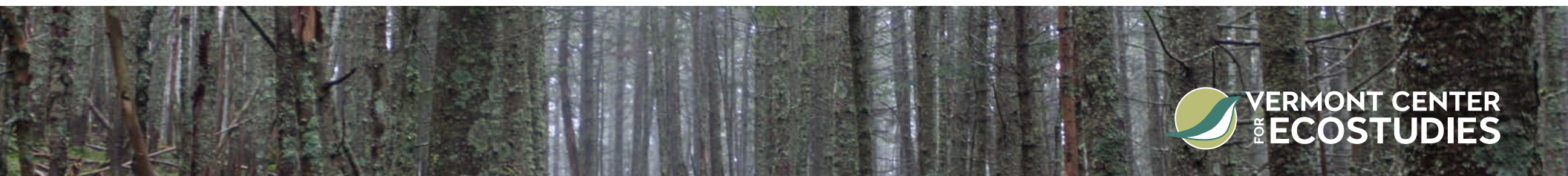
2017

THE STATUS OF VERMONT FOREST BIRDS:

A Quarter Century of Monitoring



VERMONT CENTER FOR ECOSTUDIES

ABOUT VERMONT CENTER FOR ECOSTUDIES

The Vermont Center for Ecostudies (VCE) advances wildlife conservation with the combined force of scientific research and informed citizens. Our biologists study birds, insects, amphibians, and other wildlife from Canada to South America. Enhancing our work is a legion of volunteer citizen naturalists.

What VCE discovers about wildlife and conservation we share with scientists, policy makers, conservationists, and the general public. We publish research in peer-reviewed scientific literature, and our project reports help inform public policy. Our growing body of knowledge about biodiversity is a free public resource for anyone who seeks to discover and enjoy wildlife—from school children to birdwatchers.

Far from being cloistered researchers, VCE biologists engage the public. We tweet, blog, write, lecture, live, breathe, and photograph nature. We even host a public radio show called Outdoor Radio. After all, as Executive Director Chris Rimmer likes to point out, conservation is as much about people as it is about ecology. It's one reason our motto is, "Uniting People and Science for Conservation."

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DAN LAMBERT: Dan is a conservation biologist, educator, and former director of Mountain Birdwatch, the Northeast's high-elevation bird monitoring program. He has led regional conservation science initiatives for the Vermont Center for Ecostudies, American Bird Conservancy, and High Branch Conservation Services. Dan was a contributing author to this report and now serves as Assistant Executive Director at the Center for Northern Woodlands Education. He enjoys canoeing and playing pond hockey.

JOHN LLOYD, PHD: An accomplished ornithologist, John is the Director of Science at the Vermont Center for Ecostudies, where he uses his technical expertise and experience in program management to advance VCE's science programs. His ornithological research has spanned a variety of ecosystems and species, from Roseate Terns, to grassland birds, to Mangrove Cuckoos. For this report, John conducted the population trend analyses for all species and guilds. John is a runner, fly-fisherman, and devotee of single-speed bikes.

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WHAT BIRDS CAN TELL US ABOUT THE ENVIRONMENT MAY NOT ONLY BE CRITICAL FOR THEIR LONG-TERM SURVIVAL, BUT FOR OURS AS WELL.

LISTENING TO BIRDS: WHAT CAN WE HEAR?

Take an early morning walk in a Vermont forest during May or June, and birds seem to be everywhere—singing, sight-unseen, from high in the canopy; flitting deftly through the understory; rustling through leaf litter on the forest floor. With so much forestland in our small state and so many birds, why should we be concerned with how forest birds are faring? It is well established that birds are sensitive to environmental change. If we listen well and pay careful attention, they can inform us about the health of our forests. The messages birds convey about our environment may be critical for their long-term survival and for ours as well.

Vermont forests are part of an expansive wooded landscape that extends from western New York and Massachusetts, through northern New England and southern Quebec, to the Maritime Provinces of New Brunswick and Nova Scotia. This vast Northern Forest, sometimes referred to as the *Laurentian-Acadian Forest*, provides some of the highest-quality breeding habitat for forest songbirds on the North American continent. And while the majority of our forest songbirds are reasonably common, many are also considered "responsibility species," meaning that the Northeast supports a significant proportion of their global populations. Therefore, we have a high responsibility to maintain productive breeding habitat. If we don't maintain and steward that habitat, or if we ignore what bird populations tell us about the health of our shared environment, we risk losing not only the birds, but also our forests.

This report contains insights generated by a legion of skilled volunteer birders who have been listening to forest birds since 1989 as part of the Vermont Forest Bird Monitoring Program (FBMP). Their findings from the FBMP's first 25 years illuminate population trends for 34 species, including many of our most cherished and iconic songbirds.

Overall, results from annual surveys conducted in 31 mature, unmanaged forest tracts show a 14.2% reduction in avian abundance, from an average of 14.8 birds per point over the first five years (1989-1993) to 12.7 over the last five years (2009-2013). Numbers of the two most common species, Ovenbird and Red-eyed Vireo, increased moderately over the survey period, while aerial insectivores and some wetland forest birds sharply declined. These changes occurred during a period of statewide forest maturation, dwindling insect populations, and the arrival of West Nile Virus in Vermont.

Although causal links to these and other factors remain unconfirmed, results of this study validate existing efforts to shield Vermont forests and forest birds from the most imminent, serious threats. Success in this work will hinge on the sort of resolve and collective capacity exhibited by FBMP volunteers and partners. Through scientific study and information exchange, we have already gained considerable understanding of the value, defining characteristics, and vulnerabilities of Vermont forests. Now we must act to safeguard their ecological integrity.

FINDINGS FROM THE FOREST BIRD MONITORING PROGRAM'S FIRST 25 YEARS ILLUMINATE POPULATION TRENDS FOR 34 SPECIES, INCLUDING MANY OF OUR MOST CHERISHED AND ICONIC SONGBIRDS.

Opposite Page:
Nine of the 13 species that declined significantly during 25 years of monitoring in Vermont.

Top Row (L to R): Rose-breasted Grosbeak, White-throated Sparrow, Downy Woodpecker
Middle Row (L to R): Canada Warbler, Blackburnian Warbler, Winter Wren
Bottom Row (L to R): Red-breasted Nuthatch, Yellow-rumped Warbler, Veery


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VERMONT FORESTS: OUR GREATEST NATURAL ASSET

Woodlands cover three out of every four acres in Vermont, the fourth most forested state in the U.S. Mid-summer views from our mountains and hills encompass an undulating carpet of green, stretching out for miles. The view from above is even more impressive, revealing embedded natural and human communities. Outside of the Champlain Valley's agricultural landscape, the predominating forest is etched with rivers and roads that link cities and villages, small farms, and bodies of water. These connections reflect our reliance on forests to sustain our livelihoods and wellbeing.

Forests contribute tremendous value to Vermont's economy. More than 10,500 people are employed in the state's forest products industry, producing timber, veneer, wood chips and pellets, pulpwood, firewood, and maple syrup. In addition, most recreation and tourism in Vermont depends on healthy, intact forests—from fall foliage viewing and hiking, to hunting, snowmobiling, skiing, and birding. Altogether, these activities support more than 47,000 jobs and account for roughly 15% of employment in the state (Vermont Department of Forests, Parks and Recreation 2015).

In addition to providing raw materials, jobs and recreational fulfillment, forests deliver ecosystem services that underpin our quality of life. These include erosion control, flood protection, and mitigation of climate change through carbon sequestration. As sources of clean air and water, forests uphold Vermont's identity as a healthy state where people connect with the land and relish being outdoors. Spending time in the woods offers a variety of health benefits, such as improved mood and physical vigor, reduced blood pressure, and increased longevity.

