THE EFFECTS OF SKI AREA DEVELOPMENT ON SUBALPINE SPRUCE-FIR BIRD COMMUNITIES AND THEIR HABITAT ON MOUNT MANSFIELD, VERMONT: AN ANALYSIS OF PRE-TREATMENT DATA.

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Abstract: As part of an Act 250 assessment of the proposed Nose Dive Pod ski area expansion we established a 20 ha study plot (NDPO) and a 20 ha control plot (RABR) on the east slopes of Mt. Mansfield, Vermont to examine the effects of ski area development on Bicknell's Thrush and other birds of subalpine spruce-fir forests. Spot mapping of all breeding birds and analysis of vegetation were conducted on each plot. Twenty-eight species of birds (18 breeding) were recorded on NDPO and 32 (16 breeding) on RABR. Four species are dependent on spruce-fir forest during the breeding season. Eight Bicknell's Thrush (*Catharus bicknelli*) territories (4.5 territories/20 ha) were found in or around the NDPO plot, while 10.75 territories/20 ha were recorded on RABR. Thrushes seemed to be concentrated along current ski trail edges in the NDPO. Differences in densities may have been caused by habitat differences. Examination of the flora showed NDPO to be a lower elevation, mesic site, while RABR was classified as a higher elevation subalpine forest. The conservation status of the Bicknell's Thrush, combined with the paucity of avian population data in subalpine forests and increasing development pressures, argue for careful, long-term impact assessment studies. Contingent upon Act 250 approval for ski expansion, we plan to monitor both sites for at least one more breeding season prior to construction and 6 years thereafter.

Introduction

The Mt. Mansfield Company and the State of Vermont have requested a permit from the District 5 Environmental Commission to develop additional ski trails and a ski lift on state-owned land in the "Nose Dive Pod" area on Mt. Mansfield's east slope. One component of the required Act 250 assessment for this project involves determination of the status of Bicknell's Thrush within the 126 acre project area. This report presents results of avian surveys conducted during June and July of 1995. In addition to documenting the status of Bicknell's Thrush in the Nose Dive Pod area, the work described in this report should provide a foundation for determining the impacts of ski area development on montane breeding bird populations.

Methods

During May and early June of 1995 a 20 ha (49.4 ac) study plot in the proposed project area was marked with blue survey flagging and metal tree tags in a 25 m grid using a fiberglass meter tape, meter hip-chain and compass. The study plot ranged in elevation from approximately 1,067 m (3,500 ft) to 884 m (2,900 ft), covering the highest elevations of the proposed Nose Dive Pod expansion. The approximate location of the study plot is illustrated on the attached project map (Fig 1). Because our detailed field reconnaissance indicated that the project map seemed to be incorrectly scaled, the corners of the study plot were graphically positioned on this map based on their location with known reference to existing ski trails.

We selected this plot configuration to maximize the potential to assess effects of proposed ski trail and lift development on breeding birds in the sub-alpine spruce-fir zone within the project area. Because the precise location of the proposed ski slopes has not been finalized, we attempted to place the four corner markers outside of the proposed development area. This should enable relocation of the interior points, some of which may be lost due to construction activities. The project area's rugged topography and dense vegetation, coupled with a short avian breeding season and constraints of budget and field personnel, precluded the establishment of a larger study plot that would have included both proposed and current gladed ski trails.

A 20 ha control plot was also established in the Ranch Brook watershed south of the Nose Dive Pod area. This plot was situated at similar elevations with a comparable slope aspect as the Nose Dive Pod (NDPO) plot. The Ranch Brook (RABR) plot is located on protected, state-owned land and is undeveloped except for a narrow cross-country ski trail and two hiking trails. This plot will be used to reference any future changes in bird populations and vegetation which may occur in the Nose Dive Pod following activities from the proposed ski area expansion.

