

**2014 Annual Research Report to US Fish and Wildlife and National Wildlife Refuges
Bird communities of coniferous forests in the Acadian region; their response to management, and
habitat associations.**

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Background and Project Overview

Several bird species of concern are found in the coniferous forests of Northern New England. Cape May (*Setophaga tigrina*) and Bay-breasted Warblers (*Setophaga castanea*) have been declining within the Acadian Region since region-wide monitoring began with the USGS Breeding Bird Survey in 1966, whereas, species such as Blackburnian Warbler (*Setophaga fusca*) are increasing (Sauer et al. 2012, Figure 1). The United States Federal government has the authority to manage these species under the U.S. Migratory Bird Treaty Act. Maine contributes up to 96% of breeding habitat for some of these spruce-fir associated species in the United States, and population declines are not well understood. The coniferous forests where these species reside are heavily managed by the timber industry with a variety of silvicultural and industrial prescriptions. Habitat requirements for these species are not well-defined, nor are the species' responses to management. Standardized, region-wide surveys used for assessing populations may not be sufficiently comprehensive to fully understand population trends (i.e., USGS Breeding Bird Survey), in particular, when the species of concern are absent (e.g., during the Audubon Christmas Bird Count, which occurs in the non-breeding season). Furthermore, these surveys do not typically account for detection error, where a species can be present but goes undetected.

Our goals are to investigate factors influencing the distribution and abundance of species that represent the Acadian coniferous forests and to assess the influence of prevalent silvicultural techniques on the Acadian forest bird community. Our objectives are to: (1) quantify the composition and forest associations of coniferous bird communities in five silvicultural treatments representing a gradient in mature canopy residuals including conifer regenerating, overstory removal, pre-commercially thinned, selection, and shelterwood harvest compared to mature softwood reference sites; (2) model the influences of silvicultural practices on coniferous forest bird communities while accounting for detection error; (3) use data at both landscape and local scales to determine important habitat and beneficial management; and, (4) provide accessible and interpretable results for silviculturalists that can be used to manage species of concern.

Progress in 2014

Our research focused on two components: bird community surveys and vegetation surveys in 117 forest stands in Maine, New Hampshire, and Vermont (Figure 2). Vegetation survey protocols were developed and applied at all bird community survey locations.

Field Sites

Our sites are located within the Acadian Forest Region, which coincides roughly with Bird Conservation Region 14 in the United States (Figure 2). In 2013, we established survey points in the North Maine Woods (Clayton Lake and Telos), Baxter State Park, and four National Wildlife Refuges (Nulhegan Basin Division of Silvio Conte NWR, Umbagog NWR, Moosehorn NWR, and Aroostook NWR). We attempted to have at least five samples of each treatment at every site to survey a range of possible forest conditions, however, this goal was not reached at all sites owing to the distribution of forest management types (Tables 1 and 2). In 2013, we surveyed 110 forest stands with approximately 3 to 8 survey locations per stand for a total of 609 sampled points. In 2014, we added 48 points in 7 stands to increase sample size in shelterwood harvests, increasing total samples to 657 point locations in 117 stands.

For each stand, we included one hard edge and one soft edge survey point along with as many core points as could be independently distributed within a stand (typically 3-8 points spaced >200m apart). We defined a hard edge as any abrupt change from the forest treatment to early successional habitat including roads, meadows, and recently harvested areas. We defined soft edges as any transition from one forest treatment or time since harvest to another forest treatment type. If an adjacent edge type was not available, we did not add the edge survey point. Core points were defined as ≥ 110 m from a hard edge and ≥ 150 m from any other point.