VERMONT FOREST TYPES

Vermont supports a diverse assemblage of forest types, owing to variations in geology, climate, and topography. Geography also plays an important role, since Vermont is situated in a transitional zone between boreal forests to the north and central hardwood forests to the south. Of the nearly 100 distinct natural communities that have been identified in our small state, 38 are forests, including 25 types of upland forest and 13 forested wetlands (Thompson and Sorenson 2000). Ecologists tend to divide our forest communities into three broad groups—northern hardwood forests, transitional hardwood forests, and cold-climate forests (McGrory Klyza and Trombulak 1999).

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NORTHERN HARDWOOD FORESTS

Consisting primarily of maple, American beech, birch, and hemlock, northern hardwoods are Vermont's most common and widespread forest community. They are adapted to intermediate conditions between the cold, boreal forests to our north and the central hardwoods to our south. Depending on soil conditions and climate, a variety of other tree species may also be present, including white ash, black cherry, basswood, white pine, and red oak. These are the iconic forests of Vermont—providing us with dazzling visual treats of fall foliage and spring wildflowers, the sweet taste of maple syrup, and a wide array of wood products, from firewood to lumber for fine furniture making. Northern hardwoods support a diverse community of breeding birds, including Red-eyed Vireo and Ovenbird, two of Vermont's most common and widespread species, and Hermit Thrush, our state bird.

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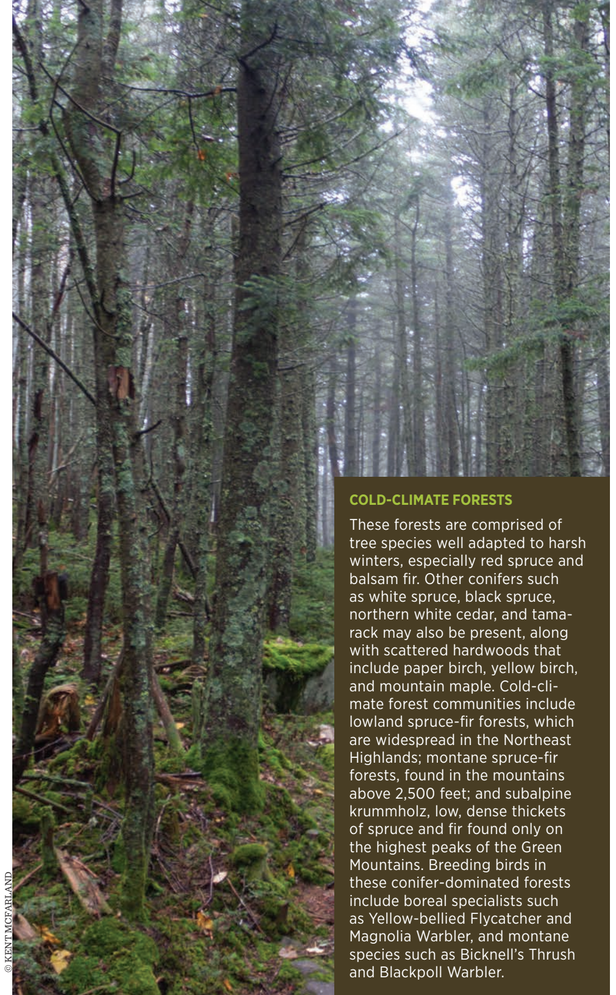
TRANSITIONAL HARDWOOD FORESTS

In transitional hardwoods, northern hardwood species mix with those found commonly in central hardwood forests. These forest communities occur in Vermont's warmer regions, including the Champlain Valley, southern Connecticut River Valley, and lower elevations of the Taconic Mountains. While typically dominated by sugar maple, beech, and yellow birch, this forest type also includes species better adapted to warmer, drier conditions such as white pine, red and white oak, and shagbark hickory. Subtle variations in aspect, elevation, and soil often allow these warmer-climate species to gain a foothold in northern hardwood stands. For example, pockets of transitional hardwoods may occur on south-facing slopes or on drier ridgelines where soils are shallow. Although these forests support many of the same birds found in northern hardwoods, species such as Eastern Wood-Pewee, Wood Thrush, and Scarlet Tanager tend to predominate.



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COLD-CLIMATE FORESTS

These forests are comprised of tree species well adapted to harsh winters, especially red spruce and balsam fir. Other conifers such as white spruce, black spruce, northern white cedar, and tamarack may also be present, along with scattered hardwoods that include paper birch, yellow birch, and mountain maple. Cold-climate forest communities include lowland spruce-fir forests, which are widespread in the Northeast Highlands; montane spruce-fir forests, found in the mountains above 2,500 feet; and subalpine krummholz, low, dense thickets of spruce and fir found only on the highest peaks of the Green Mountains. Breeding birds in these conifer-dominated forests include boreal specialists such as Yellow-bellied Flycatcher and Magnolia Warbler, and montane species such as Bicknell's Thrush and Blackpoll Warbler.

ON THE THRESHOLD OF CHANGE:
THREATS TO VERMONT FORESTS

More than a mere collection of trees, forests are interdependent biological communities composed of plants, animals, and microorganisms that interact in complex ways. Among forest-dwelling wildlife, there is no group more captivating than songbirds, whose vibrant colors and dynamic voices animate an otherwise largely green, quiet landscape. Birds are the most diverse vertebrate group inhabiting Vermont's forest ecosystems, with more than 80 breeding species. And while it's clear that forest birds need forests, there is a growing body of evidence to show that forests also need birds for the critical roles they play in providing ecosystem services that range from pollination and pest control, to seed dispersal and nutrient cycling (Whelan et al. 2015). Highlighting this interdependence is a now-classic study demonstrating that forest songbirds significantly increase tree growth by consuming leaf-eating insects, suggesting that declines in avian abundance could reduce forest productivity and health (Marquis and Whelan 1994).

Monitoring bird populations is therefore key to gaining a broader understanding of forest ecology and health. This is especially crucial at a time when our woodlands are on the threshold of dramatic change due to myriad threats that range from fragmentation and parcelization, to an ever-growing array of invasive species and a warming climate.

While the threats facing our forests are very real, changes are likely to occur slowly and to escape detection in the absence of careful, consistent monitoring. Fortunately, birds are readily observable indicators of environmental health. Changes in their abundance can reveal the timing, extent, and degree of environmental threat. Although causes of population change are often difficult to discern, monitoring data can illuminate specific hazards and guide research into sources of decline. Bird monitoring can also help evaluate specific conservation actions and provide invaluable feedback to natural resource managers. As monitoring data accumulate, their value for decision-making increases. Nearing its 30-year milestone, the Vermont Forest Bird Monitoring Program is one of the Northeast's most established and informative long-term avian surveys.

AND WHILE IT'S CLEAR THAT FOREST BIRDS NEED FORESTS, THERE IS A GROWING BODY OF EVIDENCE TO SHOW THAT FORESTS ALSO NEED BIRDS

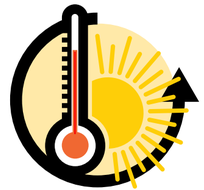
FRAGMENTATION AND PARCELIZATION

Evidence clearly shows that parcelization (the subdivision of forestland into smaller pieces and multiple ownerships) has increased forest fragmentation statewide (Fidel 2007). As forests become fragmented by roads, development and other non-forest land uses, the amount of edge habitat increases, exposing interior forest breeding birds to increased pressure from edge-dwelling nest predators such as Raccoons, Blue Jays and others, as well as brood parasitism from Brown-headed Cowbirds. Additionally, many interior forest birds are area sensitive, inhabiting only large, contiguous forest blocks or exhibiting higher densities and/or breeding success in these tracts compared to smaller woodland patches (Wilcove 1985, Robinson et al. 1995). While area-sensitive species may attempt to nest in smaller forest fragments, they are often unable to raise young successfully due to increased rates of nest predation and/or brood parasitism (Whitcomb et al. 1981).

