

**Partners In Flight
Landbird Conservation Plan:**

**Physiographic Area 26:
Adirondack Mountains**

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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, nest predation, and competition with exotic species. 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 "keeping common birds common" and reversing the downward trends of declining species.

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 PIF Landbird Conservation Planning 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 PIF 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. PIF 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

PIF 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; i.e. prioritization
- (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 conditions
- (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 Landbird Conservation Plans are intended to compliment other initiatives such as the North American Waterfowl Management Plan, National 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

The Adirondack Mountains constitutes the smallest physiographic area in North America, with a total area under consideration of roughly 25,419 square kilometers. Landforms within the planning unit include high Appalachian peaks (1,000 m to 1,620 m), as well as a broad zone of lower mountains and foothills ranging down to 120 m [?] in elevation. Roughly 90 (?) peaks surpass 1000 m, with roughly 28,400 ha of forest occurring above that elevation. Most of the region consists of an ancient dome of Precambrian rock, similar geologically to the Canadian Shield. The physiographic area also includes the Tug Hill Upland, a hilly plateau (180 m - 600 m) that is more similar geologically to the Allegheny Plateau than to the Adirondacks. Highlands within this area constitute the headwaters of the Hudson River (including Mohawk River) and part of the St. Lawrence River (including Black River and Lake Champlain) drainages. The planning unit also contains thousands of glacial lake and pond systems, as well as numerous peatlands and springs. Roughly 336,000 ha of wetlands have been identified in the Adirondacks, with an additional 21,500 ha in the Tug Hill region.

Within the planning unit are 8 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 24 (Allegheny Plateau) and 18 (St. Lawrence Plain). Average annual

precipitation ranges from roughly 90 cm on the northeastern peaks to 150 cm in the southern foothills and Tug Hill plateau. Growing season averages about 100 days throughout the physiographic area (climate data from Thompson 1966, Keys et. al. 1995).

B. Potential and present-day 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), or a combination of the two in various proportions (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 and on shallow, acidic soils. In the Western Adirondack Foothills section, drier oak-hickory-ash forest (I.B.2.a.vi.) dominates, and in the Tug Hill region, paper birch-red spruce transition forest and red cedar-white ash woodland (II.C.3.a.i.) are present. Presettlement forests in much of the region were characterized by an overstory of white pine and red spruce, with more purely hardwood forests dominating after timber removal and other disturbance.

Nonforest alliances include various open peatlands, fens, and beaver meadows. 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.).

U.S. Forest Service FIA data indicate that roughly 2.2 million ha. are covered with forest today (Table 1.1; Fig. 1.2). Present day forests are dominated by maple-beech-birch (71% of forested area), with less than 10% of the forest classified as spruce-fir. It is estimated that spruce-fir forests comprised 45%-50% of the original Adirondack forest (NYSDEC 1994). The FIA data also classify nearly 250,000 ha as white-red-jack pine forest, primarily in the easternmost portions of the physiographic area.

Table 1.1. Natural vegetation cover-types in the Adirondack Mountains physiographic area. Forest types are taken from USFS FIA data; nonforest types are from USGS data. See Fig. 2 for map of current vegetation cover types.

Vegetation type	Area (ha)	Area (ac)	% of area
Maple-beech-birch forest	1,562,500	3,860,938	61.1
White-red-jack pine forest	247,000	610,337	9.7
Spruce-fir forest	192,400	475,420	7.5
Oak-hickory forest	185,100	457,382	7.2
Oak-pine, mixed hardwoods	2,400	5,930	1.0

C. Natural disturbances

The Adirondack forests have been influenced by several natural disturbance factors, including hurricanes, windstorms, ice-storms, and fire. Results of these disturbances are evident primary at local scales. The most recent significant events in the region include [**wind storm, ice storm -- acreages, effects?**] At high elevations, nearly constant wind maintains dense, stunted conifer forests that are critical for Bicknell's Thrush.

Insect outbreaks, today a major feature of forest communities, were apparently rare before massive human alterations to the forest structure [?? -- **figure this out**].

D. History and land use

Human populations are relatively sparse throughout the physiographic area and are largely confined to several medium-sized towns (e.g., Lake George, Old Forge, Lake Placid) and numerous smaller hamlets. Agriculture was never a major land-use in the region, and today is represented primarily by pastureland in the Tug Hill Plateau area, along the lower western foothills, and the upper Hudson Valley.

