Use of Whiteface Mountain by Bicknell's Thrush and other Montane Forest Bird Species

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Executive Summary: The Wildlife Conservation Society (WCS) was contracted by the Olympic Regional Development Authority (ORDA) to assess the use of Whiteface Mtn. by Bicknell's thrush (*Catharus bicknelli*), determining, at a minimum, the presence or absence of the species at a number of locations on the mountain. A species of special concern in New York State, Bicknell's thrush makes use of high elevation conifer forest such as that found on Whiteface and other Adirondack peaks for breeding and nesting habitat during the summer months. Proposed ski trail expansion on Whiteface has raised concerns about the potential for impacts of new trail development on Bicknell's thrush habitat. We surveyed a total of 27 sample points on the mountain in 5 categories: (1) existing glade, (2) proposed glade, (3) existing trail, (4) proposed trail, and (5) control areas. Study points were sampled using standard point count methods to monitor the presence of Bicknell's thrush (BITH) and 4 other high elevation bird species: blackpoll warbler (BLPW), Swainson's thrush (SWTH), winter wren (WIWR), and white-throated sparrow (WTSP). These 5 species are also monitored on an annual basis by Mtn. Birdwatch, a volunteer, long-term monitoring program for montane forest birds that are particularly susceptible to climate change and other stresses in the northeast. We found no significant differences in the total number of individuals, total number of species, total number of Mtn. Birdwatch species, or total number of Bicknell's thrush detected among existing ski trails, existing glades, proposed ski trails, proposed glades, and control areas. Our sample sizes for some forest types were small due to the configuration of habitat on the mountain itself, and so future monitoring will help to further elucidate patterns. We believe that our power to detect statistical differences was good for total birds and total species, but was not as good for individual species differences due to higher variability at the individual species level. Preliminary analyses of the first year's data show that existing ski trails and glades do not differ statistically in terms of abundance or species richness for montane forest birds including Bicknell's thrush. Some trends appeared in the data, however, showing that control areas may have higher total bird abundance and

higher diversity of bird species than existing ski trails and glades. Glading, in particular, may be detrimental to habitat quality for Bicknell's thrush.

Introduction

The Bicknell's thrush is a species of great interest in the northeastern United States, both for birders and scientists alike. The species breeds in high elevation conifer forests, primarily above 3000 ft., on mountaintops from the Catskills to northern Maine. It is among the most rare and probably most threatened species in North America, and is ranked as the nearctic Neotropical migrant of highest conservation priority in the Northeast (Rimmer *et al.* 2001).

Bicknell's thrush habitat in the U.S. consists of montane forests dominated by balsam fir (*Abies balsamea*), with lesser amounts of red (*Picea rubens*) and black spruce (*Picea mariana*), white birch (*Betula papyrifera*), mountain ash (*Sorbus americana*), and other hardwood species. It is adapted to naturally disturbed habitats and historically probably sought out patches of regenerating forest caused by fir waves, wind throw, ice and snow damage, fire, and insect outbreaks, as well as the chronically disturbed stunted conifer forests found at high elevations in the northeast (Rimmer *et al.* 2001). Highest densities of the species are often found in continually disturbed (high winds, heavy winter ice accumulation) stands of dense, stunted fir on exposed ridgelines or along edges of human-created openings, or in regenerating fir waves (Rimmer *et al.* 2001). More than 90% of birds are believed to breed in the U.S. (versus Canada), with the Adirondacks containing the largest area of its montane breeding habitat, followed by NH, ME, VT, and the Catskills.

Bicknell's thrush wintering habitat is even more restricted than its breeding habitat, with the species occurring regularly on only 5 islands in the Greater Antilles. It prefers mesic to wet broadleaf montane forests in the Dominican Republic, Haiti, Cuba, Jamaica, and Puerto Rico. Large-scale loss and degradation of wintering habitat pose the greatest threat to the long-term viability of this species (Rimmer *et al.* 2001).

Bicknell's thrush is not well-sampled by traditional bird monitoring methods due to its preference for high elevation habitat and its uncommon mating system. Both males and females mate with multiple partners, multiple paternity is common, and more than one male often feeds nestlings at a given nest. These characteristics make it poorly sampled by bird count methods that rely on more common territorial mating systems found in many bird species. Estimates of breeding densities for the species are unreliable at best (Rimmer *et al.* 2001). Though estimation of breeding densities are difficult to obtain, Bicknell's thrush is believed to be vulnerable to extinction and has been added to the Red List of Threatened Species by the World Conservation Union. As a habitat specialist of high elevation conifer forests, it is susceptible to a number of threats on the breeding grounds including pollution (acid rain, mercury), recreational development, cell tower construction, wind power development, and climate change.

