Mountain Birdwatch 2000

Final Report to the U.S. Fish and Wildlife Service

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ABSTRACT

In June of 2000, the Vermont Institute of Natural Science (VINS) piloted Mountain Birdwatch, a long-term monitoring program for high-elevation songbirds. Mountain Birdwatch uses trained, volunteer observers to assess the status of five species breeding in montane fir forests of the Northeast. Primary emphasis is placed on Bicknell's Thrush, a high-elevation specialist that is vulnerable to ongoing and projected habitat loss. We present results from Mountain Birdwatch's pilot year and discuss improvements in survey design and methodology. We also evaluate the monitoring program's statistical power and outline goals for regional expansion.

BACKGROUND AND RATIONALE

Bicknell's Thrush (*Catharus bicknelli*), once considered a subspecies of Gray-cheeked Thrush (*C. minimus*), gained full species status in 1995. Since then, it has been recognized as one of the most at-risk passerines in eastern North America. Partners in Flight ranks Bicknell's Thrush as the top conservation priority among Neotropical migrants in the Northeast (Pashley et al. 2000), while the International Union for the Conservation of Nature classifies the songbird as "vulnerable" on its list of threatened species (BirdLife International 2000).

A number of factors contribute to the vulnerability of Bicknell's Thrush, including its limited, and naturally fragmented breeding range. In the United States, Bicknell's Thrush breeds in dense, montane fir forests of New York and northern New England (Atwood et al. 1996). In southeastern Canada, it inhabits montane fir (Ouellet 1993), maritime spruce-fir (Erskine 1992), and regenerating mixed forest (Nixon 1996). The species is similarly restricted in its wintering distribution, occurring primarily in wet, broadleaf forests of the Dominican Republic. These forests have been reduced to less than 10% of their historic extent in the last 30 years (Stattersfield et al. 1998)

Loss of the Northeast's montane fir habitat may also threaten Bicknell's Thrush. Ski area expansion, cell tower construction, and wind power development have received the most regulatory attention, as each results in highly visible forest loss. However, climate change represents the most far-reaching, long-term threat to the species. A warming climate is expected to cause incremental, but widespread changes in the composition and structure of high-elevation forests. Forest ecologists predict that balsam fir (*Abies balsamea*) will be substantially diminished, if not lost from the Northeast if atmospheric concentrations of CO_2 double, as expected within the next century (Iverson et al. 1999).

In the past fifty years, extirpations of Bicknell's Thrush appear to have occurred at isolated summits in southern New Hampshire (Monadnock, Sunapee), southern Vermont (Aeolus, Ascutney, Carmel, Glebe, Molly Stark), and western Massachusetts (Greylock, Saddleball) (Atwood et al. 1996, VINS unpubl. data). To monitor future changes in the status of Bicknell's Thrush and four other high-elevation songbirds, the Vermont Institute of Natural Science launched Mountain Birdwatch in the spring of 2000. We piloted this citizen science project in Vermont and will begin surveying sites in New York, New Hampshire, and Maine in 2001.

Mountain Birdwatchers conduct point counts to monitor Bicknell's Thrush, Swainson's Thrush (*Catharus ustulatus*), Blackpoll Warbler (*Dendroica striata*), White-throated Sparrow (*Zonotrichia albicollis*), and Winter Wren (*Troglodytes troglodytes*) along 1-km survey routes. The program complements three existing, high-elevation bird monitoring programs. Biologists contracted by the Green Mountain National Forest (GMNF) and the White Mountain National Forest (WMNF) have been surveying montane habitat since 1991 and 1992, respectively. Over the past decade, VINS has established 18 of its own routes in the high country of Vermont, New York, and Maine as part of the Forest Bird Monitoring Program (FBMP). Although these programs have the advantage of surveying the full avian community, their value is compromised by low to moderate replication (4 to 42 survey routes), a sampling bias against small units of isolated habitat, and limited geographic coverage. By involving scores of trained volunteers, Mountain Birdwatch is able to achieve greater statistical power, introduce a nearly random sampling design, and fill gaps in geographic coverage. Furthermore, Mountain Birdwatch avoids duplication of effort, since its design allows data to be pooled with subsampled results from the other monitoring programs.

Mountain Birdwatch fulfills the longstanding need for an efficient, statistically powerful program to monitor high-elevation birds at a regional scale. At the same time, it promises to advance our understanding of how landscape variables influence the distribution and relative abundance of the region's only endemic songbird, Bicknell's Thrush. Mountain Birdwatch accomplishes both of these aims while providing a learning opportunity to the hikers, bird-watchers, trail monitors, and families that participate.

METHODS

Volunteer recruitment and training

We announced the opportunity to volunteer for Mountain Birdwatch on our web site (www.vinsweb.org/conservation/citizenscience/mtnbirdwatch.html) and in VINS newsletters, flyers, and press releases. We also attracted participants by posting announcements on bird-watching list services. The Green Mountain Club assisted by recruiting volunteers through its own newsletter and web page. In all, 48 people registered, some in pairs. They were asked to identify three preferred mountains, indicate how many they would like to survey, and whether they would be willing to monitor an off-trail survey route. When route assignments were made, Mountain Birdwatchers received maps, survey instructions, an identification guide to high-elevation songbirds, and a training tape with an auditory identification quiz.