By far, the most pervasive human influence on the natural landscape has been through commercial timber harvest and production. Timber harvest began with French settlement of the adjacent St. Lawrence Valley in the 17th and 18th centuries. Early harvest concentrated on virgin white pine, primarily for ship-building, and virtually eliminated this species as a dominant tree by 1850. In the late 1800s, red spruce was harvested extensively, primarily for paper and pulp production. Virtually the entire Tug Hill plateau and most of the Adirondack Mountains were logged by 1900. A combination of timber harvesting practices, human carelessness, and dry winter conditions then led to a series of extensive forest fires; the largest in spring, 1903 burned > 250,000 ha. Today's second- or third-growth northern hardwood-dominated forest communities are largely a result of these land-use changes.

Equally important to the Adirondacks environment was the establishment, in 1885, of the Adirondack Park, a 2.4 million ha mosaic of state-owned forest preserve and private-industrial timberland. Originally, 260,400 ha of the park was declared the Forest Preserve, and under a constitutional "forever wild" clause this land is never to be logged again. In 1892, private lands were incorporated into the park; the state has steadily expanded its holdings and today comprises 975,000 ha of Forest Preserve.

In general, the total acreage and volume of the Adirondack forests have increased steadily since 1900 (Smith 1990). Recent inventories on commercial (private) forest land indicate the following trends:

- forest continues to mature and increase in volume (growth rate exceeds harvest rate, except for spruce)
- sugar maple, white pine, hemlock, and other hardwoods constitute greatest forest volume
- (soft) maple increased the most in volume (doubled) between 1968 and 1980
- white pine is expected to increase in proportion and volume, whereas spruce and hemlock will continue to decline
- shade-tolerant hardwoods, such as maple, will continue to increase in forest dominance
- hardwood timber quality is considered low, because of several cycles of "high grading"

Within the state-owned Forest Preserve, inventories indicate:

- spruce is the highest volume species, primarily because a higher proportion of land is at high elevations than on commercial forest land.
- paper birch is more prevalent, also because of competitive ability at higher elevations and adaptability to fire
- 63% of the forest is classified as sawtimber or larger, with 20,000 ha of old growth forest left unharvested
- forests will continue to mature and should eventually resemble pre-European forests

Although forests expand and mature in the region, harvest and removal of timber has increased by nearly 90% since 1968, primarily for fuelwood and pulpwood consumption (Smith 1990). Largest increases are of softwood sawtimber (especially spruce), with much of this exported outside the region. Harvest today is primarily by means of selective cutting of single trees; therefore age structure and species composition of the forest will continue to be affected without creating additional areas of early successional vegetation.

Besides commercial timber production, recreation is probably the second-most important human use of the region today, especially on public lands. Recreational activities include hunting, fishing, hiking, camping, snowmobiling, and cross-country skiing. Recreational use in the Adirondack Park is not monitored, and effects (if any) on habitats for priority bird species are not known.

Table 1.2. Current land-use and ownership patterns in portions of the Adirondack Mountains physiographic area [citation?].

Land classification	Area (ha)	Area (ac)	Percent of area
Forested land	1,400,000	3,458,000	58.5
Public ownership			
State Forest Preserve	975,000	2,408,250	40.6
other public			
Private industrial	432,000	1,067,040	18.0
Private non-industrial			
Agricultural land	511,000	1,262,170	21.3
Residential/ developed	307,000	758,290	12.8
Other nonforest lands	163,000	402,610	6.8
Wetlands	358,000	884,260	15.0

SECTION 2: PRIORITY BIRD SPECIES

A. General avifauna

Roughly 176 bird species (Appendix 2) have been documented as breeding within physiographic area 26 (Peterson 1980, Andrle and Carroll 1988). Of the nongame landbirds (145 species), the majority are migratory; these include roughly 76 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 near 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 closely aligned with the Eastern Spruce-hardwood Forest and distinct from all other physiographic regions. From a global perspective, this combined northern forest region ranks among the highest priorities for long-term bird conservation in eastern North America.

Because of the small size of this physiographic area, no species had = 10% of its global population breeding within the planning unit. For 20 species, however, = 1% of the total population is estimated to occur, indicating disproportionately large populations breeding in this

small area (Appendix 2). Many of these species are found in exceptionally high relative abundance on BBS routes, including 7 species with the highest relative abundance of any physiographic area in North America.

