

**DEVELOPING A STRATEGY TO PROMOTE BALANCE  
BETWEEN SKI AREA DEVELOPMENT AND  
HIGH ELEVATION FOREST BIRD CONSERVATION**

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16 June 1997



## **DEVELOPING A STRATEGY TO PROMOTE BALANCE BETWEEN SKI AREA DEVELOPMENT AND HIGH ELEVATION FOREST BIRD CONSERVATION**

**Project Summary:** The Vermont Institute of Natural Science (VINS) proposes an innovative project to examine the potential impacts of ski area development on subalpine forest birds and to develop a conservation strategy that will protect montane forest ecosystems in the northeastern United States. The ultimate goal is to promote a balanced approach to developing high elevation areas in a way that also protects the natural habitats there. The subalpine spruce-fir forests of New York and New England constitute a unique, limited habitat that supports a distinctive bird assemblage and faces a particular set of threats to its survival. These areas are also among the most beautiful landscapes in this region, and are perfect development prospects for the ski industry. Chronic exposure to airborne pollutants and fragmentation from human development make this restricted and vulnerable habitat one of the most potentially threatened forest types in eastern North America. Yet it is also one of the region's least-studied habitats. A balanced approach to the apparent conflict between conservation and development involves the kind of study that VINS is proposing.

One issue at the forefront of current conservation concerns in northern New England and New York is the extent to which ski area development and related activities may be affecting the ecological integrity of high elevation forests. While the importance of the ski industry to local and regional economies is well-established, the impacts of ski area development on montane forest ecosystem health are virtually unknown. Amidst mounting pressures for ski area expansion and year-round use of ski area facilities, Environmental Commissions in Vermont and other states have drawn increasing attention to this issue, often with a focus on the precarious conservation status of Bicknell's Thrush. However, regulatory decisions are invariably hindered by a lack of solid biological information, underscoring the need for carefully-conducted investigations.

VINS proposes to initiate detailed field studies of breeding bird populations and habitat conditions at 3 major northeastern U.S. ski areas in 1997 and 1998: Mt. Mansfield and Stratton Mountain in Vermont, and Hunter Mountain in the Catskills of New York. Each ski area has proposed expansions ranging from major lift and ski trail construction projects, to construction of a large year-round restaurant, to development of summer mountain biking and hiking programs. The overall purpose of this study is to collect pre- and post-development information by which to evaluate the combined effects of ski lift and trail construction, trail glading, and recreational bike and foot traffic on bird populations and forest habitat. VINS' goals for the project are threefold: 1) to assess the impacts of ski area development on ecosystem health; 2) to develop, in cooperation with the ski industry and public natural resource officials, policies for ensuring that ski area-related activities promote maintenance of viable montane forest ecosystems; and 3) to develop educational materials that will inform visitors to ski areas of the unique values and tenuous conservation status of subalpine forests. Ultimately, this project represents balance between nature and technology in two ways: first, there will be balance between the man-made entities that have created the problem as VINS helps create a cooperative working relationship between the parties involved; and second, there will be balance when ski development helps preserve natural habitats and provides visitors the opportunity to learn about them.

Information from this study will provide a critical first step in evaluating the potential impacts of year-round ski area activities on Bicknell's Thrush and other high elevation bird species and on montane forest habitats. This proposed project provides an important "test case" for a regulatory and conservation issue that is certain to surface repeatedly in northeastern states in the future. Results may have far-reaching implications for understanding the ecological effects of ski area development and for designing future expansions or new developments so as to minimize impacts.

The work proposed here adds a critical dimension to VINS' s ongoing efforts to monitor the health of high elevation forest ecosystems, as it addresses an issue of increasing prominence and tension between conservation and economic development interests. The results of this project may provide a needed foundation for a balanced approach to ecosystem-based management and land-use regulatory decisions that will ultimately protect the ecological integrity of subalpine forests in New York and New England.

