Mountain Birdwatch 2.0: 2011

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VERMONT CENTER FOR ECOSTUDIES
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Executive Summary

Mountain Birdwatch (MBW) is a long-term monitoring project for songbirds that breed in high-elevation forests of the northeastern United States and Canada. MBW's primary focus is Bicknell's Thrush, a montane-fir specialist that breeds only in the Northeastern U.S. and adjacent portions of Canada. Initiated in 2000, MBW trained citizen scientists to conduct annual surveys along point-count routes in Massachusetts, New York, Vermont, New Hampshire, and Maine. In 2010, MBW incorporated several protocol improvements, including a randomized selection of routes across the United States, a revised survey protocol to allow for more stringent statistical analyses, and an expansion into Canada to ensure consistent surveys across the entire breeding range of Bicknell's Thrush.

2011 yielded three notable accomplishments for the newly-launched program, Mountain Birdwatch 2.0 (MBW2): 1) a transition to volunteer-based surveys in the U.S.; 2) a completed launch of the full program in Canada, and 3) the establishment of a sub-sample of routes in NY and VT to more closely examine trends in the southernmost habitat of the Bicknell's Thrush breeding range. In the US, Bicknell's Thrush was detected at 32% of points, a detection rate that will allow us to achieve 80% power to detect a 3% annual change in Bicknell's Thrush abundance over 30 years at a significance level of 0.1. In Canada, detection rates were much lower (<10% of points with BITH detections), causing us to evaluate what potential program modifications will allow us to continue an international monitoring scheme while still achieving our goals.

Background and Rationale

The high-elevation forests of the northeastern United States provide habitat for a unique assemblage of breeding birds, several of which reach the southern limits of their distribution in these montane forests of spruce and fir. Most notably, mountain forests provide habitat for Bicknell's Thrush (*Catharus bicknelli*), the region's only endemic songbird. However, due to the inaccessibility of the high-elevation forests of the Northeast, several montane avian breeders are not included in any of the standardized state or federal bird monitoring schemes (e.g., the Breeding Bird Survey). As such, generating even rudimentary estimates of population trends or population size has proven difficult for species in this habitat, and the development of scientifically-defensible conservation strategies lagged accordingly. Mountain Birdwatch, a project of the Vermont Center for Ecostudies (VCE), was created to fill these information gaps.

Mountain Birdwatch began under the auspices of the VCE (at the time part of the Vermont Institute of Natural Science) Forest Bird Monitoring Program. Volunteers and staff surveyed 12 mountains from 1993 to 1999 in order to monitor changes in the status of Bicknell's Thrush and other high-elevation songbirds. In 2000, VCE biologists launched MBW as an independent project with fifty additional routes in Vermont and offered observers the option to concentrate on five species: Bicknell's Thrush, Swainson's Thrush (*Catharus ustulatus*), Blackpoll Warbler (*Dendroica striata*), White-throated Sparrow (*Zonotrichia albicollis*), and Winter Wren (*Troglodytes troglodytes*). The survey region was expanded in 2001 to include over 100 new routes in New York, New Hampshire, Massachusetts, and Maine. The objectives of this original Mountain Birdwatch were to: 1) monitor the distribution and abundance of mountain-breeding birds in northern New England and New York; 2) describe the influence of landscape

and habitat features on mountain bird distribution and abundance; and 3) guide stewardship of high-elevation forests.

Data collected under MBW have been put to a variety of uses: we have assessed the power of MBW to detect population trends (Lambert et al. 2001); examined the influence of landscape structure on high-elevation bird communities (Lambert et al. 2002); measured habitat characteristics on 45 survey routes (Lambert 2003); quantified short-term population trends (Lambert 2005); produced and validated a Bicknell's Thrush distribution model (Lambert et al. 2005); and projected effects of climate change on Bicknell's Thrush distribution (Lambert and McFarland 2004). We have also identified key management units and conservation opportunities for Bicknell's Thrush (Lambert 2003). More recently, we have conducted a ten-year trend analysis of MBW's five target species (Scarl 2011) and assessed the relative contribution of local and landscape variables to Bicknell's Thrush habitat occupancy in Vermont (Frey et al. 2011). We are currently using ten years of MBW data to construct an occupancy model assessing habitat requirements, colonization, and extinction trends for Bicknell's Thrush in the United States.