Our primary measure of population trend at present is the Breeding Bird Survey (BBS), which provides data on roughly 113 of the 176 species breeding within Area-26 (N = 25 routes). For many species in this region, however, especially those of boreal or high-elevation 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, 32 have declined significantly ($P < 0.10$) since 1966, and 3 additional species have declined since 1980 (Appendix 2). These include nearly all species associated with early successional and other disturbed habitats, including agricultural and urban areas. In addition, at least 10 common species of hardwood or mixed forests have declined significantly; among these, Canada Warbler showed the steepest declines (5.1% per year). Among the eastern physiographic areas, only the Southern Blue Ridge shows as high a proportion of forest-breeding species with declining populations as the Adirondack Mountains.

In contrast, 25 species exhibit significantly increasing population trends; 5 of these only show significant trends since 1980 (Appendix 2). A majority of the increasing species are associated with urban or other human-altered habitats (e.g. Northern Cardinal, House Finch), including those that use bird feeders (Evening Grosbeak, Black-capped Chickadee) or are abundant in managed coniferous forests (e.g. Hermit Thrush, Magnolia Warbler, Yellow-rumped (Myrtle) Warbler). Several species of freshwater wetlands (although poorly sampled) show increases, as do several widespread forest birds (e.g. Pileated Woodpecker, Red-eyed Vireo, Ovenbird)

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 different 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. Our primary means of prioritizing species is through the PIF prioritization scores generated by Colorado Bird Observatory (Hunter et al. 1993, Carter et al. in press). 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 Adirondack Mountains region are found in Appendix 2.

Explanations of the tiers, or entry levels into the priority species pool (Table 2.1) are as follows:

I. *High overall (global) priority* -- species scoring = 22 in the PIF prioritization system. Indicates high vulnerability of populations throughout the species range, irrespective of specific status in

this physiographic area. Species without manageable populations in the area (peripheral) are omitted.

II. *High physiographic area priority* -- species scoring 19-21 in the PIF system, with either (IIa) $AI + PT = 8$ or (IIb) a high percentage of the global population breeding in the physiographic area. Tier IIa indicates species that are of moderately high global vulnerability, and with relatively high abundance and/or declining or uncertain population trend in the physiographic area. Tier IIb signifies that the area shares in responsibility for long-term conservation of those species, even if they are not currently threatened. Percent of population is calculated from percent of range area, weighted by BBS relative abundance (see Rosenberg and Wells 1999). A disproportionately high percentage of global population is determined by considering the size of each physiographic area relative to the total land area of North America, south of the open boreal forest (see Appendix 3).

III. *Additional Watch List* -- species on PIF's national Watch List that did not already meet criteria I or II. Watch List species score = 20 (global scores only), or 18-19 with $PT = 5$. These species are considered to be of high conservation concern throughout their range, even in areas where local populations may be stable or not severely threatened.

IV. *Additional listed* -- species on federal or state endangered, threatened, or special concern lists that did not meet any of above criteria. These are often rare or peripheral populations.

V. *Local concern* -- species of justifiable local concern or interest. May represent a geographically variable population or be representative of a specific habitat of conservation concern.

Nine species scored at least 22 in the PIF prioritization system and are considered to be high overall or global priority (Table 2.1). Of these, Bicknell's Thrush scores high because of its very restricted range and small total population. An unknown 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. Of the remaining species, Canada Warbler, Wood Thrush, Chestnut-sided Warbler, and Rose-breasted Grosbeak show a combination of high regional importance ($AI = 4 - 5$) and significantly declining population trend; American Woodcock is also probably in this category, with a steep, declining trend evident on a small sample of BBS routes. In contrast, Golden-winged and Bay-breasted warblers, although of high global priority, are rare in the Adirondack Mountains. Golden-winged Warbler is expanding its range along the western and northern boundaries of this physiographic area, however, and may become a higher priority in this region in the future. Finally, the Black-throated Blue Warbler is a high priority, in spite of its stable long-term population trend, because of its very high area importance (5% of world population). Note that Black-throated Blue Warblers *have* declined significantly on BBS routes since 1980. Except for Bicknell's Thrush and Canada Warbler, there is not a clear distinction between most of these species and those in priority level II, below.