# DEVELOPING A STRATEGY TO PROMOTE BALANCE BETWEEN SKI AREA DEVELOPMENT AND HIGH ELEVATION FOREST BIRD CONSERVATION

## PROJECT NEED AND BACKGROUND

The subalpine spruce-fir forests of New York and New England constitute a unique, limited habitat that supports a distinctive bird assemblage and faces a particular set of threats to its survival. These montane forests are restricted primarily to elevations greater than 3000 feet and are dominated by red spruce and balsam fir. Several studies have documented severe declines of red spruce throughout the Northeast since the 1970s, as well as heavy mortality of balsam fir. The emerging consensus is that acid precipitation and cloudwater pollution are major causes of this decline. However, other human-related threats may be exacerbating the effects of atmospheric pollution by further fragmenting these sensitive forests. Mounting pressures from ski area development, communications tower construction, wind power development, heavy recreational foot traffic, and, more recently, mountain biking all pose increasing threats to the health and viability of montane spruce-fir forests. The combination of chronic exposure to airborne pollutants and fragmentation from human development make this restricted and vulnerable habitat one of the most potentially threatened forest types in eastern North America. Yet it is also one of the region's least-studied habitats.

Detailed studies conducted since 1992 by the Vermont Institute of Natural Science (VINS) have collected critically-needed baseline data to begin assessing the conservation status of this unique avian community. These studies have focused on Bicknell's Thrush (*Catharus bicknelli*), the region's only endemic breeding species and arguably its least-known and most threatened, as a potential bioindicator of ecosystem health in subalpine forests. While a foundation of valuable information on this and other montane species has been gained (see accompanying article), several crucial questions regarding the potential impacts of various human developments on subalpine birds have not been addressed. One issue at the forefront of current conservation concerns in northern New England and New York is the extent to which ski area development and related activities may be affecting the ecological integrity of high elevation forests. Amidst mounting pressures for ski area expansion and year-round use of ski area facilities, Environmental Commissions in Vermont and other states have drawn increasing attention to this issue, often with a focus on the precarious conservation status of Bicknell's Thrush. Yet regulatory decisions are invariably hindered by a lack of solid biological information, underscoring the need for carefully-conducted investigations.

In Vermont alone, 19 mountains greater than 3000 feet in elevation are developed for skiing. Eight of Vermont's major ski areas are proposing significant expansions of winter facilities during the next 1-5 years, and at least 6 areas have new or expanded plans to develop summer facilities and activities. Similar issues face New York, New Hampshire, and Maine. In addition to the direct impacts that construction of ski lifts, trails and associated buildings have on subalpine forests and their wildlife populations, the impacts of human activities during the summer breeding season now pose a potentially significant threat. The long-term effects of habitat fragmentation and degradation, in combination with potential disturbance to nesting birds and other wildlife from heavy recreational use, may diminish the capacity of some developed peaks to sustain viable breeding populations.

VINS proposes to initiate detailed studies of breeding bird populations and habitat conditions at 3 major northeastern U.S. ski areas in 1997 and 1998. Two of these, Mt. Mansfield and Stratton Mountain in Vermont, have proposed expansion plans beginning in 1998, while the third, Hunter

Mountain in New York's Catskill Mountains, plans to expand facilities at an unspecified later date. The proposed expansions range from major lift and ski trail construction projects (Mansfield and Hunter), to construction of a 34,000 square foot year-round restaurant (Stratton), to development of summer mountain biking and hiking programs (Mansfield, Stratton and Hunter). The purpose of this study is to collect pre- and post-development information by which to evaluate the combined effects of ski lift and trail construction, trail glading, and recreational bike and foot traffic on bird populations and forest habitat. The study is planned in two phases: 1) an initial 1-2 years of baseline data collection (1997 and 1998) at each site before proposed construction and expansion of summer recreational activities, and 2) careful follow-up studies during a minimum of 3 field seasons following termination of construction and expanded recreation (1999-2001).

## GOALS AND OBJECTIVES

VINS' goals for this project are threefold: 1) to assess the impacts of ski area development on ecosystem health; 2) to develop, in cooperation with the ski industry and public natural resource officials, policies for ensuring that ski area-related activities promote maintenance of viable montane forest ecosystems; and 3) to develop educational materials that will inform visitors to ski areas of the unique values and precarious conservation status of subalpine forests. We are focusing on birds as a vertebrate bioindicator and educational vehicle of choice, because of their proven sensitivity to ecological change, the relative ease with which they may be monitored and studied, their intimate association with vegetation structure and condition, and their strong public appeal.

