Partners in Flight
Bird Conservation Plan
for
The Northern New England
(Physiographic Area 27)

American Bird Conservancy

Partners In Flight
Landbird Conservation Plan:

Physiographic Area 27:
Northern New England

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EXECUTIVE SUMMARY

Area - 5,053,071 ha
Description - The Northern New England physiographic area extends from southern Maine through southern New Hampshire and Vermont and western Massachusetts, barely entering eastern New York in the Taconic Highlands. Landforms within the planning unit include Vermont's Killington Peak at 1,290 m ranging down to sea level along the Maine coast. Most of the region consists of Rolling hills and small mountains with large areas of farmland of the Connecticut, Merrimac, Androscoggin, and Kennebec river valleys. The planning unit also contains a large portion of the Green Mountain National Forest in southern Vermont. A majority of the planning unit is dominated by either sugar maple-beech-birch forest, red spruce-balsam fir forest, mesic hardwood forests dominated by northern red oak, or drier forests dominated by oak-hickory or pine-oak association. Presettlement forests in much of the region consisted largely of white pine and hemlock, with hardwood forests dominating after timber removal and other disturbance. Today, agriculture remains an important land use, but forest harvesting too shapes the habitats throughout Northern New England. Human populations have grown tremendously in this area and development for single family housing especially in rural and suburban areas is especially important.

Priority bird species and habitats

Mountaintop stunted conifer woodland -
Bicknell's Thrush -- Populations disappearing or vulnerable at the southern edge of this species' range.

Objective: ensure the protection of 100% of sites that support populations of Bicknell's Thrush "large enough to be considered source populations for other sites," and as many additional high-elevation habitat patches with smaller populations as possible.

Coastal marsh, dune, estuary -
Nelson's Sharp-tailed Sparrow -- Large proportion of *subvirgatus* race breeding range; overlap zone with Saltmarsh Sharp-tailed Sparrow in southern Maine and NH.
Piping Plover -- Small, endangered population; some habitat exists for expansion.
American Black Duck -- Important breeding, stopover, and especially wintering habitats.

Objective: Maintain stable breeding population of 350 breeding Nelson's Sharp-tailed Sparrows, distributed among no less than 7 sites on the Maine coast. Maintain stable wintering population of American Black Ducks as measured by an annual average of 3,000 individuals during the Midwinter Waterfowl Survey along the Northern New England Coast.

Northern hardwood-mixed forest -
Wood Thrush -- Declining nearly throughout its range; mid-or late successional forest.
Black-throated Blue Warbler -- Large and apparently stable population; requires dense deciduous understory, especially hobblebush.
Canada Warbler -- Declining nearly throughout its range, this species favors dense understory, especially in wet areas.
Blackburnian Warbler -- Declining significantly in this region; requires tall conifers, especially hemlock and spruce.

Objective: Roughly 800,000 ha of northern hardwood forest is required to support the entire habitat-species suite (e.g. 250,000 pairs of Wood Thrush), with 100,000 ha suitable to maintain 40,000 pairs of Black-throated Blue Warblers and 56,000 ha of mature mixed and coniferous forest suitable to maintain 25,000 breeding pairs of Blackburnian Warblers.

Early successional forest -

Chestnut-sided Warbler -- Declining significantly in this region; habitat generalist in disturbed and regenerating forests

American Woodcock -- Declining significantly; management needs can be integrated with needs for other shrub-nesting bird species

Objective: Roughly 320,000 ha of early and mid-successional forest is required to support 300,000 pairs of Chestnut-sided Warblers; this area will support entire habitat-species suite.

Conservation recommendations and needs -

Although Northern New England has been inhabited by Europeans for almost as long as any physiographic area in the country, the economic base today is largely commercial forestry and recreation and, as a result, most priority birds are still abundant and widespread. Many of the relatively high priority birds breeding in northern hardwood forest are undergoing population declines in Northern New England, however, even though the habitat remains common. Declines may be due to landscape level deficiencies in forest-age distribution, structural characteristics, and tree-species composition. A comprehensive forest management plan for the entire region would be a positive step toward long-term maintenance of source populations of this avifauna. Populations of Chestnut-sided Warbler and other species associated with successional forests (including American Woodcock) are generally declining in this area, as well as in most of the Northeast. Any comprehensive forest plan for this area must include retention of a significant area of early successional habitat in a variety of conditions. The only mountaintop habitat in this area still occupied by Bicknell's Thrush is in the Green Mountains of Vermont. All the dense, stunted balsam fir-dominated stands in which this bird breed must be maintained. Both Saltmarsh (?) and Nelson's Sharp-tailed Sparrows breed in coastal saltmarsh along this area's coastline. These birds are poorly known and require study and monitoring, and all used habitat should be maintained. Nesting beaches for Piping Plover and coastal wetlands are already high conservation priorities.

Specific conservation recommendations in this physiographic area include:

- Apply GIS-based spatial monitoring protocol to survey and monitor high-elevation habitats for Bicknell's Thrush
- Complete inventory for both species of Sharp-tailed Sparrow, with particular attention to the northern range limit for Saltmarsh Sharp-tailed Sparrow; at 5 year intervals
- maintain a "shifting mosaic" of forest-age structures, including adequate amounts of mid-successional as well as late-successional forest (both coniferous and northern hardwood)
- identify and designate Bird Conservation Areas (BCA), within which long-term sustainability of priority bird populations is a primary management objective
- protect and restore wetland habitats to enhance breeding and wintering populations of American Black Duck.

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INTRODUCTION

Continental and local declines in numerous bird populations have led to concern for the future of migratory and resident landbirds. Reasons for declines are complex. Habitat loss, degradation, and fragmentation on breeding and wintering grounds and along migratory routes have been implicated for many species. Additional factors may include reproductive problems associated with brood parasitism and nest predation. Scientists and the concerned public agreed that a coordinated, cooperative, conservation initiative focusing on nongame landbirds was needed to address the problem of declining species. In 1990, Partners in Flight (PIF) was conceived as a voluntary, international coalition of government agencies, conservation organizations, academic institutions, private industry, and other citizens dedicated to reversing the downward trends of declining species and "keeping common birds common."

PIF functions to direct resources for the conservation of landbirds and their habitats through cooperative efforts in the areas of monitoring, research, management, and education, both nationally and internationally. The foundation for PIF's long-term strategy for bird conservation is a series of scientifically based Landbird Conservation Plans, of which this document is one. The geographical context of these plans are physiographic areas, modified from original strata devised by the Breeding Bird Survey (Robbins et al. 1986). Twelve physiographic areas overlap the northeastern United States (USFWS Region-5). Although priorities and biological objectives are identified at the physiographic area level, implementation of PIF objectives will take place at different scales, including individual states, federal agency regions, and joint ventures.

A. Goal

The goal of each PIF Bird Conservation Plan is to ensure long-term maintenance of healthy populations of native landbirds. This document was prepared to facilitate that goal by stimulating a proactive approach to landbird conservation. The conservation plan primary addresses nongame landbirds, which have been vastly underrepresented in conservation efforts, and many of which are exhibiting significant declines that may be arrested or reversed if appropriate management actions are taken. The Partners in Flight approach differs from many existing federal and state-level listing processes in that it (1) is voluntary and nonregulatory, (2) focuses proactively on relatively common species in areas where conservation actions can be most effective, rather than the frequent local emphasis on rare and peripheral populations. Partners in Flight Landbird Conservation Planning, therefore, provides the framework to develop and implement habitat conservation actions on the ground that may prevent the need for future species listings.

B. Process

Partners in Flight Landbird Conservation Planning emphasizes effective and efficient management through a four-step process designed to identify and achieve necessary actions for bird conservation:

(1) identify species and habitats most in need of conservation;
(2) describe desired conditions for these habitats based on knowledge of species life history and habitat requirements;
(3) develop biological objectives that can be used as management targets or goals to achieve desired population levels.;
(4) recommend conservation actions that can be implemented by various entities at multiple scales to achieve biological objectives.

Throughout the planning process and during the implementation phase, this strategy emphasizes partnerships and actions over large geographic scales. Information and recommendations in the plans are based on sound science and consensus among interested groups and knowledgeable individuals. Specific methods used to complete this process are described within the plan or in its appendices. Additional details on PIF history, structure, and methodology can be found in Finch and Stangel (1993) and Bonney et al. (1999).

C. Implementation

This landbird conservation strategy is one of many recent efforts to address conservation of natural resources and ecosystems in the Northeast. It is intended to supplement and support other planning and conservation processes (e.g. The Nature Conservancy Ecoregion Plans, USFWS Ecosystem Plans, Atlantic Coast Joint Venture, Important

Bird Areas initiatives) by describing a conservation strategy for nongame landbirds that are often not addressed or only incidentally addressed in other plans.

PIF strategies for landbird conservation are one of several existing and developing planning efforts for bird conservation. PIF Bird Conservation Plans are intended to complement other initiatives such as the North American Waterfowl Management Plan, United States Shorebird Conservation Plan, and North American Colonial Waterbird Plan. Ongoing efforts to integrate with these initiatives during objective setting and implementation will help ensure that healthy populations of native bird species continue to exist, and that all of our native ecosystems have complete and functional avifaunal communities. In particular, the emerging North American Bird Conservation Initiative (NABCI) will provide a geographical and political framework for achieving these ambitious goals across Canada, Mexico, and The United States.

SECTION 1: THE PLANNING UNIT

A. Physical Features

Northern New England constitutes one of the smallest physiographic areas in North America, with a total area under consideration of roughly 50,903 square kilometers. Landforms within the planning unit include Vermont's Killington Peak at 1,290 m ranging down to sea level along the Maine coast. The highest peak in Massachusetts, Mount Greylock at 1,063 m, occurs here, as does New Hampshire's largest lake, Winnipesaukee. Notably, most of the mountainous terrain lies in the southern Vermont portion of the unit. Most of the region consists of Rolling hills and small mountains with large areas of farmland of the Connecticut, Merrimac, Androscoggin, and Kennebec River valleys. The planning unit also contains a large portion of the Green Mountain National Forest in southern Vermont. Roughly **xxxx** ha of wetlands have been identified in the region.

Within the planning unit are 10 Ecological Units (Keys et al. 1995), all within the New England - Adirondack Province (Appendix 1). A few additional Ecological Units are shared with adjacent physiographic areas 28 (Eastern Spruce-hardwood Forest) and 9 (Southern New England). Average annual precipitation ranges from roughly 99 cm in central Maine to 122 cm in southern Vermont and western Massachusetts. Growing season averages about 135 days throughout the physiographic area (climate data from Keys et. al. 1995).

B. Potential Vegetation:

A majority of the planning unit is dominated by either sugar maple-beech-birch forest (TNC Alliance I.B.2.a.i), red spruce-balsam fir forest (I.A.8.c.2), mesic hardwood forests dominated by northern red oak, or drier forests dominated by oak-hickory or pine-oak associations (Appendix 1). The maple-beech-birch (northern hardwood) forests are associated with lower elevations and well-drained soils, whereas the spruce-fir forests dominate at higher elevations, on shallow, acidic soils, and in the northernmost portions of the planning unit. Presettlement forests in much of the region consisted largely of white pine and hemlock, with hardwood forests dominating after timber removal and other disturbance.

Nonforest alliances include coastal saltmarsh and other wetland and shrub-dominated communities. In addition, several distinct and very important alpine communities occur on mountain peaks, including rocky summit spruce woodlands (II.A.2.b.i.), black spruce-dominated boreal heathland (III.A.3.b.i.), and subalpine heath/ krummholtz (IV.A.2.i.).

C. Natural disturbances:

Natural disturbance patterns common in other parts of the country are relatively infrequent or lack the ecological significance found elsewhere. Fire and insect outbreaks are common forms of disturbance in some forest ecosystems. In Northern New England, however, these factors are less important than weather events such as hurricanes, tornadoes, and ice storms.

Hurricanes and significant coastal windstorms are important at the stand level. Catastrophic events, like the hurricane of 1938, which effected the Massachusetts, Vermont and New Hampshire portions of the planning unit, occur rarely. Similarly, large tornadoes are uncommon. More frequent, however, are the small tornadoes and microbursts throughout Area 27. The ice storm of 1998 mostly affected the Maine portion of the unit, with lesser damage in southern New Hampshire and southern Vermont. The frequency of this type of event is unknown;

however, ice storms of lesser severity are common throughout the planning unit. Together these three factors probably have the greatest influence on natural communities in Northern New England.

D. History and land use:

It is well recognized that coastal New England was settled earlier than the interior. The mid-18th century was when many of the small towns in the central portion of the planning unit were settled. Much clearing of the forest for agriculture had taken place by 1800 and farms were abandoned because of competition with more productive midwestern farms late in the 19th century peaking in the early 1900's (Litvaitis 1993). In New Hampshire, overall, only 47% was forested in 1880, but 100 years later, area in forests had increased by 40%. Similar changes took place in Vermont and in the southern and central portion of Maine (Litvaitis 1993).

Today, agriculture remains an important land use, but forest harvesting too shapes the habitats throughout Northern New England. Human populations have grown tremendously in this area and development for single family housing especially in rural and suburban areas is especially important.

SECTION 2: PRIORITY BIRD SPECIES

A. General avifauna

Roughly 179 bird species (Appendix 2) have been documented as breeding within Physiographic Area 27 (Peterson 1985, various atlases). Of the nongame landbirds (137 species), the majority are migratory; these include 80 Neotropical migratory species. The landbird avifauna is typical of northern or boreal portions of North America, but includes some species of more southern affinity that are at the northern limits of their range. An analysis of all Neotropical migratory species in the Northeast U.S. (Rosenberg and Wells 1995) found the composition of breeding species in this area to be distinct from the Eastern Spruce Hardwood Forest area just to the north and most similar to Allegheny Plateau and St. Lawrence Plain physiographic areas. From a global perspective, this area ranked as a high priority for long-term bird conservation, based on high concentrations of Bicknell's Thrush and other regionally important forest species (Rosenberg and Wells 1995, 1999).

Because of the small size of this physiographic area, no species had >5% of its global population breeding within the planning unit. For 13 species, however, 2% of the total population is estimated to occur, indicating disproportionately large populations breeding in this small area (Appendix 2). Aside from supporting an unknown but large proportion of Bicknell's Thrush, this region is important for several species characteristic of northern hardwood forests, such as Black-throated Blue Warbler, Scarlet Tanager, and Wood Thrush. This area also supports the highest BBS relative abundance of any physiographic area for 5 species: Veery, Eastern Phoebe, Chestnut-sided Warbler, Black-and-white Warbler, and Black-capped Chickadee.

Our primary measure of population trend at present is the Breeding Bird Survey (BBS), which provides data on roughly 108 of the 179 species breeding within Area-27 (N = 50 routes). For many species in this region, however, especially those of high-elevation or other patchily distributed habitats, BBS coverage is poor, and reported trends often lack statistical significance. Nevertheless, a significant declining trend for a species on existing BBS routes may be reason enough to examine the population trend more closely, and to initiate measures to halt or reverse this trend.