NON-NATIVE INVASIVE SPECIES

More than half of Vermont's tree species are threatened with devastation from three non-native insects: the emerald ash borer, Asian longhorned beetle, and hemlock wooly adelgid. Currently, only the hemlock wooly adelgid has been confirmed in Vermont, where it has gained a foothold in three southern counties. However, the state is virtually surrounded by the emerald ash borer, with populations in southern New Hampshire, northwest Massachusetts, east-central New York, and southern Quebec. The Asian longhorned beetle, whose primary host trees include maples, birches, willows, and elms, has colonized Massachusetts within 45 miles of Vermont. These, along with numerous other non-native insects and pathogens that are already established in Vermont—including chestnut blight, beech bark disease, Dutch elm disease, and butternut canker—will result in significant ecological and economic damage to our forests (Lovett et al. 2016).

Further, numerous species of invasive earthworms are changing forest ecosystems by overconsuming leaf litter; this results in a loss of soil invertebrates, reduction in the abundance of herbaceous and understory vegetation, and alteration of soil structure (Bohlen et al. 2004). These ecological changes have been linked to reduced abundance of some ground-nesting birds, including Ovenbird and Hermit Thrush (Loss et al. 2012).



CLIMATE CHANGE

A warming planet may gradually but profoundly alter forest biodiversity, productivity, and economics. The U.S. Forest Service has already found evidence of northward migration in over 70% of the northern tree species that occur in Vermont (Woodall et al. 2009). In addition, climate change may alter the timing of seasonal events (known as phenology) so that activities of organisms that typically interact, such as predator and prey or plant and pollinator, no longer coincide. One such phenological mismatch can occur when bird reproduction no longer synchronizes with peak abundance of invertebrate food resources, which are needed to raise nestlings (Visser and Both 2005, Clausen and Clausen 2013). Evidence from a New Hampshire hardwood forest indicates that migratory species that are able to adjust the timing of breeding to spring temperatures may be at a competitive advantage compared to those lacking this capacity. For example, Black-throated Blue Warblers may raise two broods and produce more young in years when spring arrives early (Townsend et al. 2013). On the other hand, their populations slump in response to El Niño, a global climate cycle that could be intensifying (Townsend et al. 2015). Although effects of climate change on forest ecosystems are complex and unpredictable, it is clear that established patterns and longstanding ecological relationships will be disrupted, perhaps irreversibly.

ACID DEPOSITION

In addition to increasing winter injury in red spruce, acidic compounds in rain, snow, and fog leach vital nutrients from soils, limiting their availability for tree growth (Driscoll et al. 2001). Of particular concern is calcium depletion and increased aluminum toxicity, which are known to damage sugar maple (Cronan et al. 1989) and may reduce the abundance of both amphibians (Wyman and Jancola 1992) and Wood Thrushes (Hames et al. 2002). Birds may be particularly sensitive to soil calcium depletion because they require large amounts of calcium to produce viable eggshells. For example, to produce a single clutch of eggs, some small bird species require more calcium than exists in their entire skeleton (Reynolds et al. 2004). Therefore, they must rely on calcium-rich foods during the breeding season, especially snails. However, the abundance of snails is directly related to the availability of soil calcium, because snails require high levels of calcium to produce their shells and to reproduce (Hotopp 2002).

THE VERMONT FOREST BIRD MONITORING PROGRAM

Since 1989, volunteer birders have crawled out of bed in the pre-dawn hours to put their bird identification skills to work for the Vermont Forest Bird Monitoring Program. This core project of the Vermont Center for Ecostudies (VCE) started with 11 study sites, but grew steadily and by 2012 consisted of 31 sites, all located in unmanaged, mature interior forests (Figure 1). Each June, FBMP's dedicated birders fan out across Vermont and systematically survey their "adopted" routes at the crack of dawn, contributing to a database that has amassed more than 62,000 observations of 135 species.

The primary goal of the FBMP is to monitor the status and population trends of interior forest breeding birds. While numerous studies have documented declines of songbirds inhabiting fragmented landscapes, few monitor birds in protected, undisturbed forests free from the confounding influences of active forest management and edge effects brought about by roads, houses and other development.

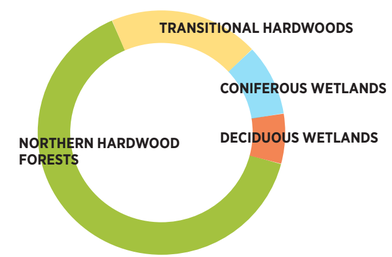
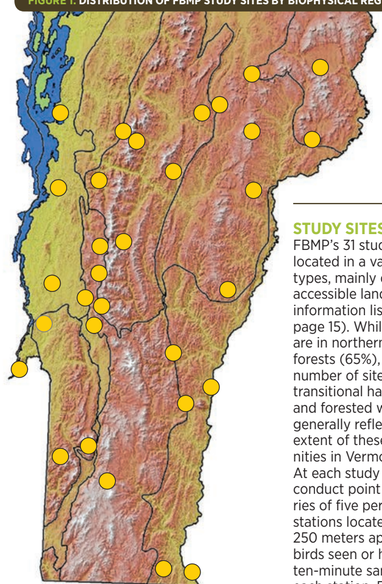


FIGURE 2: PROPORTION OF FBMP STUDY SITES BY FOREST TYPE

FIGURE 1: DISTRIBUTION OF FBMP STUDY SITES BY BIOPHYSICAL REGION



STUDY SITES

FBMP's 31 study sites are located in a variety of forest types, mainly on publicly accessible land (specific site information listed in table on page 15). While the majority are in northern hardwood forests (65%), a smaller number of sites are located in transitional hardwoods (19%) and forested wetlands (16%), generally reflecting the relative extent of these forest communities in Vermont (Figure 2). At each study site, observers conduct point counts at a series of five permanent survey stations located approximately 250 meters apart, recording all birds seen or heard during a ten-minute sampling period at each station. Because the vast majority (96%) of observations are auditory, FBMP participants must be highly skilled in identifying birds by ear.

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THE PRIMARY GOAL OF THE FBMP IS TO MONITOR THE STATUS AND POPULATION TRENDS OF INTERIOR FOREST BREEDING BIRDS.

VERMONT FOREST BIRD MONITORING PROGRAM

THIS CORE PROJECT OF THE VERMONT CENTER FOR ECOSTUDIES STARTED WITH 11 STUDY SITES, BUT GREW STEADILY AND BY 2012 CONSISTED OF 31 SITES.

Scarlet Tanagers are most common in transitional hardwood forest sites.

Table 1. Vermont Forest Bird Monitoring Program study sites, ownership, forest type and years surveyed. Listed in descending order of years surveyed.