Mountain Birdwatch is also integral to the ongoing efforts of the International Bicknell's Thrush Conservation Group (www.bicknellsthrush.org) and serves as the main tool to evaluate progress towards the group's goals. In 2010, the International Bicknell's Thrush Conservation Group unveiled a Conservation Action Plan for Bicknell's Thrush; analyses of population trends and occupancy based on MBW data informed development of the Bicknell's Thrush Conservation Action Plan (IBTCG, 2010).

Despite the enormous potential of this monitoring project, the original MBW design exhibited several limitations. First, MBW investigated breeding birds in the high-elevation

regions of New York, Vermont, New Hampshire, and Maine, yet birds are not constrained by state and country borders. High-elevation spruce-fir forests extend northward into Canada, as does the breeding range of Bicknell's Thrush (IBTCG, 2010). While Canadian-based Bicknell's Thrush distribution surveys and the High Elevation Landbird Program monitored this species in Quebec and the Canadian Maritimes, differences in survey protocols and timing made integration of results across regions difficult. Second, while initial route selection made an attempt at randomization across the available habitat, limitations in volunteer effort and the addition of new, non-random routes created a non-random MBW survey sample. This limits inferences that can be drawn across an entire population or habitat. Third, the original MBW allowed volunteers to select one of two survey protocols: volunteers could either focus on five species of high-elevation birds or note all species observed during a survey. Differences in observer attention or effort may have influenced results, even for detections of the five species that all volunteers surveyed. Finally, in recent years, scientists have recognized that detectability is an essential consideration in bird monitoring programs (MacKenzie et al. 2005); detectability is a measure of the probability of detecting a species if that species is in fact present. Analyses that account for detectability tend to more accurately represent population trends than those that do not consider this variable, especially for difficult-to-detect species (Rota et al. 2011). Although estimates of detectability are possible with MBW data, important variables that may influence detectability were not measured, and thus accuracy of detectability estimates may be poor.

Mountain Birdwatch 2.0

Mountain Birdwatch 2.0 (MBW2) was developed to address the shortcomings of the original MBW and provide a long-term, international monitoring program that surveyed high-elevation birds across the entire breeding range of the Bicknell's Thrush. MBW2 incorporates the following improvements:

1. MBW2 is a partnership between government, non-government, and academic institutions in the U.S. and Canada. Using a Bicknell's Thrush potential habitat model (Lambert et al 2005) to identify a survey frame, MBW2 routes were selected randomly across all potential Bicknell's Thrush habitat in both countries. A Generalized Random Tessellation Stratified (GRTS) sampling design ensured a spatially balanced but randomized selection of survey stations while also allowing for randomized subsampling in specific regions of interest. With randomly selected routes and systematic surveys conducted across the entire breeding range of the Bicknell's Thrush, MBW2 data will allow us to draw strong conclusions about abundance, occupancy, trends, and distribution across an entire habitat.
2. MBW2 incorporates a new survey protocol that focuses on a broader array of montane species while allowing for improved calculations of detectability. All MBW2 participants will collect data on 11 species (Table 1), leading to an expanded and consistent target list with one protocol for all participants. This expanded focus, which also incorporates surveys of a common avian montane nest predator, will allow us to draw conclusions about the broader ecosystem and predator-prey cycles as well as standardize volunteer effort.

Table 1: Species surveyed by all MBW2 participants.