Occupancy Surveys

We used standardized point count surveys (Ralph et al. 1993, Hamel 1996) to count all detected (seen or heard) bird species during the breeding season and post fledgling period in 2013 and 2014 (1 June to 1 August) totaling 3916 surveys combined. We navigated to predetermined locations, and counted the number of individuals of each bird species that were audibly or visually detected for 10 minutes. Nearly all point counts occurred within four hours of civil dawn when most birds are most active and singing. We returned to each location for a total of three repeated surveys. Repeated surveys allow us to account for the probability that an undetected bird was present during a survey. Across all study areas, we recorded 19,431 detections of 123 species in 2013 and 22,784 detections of 134 species in 2014. In addition to birds, we recorded detections of Red Squirrel (*Tamiasciurus hudsonicus*), because they are known nest predators of many passerines in New England. Species detected are summarized in Table 3.

Vegetation Surveys

We adapted methods from the Forest Inventory Analysis and Breeding Bird Research and Monitoring Database (Martin et al. 1997) to measure vegetation at each point count location. Data collected included structural and compositional measurements (Table 4). We completed 1,320 vegetation plots and measured 15,024 trees. Vegetation data were collected in only one year because we expect little change in vegetation over the course of this three year study.

Future Plans

A third field season focused on bird surveys will be conducted in 2015, followed by data analysis and report preparation in 2016.

Table 1. The number of point count locations in each treatment class at each property that were surveyed in 2013 and/or 2014.

Site	Number of point counts in each treatment						Total
	Conifer Regen	Mature	Overstory Removal	PCT	Selection	Shelterwood	
Aroostook NWR	3	28	0	0	9	0	40
Baxter State Park	0	25	0	0	0	33	58
Clayton Lake	50	0	5	0	12	0	67
Moosehorn NWR	0	46	0	0	0	6	52
Nulhegan NWR	54	11	0	33	31	3	132
Telos	55	27	0	47	23	0	152
Umbagog NWR	23	51	0	20	54	8	156
Total	185	188	5	100	129	50	657

Table 2. The number of stands in each treatment class at each property that were surveyed in 2013 and/or 2014.

Property	Number of stands in each treatment						Total
	Conifer Regen	Mature	Overstory Removal	PCT	Selection	Shelterwood	
Aroostook NWR	1	9	0	0	2	0	12
Baxter State Park	0	2	0	0	0	7	9
Clayton Lake	8	0	1	0	2	0	11
Moosehorn NWR	0	8	0	0	0	1	9
Nulhegan NWR	6	2	0	5	5	1	19
Telos	10	5	0	10	4	0	29
Umbagog NWR	6	6	0	4	10	2	28
Total	31	32	1	19	23	11	117

Table 3. Average number of birds detected (Mean) within 50m during surveys for each species and standard deviation (SD). These average counts have not been adjusted for detection probability and were averaged from the maximum number detected at each survey location from all repeated surveys within each year.

Common name	2013		2014	
	Mean	SD	Mean	SD
AMERICAN BLACK DUCK	0.002	0.040	0.000	0.000
ALDER FLYCATCHER	0.077	0.322	0.055	0.253
AMERICAN CROW	0.031	0.182	0.020	0.178
AMERICAN GOLDFINCH	0.011	0.120	0.014	0.129
AMERICAN KESTREL	0.000	0.000	0.002	0.039
AMERICAN REDSTART	0.192	0.437	0.182	0.465
AMERICAN ROBIN	0.382	0.687	0.179	0.453
AMERICAN WOODCOCK	0.008	0.201	0.002	0.039
AMERICAN THREE-TOED WOODPECKER	0.006	0.080	0.000	0.000
BALTIMORE ORIOLE	0.003	0.057	0.000	0.000
BLACK-AND-WHITE WARBLER	0.277	0.546	0.204	0.459
BAY-BREASTED WARBLER	0.074	0.291	0.155	0.445
BLACK-BACKED WOODPECKER	0.005	0.069	0.021	0.144
BLACK-CAPPED CHICKADEE	0.703	0.918	0.465	0.742
BELTED KINGFISHER	0.006	0.080	0.000	0.000
BLUE-HEADED VIREO	0.284	0.515	0.207	0.441
BLACKBURNIAN WARBLER	0.232	0.525	0.274	0.504
BLUE JAY	0.329	0.595	0.161	0.450
BLACKPOLL WARBLER	0.035	0.217	0.036	0.218
BOBOLINK	0.002	0.040	0.000	0.000
BOREAL CHICKADEE	0.300	0.668	0.222	0.568
BROWN CREEPER	0.131	0.369	0.071	0.275
BLACK-THROATED BLUE WARBLER	0.277	0.543	0.252	0.506
BLACK-THROATED GREEN WARBLER	0.561	0.798	0.419	0.629
BROAD-WINGED HAWK	0.019	0.149	0.014	0.140
CANADA GOOSE	0.002	0.040	0.000	0.000
CANADA WARBLER	0.266	0.513	0.260	0.518
CEDAR WAXWING	0.232	0.583	0.055	0.281
CHIPPING SPARROW	0.032	0.225	0.024	0.181
CHIMNEY SWIFT	0.000	0.000	0.002	0.039
CAPE MAY WARBLER	0.006	0.080	0.012	0.110
COMMON GRACKLE	0.000	0.000	0.009	0.110
COOPER'S HAWK	0.002	0.040	0.002	0.039
COMMON MERGANSER	0.002	0.040	0.015	0.390
COMMON NIGHTHAWK	0.010	0.098	0.006	0.078

