National Park Service
U.S. Department of the Interior

Northeast Region
Inventory & Monitoring Program
Northeast Temperate Network
Woodstock, Vermont

A Biological Inventory of Breeding Birds at the Marsh-Billings-Rockefeller National Historical Park and Adjacent Lands, Woodstock, Vermont

Technical Report NPS/NER/NRTR--2005/005

ON THE COVER
The Pogue at Marsh-Billings-Rockefeller National Historical Park
Photograph by: Steve Faccio

A Biological Inventory of Breeding Birds at the Marsh-Billings-Rockefeller National Historical Park and Adjacent Lands, Woodstock, Vermont

Technical Report NPS/NER/NRTR--2005/005

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U.S. Department of the Interior
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Abstract

The 555-acre Marsh-Billings-Rockefeller National Historical Park was established in 1992 to interpret conservation history and the evolving nature of land stewardship in America. In order to help guide the development of a forest management plan, a biological inventory of the breeding birds within the park and adjacent lands was conducted in 2001 and 2002. A variety of field techniques were used to document the composition and distribution of birds in the park. A total of 91 bird species were detected during the 2-year project, 72 of which were confirmed or suspected of breeding within the park or adjacent lands, 16 were considered local breeders that may nest occasionally or in the future on park lands, while 3 species were strictly transients. Of the 96 species expected to be found breeding in the park 86 (89.6%) were observed. Twenty-three of the detected species (25%) appear either on the Partners in Flight (PIF) priority list for the Northern New England Region, or on the Vermont list of rare and uncommon birds. During point count surveys, 73 species were detected, with an interpolated species richness of 92 (±4.69 SE). Fourteen species were detected at >50% of the survey points, including 5 (36%) listed by PIF as high conservation priorities for the Northern New England Region (Ovenbird, Blackburnian Warbler, Eastern Wood Pewee, Wood Thrush, and Scarlet Tanager). Recommendations for forest management at MABI include maintaining and/or enhancing mid-aged to mature forest conditions, and increasing structural diversity in the understory. These goals will benefit the suite of species that are among the most frequently encountered and abundant, and also contains the majority of conservation priority species for the region. Hayfield management recommendations include a delayed mowing regime to maintain Bobolink populations, and establishing American Kestrel nest boxes or appropriate snags to provide this species with potential nesting opportunities. Since the majority of conservation priority species breeding at MABI are forest-breeding landbirds, a monitoring program for the park should target this group as a representative sample. However, since point count surveys limited to the park would have very low power to detect trends, developing a network of monitoring sites in the area is recommended.

Acknowledgements

Special thanks to Charlie Rabatin and Ted Gaine for assisting with bird surveys. Thanks also to the members and trustees of the Vermont Institute of Natural Science, VINS staff members Dan Lambert and Kent McFarland for numerous consultations and discussions that improved both the quality of this study and the content of this report, and to helpful comments provided by K. Jones and G. Shriver on an earlier version of this document.

Background and Purpose

The Marsh-Billings-Rockefeller National Historical Park (MABI) is the only national park to focus on conservation history and the evolving nature of land stewardship in America. Established in 1992 and opened to the public in 1997, Vermont's first national park preserves and interprets the historic 555-acre Marsh-Billings-Rockefeller property located in Woodstock, Windsor County, Vermont. The National Park Service (NPS) manages the forest as a working landscape, with plans for educational forestry demonstrations, exhibits, and sustainable forestry practices. To attain these goals, a forest management plan is being developed for the park. In order to help guide the development of this plan, park managers require comprehensive information about the biological resources that occur within the park and how management practices might affect the status and distribution of these resources. To that end, the first in a series of biological inventories was conducted during 1996 when the vascular plants occurring at MABI were surveyed (Hughes and Cass 1997). That was followed by inventories of reptiles and amphibians (Faccio 2001), and bats (Reynolds and McFarland 2001). This report details the results of a 2-year biological inventory of breeding birds found in the park and adjacent conservation lands.

The broad goal of this inventory was to provide park managers with comprehensive, science-based information about breeding bird populations that occur within the park boundaries. This will help park staff develop stewardship priorities, formulate effective stand-specific management strategies that will reflect MABI's theme of conservation stewardship, and help guide future monitoring goals. The specific goals of the inventory were to:

1) Develop baseline data on the composition, distribution, and relative abundance of breeding birds within the Marsh-Billings-Rockefeller NHP and adjacent lands;

2) Evaluate species richness and relative abundance across basic habitat types (conifer plantations, northern hardwood stands, and open fields);

3) Identify ecologically sensitive and/or habitats of management interest (e.g., nest sites of raptors and/or grassland species, etc.) where forest management and/or mowing regimes may be restricted.

To achieve these goals, the inventory was designed to meet the following basic objectives:

1) To document through field investigations the occurrence of at least 90% of the breeding bird species estimated to exist within the park;

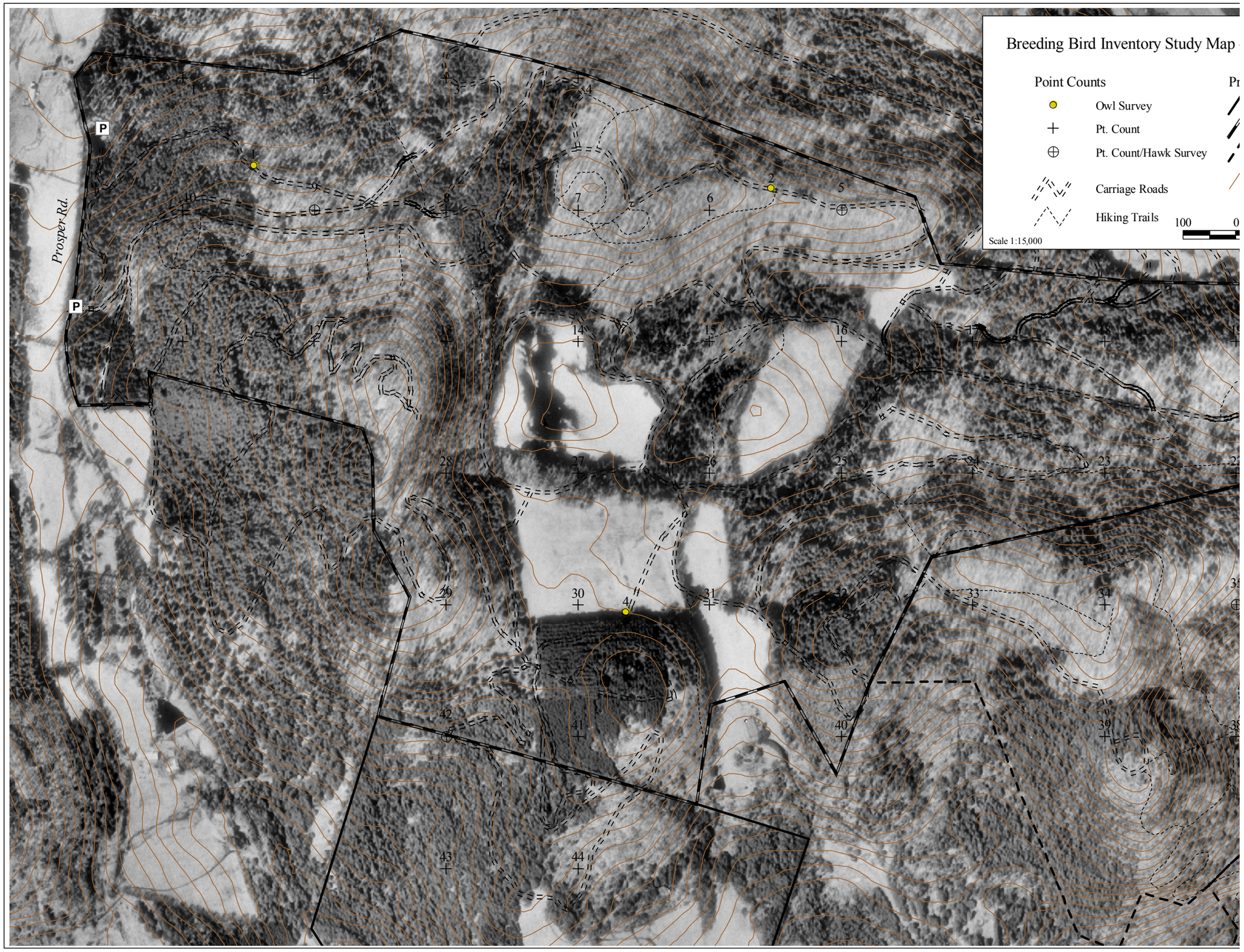
2) To describe the distribution and relative abundance of any state and/or federally-listed Endangered and Threatened species, species of Special Concern, and/or exotics occurring within the park;