Common Name	Scientific Name	Species Code
Yellow-bellied Flycatcher	*Empidonax flaviventris*	YBFL
Black-capped Chickadee	*Poecile atricopilla*	BCCH
Boreal Chickadee	*Poecile hudsonica*	BOCH
Winter Wren	*Troglodytes troglodytes*	WIWR
Bicknell's Thrush	*Catharus bicknelli*	BITH
Swainson's Thrush	*Catharus ustulatus*	SWTH
Hermit Thrush	*Catharus guttatus*	HETH
Blackpoll Warbler	*Dendroica striata*	BLPW
Fox Sparrow	*Passerella iliaca*	FOSP
White-throated Sparrow	*Zonotrichia albicollis*	WTSP
Red Squirrel	*Tamiasciurus hudsonicus*	RESQ

Goals

Mountain Birdwatch 2.0 identifies these monitoring and programmatic goals (reproduced from Hart and Lambert 2010):

Monitoring

Monitoring Goal 1: To measure the annual population status of target species in terms of distribution, abundance/density, and occupancy

Monitoring Goal 2: To measure changes in the population status of target species over time

Monitoring Goal 3: To relate population status and trend information to biotic and abiotic variables that may affect the target species

Programmatic

Programmatic Goal 1: To make observational data (date, location, count, etc.) and associated metadata publicly available for visualization and download through the Avian Knowledge Network (AKN), while recognizing legal, institutional, proprietary, and other constraints.

Programmatic Goal 2: To provide decision-makers with tools and analyses to conserve high-elevation birds in the Northern Appalachian and Laurentian Regions

Programmatic Goal 3: To increase public understanding of the ecology, status, and conservation requirements of high-elevation songbirds in the Northern Appalachian and Laurentian Regions.

For a detailed description of Mountain Birdwatch 2.0 protocols and history, please see Hart and Lambert 2010.

United States Initiative

Mountain Birdwatch 2.0 was launched in the United States in 2010. In June and July of 2010, nine technicians and Mountain Birdwatch director Judith Scarl established 96 routes with a total of 529 points across New York, Vermont, New Hampshire, and Maine. Technicians mapped and documented these routes using GPS points, written descriptions, and photographs. Since MBW2 aims to compare avian population trends with habitat characteristics, technicians measured habitat variables at up to three subplots around each survey station. Technicians conducted point counts at 410 of these stations in June and July of 2010. These efforts set the stage for decades of future surveys.

Re-Launching a Volunteer Program

Mountain Birdwatch has always been a citizen science program at its core, and in 2011 MBW2 welcomed volunteers onto its new routes. In May of 2011, Mountain Birdwatch director Judith Scarl held a volunteer training workshop in each of the four participating Mountain Birdwatch states (NY, VT, NH, and ME). 40 Mountain Birdwatch volunteers attended training sessions, with some volunteers traveling hundreds of miles to participate. At these sessions, volunteers learned about the history of the Mountain Birdwatch program, applications of the original MBW data, the benefits of the revised monitoring program, and identification characteristics of the target species. Volunteers also participated in a practice point count using recorded bird songs and calls.

In 2011, volunteers (see Figure 1) surveyed 64 routes across the northeastern United States. With the addition of new routes in 2011 and additional recruitment and training

sessions in 2012, we expect the number of routes covered by volunteers to nearly double in 2012.

Figure 1: Volunteers Peg Ackerson and Pip Richens finish a dawn survey on Mt. Blue in June of 2011.

New York and Vermont Subsample

The original MBW2 route selection procedure assigned routes largely in proportion to the available habitat in a given region. We further narrowed route selections by eliminating areas that did not have road or trail access. Based on these criteria, Vermont and New York were assigned fewer routes than Maine and New Hampshire. In Vermont, high-elevation spruce-fir habitat is limited largely to the spine of the Green Mountains and to a few high peaks in the Northeast Kingdom, and thus the total area of spruce-fir forest is small compared to other regions. New York's Catskill Mountains have an even smaller area

available for birds looking to nest in high-elevation spruce-fir forest. The Adirondacks of New York have a large percentage of the potential Bicknell's Thrush habitat in the United States; however, large portions of this habitat are difficult to access due to lack of road or trail access or overly long hike durations.