COMMON RAVEN	0.031	0.236	0.003	0.055
COMMON YELLOWTHROAT	0.356	0.620	0.287	0.572
CHESTNUT-SIDED WARBLER	0.134	0.402	0.058	0.252
DOWNY WOODPECKER	0.045	0.237	0.012	0.123
EASTERN KINGBIRD	0.002	0.040	0.000	0.000
EASTERN PHOEBE	0.019	0.138	0.005	0.087
EASTERN WOOD-PEWEE	0.034	0.198	0.018	0.134
EVENING GROSBEAK	0.003	0.080	0.000	0.000
FOX SPARROW	0.015	0.133	0.052	0.241
GREAT-CRESTED FLYCATCHER	0.011	0.106	0.000	0.000
GOLDEN-CROWNED KINGLET	0.976	0.704	0.752	0.676
GREAT HORNED OWL	0.005	0.069	0.000	0.000
GRAY JAY	0.085	0.496	0.027	0.181
GRAY CATBIRD	0.026	0.159	0.005	0.067
GOLDEN-WINGED WARBLER	0.000	0.000	0.002	0.039
HAIRY WOODPECKER	0.058	0.234	0.073	0.266
HERMIT THRUSH	0.963	0.932	0.521	0.740
HOUSE FINCH	0.002	0.040	0.000	0.000
KILLDEER	0.000	0.000	0.002	0.039
LEAST FLYCATCHER	0.166	0.436	0.064	0.339
LINCOLN'S SPARROW	0.005	0.090	0.006	0.078
MAGNOLIA WARBLER	1.139	0.938	1.178	0.910
MOURNING DOVE	0.047	0.226	0.006	0.095
MOURNING WARBLER	0.006	0.080	0.006	0.078
MYRTLE WARBLER	0.535	0.715	0.576	0.714
NASHVILLE WARBLER	0.644	0.794	0.625	0.765
NORTHERN CARDINAL	0.013	0.139	0.000	0.000
NORTHERN PARULA	0.503	0.713	0.369	0.551
NORTHERN WATERTHRUSH	0.205	0.529	0.131	0.384
ORANGE-CROWNED WARBLER	0.003	0.057	0.000	0.000
OLIVE-SIDED FLYCATCHER	0.040	0.234	0.035	0.184
OVENBIRD	0.560	0.859	0.381	0.611
PHILADELPHIA VIREO	0.005	0.069	0.000	0.000
PINE WARBLER	0.148	0.422	0.071	0.269
PILEATED WOODPECKER	0.044	0.212	0.014	0.116
PURPLE FINCH	0.113	0.332	0.079	0.286
ROSE-BREASTED GROSBEAK	0.031	0.190	0.006	0.078
RED-BREASTED NUTHATCH	0.455	0.617	0.427	0.637
RUBY-CROWNED KINGLET	0.187	0.455	0.132	0.373
RED CROSSBILL	0.002	0.040	0.002	0.039
RED SQUIRREL	0.632	0.771	1.065	0.866
RED-EYED VIREO	0.531	0.644	0.412	0.621
RUBY-THROATED HUMMINGBIRD	0.016	0.126	0.018	0.145