Our primary census method involved spot mapping, a standardized technique based on the territorial behavior of breeding birds. This technique enables accurate calculations of the numbers and densities of birds in a given unit of area, as well as determinations of the location and distribution of individual territories. Our spot mapping censuses included all breeding species on each study plot. Using our established 25m gridded reference points, the locations of all observed birds were recorded on a detailed map of each study plot. Special efforts were made to map counter-singing and counter-calling birds of each species, as these enable the most precise delineation of individual territories (Robbins 1970).

Three experienced observers made repeated visits to both plots, recording the location of each bird seen or heard on field maps while slowly walking plot transects. Locations of nests found

while spot mapping were also noted. Each plot was completely spot mapped at least five times during the breeding season. Spot mapping was conducted from 13 June to 5 July on the NDPO plot and from 9 June to 6 July on the RABR plot. Censusing was conducted from sunrise to 10:00 while birds vocalized most actively. Several evening censuses were conducted specifically to map Bicknell's Thrushes. In addition, we attempted to note the locations and numbers of all Bicknell's Thrushes observed outside of the NDPO plot but within the 126 acre project area. All observations of Bicknell's Thrushes and other species were transferred from daily field maps to base study plot maps. Simultaneous registrations of two or more vocalizing individuals were used as the primary means of discriminating between adjacent territories, as were repeated registrations in a given area over several census dates.

We examined the vegetation characteristics of each study area. A total of sixty $100m^2$ plots were established on the two gridded plots. Measurements were taken in 10m x 10m quadrats cornered at the intersections of a 100 m grid and square within the grid. NDPO was completed on 6, 11, 12, 19, and 25 September, while RABR was sampled on 29 and 31 August and 5, 7, 18, 19, and 20 September. The general location and topographic setting were described, the slope and aspect measured with clinometer and compass, and the drainage conditions, forest floor, soil, and surface rockiness noted. Within each plot all trees over 5cm dbh were tallied by diameter to the nearest cm. Canopy height was estimated using eye and tape, and canopy cover was estimated visually as a percent of the plot covered. Dead trees were also tallied by diameter, and dead downed wood was treated in the same manner if originally rooted within the plot. In addition the mortality mode (standing, snapped, snag, tip-up) and the decay class (8 step) was recorded for dead trees. A complete species list of all vascular plants was compiled for a nested series of quadrats (1 x 1m; 3.1 x 3.1m; 10 x 10m; and entire 100 x 100m plot). In addition the cover of all plants in the 1 x 1m plot cornered on the grid intersection was visually estimated. In several locations a small soil pit was dug, the soil was characterized, and soil temperature was recorded at depth. One upper mineral soil sample was recovered and used for chemical determinations. A few trees were cored for age and growth determinations. The botanical data collection and analysis were designed and supervised by Dr. Charles Cogbill. We will resample these sites immediately after ski slope development has occurred on the NDPO and every 2-3 years thereafter.

Results and Discussion

Twenty-eight species of birds were recorded on NDPO and 32 on RABR (Table 1). Twelve of these are considered neotropical migrants. Four species (Bicknell's Thrush, Blackpoll Warbler, Pine Siskin, and White-winged Crossbill) are dependent upon spruce-fir forests for breeding habitat.

We detected 18 breeding species during our censusing on NDPO and 16 on RABR (Table 1). The two plots shared 15 species in common. NDPO contained 3 breeding species (American Robin, Brown Creeper, Golden-crowned Kinglet) and RABR 1 breeding species (Ruby-crowned Kinglet) that did not breed on the other plot. Each of these species was found in very low densities. RABR supported 44 more pairs of breeding birds than were found on NDPO. Eleven species were recorded at higher densities on RABR, four species were found in equal numbers, and 5 bird species were recorded at slightly higher densities on NDPO.

Eight Bicknell's Thrush territories (4.5 territories/20 ha) were found within or near the Nose Dive Pod area (Fig. 1). All territories were found to be above approximately 945 m (3,100') elevation. Four territories were located within areas designated for ski trail construction.