Priority level II includes 9 additional species with relatively high total scores and with relatively large and/or declining populations in the physiographic area. These are primarily common birds of northern hardwood and mixed forest, but also includes one species of open peatlands and marshes (American Bittern). Olive-sided Flycatcher is noteworthy for its extremely steep population decline (8.0 % per year), paralleling similar declines nearly throughout its large range.

The Blackburnian Warbler (and possibly bittern) is the only species in this category exhibiting a stable population trend. Two additional Watch List species are represented in the priority species pool, the American Black Duck and Bobolink, both of which are local breeders in the region.

Table 2.1. Priority species pool for Physiographic Area 26, the Adirondack Mountains. 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., in press).

Entry level	Species	Total score	% of pop.	AI	PT	Local status
I						
	Bicknell's Thrush (NY - SC)	25	??	5	3	B
	Canada Warbler	25	1.2	5	5	B
	Golden-winged Warbler (NY - SC)	25	< 1	2	3	B
	Wood Thrush	23	1.4	4	5	B
	Black-throated Blue Warbler	23	5.1	5	2	B
	Bay-breasted Warbler	23	< 1	2	4	B
	Chestnut-sided Warbler	23	1.7	5	5	B
	American Woodcock	22	< 1	3	5	B
	Rose-breasted Grosbeak	22	1.0	5	5	B
II						
a.	Veery	21	1.7	5	5	B
	Scarlet Tanager	20	1.1	3	5	B
	Black-and-white Warbler	20	1.0	5	4	B
	Olive-sided Flycatcher	20	< 1	3	5	B
	American Bittern (NY - SC)	20	< 1	5	3	B
	American Redstart	19	1.2	5	5	B
	Great Crested Flycatcher	19	< 1	3	5	B
	Eastern Wood-pewee	19	< 1	3	5	B
b.	Blackburnian Warbler	21	2.6	5	2	B
III						
	American Black Duck	20	< 1	3	3	B
	Bobolink	18	< 1	2	3	B
IV						
	Upland Sandpiper (NY - T)	19	< 1	1	3	B
	Common Loon (NY-SC)	18	< 1	3	3	B
	Northern Goshawk (NY - SC)	18	< 1	3	3	R
	Northern Harrier (NY-T)	17	< 1	2	3	B
	Sharp-shinned Hawk (NY - SC)	17	< 1	5	3	B
	Peregrine Falcon (NY-E)	16	< 1	1	3	B
	Spruce Grouse (NY-E)	16	< 1	2	3	R
	Bald Eagle (NY-E)	15	< 1	1	3	B
	Osprey (NY-SC)	15	< 1	2	3	B
	Golden Eagle (NY-E)	14	< 1	1	3	B
	Cooper's Hawk (NY-SC)	14	< 1	2	3	R
	Pied-billed Grebe (NY - T)	13	< 1	1	3	B
	Vesper Sparrow (NY- SC)	13	< 1	1	3	B

Thirteen additional species that are listed in New York as either endangered, threatened or special concern have at least small breeding populations in the Adirondack Mountains. 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. The Spruce Grouse is notable on this list because it represents one of the few disjunct resident populations of this species south of the extensive boreal forests and highlights the need to protect dense conifer and boreal peatland habitats within the Adirondacks.

The overall priority pool of 33 species (20% of the breeding avifauna) is dominated by common forest-breeding species, many of which are declining in the Adirondacks. Considering all priority categories, the species of highest conservation concern include Bicknell's Thrush, Canada Warbler, American Woodcock, Olive-sided Flycatcher, and a suite of additional 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 elsewhere in the Northeast, 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 House Sparrow 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. Similarly, American Woodcock is a species of regional and global concern that requires disturbed or managed habitats.

Data on forest growth trends and bird populations in this region present a paradox. Why, if forest area and volume have increased since 1968, have so many forest bird populations declined during the same period? Several explanations are possible: (1) declines represent local development along secondary roads (BBS routes) and do not reflect overall population trends [**would be interesting to see BBS route distribution on state and private land**]; (2) declines are real and reflect dependence of many species on disturbed or successional forests (i.e., maturing forests are less favorable); (3) declines are due to, at least partly, to forest health

problems such as acid precipitation; or (4) declines are due to problems certain species face on their tropical wintering grounds. Given that many of the declining species are associated with dense understories or canopy openings, the second scenario is plausible. A disproportionate number of the declining forest species also winter along the east slope of the Andes in South America, one of the most besieged forest areas in the Neotropics.