Study Site Name	Town	Ownership	Natural Community Type	Year First Surveyed	No. Years Surveyed *
Concord Woods Natural Area	Concord	University of Vermont	Northern Hardwood Forest	1989	25
Pease Mt. Natural Area	Charlotte	University of Vermont	Mesic Maple-Ash-Hickory-Oak Forest	1989	25
Sugar Hollow Preserve	Pittsford	The Nature Conservancy	Rich Northern Hardwood Forest	1989	25
Bear Swamp	Wolcott	Sterling College	Fir-Tamarack Swamp	1990	24
Buckner/Bald Mt. Preserve	West Haven	The Nature Conservancy	Dry Oak-Hickory-Hophornbeam Forest	1989	24
Dorset Bat Cave	Dorset	The Nature Conservancy	Northern Hardwood Forest	1989	24
Moose Bog Wildlife Man. Area	Ferdinand	VT Fish & Wildlife Dept.	Lowland Spruce-fir	1989	24
Roy Mt. Wildlife Man. Area	Barnet	VT Fish & Wildlife Dept.	Northern White Cedar Swamp	1989	24
Sandbar Wildlife Man. Area	Milton	VT Fish & Wildlife Dept.	Lakeside Floodplain Forest	1989	24
The Cape Research Natural Area	Chittenden/Goshen	Green Mt. Nat. Forest	Rich Northern Hardwood Forest	1989	24
May Pond Preserve	Barton	The Nature Conservancy	Northern Hardwood Forest	1990	23
Shaw Mt. Natural Area	Benson	The Nature Conservancy	Mesic Maple-Ash-Hickory-Oak Forest	1989	21
Cornwall Swamp	Cornwall	VT Fish & Wildlife Dept.	Red Maple-Cedar Swamp	1989	20
Underhill State Park	Underhill	VT Forests, Parks & Rec.	Northern Hardwood Forest	1991	20
Green Mt. Audubon	Huntington	Audubon Vermont	Northern Hardwood Forest	1997	17
Bancroft Woods	Lincoln/Bristol	Private-conserved	Rich Northern Hardwood Forest	1998	16
Steam Mill Brook Wildlife Man. Area	Stannard	VT Fish & Wildlife Dept.	Northern Hardwood Forest	1998	16
Bristol Cliffs Wilderness Area	Bristol	Green Mt. Nat. Forest	Northern Hardwood Forest	1998	14
Chandler Ridge	Leicester	Green Mt. Nat. Forest	Mesic Red Oak-Maple Forest	2000	14
Lye Brook Wilderness Area	Winhall	Green Mt. Nat. Forest	Northern Hardwood Forest	2000	13
Marsh-Billings-Rockefeller NHP	Woodstock	National Park Service	Northern Hardwood Forest	2001	13
Little Ascutney Wildlife Man. Area	Weathersfield	VT Fish & Wildlife Dept.	Mesic Red Oak-Northern Hardwoods	1998	11
Merck Forest	Rupert	Merck Forest Center	Mesic Red Oak-Maple Forest	1992	11
Green River Reservoir	Hyde Park	VT Forests, Parks & Rec.	Northern Hardwood Forest	2004	9
Breadloaf Wilderness Area	Granville	Green Mt. Nat. Forest	Northern Hardwood Forest	2006	7
Ethan Allen Firing Range	Jericho	U.S. Military	Northern Hardwood Forest	1998	7
Black Mt. Preserve	Dummerston	The Nature Conservancy	Northern Hardwood Forest	2004	5
North Branch River Park	Montpelier	Town of Montpelier	Hemlock-Northern Hardwood Forest	2008	5
Baker Bush	Strafford	Private-conserved	Hemlock-Northern Hardwood Forest	2010	4
Adams Camp	Stowe	Trapp Family Lodge	Northern Hardwood Forest	2012	2
Craftsbury Outdoor Center	Craftsbury	Craftsbury Outdoor Center	Northern Hardwood Forest	2012	2

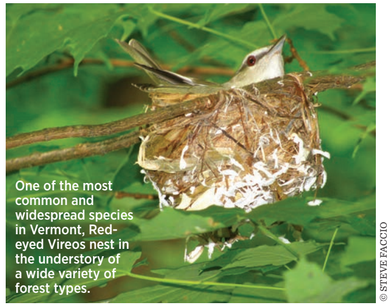
** The number of years surveyed through 2013.*

THE STATUS OF VERMONT BIRDS: 1989-2013

For this report, we analyzed 2,464 point count surveys, in which a total of 32,381 birds of 125 species were detected, for an average of 13 birds per point. During the 25 years of this study, the number of birds detected declined from an average of 14.8 individuals per point over the first five years to 12.7 over the last five years. This 14.2% decrease mainly occurred during the first half of the survey period (Figure 3). In addition, we found turnover in the composition of the ten most commonly detected species. While Ovenbird and Red-eyed Vireo remained as the two most abundant and widely distributed species, Blue Jay, Scarlet Tanager, and Black-capped Chickadee dropped off the top-ten list during last five years (2009-2013) and were replaced by Black-throated Green Warbler, American Robin, and Yellow-bellied Sapsucker.

Composition of the top-ten species varied by habitat, especially among coniferous and deciduous wetland forests, which shared no species in common (Table 2). As expected, coniferous wetland sites supported a more boreal avian mix, including Yellow-bellied Flycatcher, Nashville and Magnolia warblers, Northern Parula, and Golden-crowned Kinglet. Deciduous-dominated wetland sites included species such as Veery, Common Yellowthroat, Northern Waterthrush, and Great Crested Flycatcher. Among the ten most abundant species on northern and transitional hardwood study sites, five were found in both habitats (Ovenbird, Red-eyed Vireo, Hermit Thrush, Wood Thrush, and Rose-breasted Grosbeak). Northern hardwood sites also included Black-throated Blue and Black-throated Green warblers, Winter Wren, Yellow-bellied Sapsucker, and Veery, which were replaced on transitional hardwood sites by Eastern Wood-Pewee, Scarlet Tanager, American Redstart, Great Crested Flycatcher, and Black-capped Chickadee.

A TOTAL OF 32,381 BIRDS OF 125 SPECIES WERE DETECTED AND ANAYLYZED FOR THIS REPORT



One of the most common and widespread species in Vermont, Red-eyed Vireos nest in the understory of a wide variety of forest types.

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FIGURE 3: CHANGE IN RELATIVE ABUNDANCE FOR ALL SPECIES AT ALL STUDY SITES

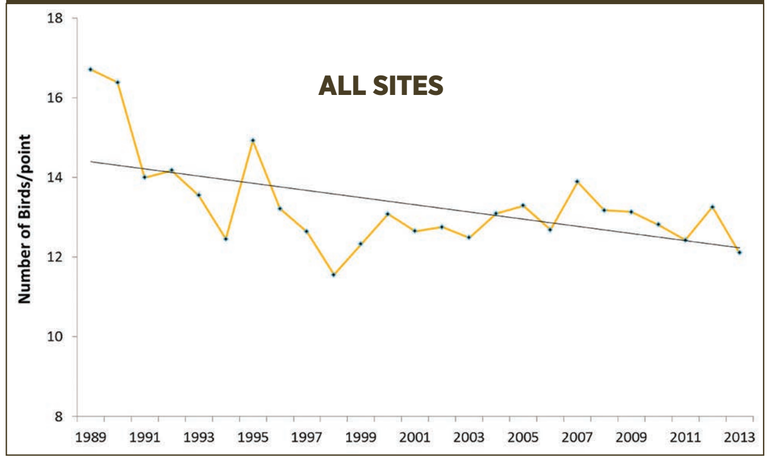

TABLE 2. Relative abundance of the ten most common species by habitat. Listed in order of abundance for all study sites combined. Abundance indices in bold indicate species included in top ten for that habitat.