Table 1. Species detected, number of territories and breeding status on Nose Dive Pod and Ranch Brook plots, Mt. Mansfield, Vermont, 1995.

Species Detected	No. of NDPO Territories.	Status	No. of RABR Territories	Status
Blackpoll Warbler	23.5	Breeding	40.25	Breeding
Swainson's Thrush	5.5	Breeding	16.5	Breeding
White-throated Sparrow	16	Breeding	16	Breeding
Winter Wren	9	Breeding	12	Breeding
Dark-eyed Junco	4	Breeding	11	Breeding
Bicknell's Thrush	4.5	Breeding	10.75	Breeding
Myrtle Warbler	8	Breeding	10	Breeding
Yellow-bellied Flycatcher	5	Breeding	9	Breeding
Magnolia Warbler	7	Breeding	6	Breeding
Purple Finch	3	Breeding	5	Breeding
Red-breasted Nuthatch	8	Breeding	5	Breeding
Nashville Warbler	3	Breeding	2	Breeding
Black-capped Chickadee	1	Breeding	2	Breeding
Blue Jay	1	Breeding	1	Breeding
Solitary Vireo	1	Breeding	1	Breeding
American Robin	3	Breeding	0	Transient
Brown Creeper	1	Breeding	0	Transient
Golden-crowned Kinglet	2	Breeding	0	Transient
Ruby-crowned Kinglet	0	Not Detected	2	Breeding
Ruffed Grouse	1	Early Breeder	1	Early Breeder
Pine Siskin	0	Early Breeder/ Transient	0	Early Breeder/ Transient
White-winged Crossbill	0	Early Breeder/ Transient	0	Early Breeder/ Transient
Northern Saw-whet Owl	0	Not Detected	0	Early Breeder/ Transient
Northern Flicker	0	Not Detected	0	Transient
Black-and-white Warbler	0	Not Detected	0	Transient
Mourning Dove	0	Not Detected	0	Transient
Cedar Waxwing	0	Not Detected	0	Transient
Hermit Thrush	0	Transient	0	Not Detected
White-breasted Nuthatch	0	Transient	0	Not Detected
Hairy Woodpecker	0	Transient	0	Transient
American Redstart	0	Transient	0	Transient
Black-throated Green Warbler	0	Transient	0	Transient
Black-throated Blue Warbler	0	Transient	0	Transient
Red Crossbill	0	Transient	0	Transient
Total Breeding Territories	106.5		150.5	
Red Squirrel Territories	5 (7 Records)		10 (17 Records)	