The specific objectives of this project include:

1. establishment of two 10-20 hectare study plots on each mountain. One will be designated an "experimental" plot in areas that are currently developed and/or slated for further development, the other a "control" plot in areas that are undeveloped. Each plot is intended to serve as a long-term study site;
2. complete inventories of all breeding bird species on each plot, determination of population densities, and mapping of territory locations. Data collected will serve as a baseline reference against which to measure future changes and will be compared to similar data from other northeastern U.S. peaks;
3. intensive demographic studies of 3 focal species (Bicknell's Thrush, Swainson's Thrush, and Blackpoll Warbler) to investigate population ecology, reproductive success, and habitat use;
4. on Mt. Mansfield and Stratton Mountain, an experimental study of nest predation, using artificial nests and eggs, to compare predation rates between fragmented and heavily disturbed vs. unfragmented and lightly disturbed habitats;
5. radio telemetry of Bicknell's Thrush on Mt. Mansfield and Stratton Mountain plots, to compare movements, territory and nest site locations, breeding success, survivorship, and behavioral responses to mountain biking and hikers;
6. using the above methods, evaluation of the extent to which mountain biking, recreational foot traffic and construction activities impact avian behavior, reproductive success and habitat use;
7. careful characterization of habitat on each plot, to assess possible changes in forest health following proposed construction or repeated human disturbance at each site;
8. development of recommendations to minimize documented impacts of ski area activities on breeding birds and to guide future ski area planning in an ecologically sensitive manner;
9. cooperative development with the Mt. Mansfield Company, Stratton Corporation, and Northern Catskills Audubon Society of site-specific interpretive displays and other educational materials for visitors to the summits of each mountain.

## IMPLEMENTATION

Two permanent 10± hectare (25 acre) study plots will be established on each mountain. Two existing plots will be studied on Mt. Mansfield, one in the proposed 126 acre Nose Dive Pod area, the site of a planned major ski lift and trails expansion project in 1998, the other in an adjacent undeveloped watershed. Two plots will be established on Stratton Mountain's twin summit peaks. One plot will be situated on the north peak, in an area that is currently fragmented by ski area development and in which future construction and increased summer recreational activities (mountain biking and hiking) are planned. A second plot will be located on Stratton's south peak, which consists of undeveloped Green Mountain National Forest land bisected only by the Long Trail. On Hunter Mountain, a 10 hectare plot will be centered on the peak's currently undeveloped summit, while an existing plot on nearby undisturbed Plateau Mountain will be used as a "control" site. All pairs of study plots are characterized by similar forest structure, elevations and aspects, and will provide optimal "experimental" vs. "control" situations in which to investigate the impacts of human activities.

Each plot will be marked with metal tree tags and temporary blue flagging in a 25-meter gridded system. This will enable observers to precisely reference all encounters (e.g., sightings, vocal registrations, captures, nest locations, telemetry positions) recorded during the study. One full-time VINS biologist will be assigned to cover each plot for 10 weeks beginning in late May. On Mt. Mansfield and Stratton Mountain, field assistance will be provided by a third full-time VINS biologist, whose primary duties will involve radio telemetry monitoring of Bicknell's Thrushes, and by other VINS project staff and experienced volunteers, as needed. Special efforts will be made to enlist the field assistance of committed local volunteers at each site, as a means to increase local participation in and knowledge of the projects, and to provide educational outreach to visitors.

Complete inventories of all breeding birds on each plot will be conducted by repeated territory mapping during the month of June and early July. This will enable calculations of population densities for each species, as well as accurate determination of territory positions, and will provide a reference against which to measure within- and between-year changes on the two plots. In addition, a series of five point counts will be established on each plot, to complement the more intensive territory mapping technique and to provide a long-term census protocol at the site. Points will consist of 50-meter radius circles that will be censused twice during the summer. Detailed habitat measurements will be collected at each point. Results of both bird and habitat sampling will be comparable to those being collected by VINS on 20 other peaks throughout the Northeast.