SPECIES	RELATIVE ABUNDANCE (AVG. # OF BIRDS/POINT) BY HABITAT				
	ALL STUDY SITES	NORTHERN HARDWOODS	TRANSITION HARDWOODS	CONIFEROUS WETLANDS	DECIDUOUS WETLANDS
Ovenbird	**1.57**	**2.12**	**1.71**	0.15	0.37
Red-eyed Vireo	**1.35**	**1.71**	**1.65**	0.11	**0.81**
Black-throated Blue Warbler	**0.59**	**0.88**	0.21	0.18	0.00
Hermit Thrush	**0.57**	**0.61**	**0.50**	**0.74**	0.12
Black-throated Green Warbler	**0.56**	**1.03**	0.17	0.25	0.00
Eastern Wood-Pewee	**0.48**	0.29	**1.19**	0.00	**0.71**
Veery	**0.44**	**0.32**	0.35	0.17	**1.87**
Yellow-bellied Sapsucker	**0.37**	**0.54**	0.18	0.19	0.17
Winter Wren	**0.36**	**0.35**	0.17	**0.77**	0.05
Scarlet Tanager	**0.34**	0.32	**0.69**	0.03	0.14
Blue Jay	0.33	0.25	0.31	0.43	**0.62**
Wood Thrush	0.33	**0.34**	**0.73**	0.00	0.02
Black-capped Chickadee	0.32	0.18	**0.40**	0.46	0.58
Rose-breasted Grosbeak	0.30	**0.34**	**0.49**	0.01	0.15
American Redstart	0.27	0.27	**0.48**	0.01	0.45
American Crow	0.26	0.18	0.19	0.30	**0.86**
White-throated Sparrow	0.22	0.05	0.00	**0.98**	0.31
Common Yellowthroat	0.20	0.02	0.05	0.21	**1.43**
Northern Waterthrush	0.20	0.00	0.00	0.42	**1.39**
Yellow-rumped Warbler	0.19	0.11	0.09	**0.67**	0.00
Great Crested Flycatcher	0.19	0.04	**0.35**	0.02	**0.86**
Song Sparrow	0.14	0.00	0.04	0.02	**1.32**
Red-breasted Nuthatch	0.13	0.03	0.04	**0.66**	0.00
Golden-crowned Kinglet	0.10	0.01	0.00	**0.64**	0.00
Magnolia Warbler	0.10	0.01	0.01	**0.60**	0.00
Yellow-bellied Flycatcher	0.09	0.00	0.00	**0.53**	0.00
Nashville Warbler	0.09	0.00	0.01	**0.52**	0.04
Yellow Warbler	0.09	0.00	0.07	0.00	**0.95**
Northern Parula	0.08	0.01	0.00	**0.46**	0.00

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POPULATION TRENDS

Utilizing the 25-year FBMP data set, we produced trend estimates for 34 of the most abundant and widely distributed species (a minimum of 100 individuals occurring on at least 10 study sites) (Table 3). In addition, we estimated population trends for 12 groups, or guilds, of birds that share similar ecological traits, such as foraging style, foraging and nesting location, and migratory strategy (Table 4). In preparing data for guild analysis, all 125 species detected on FBMP surveys were included and assigned to guilds based on O'Connell et al. (1998) (see **http://vtecostudies.org/sofb-guilds** for list of species in each guild). Understanding which guilds are increasing or decreasing can help reveal broader ecological patterns that may be affecting bird populations. For example, an increase in woodpeckers and other "bark probers" might suggest that our maturing forests provide an abundance of decaying trees on which to forage, or that invasive forest pests and pathogens are causing abnormally high tree mortality.

UNDERSTANDING WHICH GUILDS ARE INCREASING OR DECREASING CAN HELP REVEAL BROADER ECOLOGICAL PATTERNS THAT MAY BE AFFECTING BIRD POPULATIONS.

TABLE 3. Results of population trend analysis for 34 species, Vermont Forest Bird Monitoring Program, 1989-2013, and comparison with Vermont Breeding Bird Survey (BBS) trends, 1989-2013.
Blue = significantly increasing trend; Red = significantly decreasing trend; Black = no significant trend.
Species listed in taxonomic order. Species included in analysis if they occurred at ≥10 study sites with ≥100 individuals.

SPECIES	Annual Change (%)	25-year Change (%)	P-value	Statistical Significance	VT BBS (1989-2013) Annual Change (%)	VT BBS (1989-2013) Agreement w/ FBMP
Mourning Dove	3.67	137.61	0.000	***	1.38	Strong
Yellow-bellied Sapsucker	3.82	146.14	0.000	***	2.90	Strong
Downy Woodpecker	-3.35	-55.91	0.000	***	-0.01	Moderate
Hairy Woodpecker	2.50	80.64	0.005	**	-1.24	None
Pileated Woodpecker	2.13	65.81	0.029	*	2.44	Moderate
Eastern Wood-Pewee	-1.76	-34.63	0.000	***	-2.31	Strong
Least Flycatcher	0.91	24.42	0.329		-3.08	None
Great Crested Flycatcher	-4.50	-66.92	0.000	***	0.37	None
Blue-headed Vireo	-0.79	-17.26	0.296		-0.55	Strong
Red-eyed Vireo	0.60	15.42	0.050	*	1.75	Strong
Blue Jay	-1.97	-38.00	0.000	***	-0.64	Moderate
Black-capped Chickadee	-0.59	-13.27	0.270		0.38	Moderate
Red-breasted Nuthatch	-2.90	-50.63	0.000	***	-0.52	Moderate
White-breasted Nuthatch	-0.24	-5.62	0.742		0.29	Moderate
Brown Creeper	-0.91	-19.74	0.244		2.31	Weak
Winter Wren	-1.82	-35.62	0.000	***	1.82	None
Veery	-2.14	-40.45	0.000	***	-1.46	Strong
Hermit Thrush	-0.15	-3.51	0.723		1.06	Weak
Wood Thrush	-0.07	-1.75	0.889		-4.55	Moderate
American Robin	1.33	37.27	0.015	*	-0.50	None
Cedar Waxwing	0.02	0.42	0.987		1.43	Strong
Black-throated Blue Warbler	0.31	7.60	0.462		-0.21	Moderate
Yellow-rumped Warbler	-4.49	-66.83	0.000	***	-1.42	Moderate
Black-throated Green Warbler	1.90	57.13	0.000	***	0.92	Moderate
Blackburnian Warbler	-1.73	-34.25	0.014	*	2.46	None
Black-and-White Warbler	-0.91	-19.71	0.279		0.12	Moderate
American Redstart	0.14	3.41	0.811		-1.91	None
Ovenbird	1.86	55.67	0.000	***	0.88	Strong
Common Yellowthroat	-6.30	-79.02	0.000	***	-0.46	Moderate
Canada Warbler	-5.10	-71.55	0.000	***	-5.42	Strong
Scarlet Tanager	-0.68	-15.02	0.200		-1.18	Moderate
White-throated Sparrow	-3.99	-62.37	0.000	***	-3.91	Strong
Dark-eyed Junco	-0.82	-17.88	0.260		-0.26	Strong
Rose-breasted Grosbeak	-1.83	-35.85	0.001	***	-1.50	Moderate

Significance: * = P ≤ 0.05, ** = P ≤ 0.01, *** = P ≤ 0.001
NOTE: 73% of FBMP and BBS trends agree, either strongly (32%) or moderately (41%), while 27% show either weak (6%) or no (21%) agreement.

Ovenbirds have responded favorably to Vermont's maturing forests, as populations of this ground-nesting warbler have increased by 56% since 1989.

UTILIZING THE 25-YEAR FBMP DATA SET, WE PRODUCED TREND ESTIMATES FOR 34 OF THE MOST ABUNDANT AND WIDELY DISTRIBUTED SPECIES

Most abundant on forested wetland study sites, the Common Yellowthroat declined by 79% since 1989, the largest decline among 34 species analyzed.