3) To provide information necessary to develop a general monitoring strategy and design tailored to specific threats and resource issues of the park, which can be implemented following the inventory.

Methods

Point Counts

Point count surveys were used to document most avian species and to establish a baseline from which to detect trends over time. The sampling frame was established in ArcView by overlaying a 250 m grid on top of park boundaries, cover types, and other GIS layers, with point counts located at the intersections of this 250 m grid. During winter 2001, I located these points in the field using a Trimble GPS unit and marked them with flagging and aluminum tree tags. A total of 44 point counts were established – 36 at MABI, 6 on the adjacent Woodstock Town Park land, and 2 on the King Farm property (Fig. 1, Appendix 3). All point counts were visited 3 times annually during the 2001 and 2002 breeding seasons (late-May through June), for a total of 6 visits/point. Each point was surveyed for 10 minutes, with each count divided into 3, 2, and 5 minute intervals. Observers counted all individual birds detected within 2 distance classes (within and beyond 50 m). Surveys were only conducted on mornings with favorable weather conditions, began within 15 minutes of sunrise, and ended within four hours. Species not detected during point counts, but observed between stations, were recorded for a species list.


Breeding Bird Inventory Study Map
Point Counts
Owl Survey
Pt. Count
Pt. Count/Hawk Survey
Carriage Roads
Hiking Trails
100
0
Scale 1:15,000
Prosper Rd.
P
P

For all species detected within the 50 m radius circle, I calculated frequency of occurrence and relative abundance for the entire study site, as well as for each of the three primary habitat types (forest, conifer plantation, and hayfield). I defined frequency of occurrence as the number of points at which a species occurred divided by the total number of points surveyed. Relative abundance was measured as the mean number of individuals divided by the total number of points surveyed.

I then calculated species richness and diversity for the entire study site, and for each of the three habitats listed above. To standardize the sampled area between plantation and non-plantation forests, I randomly selected 7 point count stations (points 6, 15, 18, 19, 21, 25, 34) within non-plantation forests to represent this habitat type. Species richness was calculated using the program SPECRICH (Hines 1996), which estimates the total number of species from empirical species abundance distribution data based on methods described by Burnham and Overton (1979). I used Shannon's diversity index (H), whichaccounts for species richness, abundance, and evenness. In the formula below, s represents richness, and p is the proportionate representation of species i among the total number of species.

$$\mathrm{H} = -\sum_{i=1}^{s} (p_i)(\ln p_i)$$

To determine species richness for the entire study site, I used data from both distance classes to avoid eliminating a species that may have only been detected outside the 50 m radius. Because Shannon's index assumes that species do not differ in their detectability, I used the distance class which best supports this assumption (<50 m) in the calculations. In determining species richness and diversity for each habitat type, I only used data from within the 50 m radius, and for non-plantation forest points, from the subset of 7 randomly selected points within that habitat.

Audio-Playback Surveys

I selected 4 nocturnal owl survey points spaced at approximately 1 km intervals along the existing MABI trail network to facilitate locating them at night (Fig. 1, Appendix 3). Each point was visited twice annually at least 30 minutes after sunset; once between 18 and 28 March and once between 5 and 15 April. At each point, I listened silently for 3 minutes and then broadcast an audio playback alternating between owl vocalizations and silent listening periods. The taped sequence was as follows: 20 seconds of Northern Saw-whet Owl calls, a minute of listening; 20 seconds of Eastern Screech Owl calls, a minute of listening; 20 seconds of Barred Owl calls, a minute of listening; 20 seconds of Great Horned Owl calls, a minute of listening. The total observation time at each station was 8:20 minutes.

Forest-nesting hawks were surveyed with audio-playback at a subset of 4 point count stations (Fig. 1, Appendix 3). Each point, located in appropriate forested habitat and spaced at approximately 1 km intervals, was visited twice during April. During each survey I listened silently for 3 minutes, and then broadcast an audio playback alternating between hawk

vocalizations and silent listening periods. The taped sequence was as follows: 10 seconds of Sharp-shinned Hawk calls, followed by a minute of listening; 10 seconds of Cooper's Hawk calls, a minute of listening; 10 seconds of Broad-winged Hawk calls, a minute of listening; 10 seconds of Red-shouldered Hawk calls, a minute of listening; 10 seconds of Northern Goshawk calls, a minute of listening; 10 seconds of Red-tail Hawk calls, a minute of listening. The total observation time at each station was 10 minutes.

Area Searches

Area searches for species not well surveyed by other methods, particularly hawks and waterfowl, were conducted in appropriate habitats between April 15 and July 30. Special attention was paid to locating nests of Accipiter species and woodland Buteos, as well as documenting waterfowl species breeding in park wetlands. In addition, grassland habitat at MABI was surveyed to determine the number of breeding Bobolink pairs, and cliff areas on lands adjacent to MABI were searched for nesting Common Ravens and Turkey Vultures. During area searches, efforts were made to locate and monitor nests of other species as well.

Results and Discussion

A total of 91 bird species were detected during the 2-year inventory project. Of these, 72 species were confirmed or suspected of breeding within the park or on adjacent lands, 16 species were considered local breeders that may nest occasionally or in the future on park lands, while 3 species (Common Loon, Blackpoll Warbler, and Vesper Sparrow) were strictly transients (Table 1). Of the 96 species expected to be found breeding in the park (see Appendix 1), 86 (89.6%) were observed. However, 3 introduced

Table 1. Status and abundance of 91 species detected during breeding bird inventory at Marsh-Billings-Rockefeller National Historical Park, Woodstock, VT, 2001-2002. Species listed in taxonomic order.