Of the species sampled by BBS, 27 have declined significantly ($P < 0.10$) since 1966, and 9 additional species have declined since1980 (Appendix 2). Of the 35 declining species, 21 are associated with grassland and other early successional habitats, including urban areas. Species nesting in shrub-scrub habitats (e.g. Brown Thrasher, Eastern Towhee, Field Sparrow) are among the most steeply declining birds in this physiographic area. Of the declining species that are associated with forested habitats, many use either forest edges or openings (e.g. Eastern Wood Pewee, Yellow-shafted Flicker, Baltimore Oriole) or regenerating forests (e.g. Chestnut-sided Warbler, Nashville Warbler, Purple Finch, White-throated Sparrow). Among the few mature-forest species on this list, the steep decline shown by Blackburnian Warbler is in contrast to this species' trend in other parts of the Northeast. Broad-winged Hawk, Yellow-billed and Black-billed cuckoos, and Magnolia Warbler show steep declines since 1980.

In contrast, 41 species exhibit significantly increasing population trends; 6 of these only show significant trends since 1980 (Appendix 2). A majority of these are species that have adapted particularly well to human activities or development, including those using bird feeders or nest boxes, as well as those that breed in urban wetlands or

conifer plantations (e.g. Pine Warbler, Hermit Thrush). Several species, such as House Finch, Tufted Titmouse, and Northern Cardinal have experienced widespread population increases throughout the Northeast. About as many mature forest species are increasing in this region as are declining, including several regionally important species such as Black-throated Blue Warbler, Northern Parula, Ovenbird, and Yellow-bellied Sapsucker.

B. Priority species pool

From among the breeding avifauna, a pool of species may be derived that represents priorities for conservation action within the physiographic area (Table 2.1). Note that a species may be considered a priority for several reasons, including global threats to the species, high concern for regional or local populations, or responsibility for conserving large or important populations of the species. The different reasons for priority status are represented by levels or tiers in Table 2.1. The primary tool for creation of this pool is the PIF prioritization process (Carter et al. 2000). This system ranks species according to seven measures of conservation vulnerability. These include four global measures (i.e., they do not change from area to area), as well as threats to breeding populations (TB), area importance (AI), and population trend (PT), which are specific to each physiographic area. Categories of priority status are determined by examining combinations of parameter scores, as well as the total rank score, which is a measure of overall conservation priority. This process of identifying priority species has been standardized across all physiographic areas of North America. Scores for all breeding species in the Northern New England region are found in Appendix 2.

There are five entry levels into the priority species pool, as follows:

Tier I. *High Continental Priority*. -- Species that are typically of conservation concern throughout their range. These are species showing high vulnerability in a number of factors, expressed as any combination of high parameter scores leading to an average score > 3 (the midpoint); total of 7 parameter scores will be = 22, with AI = 2 (so that species without manageable populations in the region are omitted.

> Tier IA. *High Continental Priority - High Regional Responsibility*. Species for which this region shares in major conservation responsibility; i.e., conservation in this region is critical to the overall health of this species. Species with AI of 4 or 5 or a high percent population (above threshold in IIC).
>
> Tier IB. *High Continental Priority - Low Regional Responsibility*. Species for which this region can contribute to rangewide conservation objectives where the species occurs. Species with AI of 2 or 3.

Tier II. *High Regional Priority*. Species that are of moderate continental priority, but are important to consider for conservation within a region because of various combinations of high parameter scores, as defined below; total of 7 parameter scores = 19-21.

> Tier IIA. *High Regional Concern*. Species that are experiencing declines in the core of their range and that require short-term conservation action to reverse or stabilize trends. These are species with a combination of high area importance and declining (or unknown) population trend; total of 7 parameters = 19-21, with AI + PT = 8.
>
> Tier IIB. *High Regional Responsibility*. Species for which this region shares in the responsibility for long-term conservation, even if they are not currently declining or threatened. These are species of moderate continental priority with a disproportionately high percentage of their total population in the region; total of 7 parameters = 19-21, with % population > threshold (see Appendix 3).
>
> Tier IIC. *High Regional Threats*. Species of moderate continental priority that are uncommon in a region and whose remaining populations are threatened, usually because of extreme threats to sensitive habitats. These are species with high breeding threats scores within the region (or in combination with high nonbreeding threats outside the region); total of 7 parameters = 19-21 with TB + TN > 6, or local TB or TN = 5.

Tier III. *Additional Watch List*. These species are on the US national Watch List not included in the above tiers. These species score highly enough based on global criteria to warrant conservation attention wherever they occur with an AI of 2 or more.

Tier IV. *Additional Federally Listed*. Spepcies listed under the U.S. Endangered Species Act receive conservation attention wherever they occur.

Tier V. *Additional State Listed*. - Species on state endangered, threatened, or special concern lists that did not meet any of above criteria. These are often rare or peripheral populations.

Table 2.1. Priority species pool for Area 27. Percent of population calculated from percent of range area, weighted by BBS relative abundance (see Rosenberg and Wells 1999). PIF regional and global scores from CBO (Carter et al. 2000 -- all scores updated 10/2000).

Entry level	Species	Total score	% of pop.	AI	PT	Local status
I						
A.	Bicknell's Thrush	28	??	4	4	B
	Canada Warbler	23	1.4	5	2	B
	Chestnut-sided Warbler	23	3.6	5	4	B
	Black-throated Blue Warbler	23	3.6	4	2	B
	Wood Thrush	23	3.1	4	4	B
	American Woodcock	22	1.3	4	5	B
	Blackburnian Warbler	22	1.2	3	5	B
B.	Golden-winged Warbler	27	< 1	2	5	B
	Piping Plover (F-T)	26	< 1	2	3	B
	Saltmarsh Sharp-tail. Sparrow (SC-ME)	26	< 1	2	3	B
	Nelson's Sharp-tailed Sparrow	25	??	2	3	B
	Upland Sandpiper (E-VT, MA; T-VT, ME)	23	< 1	2	5	B
	Bay-breasted Warbler	23	< 1	2	3	B
II						
A.	Scarlet Tanager	21	3.2	4	4	B
	Rose-breasted Grosbeak	20	1.9	5	3	B
	Least Flycatcher	20	1.0	4	5	B
	Eastern Wood-pewee	19	1.2	4	4	B
	Purple Finch	19	1.4	4	5	R
	Gray Catbird	19	2.7	4	4	B
B.	Veery	19	3.9	5	2	B
	Ovenbird	19	2.5	5	2	B
C.	Whip-poor-will	21	< 1	2	3	B
	Sedge Wren (E-ME)	21	< 1	2	3	B
	Black-backed Woodpecker	20	< 1	2	3	R
	Chimney Swift	20	< 1	3	4	B
	Bobolink	19	1.8	4	2	B
III						
	Blue-winged Warbler	21	< 1	2	3	B
	American Black Duck	20	1.9	4	1	R
	Prairie Warbler	20	< 1	2	3	B
	Red-headed Woodpecker	19	< 1	2	3	B
V						
	Blackpoll Warbler (SC-MA)	19	< 1	2	3	B
	Grasshopper Sparrow (E-ME,CT; T-MA)	19	< 1	1	5	B
	Northern Goshawk (SC-ME)	19	< 1	3	3	R
	Mourning Warbler (SC-MA)	19	< 1	2	3	B
	Roseate Tern (E-ME)	19	< 1	1	3	B
	Common Loon (E-VT, T- NH, SC-MA)	18	< 1	3	2	B
	Bald Eagle (T-ME)	18	< 1	2	3	B
	Least Bittern (SC-ME)	18	< 1	2	3	B
	Eastern Screech-Owl (SC-ME)	18	< 1	2	3	R
	Eastern Meadowlark (SC-ME)	18	< 1	2	5	B
	Olive-sided Flycatcher (SC-ME)	17	< 1	2	4	B
	Sharp-shinned Hawk (SC-MA)	17	1.0	5	2	R

Entry level	Species	Total score	% of pop.	AI	PT	Local status
	Northern Harrier (T-NH,MA)	17	< 1	2	3	B
	Black Tern (E-ME)	17	< 1	2	3	B
	Orchard Oriole (SC-ME)	16	< 1	1	3	B
	Arctic Tern (T-ME)	16	< 1	2	3	B
	Cooper's Hawk (T-NH, SC-MA, ME)	15	< 1	2	3	R
	Vesper Sparrow (E-CT, T-MA, SC-ME)	15	< 1	2	3	B
	Osprey (E-VT; T-NH)	15	< 1	2	3	B
	Common Tern (SC-ME)	15	< 1	2	3	B
	N. Saw-whet Owl (SC-CT)	15	< 1	2?	3	R
	Common Nighthawk (T-NH)	14	< 1	2	3	B
	Least Tern (E-ME)	14	< 1	1	3	B
	Common Moorhen (SC-ME)	14	< 1	2	3	B
	Pied-billed Grebe (E-NH,MA)	14	< 1	2	3	B
	American Coot (SC-ME)	12	< 1	1	3	B

Thirteen species scored at least 22 in the PIF prioritization system and are considered to be high continental or global priority (Table 2.1). A small but significant proportion of the world's Bicknell's Thrushes breed on mountaintops in this physiographic area, making this species perhaps the highest priority for conservation planning. The coastal populations of Nelson's Sharp-tailed and Saltmarsh Sharp-tailed Sparrows overlap here at limit of both species' range -- conservation efforts for these high-priority species should be combined with those in physiographic area 28 to the north and Area 9 to the south.

Of the remaining species, Wood Thrush, Chestnut-sided Warbler, Blackburnian Warbler, and American Woodcock show a combination of high regional importance and significantly declining population trend, whereas Canada and Black-throated Blue warblers are regionally important species that show stable long-term population trends at present. Piping Plover, Upland Sandpiper, and Bay-breasted Warbler are high priority species with very small regional populations. Golden-winged Warbler, although of high global priority, is extremely rare in Northern New England at present and may be considered too peripheral to be of high local priority.

Priority level II A. includes 6 additional species with a combination of relatively large and significantly declining populations in the physiographic area. These are primarily common birds of northern hardwood forest, but also include several species of mid-successional habitats (e.g., Gray Catbird, Least Flycatcher). Ovenbird and Veery are included in level II B., on the basis of their disproportionately high, though stable, populations in the physiographic area. Five additional species are included in II C.because of high threats scores; these species highlight the need to conserve remaining grassland habitats, as well as large-diameter trees and snags for cavity-nesters.

Four additional Watch List species are represented in the priority species pool, but did not meet any of the above criteria; all but the American Black Duck are quite rare in this region.

A long list of 26 additional species that are listed in various states as endangered, threatened or special concern have at least small breeding populations in Northern New England. As elsewhere in the Northeast, state-listed species are dominated by raptors, wetland, and grassland birds, many of which can be considered rare or peripheral in the region and otherwise score relatively low in the PIF prioritization process. Conservation attention for these species, however, will often benefit other high priority specie in the same habitats.

The overall priority pool of 56 species (31% of the breeding avifauna) is dominated by common forest-breeding species, many of which are declining in Northern New England. Considering all priority categories, the species of highest conservation concern include Bicknell's Thrush, the "Sharp-tailed" Sparrows and other coastal wetland species, and a suite of northern-hardwood forest breeders. These may represent focal species that help define conservation actions in their respective habitats (see Section 4). The rather large group of state-listed species may represent local priorities that often highlight the need to conserve uncommon and fragile habitats within the forested landscape.

SECTION 3: BIRD CONSERVATION ISSUES AND OPPORTUNITIES

A. Early vs. late-successional habitats and species -- historical baselines

Because most of the Northeast region has undergone major changes in forest cover during the past two centuries, the relative importance placed on early- versus late-successional species and their habitats today depends in large part on the historical baseline chosen for comparison. This issue, which permeates bird-conservation planning throughout the Northeast, must be resolved before priority species and habitats are determined. As elsewhere in the region, species with relatively large proportions of their total population in the planning unit (or those with high AI scores) are mostly associated with mature forest habitats. In contrast, early successional species are less represented here than in other regions, and the vast majority of these show declining population trends.

To some extent, deciding on the "value" of early-successional bird populations is subjective; for example, the fact that two species with significant declining trends in the region are Brown-headed Cowbird and European Starling is hardly reason for concern. Other species such as Chestnut-sided Warbler, however, rank high in regional importance and have undoubtedly benefited from forest regeneration following harvesting.

[contrast with regions to the north and south]

This plan recognizes the overriding importance of mature-forest species in long-term conservation planning, but calls for a balance of maintaining naturally disturbed habitats as well as some early successional stages within the managed forest landscape. In addition, areas that are currently in agricultural production could be managed to benefit high-priority grassland species, thus maintaining the overall diversity of the avifauna.

B. Regional economics of commercial timber production

Clearly, any successful landbird conservation plan in this region must reconcile the needs of long-term, sustainable timber production and the habitat needs of high-priority bird species. Loss of the economic sustainability of commercial forestry could result in conversion of forest habitats to urban development or other less bird-friendly landscapes. In general, over a century of timber harvesting in this region has not resulted in the significant loss of species or populations of forest birds. Avifaunal changes have mostly been in the form of changes in local composition and relative abundances, as the mix of successional stages and conifer vs. hardwood forest types shifted across the landscape.

The primary goal of this bird conservation plan is to ensure the long-term maintenance of all important forest types in the future landscape mosaic. This must be achieved through careful forest-planning on both private and public lands, with the goals of economic gains and sustainability balanced with the needs of birds and other wildlife. This balance will likely differ in areas of different land ownersip. By taking a landscape perspective, we can take advantage of the opportunities in each area, such that the cumulative result will be to maintain healthy bird populations into the future.

C. Urban and recreational development on private land

xxxx

D. Changing age structure and species composition of the forest

Much research has been directed at the effects of forestry practices on bird populations and several authors have pointed out the importance of landscape scale considerations in interpreting the effects of logging on songbirds (Thompson and Capen 1988, Derleth et al. 1989, Hagan and Grove 1995, Hagan et al. 1997). Early successional forests that result from timber harvesting have species assemblages different from those of mature forests (Webb et al. 1977, Morgan and Freedman 1986, Thompson and Capen 1988, Hagan et al. 1997). As these regenerating stands mature, avian communities also change (Morgan and Freedman 1986, Thompson and Capen 1988). Forest structure including development of dense understory, canopy closure, and increasing basal area are widely referenced as important determinants of change in bird species assemblages (Morgan and Freedman 1986, Thompson and Capen 1988, Hagan et al. 1997). Inclusions of structurally different forest types, as may result from changing edaphic conditions or topographic position, also can greatly influence the presence and overall richness of birds in a forest (DeGraaf et al. 1993). Changes in harvesting strategies, too greatly determines compositon and structure of the

resulting forest and consequently the avian community at the stand scale. However, these factors may be less important than the actual array of harvest strategies on the landscape (Hagan and Grove 1995).

E. Forest health

A variety of defoliators affect the health of forests in this physiographic region. Many are exotic pests such as Gypsy Moth (*Lymantria dispar*) that have been present for relatively short periods of time. Others, like Spruce Budworm are part of the original invertebrate fauna of the region, but are no less catastrophic in their effect on the forest ecosystem. The most recent epidemic of Spruce Budworm largely effected the Eastern Spruce-Hardwood Forest (Area 28) and not the Northern New England Physiographic Region; however, localized mortality to balsam fir and spruce did occur. Unlike Spruce Budworm larvae, which are widely consumed by birds, Gypsy Moth caterpillars are not. The most recent outbreak in the region peaked in the early 1990's and over 620,000 acres were defoliated in southern Maine alone. This pest is well established in the region and will likely affect oak forests for decades to come. The complex of organisms attacking American beech, collectively referred to as beech bark disease is widespread in the eastern portion of the region. Southern and western Maine, as well as southern New Hampshire, are much less affected. The Beech Bark Disease complex deforms and kills trees; however, some disease resistant individuals appear in some stands. The region remains fortunate in that Asian long-horned beetle (*Anoplophora glabripennis*; a wood-boring pest of deciduous trees especially maples), Asian Gypsy Moth, and Hemlock Wooly Adelgid (*Adelges tsugae*) have not yet established themselves. Quarantine and close inspection of nursery stock and at log yards (i.e., that import Hemlock logs) are needed to prevent the spread of the Hemlock Wooly Adelgid.