Intensive research on the breeding ecology and population dynamics of 3 focal species (Bicknell's Thrush, Swainson's Thrush, and Blackpoll Warbler) will be conducted on each plot. Work on these 3 subalpine spruce-fir specialist species will add a higher level of resolution to data collected on the entire avian community. All known breeding individuals and juveniles of the 3 species will be uniquely color-banded on each plot. Birds will be harmlessly captured using a variety of methods: passive mist-netting at strategic locations, active mist-netting using tape recorded playbacks and lifelike wooden decoys, and banding of nestlings at 6-8 days of age. All locations of visual observations and mist net captures of color-banded birds will be plotted on detailed study plot maps. Focused nest searching of each species will be conducted, and all active nests will be closely monitored to provide information on breeding success and productivity. Detailed habitat characterizations will be conducted at each active nest.

To investigate possible differences in rates of nest predation between the disturbed and undisturbed plots, an experimental study using artificial nests and eggs will be conducted on Mt. Mansfield and Stratton Mountain. Fifty "dummy" nests, either newly-constructed from natural materials or

collected after use in previous years, will be supplied with life-like clutches of clay eggs and placed on each study plot. Nests will be checked every 3 days, and attempted predation events will be recorded through removal of eggs or evidence of their handling by predators (e.g., teeth, claw or bill marks). Results from this controlled experiment will complement those obtained from monitoring of actual nests to provide important comparative insights between the two plots.

Forty to 50 adult Bicknell's Thrushes will be fitted with 0.5 gram radio transmitters over both years, 8-10 on each Mansfield and Stratton study plot. This technique was piloted successfully on Mt. Mansfield in 1996 with no apparent effects on the behavior or survival of marked birds. Transmitters will signal for 28-30 days, during which time locations of all radio-tagged birds will be monitored daily for 2-3 hours. On at least 2 days per week, each transmitted bird will be located hourly to provide day-long information on movements and habitat use. During peak periods of mountain biking and hiking, or construction activities, telemetry monitoring will be conducted to specifically observe the responses of marked thrushes to these activities. An attempt will be made to mark at least 2 incubating females on each plot, in order to monitor responses of actively nesting birds to human disturbance. Radio telemetry will provide the only available technique to reliably document both the short-term (i.e., immediate behavioral response) and longer-term (i.e., nest abandonment, territory relocation or shift, change in habitat use) impacts of human disturbance on the ecology of Bicknell's Thrushes.

Detailed vegetation measurements will be collected at regular intervals along the grid system on each plot and at each monitored nest. Standardized, repeatable sampling methods will be used to allow comparisons between plots and to serve as a reference for characterizing future changes in forest health that may result from human activities.

Findings from the above field activities will be used to evaluate the extent to which mountain biking, foot traffic, ski area facility construction, and existing habitat fragmentation impact breeding bird populations at each site. Changes in bird densities, territory and nest locations, singing behavior, movement patterns, habitat use, and survivorship will be compared between plots, over the course of each breeding season, and in response to documented disturbance events. Disturbances will be recorded both qualitatively (e.g. type of activity, noise level, direct evidence of impact to habitat) and quantitatively (e.g. date, time of day, number of participants, location and route of travel, equipment used, proximity to known nests or individual birds). Some controlled experiments will be conducted with project staff and volunteers to mimic actual disturbances and more accurately measure their effects. Success rates of both artificial and natural nests will be compared between plots and correlated with types and timing of disturbance events. While most of the impacts to be measured in this 2-year study are of a short-term nature (i.e. immediate or within-season), the longer-term effects of human activities (i.e. those occurring between seasons), such as possible changes in avian population levels, territorial dispersion and forest condition, will require several years of careful follow-up investigations.