Despite the small number of routes initially selected for New York and Vermont, the high-elevation regions of these two states merit closer attention. The Catskills and the southern Green Mountains of Vermont represent the southernmost extent of the high-elevation spruce-fir forest in which Bicknell's Thrush breeds. Climate-related changes in species' ranges often manifest as expansions or contractions at range edges (Parmesan 2006) and a regional increase of 1 degree Celsius may be enough to eliminate all Bicknell's Thrush breeding habitat from these regions (Rodenhouse et al 2008). Thus to detect early warning signs of global climate change, the southernmost limits of Bicknell's Thrush breeding habitat merit closer monitoring. Second, data from the original Mountain Birdwatch project indicate that unlike in other regions, Bicknell's Thrush detections have increased in the Adirondacks and Catskills over the past decade (Scarl 2011). More extensive monitoring will elucidate whether Bicknell's Thrush population size is increasing in New York State or whether these trends are a short-term spike or an artifact of sampling effort. Third, the greatest numbers of Mountain Birdwatch volunteers have historically been active in New York and Vermont, demonstrating a potential for closer monitoring in those states.

In 2011, technicians established an additional 5 routes in the Catskills, 8 in the Adirondacks, and 12 in the Green Mountains of Vermont as part of a regional subsample. In addition to this subsample, technicians established and surveyed an additional 17 routes for the national sample that were not established in 2010 or required revisions. Thus, 2011 marked the completion of the US launch of MBW2. Our randomized, statistically rigorous subsampling will allow us to draw conclusions about Bicknell's Thrush and other high-elevation breeding birds at international, national, and regional scales.

2011 U.S. Season Results

Volunteers and technicians surveyed 636 points along 118 routes in the United States in 2011 (see Figure 2); data from 23 points were excluded from analysis due to improper collection (survey methods not followed, data collected at wrong location, survey station not within Bicknell's Thrush habitat model). Bicknell's Thrush was detected on 59% of routes and at 31.9% of points (Table 2). Vermont had the lowest percentage of points with Bicknell's Thrush detections; BITH was observed at only 23% of points in this state. The Catskills had the highest detection rates of any region; 18 out of 31 points (58.1%) had Bicknell's Thrush detections. While these data are uncorrected for detectability, observer skill, or field conditions, they do suggest that the New York mountains provide important habitat for this vulnerable species.

Table 2: U.S. sampling effort in 2011.

Region	Routes Surveyed	Points Surveyed	Routes with BITH detections	Points with BITH detections
Catskills (NY)	6	31	6 (100%)	18 (58.1%)
Adirondacks (NY)	16	84	9 (56.3%)	33 (39.3%)
New York Total	22	115	15 (68.2%)	51 (44.3%)
Vermont	23	120	11 (47.8%)	28 (23%)
New Hampshire	46	236	31 (67.4%)	79 (33.5%)
Maine	27	142	13 (48.1%)	38 (26.7%)
Overall (U.S.)	**118**	**613**	**70 (59.3%)**	**196 (31.9%)**