This report details the first of three seasons of field work conducted by the Wildlife Conservation Society to examine the potential impacts of ski area development on breeding habitat for Bicknell's thrush and other montane forest species on Whiteface Mtn. in the Adirondacks of New York State.

Study Area

Whiteface Mtn. is located in the high peaks region of the Adirondacks and contains approximately 1,020 acres of suitable Bicknell's thrush breeding habitat, with approximately 27 acres of suitable habitat within the proposed Tree Island Pod expansion area. Elevations in the high peaks region range from 1,000 – 5,300 ft. The study site is characterized by spruce-fir forest at high elevations and transitions into a mix of softwood and hardwood species including paper birch and red maple (*Acer rubrum*) at low elevations.

Methods

We used standard point count methods to assess presence/absence and relative abundance of BITH and other high elevation bird species on Whiteface Mtn. (Ralph *et al.* 1995, Rosenstock *et al.* 2002, Thompson 2002). In a previous report to ORDA by the Vermont Institute of Natural Science, distance sampling methods were suggested as a means by which to obtain density estimates of BITH on Whiteface Mtn. However, authors of that report and several others discussed the limitations of the distance sampling approach in providing reliable density estimates, both because of the unique characteristics of the Bicknell's thrush mating system, and also due to the difficulty of meeting stringent assumptions of distance sampling methods (Farnsworth *et al.* 2002, Ralph *et al.* 1995, Rimmer *et al.* 2004, Rosenstock *et al.* 2002, Thompson 2002). Rimmer *et al.* (2004), in their draft report to ORDA, mention that these limitations, coupled with the single-site study design of the work on Whiteface, mean that distance sampling methods used in this study are unlikely to produce statistically defensible results. In an effort to make the best attempt possible, given these constraints, to obtain reliable information on BITH and other species, we adopted a point count method that allows for calculation of densities for individual species, if adequate detections are made. Standard distance sampling methods require that the distance to each bird detected be accurately estimated, a requirement that we felt was challenging given the conditions of the habitat we were working in and the known difficulties in meeting this and other assumptions of distance sampling. Farnsworth *et al.* (2002) describe a technique whereby densities of individual species may be calculated from standard point count data collected in a series of time intervals, given that researchers used a fixed radius for point counts (suggested radius = 50 m). We had more confidence in our ability to detect whether birds were within or outside of a 50 m radius, than in our ability to accurately estimate exact distances to all birds heard. Therefore, we used a standard 10 minute point count method that would allow for future calculations of density given adequate numbers, but required only that we determine whether birds were within or outside of 50 m. This point count method enables us to determine presence/absence, and relative abundance among different site on the mountain.

We conducted all sampling on Whiteface Mtn. between June 11th and June 16th, 2004. We established sampling points in 5 different treatment types: (1) existing glades (*n*=1), (2) proposed glades (*n*=3), (3) existing trails (*n*=4), (4) proposed Tree Island Pod trail area (*n*=5), and (5) control areas (*n*=14) for a total of 27 sample points (Figure 1). Configuration of habitat on the mountain limited us to small sample sizes within several of the treatment types (i.e., existing glades, proposed glades, existing trails). To ensure that individual birds are counted only once at each sample point, standard methods require that sample points be approximately 200-250 m apart. This distance precluded us from having more than a few points within some of our treatment types. Battles *et al*. (1992, 2003) have conducted prior work on Whiteface Mtn. to examine trends in red spruce decline and tree community dynamics. In anticipation that habitat data collected at these points may one day be useful to this study, we conducted point counts at two locations also used by Battles *et al*. (1992, 2003) in one of our control areas that overlapped with their study sites.

We sampled all points between the hours of 4:30 and 6:30 am, during the time in which Bicknell's thrush is believed to be most vocal. At each sample point, bird were recorded by species, time period of detection (i.e., 0-3 minutes, 3-5 minutes, 5-10 minutes), activity (i.e., singing, calling, individual seen), and whether or not they were within 50 m of the observer. In the interest of safety, two observers were present on each sampling route, but only one observer was responsible for data collection. Due to very cold temperatures on the morning of 6/11/04 and the probable effect on singing activity of BITH and other species, we resampled two of our point transects (proposed trail and one control area) on 6/16/04. Data from these two samples was averaged in all analyses. Standard point count methodology dictates that each point should be sampled only once each season (Ralph *et al*. 1995). Counts can be repeated, however, if a particular goal dictates good estimates of the bird community at specific locations (Ralph *et al*. 1995). We felt that because the determination of the presence of Bicknell's thrush was critical to this study, and because it is likely that the temperature on the morning of 6/11/04 is likely to have resulted in decreased singing activity, a second sample of the location on a warmer day was appropriate.