Findings from this study will be summarized in reports accessible to both technical and non-technical audiences. These will not only present results of VINS' investigations, but will provide overviews of the subalpine forest and wildlife community at each site, relevant conservation issues, and recommendations for balancing recreational ski area development with continued montane forest ecosystem health. Management recommendations will be both general and site-specific, as appropriate. Broader guidelines may include recommended design features (e.g. siting, dimensions, buffers) for buildings or trails, minimum requirements for forest understory removal on gladed trails, minimum sizes of habitat patches needed to provide breeding opportunities for certain species, restrictions on the daily or seasonal timing of certain activities, or specifications for informational or interpretive materials provided to recreational users. More site-specific



recommendations might include designation of selected sensitive areas as off-limits to certain activities or during certain critical periods, avoidance or modification of planned construction in areas identified as locally significant (e.g. movement corridors between habitat fragments, high density nesting areas), or limitations on numbers of visitors or types and frequency of certain activities. Reports will be broadly disseminated to the ski industry, state and federal natural resource agencies, state environmental commissions, conservation organizations, the scientific community, and the general public. VINS will work closely with the involved parties at each site to implement recommended guidelines.

Educational materials and interpretive displays will be developed at each of the 3 mountains. These will range from annotated checklists of birds and other wildlife, to pamphlets describing subalpine ecology and conservation issues, to informational signs and handouts on recreational ethics and allowed activities on each mountain, to permanent displays featuring maps and photographs. VINS will work closely with the Mt. Mansfield Company, the Vermont Forests and Parks Department, the Stratton Corporation, and the Northern Catskills Audubon Society in developing these materials.

### **PROJECT TIMETABLE**

Preliminary site visits to Stratton and Hunter mountains will take place in early May of 1997, for selection and establishment of study plots. Mt. Mansfield will be visited in mid-May to check condition of markers on the existing plots there. Field work will begin in late May and continue through the completion of avian breeding activities in mid-August. Data analysis and summarization will take place during the fall and early winter of 1997/98, and a progress report will be completed by 1 March 1998. Development of interpretive educational materials will also take place during winter 1997/98. The 1998 field season will begin in late May and continue through mid-August. A final project report detailing both years' findings and specifying management recommendations will be completed by 1 April 1999.

### **CONSERVATION IMPLICATIONS**

Information from this study will provide a critical first step in evaluating the potential impacts of year-round ski area activities on Bicknell's Thrush and other high elevation bird species and montane forest habitats. A recent report to the U.S. Fish and Wildlife Service by the Cornell Laboratory of Ornithology, titled "Importance of Geographic Areas to Neotropical Migrant Birds in the Northeast", ranked Bicknell's Thrush as the species of highest conservation concern in the region. Detailed information on the population ecology, reproductive success and habitat needs of Bicknell's Thrush and other subalpine breeding bird species are critical to the formulation of a sound management plan for threatened montane forest habitats. This proposed project provides an important "test case" for a regulatory and conservation issue that is certain to surface repeatedly in northeastern states in the future. Results may have far-reaching implications for understanding the ecological effects of ski area development and for designing future expansions or new developments so as to minimize impacts. While VINS hopes that data collection on Mt. Mansfield, Stratton Mountain and Hunter Mountain will extend beyond the two years currently proposed, this time frame is considered a minimum for conducting a meaningful preliminary evaluation.

The work proposed here adds a critical dimension to VINS' ongoing efforts to monitor the health of high elevation forest ecosystems, as it addresses an issue of increasing prominence and tension between conservation and economic development interests. We believe that the results of this project will provide a necessary foundation for ecosystem-based management and land-use regulatory decisions that will ultimately protect the ecological integrity of subalpine forests in New

York and New England. The viability of a very distinctive and geographically restricted community of Northern Forest plants and animals is at stake.

## **EVALUATION**

The project's success will be measured in the short-term by its contribution to an understanding of how ski area-related activities affect breeding bird populations. While VINS believes that the study design proposed here is the best available, given logistical constraints of working in subalpine forests, its success will be ultimately be determined by the quality of information obtained and by VINS' ability to draw meaningful conclusions from it. The project's longer-term success will be gauged by its contribution to the development of a sound conservation plan for subalpine forest ecosystems and by its incorporation in the regulatory decision-making process. Improved coordination of planning efforts between the ski industry and conservation interests will be an important measure of this project's success, as will increased awareness of montane forest conservation issues among both the professional community and general public.