Selecting sites and assigning volunteers

Using ArcView GIS, we joined digital elevation data from the U.S. Geological Survey with land cover data from the Vermont gap analysis project to model Bicknell's Thrush habitat throughout the state. We created a map of 95 polygons, or habitat units, that equaled or exceeded 823 m in elevation and contained $\geq$ 5 ha of conifer-dominated forest. We chose not to use the 915-m threshold applied by Atwood et al. (1996) because of seven previous observations of Bicknell's Thrush between 823 and 915 m in Vermont. Next, we identified landowners and requested their permission to conduct annual bird surveys. Polygons for which landowner permission was not obtained were removed from our list of prospective survey sites.

We randomly assigned priority ranks to each of the remaining polygons and matched volunteers with 51 survey routes in order of priority. VINS staff were assigned 18 additional routes for which volunteers were not available. The 69 assigned routes represented 73% of the habitat units that were originally identified. This approach to site selection, while not truly random, best approximated a random sample given the logistical constraints.

Route placement and coverage

We used land cover data and topographic maps to situate routes within polygons, favoring extensive conifer stands, upper elevations, and trails. Wherever possible, a clearly mapped feature (e.g. trail junction or summit) served as a route's first survey point. Volunteers placed up to four additional points at 325-step (250± m) intervals along each mapped route. Upon completion, they submitted a detailed description of all listening stations in order to facilitate their location in future years.

Route monitors contended with unusually wet weather in 2000, with rain falling somewhere in Vermont on every day of the survey period. Some experienced further difficulty navigating through forests damaged by the 1998 ice storm. Despite these challenges, Mountain Birdwatchers completed 44 surveys, along routes scattered throughout the state. We present our results together with data from six FBMP routes and three routes surveyed by the University of Vermont's Spatial Analysis Lab (UVM) for the GMNF. We also present findings from ten additional sites surveyed only for the presence of Bicknell's Thrush, in most cases after the main sampling period.

Table 1. High-elevation sites monitored by Mountain Birdwatch, the Forest Bird Monitoring Program, and the University of Vermont in 2000. Asterisks indicate sites surveyed for Bicknell's Thrush presence only.

Route name	Summit(s) contained within the habitat unit	Maximum elevation (m)	Survey
Abe	Abraham, Cutts, Ellen, Lincoln, Nancy Hanks, Stark	1245	UVM
Aeolus	Aeolus	985	MBW
Ascutney	Ascutney	960	MBW
Baby	Baby Stark	873	MBW
Belvidere	Belvidere	1024	MBW
Bloodroot	Bloodroot, Farr, Goshen	1062	MBW
Blueridge	Blue Ridge	999	MBW
Bluff	Bluff	846	MBW
Bolton	Bolton, Bone, Mayo, Ricker, Woodward	1122	MBW
Braintree	Braintree	924	MBW
Breadloaf	Battell, Boyce, Kirby, Cleveland, Grant, Roosevelt, Wilson	1141	MBW
Bromley	Bromley	1000	MBW
Brousseau*	Brousseau	827	MBW
Buckball	Buckball, South Buckball	873	MBW
Burke	Burke	996	FBMP
Camels	Bald, Burnt Rock, Camels Hump, Ira Allen	1244	FBMP
Carmel	Carmel	1026	MBW
Corporation*	Corporation, Round	1019	MBW
Dewey	Dewey	1024	MBW
Domey's	Domey's Dome	888	MBW
Dorset*	Dorset	1071	MBW
East	East	1048	MBW
Equinox*	Equinox	1174	MBW
Gillespie	Gillespie	901	MBW
Gilpin	Gilpin	919	MBW

Glastenbury	Glastenbury, Hagar Hill	1142	MBW
Glebe	Glebe (Magic)	896	MBW
Gore*	Gore, Round	1015	MBW
Haynorth	Haystack (in Lowell)	982	MBW
Heartwellville	unnamed NE of Heartwellville in Readsboro	950	MBW
Hemlock	Unnamed E of Beane	876	MBW
Hunger	Hogback, Hunger, Worcester, White Rock	1110	FBMP
Jay*	Big Jay, Jay, Little Jay	1177	MBW
Killington	Bear, Killington, Mendon, Pico, Shrewsbury, Snowden, Smith	1291	MBW
Laraway	Laraway	852	MBW
Lewis	unnamed N of Lewis	860	MBW
Lockwood	unnamed N of Belvidere	878	MBW
Madonna	Madonna, Morse, Spruce, Sterling, White Rocks	1132	MBW
Mansfield	Mansfield	1339	FBMP
Molly	Molly Stark, Beane	904	MBW
Monadnock	Monadnock	957	MBW
Monastery	Monastery	983	MBW
Mother	Mother Myrick	1024	MBW
Mud	unnamed NE of Big Mud Pond	847	MBW
NoJay	North Jay	1036	MBW
Okemo*	Ludlow	1019	MBW
Pete Parent	Pete Parent	903	MBW
Philadelphia*	Philadelphia	976	MBW
Romance	Cape Lookoff, Gillespie, Horrid, Romance	1026	UVM
Saltash	Bear, Saltash	1002	MBW
Scrag	Scragg	887	MBW
Seneca	Seneca, Starr	963	MBW
Signal*	Burnt, Signal	1020	MBW
Snow	Haystack (in Wilmington), Snow	1084	FBMP
South	South	966	MBW
Spruce	Spruce (in Plainfield)	926	MBW
Stratton	Stratton	1201	FBMP
Styles	Peru, Styles, Tabor	1045	UVM
Tillotson	Tillotson	914	MBW
Westmore	Bald (in Westmore)	1010	MBW
Wilcox	Unnamed NW of Wilcox	865	MBW
Woodford	Bald (in Woodford)	871	MBW
Worth*	Worth	986	MBW