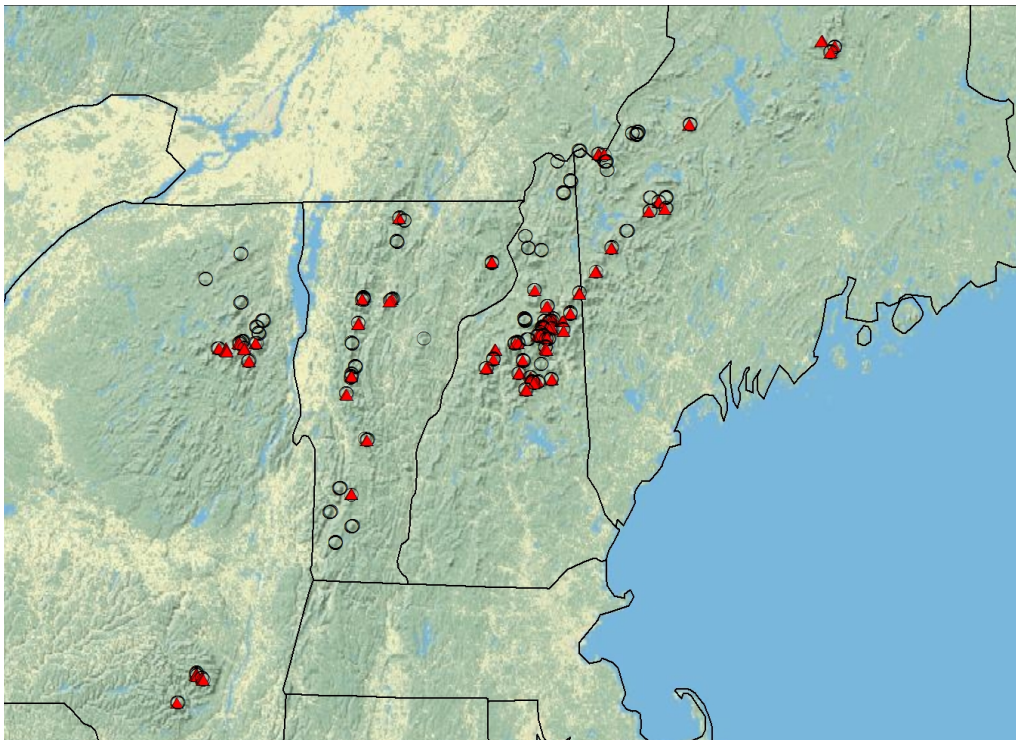

Figure 2: MBW2 points surveyed in the U.S. in 2011. Red triangles represent points with BITH detections; open circles represent points where no BITH was detected. Some data from Maine has been excluded from this map due to confidentiality agreements with landowners.

"Across the Breeding Range"- International Mountain Birdwatch

Launch and Surveys

2011 marked the international launch of MBW2. A total of 1063 points were surveyed internationally as part of Mountain Birdwatch 2.0 (Figure 3); approximately 475 of these points were part of the original international sample, while the remaining points represented U.S. and statewide subsamples. As noted above, 636 points along 118 routes were surveyed in the United States, and Bicknell's Thrush was detected at 196 points (32%) along 70 routes in the U.S. alone. In Québec, 338 points along 58 routes were surveyed in 2011, with BITH detected at only 3% of these points. In the Maritimes, 88 points were surveyed along 15 routes, and Bicknell's Thrush was detected at 7 (8%) of these points. However, all of the BITH detections in the Maritimes occurred in New Brunswick; no BITH were detected in Nova Scotia. Overall, BITH was detected at 6% of international survey stations (see Table 3).