Common Name	Scientific Name	Observation Method [a]	Park Status [b]	Abundance [c]	State/PIF Priority Rank [d]
Common Loon	Gavia immer	P, I	M	R	E
Turkey Vulture	Cathartes aura	I	L	U	
Canada Goose	Branta canadensis	P	L	U	
Wood Duck	Aix sponsa	P, I	B	C	
Hooded Merganser	Lophodytes cucullatus	I	L	U	
Mallard	Anas platyrhynchos	P, I	B	C	
Common Merganser	Mergus merganser	P, I	L	U	
Cooper's Hawk	Accipiter cooperii	P, I	L	U	SC
Broad-winged Hawk	Buteo platypterus	P, I	L	U	
Red-tailed Hawk	Buteo jamaicensis	P, I	L	U	
American Kestrel	Falco sparverius	I	L	U	II-A
Ruffed Grouse	Bonasa umbellus	I	B	C	
Wild Turkey	Meleagris gallopavo	P	L	C	
Killdeer	Charadrius vociferus	I	L	C	
Spotted Sandpiper	Actitis macularia	P	B	U	
Common Snipe	Gallinago gallinago	I	L	C	
American Woodcock	Scolopax minor	I	L	C	I
Mourning Dove	Zenaida macroura	P, I	B	A	
Barred Owl	Strix varia	P, I, A	B	C	
Chimney Swift	Chaetura pelagica	P, I	L	C	II-C
Ruby-throated Hummingbird	Archilochus colubris	P, I	B	C	
Belted Kingfisher	Ceryle alcyon	I	L	C	
Yellow-bellied Sapsucker	Sphyrapicus varius	P, I	B	A	
Downy Woodpecker	Picoides pubescens	P, I	B	C	
Hairy Woodpecker	Picoides villosus	P, I	B	C	
Northern Flicker	Colaptes auratus	P, I	B	U	
Pileated Woodpecker	Dryocopus pileatus	P, I	B	C	
Eastern Wood Pewee	Contopus virens	P, I	B	A	II-A
Least Flycatcher	Empidonax minimus	P, I	B	C	II-A
Eastern Phoebe	Sayornis phoebe	P, I	B	C	III
Great Crested Flycatcher	Miarchus crinitus	P, I	B	A	
Eastern Kingbird	Tyrannus tyrannus	P	B	U	
Blue-headed Vireo	Vireo solitarius	P, I	B	A	
Warbling Vireo	Vireo gilvus	I	B	U	
Red-eyed Vireo	Vireo olivaceus	P, I	B	A	
Blue Jay	Cyanocitta cristata	P, I	B	A	
American Crow	Corvus brachyrhynchos	P, I	B	A	
Common Raven	Corvus corax	P, I	B	U	
Tree Swallow	Tachycineta bicolor	P, I	B	C	
Barn Swallow	Hirundo rustica	I	B	U	
Black-capped Chickadee	Poecile atricapillus	P, I	B	A	III
Eastern Tufted Titmouse	Baeolophus bicolor	P	B	U	
Red-breasted Nuthatch	Sitta canadensis	P, I	B	C	
White-breasted Nuthatch	Sitta carolinensis	P, I	B	A	
Brown Creeper	Certhia americana	P, I	B	C	
House Wren	Troglodytes aedon	P	B	U	
Winter Wren	Troglodytes troglodytes	P, I	B	C	
Golden-crowned Kinglet	Regulus satrapa	P	B	C	
Eastern Bluebird	Sialia sialis	P	B	U	

Table 1. Status and abundance of 91 species detected during breeding bird inventory at Marsh-Billings-Rockefeller National Historical Park, Woodstock, VT, 2001-2002. Species listed in taxonomic order (continued).

Common Name	Scientific Name	Observation Method [a]	Park Status [b]	Abundance [c]	State/PIF Priority Rank [d]
Veery	Catharus fuscescens	P	B	C	II-B
Swainson's Thrush	Catharus ustulatus	P	L	U	
Hermit Thrush	Catharus guttatus	P, I	B	A	
Wood Thrush	Hylocichla mustelina	P, I	B	A	I
American Robin	Turdus migratorius	P, I	B	A	
Gray Catbird	Dumetella carolinensis	P	B	U	II-A
Brown Thrasher	Toxostoma rufum	P	B	U	
Cedar Waxwing	Bombycilla cedrorum	P, I	B	C	
Northern Parula	Parula americana	P	B	U	
Chestnut-sided Warbler	Dendroica pensylvanica	P	B	U	I
Magnolia Warbler	Dendroica magnolia	P	B	U	
Black-throated Blue Warbler	Dendroica caerulescens	P, I	B	C	I
Yellow-rumped Warbler	Dendroica coronata	P, I	B	A	
Black-throated Green Warbler	Dendroica virens	P, I	B	A	
Blackburnian Warbler	Dendroica fusca	P, I	B	A	I
Pine Warbler	Dendroica pinus	P	B	R	
Blackpoll Warbler	Dendroica striata	P	M	C	
Black-and-White Warbler	Mniotilta varia	P	B	C	III
American Redstart	Setophaga ruticilla	P	B	C	III
Ovenbird	Seiurus aurocapillus	P, I	B	A	II-B
Northern Waterthrush	Seiurus noveboracensis	P	B	U	
Louisiana Waterthrush	Seiurus motacilla	P	B	U	
Common Yellowthroat	Geothlypis trichas	P, I	B	C	
Scarlet Tanager	Piranga olivacea	P, I	B	A	II-A
Chipping Sparrow	Spizella passerina	P, I	B	C	
Vesper Sparrow	Pooecetes gramineus	P	M	R	SC
Savannah Sparrow	Passerculus sandwichensis	P	B	U	
Song Sparrow	Melospiza melodia	P, I	B	C	
White-throated Sparrow	Zonotrichia albicollis	P, I	B	C	
Dark-eyed Junco	Junco hyemalis	P, I	B	A	
Northern Cardinal	Cardinalis cardinalis	P	B	U	
Rose-breasted Grosbeak	Pheucticus ludovicianus	P, I	B	A	II-A
Indigo Bunting	Passerina cyanea	P	B	U	
Bobolink	Dolichonyx oryzivorus	P, I	B	C	II-C
Red-winged Blackbird	Agelaius phoeniceus	P, I	B	C	
Common Grackle	Quiscalus quiscula	P, I	B	C	
Brown-headed Cowbird	Molothrus ater	P	B	C	
Baltimore Oriole	Icterus galbula	P	B	U	
Purple Finch	Carpodacus purpureus	P	B	U	II-A
Pine Siskin	Carduelis pinus	P	B	U	
American Goldfinch	Carduelis tristis	P, I	B	C	
Evening Grosbeak	Coccothraustes vespertinus	P, I	L	U	

[a] Observation Method; P = Point count survey, I = incidental observation, A = Audio playback survey
[b] Park Status; B = confirmed or suspected of breeding in park, L = local breeder, may nest in park, M = migrant only
[c] Abundance in park; A = abundant, C = common, U = uncommon, R = rare
[d] Partners In Flight Priority Rank for physiographic region 27 (Northern New England);
I = High Overall Priority
II-A = High Regional Concern, II-B = High Regional Responsibility, II-C = High Regional Threats
III = Additional Watch List Species
Vermont State Ranks

E = Vermont State Endangered
SC = Vermont Species of Special Concern

species that were not detected (European Starling, House Finch, and House Sparrow) were only expected to be found near the park administration buildings adjacent to Billings Farm, an area which was not surveyed thoroughly. Twenty-three of the detected species (25%) appear either on the Partners in Flight (PIF) priority list for the Northern New England Region (physiographic region 27) (Rosenberg and Hodgman 2000), or on the Vermont list of rare and uncommon birds (Vermont Department of Fish and Wildlife 2000).

Point Count Surveys

A total of 2,235 individuals of 73 species were detected during point count surveys (Table 2, Appendix 2). Overall, the interpolated species richness of 92 (±4.69 SE) was just 1 more than the total number of species detected using all observation methods. Fourteen species were detected at >50% of the survey points, including 5 (36%) that are listed as PIF Tier I or Tier II priority species for the Northern New England Region (NNER); Ovenbird, Blackburnian Warbler, Eastern Wood Pewee, Wood Thrush, and Scarlet Tanager. Both Blackburnian Warbler and Wood Thrush are listed as Tier I species, those with a high overall priority for which the region has a high responsibility for conservation (Panjabi 2001). Additional PIF priority species detected at relatively high frequencies (>25% of points) included Rose-breasted Grosbeak and Black-throated Blue Warbler.