RUSTY BLACKBIRD	0.005	0.090	0.000	0.000
RUFFED GROUSE	0.037	0.267	0.014	0.160
RED-WINGED BLACKBIRD	0.013	0.126	0.002	0.039
SAVANNAH SPARROW	0.013	0.139	0.005	0.087
SLATE-COLORED JUNCO	0.185	0.475	0.277	0.559
SCARLET TANAGER	0.008	0.106	0.006	0.078
SORA	0.003	0.080	0.002	0.039
SONG SPARROW	0.026	0.178	0.017	0.140
SPRUCE GROUSE	0.006	0.080	0.014	0.129
SHARP-SHINNED HAWK	0.013	0.126	0.003	0.055
SWAMP SPARROW	0.019	0.169	0.024	0.190
SWAINSON'S THRUSH	0.655	0.784	0.739	0.863
TENNESSEE WARBLER	0.016	0.126	0.003	0.055
VEERY	0.087	0.315	0.021	0.155
VIRGINIA RAIL	0.002	0.040	0.000	0.000
WHITE-BREASTED NUTHATCH	0.010	0.127	0.005	0.067
WILSON'S SNIPE	0.000	0.000	0.003	0.055
WILD TURKEY	0.011	0.120	0.000	0.000
WILSON'S WARBLER	0.015	0.133	0.018	0.165
WINTER WREN	0.689	0.749	0.441	0.587
WOOD DUCK	0.002	0.040	0.000	0.000
WOOD THRUSH	0.002	0.040	0.000	0.000
WHITE-THROATED SPARROW	0.808	1.034	0.565	0.820
WHITE-WINGED CROSSBILL	0.000	0.000	0.003	0.078
YELLOW-BELLIED FLYCATCHER	0.311	0.522	0.450	0.623
YELLOW-BELLIED SAPSUCKER	0.106	0.339	0.100	0.369
YELLOW WARBLER	0.008	0.090	0.005	0.067
YELLOW PALM WARBLER	0.197	0.568	0.081	0.342
YELLOW-SHAFTED FLICKER	0.134	0.372	0.062	0.248
YELLOW-THROATED VIREO	0.002	0.040	0.000	0.000

Table 4. Vegetation variables measured in 2014.

Scale	Vegetation variable	Variable type	Description
Individual tree	Basal area	Count	2 factor metric glass prism, tree counts ≥ 10 cm dbh (diameter at breast height)
	Tree dbh	Continuous (cm)	For all tree counted as 'in' using the glass prism using a Biltmore stick
	Tree species	Category	Identified all trees to genus or species
	Crown class	Category	Visual estimate of relative position of tree crown to other tree crowns
	Crown condition	Category	Visual estimate of fullness of crown
	Height	Continuous (m)	Measured with a clinometer and range finder
	Live crown length	Continuous (m)	Measured with a clinometer and range finder
Plot level	Live or dead	Binary	Whether a standing tree living or dead
	Canopy gaps	Continuous (%)	Percent canopy gaps within 30m defined as
	Canopy density	Continuous (%)	Both gridded plexiglass and densiometer
	Midstory density	Continuous (%)	Gridded plexiglass
	Elevation	Continuous (m)	GPS unit reading
	Water	Category	Standing water present, running, or none
	All green cover	Continuous (%)	Visual estimate of all green ground cover excluding moss
	Moss cover	Continuous (%)	Visual estimate
	Total cover 0.5 to <2m	Continuous (%)	Visual estimate
	Deciduous cover 0.5 to <2m	Continuous (%)	Visual estimate
	Coniferous cover 0.5 to <2m	Continuous (%)	Visual estimate
	Dominant species 0.5 to <2m	Category	Species or genus
	Large downed logs	Binary (y/n)	Present or absent
	Tip ups	Binary (y/n)	Present or absent
	Leaf litter cover	Continuous (%)	Visual estimate