A number of abiotic factors too, may influence the health of the regions forests. Atmospheric deposition ("acid rain") has been a problem for decades and will likely continue to be. Accumulation of toxins such as mercury present threats to many bird species especially those inhabiting aquatic habitats. Global climate change with the largest effect region-wide could greatly alter the distribution of many tree species. Furthermore, insects and diseases currently incapable of overwintering successfully, might expand into the region if minimum winter temperatures rise.

F. Bird conservation opportunities and solutions

Several factors contribute to an optimistic assessment of future bird conservation in this region: (1) most priority bird species are still abundant and widespread, exemplifying the PIF objective of "keeping common birds common;" (2) commercial forestry and recreation are important components of the regional economy, so it is unlikely that habitats for forest birds will be severely threatened in the near future; (3) a skilled network of volunteers exists that has been, and likely will continue to be, critical in monitoring and outreach efforts.

Identification of *Important Bird Areas* in the planning unit has not reached the level of implementation achieved in other portions of the Northeast. Some effort has been made in Maine and it is likely that IBAs will be identified in the near future. Specific areas will be referred to in greater detail under appropriate habitat sections, below.

SECTION 4: PRIORITY HABITATS AND SUITES OF SPECIES

When species in the priority pool (Table 2.1) are sorted by habitat, the highest priority habitats and associated species can be identified (Table 4.1). These represent the habitats that are either in need of critical conservation attention or are critical for long-term planning to conserve regionally important bird populations. The highest priority species do not form a cohesive habitat group, but rather separate among seven different forest, early successional, and wetland habitats. The species of greatest concern, however, is Bicknell's Thrush, and by association, the stunted conifer habitats of mountaintops rank first in regional priority. Other habitats may be loosely ranked according to the highest-scoring species in the habitat suites. Within each habitat-species suite, certain species that represent particular limiting requirements (e.g., area sensitivity, snags) are considered focal species for setting population-habitat objectives and determining conservation actions (sensu Lambeck 1997).

Table 4.1. Priority habitat-species suites for Area 27. TB (threats breeding), AI (area importance), PT (population trend), and total PIF scores from CBO prioritization database (Carter et al., in press). Focal species for each habitat in boldface.

Habitat	Species	Total score	TB	AI	PT	Action level [a]
Mountaintop -- conifer woodland						
	Bicknell's Thrush	28	3	4	4	II
	Blackpoll Warbler	19	3	2	3	IV
Coastal saltmarsh, dune and estuary						
	Saltmarsh Sharp-t. Sparrow	26	3	2	3	II
	Nelson's Sharp-t. Sparrow	25	3	2	3	II
	Piping Plover	26	4	2	3	II
	American Black Duck	20	3	4	1	II
	Roseate Tern	19	3	1	3	II
	Northern Harrier	17	4	2	3	IV
	Arctic Tern	16	3	2	3	IV
	Common Tern	15	3	2	3	IV
	Osprey	15	3	2	3	IV
	Least Tern	14	3	1	3	IV
Northern hardwood-mixed forest						
	Wood Thrush	23	2	4	4	III
	Black-throated Blue Warbler	23	2	4	2	IV
	Canada Warbler	22	2	5	2	IV
	Blackburnian Warbler	22	3	3	5	III
	Scarlet Tanager	21	2	4	4	III
	Rose-breasted Grosbeak	20	2	5	3	IV
	Chimney Swift	20	3	3	4	III
	Least Flycatcher	20	2	4	5	III
	Eastern Wood-Pewee	19	2	4	5	III
	Veery	19	2	5	2	IV
	Purple Finch	19	2	4	5	III
	Northern Goshawk	19	3	3	3	IV
	Ovenbird	19	2	5	2	IV
	Eastern Screech-Owl	18	3	2	3	IV
	Sharp-shinned Hawk	17	2	5	3	IV
	Cooper's Hawk	15	2	3	3	IV
Early successional forest/edge						
	Golden-winged Warbler	27	4	2	5	II
	Chestnut-sided Warbler	23	2	5	4	III
	American Woodcock	22	3	4	5	III
	Whip-poor-will	21	3	2	3	III
	Blue-winged Warbler	21	2	2	3	V
	Prairie Warbler	20	2	2	3	V
	Red-headed Woodpecker	19	3	2	3	IV
	Mourning Warbler	19	2	2	3	V
	Gray Catbird	19	2	4	5	III
	Mourning Warbler	18	2	2	3	VI
	Olive-sided Flycatcher	17	3	2	4	III

Orchard Oriole	16	2	1	3	V
Common Nighthawk	13	3	1	3	V
Mature conifer (spruce-fir) forest					
Blackburnian Warbler	22	3	3	5	III
Bay-breasted Warbler	23	3	2	3	IV
Black-backed Woodpecker	20	3	2	3	IV
Blackpoll Warbler	19	3	2	3	IV
Sharp-shinned Hawk	17	2	5	3	IV
Olive-sided Flycatcher	17	3	2	4	III
N. Saw-whet Owl	14	2	2	3	IV
Grassland/agricultural					
Upland Sandpiper	23	4	2	5	III
Sedge Wren	21	4	2	3	IV
Bobolink	19	3	4	2	IV
Grasshopper Sparrow	19	4	1	5	III
Eastern Meadowlark	18	4	2	5	III
Northern Harrier	17	4	2	3	IV
Vesper Sparrow	15	4	1	4	III
Freshwater wetland -- river/lake					
American Black Duck	20	3	4	1	IV
Common Loon	18	3	3	2	IV
Bald Eagle	18	3	2	3	IV
Least Bittern	18	3	2	3	V
Black Tern	17	3	2	3	IV
Osprey	15	2	2	3	IV
Pied-billed Grebe	14	3	2	3	V
Common Moorhen	14	3	2	3	V
American Coot	12	3	1	3	V

[a] Action levels: I = crisis; recovery needed; II = immediate management or policy needed rangewide; III = management to reverse or stabilize populations; IV = long-term planning to ensure stable populations; V = monitor population changes only.

A. Mountaintop-stunted conifer woodland

Importance and conservation status: The recognition of Bicknell's Thrush as a separate species (Ouellet 1993, AOU 1995) has elevated the importance of its primary habitat, high-elevation conifers, to a top regional conservation priority (Rosenberg and Wells 1995). This habitat type occurs naturally at high elevations (>900m; slightly lower at higher latitudes), occurring on **xxx** peaks in the Northern New England physiographic area. Its distribution is therefore naturally fragmented at the landscape level, with most patches estimated to be <1000 ha in extent (Atwood et al. 1996). Mountaintop habitats in this planning unit should be considered an extension of those to the north in the Eastern Spruce-Hardwood Forest (area 28).

Current threats to the habitat fall into three categories: (1) global climate change; (2) atmospheric pollution (including acid precipitation); and (3) recreational and other development. The first factor, a global warming trend resulting in the shrinkage or retraction of cool-temperate forests regionwide, has been postulated to influence bird distribution and abundance (Erskine 1992, Atwood et al**.** 1996). Indeed, recent models for change in CO_2 indicate that high elevation conifer habitat will eventually disappear from the region (http://www.fs.fed.us/ne/delaware/atlas/ for fir). Although such an effect cannot be controlled by bird-conservation efforts alone, we must make every effort to influence the larger factors that ultimately may determine the fate of this entire habitat-species suite. Atmospheric pollution in the form of acid rain has been shown to adversely influence the health of balsam fir and spruce-dominated communities in New York and New England, resulting in heavy mortality in some areas (Miller-

Weeks and Smoronk 1993). Although studies of the effects of acid rain on bird communities in these areas have just begun, a likely factor is the reduction of available calcium in the soil, ultimately reducing egg production and egg-shell thickness in nesting birds (ref). Recreational development, primarily for expansion of ski resorts is everpresent. Direct elimination of vegetation for building construction is the primary threat, although fragmentation of habitats for the creation of ski slopes may also have impacts on the bird community.

Associated priority species: BICKNELL'S THRUSH, Blackpoll Warbler. Bicknell's Thrush appears to be the only species that is restricted to this habitat nearly throughout its range.

The other species associated with Bicknell's Thrush tend to be species of open coniferous and disturbed forests in the more northern portions of their range, but are habitat specialists on the stunted mountaintop conifers in New England and New York at the southern edge of their range. Blackpoll Warbler is a priority species in this habitat further north in the Eastern Spruce-Hardwood physiographic area (significant declining trend), and it ranks lower in Northern New England primarily because it is not sampled on BBS routes (hence, low AI; PT = 3). It- remains a species of special concern in Massachusetts, where a single population that occurred on Mt. Greylock (Veit and Peterson 1993) was not reconfirmed by Atwood et al. (1996). Preferred habitat has been described as dense stands, dominated by stunted balsam fir, with varying amounts of red spruce, white birch, mountain ash, and other species (Wallace 1939, Atwood et al 1996).

Habitat and population objectives: Despite the small size of most available habitat patches, Bicknell's Thrush and other associated species occur in high densities. Recent estimates of Bicknell's Thrush densities on Mt. Mansfield in Vermont range from about 40 to 60 pairs per 40 ha of continuous habitat (Rimmer et al. 1996) , but these do not take into account more recent discoveries of highly skewed sex ratios (1.8 males:1 female) and very patchy distributions within suitable habitat. Using the most up-to-date GIS data available, K. McFarland (unpubl. data) estimates a maximum 53,000 breeding Bicknell's Thrush occurring within the U.S. portion of the range. The actual number may be closer to 15,000-30,000 individuals, with the number occuring within the Northern New England Physiographic area estimated at **xxxxxx**. Thrushes were present on mountaintop "islands" as small as 1.5 ha (Atwood et al 1996), and area of available habitat was not a significant predictor of occupancy (Rimmer et al 1996).

Population trends for species in this habitat are difficult to assess, because BBS routes do not sample such high-elevation sites. Using the density estimate and the esimate of total habitat available (see above), a minimum of xxxxx pairs of breeding Bicknell's Thrush may be present within Northern New England. This may be an overestimate, however, because densities at other sites were lower than those published for Mt. Mansfield (C. Rimmer, pers. com.). All currently occupied sites for this species in the planning unit are within the Green Mountains of Vermont, where the species was reported in 10 atlas blocks during the 1976-1981 Vermont Breeding Bird Atlas (Laughlin and Kibbe (1985). During more recent surveys, Atwood et al. (1996) found them on xxxx peaks in this portion of Vermont. Historically, Bicknell's Thrush has bred on Mts. Kearsage, Manadnock, and Sunapee in southern New Hampshire, but none were found during the New Hampshire atlas (Foss 1994) or during recent surveys (Atwood et al. 1996). The disappearance of this species from Mt. Greylock, in Massachusetts, is well documented (in Atwood et al. 1996). Data on differential reproductive success and source-sink dynamics of Bicknell's Thrush populations in relation to habitat-patch size or quality are much needed and will be difficult to obtain.

> OBJECTIVE 1: In order to maintain a regional population of xxx breeding individuals, ensure the protection of 100% of sites that support populations of Bicknell's Thrush "large enough to be considered source populations for other sites," and as many additional high-elevation habitat patches with smaller populations as possible.

Implementation strategy: A strategy for protecting high-elevation habitats and ensuring a stable population of Bicknell's Thrush and associated species in Northern New England needs to be part of a larger effort throughout the range of the species. Such an overall strategy should include the following elements (not necessarily sequential):

- identification and characterization (habitat size, quality, land ownership) of all potential habitat patches, using GIS (now complete for Vermont; K. McFarland unpubl. data);
- completion of on-the-ground inventories to determine numbers of breeding Bicknell's Thrushes at all sites
- identification and designation of most important sites, through state Important Bird Area program
- identification of specific threats to particularly important sites
- incorporation of research on reproductive success of Bicknell's Thrush and other species into ongoing studies of forest health, in relation to pollution and development

- explicit and "official" recognition of Bicknell's Thrush and its associated habitat as a high conservation priority in public agency and private land-use planning efforts
- if future declines in habitat availabilty or Bicknell's Thrush populations warrant, legal mandates for implementation of habitat-protection objectives.

High elevation habitats are currently protected to some extent by existing laws in Vermont, New Hampshire, and Maine, but Bicknell's Thrush is listed as a species of Special Concern in only Maine and Massachusetts. Within the Northern New England planning unit however, this species is found only in Vermont and as such potential for strict protection of important habitat patches is highest on publicly owned lands within Green Mountain National forest **[any habitat on private lands?]**. An immediate priority is the determination of how much habitat (acreage and proportion of Bicknell's Thrush population) is already protected, as well as a review of agency policies potentially affecting these habitat patches.

Potential conflicts or threats at specific, important sites should be identified quickly and cooperative agreements sought. These threats may include ski-resort developments, clearing of habitat for erecting communications towers and wind power generators, inclusion in commercial timber sales, or agency policies that neglect or inadvertently threaten mountaintop sites. Furthermore, long-term protection of this habitat type and its associated bird species may depend on a multilateral, international effort to halt or reverse the effects of acid precipitation in the Northeast.

***Management recommendations**:* xxxxx

***Research and monitoring needs**:* Several ongoing research efforts are now focusing on mountaintop bird communities and the breeding biology of Bicknell's Thrush. These and additional studies should be supported at the highest level of conservation priority. Specific research and monitoring needs that are most relevant to implementation of this conservation plan include the following:

- application of GIS and GAP analyses to determine distribution and conservation status of all habitat patches.
- continued censuses of Bicknell's Thrush and other species at all sites
- studies of Bicknell's Thrush demography, to be applied to source-sink dynamics modeling and metapopulation analysis throughout this region
- studies of calcium availability in relation to acid precipitation and avian reproductive success at high elevation sites
- determination of potential limiting factors affecting Bicknell's Thrush on its nonbreeding grounds, in winter and at migration-stopover sites
- development of efficient monitoring protocols for evaluating Bicknell's Thrush population trends

Recommended protocols for surveying breeding Bicknell's Thrushes are now available (Rimmer et al. 1996). A potential technique for monitoring this species along its migration routes may employ the recording of distinct nocturnal flight calls (Evans 1993). Studies of Bicknell's Thrush on its wintering grounds and development of a conservation plan for this species in the Dominican Republic are also ongoing (C. Rimmer, pers. comm.).

***Outreach**:* Increased public awareness of the uniqueness and vulnerability of mountaintop coniferous woodland will be necessary for full implementation of the conservation plan. This can be achieved through PIF state working group, as well as programs by NGOs such as National Audubon Society's Important Bird Areas Program. Awareness, even among professional conservationists, remains low and should be raised via improved interagency communications at both state and federal levels. Effective state PIF working groups should include professionals from agencies whose mandate covers high elevation habitats. Local outing clubs as well as larger organizations such as the Appalachian Mountain Club are potential partners in high elevation habitat protection and outreach directly to their members could greatly benefit this group of species. Many avid hikers also may be proficient with bird identification and could be encouraged to participate in high elevation bird monitoring programs such as the Mountain Birdwatch program initiated by VINS in 2000.