Table 2. Relative abundance, frequency of occurrence, and species richness and diversity for all point count surveys and by habitat, at Marsh-Billings-Rockefeller National Historical Park, Woodstock, VT, 2001-2002. Species listed by relative abundance at all point count stations.

	All Points (n = 44)		Forest (n = 34)		Plantation (n = 7)		Hayfield (n = 3)	
Species	Relative abundance	Frequency	Relative abundance	Frequency	Relative abundance	Frequency	Relative abundance	Frequency
Ovenbird	1.409	0.955	1.529	0.941	1.429	1.000	0.667	1.000
Red-eyed Vireo	1.318	0.977	1.500	1.000	0.929	1.000	0.833	0.667
Black-throated Green	0.989	0.864	1.147	0.912	0.571	0.714	0.500	0.667
Blackburnian Warbler	0.670	0.795	0.618	0.794	1.500	1.000	0.167	0.333
Hermit Thrush	0.545	0.750	0.588	0.794	0.571	0.857		
Blue-headed Vireo	0.443	0.864	0.500	0.912	0.500	1.000		
American Goldfinch	0.398	0.614	0.250	0.559	0.500	0.857	2.000	0.667
American Robin	0.386	0.773	0.426	0.765	0.429	0.714	0.167	1.000
Black-capped Chickadee	0.386	0.773	0.353	0.765	0.786	1.000	0.333	0.333
Eastern Wood Pewee	0.295	0.614	0.309	0.647	0.286	0.571	0.333	0.333
Blue Jay	0.284	0.659	0.235	0.618	0.643	0.857	0.333	0.667
Yellow-bellied Sapsucker	0.261	0.545	0.294	0.588	0.286	0.429	0.167	0.333
Wood Thrush	0.239	0.409	0.279	0.471	0.143	0.286		
Scarlet Tanager	0.239	0.773	0.294	0.824	0.286	0.571	0.167	0.667
Yellow-rumped Warbler	0.227	0.432	0.132	0.353	0.714	0.714	0.333	0.667
Great Crested Flycatcher	0.205	0.409	0.250	0.441	0.143	0.286	0.333	0.333
White-breasted Nuthatch	0.193	0.591	0.221	0.706	0.071	0.143	0.333	0.333
Dark-eyed Junco	0.170	0.432	0.191	0.441	0.071	0.143	0.500	1.000
Rose-breasted Grosbeak	0.159	0.341	0.206	0.382	0.071	0.286		
Brown Creeper	0.148	0.386	0.103	0.294	0.429	0.714	0.333	0.667
Winter Wren	0.136	0.250	0.147	0.294			0.333	0.333
Hairy Woodpecker	0.114	0.205	0.132	0.235			0.167	0.333
Black-and-White Warbler	0.102	0.318	0.103	0.353	0.071	0.143	0.167	0.333
Black-throated Blue	0.102	0.250	0.103	0.265	0.143	0.143	0.167	0.333
Cedar Waxwing	0.102	0.136	0.044	0.088	0.429	0.429		
Mourning Dove	0.102	0.250	0.074	0.206	0.357	0.571		
Bobolink	0.102	0.045					1.500	0.667
American Crow	0.080	0.341	0.088	0.324	0.143	0.429	0.167	0.333
Downy Woodpecker	0.080	0.159	0.088	0.147	0.143	0.286		
Chimney Swift	0.068	0.159	0.074	0.118	0.214	0.286	0.167	0.333
Golden-crowned Kinglet	0.057	0.159	0.059	0.118	0.286	0.286	0.333	0.333
Chipping Sparrow	0.057	0.114	0.029	0.059			0.667	1.000
Red-breasted Nuthatch	0.057	0.227	0.029	0.088	0.214	0.714	0.333	0.667
Evening Grosbeak	0.057	0.091	0.074	0.088	0.143	0.143		
Red-winged Blackbird	0.057	0.091	0.074	0.118				
American Redstart	0.045	0.114	0.059	0.147				
Ruby-throated	0.045	0.091	0.044	0.088			0.167	0.333
Common Grackle	0.045	0.068	0.059	0.059	0.214	0.143		
Least Flycatcher	0.034	0.091	0.029	0.088	0.071	0.143		
Pileated Woodpecker	0.034	0.045	0.044	0.059				
Veery	0.034	0.091	0.044	0.088	0.071	0.143		
Blackpoll Warbler	0.034	0.068	0.029	0.059	0.071	0.143		
Pine Siskin	0.034	0.045	0.029	0.029	0.071	0.143		
Common Yellowthroat	0.034	0.045	0.044	0.029			0.167	0.333
Northern Parula	0.034	0.068	0.044	0.088				
Broad-winged Hawk	0.023	0.045	0.029	0.059				
Chestnut-sided Warbler	0.023	0.045	0.015	0.029			0.167	0.333
Common Raven	0.023	0.045	0.029	0.029			0.167	0.333
Eastern Phoebe	0.023	0.045	0.015	0.029			0.167	0.333
Indigo Bunting	0.023	0.068	0.029	0.059			0.167	0.333
Louisiana Waterthrush	0.023	0.045	0.015	0.029			0.167	0.333

Table 2. Relative abundance, frequency of occurrence, and species richness and diversity for all point count surveys and by habitat, at Marsh-Billings-Rockefeller National Historical Park, Woodstock, VT, 2001-2002. Species listed by relative abundance at all point count stations (continued).

	All Points (n = 44)		Forest (n = 34)		Plantation (n = 7)		Hayfield (n = 3)	
Species	Relative abundance	Frequency	Relative abundan	Frequen cy	Relative abundan	Frequen cy	Relative abundan	Frequen cy
Purple Finch	0.023	0.091	0.029	0.059	0.071	0.286		
Unidentified Woodpecker	0.023	0.068	0.029	0.059	0.071	0.143		
Eastern Tufted Titmouse	0.023	0.068	0.029	0.059	0.071	0.143		
Magnolia Warbler	0.023	0.045	0.015	0.029	0.071	0.143		
Mallard	0.023	0.023					0.333	0.333
Song Sparrow	0.023	0.045					0.333	0.667
Brown-headed Cowbird	0.023	0.023	0.029	0.029				
Common Loon	0.023	0.045	0.029	0.059				
Northern Waterthrush	0.023	0.045	0.029	0.059				
Wild Turkey	0.023	0.023	0.029	0.029				
Wood Duck	0.023	0.023	0.029	0.029				
Northern Flicker	0.011	0.045	0.015	0.059				
Gray Catbird	0.011	0.023			0.071	0.143		
Pine Warbler	0.011	0.023			0.071	0.143		
Swainson's Thrush	0.011	0.023			0.071	0.143		
Red-tailed Hawk	0.011	0.023					0.167	0.667
Savannah Sparrow	0.011	0.023					0.167	0.333
Tree Swallow	0.011	0.023					0.167	0.333
Baltimore Oriole	0.011	0.023	0.015	0.029				
Barred Owl	0.011	0.023	0.015	0.029				
Cooper's Hawk	0.011	0.023	0.015	0.029				
Eastern Kingbird	0.011	0.023	0.015	0.029				
Spotted Sandpiper	0.011	0.023	0.015	0.029				
Total Relative Abundance	8.784		9.088		8.714		10.000	
Number of Species	73		65		41		38	
Shannon Index	3.801		4.323[a]		4.430		3.525	
Species Richness[b]	92.0	±4.69 SE	70.24[a]	±8.97	54.00	±4.90	53.00	±5.48