Figure Legends

Figure 1. Several species of concern, their estimated population trends in Bird Conservation Region 14 from USGS Breeding Bird Survey data, and breeding distributions. Photo credits: Bay-breasted Warbler by Bill Majoros, Cape May Warbler and Blackburnian Warbler were used from the USGS Breeding Bird Survey website.

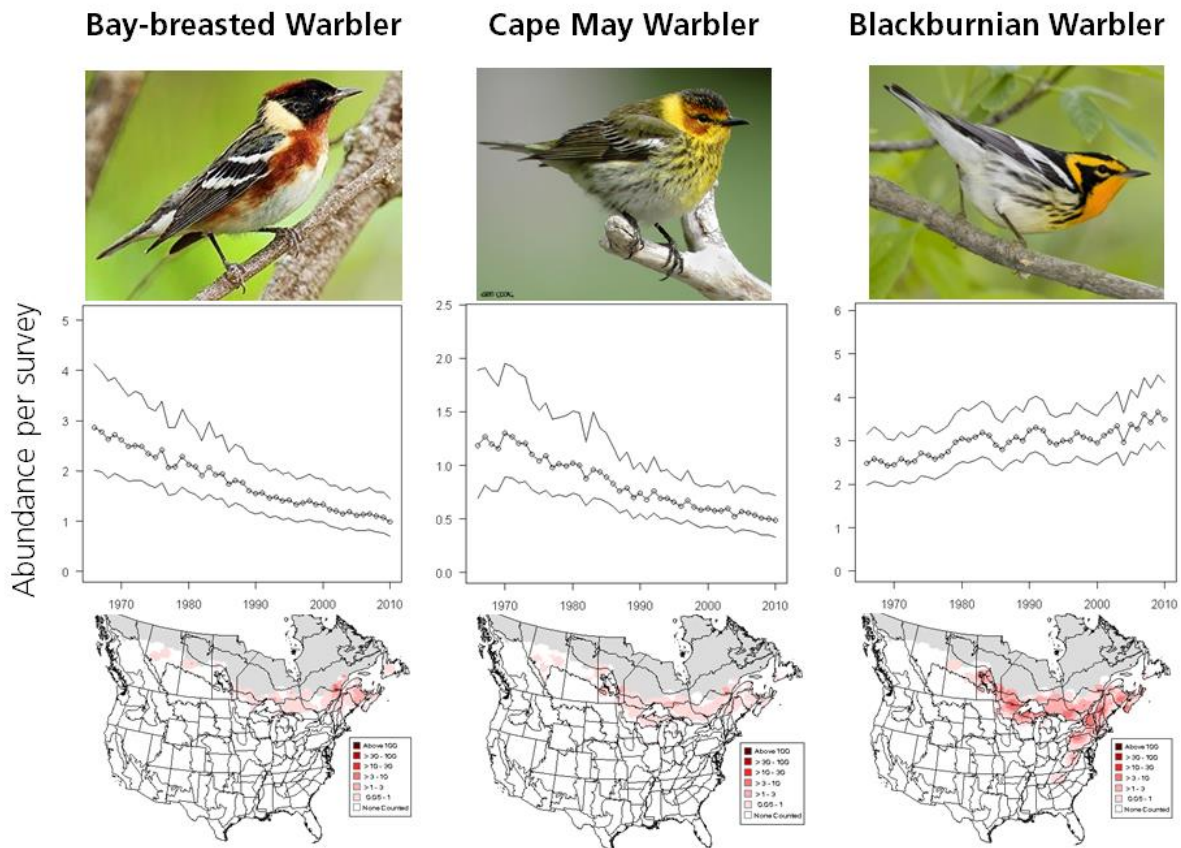