Field Methods

The volunteer training materials in Appendix 1 describe the Mountain Birdwatch field methods in detail. In summary, surveys were conducted under acceptable weather conditions between 4:30 and 8:00 a.m. during the first half of June. Observers listened quietly for five minutes at up to five stations, separated by approximately 250 m. They recorded the number of each focal species seen or heard at each station, noting Bicknell's Thrush observations between points, as well. If Bicknell's Thrush was not detected during or between point counts, Mountain Birdwatchers returned to each point and broadcast a three-minute recording of the bird's vocalizations in order to elicit a response from present, but silent birds. Audioplaybacks were discontinued upon detection of one or more Bicknell's Thrushes. If no Bicknell's Thrushes responded to the broadcasts, the species was presumed absent.

Monitors who completed their surveys without encountering Bicknell's Thrush quickly notified VINS so that we could gain greater confidence in "presumed absent" designations. We achieved this primarily through follow-up, audioplayback surveys, conducted at dusk or dawn between 16 June and 15 July (after Atwood et al. 1996). Follow-up surveys were considered unnecessary for routes where observers reported unsuitable habitat. We also conducted audioplayback surveys for Bicknell's Thrush at several sites that were not visited during the main sampling window due to poor weather or low priority rank.

Appendix 2 describes the point count methods employed by UVM and FBMP, as well as our subsampling approach. Both surveys lack the audioplayback component described above. However, where Bicknell's Thrush was not recorded during the subsampled point counts, ancillary data typically revealed the bird's presence, making audioplaybacks unnecessary.

Data Analysis

We measured frequency of occurrence and relative abundance for each of the focal species. For frequency of occurrence, we divided the number of routes on which a species was detected during point counts by the total number of routes surveyed by point count. To produce a more informative frequency measure for Bicknell's Thrush, we divided the number of sites on which the species was detected by any means by the total number of sites sampled.

To avoid problems of statistical dependence among neighboring point count stations, we used routes as the sample unit for measures of relative abundance. We first calculated a route total for each species (t) and corrected the totals to standardize for number of point counts (c) per route. To produce a statewide abundance index (A) for each species, we summed the corrected totals and divided by the number of routes surveyed by point count (r).

$$A = \frac{\Sigma\ t_i\,(c_i/5)}{r}$$

Because of interspecific differences in detectability, caution should be exercised when comparing frequency of occurrence and relative abundance measures among species. The data are best suited for quantifying changes in species distribution and abundance over time.

To assess Mountain Birdwatch's capacity to detect population changes, we conducted a power analysis for each of the five focal species. For this purpose, we used an online analytical tool derived from Monitor 4.0 (Gibbs 1995) and made available by the Patuxent Wildlife Research Center (see Eagle et al. 1999). This tool permits efficient evaluation of a monitoring program's statistical power, given a reasonable estimate of a population's coefficient of variation (CV). This value is calculated for each route separately by dividing the standard deviation of counts by the mean annual count.

To estimate the CV for each species, we analyzed results from nine high-elevation routes, monitored by UVM and FBMP over the last three to ten years (mean = 8.6 years). For each power analysis, we used the CV default value that best approximated the mean CV for the 9 routes, as shown in Table 2. Outlying coefficients of variation (> 3) were excluded from this analysis.

Table 2. Mean and default coefficients of variation for Mountain Birdwatch species, based on analysis of nine routes monitored between 1991 and 2000.

Species	Mean CV	Default CV
Bicknell's Thrush	0.96	1.0
Blackpoll Warbler	0.42	0.4
Swainson's Thrush	0.86	0.8
Winter Wren	0.73	0.8
White-throated Sparrow	0.38	0.4

2000 RESULTS AND DISCUSSION

Distribution and Relative Abundance

Blackpoll Warbler, Winter Wren, and White-throated Sparrow were the most common of the monitored species, each averaging over 3 individuals per route (Table 3). They were also the most widespread, detected in over 90% of the point count surveys. Swainson's Thrush, which was detected during 3 out of 4 surveys, averaged about 2 individuals per route. Mountain Birdwatch's flagship species, Bicknell's Thrush, was detected by point count on just over 1 in 4 surveys (28%), averaging less than one individual per route (0.77).