[a] Based on randomly selected subset from non-plantation forest habitat (n = 7)

[b] Interpolated species richness as determined by the program SPECRICH

Among major habitat types, 65 species were detected in non-plantation forests, the highest of the 3 habitat groups (Table 2). When this habitat was sub-sampled to standardize the number of point counts between non-plantation forests and conifer plantations, the number of species detected was similar (42 and 41 respectively), as was the Shannon Index (4.323 and 4.430 respectively) (Table 2). However, the interpolated species richness was much greater for non-plantation forests (70.24 ±8.97) than for plantations (54.00 ±4.90), or hayfields (53.00 ±5.48 SE). Three species were found only at points within conifer plantations – Gray Catbird, Pine Warbler, and Swainson's Thrush – although just 1 individual of each species was detected. Among these species, only Pine Warbler and Swainson's Thrush are considered conifer "specialists," and both were considered rare or uncommon local breeders (Tables 1 and 2). Among the 7 most common PIF priority species, only Blackburnian Warbler was more abundant and occurred at a higher frequency in conifer plantations than in non-plantation forests (Table 2). This species occurred at every conifer-dominated point surveyed, but reached its maximum abundance in stands with a mixed conifer/deciduous canopy such as point 32 (a mixed Norway spruce/white pine/European ash stand), and point 18 (a hemlock/northern hardwood stand) (Fig. 1).

The results of comparing non-plantation forests with conifer plantations must be interpreted with caution however. Points within these 2 habitat groups were located in stands containing a variety of tree species, stand ages, and structural diversity, particularly within the conifer plantation group. Plantations represented by single-species monocultures with low structural diversity had relatively low abundance and species counts compared to those with mixed tree species and ages. For example, point 11, an even-aged monoculture of dense white pine, had both the lowest total abundance (33 individuals) and lowest species count (11) of any of the 44 points surveyed (Appendix 2). Similarly, point 41, which was located in an even-aged stand of red pine with virtually no understory, also had low abundance and species richness (44 and 15, respectively). In contrast, point 10, located in an uneven-aged stand of mixed red and white pine with a sugar maple understory, had the highest species count (23) of any point. In addition, the highest total abundance (81 individuals) occurred at point 32, which consisted of a mixed plantation of Norway spruce, European ash, and white pine, with a structurally diverse, primarily hardwood, understory.

The total number of species detected, interpolated species richness, and Shannon Index were all lower in the 3 hayfield points compared to forested sites (Table 2). Bobolink, a PIF Tier II species, and Savannah Sparrow were the only true grassland species present, although only 1 individual of the latter species was detected. Several early successional/edge species were also detected in low abundances at these points, including Chestnut-sided Warbler, Common Yellowthroat, Indigo Bunting, and Song Sparrow. Four to 5 pairs of Bobolinks were estimated to nest in the largest hayfield directly south of the Pogue.

Audio-Playback Surveys

The audio-playback surveys for hawks and owls had poor success. Only 1 owl responded to the broadcast calls. On 28 March 2001, at Owl Survey Point 1 (Fig.1), a Barred Owl responded by flying in and perching above the tape player immediately following the Barred Owl segment of the tape. In addition, one Barred Owl was observed during a point count survey, and they were occasionally seen during active searches, particularly in hemlock-dominated stands throughout the study area (Tables 1 and 2). While Barred Owl was not confirmed to be breeding within the park, on 18 May 2001 an individual was observed carrying prey just north of the Pogue. In addition, both Great Horned and Northern Saw-whet owls nest locally and may breed in the study area. Local birders often hear Great Horned Owls calling near the cemetery in West Woodstock, not far from the King Farm Property (J. Nicholson, pers. comm.).

Although no hawks responded to the taped broadcasts of forest hawk calls, 4 species (Broad-winged Hawk, Red-tailed Hawk, Cooper's Hawk, and American Kestrel) were observed incidentally or during point count surveys (Tables 1 and 2). While none of these species were confirmed as breeding within the park, both Broad-winged and Cooper's hawks appeared to have territories that included at least a portion of MABI lands. Broad-winged Hawks were observed on several occasions along the stream in the NE portion of the park. On 2 occasions, Cooper's Hawks (a Vermont species of Special Concern) were observed in the SE portion of the study area. On 26 April 2001, I observed a pair of Cooper's Hawks at point 36, counter-calling with soft "kek, kek" calls, before both birds flew east toward the park headquarters. On 31 May 2002, I observed a single Cooper's Hawk during a point count at station 35. Active searches for nests of both these species were unsuccessful.

Suitable habitat to support a breeding pair of American Kestrels, a PIF Tier II priority species, may exist in the fields around the Pogue. However, no evidence of a nesting pair was found, possibly due to a lack of suitable cavity trees or nest boxes in the area.

Management Recommendations

MABI has a long history of forest management dating back more than 100 years. Recent management practices have served multiple uses, from increasing recreational opportunities, to enhancing aesthetic and wildlife values, and producing forest products through timber harvesting (Wiggin 1993). While it is unknown how past management practices at MABI have affected the bird community, the following recommendations are intended to guide the development of an ecologically sound management plan that will promote biological conservation while maintaining the educational, aesthetic, and recreational values of the land.

Forest Management

Among the 14 forest bird species identified as conservation priorities, only 3 exhibit a preference for forests that are in the early stages of regeneration (Table 3). All 3 of these species were rarely encountered in the study area. One species from this group (American Woodcock), along

with Veery, occur in sapling to pole-size stands, although Veery is often associated with older forest types as well. Four priority species occur in semi-open forests, in which partial cutting or natural disturbance creates structural heterogeneity. The majority of priority species that inhabit woodlands are associated with mid-aged or mature forests (71%), particularly hardwood and/or mixedwoods. These species were also among the most-abundant in the study area. Only 3 priority species show a preference for mature softwoods, and none are exclusively found in softwoods.

Table 3. Seral stage associations of forest-dwelling bird species identified as conservation priorities by Partners in Flight or the Vermont Fish & Wildlife Department present at MABI. An x denotes preferred habitat.

Species	Regeneration to Seedling	Sapling to Pole-size	Semi-open or Disturbed Forest	Mid- Age	Mature Hardwood	Mature Mixedwood	Mature Softwood
American Woodcock	x	x					
Cooper's Hawk				x	x	x	x
Eastern Wood Pewee					x	x	
Least Flycatcher				x	x		
Veery		x	x	x			
Wood Thrush				x	x	x	
Gray Catbird	x						
Chestnut-sided Warbler	x						
Black-throated Blue Warbler			x	x	x		
Blackburnian Warbler				x		x	x
Ovenbird				x	x	x	
Scarlet Tanager				x	x	x	
Rose-breasted Grosbeak			x	x	x	x	
Purple Finch			x	x		x	x
Totals	3	2	4	10	10	8	3

Habitat designations are based primarily on Hagan and Grove (1999), Hagan et al. (1997), and Thompson and Capen (1988).