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. As state Forest Preserve lands are exempt from future harvesting, opportunities for early successional species on these lands will depend on extensive natural disturbances, such as windstorms and fire. On commercial forest lands, however, continued emphasis on regrowth of young trees will ensure habitat for these birds, provided that forest structure (e.g., shrub understory) is suitable. 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 abundance, 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 ownership. 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 -- Hagan refs., DeGraaf refs., etc [**need to flesh all this out**]

E. Forest health

Acid precipitation; beech bark disease; hemlock wooly adelgid; pear thrips, a defoliator of maple; climatic warming.

F. Bird conservation opportunities and solutions

Several factors contribute to an optimistic assessment of future bird conservation planning in this region: (1) most priority bird species are still abundant and widespread, exemplifying the PIF objective of "keeping common birds common; (2) The economic base of the region is in commercial forestry and recreation, so it is unlikely that habitats for forest birds will be severely threatened in the near future; (3) The inclusion of most of the planning unit within Adirondack State Park, including vast acreages of designated wilderness, will ensure that adequate habitat for source populations of priority species will be maintained.

Large portions of the Adirondack Mountain region are under the jurisdiction of the Adirondack Park Agency, thus simplifying the implementation of conservation planning. In addition, commitments by several large timber companies would ensure that conservation objectives are met over vast areas. In general, there is a strong commitment in this area, both within the state agencies and among private landowners, to preserving open space. A Commission on the Adirondacks in the 21st Century (1990) recommended expanding the state Forest Preserve to 52% of the Adirondack Park and instituting a set of easements and zoning ordinances to limit the extent of development without curtailing population and economic growth.

Identification of *Important Bird Areas* in the planning unit has recently been carried out by National Audubon Society's New York State chapter (Wells 1998). The seven IBAs identified in this area to date include the Adirondack High Peaks Wilderness Area (90,574 ha), Moose River Plains (40,000 ha), and several important lakes and boreal peatlands. Conservation planning for these Important Bird Areas has begun and includes implementation of PIF plan objectives for high-priority landbirds. 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 divide among nine 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 (*sensu* Lambeck 1997) for setting population-habitat objectives and determining conservation actions.

Table 4.1. Priority habitat-species suites for Area 26. 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	PTD Q	Action level ^a
<u>Mountaintop -- stunted conifer woodland</u>							
	Bicknell's Thrush	25	2	5	3	F	II,V
	Peregrine Falcon	16	3	1	3	F	III
	Golden Eagle	14	2	1	3	F	III
<u>Northern hardwood-mixed forest</u>							
	Canada Warbler	25	3	5	5		III,V
	Black-throated Blue Warbler	23	2	5	2		IV
	Wood Thrush	23	2	4	5		III
	Rose-breasted Grosbeak	22	2	5	5		III
	Veery	21	2	5	5		III
	Scarlet Tanager	20	2	3	5		III
	Black-and-white Warbler	20	2	5	4		III
	Eastern Wood-Pewee	19	2	3	5		III
	American Redstart	19	2	5	5		III
	Great Crested Flycatcher	19	2	3	5		III
	Northern Goshawk	18	3	3	3		IV
	Cooper's Hawk	14	2	2	3		IV
<u>Early successional forest/edge</u>							
	Golden-winged Warbler	25	4	2	3		II,V
	Chestnut-sided Warbler	23	2	5	5		III
	American Woodcock	22	3	3	5		III
	Olive-sided Flycatcher	20	3	3	5		III,V
<u>Mature conifer (spruce-fir) forest</u>							
	Bay-breasted Warbler	23	3	2	4		IV
	Blackburnian Warbler	21	3	5	2		IV
	Olive-sided Flycatcher	20	3	3	5		III,V
	Spruce Grouse	16	3	2	3		III,V
	Sharp-shinned Hawk	17	2	5	3		IV
<u>Grassland/agricultural</u>							
	Bobolink	19	3	2	4		IV
	Upland Sandpiper	19	4	1	3		IV
	Northern Harrier	17	3	2	3		IV
	Vesper Sparrow	13	3	1	3		IV
<u>Boreal peatlands</u>							