Table 3. Frequency of occurrence and relative abundance of five songbirds surveyed along 53 high-elevation routes. Frequency of occurrence refers to the proportion of routes on which a given species was detected by point count; relative abundance values represent the average number of individuals per five-point survey route ± SE.

Species	Frequency of Occurrence	Relative Abundance
Bicknell's Thrush	0.28	0.77 ± 0.22
Blackpoll Warbler	0.91	4.75 ± 0.38
Swainson's Thrush	0.74	2.03 ± 0.28
Winter Wren	0.92	3.35 ± 0.31
White-throated Sparrow	0.92	3.99 ± 0.34

Incidental and audioplayback encounters nearly doubled the frequency of Bicknell's Thrush detections on point count routes, raising it to 51% (n = 53 routes). Bicknell's Thrush occurred at 53% of all sites sampled by any means (n = 63). These findings confirm that point counts, by themselves, are inadequate to document the distribution of Bicknell's Thrush.

Our failure to observe Bicknell's Thrush in nearly half of the surveyed areas indicates a flaw in our preliminary model of Bicknell's Thrush habitat. Lowering the elevational threshold from 915 m to 823 m allowed us to detect Bicknell's Thrush at three northern sites below 915 m. However, it also resulted in the inclusion of several southern sites that lacked the young, dense conifer thickets favored by this species. We have refined our model to account for the influence of latitude on the elevational occurrence of Bicknell's Thrush, which is mediated through climatic effects on forest composition and structure. Survey modifications, discussed below, will ensure that future surveys concentrate on sites currently occupied by Bicknell's Thrush.

Statistical Power

Figures 1-3 show the minimum number of routes needed to obtain ≥ 90% power to detect three levels of population decline (2, 3, and 5%) for the focal species.

Figure 1. Minimum number of routes needed to obtain ≥ 90% power to detect 2%, 3%, and 5% annual declines in Bicknell's Thrush, assuming a 100% coefficient of variation.

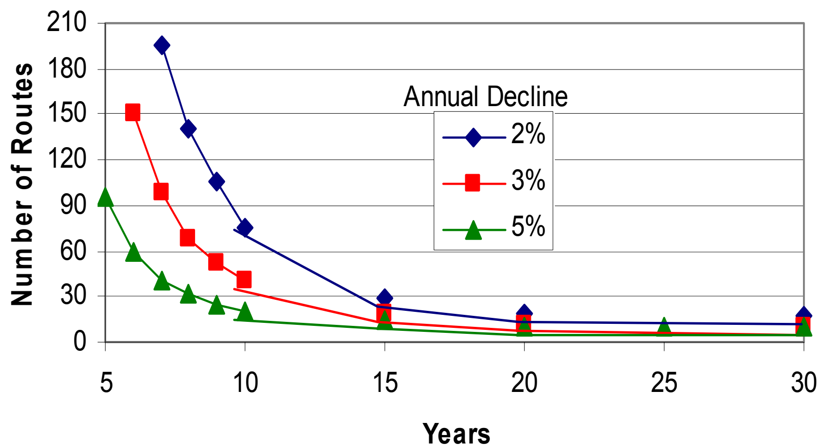


Figure 2. Minimum number of routes needed to obtain ≥ 90% power to detect 2%, 3%, and 5% annual declines in Swainson's Thrush and Winter Wren, assuming an 80% coefficient of variation.

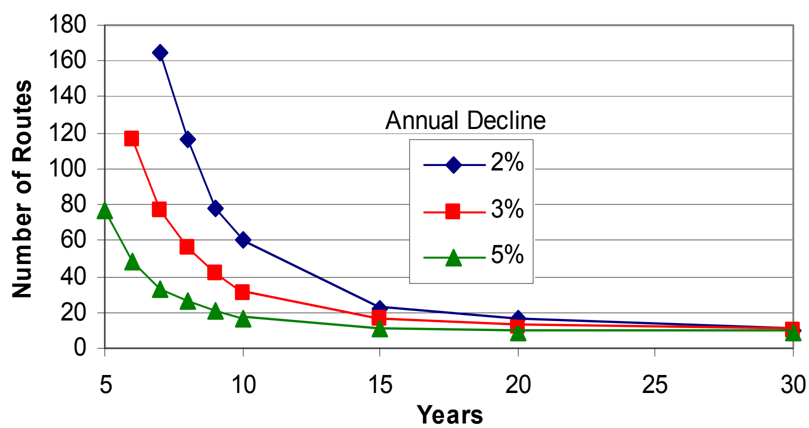
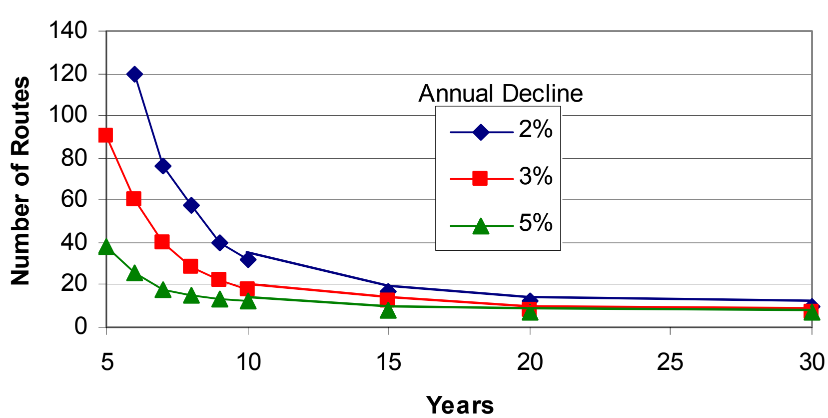


Figure 3. Minimum number of routes needed to obtain ≥ 90% power to detect 2%, 3%, and 5% annual declines in Blackpoll Warbler and White-throated Sparrow, assuming a 40% coefficient of variation.