B. Coastal saltmarsh, beach, and estuary

***Importance and conservation status**:* Although only a small portion of this physiographic area lies along the Maine coast (approximately 150 km), this coastline provides habitat for more priority bird species than any other single habitat unit in this physiographic area. Included are 2 of Maine's most significant estuaries, the Penobscot and Kennebec River systems. The Kennebec is relatively unique in the northeast in that where it meets the Androscoggin River, several miles inland it forms a large tidal freshwater bay. The coast in this area is busy with

tourists during the summer, fortunately, the largest beach and most of the significant saltmarsh habitat in this unit are in conservation ownership. A few small private beaches occur along the coastline of this planning unit and even these are a focal point of summer tourist activity. Five large saltmarshes in this planning unit are currently in conservation ownership. Significant restoration activity (ditch plugging and panne creation) has taken place at 1 marsh in 1997 and 1998; no other saltmarsh restoration projects work has taken place in this planning unit (Cornelison 1998), but projects are pending at additional sites.

Associated priority species: NELSON'S SHARP-TAILED SPARROW, SALTMARSH SHARP-TAILED SPARROW, PIPING PLOVER, AMERICAN BLACK DUCK, Arctic Tern, (Ipswich Sparrow), etc.

In this physiographic area, Saltmarsh Sharp-tailed Sparrows reach the northern limit of their range whereas Nelson's Sharp-tailed Sparrow occurs along the entire coastal portion of this physiographic area and into the Southern New England area (T. Hodgman, unpubl. data). Because Saltmarsh Sharp-tailed Sparrows are found almost entirely within the northeast region (AOU 1995), this species is one of the highest priority birds in the northeast. The Maritime race of Nelson's Sharp-tailed Sparrow also has significant populations along the Maine Coast and this species too is recognized as having high regional priority. Furthermore, the saltmarshes along portions of the Northern New England and Southern New England physiographic areas support both species and provide contact for potential interbreeding (Rising and Avise 1993, G. Shriver, upubl. data). A few Piping Plovers (federally Threatened, Maine Endangered) also nest in this area. From 1996-1998, about 32% (18 pairs) of Maine's population nested in this physiographic area and contributed nearly 22% of the fledglings statewide (Maine Audubon Society, unpubl. data). Although some habitat exists for population expansion in Area 27, human disturbance and predation limit populations in this region. American Black Ducks breed regularly in coastal marshes, but they are especially abundant in coastal habitats during winter. Midwinter inventory data, a federal index of wintering waterfowl, reports roughly 3,000 American Black Ducks among the sections surveyed each year from 1996-98 (MDIFW, unpublished data). Coastal wintering populations of American Black Ducks within the Northern New England area are smaller than those along coastal portions of the Eastern Spruce Hardwood area, yet greater than in the Southern New England area (P. Corr, MDIFW, pers. comm.).

Habitat and population objectives: Merrymeeting Bay, at the confluence of the Androscoggin and Kennebec Rivers, is a tidal freshwater system approximately 25 km from the mouth of the Kennebec River and is especially important for migrating waterfowl, shorebirds, and rails. Very little beach habitat occurs in the planning unit and is primarily restricted to the southern portion of the physiographic area. Of the beaches in Northern New England, many are composed of pebble or cobbles and not fine sand, which is more typical of beaches in Southern New England. This portion of the Northern New England coastline marks a transition in saltmarsh types too with fewer, smaller marshes with greater tidal fluctuation to the north and larger marshes formed in drowned river valleys often behind barrier dune habitat to the south. Much "fringing" marsh occurs in Northern New England given appropriate conditions, however, large expanses of saltmarsh are rare especially along the shoreline of Penobscot Bay.

Priority bird species using this habitat type are virtually unrepresented on BBS routes within the physiographic area, and therefore, population estimates and trends are not available. Local surveys, with the exception of those for Piping Plovers, Arctic and Common Terns, and breeding bird atlas work on the Maine coast permit VERY CRUDE estimates:

Table 4.2. Population estimates for priority species of coastal saltmarsh, beach, and estuary habitats in the Northern New England physiographic area. Number of atlas blocks reporting each species from Maine Breeding Bird Atlas.

Species	Population Estimate	% Atlas Blocks (ME)
Saltmarsh Sharp-tailed sparrow	100	0
Nelson’s Sharp-tailed Sparrow	350	12
Piping Plover	36	0
American Black Duck	2000	52
Roseate Tern	??	0
Northern Harrier	75	19
Osprey	1000	36
Arctic Tern	2105	2
Common Tern	3280	8
Least Tern	??	0

OBJECTIVE 1. Maintain stable breeding population of 100 breeding Saltmarsh Sharp-tailed Sparrows, distributed among no less than 3 sites on the Area 27 portion of the Maine coast.

OBJECTIVE 2. Maintain stable breeding population of 350 breeding Nelson's Sharp-tailed Sparrows, distributed among no less than 7 sites on the Area 27 portion of the Maine coast.

OBJECTIVE 3. Increase breeding population of Piping Plovers to 27 pairs at 4 sites on the Area 27 portion of the Maine coast. This assumes boundary between Area 27 and Area 9 is at Yarmouth, Maine on Casco Bay.

OBJECTIVE 4. Maintain stable wintering population of American Black Ducks as measured by an annual average of 3,000 individuals during the Midwinter Waterfowl Survey in Casco Bay (section 13A-13L), Muscongus Bay, and Penobscot Bay subsections of the Northern New England Coast.

OBJECTIVE 5. Increase numbers of American Black Duck broods to ____ in coastal wetland habitats of the Area 27 portion of the Maine coast.

Acreage estimates needed for species in this habitat suite have not yet been calculated.

***Implementation strategy**:* For both species of sharp-tailed sparrows, a combination of habitat protection and increased awareness (outreach) of the importance of these species in the region is needed. Piping Plover numbers are increasing slowly but there is little habitat for them in this region. Reducing predation and human disturbance and maintaining habitat quality in cooperation with USFWS, Maine Audubon Society, Maine Bureau of Parks and Lands, and TNC is essential. Habitat protection for Black Ducks is likely the most effective strategy at maintaining stable numbers of both wintering and breeding birds. Further reductions in the harvest, at least in Maine are unlikely. For all three species, increasing undeveloped buffers around coastal habitats should reduce disturbance and benefit priority species populations.

Management Recommendations: In a recent survey of sharp-tailed sparrows in coastal marshes of Area 27, 18 marshes were found to have populations of sharp-tailed sparrows (T. Hodgman, pers. comm.). Eleven sites were occupied by Saltmarsh Sharp-tailed Sparrows and 13 by Nelson's Sharp-tailed Sparrows. Five of these 18 sites are currently in conservation ownership. Point counts from 1998, indicated that the sites with the maximum number of singing males per point for both species was unprotected. This site (Dyer River, Town of Newcastle, Lincoln County, Maine) has been added to a list of acquisition priorities for the State of Maine's Department of Inland Fisheries and Wildlife, but other conservation entities such as Petit Manan National Wildlife Refuge or local land trusts also should consider acquisition or easement for this site. The importance of the five currently protected sites should not be diminished and buffers should be secured around these as well, especially the 2 sites at Reid State Park (Town of Georgetown, Sagadahoc County).

Some ditching is present at marshes in this region and the Weskeag River Marsh (Town of South Thomaston, Knox County) is currently under restoration (ditch plugging). Persons in charge of restoration activities need to be informed about the seasonal timing of nesting of both species and be aware of nesting areas as both species nests are often clumped in distribution. The influence of ditch plugging and panne creation/deepening on priority species in this habitat type is unknown.

Expansion of piping plovers along the Area 27 coastline is hampered by losses of both habitat quantity and quality. The most significant detriments to habitat quality include predation of nests and young and human disturbance in and around nest areas. A detailed Management System (i.e., recovery plan) has been prepared for this species for the entire coast of Maine (MDIFW 1994). Specific management strategies identified include:

- continuation of annual plover nesting census
- maintaining legal protection for nesting habitat and seeking protection for new areas as appropriate
- reclaiming habitat through vegetation management and discouraging dune stabilization activity at sites with either historical high potential for nesting
- continueing to track existing sites and to add new sites via Natural Heritage Database (MDIFW 1994).

Black Duck management in Maine and other northeast states has managed to stem the decline in the species but has not contributed to an overall increasing population. A variety of harvest reductions including reducing daily bag limits (1 bird per day in Maine), reducing season length and delaying opening for this species appear to have been

effective at stopping declines. Conservative harvest measures have been adopted throughout the 3 states in Area 27 but not necessarily in states or provinces in neighboring physiographic regions. The American Black Ducks present in Coastal habitats in winter may not have been produced in these same marshes, so wintering numbers of this species may have much to do with production and harvest outside Area 27.

***Research and monitoring: needs**:*

- Complete inventory for both species of Sharp-tailed Sparrow, with particular attention to the northern range limit for Saltmarsh Sharp-tailed Sparrow; at 5 year intervals, revisit marshes at the northern limit of Saltmarsh Sharp-tailed Sparrows to indicate range expansion or contraction; determine factors that influence habitat suitability and quality.

- Develop program (perhaps using volunteers) to monitor populations of sharp-tailed sparrows and other saltmarsh birds at key sites in Area 27.

- Identify threats to the most important sites for saltmarsh sparrows and develop ways to diminish these threats; examine nesting success in areas with extreme tidal ranges; examine effects of ditch plugging on nesting success; document the duration of the breeding season in both species; identify limiting factors other than or that interact with tidal flooding of nests.

- Support efforts to continue monitoring of piping plovers; develop, if possible, new methods for controlling predators on or near nesting areas and other methods for improving recruitment; identify potential nesting beaches in Area 27 and proactively monitor them for prospecting birds.

- Support efforts to monitor wintering American Black Ducks in coastal habitats in Area 27; expand coverage or develop (correction factors) to estimate total wintering population in area 27.

- Identify factors that affect habitat quality for breeding Black Ducks in coastal versus inland habitats; improve monitoring of Black Duck productivity in coastal habitats.

- Determine what proportion of birds wintering in Area 27 were fledged there and determine where (i.e., which Physiographic Area) remaining portion was fledged.

***Outreach**:* Increase awareness among the public and among conservationists of the importance of Sharp-tailed Sparrows among the northeast avifauna. Because people have difficulty getting excited about a species that is difficult to identify, encourage identification workshops at bird festivals, national wildlife refuges, and presentations to local Audubon chapters and birding clubs. These should target the intermediate birder and encourage both sight and sound identification. Whenever possible, emphasize the dependence of sharp-tailed sparrows on saltmarsh habitats for all aspects of their life history.

- Seek cooperative relationships with landowners and beach users to protect Piping Plover habitat.
- Develop detailed signs that depict the nesting ecology and Piping Plovers (and Least Terns) and the threats posed to them through predation and human activity; place signs at state parks and other public beaches.
- Continue to encourage hunters to learn to identify (and refrain from shooting) Black Ducks, through distribution of color posters at sporting goods stores, municipal offices, wildlife refuges, etc

C. Northern hardwood and mixed forests

***Importance and conservation status**:* Northern hardwood and mixed forests, usually dominated by sugar maple, beech, and birch, represent the most widely distributed habitat-type within the planning unit. As mature softwoods (especially white pine) were extensively harvested in the past century, hardwood forests have regenerated over most of the region during the past 80 years. Today, hardwood and mixed forest types dominate xxxxxxx?.

The importance of this habitat type in the planning unit is great, because of the number of associated bird species with high priority scores. In general, these species are relatively abundant throughout the region, but unlike in the larger Eastern Spruce-Hardwood Forest physiographic area, many of these species show decreasing population trends in Northern New England. Setting habitat and population objectives is therefore not as straightforward as in the mountaintop habitat types. Conservation planning should focus on extensive tracts of representative forest types,

and should address the microhabitat needs of species showing regional or local declines. A majority of high-priority species in this habitat are dependent on particular characteristics of the forest understory.

Associated priority species: WOOD THRUSH, BLACK-THROATED BLUE WARBLER, CANADA WARBLER, BLACKBURNIAN WARBLER, Veery, Scarlet Tanager, etc. The total suite of 16 priority species in this habitat represents a cross section of the entire diverse breeding bird community. All four featured species occur throughout Northern New England. Wood Thrushes have the broadest geographic range of the species listed, and it is the most abundant species in this habitat suite, based on extrapolations from BBS data (Table 4.3). Although many forest birds are in significant decline in this region, Canada and Black-throated Blue warblers have shown stable long-term trends. Indeed, Black-throated Blue Warblers have increased significantly (+3.1%, P = 0.03, n = 43) during 1980 to 1999, owing largely to a strong significant increase in Maine (Sauer et al. 1999), where nearly 19% of the global population occurs (Rosenberg and Wells 1999)

Most species in this habitat suite occupy mixed forests of various age classes and density. Blackburnian Warbler and Canada Warbler frequently occupy sites with heavier stocking of coniferous species (Morse 1994, Conway 1999), whereas Wood Thrush and Black-throated Blue Warbler are found in stands with heavier deciduous stocking (Hagan et al. 1997). Canada and Black-throated Blue Warblers appear to select stands with relatively dense understory vegetation (Holmes 1994, Conway 1999). This dense understory association with mature forest conditions is especially strong for Blackburnian Warblers (Hagan et al. 1997). Wood Thrushes are widely considered to be a forest interior species (Forman et al. 1976) and are especially vulnerable to forest fragmentation via nest parasitism (Roth et al. 1996), although these relationships have not been demonstrated in Northern New England.

Habitat and population objectives: Based on extrapolations from BBS relative abundances (assuming each route samples approximately 2.5 km^2 of forest habitat; appendix 3), VERY ROUGH estimates of population size for priority species in this habitat suite can be derived (Table 4.3).

Table 4.3. Population estimates for priority species of northern hardwood and mixed forest habitat in the Northern New England physiographic area. Percent of Atlas blocks based on number of 5-km blocks in which the species was reported (from Rosenberg and Wells 1995, appendix 4).

Species	BBS population	% Atlas blocks ME	VT	NH	MA
Wood Thrush	238,700	94	100	98	97
Black-throated Blue Warbler	40,000	73	82	74	84
Canada Warbler	18,800	82	63	71	62
Blackburnian Warbler	22,900	74	67	73	77
Veery	313,200	97	100	98	95
Scarlet Tanager	81,000	87	97	98	95
Eastern Wood-Pewee	81,800	87	98	96	89
Purple Finch	42,700	96	75	98	88
Least Flycatcher	120,000	87	93	91	82
Ovenbird	500,000	96	100	99	93
Rose-breasted Grosbeak	88,000	95	100	99	88
Northern Goshawk	??				
Eastern Screech-Owl	??				
Sharp-shinned Hawk	1,500				
Cooper's Hawk	600				

These crude estimates are most useful in illustrating the relative population sizes of various species and, perhaps, giving order-of-magnitude figures for setting population objectives for the region. Note that the relative abundances used to for these estimates are averages across all BBS routes in the physiographic area using data from 1990-1998. Most of these species are common and widespread, with fairly even distributions among the represented states. Because many of the highest priority species in this suite have declined over the past 30 years, a reasonable population objective would be to reverse these recent declines, returning populations to pre- or early BBS levels.