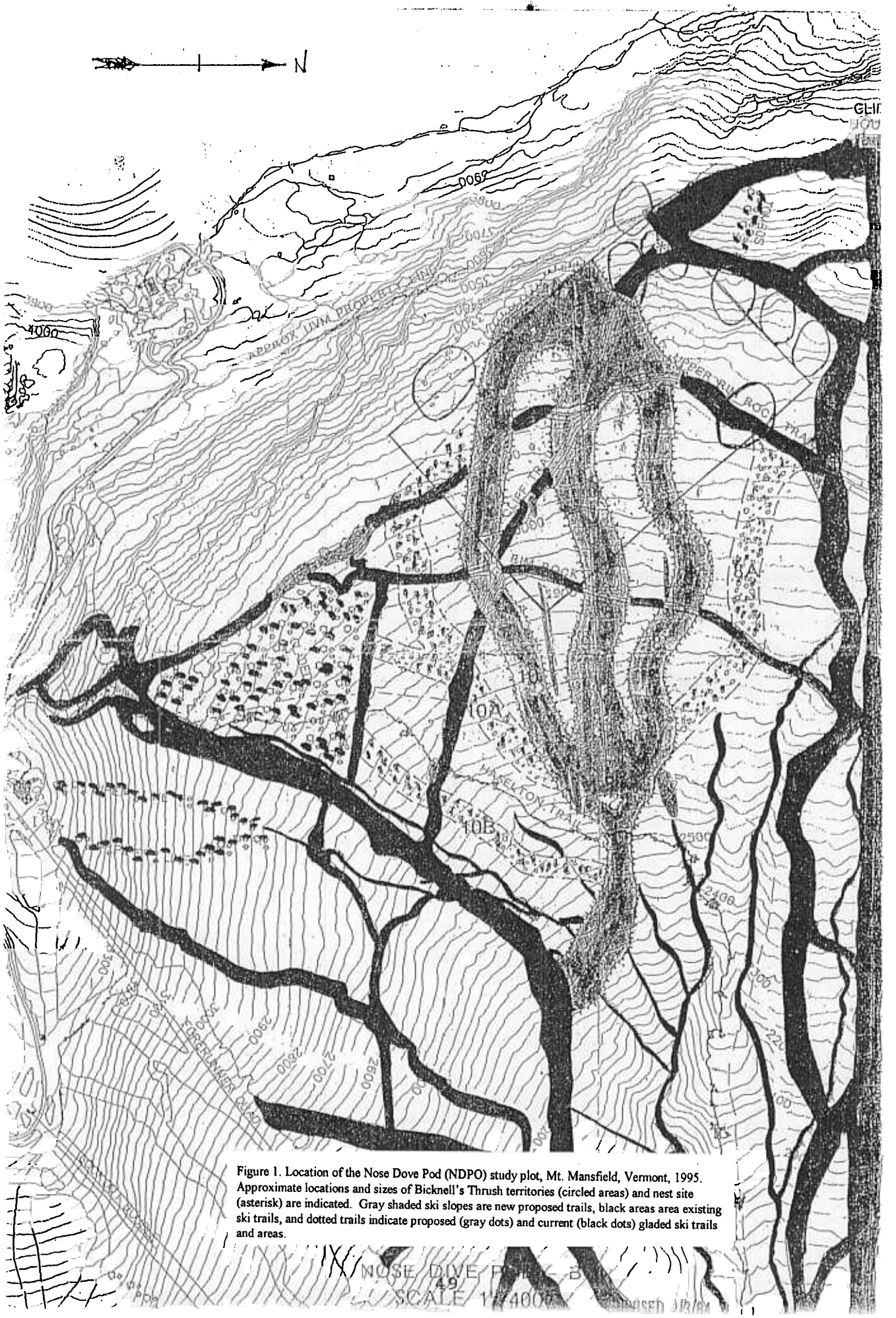

Figure 1. Location of the Nose Dove Pod (NDPO) study plot, Mt. Mansfield, Vermont, 1995. Approximate locations and sizes of Bicknell's Thrush territories (circled areas) and nest site (asterisk) are indicated. Gray shaded ski slopes are new proposed trails, black areas area existing ski trails, and dotted trails indicate proposed (gray dots) and current (black dots) gladed ski trails and areas.

Seven thrush territories were located near existing ski trails. On NDPO, areas of high stem densities are most common immediately along existing ski trail corridors. It appears that Bicknell's Thrush are attracted to these areas, as they provide the species' preferred habitat structure. Similarly, in New Brunswick, Canada, presence/absence surveys for Bicknell's Thrush found the species to be disproportionately located along logging roads where regenerating dense, young balsam fir growth occurred (D. Busby, pers. comm.).

Recent studies have determined that artificial (i.e., human-induced) edge habitats may not be beneficial to birds (e.g., Gates and Gysel 1979; Whitcomb et al. 1981; Wilcove et al. 1986). While many bird species are attracted to the vegetation diversity and structure at artificial edges, they tend to experience higher rates of nest depredation and brood parasitism near these edges. If nesting success is reduced below that occurring in habitats less subject to edge effects, such areas may act as population sinks. We are not currently able to assess this either for the already-fragmented Nose Dive Pod area or for subalpine forests in general, as there are extremely few productivity data available for natural or artificial edge habitats in subalpine spruce-fir forests.