To achieve a given level of power, species with low CV's (Blackpoll Warbler and White-throated Sparrow) require fewer survey routes than species with high CV's (Swainson's Thrush, Winter Wren, Bicknell's Thrush). Overall, the program's power to detect population changes will increase substantially after the first decade. Nonetheless, moderate declines will be detectable even in the short-term. Our analysis demonstrates that 100 survey routes may be adequate to detect annual declines of 2% for all five species within 10 years (Table 4). With 100 routes, as few as 5 years would be required to detect 5% annual declines. One hundred routes, scattered throughout the region, would also achieve the geographic coverage necessary to monitor changes in breeding distribution. Non-profit conservation organizations and government agencies in New York, Vermont, New Hampshire, and Maine are helping VINS accomplish this goal. To date, eighteen such groups have offered assistance with volunteer recruitment and training.

Table 4. Minimum number of years required to obtain $\geq$ 90% power to detect annual population declines of 2%, 3%, and 5% with 100 survey routes.

Species	**2%**	**3%**	**5%**
Bicknell's Thrush	9	7	5
Blackpoll Warbler	7	5	2
Swainson's Thrush	9	7	4
Winter Wren	9	7	4
White-throated Sparrow	7	5	2

Survey Modifications

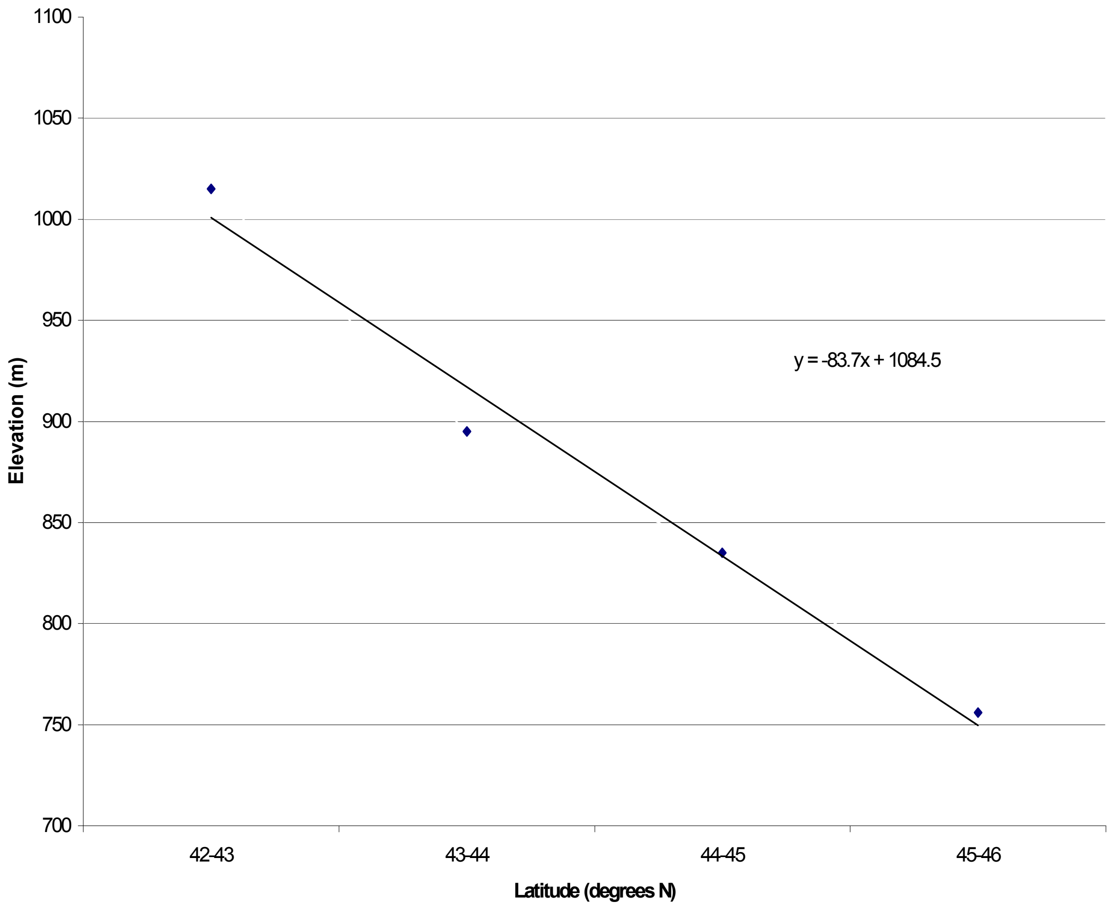
Beyond the goal of 100 active survey routes lies the challenge of volunteer retention. In response to feedback from pilot-year volunteers, we have modified the protocols to reduce the strain on participants. Off-trail points proved to be difficult to locate and describe in 2000. In the future, all survey points will be located along footpaths except where volunteers specifically request backcountry routes. Furthermore, we will limit route assignments to one per volunteer. Several individuals who volunteered for more than one route in 2000 found the commitment to be burdensome, particularly when poor weather required rescheduling. By retaining volunteers, we will improve survey efficiency and confidence in our findings.