Results

Numbers of detections of all species were far below minimal standards required for calculating densities by distance sampling. In lieu of densities, we calculated relative abundances for Bicknell's thrush and the 4 other montane bird species. We used analysis of variance (ANOVA; Zar 1999) to test whether there were differences in the total number of individual birds, the total number of species, the total number of Mtn. Birdwatch species, and the abundance of individual species (BITH, BLPW, SWTH, WIWR, and WTSP) among the treatment types. One type, existing glades, could not be included in the analysis because we had only one sample point within an existing glade, and variance cannot be calculated from a single sample. We tested normality of variables and homogeneity of variances to ensure that we had not violated the assumptions of ANOVA. An analysis of variance allows for the test of whether there are differences in

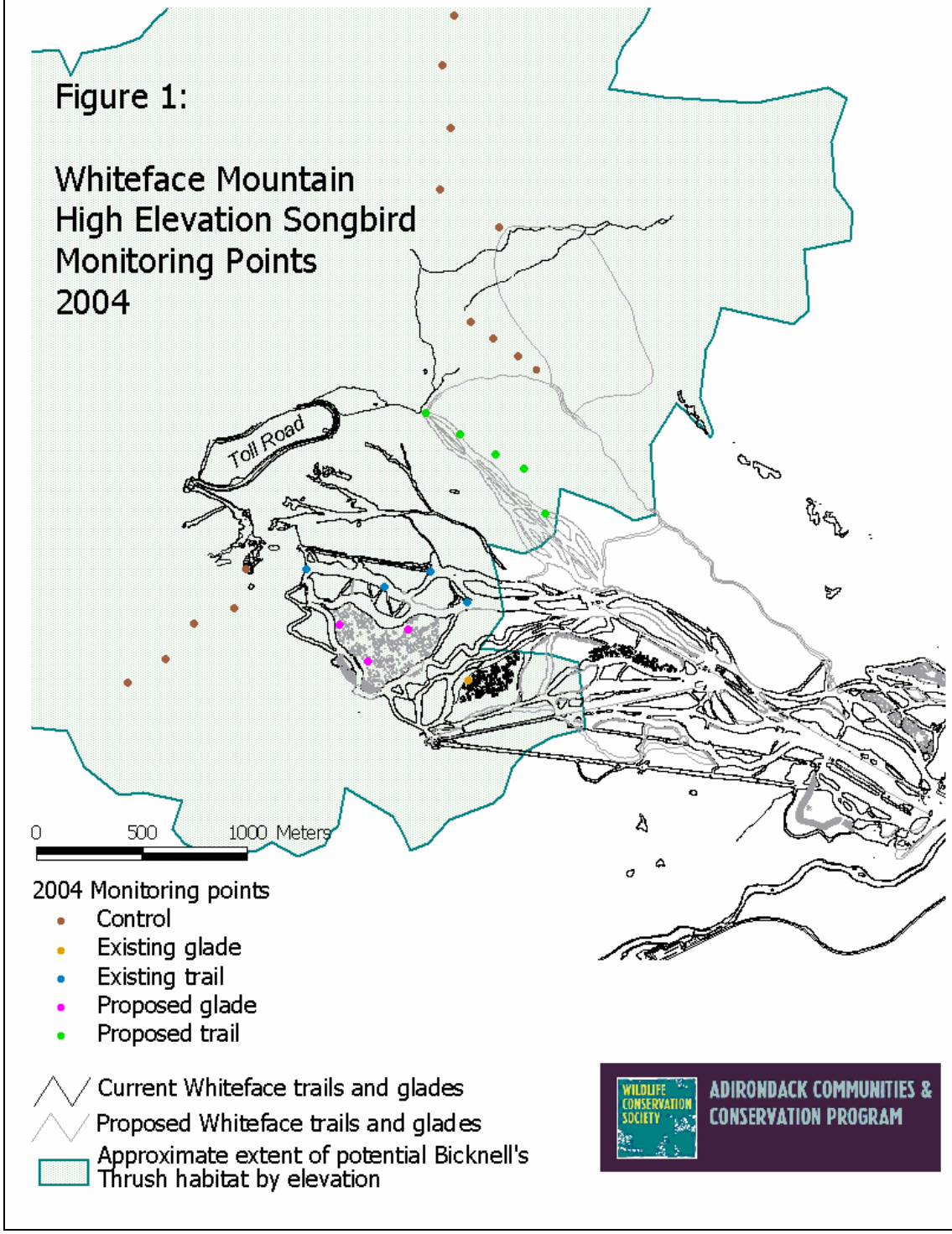
Figure 1:
Whiteface Mountain
High Elevation Songbird
Monitoring Points
2004
Toll Road
0
500
1000 Meters
2004 Monitoring points
Control
Existing glade
Existing trail
Proposed glade
Proposed trail
Current Whiteface trails and glades
Proposed Whiteface trails and glades
Approximate extent of potential Bicknell's Thrush habitat by elevation
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the means observed for more than 2 different treatment types. We used a commonly accepted *P* value of 0.05 to denote statistical significance; values $\leq$ 0.05 are considered statistically different. We found no statistical differences in the total number of birds observed, the total number of species observed, or the total number of Mtn. Birdwatch species observed (Table 1). The only individual species difference that was statistically significant was that for SWTH, which was higher in abundance in the proposed trail area than in the proposed glade.