We confirmed breeding by Bicknell's Thrush in the Nose Dive Pod area with the discovery of 3 nests (one recently depredated/abandoned, two from previous years) and the capture of a female in full breeding condition. All three nests were located within an area designated for ski trail construction (Fig. 1). We mist-netted and color-banded 4 adults (3 males, 1 female) on and immediately adjacent to the plot's northwest corner, which supports the highest density of thrushes in the project area (Fig. 1). We plan to monitor these and additional banded birds on the plot in future years.

Bicknell's Thrush densities were higher on the RABR and summit ridgeline plots than on the NDPO plot (Table 2). Vegetation analysis placed the RABR forest in the class of higher elevation subalpine forests and NDPO at lower elevations in the subalpine zone. These habitat differences may account for the lower densities of thrushes on NDPO. The summit ridgeline supports one of the highest breeding densities of Bicknell's Thrush recorded anywhere in the species' range, probably due to the dense, contiguous krummholz forest found at that high elevation. Although at its upper elevations the Nose Dive Pod area is characterized in part by the stunted forests favored by Bicknell's Thrush, the overall structure of the spruce-fir forest in this basin does not provide optimal habitat for the species.

Collection of vegetation and physiographic data before ski area development enabled us to compare the two study sites. Mean slope and aspect of NDPO was 20.9°±7.9 and 106.8 mag°±22.0 (due E), and RABR was 21.3°±7.1 and 162 mag°±32.9 (SSE). The NDPO plot covered an elevational gradient from approximately 915 to 1,070m, while RABR ranged from 975 to 1,150m elevation. Mid-September soil temperatures were 10.5°C on NDPO and 9.4° C on RABR. A soil sample from plot K7 at approximately 1095m elevation on RABR was a well drained histosol with 3cm A/O and Regolith. Organic material content was 8.8%, pH 3.42, 26.7cmol/Kg exchange acidity, Ca 69 mg/Kg, K 75 mg/Kg, Mg 20.9 mg/Kg, Mn 3.8 mg/Kg, and Fe 29 mg/Kg. On the NDPO a soil sample was obtained on plot 6C at approximately 990m elevation. It was identified as a well drained spodsol with weak E and B's. Organic material content was 6.5%, pH 4.37, 27.5 cmol/Kg exchange acidity, Ca 168 mg/Kg, K 29 mg/Kg, Mg 20.9 mg/Kg, Mn 3.7 mg/Kg, and Fe 239 mg/Kg.

Table 2. Bicknell's Thrush territory densities on Mount Mansfield, Vermont.

Study Plot Location	Number of Territories	Breeding Densities[a]
Nose Dive Pod 1995	4.5 / 20 ha	9.0 / 40 ha
Ranch Brook 1995	10.75 / 20 ha	21.5 / 40 ha
Ridgeline 1992-1995	8-12 / 8.8 ha	36.0 - 65.0 / 40 ha

[a] Presumed breeding pairs

Table 3. Understory (below 1.5m tall) from $1m^2$ plots on the NDPO (n=27 plots) and RABR (n=30) study plots, Mt. Mansfield, Vermont, 1995.