Pursuit of greater efficiency has led to other modifications in the survey design. In 2000, several Mountain Birdwatchers who began their surveys at dawn reported a sharp reduction in the frequency of Bicknell's Thrush vocalizations after sunrise. This occurred most often in marginal habitat units, where low density presumably diminishes the importance of vocal display. To increase the likelihood of detecting Bicknell's Thrush on the first visit, surveys will be completed before 6:30 a.m. in 2001. The change from an 8:00 a.m. completion time should reduce the need for follow-up surveys by encouraging earlier start times. Unlike in 2000, when follow-ups were made by VINS staff, volunteers will be asked to make their own second visits, as necessary. Those who are unable to do so will notify VINS so that an intern can be dispatched to conduct this part of the survey.

Improved standards for site selection should further reduce the need for follow-up surveys. Our original model of Bicknell's Thrush habitat, which was based on the 823-m elevation limit, accurately predicted the species' presence only half of the time. The majority of vacant sites were located in southern Vermont, where the species went undetected on all 16 mountains under 986 m. By comparison, 9 northern mountains below this threshold contained Bicknell's Thrush. This contrast underscored the need to develop a habitat model that is sensitive to latitude.

To examine the influence of latitude on the distribution of Bicknell's Thrush, we searched the literature for the lowest-elevation record of the species in each of four latitudinal zones (42-43° N, 43-44° N, 44-45° N, and 45-46°N). We graphed these data, using latitude as the independent variable and elevation as the response variable. Figure 4 shows the strong linear relationship that resulted, whereby the lower limit of Bicknell's Thrush habitat drops 84 m in elevation for every one-degree increase in latitude.

Figure 4. Lowest-elevation detections of Bicknell's Thrush in four latitudinal zones.



We used this relationship to refine our elevation-based model of Bicknell's Thrush habitat. In ArcInfo GIS, we first created a grid that covers the U.S. breeding range of Bicknell's Thrush. Cell values throughout the grid corresponded with the lowest-elevation occurrence of Bicknell's Thrush, as predicted by the linear model. The result was a grid that sloped 84 m per degree gain in latitude. We used this sloping grid to mask our digital elevation model of Vermont . We then eliminated polygons containing less than 5 ha of conifer-dominated forest. The remaining sites represent our best, statewide approximation of Bicknell's Thrush habitat to date. Figure 5 compares the model used to select survey sites in 2000, with the updated model. Note that several southern Vermont sites are eliminated in the current version, while most northern Vermont sites are retained.