In terms of bird populations, forest management goals at MABI should be directed toward maintaining and/or enhancing mid-aged to mature forest conditions. This will benefit the suite of species that are among the most frequently encountered and abundant, and contains the majority of conservation priority species for the region. Three PIF Tier I species are included within this suite (Blackburnian Warbler, Wood Thrush, and Black-throated Blue Warbler), all of which have somewhat different habitat requirements. Blackburnian Warbler, an abundant species encountered at 80% of MABI census points, is a canopy specialist found in mature, mixed deciduous-coniferous stands, especially those with hemlock or spruce in the canopy (Morse 1994). This species gleans insects from both deciduous and coniferous foliage, and nests almost exclusively in coniferous trees. The Wood Thrush, which was found at 41% of MABI point counts, primarily occupies mature deciduous and mixed woodlands with a relatively high diversity of deciduous tree species, moderate sub-canopy and shrub density, and a fairly open forest floor with high soil moisture (Roth et al. 1996). In contrast, the Black-throated Blue Warbler was the least abundant of these 3 high priority species in MABI woodlands, encountered at just 25% of the point count stations. This wood warbler occupies deciduous-dominated forests with a dense, heterogeneous shrub layer where their foraging and nesting activities are concentrated (Holmes 1994). Forest management strategies that allow the development of this dense shrub layer will benefit this priority species. Past management goals at MABI have been to maintain an open understory for aesthetic purposes (Wiggin 1993). This practice, combined with a potential deer over-browse problem, has likely been responsible for limiting the abundance of Black-throated Blue Warblers within the park. Data from the Vermont Forest Bird Monitoring Program (FBMP) indicate that this warbler is 8th most abundant species, and the 4th most abundant wood warbler encountered in Vermont forests (S. Faccio and C. Rimmer, unpubl. data).

Hayfield Management

The breeding population of Bobolinks present in the ca. 25-acre hayfield south of the Pogue is significant. This PIF Tier II priority species has reduced breeding success in most of the region's hayfields that are mowed for high quality hay (Jones and Vickery 1997). To maintain the breeding population at MABI, and avoid destroying nests and young, this field should only be hayed after August 1st. In addition, consider delaying mowing until late-August to allow the development of late-blooming wildflowers, lepidopterans, odonates, and other invertebrates. This will enhance the quality of the habitat for Bobolinks, which prefer a mosaic of grasses, sedges, and broad-leaved forbs. Lastly, do not use pesticides or chemical fertilizers.

This hayfield, combined with other fields south and east of the Pogue, total ca. 45 acres in size. Together they have the potential to support a breeding pair of American Kestrels, another PIF Tier II priority species. An obligate secondary cavity nester, kestrels require a minimum of 45 acres of open habitat covered with short vegetation around their nest site (Smallwood and Bird 2002). In addition, they prefer cavities in large snags (especially those excavated by Northern Flickers), or nest boxes with unobstructed entrances. Snags, particularly along field edges, are rare at MABI, and may be a limiting factor for this and other secondary cavity nesters. Consider

erecting 1 or 2 kestrel nest boxes on poles to provide this species with potential nesting opportunities. Alternately, girdle several trees along field edges to provide snags in which Northern Flickers may excavate nest sites that could be used by kestrels in the future.

Recommended Monitoring Strategy

Since the majority of conservation priority species breeding within MABI are forest-breeding landbirds, a monitoring program for the park should target this group of birds as a representative sample. However, due to the small size of MABI, point count surveys limited to the park would have very low power to detect trends for all but the most common species present. For example, I used the freeware program MONITOR (Gibbs 1995) to determine the power of detecting declining trends for a moderately-abundant species (Wood Thrush) using point count data collected at MABI during the 2-year breeding bird inventory. The analysis was run using 500 simulated data sets modelled using exponential trends, two-tailed hypothesis testing, a coefficient of variation (CV) of 0.52, and an alpha level of 0.10. The results of this simulation revealed that after 10 years of monitoring, the power to detect a 3% annual decline in Wood Thrush abundance was just 40% (Fig. 2). Thus, it would be possible that low to moderately abundant species could exhibit long-term declines before the monitoring program collected enough data to detect declines (Peterman and Bradford 1987). A power analysis conducted with data from the Ontario FBMP, indicated that 150 point count stations would be required to detect 2-3% annual declines (18-26% decline over 10 years) for the majority of landbird species with adequate power (80%) (Schalk et al. 2002). Similarly, a power analysis conducted using data from the Vermont FBMP, indicated that 75 point count stations detected a 5% decline in Ovenbirds (low CV) and a 6% decline in Hermit Thrush (moderate CV) over 10 years with a minimum of 80% power, while 15 years were required to detect a 3% decline (Table 4) (Faccio et. al. 1998).

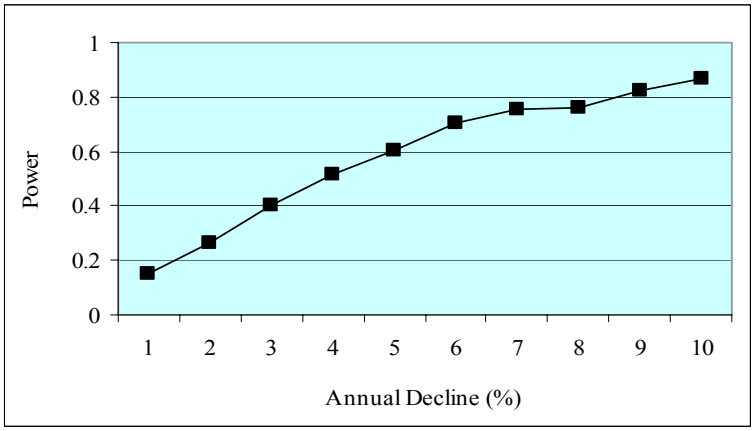


Fig. 2. Power to detect 1-10% annual declines in Wood Thrush abundance after 10 years of mnitoring at 35 point counts at MABI.

Table 4. Power to evaluate trends for species with low variability (Ovenbird) and moderate variability (Hermit Thrush) occurring at 15 VT FBMP study sites, each with 5 point count stations and 2 counts/year.

Years Monitoring	Annual Decline (%)	Ovenbird (low CV)		Hermit Thrush (moderate CV)
		Power		Power
10	6	0.97		0.86
	5	0.91		0.78
	4	0.79		0.63
	3	0.61		0.44
	2	0.37		0.23
15	6	1.00		1.00
	5	1.00		0.99
	4	1.00		0.95
	3	0.97		0.86
	2	0.76		0.61
20	6	1.00		1.00
	5	1.00		1.00
	4	1.00		1.00
	3	1.00		0.99
	2	0.98		0.89

Therefore, since the birds at MABI represent a metapopulation from throughout the region, I recommend developing a network of study sites in the greater Woodstock region that, when combined with point count stations already established at MABI and adjacent lands, would provide the necessary sample size (100 – 150 points) to detect annual declines of 2-3% with adequate power (80%). Such a "Regional Monitoring Strategy" could be established on a variety of private and public forest lands, including those owned by the Woodstock Aqueduct Company, State and Town Forests, State Wildlife Management Areas, Saint-Gaudens National Historic Site, and others. Each study site would consist of at least 100 acres of suitable forest habitat in which a series of 5 point count stations are spaced at least 200 m apart. Larger study sites such as MABI, would be sub-divided into multiple "sites," each consisting of 5 points as the replicate unit. All points will be surveyed twice annually using the protocol of the Vermont FBMP (Faccio et al. 1998). If this monitoring scheme were incorporated into the Vermont FBMP, then data collection, management, analyses, and reporting would be coordinated by VINS, with the advantage of combining these data with a larger regional dataset for more powerful trend estimates. This monitoring strategy would provide a reasonable tradeoff between minimizing sampling effort (and therefore cost) and maximizing the ability to detect changes.

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Appendix 1. List of 96 expected breeding bird species at MABI.