OBJECTIVE 1. Stabilize or reverse declining population trend for Wood Thrush; maintaining long-term population of 250,000 breeding pairs.

OBJECTIVE 2. Maintain stable population of (40,000+) Black-throated Blue Warblers (2 birds per BBS route) and 20,000 pairs of Canada Warblers (1-2 per BBS route) throughout the physiographic area.

OBJECTIVE 3. Maintain xxx pairs of Northern Goshawk, 1,500 pairs of Sharp-shinned Hawks and 600 pairs of Cooper's Hawks as stable regional populations.

Assumptions: (1) maintaining suitable habitat (including habitat structure and quality) for Wood Thrush, Canada and Black-throated Blue warblers will be sufficient to support sustainable populations of most other birds in this habitat suite; (2) maintaining adequate area for breeding accipiters will meet repuirements of other potentially area-sensitive species.

Based on published density estimates, roughly 800,000 ha (2 million ac) of northern hardwood forest is required to support the entire habitat-species suite (e.g. 250,000 pairs of Wood Thrush), with 100,000 ha (250,000 ac) suitable to maintain 40,000 pairs of Black-throated Blue Warblers and roughly 56,000 ha (140,000 ac) of mature mixed forest suitable to maintain 25,000 breeding pairs of Blackburnian Warblers.

Implementation strategy: Implementing the broad objectives for this habitat-species suite will require a comprehensive forest management plan for the entire New England region that acknowledges the long-term importance of maintaining large source populations of priority forest birds. Elements of such a plan that are most relevant to the high-priority birds include:

- maintaining a balance of forest-age classes, including adequate amounts of mid-successional as well as late-successional forest
- ensuring long-term tree-species composition; i.e. prevent loss of particular species from stands, such as eastern hemlock, white pine, or American beech, through disease or selective harvest.
- ensuring adequate structural diversity, especially regarding understory components (shrubs, treefalls); monitor effects of natural disturbances (e.g. wind storms) as well as deer browsing and forestry practices
- set maximum allowable levels of forest fragmentation due to forestry practices or planned development; e.g. do not allow any 10,000 km^2 landscape to fall below 70% forest cover
- identify and designate Bird Conservation Areas (BCA), within which long-term sustainability of priority bird populations is a primary management objective.

An as yet untested approach to the long-term conservation of forest birds is the establishment of Bird Conservation Areas (BCA) within the forested landscape that maximize the chances of sustaining source populations of priority species. Such an approach would essentially superimpose an island or patch model onto a seemingly continuous landscape. Identification of potential BCAs would take into account present-day local distributions of priority species, specific habitat relationships that optimize density or reproductive success, land ownership status, and prospects for long-term maintenance of desired habitat conditions. Land-management goals within BCAs would explicitly include sustainability of priority bird populations; i.e., these areas would sustain target populations for the phsyiographic area. Areas outside of designated BCAs might support similar habitats and bird populations, and might contribute substantially to the overall bird community, but they would not be *essential* to meeting specific population objectives for priority species. This basic approach is being developed and tested in patchily distributed grassland habitats in the Midwestern U.S. (refs).

A procedure for designating Bird Conservation Areas for forest birds in a region such as the Northern New England planning unit would involve the following steps:

- determine local optimum densities of priority species in suitable habitats.
- determine area required to support source population (e.g. 500 pairs) of priority species, assuming optimum habitat conditions.
- determine present distribution of priority species; e.g. using Breeding Bird Atlas or similar occurrence data.
- identify potential patches of suitable or optimal habitat, using GIS, that meet requirements of habitat type (e.g. forest type, elevation), minimum size, and known or suspected occupancy for each priority (focal) species.
- superimpose suitable habitat patches identified for multiple priority species to identify patches capable of supporting entire habitat-species suite.
- overlay land-ownership, conservation status, and other relevant features (e.g. using GAP analysis) to identify potential BCAs.
- work cooperatively with landowners, local conservation NGO's, state and federal agency personnel, municipal conservation commissions, land trusts, etc. to develop long-term habitat conservation plans for these areas.

This basic procedure is similar to that used for GAP Analysis, identification of focal areas within TNC's Ecoregions, and probably other conservation planning processes, but it has not been applied previously to PIF planning for forest birds. Note that if similar initiatives to identify conservation focus areas are ongoing within a physiographic area, then a modified approach could begin with already-identified areas (i.e., existing or target conservation lands), assessing their potential for supporting priority bird populations, and then following the above procedure to identify any additional areas that are needed to meet population objectives.

This strategy may work best in other physiographic areas such as the Eastern Spruce-Hardwood Area because of few large landowners, large tracts of conservation land (i.e., 1 - 3 townships), and a resource based infrastructure. In contrast, within Northern New England forests, the majority of land ownership is in small parcels, Conservation lands too are many, but generally in small tracts, and the degree of human development pressures are far greater. Despite these differences, the BCA model should be an effective strategy for conserving forest birds in this region if sufficient source populations can be identified and maintained.

If BCAs are being identified in more than one forest type, then these processes should be coordinated, or perhaps combined. For example, BCAs can be identified for species of both northern hardwood/mixed forests and mature conifer forests within the planning unit. If these forest types occur as distinct, large patches, then BCAs for each habitat-species suite could be distinct. If, however, forest types occur primarily as a mosaic over large landscapes (more likely), then particular BCAs might be selected that are large enough to meet the needs of species in both habitats.

Management guidelines*:* Most of the priority species in northern hardwood forest habitat have been shown to respond positively to various silvicultural practices, and only one species (Northern Goshawk) may require very large blocks of mature forest. In particular, Canada and Black-throated Blue Warbler populations were enhanced by modest timber harvesting in Maine (Hagan and Grove, 1995). Similarly, Webb et al. (1977) found Canada Warblers increased following partial harvesting in the Adirondacks, whereas Black-throated Blue Warbler was neither positively nor negatively effected. In contrast, Wood Thrushes and Blackburnian Warblers were negatively effected by partial cutting (Webb et al. 1977). However, in northern New Hampshire, Blackburnian Warblers were as abundant in managed stands as on unmanaged stands (Welsh and Healy 1993) and in eastern Maine, Derleth et al. (1989) reported that numbers of Black-throated Blue Warbler were significantly higher in stands treated with small clearcuts than in uncut controls. Germaine et al. (1997) found that abundance of Black-throated Blue Warblers and Wood Thrushes were highest in plots 50 m from small clearcuts, whereas abundance of Blackburnian Warblers was not different among plots within cuts or at increasing distances from the edges of cuts.

Because songbirds have small area requirements and frequently dense populations, greater consideration should be given to the diversity and arrangement of habitats at the landscape-level rather than focus on species abundance at the stand level (Hagan and Grove, 1995). Hagan and Grove (1995) projected that populations of all 4 featured species would be lower in a landscape harvested entirely with partial (selection) cutting. If that same landscape were left uncut, however, only populations of Canada Warbler would be lower than observed on the study sites; populations of the remaining 3 species were projected to be larger (Hagan and Grove 1996). In contrast, Buford and Capen (1999) reported significantly more Blackburnian Warblers in landscapes where 10% of the area was in nonforest habitat than in undisturbed landscapes. The degree of overstory (or perhaps volume) removed appears especially important to understanding habitat suitability in this group of species.

No single silvicultural practice benefits all species of Neotropical migrant birds (DeGraaf et al. 1993); rather, forest management activity can benefit most species at some time in the rotation cycle. Strong associations of dense understory to populations of Black-throated Blue and Canada Warbler (Holmes 1994, Conway 1999) suggests that certain forest harvesting practices (on appropriate sites), like selective cutting or group selection, could be especially useful at creating or maintaining suitable habitat.

Research and monitoring needs: Although some of the greatest needs for research and monitoring for any Neotropical migrant birds relate to their wintering grounds, our primary focus is on the breeding grounds. Two of the focal species are well studied in North America. Wood Thrushes have been extensively studied, especially in the Midwest, and Black-throated Blue Warblers in the Northeast, particularly in the White Mountains, just outside the planning unit. Additional research and monitoring is still needed for the these species and especially for Canada Warbler and Blackburnian Warbler, the latter of which has been poorly studied with regard to its reproductive ecology.

Within the planning unit, populations of the four focal species within this habitat appear adequately monitored by the BBS with a minimum of 39 of 51 possible routes reporting for Blackburnian Warbler. In addition, a regional or national database that coordinates this information would be a useful check on BBS trend data. Numerous sites are visited annually and bird abundance is recorded using point counts, yet no coordinated database exists for these data. Several specific needs are outlined below that form a basis for greater understanding and conservation of this suite of species.

- determine specific habitat needs (and causes of declines) for Canada Warbler; why, for example, is Canada Warbler declining while Black-throated Blue Warbler is stable, if both require shrubby understory of mature forest?
- better understanding of landscape-level effects of land-use practices on forest bird populations
- better understanding of role of stand age and stand structure on habitat quality and ultimately survival and reproductive success of priority species.
- better methods for monitoring species that use patchily distributed components of the forest, such as treefall gaps, small wetlands, snags.
- catalog the number, size and arrangement of conservation lands within the planning unit and complete BCA needs (as described above); develop region-wide monitoring program targeted for high priority forest birds.

Outreach: Increased public awareness of forest birds will be necessary for full implementation of this conservation plan. This can be achieved through PIF state working groups, as well as programs by NGOs such as National Audubon Society's Important Bird Areas Program. Awareness among professionals even outside avian conservation is good largely because of such high profile initiatives as PIF. State PIF working groups should include professionals from organizations and agencies whose mandate covers forested habitats. Keeping working groups abreast of the latest information on conservation of these species should remain a focus. Additional partners should be sought to help meet monitoring and perhaps atlasing needs. This habitat holds some of the most attractive species which could be used to encourage participation in birding and ultimately capable volunteer for citizen science projects and other volunteer opportunities.

D. Early successional forest/edge

Importance and conservation status*:* In the planning unit, early successional and edge habitats occur under a variety of conditions on the landscape. Naturally occurring shrublands occur in association with Pitch Pine/Scrub Oak woodland over well-drained soils. These areas are typically fire-dependant and following fires would have been suitable habitat for this suite of species. Wetter sites too provide habitat for early successional species. Throughout much of Northern New England, alder and winterberry are common shrubs forming structurally diverse wetland habitats. With stable water levels, edges of some emergent marshes are often "fringed" with shrubs creating a habitat transition into surrounding uplands. Many bird species use these edge habitats and their territories often encompass patches of forested wetland where tree species are stunted and are structurally similar to shrub-dominated sites. Beaver populations greatly influence these sites, especially as beavers have recolonized Northern New England following their near elimination during the height of the colonial fur trade. Some shrub habitat is lost as beavers flood alder-dominated riparian areas. When forested habitats are flooded, trees are killed, but these sites readily revert to shrubland habitat if followed with prolonged abandonment by beavers.

Human-influenced shrubland represents a significant portion of this habitat in the planning unit. These habitats are the result of regeneration following logging activity and by abandonment of agricultural fields. These habitats may be especially short-lived in logged over areas and longer lasting in agricultural sites. In the southern portions of the planning unit, southern New Hampshire and southern Maine especially, abandoned agricultural fields have largely regenerated to forest, whereas in central Maine and portions of the Connecticut River Valley along the northern edges of Area 27, abandoned fields remain in early successional habitat.

Without management and given enough time, most early successional habitat in this region will revert to forest. Interestingly, significant amounts of habitat for this group of birds exists along powerline and pipeline corridors. Although, not all corridors in the planning unit are managed equally; some are maintained with little shrub and tree growth and others are allowed to develop robust stands of deciduous shrubs. How these sites are managed is extremely important and determines the amount and structure of the habitat that occurs there. In drier parts of the unit, chemical (and mechanical) control of tree and shrub growth results in extensive cover of ground juniper. The value of this habitat for shrub-dependant birds is unknown.

Associated priority species: GOLDEN-WINGED WARBLER, CHESTNUT-SIDED WARBLER, AMERICAN WOODCOCK, Whip-poor-will, Olive-sided Flycatcher, Gray Catbird, etc. Despite the fact that all species are closely associated with early successional, shrubby habitats, Chestnut-sided Warbler and Gray Catbird have the broadest distribution and occur at significantly greater density than other species in this suite. Habitats used by these species are quite similar and most frequently result from disturbances such as fire, timber harvesting or abandonment of agricultural lands or as a result of utility corridor if vegetation is allowed to develop a dense shrub cover (Confer 1992, Richardson and Brauning 1995).

Many species use wet shrubby habitats (Confer 1992, Richardson and Brauning 1995), although Golden-winged Warblers probably exhibit greater affinity for this habitat than do Chestnut-sided Warblers. Confer (1992) also noted that Golden-winged Warblers include a portion of forested edge in their territories and that this species is frequently absent from sites which appear to have suitable habitat. Golden-winged Warblers were found in 4% to 15% of atlas blocks in VT, NH, and MA during the 1970s and 1980s, but not in Maine. It's occurrence in the region today, however, may be restricted to northwestern Connecticut and adjacent New York (Taconic Highlands). As a result, Golden-winged Warblers are virtually unrepresented on BBS routes in Northern New England. However, the species is well-documented to be in decline throughout it's overall breeding range (Confer 1992). In contrast, Chestnut-sided Warblers are well represented, occurring on all BBS routes in the region. However, the species too is in significant long-term (1966-1999) decline at -2.1% ($P < 0.01$, 53 routes). Olive-sided Flycatcher is listed here as a forest-edge species, although it also occurs in mature coniferous forest with natural openings.

American Woodcock was found to be distributed rather uniformly within the physiographic area, according to regional breeding bird atlas projects. Although the BBS does not adequately sample this largely nocturnal species, singing-route surveys (Tautin et al. 1983) indicate a significant decline of 2-3% per year since 1968 in most of the region (Bruggink 1996). Woodcocks require a mix of habitats, including forest openings or clearings for singing displays in spring, alder or other young hardwoods on moist soils for feeding and daytime cover, young second-growth hardwoods for nesting, and large fields for night-time roosts (Mendall and Aldous 1943; Connor, in Andrle and Carroll 1988). Although there have been many studies of seasonal habitat use, the relationship between specific habitat features and population demography remain unknown (Keppie and Whiting 1994). Silvicultural practices can enhance habitat available for woodcocks (Sepik et al. 1981), although a shift away from even-aged management (creating large areas of uniform shrub cover) may be detrimental to populations (Keppie and Whiting 1994).

Because of their diverse habitat requirements, these species probably do not constitute a "habitat-species suite" per se. Listing them together, however, highlights the need to include early successional habitats in the conservation plan, where doing so is not in conflict with higher-priority forest-bird objectives.

Habitat and population objectives*:* Based on extrapolations from BBS relative abundances (assuming each route samples approximately 2.5 km^2 -6.3 km^2 of available habitat; see appendix 3), VERY ROUGH estimates of population size for priority species in this habitat suite can be derived (Table 4.4).

Table 4.4. Population estimates for priority species of early successional and forest-edge habitat in the Northern New England physiographic area. Percent of Atlas blocks based on number of 5-km blocks in which the species was reported (from Rosenberg and Wells 1995, appendix 4).