Table 1. Mean and statistical difference observed for 9 response variables among areas of proposed glade, existing trail, proposed trail, and control areas on Whiteface Mtn. Superscripts denote statistical differences.

Response variable	Proposed glade	Existing trail	Proposed trail	Control	*P* value
Total birds	5.00	7.50	6.60	8.39	0.162
Total # species	4.00	6.00	4.80	5.75	0.439
Total # Mtn. Birdwatch species	2.00	3.00	3.20	3.68	0.098
Bicnkell's thrush (BITH)	0.00	0.25	0.80	0.68	0.430
Blackpoll warbler (BLPW)	0.67	0.50	0.40	1.21	0.183
Swainson's thrush (SWTH)	0.33^{a}	1.00	1.60^{b}	1.21	0.043
Winter wren (WIWR)	1.33	1.50	1.20	1.11	0.799
White-throated sparrow (WTSP)	0.67	1.00	1.00	1.25	0.844

In the interest of knowing whether there were differences in bird communities found in any kind of ski trail versus the undisturbed forested areas on the mountain, we also conducted an analysis in which we lumped the existing glade and trail data into one category (ski trails) and compared it against a second category comprising all of the areas which at this time are undeveloped including the proposed Tree Island Pod points, the proposed glade points, and the control points. When comparing existing trails to currently uncut forest areas, we again found no statistical differences in total number of birds, total number of species, total number of Mtn. Birdwatch species, or individual abundance of BITH, BLPW, SWTH, WIWR, and WTSP.

Though no statistical differences were detected among treatment types, control areas did demonstrate a trend of higher total abundance, higher Mtn. Birdwatch species richness (Figure 2), and higher abundances of blackpoll warbler and white-throated sparrow (Figure 3). Other species showed different patterns, with Bicknell's thrush and Swainson's thrush found in highest abundance in the proposed expansion area, and winter wren in highest abundance in existing trail areas (Figure 3).

Figure 2. Differences in Total Abundance, Species Richness, and Mt. Birdwatch Species Richness among Trail and Non-trail areas on Whiteface Mtn.