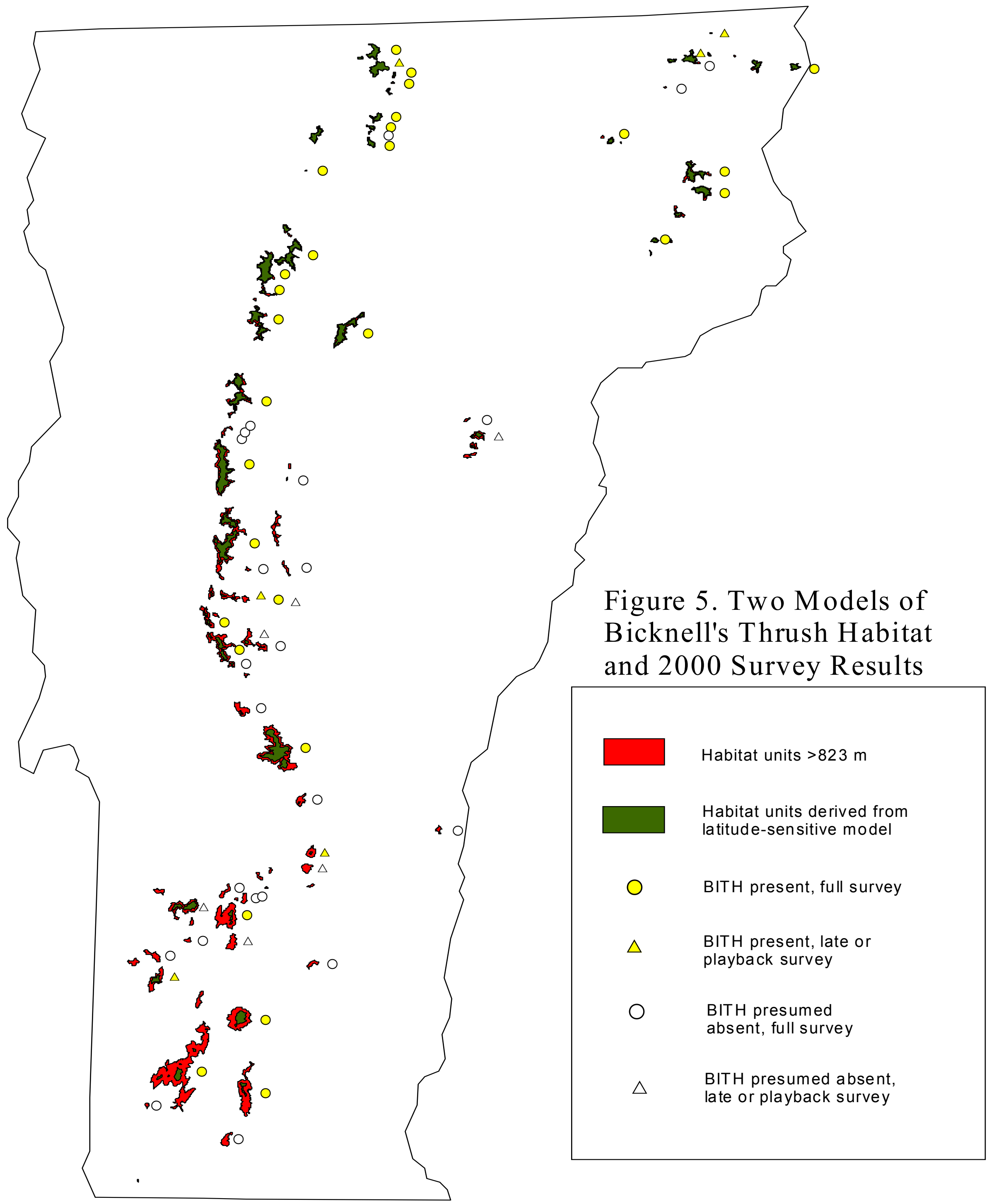


Figure 5. Two Models of Bicknell's Thrush Habitat and 2000 Survey Results

The refined GIS model is considerably more reliable than the one based on the 823-m threshold. Bicknell's Thrush was observed in 82% of the updated polygons that were sampled in 2000, compared with 53% of the old ones. Meanwhile, the species was detected in just 2 of the 24 polygons excluded by model revision. We will make further efforts to improve our representation of Bicknell's Thrush habitat in future analyses. Specifically, we will evaluate the influence of area and isolation, with measurements based on the amount of conifer forest within the new, latitude-sensitive habitat units. We will also investigate opportunities to integrate remotely sensed, forest structure data to model Bicknell's Thrush habitat at a finer scale.

CONCLUSION

Improved modeling increases the efficiency and statistical power of Mountain Birdwatch by concentrating survey attention on occupied mountains. It also minimizes volunteer turnover by raising the likelihood of observing Bicknell's Thrush. Most importantly, improved modeling allows us to identify especially valuable habitat for the Northeast's high-elevation bird community. Proper stewardship of these breeding areas requires a statistically powerful monitoring program, executed at a regional scale. Mountain Birdwatch is poised to fill this role in coordination with more localized monitoring schemes. Together, we expect to survey over 100 routes between the Catskills and Mount Katahdin in 2001. Partnerships that have enabled expansion to neighboring states may soon extend across the Canadian border. Bird Studies Canada, which is considering a similar monitoring program for New Brunswick and Nova Scotia, has shown interest in the Mountain Birdwatch model.

ACKNOWLEDGMENTS

We gratefully acknowledge the participation of the following Mountain Birdwatch and Forest Bird Monitoring Program volunteers: Andrea Ambros, Mary Anderson, David Bailey, Jayson Benoit, Debra Blake, Matt Bourgault, Ray Canning, Ann Caswell, Nicole Conte, Randy Dettmers, Jim Eldridge, Brent Farrell, Shawn and Nancy Finn, Dieter Gump, Ed Hack, Paul Hannan, Tom Kastner, Dave Lazicki, Dan Lindner, Sebastian Lousada, Scott MacLachlan, Chris McDonald, Lynn McNamara, Matt Moore, Alan Quackenbush, Ron Rancatti, Craig Reiser, Kristen Rose, Chris Runcie, Bill Shepard, Jim Siriano, Mark Skakel, George Springston, Rose Paul, Matt Stevens, Susan Swindell, Bob Tudek, and John Weeks. We thank our field assistant Charlie Rabatin, who scoured Vermont for evidence of Bicknell's Thrush in marginal habitat. David Capen, Ernie Buford and Sean MacFaden of the University of Vermont's Spatial Analysis Lab generously provided access to high-elevation point count data from the Green Mountain National Forest. Andrew Toepfer provided patient GIS support. Joel Schlagel donated considerable time and expertise introducing latitude-sensitivity to our habitat model. We are grateful to the following agencies, individuals, and corporations for allowing us to conduct bird surveys on their lands: the Carthusian Monastery, Essex Timber Company, LLC, the Green Mountain Club, the Green Mountain National Forest, Roger Mann, Ron McGraw, Mettowee Lumber and Plastics Co., Ed Sawyer, The Nature Conservancy, and the Vermont Agency of Natural Resources. The launch of Mountain Birdwatch was made possible by funds from the U.S. Fish and Wildlife Service. Special thanks to Randy Dettmers for supporting our work.

