1	2	7
Rose-breasted Grosbeak	**5**			**1**			**4**	**1**	**1**	**1**			**8**
Scarlet Tanager	5	1				1	1			3	1		7
American Redstart	5			1		1	1		1	1			5
Blue Jay	3	2					4				1		7
Dark-eyed Junco	3			1				2			2		5
Black-throated Green Warbler	3			1			1				2		4
Black-and-White Warbler	3		1		1							1	3
Chestnut-sided Warbler	**3**				**1**			**1**			**1**		**3**
Wood Thrush	**2**		**1**					**3**					**4**
Canada Warbler	**2**			**1**				**2**					**3**
American Robin	2					1				1			2
Hairy Woodpecker	2			1			1						2
Brown-headed Cowbird	1				4								4
Common Raven	1										3		3
Blackburnian Warbler	1							2					2
Downy Woodpecker	1					2							2
Gray Catbird	1		1										1
Hermit Thrush	1							1					1
Pileated Woodpecker	1			1									1
White-breasted Nuthatch	1	1											1
Total number of individuals		8	8	10	12	10	19	22	9	16	19	8	141
Species richness		7	7	10	9	7	11	11	7	9	11	5	26