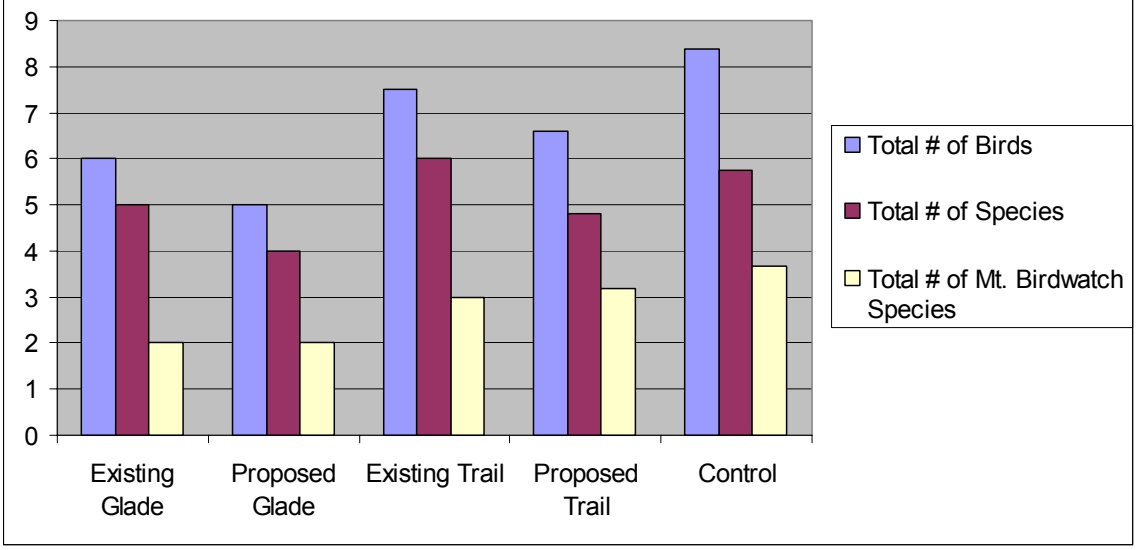
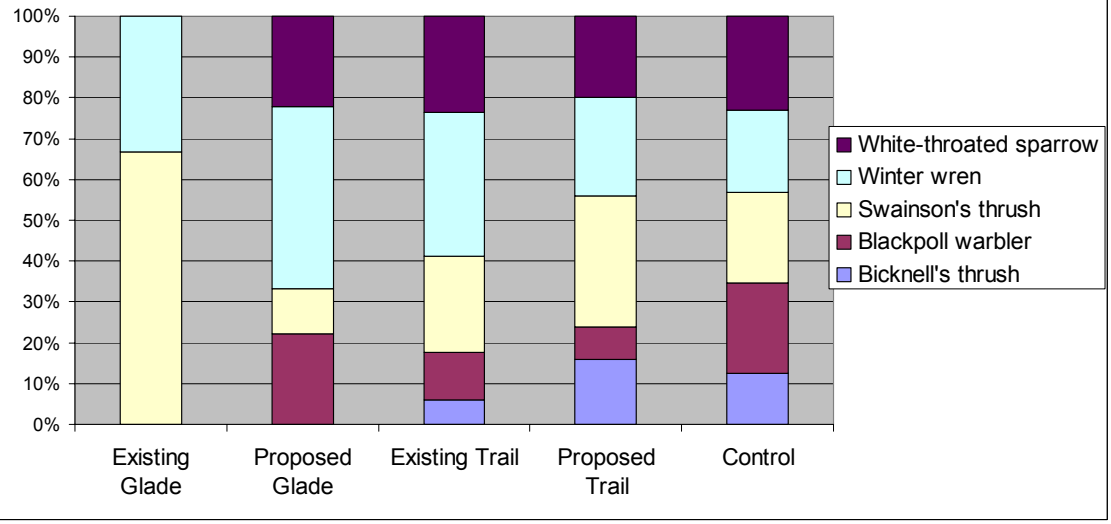


Figure 3. Proportional Representation of Bicknell's thrush, Blackpoll warbler, Swainson's thrush, Winter wren, and White-throated sparrow on Trail and Non-trail areas on Whiteface Mtn.



Visual examination of the community structure among different treatment types reveals that control areas appear to have a more even distribution of birds among species than do existing trails, proposed glades, and existing glades. An even distribution of species representation implies a more diverse community of birds in these areas. A statistical test of these patterns revealed that diversity and evenness are, in fact, highest in control areas but differ statistically only from proposed glades ($P < 0.009$ and $P < 011$, respectively).

Existing glades could not be included in that analysis because we had only one sample point.

Discussion

We have completed the field work for the first year of a three-year study to determine the potential impacts of ski area development on habitat for Bicknell's thrush and other montane forest birds. We sampled a total of 27 points on Whiteface Mtn. in June of 2004, though the configuration of Bicknell's thrush habitat on the study site, combined with the requirements of point count sampling, constrained us to small sample sizes for some treatment types. In particular, the amount of existing gladed area on the mountain at elevations high enough to provide potential Bicknell's thrush habitat was small and allowed for only one point within this type. Similarly, we were able to sample only 3 points in the proposed glade and 4 points in the existing trail due to constraints of the habitat and the time required to reach these points, even when camping overnight on the mountain. Our primary concern, however, was to address the potential impacts of ski development within the proposed expansion area, or Tree Island Pod, and to establish a series of sample points within this area that can be compared to control areas on the mountain not open to development. We were able to sample 5 points within the Tree Island Pod itself, and a total of 14 points within 3 different control areas on the mountain. Getting to more than 5 points on a transect within the Tree Island Pod would be difficult within the 2 hour time window of 4:30 to 6:30 am that is generally used for observations of Bicknell's thrush. Likewise, the area of the Tree Island Pod itself is not large, and placing more points within it would be challenging without resulting in points closer than the recommended 200 m minimum between sample points on a transect to avoid double counting of individuals.