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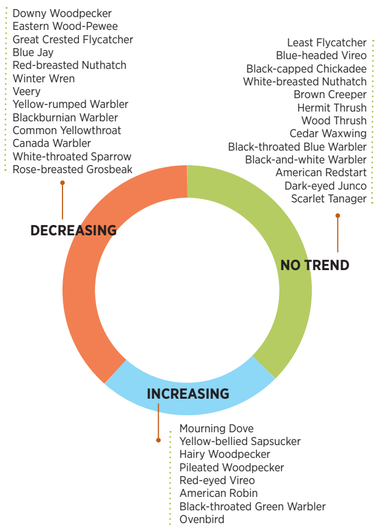
Species Trends

Among the 34 species included in the analysis, 13 (38%) declined significantly, eight (24%) increased significantly, and 13 showed no significant trend (Figure 4: Table 3). To help interpret these results, we compared FBMP trends with those from the North American Breeding Bird Survey (BBS) in Vermont over the same time period. The BBS is an international program with thousands of road-based survey routes in the U.S., Canada, and Mexico, including 23 routes in Vermont. Overall, 73% of FBMP and BBS trends agreed, either strongly (32%), or moderately (41%), while 27% showed either weak (6%) or no (21%) agreement (see Table 3). Trends showing the strongest agreement between both surveys included four species that increased significantly (Mourning Dove, Yellow-bellied Sapsucker, Red-eyed Vireo, and Ovenbird), and four species that declined significantly (Eastern Wood-Pewee, Veery, Canada Warbler, and White-throated Sparrow). Three of the consistently increasing species (all but Mourning Dove) favor intermediate to old forests, while three of the consistently declining species (all but Eastern Wood-Pewee) reach peak abundance in forested wetlands but also occupy young forest patches and undergrowth (DeGraaf et al. 2005). Statewide maturation of Vermont forests (Morin et al. 2011) may have contributed to this shift toward mature forest birds; however, other factors are likely to be at play.

AMONG THE 34 SPECIES INCLUDED IN THE ANALYSIS, 13 DECLINED SIGNIFICANTLY, 8 INCREASED SIGNIFICANTLY, AND 13 SHOWED NO SIGNIFICANT TREND.

FIGURE 4. LIST OF 34 SPECIES ANALYZED AND THEIR PROPORTION IN EACH OF THREE TREND CATEGORIES.



Declining Trends

Seven species that declined (Veery, Canada Warbler, Common Yellowthroat, White-throated Sparrow, Winter Wren, Yellow-rumped Warbler, and Blackburnian Warbler) reach their greatest abundance on our forested wetland sites. The first four of these species showed very low counts between 1999 and 2002. This period corresponds to the spread of West Nile virus across North America, which has been shown to have persistent impacts on bird populations, with some species being more susceptible than others (George et al. 2015) (Figure 5). If any habitat were to be at high-risk for this mosquito-borne disease, for which birds are the primary host, it would likely be wetlands. Additionally, five of these seven species nest and feed on or near the ground, suggesting that changes in understory structure or composition might have contributed to their declines. For example, if the density or species composition of understory vegetation changed over 25 years, such changes could have affected the birds breeding there. Invasive, exotic shrubs, such as Glossy Buckthorn and Japanese Honeysuckle, have become more common at some of our study sites. This is cause for concern, as exotic plants reduce invertebrate abundance and diversity (Burghardt et al. 2010) and may increase risk of nest predation (Rodewald et al. 2010).

FIGURE 5. THE POTENTIAL EFFECTS OF WEST NILE VIRUS (WNV) ON THE RELATIVE ABUNDANCE OF SIX SPECIES DETECTED ON THE VERMONT FBMP, 1989-2013. SPECIES IN LEFT ROW SHOWED PERSISTENT EFFECTS FROM WNV, WHILE THOSE IN RIGHT ROW SHOWED RECOVERY AFTER INITIAL DECLINE. DOTTED LINE INDICATES YEAR WHEN WNV WAS FIRST DETECTED IN VERMONT.

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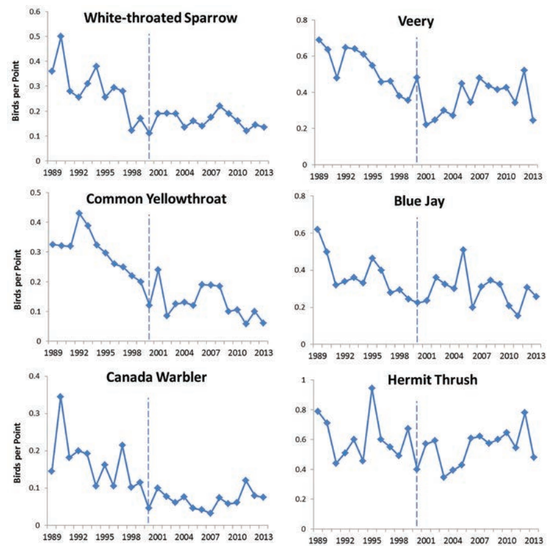

Increasing Trends

Among the eight species that showed significant population increases are Ovenbird, Red-eyed Vireo, Black-throated Green Warbler, and Yellow-bellied Sapsucker. These are some of the most abundant, easily detected, and widespread species on FBMP surveys, bolstering our confidence that their trends are "real." In addition, each prefers slightly different habitats (mature interior hardwoods, mixed forests, and second-growth/forest edges), and occupies a distinct ecological niche (a ground-forager, two canopy-foragers, and a bark-prober), suggesting that Vermont forests are meeting a diversity of habitat and ecological requirements. Moreover, all four are listed as Species of Regional Conservation Concern by Partners in Flight, primarily because the Northeast encompasses a large proportion of their breeding ranges (Rosenberg et al. 2016).

Guild Trends

Overall, seven (58%) of the 12 guilds declined, while only two (17%) increased (Table 4). Declining guilds occurred within all four guild categories (Breeding, Insectivore Foraging, Migratory Strategy, and Nest Location), while increasing trends were confined to the Insectivore Foraging guild category. Both long- and short-distance migrant guilds showed slight declines, while year-round residents showed no trend. Twenty-four percent of species included in both the Neotropical migrant and short-distance migrant guilds declined significantly. These included eight long-distance migrants, such as Blackburnian Warbler, Canada Warbler, and Rose-breasted Grosbeak, and four short-distance migrants, such as Winter Wren and White-throated Sparrow.

Although birds that nest in the canopy and those that nest on the ground both showed moderate declines, insectivores that forage within the high canopy and those that feed on the ground both showed moderate increases. The apparent disparity between ground foragers and ground nesters was likely due to the small number of species that were included in the ground gleaning guild (n=5), including Ovenbird, which increased by 55% over the study period and may have been driving the trend for this guild. The disparity among canopy foragers and nesters may be due to the fact that canopy-foraging species were split into two guilds based on the height at which they feed in the canopy (high and low canopy), while species were lumped into a single canopy group for the nesting guild. It is also interesting to note that the low-canopy foraging guild, consisting of 20 species, declined while the low-canopy nesters, including 19 species, showed no trend. Surprisingly, only seven species within these two guilds overlap, primarily because many of the shrub-nesters are omnivores, feeding on seeds and berries in addition to insects.

TWENTY-FOUR PERCENT OF SPECIES INCLUDED IN BOTH THE NEOTROPICAL MIGRANT AND SHORT- DISTANCE MIGRANT GUILDS DECLINED SIGNIFICANTLY.

Both Eastern Wood-Pewee and Great Crested Flycatcher (right) declined significantly, corroborating a widespread and alarming trend among aerial insectivores.

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TABLE 4. Results of population trend analysis for 12 ecological guilds in four categories, Vermont Forest Bird Monitoring Program, 1989-2013. Blue = significantly increasing trend; Red = significantly decreasing trend; Black = no significant trend

GUILD CATEGORY	GUILD	No. of species in Guild*	Annual change (%)	25-year change (%)	P-value	Statistical Significance
Breeding	Single-brooded	58	-0.36	-8.25	0.001	***
Insectivore Foraging	Aerial Insectivores	11	-2.46	-44.93	0.000	***
	Bark-probers	11	-0.12	-2.73	0.699	
	Ground Gleaners	5	0.83	21.92	0.000	***
	High Canopy Foragers	14	0.44	11.06	0.018	*
	Low Canopy Foragers	20	-1.58	-31.83	0.000	***
Migratory Strategy	Neotropical Migrants	33	-0.35	-7.98	0.002	**
	Residents	10	-0.23	-5.38	0.362	
	Short-distance Migrants	17	-0.40	-9.23	0.023	*
Nest Location	Canopy Nesters	28	-0.72	-15.89	0.000	***
	Ground Nesters	14	-0.45	-10.19	0.003	**
	Shrub Nesters	19	-0.12	-2.73	0.489	

* Number of species included in guild analyses out of a total of 125 species detected on FBMP surveys.
Significance: * = P ≤ 0.05, ** = P ≤ 0.01, *** = P ≤ 0.001
See **http://vtecostudies.org/sofb-guilds** for list of species in each guild.