Species	BBS population	% Atlas blocks ME	VT	NH	MA
Golden-winged Warbler	325	0	15	4	12
Chestnut-sided Warbler	262,000	97	100	100	98
American Woodcock	(2,000+)				
Gray Catbird	220,000	100	100	98	99
Whip-poor-will	???				
Blue-winged Warbler	725				
Prairie Warbler	725				
Red-headed Woodpecker	???				
Mourning Warbler	3,300	13	35	12	5
Olive-sided Flycatcher	650				
Orchard Oriole	???				
Common Nighthawk	???	42	22	18	3

These crude estimates are most useful in illustrating the relative population sizes of various species and, perhaps, giving order-of-magnitude figures for setting population objectives for the region. Note that the relative abundances used to for these estimates are averages across all BBS routes in the physiographic area using data from 1990-1998. Because many of the high priority species in this suite have declined over the past 30 years, a reasonable population objective would be to reverse these recent declines, returning populations to pre- or early BBS levels.

> OBJECTIVE 1. Encourage and enhance population expansion of Golden-winged Warbler by maintaining known breeding sites in suitable habitat condition and replicating these conditions wherever feasible; strive to maintain long-term population of 500+ breeding pairs.
>
> OBJECTIVE 2. Maintain stable breeding population of (????) Amercian Woodcocks throughout the physiographic area as measured by a mean of ___ singing males per Singing Ground Survey route; allow no net increase in number of routes reporting zero singing males.
>
> OBJECTIVE 3. Stabilize declining population trend for Chestnut-sided Warbler; maintaining long-term population of 300,000 breeding individuals (14-15 per BBS route).

Based on a published density of 11 pairs per 10 ha, roughly 320,000 ha (800,000 ac) of early and mid-successional forest is required to support 300,000 pairs of Chestnut-sided Warblers; this area will be sufficient to support sustainable populations of most other birds in this habitat suite. Roughly 1000 ha (2,500 ac) should be managed specifically to support 500 pairs of Golden-winged Warblers in areas where this species occurs.

***Implementation strategy**:* Conserving populations of early successional species will require a combination of monitoring changes in abundance of natural, early successional communities as well as active management to maintain early successional conditions. Development of best management practices for utility corridors might minimize use of herbicides to control woody plants and allow for sufficient growth to be suitable for some members of this suite of species.

Important components of an implementation strategy should include:

- outreach targeted at both professional and private audiences (see "*Outreach*").
- identification and protection of naturally occurring habitat and potentially designating these as IBAs.
- improved monitoring for species that show long-term declines especially at the state level.
- build partnerships with utility operators for maintenance of shrubby conditions along powerlines and other corridors.
- build volunteer network for monitoring of shrub (and forest) birds along utility corridors perhaps using mountain bikes.

Implementing conservation for this group of birds may seem at odds with conserving grassland-dependant species. However, the majority of habitat for both species will not be maintained without human intervention. This contradiction needs to be recognized in view of the area sensitivity of some grassland birds and the scrubby fringe that often accompanies grassland habitats, especially abandoned fields. Furthermore, shrub-associated birds are typically not sensitive to patch size. Many of these species will use small patches of habitat within an otherwise undesirable matrix. Enlarging patches of grassland habitats may be desirable at the expense of habitat for shrubland associated species if the vegetation community and the bird species there are sufficiently common to justify such a strategy.

***Research and monitoring needs**:* Basic research on the biology of high priority species in this suite is warranted especially for the two warblers. Ecological studies of Golden-winged and Chestnut-sided Warblers on their wintering grounds is especially important. Specific needs on the breeding grounds include:

- determine range of suitable habitats and identify present breeding sites for Golden-winged Warbler in this region.
- develop improved monitoring program for Golden-winged Warbler that considers their patchy distribution and low population size.
- designate sites where significant populations of Golden-winged Warblers occur as Important Bird Area and encourage monitoring programs at these sites.
- compare early successional habitats resulting from natural disturbances vs. forestry practices with regard to suitability for high-priority species

- determine effects of woodcock habitat management techniques on other priority, early-successional bird species

Outreach: This group of species, with the exception of American Woodcock is largely overlooked by agency biologists. Considerable attention has focused on the decline of American Woodcock populations and where management programs have been introduced for this species other birds of early successional habitats have likely benefited. Recently, awareness of habitat loss for early successional species has broadened to include nongame birds. Consequently, attention, especially by conservationists, has been focused on grassland birds. Witham and Hunter (1992) raised awareness of the declines in early successional species in coastal New England, but did not relate these declines directly to habitat loss in the region. There appears to be overwhelming evidence that habitat loss, either through reforestation of abandoned agricultural land or degradation of habitat quality through increased residential development, is certainly an important contributor to the decline of these species in this region.

Despite this increase in awareness, early successional species of birds could benefit greatly from further public (and professional) outreach. Important components of an outreach message for these species would include:

- many species using this habitat type are in decline.
- shrubland-associated species are not typically sensitive to patch size, unlike grassland birds, therefore even efforts on small properties can effect local populations.
- The origin of much of this habitat in Northern New England is via human disturbance either through forestry practices or former agricultural land.
- suitable habitat for some species exists in such heavily managed systems as utility corridors.
- periodic disturbances, either mechanical or fire for example, are important if persistence of this habitat type is desired over long periods of time.

E. Mature conifer (spruce-fir) forest

Importance and conservation status: Cool coniferous forests, dominated by balsam fir and red spruce, are not as prevalent here as further north in the Eastern Spruce-Hardwood physiographic area. Large continuous areas of coniferous forest exist at high elevations in the Green Mountains of southern Vermont and in portions of southwestern New Hampshire and in the Berkshires of northwest Massachusetts. Stands dominated by spruces or firs also occur as islands throughout the mixed and hardwood-dominated forests at lower elevations, especially in central Main, depending on drainage and disturbance regimes. Total area of this forest type is 710,000 ha, and a large proportion is on federal (USFS) land.

Except for lands in federal ownership, much of this habitat in the planning unit is not subjected to large-scale forest management. Instead, a significant portion is in small private holdings. Consequently, implementation will be more difficult given the large number of landowners and diversity of forest management objectives that likely exist. Threats to this habitat include those typical of high elevation sites: atmospheric deposition, climate change, etc. Where restricted to higher elevations in the southern portion of the planning unit, loss of this type through human development is less prevalent. However in northern portions and in central Maine, this habitat could be reduced by expanding communities and associated urban/suburban sprawl. The region is important to a variety of high priority species but none rely strictly on this habitat within this region.

Associated priority species: BLACKBURNIAN WARBLER, BAY-BREASTED WARBLER, BLACK-BACKED WOODPECKER, Sharp-shinned Hawk, Olive-sided Flycatcher, N. Saw-whet Owl. Unlike in the vast Eastern Spruce-hardwood Forest physiographic area to the north, relatively few coniferous-forest species are high priority in Northern New England, and these tend to be uncommon and locally distributed.

Blackburnian Warbler is broadly distributed in the planning unit and has a higher total score than in the Eastern Spruce Hardwood region to the north largely because of a declining population trend in Northern New England. Bay-breasted Warbler reaches its southern range boundary in the planning area. It maintains a lower total score in Northern New England compared to the Eastern Spruce Hardwood region because of a lower Area Importance score in Northern New England. Population trend information for Bay-breasted Warbler is based on too few routes to reliably report; however, populations of this species are well-known to increase tremendously during outbreaks of Spruce Budworm (Williams 1996). Consequently, short-term declines in species such as Bay-breasted Warbler should be viewed in the context of declining availability of important prey species. Blackburnian Warblers too, respond positively to outbreaks of Spruce Budworm but not to the extent of Bay-breasted Warblers (Morse 1994).

Blackburnian Warblers are better represented by BBS routes and show significant long-term and short-term declines. The role to which fluctuating Lepidopteran populations are responsible remains unknown for this species.

In addition to mature conifer habitat, Blackburnian Warblers also select mixed stands (Morse 1994) probably more so than do Bay-breasted Warblers (Hagan et al. 1997). Blackburnian Warblers forage in the upper parts of mature trees, whereas Bay-breasted Warblers forage at mid-level towards the bole of the tree (MacArthur 1958). Understory characteristics often differ greatly in stands selected by these two species, Blackburnian Warblers are more often associated with stands having a dense understory compared to Bay-breasted Warblers which tend to be found in stands with less structure in the understory (Hagan et al. 1997). Analyses by Hagan et al. (1997) also suggested some degree of area sensitivity in Bay-breasted Warblers. They reported a positive area effect between presence of this species and the amount of mid- and late-successional forest.

The Black-backed Woodpecker is known from only a few breeding localities within this Physiographic Area, in the southern Green Mountains of Vermont and in central Maine. This species is found in mature black spruce and balsam fir forests, especially those with many dead or dying conifers. It is relatively tolerant of disturbance and may increase in population following fire.

Habitat and population objectives*:* Based on extrapolations from BBS relative abundances (assuming each route samples approximately 2.5 km^2 of forest habitat; see appendix 3), VERY ROUGH estimates of population size for priority species in this habitat suite can be derived (Table 4.5).

Table 4.5. Population estimates for priority species of mature coniferous forest in the Northern New England physiographic area. Percent of Atlas blocks based on number of 5-km blocks in which the species was reported (from Rosenberg and Wells 1995, appendix 4).

Species	BBS population	% Atlas blocks ME	VT	NH	MA
Blackburnian Warbler	23,000	74	67	73	77
Bay-breasted Warbler	800	19	1	5	0
Black-backed woodpecker	???	5	1	0	0
Blackpoll Warbler	???	5	7	8	0
Olive-sided flycatcher	650				
Sharp-shinned Hawk	1,500		26	16	
N. Saw-whet Owl	???		14	15	

These crude estimates are most useful in illustrating the relative population sizes of various species and, perhaps, giving order-of-magnitude figures for setting population objectives for the region. Note that the relative abundances used to for these estimates are averages across all BBS routes in the physiographic area using data from 1990-1998.

Bay-breasted Warbler, although of the highest global priority in this species suite, is rare as a breeder and locally distributed in the region (primarily Maine). Blackburnian Warbler is much more abundant and may better represent the spruce-fir bird community in terms of long-term population objectives. Unlike in much of the Northeast, this species is showing steeply declining population trends at present. Sharp-shinned Hawk also is widespread and relatively common, and may represent the most area-sensitive of the high priority species in coniferous forests of the region.

> OBJECTIVE 1. Maintain sustainable population of 25,000+ pairs of Blackburnian Warblers (1.0-1.5 birds per BBS route). Assumption: sufficient habitat for this species will support entire spruce-fir warbler community (including Bay-breasted Warbler), within natural population fluctuations (e.g., spruce-budworm outbreaks).
>
> OBJECTIVE 2. Maintain sustainable regional population of 1,500 [??] Sharp-shinned Hawks. Assumption: sufficient habitat for Sharp-shinned Hawk will also be sufficient for other area-sensitive, coniferous forest species.

Based on a published density of 4-5 pairs per 10 ha, roughly 56,000 ha (140,000 ac) of mature spruce-fir forest is necessary to sustain 25,000 pairs of of Blackburnian Warblers; as much as 400,000 ha (1 million ac) of conifer forest may be necessary to support 1,500 pairs of breeding Sharp-shinned Hawks.

***Implemention strategy*:** Because the planning area is owned by such a large number of private individuals and overall little is owned by the forest products industry, cooperative agreements for maintaining minimum proportions of habitat in mature coniferous forest as is possible in the Eastern Spruce Hardwood Forest, is unlikely. Instead the BCA model as previously described likely would be a more effective implementation strategy. A thorough discussion of this landscape conservation strategy is presented in Section C. Northern Hardwood and Mixed Forests, within this document. As previously described, a procedure for designating Bird Conservation Areas for forest birds in a region such as the Northern New England planning unit would involve the following steps:

- determine local optimum densities of priority species in suitable habitats.
- determine area required to support source population (e.g. 500 pairs) of priority species, assuming optimum habitat conditions.
- determine present distribution of priority species; e.g. using Breeding Bird Atlas or similar occurrence data.
- identify potential patches of suitable or optimal habitat, using GIS, that meet requirements of habitat type (e.g. forest type, elevation), minimum size, and known or suspected occupancy for each priority (focal) species.
- superimpose suitable habitat patches identified for multiple priority species to identify patches capable of supporting entire habitat-species suite.
- overlay land-ownership, conservation status, and other relevant features (e.g. using GAP analysis) to identify potential BCAs.

work cooperatively with landowners, local conservation NGO's, state agency personnel, municipal conservation commissions, landtrusts, etc. to develop long-term habitat conservation plans for these areas.

Management recommendations: -Priority species in this habitat by definition are sensitive to stand age, thus, trends towards shorter rotations could limit habitat quality (Erskine 1992). However, in the bulk of small woodlots that occur throughout the region and even in higher elevation national forests, partial harvesting with longer rotation lengths are probably the norm. This is likely an important distinction between Northern New England and the Eastern Spruce Hardwood Forest.

Partial or selective cutting of stands appears favorable to populations of Bay-breasted Warblers and overall numbers of this species were predicted to be higher in a forest treated entirely with selection cutting (Hagan and Grove 1995). In contrast, Blackburnian Warblers appear more sensitive to timber removal. Webb et al. (1977) reported that Blackburnian Warblers declined in abundance regardless of the amount of merchantable timber removed (down to only 25% removal). Furthermore, Hagan and Grove (1995) predicted a negative effect on the population of Blackburnian Warblers if a landscape were entirely selection harvested. If that same landscape were instead left entirely undisturbed, Blackburnian populations were predicted to increase (Hagan and Grove 1995). In contrast, in landscapes with canopy disturbance at 10%, Buford and Capen (1999) reported significantly higher numbers of Blackburnian Warblers than on undisturbed control sites. This suggests that perhaps single tree harvesting, or small patch cutting, which probably already is extensively practiced on small woodlots may be more favorable to this species. Small-scale timber harvesting is unlikely to contribute to the loss of any species (Welsh and Healy 1993) in the region, and if consideration is given to stand level-effects, habitat for priority species should remain abundant.

Research and monitoring needs: -Even on their breeding grounds, Bay-breasted and Blackburnian Warblers are some of the poorest studied Passerines in the planning unit (Morse 1994, Williams 1996). Some basic aspects of their reproductive strategy remain unknown and wherever possible these should be addressed. Innovative techniques for finding nests or otherwise monitoring reproductive success need to be developed and implemented. Other, general guidelines for research include:

- provide better understanding of role of stand age and stand structure on habitat quality and ultimately survival and reproductive success of priority species.
- determine possible causes of population declines of Blackburnian Warbler; explore management practices that might enhance populations of this species
- landscape and stand-level investigations on the effects of the predominant silvicultural practices in this planning unit are needed especially for priority species with an affinity for coniferous habitats.
- examine the role of stand size in habitat selection and reproductive success.
- examine effects of various timber harvesting methods typical of small woodlot management on high priority species especially raptors.
- improve understanding of metapopulation dynamics for species using patches of mature conifer within a matrix of mixed or deciduous forest and apply this to BCA concept.