One of the potential results of low sample sizes in any statistical analysis is a low power to detect differences. Statistical power is defined as the ability to detect a statistical difference, if one is present. Our power was good for detecting differences in the total number of birds, the number of total species, and the number of Mtn. Birdwatch species observed. Our power was lower, however, for detecting individual species differences because the variability at the individual species level is much higher. Therefore, the conclusions drawn from this initial year must be taken with some caution. It is our hope that future sampling in the summers of 2005 and 2006 will allow us to reduce some of the variability in observed species differences and thereby increase our statistical power to detect differences between types.

Given the caveats mentioned, there are interesting patterns in the data obtained from year 1 of this study. We found no statistical differences in the total number of birds, total species richness, or Mtn. Birdwatch species richness among existing glades, proposed glades, existing trails, proposed trails, and control areas. Likewise, we found few differences in the abundances of Bicknell's thrush, blackpoll warbler, Swainson's thrush, winter wren, and white-throated sparrow among these treatment types. The Vermont Institute of Natural Science has been studying the impacts of ski area development on Bicknell's thrush on Stratton and Mansfield mountains for a number of years (Rimmer *et*

al. 2004). Preliminary results from their analyses indicate that there are few differences in population and reproductive parameters for Bicknell's thrush between existing ski areas and control areas on those 2 mountains. This study, much more extensive than our own, has examined differences in reproductive success, survivorship, and nest predation for Bicknell's nesting near or along existing ski trails versus those nesting in uncut controls and found very few differences among observed parameters between ski areas and controls. It appears that ski areas are not negatively impacting Bicknell's thrush survival or nest success on these 2 mountains. Whether these same results would be obtained for other montane forest species is unknown. Our preliminary data, however, appear to show that relative abundances of the montane species we studied are similar in existing trail and control areas on Whiteface Mtn.

It is important to note that most of the human-related activity occurring on Whiteface and other ski areas occurs during the winter months when most bird species are absent. It may be that direct effects of humans are minimal during the summer months when breeding activity is occurring, and that loss of habitat and other human impacts on the wintering grounds may be much more critical to the long-term survival of Bicknell's thrush. One of the most common results of habitat fragmentation, such as that created by ski trails, is increased predation created by better access for predators along habitat edges. Rimmer *et al.* (2004) have not detected this pattern on Stratton and Mansfield mountains, however. Nest success and predation rates appear similar in ski trail areas and in controls (Rimmer *et al.* 2004). This may be due to the fact that the generalist predators such as raccoons or coyotes that are more common in fragmented habitats at low elevations are less prevalent at high elevations where Bicknell's thrush commonly nests. Red squirrels are the most significant nest predator for Bicknell's thrush, and squirrels appear to be more evenly disbursed throughout the landscape than are more generalist predators which concentrate along and use edges as travel corridors.

Though we did not detect statistical differences among the ski trail and control types examined, there were some apparent trends of higher species diversity and higher overall numbers of birds in control areas than in existing trails. This may be due to the fact that the control areas have larger expanses of continuous habitat, allowing a larger number of birds to find suitable nesting habitat within them. Some bird species are sensitive to forest edges, and though we did not observe strong patterns in individual species differences in this study, it is possible that species such as blackpoll warbler or Swainson's thrush will make use of edges but nest preferentially in unfragmented habitat.

It is worth noting that we detected no Bicknell's thrush in the existing glade area, and that we detected highest abundance of Bicknell's thrush in the proposed Tree Island Pod area. Rimmer *et al.* (2004) stress that glade creation may effectively eliminate suitable Bicknell's thrush habitat by removing the dense subcanopy structure favored by this species. The Tree Island Pod area, in contrast, is in an area of the mountain that has a very dense subcanopy, a habitat characteristic favored by Bicknell's thrush. We look forward to continuing this work and further elucidating these patterns during the next two summers.

Acknowledgements

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