Common Name	Scientific Name	Present	Presumed Absent
Wood Duck	Aix sponsa	x	
Mallard	Anas platyrhynchos	x	
Hooded Merganser	Lophodytes cucullatus	x	
Common Merganser	Mergus merganser	x	
Sharp-shinned Hawk	Accipiter striatus		x
Cooper's Hawk	Accipiter cooperii	x	
Red-shouldered Hawk	Buteo lineatus		x
Broad-winged Hawk	Buteo platypterus	x	
Red-tailed Hawk	Buteo jamaicensis	x	
American Kestrel	Falco sparverius	x	
Ruffed Grouse	Bonasa umbellus	x	
Wild Turkey	Meleagris gallopavo	x	
Killdeer	Charadrius vociferus	x	
Spotted Sandpiper	Actitis macularia	x	
Common Snipe	Gallinago gallinago	x	
American Woodcock	Scolopax minor	x	
Mourning Dove	Zenaida macroura	x	
Black-billed Cuckoo	Coccyzus erythropthalmus		x
Great Horned Owl	Bubo virginianus		x
Barred Owl	Strix varia	x	
Northern Saw-whet Owl	Aegolius acadicus		x
Chimney Swift	Chaetura pelagica	x	
Ruby-throated Hummingbird	Archilochus colubris	x	
Belted Kingfisher	Ceryle alcyon	x	
Yellow-bellied Sapsucker	Sphyrapicus varius	x	
Downy Woodpecker	Picoides pubescens	x	
Hairy Woodpecker	Picoides villosus	x	
Northern Flicker	Colaptes auratus	x	
Pileated Woodpecker	Dryocopus pileatus	x	
Eastern Wood Pewee	Contopus virens	x	
Alder Flycatcher	Empidonax alnorum		x
Least Flycatcher	Empidonax minimus	x	
Eastern Phoebe	Sayornis phoebe	x	
Great Crested Flycatcher	Miarchus crinitus	x	
Eastern Kingbird	Tyrannus tyrannus	x	
Blue-headed Vireo	Vireo solitarius	x	
Warbling Vireo	Vireo gilvus	x	
Red-eyed Vireo	Vireo olivaceus	x	
Blue Jay	Cyanocitta cristata	x	
American Crow	Corvus brachyrhynchos	x	
Common Raven	Corvus corax	x	
Tree Swallow	Tachycineta bicolor	x	
Barn Swallow	Hirundo rustica	x	
Black-capped Chickadee	Poecile atricapillus	x	
Eastern Tufted Titmouse	Baeolophus bicolor	x	
Red-breasted Nuthatch	Sitta canadensis	x	
White-breasted Nuthatch	Sitta carolinensis	x	
Brown Creeper	Certhia americana	x	
House Wren	Troglodytes aedon	x	
Winter Wren	Troglodytes troglodytes	x	
Golden-crowned Kinglet	Regulus satrapa	x	

Appendix 1. List of 96 expected breeding bird species at MABI (continued).

Common Name	Scientific Name	Present	Presumed Absent
Eastern Bluebird	Sialia sialis	x	
Veery	Catharus fuscescens	x	
Hermit Thrush	Catharus guttatus	x	
Wood Thrush	Hylocichla mustelina	x	
American Robin	Turdus migratorius	x	
Gray Catbird	Dumetella carolinensis	x	
Brown Thrasher	Toxostoma rufum	x	
European Starling	Sturnus vulgaris		x
Cedar Waxwing	Bombycilla cedrorum	x	
Northern Parula	Parula americana	x	
Yellow Warbler	Dendroica petechia	x	
Chestnut-sided Warbler	Dendroica pensylvanica	x	
Magnolia Warbler	Dendroica magnolia	x	
Black-throated Blue Warbler	Dendroica caerulescens	x	
Yellow-rumped Warbler	Dendroica coronata	x	
Black-throated Green Warbler	Dendroica virens	x	
Blackburnian Warbler	Dendroica fusca	x	
Pine Warbler	Dendroica pinus	x	
Black-and-White Warbler	Mniotilta varia	x	
American Redstart	Setophaga ruticilla	x	
Ovenbird	Seiurus aurocapillus	x	
Northern Waterthrush	Seiurus noveboracensis	x	
Louisiana Waterthrush	Seiurus motacilla	x	
Common Yellowthroat	Geothlypis trichas	x	
Scarlet Tanager	Piranga olivacea	x	
Chipping Sparrow	Spizella passerina	x	
Savannah Sparrow	Passerculus sandwichensis	x	
Song Sparrow	Melospiza melodia	x	
Swamp Sparrow	Melospiza georgiana		x
White-throated Sparrow	Zonotrichia albicollis	x	
Dark-eyed Junco	Junco hyemalis	x	
Northern Cardinal	Cardinalis cardinalis	x	
Rose-breasted Grosbeak	Pheucticus ludovicianus	x	
Indigo Bunting	Passerina cyanea	x	
Bobolink	Dolichonyx oryzivorus	x	
Red-winged Blackbird	Agelaius phoeniceus	x	
Common Grackle	Quiscalus quiscula	x	
Brown-headed Cowbird	Molothrus ater	x	
Baltimore Oriole	Icterus galbula	x	
Purple Finch	Carpodacus purpureus	x	
House Finch	Carpodacus mexicanus		x
Pine Siskin	Carduelis pinus	x	
American Goldfinch	Carduelis tristis	x	
Evening Grosbeak	Coccothraustes vespertinus	x	
House Sparrow	Passer domesticus		x

Appendix 2. Total number of individuals and species encountered at each point count station (<50 m), Marsh-Billings-Rockefeller National Historical Park and adjacent lands, Woodstock, VT, 2001-2002 (continued)

Species	Tot. # Pts.	Point Count Station Number																																												
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
Red-eyed Vireo	43	7	10	8	13	14	12	6	5	11	4	3	5	11	5	6	9	7	5	5	6	11	2	11	8	5	5	7	11	13		2	3	6	8	6	6	3	14	1	6	2	9	6	8
Ovenbird	42	10	7	5	13	13	12	16	15	11	8	5	7	8	3	7	3	6	7	12	8	4	1	5	7	8	3	3	12	13	1	2	12	7	1		8	9	4		7	7	9	10	15
Black-thr. Green Warbler	38	6	7	5	5	1	9	5	7	8	1	2	2		4	10	4	3	6	7	6	7	14	7	10	9	6	1	3		1			5	4	12	4		7	14		2	8	16	5
Blue-headed Vireo	38	3	3	3	1	1		1	6	4	2	1	2	4		2		2	3	1	5	5	9		2	1	4	2	3	1			3	3	4	3	1	1	3	5	2	2	1	6	1
Blackburnian Warbler	35	1	4	6	2				5	1	7	10	3		3	1		2	10	4	5	8	6	2	2	4	1			1		2	19		4	8	8	7	2	3	1	6	1	8	3
American Robin	34	2	4	3		1		2	5	3	3		5	1	3	1	1	1	1		1			4	1	2	2	3	3	3	1	1			4			2	2	2	1	3	6	3	4
Black-capped Chickadee	34	2		3	2	1	2		1	4	4	2	2	1		6		3	3		3	2		4	5	1	2		3	1		2	3	6	1	3	1		2	3	4	2	3		1
Scarlet Tanager	34			2	1	1	3	2	1	2	1		2	2	2	2	1						1	1	1	1	1	1	1	1		1	2	2	1	2	3	1	4	1	3		2	2	2
Hermit Thrush	33	3	3	2	4	4	4	10	4	4	1	1	2	1		5		3	1	3		2	2	1		1	3			5			4	4	2	2			3	4	4		1	2	3
Blue Jay	29	2	1	2	2	3	1	1	1		2		1	1	4	1		1		2					1	1			1		1	1	1	3	1			1		3	3	1		3	1
American Goldfinch	27	1		1			3	1		1	3	1		2	3			1	4	1	1	1		1	3		1	1		1	11	8	2	1		1	2	1			2				
Eastern Wood Pewee	27	2	3	2		1	1	2		3	1			4		1	2			1		2	2	2	4	2	2		2	2				4	5	1	1	1			3				2
White-breasted Nuthatch	26		1		1	1	1	1						4	2	3	4	1		1		2	1		2		1	2	2				2	1	2	1	1	1	1	2					2
Yellow-bellied Sapsucker	24	2	2	2	2	2	1	1	1							1	2	3				3	4	5	7			7	1					1	1	1	1			1	1				3
Dark-eyed Junco	19													2	1		2			1	1		1	1		1			1	2	2	3				3	1		1	2		1	1		1
Yellow-rumped Warbler	19							1	1		4	3	4		1					1							1	1	1	1	1	2	8			2	1	2			1	3			
Great Crested Flycatcher	18		1			3					1				2	4	2	1							1	3	2	2						2	2	2	1		2	3	1				
Wood Thrush	18	4	2		2		1	1	4	2	1		5	1	3	2		1	1										1						1		1						1		
Brown Creeper	17	2		2	1	1	1			2	1		1					1		1	2			2							1	1	2					2			3				
American Crow	15		1		1			1			1			1		1									1	1						1					2	3		1	1	2			1
Rose-breasted Grosbeak	15				1	1	2	4	1	3	1	1	2	8											2				1					2	1										1
Black-and-White Warbler	14						2				1					1	1	1					1			1		1	1	1						1			1	1						1
Black-thr. Blue Warbler	11			3			2	3	2					2	1	1													1			1			1				4						
Mourning Dove	11	1							2	1	2		1																	1			1			1		1				1			1
Winter Wren	11													1			3	1	2	3				2			2	1								3		2	6						