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Appendix 1. Mountain Birdwatch Training Manual – 2000

Appendix 2. Survey methods employed by two other high-elevation bird monitoring programs with notes on Mountain Birdwatch's subsampling approach.

VINS Forest Bird Monitoring Program

1) Counts begin shortly after dawn on days where weather conditions are unlikely to reduce count numbers (i.e., calm winds and very light or no rain). Censusing begins shortly (<1min.) after arriving at a station.
2) Observers record all birds seen and heard during a 10-min sampling period, divided into 3 time intervals: 3, 2, and 5 mins. Observers note in which time interval each bird is first encountered and are careful to record individuals only once. To reduce duplicate records, individual birds are mapped on standardized field cards and known or presumed movements noted. Different symbols are used to record the status of birds encountered (i.e., singing male, pair observed, calling bird, etc.).
3) Each site, consisting of 5 point count stations, is sampled twice during the breeding season; once during early June (ca. 2-12 June) and once during late June (ca. 14-25 June). Observers are encouraged to space their visits 7-10 days apart. For each site visit, all stations are censused in a single morning and in the same sequence.

Mountain Birdwatch subsamples focal species results from all five points surveyed during the first sampling period.

High-elevation Bird Surveys on the Green Mountain National Forest
(conducted by UVM-SNR personnel under the direction of Dr. David E. Capen)

1) Four routes are done in June-July to monitor Blackpoll warbler and other high-elevation species. Each route consists of 12-22 point-count locations (66 total).
2) Two routes are located in the northern half of the GMNF, two more in the southern half. All routes follow the Long Trail except Mt. Snow, which follows the Deerfield Ridge Trail.
3) Counts are conducted twice per year: once after birds are on territory (second or third week of June), and again 1 or 2 weeks later (usually the first week of July). Counts last for 5 minutes, during which time all birds seen or heard are recorded.

Mountain Birdwatch subsamples focal species results from first five points of each route surveyed between June 1 and 15.

Appendix 3. Survey results from 2000 by route. Routes with no points were surveyed outside the main sampling window or by audioplayback only.

Route	points	BITH	BLPW	SWTH	WIWR	WTSP	BITH present
Abe	5	2	2	2	6	3	y
Aeolus	5	0	0	0	1	2	n
Ascutney	5	0	0	3	3	4	n
Baby	2	0	4	2	3	1	n
Belvidere	5	1	8	1	7	4	y
Bloodroot	5	0	8	6	2	5	y
Blueridge	5	0	0	5	3	1	n
Bluff	2	0	3	0	0	1	n
Bolton	5	4	8	3	6	8	y
Braintree	5	0	2	0	3	3	n
Breadloaf	5	1	6	2	6	5	y
Bromley	5	0	3	0	2	0	n
Brousseau	0						y
Buckball	5	0	0	0	1	2	n
Burke	5	0	2	4	3	8	y
Camels	5	4	6	5	11	8	y
Carmel	5	0	3	0	2	0	n
Corporation	0						n
Dewey	5	1	7	0	5	4	y
Domey's	3	0	5	0	2	2	y
Dorset	0						n
East	5	5	1	0	5	1	y
Equinox	0						y
Gillespie	4	0	3	2	0	1	n
Gilpin	5	0	6	2	3	7	y
Glastenbury	5	0	6	2	1	2	y
Glebe	5	0	3	2	1	2	n
Gore	0						y
Haynorth	5	2	7	2	5	9	y
Heartwellville	5	0	5	1	2	4	n
Hemlock	4	0	3	2	2	3	n
Hunger	5	0	5	1	4	7	y
Jay	0						y
Killington	5	1	4	0	2	5	y
Laraway	5	6	8	10	1	2	y
Lewis	4	0	4	1	2	3	n
Lockwood	5	0	6	3	3	3	n
Madonna	5	2	6	1	4	9	y
Mansfield	5	7	8	1	4	9	y
Molly	5	0	7	2	4	3	n
Monadnock	5	0	7	2	5	2	y
Monastery	5	0	3	3	3	0	y
Mother	5	0	0	0	0	0	n
Mud	5	0	1	2	3	5	n
NoJay	5	2	9	2	4	4	y
Okemo	0						y

Route	points	BITH	BLPW	SWTH	WIWR	WTSP	BITH present
Pete Parent	4	0	1	5	2	2	n
Philadelphia	0						n
Romance	5	0	5	3	4	4	y
Saltash	5	0	1	1	3	2	n
Scrag	4	0	1	0	0	3	n
Seneca	5	0	5	5	8	4	y
Signal	0						n
Snow	5	0	5	2	2	2	y
South	5	0	7	2	4	5	n
Spruce	5	0	2	5	1	5	n
Stratton	5	2	5	0	3	5	y
Styles	5	0	9	2	1	6	
Tillotson	5	1	6	1	4	7	y
Westmore	5	0	6	0	7	8	y
Wilcox	5	0	7	1	5	4	n
Woodford	5	0	6	1	2	5	n
Worth	0						y