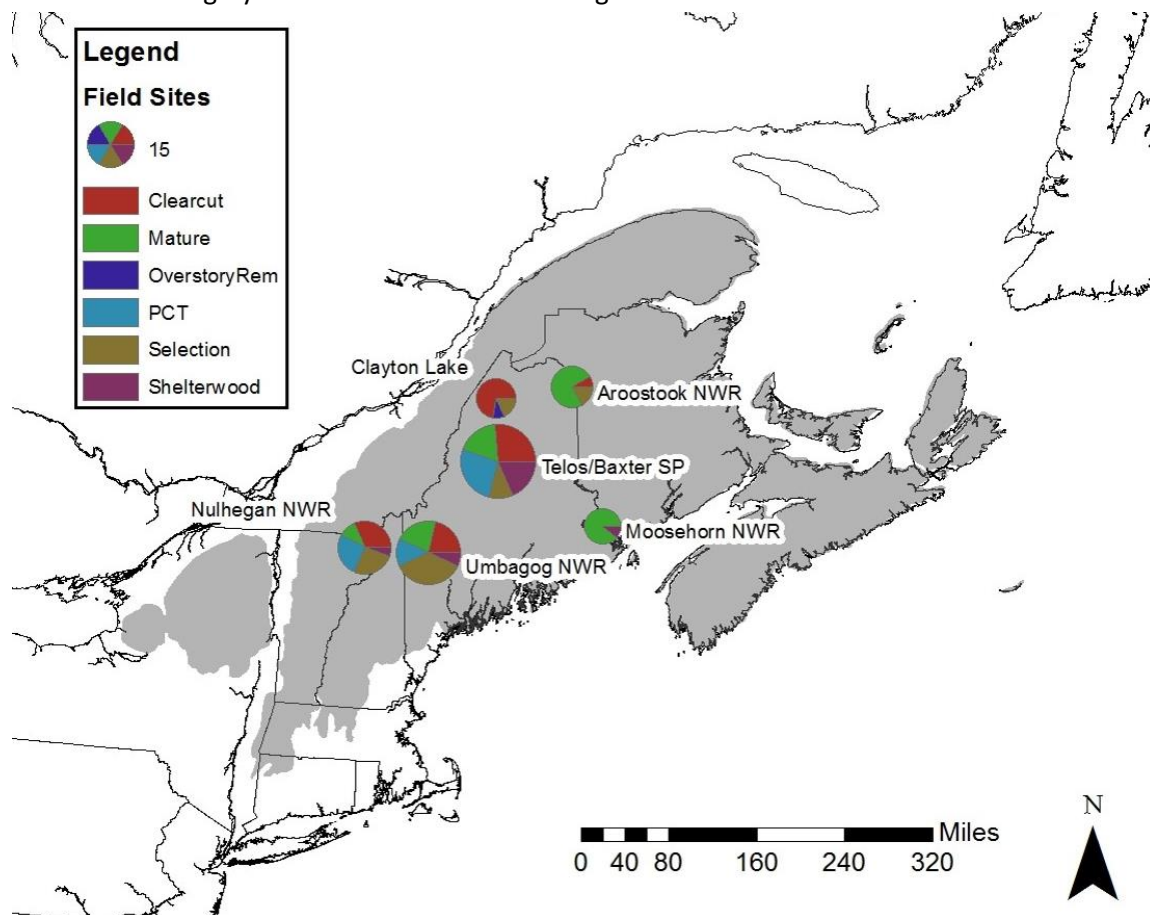


Figure 2. Survey areas in Northern New England. The size of each pie chart is proportional to the number of stands surveyed in each area; pie charts show the proportion of stands in each treatment category; and the shaded gray area is Bird Conservation Region 14.



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