Species	% Frequency		% Coverage	
	NDPO	RABR	NDPO	RABR
Abies balsamea	48	50	8.22	8.87
Acer saccharum	0	3	0	0.07
Acer spicatum	4	0	0.07	0
Aster acuminatus	11	17	0.74	0.43
Athyrium felix-femina	7	3	1.19	0.07
Betula cordifolia	7	13	0.30	0.43
Carex arctata	7	0	0.11	0
Carex disperma	0	3	0	0.03
Cinna latifolia (?)	4	0	0.15	0
Clintonia borealis	37	67	5.37	4.57
Coptis groenlandica	0	23	0	0.93
Cornus canadensis	7	7	0.11	0.33
Dennstaedtia punctiloba	4	0	0.37	0
Dryopteris Campyloptera	63	60	16.74	5.47
Dryopteris phegopteris	15	3	0.30	0.27
Fragaria virginiana	4	0	0.15	0
Gaultheria hispidula	4	0	0.15	0
Lycopdium lucidulum	[illegible]	37	3.67	2.10
Maianthemum canadense	0	10	0	0.47
Monotropa uniflora	11	0	0.19	0
Oxalis montana	70	73	14.89	9.57
Picea rubens	33	10	8.70	1.67
Pyrus americana	11	0	1.37	0
Solidago macrophylla	19	13	0.59	0.27
Thelypteris novaborensis	4	3	0.15	0.27
Trientalis borealis	0	10	0	0.13
Trillium undulatum	4	3	0.19	0.03

Both sites are relatively heterogeneous with ragged canopies averaging 10.7m (±2.9) in height with 62% canopy cover at NDPO and 9.5m (±3.6) in height with 52% canopy cover on RABR. There were many openings covered with low, herbaceous growth (more at NDPO). NDPO was crossed by three narrow ski trails, while RABR contained one narrow ski trail and a hiking trail. Neither site was considered enriched. The understory was richer at the NDPO, but RABR contained more moss, probably because of its more open canopy (Table 3). Both areas are dominated by balsam fir but NDPO has a higher density with a sizable mix of heart-leafed paper birch (Table 4). Red spruce were scattered and generally small on both sites. NDPO had more spruce, while RABR had larger, although not especially old, trees. The total basal area of 29 m^2/ha on NDPO was about 2/3 that expected of a well developed subalpine forest in the region, while the 24 m^2/ha at RABR reflected that site's more open, distinctly glade-like vegetation over shallow soil on rock ledges (Table 5). Dynamics seen in dead trees were prominent at both sites. RABR had the expected 1:1 ratio of dead to live trees, but NDPO was closer to a 1:2 ratio, indicating its relatively younger and aggrading forest. Both sites were significantly disturbed (distinctly second-growth), most probably by cutting 90 to 110 years ago, and RABR supported a cohort of 60-70 year old trees.

An ordination of the understory vascular flora from 59 subalpine sites that have been sampled in Vermont, New Hampshire, and New York place the two sites within the middle, with the NDPO being toward the wet-mesic end and RABR being toward a slightly higher elevation affinity. A classification (TWINSPAN) of these sites placed both together with many other sampled sites in the Green Mountains, particularly nearby Bolton Mountain. RABR was joined with the Mt. Abraham site at 1,040m elevation while the NDPO site stood alone but close to lower elevation sites such as those on Bolton Mountain at 975m and 1,040m, on Camel's Hump at 914m and on Jay Peak at 975m. Thus, the understory flora seems routine for the Green Mountains and at the expected position (mid-subalpine) based on an elevation gradient. RABR seems to be a higher, lee slope, snow bank system while the NDPO seems to be a lower slope, mesic system. A list of all vascular plants found on each plot and areas of similar elevation on the western side of Mt. Mansfield are found in Table 6.

We believe that the tenuous conservation status of Bicknell's Thrush, combined with the paucity of avian population data in subalpine spruce-fir habitats and increasing development pressures in these habitats throughout Vermont and the Northeast, argue strongly for careful, long-term impact assessment studies. Our current plans, while contingent on Act 250 approval and actual implementation of the Nose Dive Pod expansion plan, involve a minimum six-year follow-up study to evaluate potential impacts of the proposed development on breeding bird populations and the subalpine habitat. While we hope that data collection on both plots will extend well beyond the six years following proposed construction activities, we believe that this time frame is a minimum for performing a meaningful evaluation of the ecological effects of ski area development.

Table 4. Overstory tree (>5cm dbh) density and basal area (m2/ha) from 10 x 10m plots on the NDPO study area (n=27 plots) and RABR (n=30) Mt. Mansfield, Vermont, 1995.