In general, the high priority species in Northern New England are inadequately monitored by conventional programs. Between the two focal species, only Blackburnian Warbler is adequately monitored by the BBS. Bay-breasted and Blackpoll Warblers occur on too few routes in this region for reliable estimates of population trend. Estimates of population trend are available for Sharp-shinned Hawks, but are marginal in terms of number of routes reporting. A centralized database created from hawk-watching sites from around the region would improve our understanding of this species in Northern New England and physiographic areas to the north. Methods for monitoring nocturnal species such as owls need further development and networks of volunteer to conduct owl monitoring programs is warranted throughout the planning unit. Banding studies with Saw-whet Owls are increasing throughout the northeast and should yield important information on migration and stopover habitat for this species. Other, general guidelines for improved monitoring include:

- develop better methods for monitoring species that use patchily distributed components of the forest, such as treefall gaps, small wetlands, and snags.
- develop techniques for monitoring woodland hawks that offer sufficient power to detect trends within reasonable time periods.

Outreach: Needs for outreach for this group are largely the same as for high priority species in the Northern Hardwood and Mixed Forest. As previously mentioned, increased public awareness of forest birds will be necessary for full implementation of this conservation plan. This can be achieved through PIF state working groups, as well as programs by NGOs such as National Audubon Society's Important Bird Areas Program. Awareness among professionals even outside avian conservation is good largely because of such high profile initiatives as PIF. State PIF working groups should include professionals from organizations and agencies whose mandate covers forested habitats. Keeping working groups abreast of the latest information on conservation of these species should remain a focus. Additional partners should be sought to help meet monitoring and perhaps atlasing needs. This habitat holds some of the most attractive species which could be used to encourage participation in birding and ultimately capable volunteers for citizen science projects and other volunteer opportunities.

F. Grassland and agricultural land

Importance and conservation status*:* Natural grasslands were not a major feature of the presettlement landscape of Northern New England, and it is unlikely that other natural openings, such as bogs or wet meadows, supported significant populations of grassland birds (except possibly Northern Harrier). Today, agricultural land represents a minor and declining feature of the landscape. In Maine alone (i.e., Androscoggin, Kennebec, Knox, Lincoln, and Waldo Counties), the number of farms declined 13.3% just between 1987 and 1992 to 1554 farms. Similarly, within the same 5 Maine Counties, acreage in farmland declined 14.8% during the same time period to 281,506 acres (U.S. Bureau of the Census 1992). This rate of decline is likely similar or more severe for portions of southern New Hampshire and southern Vermont that occur in Area 27.

Other than maintaining overall avian richness in the region, grassland birds are a relatively low priority in Northern New England. Large geographic ranges and larger populations in other parts of North America greatly contributes to their lower priority. Where land is in active agricultural production, however, efforts to maintain populations of priority bird species will contribute to conservation objectives for these species throughout the Northeast.

Associated priority species*:* UPLAND SANDPIPER, SEDGE WREN, BOBOLINK, Northern Harrier, Grasshopper Sparrow, Vesper Sparrow.

With the exception of Bobolink, the species in this suite of priority birds have small populations in this region and are included because they are broadly listed on various state endangered, threatened, and special concern lists. This reflects the concern over grassland conservation in those states. In addition, Upland Sandpiper and Northern Harrier were identified by Schneider and Pence (1992) as nongame species of management concern in the Northeast. They also included Short-eared Owl, but was not deemed a priority species in Northern New England according to the PIF prioritization scheme.

Habitat and population objectives*:* Based on extrapolations from BBS relative abundances (assuming each route samples approximately 6.3 km^2 of appropriate habitat; see Appendix 3), VERY ROUGH estimates of population size for priority species in this habitat suite can be derived (Table 4.6).

Table 4.6. Population estimates for priority species of grassland and agricultural habitats in the Northern New England physiographic area. Percent of Atlas blocks based on number of 5-km blocks in which the species was reported (from Rosenberg and Wells 1995, appendix 4).

Species	BBS population	% Atlas blocks ME	VT	NH	MA
Upland Sandpiper	0		1	1	2
Sedge Wren	0				
Bobolink	76,300	86	95	85	62
Grasshopper Sparrow	100	0	2	2	2
Eastern Meadowlark	16,200				
Northern Harrier	60		8	4	0
Vesper Sparrow	210	19	25	14	2

These crude estimates are most useful in illustrating the relative population sizes of various species and, perhaps, giving order-of-magnitude figures for setting population objectives for the region. Note that the relative abundances used to for these estimates are averages across all BBS routes in the physiographic area using data from 1990-1998.

Bobolink is the most abundant and widespread species and also the least area sensitive. Only in Maine are BBS data for Bobolink indicating a significant downward trend (Maine statewide 1980-1996: -6.4%, $P < 0.01$, $n = 46$ routes). For the Northern New England Region during 1980-1996, BBS data indicate only slightly negative, nonsignificant trends.

Upland Sandpipers are probably the most specialized and area sensitive species in this suite. Many sites supporting this species would likely support populations of one or more other priority species. Population trend estimates for Upland Sandpipers are only available for FWS region 5 as a whole, because too few routes encounter this species. Data from the BBS indicate a stable population from 1980 through 1996 in the northeast region (+0.1%, $P = 0.98$, $n = 23$ routes).

> OBJECTIVE 1: Maintain stable population of 80,000+ Bobolinks (averaging 10 per BBS route) on lands in active agriculture (including pastureland) with no reduction in the number of BBS routes reporting this species (approximately 50 routes).
>
> OBJECTIVE 2: Maintain existing population of ??? Upland Sandpipers, ensuring the long-term representation of the full habitat/species suite in this region.

Based on published density estimates, roughly 90,000 ha (230,000 ac) of agricultural grassland is needed to support 80,000 pairs of breeding Bobolinks; if specific sites for uncommon and area sensitive species are protected, this acreage should be sufficient to support the entire grassland species suite in this physiographic area.

Implementation strategy: Maintaining existing populations of any grassland bird species in Northern New England is closely associated with human use of their habitats. Most of the grasslands in the region are of agricultural origin, yet, many modern agricultural practices can be detrimental to successful reproduction of these species. This contradiction needs to be considered in any implementation strategy. If farmers are unable to "earn a living", these lands will be converted to other uses such as residential developments and surrounding land will revert to forest. This scenario is evident throughout the Northeast and portions of Northern New England (southern New Hampshire, southwestern Maine, and western Massachusetts) are strong examples of this. Keeping farmland as farmland and balancing any detrimental effects of agricultural uses will be key to successful implementation. Combinations of increased awareness among conservationists and the public are essential for successful implementation.

Management recommendations: In addition to broad outreach efforts targeted specifically for agricultural lands, the many small native grasslands also need attention. Many of these sites are formed on natural sandplains and need regular burning to remain suitable for grassland birds. Sandplain grasslands are a fairly rare community in the northeast and support other rare species of plants and animals. Ensuring that grassland bird issues are incorporated into management plans for protected natural grasslands is an obvious first step. Protection of these sites through acquisition may be easier if justification can be based on priority birds as well as rare plants and invertebrates.

Research and monitoring needs: Bobolinks have been well studied in other parts of the northeast region, yet have not been the focus of investigations in Northern New England. A variety of methods, centered largely around haying practices, have been proposed to minimize losses of nests and nestlings during typical agricultural activities (Bollinger and Gavin 1992, Jones and Vickery 1997). However, little is known about relative reproductive success following these practices. For example, would leaving unmowed sections or strips increase fledging success or serve to focus mammalian predation on nests later in the season when females are less likely to renest? Furthermore, lifetime reproductive output is not known for individuals in agricultural ecosystems in Northern New England.

Monitoring of grassland birds like other species with patchy distributions will require special efforts targeted toward appropriate habitats. A monitoring program for grassland birds within Northern New England, may be inappropriate. Rather, specific sites within the region could be included in a northeast regional program. The Northeast PIF Grassland Bird Working Group could be used to nominate sites (given statistical considerations) based on results of the regional grassland bird surveys conducted by Massachusetts Audubon in 1997 and 1998. State working groups could assist with identifying qualified volunteers to perform the actual counts.

Outreach: Considerable effort has been given to developing guidelines for management of grassland habitats in the northeast (see booklets by Jones and Vickery 1997). We encourage the broad distribution of these materials throughout the region. Agency personnel could be especially effective at encouraging airports to consider habitat management for grassland birds, which may actually discourage loafing by species such as gulls and other large birds. Agency personnel also should consider their land management practices on refuges and wildlife management areas in the region and consider delaying mowing for as long as possible. Despite the overall increased awareness and outreach materials developed for this suite of species more needs to be done to reverse declining trends in populations of grassland birds in Northern New England.

G. Freshwater lakes and wetlands

Importance and conservation status: The Northern New England Physiographic Region supports thousands of lakes and ponds and tens of thousands perhaps hundreds of thousands of wetlands. This area is not unlike others in the northeast having lost large portions of the wetland resource. Estimates from the Maine portion of Area 27 are as high as 50% loss of wetland present before European settlement. The greatest losses occurred in floodplain wetlands (including forested wetlands and vernal pools) following hydropower development along major rivers. Over time, agriculture also has contributed heavily to losses (and conversion) of wetland habitat throughout Northern New England.

American Black Ducks are synonymous with beaver flowages, small ponds and marshes in the northeast. Despite long-term declines they remain a common, if not abundant, breeder in the region. The wetland habitats used by black ducks and other associated species are protected by both state and federal laws. However, small incremental losses continue to occur across the region. Lack of undeveloped buffers surrounding Black Duck breeding habitat will likely contribute to a decline in habitat quality for this species, especially as urban and suburban sprawl continue to increase.

Associated priority species: AMERICAN BLACK DUCK, Common Loon, Bald Eagle, etc.

As with the grassland habitat suite, all species are considered a priority because of their Watch List status (American Black Duck) or special concern listing in various states. This habitat suite therefore represents continued nationwide concern for wetland habitats and their potentially vulnerable species, even though they do not rank highly in the global PIF prioritization system.

Habitat and population objectives: Based on extrapolations from BBS relative abundances (assuming each route samples approximately 6.3 -25 km^2 of appropriate habitat; see appendix 3), VERY ROUGH estimates of population size for priority species in this habitat suite can be derived (Table 4.6).

Table 4.6. Population estimates for priority species of grassland and agricultural habitats in the Northern New England physiographic area. Percent of Atlas blocks based on number of 5-km blocks in which the species was reported (from Rosenberg and Wells 1995, appendix 4).

Species	BBS population	% Atlas blocks ME	VT	NH	MA
American Black Duck	3,100		40	75	
Common Loon	2,500		8	19	1
Bald Eagle					
Least Bittern					
Black Tern					
Osprey	200		0	2	
Pied-billed Grebe	150		6	6	
Common Moorhen					
American Coot					

These crude estimates are most useful in illustrating the relative population sizes of various species and, perhaps, giving order-of-magnitude figures for setting population objectives for the region. Note that the relative abundances used to for these estimates are averages across all BBS routes in the physiographic area using data from 1990-1998.

OBJECTIVE 1. Increase numbers of American Black Duck broods to ____ in interior wetland habitats of Area 27.

Implementation strategy*:* Habitat protection for Black Ducks is likely the most effective strategy at maintaining stable number of both wintering and breeding birds. Because American Black Ducks frequently nest in upland habitats (i.e., forests; Longcore et al. 2000a), providing undeveloped buffers of conservation land surrounding wetlands is especially important for this species. Further reductions in the harvest, at least in Maine are unlikely, given the long period in which harvests have been low.

Management recommendations*:* Black Duck harvest management in Maine and other northeast states has managed to stem the decline in the species but has not contributed to an overall increasing population. A variety of harvest reductions including reducing daily bag limits (1 bird per day in Maine), reducing season length and delaying opening for this species appear to have been effective at stopping declines. Conservative harvest measures have been adopted through the 3 states in Area 27, but not necessarily to the same degree or at the same time by state and provinces in neighboring physiographic regions (Longcore et al. 2000b). The numbers of Black Ducks present in Coastal habitats in winter may not have been produced in these same marshes, so wintering numbers of this species may have much to do with production and harvest outside Area 27.

Research and monitoring needs*:* Monitoring production of Black Ducks is possible through an interstate network of refuges and management areas, but will require endorsement by the Flyway Council and appropriate state and federal biologists charged with managing waterfowl populations in the region. Such a need would be more likely to be filled if the region's state directors and the federal division of refuges fully embrace the concepts of NABCI. Additional needs follow:

- Support efforts to monitor American Black Ducks via aerial surveys in cooperation with federal biologists;
- identify factors that affect habitat quality for breeding Black Ducks in coastal versus inland habitats (why disturbance is important during pairing, but not during the rest of the year).

Outreach: Continue to encourage hunters to learn to identify the Black Duck, through distribution of color posters at sporting goods stores, municipal offices, wildlife refuges, etc.

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APPENDIX 1: ECOLOGICAL UNITS AND VEGETATION ALLIANCES

Ecological Units and associated vegetation alliances within the Northern New England PIF planning unit (physiographic area 27). Modified from Keys et al. (1995). SM-B-B = Sugar Maple-beech-birch forest; RS-BF = red spruce-balsam fir forest. Human use categories: F = forestry, A = agriculture, R = recreation, U = urban, Q = quarrying.

Subunit (state)	Description	Vegetation	Human use
212Da (ME)	Central Maine Embayment	SM-B-B, Maritime RS-BF, oak-hickory-ash dry forest	F, A, R
212Db (ME)	Penobscott Bay Coast	SM-B-B, Maritime RS-BF, Maritime communities, pitch pine-scrub oak	rural, R
212Dc (ME)	Casco Bay Coast	SM-B-B, RS-BF, Atlantic white cedar swamp	rural, R
221Al (ME,NH)	Sebago-Ossipee Hills and Plain	hemlock-white pine-oak, SM-B-B, red maple-red spruce swamp	F, resid, A
M212Bc (NH)	Sunapee Uplands (part)	SM-B-B; n. red oak-hardwood mesic forest; RS-BF	F, A, R
212Bd (NH, MA)	Hillsboro Inland Hills and Plain	N. red oak-hardwood mesic forest, SM-B-B, oak-pitch pine woodland	F, A, R
M212Bb (NH,VT, MA)	N. Connecticut River Valley	SM-B-B; oak-pine dry forest; silver maple floodplain forest	A, U
M212Cb (VT, NY)	Taconic Mountains (part)	RS-BF; SM-B-B; oak-hickory dry forest	F, R, Q
M212Cc (VT, MA)	Berkshire/ Vermont Upland (part)	SM-B-B; RS-BF; oak-hickory dry forest	F, A, R
M212Cd (VT, MA)	Southern Green Mountains (part)	RS-BF; SM-B-B; oak-hickory dry forest	F, R

APPENDIX 2: AVIFAUNAL ANALYSIS

In this section we provide additional details on the status of the roughly 179 species known to breed in the physiographic area. Global and area scores for all species from the PIF prioritization database (Carter et al. 2000) are provided in Table A2.1.

Species are then ranked according to the importance of this planning unit to their total species population (Table A2.2). Species with high proportions of their total populations in this region are considered of greatest importance for long-term conservation planning; i.e., this region has the greatest responsibility for the long-term maintenance of their populations (Rosenberg and Wells 1995, 1999).

Table A2.2. Species with high proportions of their total population in Area-27. Percent of population calculated from percent of range area, weighted by BBS relative abundance (see Rosenberg and Wells 1999; Appendix 3). Population trend from BBS data (% change per year from 1966-1999).