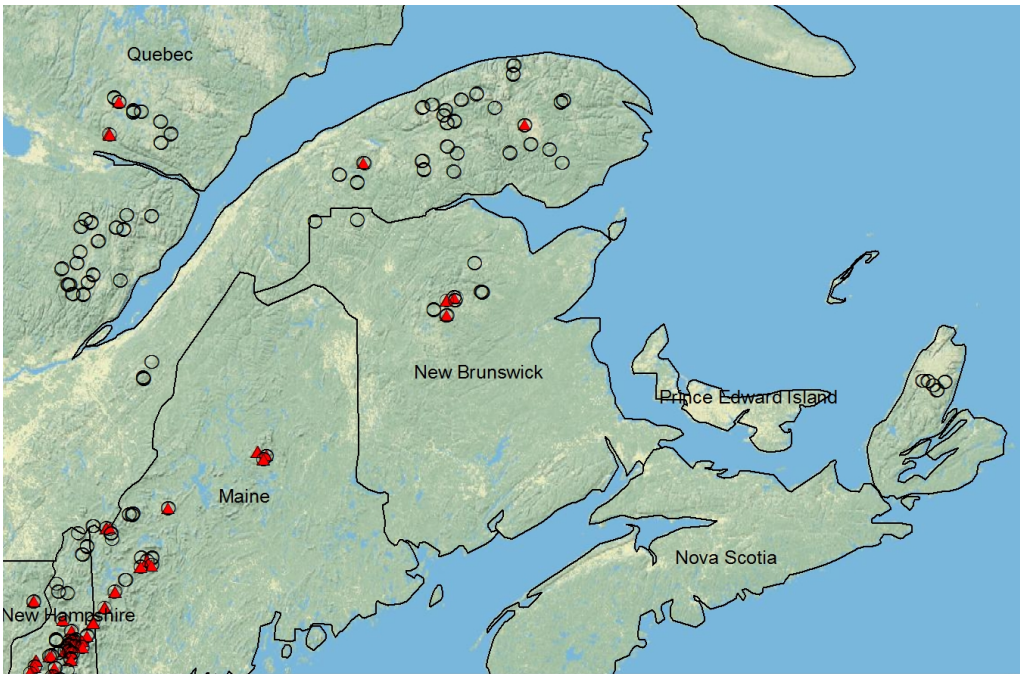

Figure 3: MBW2 points surveyed in Canada in 2011. Red triangles represent points with BITH detections; open circles represent points where no BITH was detected.

Table 3: International MBW2 sampling effort in 2011. Data from the U.S. represent points surveyed as part of the international sample only.

Region	Routes Surveyed	Points Surveyed	Points with BITH detections
Québec	58	338	11 (3%)
Maritimes	15	88	7 (8%)
U.S. (Int'l Sample)	8	46	10 (21.7%)
TOTAL	**81**	**472**	**28 (5.9%)**

International Survey: Meeting our Goals?

As part of MBW2's objectives, detailed in Hart and Lambert 2010, this project aimed to:

- Achieve 80% power to detect a 3% annual change in Bicknell's Thrush abundance over 30 years at a significance level of 0.1
- Maintain a coefficient of variation less than or equal to 0.4 for BITH population trend estimates over 30 years.

Prior to the launch of MBW2, Frank Rivera of the U.S. Fish and Wildlife Service analyzed MBW2 pilot data from 2008 and concluded that 400-700 stations would allow a coefficient of variation of 0.2 on an annual estimate of Bicknell's Thrush density (Hart and Lambert 2010). However, Rivera's calculations of sample size were based on pilot data from the U.S., where Bicknell's Thrush densities may be much higher than in Canada (COSEWIC 1999); 30% of pilot survey stations yielded BITH detections. With Bicknell's Thrush detected at fewer than 6% of international points in 2011, MBW2 partners are concerned that Mountain Birdwatch will not achieve its original objectives. In addition, participants are concerned about the difficulty of financially sustaining the international program; Canadian funders may not want to support a program that fails to detect Bicknell's Thrush across such a large percentage of Canadian routes.

At an IBTCG meeting in Québec in November 2011, regional managers discussed whether to modify MBW2 protocols to obtain higher rates of BITH detections in Canada. With much of the potential BITH habitat in Canada falling within industrial forest, many MBW2 stations may exist within recently harvested parcels, with no appropriate habitat remaining. Alternatively, elevation thresholds of the BITH habitat model may include areas that are generally too low to support high-quality Bicknell's Thrush habitat, except in extreme conditions. Limiting route selection to higher-quality habitat would limit the program's conclusions to birds only in that habitat, but the benefits of detecting BITH more frequently may outweigh the downsides of further limiting route selection. As of April 2012, international MBW2 managers are exploring the possibility of developing separate sampling schemes for protected/unmanaged land and industrial forests to further

elucidate the impact forestry practices have on Bicknell's Thrush while concentrating sampling effort on current high-quality potential Bicknell's Thrush habitat. The existing MBW2 protocol and established routes will continue to be surveyed in the United States.

Conclusions

The past two years have marked an important transition for the Mountain Birdwatch program; we concluded a decade of data collection across the mountains of NY, VT, NH, and ME, and we launched an international collaboration to monitor high-elevation birds throughout the spruce-fir forests of the northeastern U.S. and Canada. With a dual focus on high-elevation conservation and citizen science, Mountain Birdwatch engages and trains more than 100 volunteers who collect extensive data that are critical for conservation. The launch of Mountain Birdwatch 2.0 expands an already-successful conservation initiative across state and country borders, a powerful initiative that will allow us to draw conclusions across the entire breeding range of Bicknell's Thrush. Although the international protocols require modification to account for low densities of Bicknell's Thrush and high levels of forestry in Canada, this first full year of Mountain Birdwatch represents an essential first step towards understanding habitat use and distribution of Bicknell's Thrush across its entire breeding range.

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