Species	Live				Dead			
	stems/ha		m2/ha		stems/ha		m2/ha	
	NDPO	RABR	NDPO	RABR	NDPO	RABR	NDPO	RABR
Abies balsamea	904	1350	15.31	16.80	270	801	8.09	17.80
Betula cordifolia	367	340	10.15	4.75	130	111	3.55	1.76
Picea rubens	215	150	2.93	1.72	82	73	3.59	4.17
Pyrus americana/decora	63	66	0.74	0.39	0	0	0	0
Prunus pensylvanica	7	10	0.02	0.06	0	0	0	0
Betula alleghaniensis	0	0	0	0	11	3	0.27	0.01
Total	2915	29.15	493	15.5	1920	23.72	986	23.71

Table 5. Basal area (in m²/ha of trees, >5 cm dbh) in 100m² sample plots on NDPO and RABR, Mt. Mansfield, Vermont, 1995.

Plot Location	Balsam Fir		Mt. Birch		Spruce		Mt. Ash		Pin Cherry		m^2/ha	
	NDPO	RABR	NDPO	RABR	NDPO	RABR	NDPO	RABR	NDPO	RABR	NDPO	RABR
1A	0	24.7	0	3.4	0	0	0	0	0	0	0	27.9
1C	0.87	29.1	4.59	10.1	3.68	0	0.67	0	0	0	9.81	39.2
1E	13.7	26.4	0	3.1	0	0	0	0	0	0	13.7	29.5
1G	9.04	11.1	24.28	.3	1.74	.3	0	0	0	0	35.06	11.7
1I	1.15	11.2	7.69	1.6	15.43	2.0	0	0	0	0	24.27	14.7
1K	2.45	34.2	8.15	2.0	0.28	1.8	0	0	0	0	10.88	37.9
3A	24.78	41.5	17.14	3.5	0	1.8	0	0	0	0	41.92	46.7
3C	7.74	26.2	0	0	25.38	0	0	0	0	0	33.12	26.2
3E	12.13	8.1	8.33	1.0	4.59	0	0	0	0	0	25.05	9.1
3G	28.67	33.8	5.73	3.2	0.95	.8	0	0	0	0	35.35	37.8
3I	13.38	36.7	0	5.0	2.54	0	0	0	0	0	15.92	41.7
3K	31.6	16.1	24.63	3.6	1.02	0	0	0	0	0	57.25	19.7
5A	10.21	9.0	8.55	3.3	0.7	.3	1.13	0	0	0	20.59	12.7
5C	5.32	1.7	7.38	.6	0	0	0	0	0	0	12.7	2.4
5E	0	13.9	.20	4.9	0	0	0	0	0	0	.20	18.8
5G	21.18	11.9	13.2	0	6.19	15.6	0.2	0	0	0	40.77	27.6
5I	28.55	6.3	11.34	2.3	0	3.0	0	0	0	0	39.89	11.6
5K	28.14	4.4	5.26	4.5	0.95	0	0	0	0	0	34.35	8.9
7A	9.26	15.0	17.55	8.1	0.5	0	0	.9	0	0	27.31	24.0
7C	0	12.6	.90	10.6	0	0	2.5	.3	3.7	0	7.1	23.5
7E	14.29	29.2	18.21	7.8	0.38	0	0	.4	0	0	32.88	37.4
7G	28.41	9.3	0	4.7	0.48	2.0	0	.4	0	0	28.89	16.3
7I	14.76	17.9	10.75	.5	9.08	.4	0.38	.2	0	1.3	34.97	20.3
7K	0	12.4	0	6.9	0	5.6	0	0	.9	0	0.9	24.9
9A	21.61	8.2	9.7	7.4	0.38	3.1	1.15	5.4	0.57	0	33.41	24.2
9C	8.44	9.4	3.55	29.9	0.28	3.9	3.46	0	0	0	15.73	43.2
9E	10.19	18.1	16.48	2.9	2.75	1.2	8.91	0	0	0	38.33	22.1
9G	12.24	7.2	12.27	5.3	0.67	1.5	3.46	3.5	0	.5	28.64	18.0
9I	27.9	13.7	7.8	6.3	0.92	2.8	0.2	.8	0	0	36.82	23.6
9K	12.11	4.7	18.33	0	0	5.5	0.39	0	0	0	30.83	10.3
All Plots	15.3	16.8	10.2	4.7	2.9	1.7	0.7	.4	0.02	.1	29.15	23.7