Appendix 2. Total number of individuals and species encountered at each point count station (<50 m), Marsh-Billings-Rockefeller National Historical Park and adjacent lands, Woodstock, VT, 2001-2002 (continued)

Species	Tot. # Pts.	Point Count Station Number																																										
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
Red-breasted Nuthatch	10	2	1	1							1	1												1							2	1							1		1				
Hairy Woodpecker	9				1	1								4			1		2										2						1		2		3						
Chimney Swift	7														3																	1			2			1		2	1	3			
Downy Woodpecker	7	1																										3					1			2	1	2		1					
Golden-crowned Kinglet	7														1				1	1												3	3							2	1				
Cedar Waxwing	6	3									2		1							1								2					2												
American Redstart	5							1		2						1												1								1									
Chipping Sparrow	5																1										1				3	3			1										
Evening Grosbeak	4				2				1					2																												2			
Least Flycatcher	4	1			1		1																						1																
Purple Finch	4	1																	1					1									1												
Red-winged Blackbird	4													1	1													4										1							
Ruby-thr. Hummingbird	4									1							1									1													1						
Veery	4	1	1																		1	1																							
Blackpoll Warbler	3																																	1							1			1
Common Grackle	3										3				4													1																	
Eastern Tufted Titmouse	3					1																											1					1							
Indigo Bunting	3																													1		1			1										
Northern Parula	3																																			1	1		2						
Unidentified Woodpecker	3			1												1									1																				
Bobolink	2																														22	1													
Broad-winged Hawk	2						1									1																													
Chestnut-sided Warbler	2																					1										1													
Common Loon	2														1													1																	
Common Raven	2																														1				2										
Common Yellowthroat	2																1																					3							
Eastern Phoebe	2															1	1																												

Appendix 2. Total number of individuals and species encountered at each point count station (<50 m), Marsh-Billings-Rockefeller National Historical Park and adjacent lands, Woodstock, VT, 2001-2002 (continued)

Species	Tot. # Pts.	Point Count Station Number																																											
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
Louisiana Waterthrush	2																1		1																										
Magnolia Warbler	2			1																																1									
Northern Flicker	2																									1											1								
Northern Waterthrush	2																	1			2																								
Pileated Woodpecker	2																					1	2																						
Pine Siskin	2												2																												1				
Song Sparrow	2																														1	1													
Baltimore Oriole	1																												1																
Barred Owl	1																	1																											
Brown-headed Cowbird	1																																										3		
Cooper's Hawk	1																																			1									
Eastern Kingbird	1																										1																		
Gray Catbird	1																																									1			
Mallard	1																														2														
Pine Warbler	1																																1												
Red-tailed Hawk	1																1																												
Savannah Sparrow	1																1																												
Spotted Sandpiper	1														1																														
Swainson's Thrush	1																																								1				
Tree Swallow	1																														1														
Wild Turkey	1													2																															
Wood Duck	1														2																														
Total number of individuals		60	56	56	56	52	61	62	65	65	60	33	51	65	56	66	43	42	48	46	42	52	47	50	58	44	44	47	53	50	51	44	81	58	53	59	52	53	68	57	56	44	46	56	58
Total number of species		21	16	18	18	17	18	18	17	17	23	11	17	21	21	22	20	19	15	16	12	14	13	16	17	17	17	19	20	15	15	21	19	15	22	22	20	20	19	18	22	15	12	9	19

Appendix 3. UTM Coordinates (NAD 1983) of breeding bird inventory survey point locations at MABI, 2001-2002.

Survey Point Number	UTM Y Coordinate	UTM X Coordinate	TYPE
1	4834750	697500	Pt. Count
2	4834750	697750	Pt. Count
3	4834750	698000	Pt. Count
4	4834750	698250	Pt. Count
5	4834500	698750	Pt. Count/Hawk
6	4834500	698500	Pt. Count
7	4834500	698250	Pt. Count
8	4834500	698000	Pt. Count
9	4834500	697750	Pt. Count/Hawk
10	4834500	697500	Pt. Count
11	4834250	697500	Pt. Count
12	4834250	697750	Pt. Count
13	4834250	698000	Pt. Count
14	4834250	698250	Pt. Count
15	4834250	698500	Pt. Count
16	4834250	698750	Pt. Count
17	4834250	699000	Pt. Count
18	4834250	699250	Pt. Count
19	4834250	699500	Pt. Count
20	4834250	699750	Pt. Count
21	4834000	699750	Pt. Count
22	4834000	699500	Pt. Count
23	4834000	699250	Pt. Count
24	4834000	699000	Pt. Count
25	4834000	698750	Pt. Count
26	4834000	698500	Pt. Count
27	4834000	698250	Pt. Count
28	4834000	698000	Pt. Count
29	4833750	698000	Pt. Count
30	4833750	698250	Pt. Count
31	4833750	698500	Pt. Count
32	4833750	698750	Pt. Count
33	4833750	699000	Pt. Count
34	4833750	699250	Pt. Count
35	4833750	699500	Pt. Count/Hawk
36	4833750	699750	Pt. Count
37	4833500	699750	Pt. Count
38	4833500	699500	Pt. Count
39	4833500	699250	Pt. Count
40	4833500	698750	Pt. Count
41	4833500	698250	Pt. Count
42	4833500	698000	Pt. Count/Hawk
43	4833250	698000	Pt. Count
44	4833250	698250	Pt. Count
1	4834588	697625	Owl Survey
2	4834549	698621	Owl Survey
3	4834124	699541	Owl Survey
4	4833739	698339	Owl Survey

As the nation's primary conservation agency, the Department of the Interior has responsibility for most of our nationally owned public land and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

NPS D-15 September 2003

National Park Service
U.S. Department of the Interior

Northeast Region
Inventory & Monitoring Program
Northeast Temperate Network
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http://www1.nature.nps.gov/im/units/netn/index.cfm

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