Species	% of pop.	rel. abun.	Pop. trend		N
Bicknell's Thrush	?	?	?		0
Veery	3.9	15.42 [a]	**-0.8**	0.05	53
Black-throated Blue Warbler	3.6	1.98	2.2	0.30	47
Chestnut-sided Warbler	3.6	12.92 [a]	**-2.1**	0.00	53
Black-and-white Warbler	3.2	7.35 [a]	-0.6	0.60	53
Eastern Phoebe	3.2	9.84 [a]	1.8	0.06	53
Scarlet Tanager	3.2	3.81	**-1.1**	0.05	49
Wood Thrush	3.1	11.86	**-1.9**	0.00	53
Black-capped Chickadee	2.8	19.74 [a]	1.9	0.00	53
Gray Catbird	2.7	10.84	**-1.1**	0.00	53
Ovenbird	2.5	24.40	1.0	0.01	53
American Redstart	2.1	10.07	-0.7	0.63	53
Cedar Waxwing	2.0	14.41	1.2	0.06	53

[a] Relative abundance is the highest recorded for any physiographic area

Declining species

Of the 13 species with =2% of their total population in the planning unit, 5 species have declined significantly ($P < 0.10$) since 1966 (Table A2.2). Other declining species may be of local or regional concern, even if they don't rank highly in regional importance. In addition, suites of declining species may signal added regional concern for a habitat type that also supports high-priority species. Twenty-seven species have declined significantly in Northern New England since 1966, with additional 9 species declining only since 1980 (Table A2.3). The steepest long-term declines are shown by species of shrub (Brown Thrasher, Eastern Towhee, Field Sparrow) and grassland habitats (Eastern Meadowlark). Mature forest species showing long-term declines are Blackburnian Warbler, Yellow-throated Vireo, Eastern Wood Pewee, and Scarlet Tanager, with several others declining steeply since 1980.

Table A2.3. Species showing large or significant population declines within Physiographic Area 27, based on Breeding Bird Survey, 1966-1999 trends (N = 53 routes). CF = conifer forests; HF = hardwood or mixed forests; ES = early successional; GR = grassland; W = wetland; UR = urban.

Species	Trend (% per year)	N	Significance	Relative abundance	Primary habitat
Broad-winged Hawk	-13.8 [a]	32	0.08	0.21	HF
Brown Thrasher	-9.3	48	0.00	1.10	ES
Yellow-billed Cuckoo	-8.3 [a]	8	0.05	0.06	HF
Eastern Towhee	-8.0	41	0.00	5.29	ES
Magnolia Warbler	-7.2 [a]	41	0.03	1.09	HF, CF
Field Sparrow	-7.1	45	0.00	1.47	ES
Black-billed Cuckoo	-6.5 [a]	39	0.03	0.50	HF
Blackburnian Warbler	-6.0	45	0.02	0.87	CF, HF
Eastern Meadowlark	-5.0	49	0.00	2.00	GR
Yellow-throated Vireo	-4.0	22	0.02	0.30	HF
American Kestrel	-4.3	42	0.08	0.45	GR
Herring Gull	-4.2	16	0.03	2.89	W
White-throated Sparrow	-3.8	53	0.00	11.62	CF (ES)
Nashville Warbler	-3.8 [a]	41	0.01	2.24	CF (ES)
Purple Finch	-3.6	52	0.00	2.70	CF (ES)
Least Flycatcher	-3.2	53	0.00	6.24	HF
Yellow-shafted Flicker	-3.1	53	0.00	3.22	HF
Indigo Bunting	-3.0 [a]	46	0.01	2.15	ES
Barn Swallow	-2.9	53	0.00	17.15	GR
Eastern Kingbird	-2.7 [a]	51	0.00	4.76	GR, ES
Eastern Wood-pewee	-2.4	53	0.00	3.90	HF
House Wren	-2.4	43	0.00	3.01	ES
Song Sparrow	-2.3	53	0.00	25.66	ES
Chestnut-sided Warbler	-2.1	53	0.00	13.74	HF (ES)
Baltimore Oriole	-2.0 [a]	49	0.05	5.30	HF
Rose-breasted Grosbeak	-2.0 [a]	50	0.06	4.18	HF
European Starling	-2.0	53	0.04	45.56	UR
Chimney Swift	-1.9	52	0.00	6.08	UR
Wood Thrush	-1.9	53	0.00	15.93	HF
Brown-headed Cowbird	-1.6	53	0.01	7.62	ES
Common Grackle	-1.3	53	0.00	16.16	ES, UR
Common Yellowthroat	-1.3	53	0.00	23.52	ES (W)
Gray Catbird	-1.1	53	0.01	11.60	ES
Scarlet Tanager	-1.0	52	0.10	3.91	HF
Yellow Warbler	-0.9	53	0.09	10.39	ES
Veery	-0.8	53	0.05	15.41	HF

[a] Significant declining trend for period 1980-1996 only.

Increasing species

It is informative to also examine the species that are increasing significantly in a physiographic area. In Northern New England, 41 species show increasing population trends (Table A2.4), with 6 of these species declining only since 1980.

Table A2.4. Species showing large or significant population increases within Physiographic Area 27, based on Breeding Bird Survey, 1966-1999 trends (N = 53 routes). CF = conifer forests; HF = hardwood or mixed forests; ES = early successional; GR = grassland; W = wetland; UR = urban.

Species	Trend (% per year)	N	Significance	Relative abundance	Primary habitat
Evening Grosbeak	27.3	29	0.00	0.42	CF, HF
Tufted Titmouse	22.7	34	0.00	0.90	UR, HF
Canada Goose	21.1	21	0.00	0.66	W (UR)
Barred Owl	16.6	13	0.00	0.08	HF, CF
Yellow-bellied Flycatcher	16.3	9	0.05	0.05	CF
Mallard	15.2	33	0.00	0.63	W (UR)
Wood Duck	14.6	24	0.06	0.12	W
Spotted Sandpiper	14.1	14	0.03	0.11	W
House Finch	12.2	48	0.00	3.27	UR
Pine Warbler	9.0	29	0.00	0.83	CF
Turkey Vulture	8.9	16	0.07	0.20	ES
American Black Duck	8.8	27	0.00	0.43	W
Northern Cardinal	7.1	39	0.00	1.59	UR, HF
Mourning Dove	7.0	53	0.00	13.03	ES, UR
Eastern Bluebird	6.8 [a]	39	0.07	0.60	ES
Ruffed Grouse	6.4	29	0.03	0.15	HF, ES
Savannah Sparrow	6.1 [a]	36	0.00	1.60	GR
Common Raven	6.1	43	0.02	1.05	CF, HF
Northern Mockingbird	5.8	32	0.00	0.41	UR
Pileated Woodpecker	5.6	45	0.01	0.63	HF
Winter Wren	5.5 [a]	46	0.00	1.68	CF
Red-breasted Nuthatch	5.4	51	0.00	1.51	CF
Great Blue Heron	5.2	34	0.01	0.42	W
Blue-headed Vireo	4.9	52	0.06	1.66	CF, HF
Yellow-bellied Sapsucker	4.8	51	0.00	2.37	HF, CF
Northern Parula	4.5	33	0.08	1.16	CF
Hermit Thrush	4.5 [a]	51	0.07	2.67	CF
Red-tailed Hawk	4.4	15	0.03	0.07	ES, HF
Great Crested Flycatcher	3.7	52	0.00	2.33	HF
White-breasted Nuthatch	3.7	52	0.01	2.12	HF
American Crow	3.5	53	0.00	24.00	ES, UR
Black-thr. Blue Warbler	3.1 [a]	43	0.03	1.13	HF
American Goldfinch	2.9 [a]	51	0.00	13.09	ES, UR
Yellow-rumped Warbler	2.8	51	0.00	2.7	CF, ES
Warblling Vireo	2.3	52	0.04	2.14	HF
Alder Flycatcher	2.2	50	0.01	3.45	ES
Black-capped Chickadee	1.9	53	0.00	15.00	HF, UR
Eastern Phoebe	1.8	53	0.06	8.45	ES, UR
Chipping Sparrow	1.6	53	0.04	11.76	ES, UR
Cedar Waxwing	1.2	53	0.06	11.61	ES, UR
Ovenbird	1.0	53	0.01	20.22	HF

[a] Significant increasing trend for period 1980-1996 only.

APPENDIX 3: POPULATION ESTIMATES AND ASSUMPTIONS

In this PIF bird conservation plan, several estimates are presented of relative or absolute bird population sizes. Relative population size (percent of global population) is used to illustrate the importance of a given geographic area to priority bird species (Rosenberg and Wells 1999), whereas estimates of absolute population size are used to set numerical population objectives for habitat-species suites within a physiographic area. Both types of estimates are derived using Relative Abundance values from the Breeding Bird Survey (BBS). These values represent the average number of birds per BBS route, across all routes in a physiographic area, for the period 1990 through 1998 (J.R. Sauer, pers. com.). These same Relative Abundance values are used to calculate Area Importance (AI) scores in the PIF species prioritization database (see Carter et al. 1999). Note that prior to July, 1999 BBS Relative Abundance was calculated differently; so any previously presented or published population estimates using these values will differ from those calculated after July 1999 (J.R. Sauer, pers. com.).

Percent of Population

The percent of total or global population (% pop) for a species is calculated according to the methods originally described by Rosenberg and Wells (1999). For species sampled by the BBS, the Relative Abundance value for each physiographic area is multiplied by the size of that area (km^2) and then summed across all the physiographic areas in which the species occurred to yield a total "BBS population." The area-weighted value for each physiographic area is then divided by this total to yield the proportion of the total population in that area. Thus:

$$\%\ \text{Pop} = \frac{\text{Relative Abundance (area)}}{\cdot\ \text{(Relative Abundance) (area)}}$$

Estimates of % Pop are relative values and are not dependent on the "correctness" of Relative Abundance values for individual routes; i.e., even if BBS greatly underestimates absolute abundance of "poorly sampled" species, such as nightjars and raptors, Relative Abundance values and % pop estimates should be valid, *as long as the detectability of a species on BBS routes is relatively constant across the range of the species*. These estimates are more questionable for species occupying very patchy habitats (e.g. wetlands) in regions where BBS routes do not adequately sample these habitats.

In cases where additional survey data for groups of species are available (e.g. waterfowl, colonial waterbirds), relative abundance and % pop estimates should be calculated with these data to compare with or replace BBS data. For some species (e.g. Piping Plover), direct censuses of populations exist and should be used to calculate the percentage of the total population in each region. Wherever supplemental data exist, these new estimates should be entered into the PIF prioritization database at Colorado Bird Observatory.

Within PIF plans, a threshold of % Pop has been determined that signifies a disproportionate abundance of a priority species in a physiographic area, or that an area shares a disproportionate responsibility for the long-term conservation of that species. This threshold is based on the size of a physiographic area relative to the total area of North America south of the open boreal forest (roughly 12 million km^2). An analysis of North American bird species' distribution and abundance (K. V. Rosenberg, unpublished data) resulted in the % Pop thresholds listed in Table A3.1.

Table A3.1. Percent of Population thresholds, signifying disproportionate population size, relative to size of physiographic area.

Physiographic area size (km^2)	Proportion of North America	Percent of population threshold
< 57,000	< 0.50	2
57,000 - 80,000	0.51 - 0.69	3
81,000 - 100,000	0.70 - 0.89	4
101,000 - 125,000	0.90 - 1.09	5
126,000 - 153,000	1.10 - 1.30	6
154,000 - 173,000	1.31 - 1.49	7
174,000 - 191,000	1.50 - 1.69	8
192,000 - 222,500	1.70 - 1.89	9
223,000 - 246,000	1.90 - 2.10	10
300,000 - 500,000	2.60 - 3.50	15
> 600,000	> 5.0	25

Absolute population estimates

In order to set appropriate and justifiable habitat goals within physiographic areas, it is usually necessary to first set numerical population objectives for priority bird species. Population estimates rarely exist, however, for most nongame bird species. For relatively widespread and common species of forest, shrub, and some grassland habitats, the BBS may provide a landscape-level density estimates that can be converted into regional population estimates if the following assumptions are made:
(1) BBS routes constitute a random sample of the landscape;
(2) habitats in question are fairly evenly distributed across the region; and
(3) each bird species has a relatively fixed average detection distance at BBS stops, within which a reasonable estimate of the number of individuals present may be obtained.

Because BBS route locations are selected at random (ref), the first assumption is reasonable. Furthermore, several studies have shown that common habitat types are represented along secondary roads used as BBS routes in roughly the same proportions as in the overall landscape (refs). The third assumption is the most problematic; although most species probably do have a fairly constant average detection distance, selecting that distance is difficult and has a large effect on total population estimates. For example, an entire BBS route composed of 50 stops, each consisting of a 0.25 mi. (400 m)-radius circular count, potentially surveys roughly 25 km^2 of heterogeneous landscape. For a species that is detected routinely only out to 200 m at each stop, the effective area surveyed is reduced to 6.3 km^2; for a species detected only out to a distance of 100 m, the BBS route surveys 1.6 km^2. A simple method of extrapolating avian density from counts of singing males using detection threshold distances was proposed by Emlen and DeJong (1981), who also provided average maximum detection distances for 11 species of common forest birds. These distances ranged from 72 m (Blue-gray Gnatcatcher) to 186 m (Wood Thrush) and averaged 128 m for the 11 species. Emlen and DeJong (1981) further proposed that numbers of singing males be doubled to obtain a total population estimate and that a correction factor be applied to account for variable singing rate (i.e. birds that were missed because they didn't sing during the survey period).

In the absence of additional empirical data on species-specific detection distances and singing frequencies, we may take a simple and conservative approach to estimating regional population sizes from BBS relative abundance data. Species were initially placed in three categories, according to their presumed detection-threshold distances. A majority of forest-breeding songbirds and similar species of scrubby and open habitats were assigned a detection distance of 125 m (close to the average distance for forest birds in Emlen and DeJong's study) -- for these species a BBS route samples an effective area of 2.5 km^2. A second group of species that are detected primarily visually or have unusually far-carrying vocalizations in open habitats were assigned detection distances of 400 m; ie., they are detected out to the limit of each BBS circular stop (e.g. raptors, Upland Sandpiper). For these species the BBS samples roughly 25 km^2. A third group of species is considered to be intermediate and was assigned a detection distance of 200 m (effective sampling area = 6.3 km^2). These include species, such as Bobolink and Eastern Meadowlark, that are detected by a combination of song and visual observations in open habitats.

Population estimates for a physiographic area are then calculated as the average landscape-level density (number of birds per route * effective area sampled by each route) multiplied by the size (km^2) of the physiographic area. Note that landscape-level densities are not assumed to be similar to species densities in uniform optimum habitats, but rather reflect habitat heterogeneity at larger scales as sampled by BBS routes. Because the great majority of

detections on typical BBS routes are of singing or displaying males, the population estimate derived from this method is assumed to represent number of breeding pairs, unless specifically noted otherwise.

Clearly, much additional research and analysis is necessary to (1) test assumptions of this approach, (2) provide refined empirical estimates of detection distances and frequencies that can be applied to density estimation, and (3) to develop independent means of estimating population size in order refine or calibrate estimates derived from BBS data. The crude population estimates provided in this PIF plan are a reasonable starting point, however, that are based on the best information yet available, and that can serve as preliminary population objectives for priority species in each physiographic area. These population objectives can then be translated into habitat objectives, with the goal of assuring the long-term sustainability of priority species in each region. As better population data become available, these should be incorporated into later versions of the PIF conservation plans.