Aerial Insectivores

Among the seven ecological guilds with declining trends, there is none more alarming than the steep drop of aerial insectivores, a diverse group of birds that specialize in capturing flying insects on the wing (Table 4; Figure 6). In our region, 19 species are included within this guild—primarily flycatchers, swallows, and nightjars (Eastern Whip-poor-will and Common Nighthawk)—but since swallows do not occupy forested habitats and nightjars are nocturnal, only 11 aerial insectivores were detected on FBMP surveys. As a group, these 11 species showed a significant annual decline of 2.5% on our study sites (see Figure 6), which equates to a 45% drop in their relative abundance over 25 years. This result corroborates a disquieting and widespread trend that ornithologists have noted for this group over the last two decades, especially in the Northeast (Nebel et al. 2010). Although only three of the 11 species were abundant enough to be included in our species trend analysis, both Eastern Wood-Pewee and Great Crested Flycatcher declined significantly (Table 2).

Given that aerial insectivores show tremendous diversity in life history and ecology, but share the attribute of dependence on flying insects as a food source, it seems likely that this steep and troubling decline reflects broad-scale changes in insect populations or phenology, rather than effects of habitat loss or direct mortality from disease or other factors. Declines of insect populations have been attributed to a variety of causes, including changes in agricultural practices (Benton et al. 2002), pesticide use (Stark and Banks 2003, Potts et al. 2010), polarized light pollution (Horvath et al. 2009), calcium depletion due to acid precipitation (Graveland 1998, Jeziorski et al. 2008), and climate change (Deutsch et al. 2008). Science-based changes to environmental policy, such as the 1990 Clean Air Act amendments and state Renewable Portfolio Standards, are tempering wildlife threats that originate from burning fossil fuels. Similarly ambitious initiatives are needed to curb pesticide use and evaluate other causes of insect decline.

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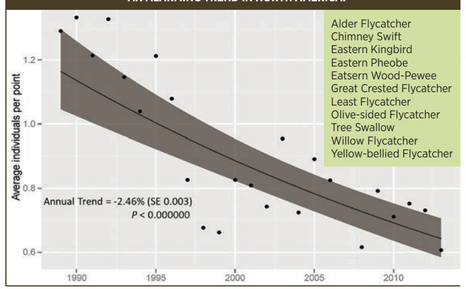
FIGURE 6. AS A GROUP, AERIAL INSECTIVORES (CONSISTING OF THE 11 SPECIES LISTED IN THE UPPER RIGHT) HAVE DECLINED BY 45% ON FBMP SURVEYS, CORROBORATING AN ALARMING TREND IN NORTH AMERICA.



POLARIZED LIGHT POLLUTION

Polarized light pollution refers to light that has undergone linear polarization by reflecting off certain artificial surfaces, including smooth, dark-colored paintwork (e.g. buildings, vehicles, etc.), glass windows, asphalt roads and parking lots, and black plastic sheeting (used in commercial agriculture). Artificial polarizers can act as ecological traps, threatening populations of polarization-sensitive species, especially aquatic-breeding insects. Although water is the primary natural source of polarized light, human development has vastly increased the extent of polarizing surfaces globally and introduced the phenomenon to places where it does not occur naturally. Many animals, including birds, reptiles, amphibians, fish, and insects, have vision that is well-tuned to polarized light. Hundreds, if not thousands, of species of flying insects, including dragonflies, mayflies, caddisflies, diving beetles, water bugs, and other aquatic insects, use polarized light in order to locate suitable water bodies in which to deposit their eggs. However, because many artificial polarizing surfaces reflect a stronger polarizing "signal" than water, insects are often preferentially attracted to them and consequently experience complete reproductive failure by laying eggs on windows or other surfaces. Countless others are killed by vehicles when they are attracted to busy roadways, which to them appear very much like rivers. (For more information, see review in Horvath et al. 2009).

RECOMMENDED LAND CONSERVATION AND FOREST MANAGEMENT PRACTICES

A number of policy instruments exist to maintain a high level of forest cover in Vermont, including the Land Use Value Appraisal Program, the Working Lands Enterprise Initiative, and regional and municipal plans. In 2016, the state formed a study committee to explore new alternatives for enhancing forest integrity through amendments to regulations such as the Land Use and Development Act.

Although land-use planning and policy are essential tools for statewide forest conservation, our recommendations focus on conservation and management practices that can be implemented at the property level. Of course, no single approach can sustain Vermont's forest bird communities, which are as diverse as the state's forests themselves. Rather, the most effective strategies will incorporate local knowledge of habitat values and stressors, forest dynamics, and socio-economic context.

For example, harvest-based strategies may be well suited to wooded uplands in areas where the forestry sector is important to the local economy and acts as a buffer against subdivision and development. Elsewhere, land protection may be the preferred approach, particularly in and around forested wetlands or in communities where forests are prized mainly for aesthetic and recreational values. Combined methods are often most effective at meeting a range of conservation objectives.

Use of varied approaches will help sustain both landscape- and stand-level heterogeneity that supports the full suite of Vermont's native birds, including those primarily associated with forest interiors. Because old forests contain tree-fall canopy gaps, these birds are well adapted to patchy and layered woods. Areas of high sapling density provide valuable cover and food resources to mature forest species, especially during the post-breeding period when risk of mortality is particularly high (Chandler et al. 2012, Stoleson 2013). We suggest that landowners, conservation planners, and foresters seek opportunities to sustain and/or emulate natural disturbance patterns in their work.

USE OF VARIED APPROACHES WILL HELP SUSTAIN BOTH LANDSCAPE- AND STAND-LEVEL HETEROGENEITY THAT SUPPORTS THE FULL SUITE OF VERMONT'S NATIVE BIRDS, INCLUDING THOSE PRIMARILY ASSOCIATED WITH FOREST INTERIORS.

Despite the need for locally-driven and customized practices, the following general recommendations apply to most forested properties under consideration for conservation or uneven-aged forest management. They are not intended for commercial timberlands, which are managed primarily with even-age silvicultural systems.

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At Right:
Populations of Black-throated Blue Warbler and American Redstart (below) remained stable.