## **PROJECT ORGANIZATION AND STAFF**

VINS is a private, non-profit, statewide membership organization governed by an elected board of Trustees and headquartered in Woodstock, Vermont. Founded in 1972, VINS' mission is to protect Vermont's natural heritage through environmental education and research. Its educational programs, whether for children or adults, are directed toward developing an understanding of the human interrelationships with and dependence upon the natural world. The research department conducts ecological research, with an emphasis on long-term population monitoring of birds, to guide natural resource planning for the conservation of biological communities. VINS' recent efforts to clarify the conservation status of Bicknell's Thrush have added both regional and hemispheric dimensions to the organization's scope.

Christopher Rimmer, Director of Research at VINS since 1986, will serve as principal investigator of this project. He will be responsible for overall project administration, will supervise project staff, will participate in field work, will oversee data analysis, and will prepare reports, publications and other products resulting from this project. He has led VINS' investigations of subalpine birds in the Northeast since 1992, has coordinated studies of the wintering ecology of Bicknell's Thrush in the Dominican Republic since 1994, has served as an "expert witness" on subalpine bird and habitat conservation issues during several regulatory hearings in Vermont, and has authored 6 scientific and semi-technical articles on Bicknell's Thrush.

Kent McFarland, Staff Biologist at VINS since 1994, will serve as the field coordinator and project data manager. He will coordinate project logistics, will supervise field staff, will participate in field work, will oversee computer entry and management of all field data, will perform the bulk of data analysis, and will assist in preparation of project reports, publications, and other end products. He has coordinated VINS' field investigations of subalpine birds in the Northeast since 1994, has participated in VINS' studies of Bicknell's Thrush in the Dominican Republic since 1995, and has co-authored 4 scientific articles on Bicknell's Thrush.

## PROJECT BUDGET, 1997 AND 1998

### Salaries

Principal Investigator: 20% time x 2 yrs	\$14,000
Project Field Coordinator: 25% time x 2 yrs	\$12,500
Stratton Mt. Field Biologists (2): 10 wks @ \$250 x 2 yrs	\$10,000
Stratton Mt. Field Biologist (1): 8 wks @ \$250 x 2 yrs	\$4,000
Mt. Mansfield Field Biologists (2): 10 wks @ \$250 x 2 yrs	\$10,000
Mt. Mansfield Field Biologist (1): 8 wks @ \$250 x 2 yrs	\$4,000
Hunter Mt. Field Biologist (2): 10 wks @ \$250 x 2 yrs	\$10,000
VINS Support Staff	\$5,000
FICA and benefits (12%)	\$8,340

### Supplies and Equipment

Mist nets: 50 @ \$45	\$2,250
Banding supplies (color bands, pliers, wing rules, scales, etc.)	\$250
Cassette recorders: 3 @ \$75	\$225
Radio transmitters: 40 @ \$120	\$4,800
Receiving unit: 2 @ \$770	\$1,540
Portable antennas: 2 @ \$95	\$190
Rechargers, cables, carrying cases	\$225
Miscellaneous field supplies (e.g., flagging tape, first aid kits, flashlights, batteries, film)	\$250

### Educational Products

Design and materials for interpretive displays: 3 @ \$2,000	\$6,000
Design and printing of brochures and checklists	\$3,500

### Miscellaneous

Travel: 4000 miles @ \$0.30	\$1,200
Phone, fax, xerox, postage, office and computer supplies	\$750
Topographic maps and aerial photos	\$300

### **TOTAL**

**\$99,320**

To date, VINS has received the following funding commitments for this proposed project: 1) \$8,000 from the U.S. Fish and Wildlife Service Region 5 for work on Mt. Mansfield in 1997 and 1998; 2) \$1,000 from the William P. Wharton Trust for radiotelemetry studies on Mt. Mansfield in 1997; 3) \$10,000 from the Stratton Corporation for work on Stratton Mountain in 1997 and 1998; and 4) \$3,000 from the National Audubon Society for studies on Hunter Mountain in 1997. Additional funding support for 1997 has been requested from the Windham Foundation (\$3,000) for work on Stratton Mountain and from the Nuttall Ornithological Club (\$2,500) and the Vermont Monitoring Cooperative (\$2,500) for work Mt. Mansfield. Although no financial commitments have been secured for development of educational displays and materials, VINS expects partial support from the Stratton Corporation, the Mt. Mansfield Company, the Northern Catskills Audubon Society, and the Vermont Forests and Parks Department for this aspect of the project.