Table 4. Species list from the NDPO and RABR 20 ha study areas and the Vermont Monitoring Cooperative studies from the west side of Mt. Mansfield, Vermont at comparable elevations.

Species	NDPO	RABR	West Slope
Abies balsamea	p	p	p
Acer saccharum	p	p	
Acer pensylvanicum	p	p	p
Acer rubrum	p	p	
Acer spicatum	p	p	p
Aralia nudacaulis	p	p	p
Aster acuminatus	p	p	p
Aster punicius	p		
Athyrium felix-femina	p	p	
Amelanchier bartramiana	p		
Betula alleghaniensis	p		
Betula cordifolia	p	p	p
Rumex acetocella	p		
Carex arctata	p	p	
Carex debilis		p	
Carex disperma	p	p	
Carex brunnescens	p	p	
Carex trisperma	p	p	p
Carex intumescens	p	p	p
Chysoplenium sp.	p		
Chelone glabra	p		
Cinna latifolia?	p		
Clintonia borealis	p	p	p
Coptis groenlandica	p	p	p
Cornus canadensis	p	p	p
Deschampsia flexulosa		p	
Diervilla lonicera	p		
Dennstaedtia punctiloba	p	p	p
Drosera rotundifolia	p		
Dryopteris campyloptera	p	p	p
Dryopteris disjuncta	p		
Dryopteris phegopteris	p	p	p
Fagus grandifolia	p		
Habenaria dilatata		p	
Gaultheria hispidula	p	p	p
Glyceria melicaria	p	p	
Lycopodium annotinum			p
Lycopodium lucidulum	p	p	p
Lycopodium clavatum		p	
Lycopodium obscurum		p	
Maianthemum canadense	p	p	p
Medeola virginiana	p		
Monotropa uniflora	p	p	p
Nemopanthus mucronata		p	p
Oxalis montana	p	p	p
Osmumda cinnamonea	p		
Osmunda claytoniana	p	p	
Picea rubens	p	p	p

Table 4. Continued.

Species	NDPO	RABR	West Slope
Picea mariana			p
Prunus pensylvanica	p	p	p
Polypodium virginianum	p	p	
Prunus serotina			p
Pyrus americana	p	p	p
Pyrus decora	p	p	p
Ribes glandulosum	p	p	p
Rubus idaeus	p	p	
Rubus allegheniensis			p
Rubus pubescens	p		
Sambucus pubens	p		
Salix bebbiana	p		p
Solidago macrophylla	p	p	p
Streptopus amplexifolius	p	p	
Streptopus roseus		p	
Thalactrium polygamum	p		
Trientalis borealis	p	p	p
Thelypteris novaborensis	p	p	
Tsuga canadensis	p		
Trillium erectum	p		p
Trillium undulatum	p	p	p
Vaccinium angustifolium	p	p	p
Veratrum viride	p	p	p
Viburnum alnifolium	p		
Viburnum cassinoides		p	
Viola incognita	p	p	
Total Number of Species	62	50	36

Future Plans

In 1996 we will collect a second year of pre-treatment data. We will spot map all breeding bird species on each plot during the month of June. Contingent upon funding availability, we wish to expand studies of possible ski area impacts on the breeding bird communities by establishing 10-20 ha plots on Stratton, Killington, and Burke mountains. Field protocols would be the same as those on Mt. Mansfield plots.

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