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Land Conservation

- Identify and conserve forest types that are uncommon, are under-represented in the existing network of protected areas, and/or encompass a range of elevations and landforms.
- Focus resources on forest blocks >250 acres (Robbins et al. 1989, Rosenberg et al. 2003) with > 80% forest cover within 1-2 km (Suarez-Rubio et al. 2013) and > 65% forest cover within 5 km (Driscoll et al. 2005). Acre for acre, these are more likely to produce greater numbers of forest-interior birds than smaller tracts in more developed landscapes.
- Favor forest units with large core areas and low edge-to-area ratios in order to reduce the risk of predation and brood parasitism originating from surrounding agriculture or development.
- When feasible, consider forest conservation strategies that allow natural processes to occur with minimal human disturbance. Besides protecting native biodiversity, these forests can serve as scientific "control" areas.
- Build connections among existing conservation areas.
- Develop easements and/or stewardship plans that take nearby land uses into account and enable adaptation to changing landscape and climatic conditions.
- Use communication and education resources to promote a broader understanding of the ecological connections that link Vermont forests with the Neotropics.
- Make strategic investments in the protection of Latin American and Caribbean wintering grounds through international partnerships.
- Maintain FBMP sites as vital benchmarks whose scientific and ecological value will increase with accumulated information and with the recovery of natural processes and old-forest characteristics

Forest Management

- In mature stands, emulate natural disturbance scale and frequency with single-tree selection, variably sized group selection (0.1-1 acre, infrequently up to 2 acres), and/or expanding gap group shelterwoods (North and Keeton 2008, Hagenbuch et al. 2011).
- When using single-tree selection or release methods to promote old-growth characteristics, target a residual basal area of 90-115 sq.ft/acre (Thompson and Capen 1988, Keeton 2006).
- Retain a high proportion of large-diameter trees and snags (>20-inch dbh) to support canopy and cavity nesters and to promote the development of late-successional forest structure. Accelerate growth of the largest and healthiest trees with two- to four-sided crown release (Keeton 2006).
- If snags are uncommon, retain or girdle medium to large, low-vigor trees.
- In pole-sized stands, speed up the development of a high, vigorous canopy with variable density thinning, crop-tree release, or crop-tree release with canopy gap formation (Hagenbuch et al. 2011).
- Protect soils, regeneration, and down wood by harvesting on dry or frozen ground and restricting heavy machines to temporary routes and landings. When operating in a stand, minimize travel and maximize trail-spacing and machine reach.
- Where invasive species are a problem, apply best practices in invasive plant and earthworm control to promote regeneration of native flora and leaf-litter fauna. When possible, treat invasive plants before harvest and clean tires of forestry equipment between jobs.
- Limit the number, width, and length of haul roads and skid trails.
- Avoid harvesting during periods of nesting and fledgling activity (May through mid- August).

FBMP PARTNERS AT WORK

Every day, volunteers and professionals from throughout the state are working to secure a bright future for Vermont's forest birds. Some participate in citizen groups organized to conserve large tracts of forest for native biodiversity and for sustainable human use. Many are long-standing FBMP partners who develop resources and learning opportunities for landowners and others involved in forest stewardship. The following profiles and web links provide a sampling of their accomplishments and offerings.

VERMONT FISH AND WILDLIFE DEPARTMENT: COMMUNITY WILDLIFE PROGRAM *
The Community Wildlife Program provides municipal planners and non-governmental organizations with a variety of resources for identifying and conserving important wildlife habitat. The program staff is available to share scientific information and to review town plans and local land-use regulations. Download a free copy of their comprehensive manual for community-based wildlife conservation, Conserving Vermont's Natural Heritage.

VERMONT DEPARTMENT OF FORESTS, PARKS AND RECREATION: ADAPTING FORESTS TO CLIMATE CHANGE *
This report contains an overarching vision and practical guidance for managing Vermont forests so that they can withstand climate-related stress and recover to a healthy condition. It includes adaptation strategies for northern hardwood, spruce-fir, and oak-pine forest types, with detailed considerations for timber management.

VERMONT BIOFINDER: VERMONT AGENCY OF NATURAL RESOURCES *
This cooperatively developed online mapping platform enables users to identify ecologically significant forests and other high-priority habitats in their communities. Users can draw from up to 21 overlapping data sets to create customized maps and reports to inform their stewardship and conservation projects. Video tutorials and an intuitive interface make this a simple and fascinating tool.

VERMONT INVASIVES *
Collaborators from the University of Vermont Cooperative Extension, The Nature Conservancy, and the Vermont Department of Forests, Parks and Recreation have collected and organized information about invasive insects, plants, and pathogens and are serving it online at **www.vtinvasives.org**. Visitors to the site can access monitoring tools and learn about a variety of control strategies. Workshops and outreach events are posted on a regularly updated calendar.

VERMONT CENTER FOR ECOSTUDIES: VERMONT ATLAS OF LIFE *
The mission of the Vermont Atlas of Life is to bring over 150 years of accumulated knowledge of the biodiversity of Vermont into currency for science and society. The atlas features applications for sharing and accessing information about Vermont forest birds, such as Vermont eBird, iNaturalist Vermont, and the Vermont Breeding Bird Atlas. This biodiversity data hub also maps observations of mammals, amphibians, reptiles, invertebrates, and plants.

AUDUBON VERMONT: FORESTERS FOR THE BIRDS *
This initiative, launched in partnership with the Vermont Department of Forests, Parks and Recreation, engages foresters and landowners in the implementation of forestry practices that add vertical and horizontal complexity to forests in order to boost avian abundance and diversity. The program aims to help woodlot owners achieve their timber management goals by operating with patterns that mimic the scale and effects of natural disturbance events. Some of the recommended treatments are eligible for cost-share funding under the Natural Resources Conservation Service Environmental Quality Incentives Program.

NORTHWOODS STEWARDSHIP CENTER: SPITZER DEMONSTRATION FOREST *
This 1,475-acre forest, located in East Charleston, is an Audubon Vermont Forestry for the Birds demonstration site and is recognized by the Forest Guild as a model of sustainable forest management. Those unable to attend a NorthWoods program at the Spitzer Demonstration Forest, can go online to view photos and detailed descriptions of habitat enhancements involving a variety silvicultural practices.

THE VERMONT FOREST ECOSYSTEM MANAGEMENT DEMONSTRATION PROJECT
In 2004, a multi-disciplinary team of scientists at the University of Vermont began a long-term study of the effects of disturbance- or structure-based forestry practices on a wide range of forest values. Initial findings show that modified uneven-aged silviculture can promote old-growth characteristics, particularly when specific goals for tree diameter distribution are set. Although results from the bird study are pending, research performed in New York and Vermont has shown that moderate partial harvests can increase the number of species and the overall number of birds in the forest, with little effect on mature forest species (Hartley et al. 2004, Rankin and Perlut 2015).

WINDMILL HILL PINNACLE ASSOCIATION
This visionary group of conservation-minded neighbors has been coordinating land protection and stewardship activities in Rockingham, Athens, Grafton, Brookline, and Westminster since 1991. Their balanced and collaborative approach recognizes the essential role forests play in sustaining native biodiversity and bringing clean water, fresh air, wood products, and joy to our lives. The association is one of several conservation partnerships in Vermont that offer models to sustain the vitality of our forests for birds and for people. Others include the Orange County Headwaters Project and the Taylor Valley Conservation Project.

* Designates programs involving FBMP partners

Populations of Vermont's state bird, the Hermit Thrush, remained relatively stable over the 25 years of this study.

VOLUNTEERS AND PROFESSIONALS FROM THROUGHOUT THE STATE ARE WORKING TO SECURE A BRIGHT FUTURE FOR VERMONT'S FOREST BIRDS

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OH SONGBIRD IN MY WEARIEST DAY
A FEW CLEAR NOTES IS ALL I NEED
AND I SEE WITHOUT WARNING A PRECIOUS RAY
OF MAGIC IN EACH ORDINARY THING

YOU ILLUMINATE, RENEW,
TAKE THE SAD OUT OF THE BLUE
SONGBIRD WHAT WOULD I DO WITHOUT YOU
WHAT WOULD I DO WITHOUT YOU

—Eilen Jewell

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Chris Rimmer
Betty Rist
Sue Staats
Ruth Stewart
Matt Stone
Ned Swanberg
Michael Sweatman
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Front Cover: A common and widespread species in mixed forest stands, the Black-throated Green Warbler has increased by 57% on Vermont Forest Bird Monitoring study sites since 1989. However, the species could be at risk if the hemlock wooly adelgid continues to expand its range in Vermont. Photo by Matt Stratmoen.

Back cover: Old growth forest at The Cape Research Natural Area, Green Mountain National Forest, Goshen, Vermont; one of 31 Vermont Forest Bird Monitoring Program study sites. Photo by Steve Faccio

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