Olive-sided Flycatcher	20	3	3	5	III,V
Spruce Grouse	16	3	2	3	III,V

Freshwater wetland -- river/lake

American Bittern	20	3	5	3	IV
American Black Duck	19	3	3	3	III
Northern Harrier	17	3	2	3	IV
Common Loon	16	3	3	3	IV
Bald Eagle	15	2	1	3	IV
Osprey	14	2	2	3	IV
Pied-billed Grebe	13	3	1	3	VI

^a Action levels: I = crisis; recovery needed; II = immediate management or policy needed range-wide; III = management to reverse or stabilize populations; IV = long-term planning to ensure stable populations; V = research needed to better define threats; VI = 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, stunted high-elevation conifers, to a top regional conservation priority (Rosenberg and Wells 1995). This habitat type occurs naturally at high elevations (>1000m), occurring on about 90 peaks in the Adirondack Mountains. Its distribution is therefore naturally fragmented at the landscape level, with habitat patches ranging in size from 0.1 ha to 4,200 ha (J. Ross, in litt). The total areal extent of this habitat type has been estimated at 100,000 to 150,000 ha in the U.S. (Atwood et al. 1996), plus ???? in Canada, with roughly 28,400 ha in the Adirondack region.

Current threats to the habitat fall into three categories: (1) global climate change; (2) acid precipitation; and (3) recreational and other development. The first factor, a global warming trend resulting in the shrinking or retraction of cool-temperate forests region-wide, has been postulated to influence bird distribution and abundance (Erskine 1992, Atwood et al 1996). Although such an effect cannot be controlled by conservation efforts, we must recognize the potential for long-term population changes that are "beyond our control." 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). The structure of high-elevation forests in the Adirondacks also is effected, as red spruce is replaced by white birch and balsam fir, resulting in shorter, denser vegetation [**clarify with Judy Ross, get refs**]. 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 ski resorts is a growing threat to high-elevation habitats in parts of New England, but is less of a factor in the Adirondacks. Minimal ski area development, strict limits to forest cutting, and forever wild status of most high peaks contribute

to a high degree of protection for this habitat type. The effects of lighter recreation, such as hiking and camping, are not well known. In addition, the recent proliferation of communication towers on mountaintops may represent another potential threat.

Associated priority species: BICKNELL'S THRUSH, Peregrine Falcon, Golden Eagle, (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 specialists on stunted mountaintop conifers in New England and New York. Blackpoll Warbler is a priority species of this habitat further north in the Eastern Spruce-Hardwood physiographic area (significant declining trend), and it ranks lower in the Adirondacks primarily because it is not sampled on BBS routes (hence, low AI; PT = 3). Both Peregrine Falcon and Golden Eagle are rare breeders on the high peaks (above treeline), with no confirmed records of the latter in recent years.

Habitat and population objectives: Despite the small size of most available habitat patches, Bicknell's Thrush and other associated species occur there 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). Using this estimate and the estimate of total habitat available (see above), a minimum of 25,000-30,000 pairs of breeding Bicknell's Thrush may be present within the Adirondack Mountains. This may be an overestimate, however, because densities at other sites were lower than those published for Mt. Mansfield (C. Rimmer, pers. com.); nonetheless, the Adirondacks population may represent up to one-half of the total U.S. population of Bicknell's Thrush (K. McFarland pers. com.). The New York breeding bird atlas reported this species from 25 5-km blocks, based on 1980-1985 field work (Andrle and Carroll 1988). Recent surveys have confirmed individuals on 24 peaks in 1992-94, including 12 of 12 sites of known historic occurrence (USFWS report 1994). In New England, 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). Preferred habitat has been described as dense, stunted stands dominated by balsam fir, with varying amounts of red spruce and sometimes white birch, mountain ash and other species (Wallace 1939, Atwood et al 1996). The exact structural characteristics representing optimum habitat for Bicknell's Thrush in the Adirondack Mountains are not known.

Population trends for species in this habitat are difficult to assess, because BBS routes do not sample such high-elevation sites. 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. Multi-year research in Vermont indicates that reproductive success is highly variable from year to year, with nest failure primarily attributed to predation by red squirrels and red-backed voles. Nest predation is highest in years following high spruce (?) cone abundance and may involve an upslope movement of predators from lower-elevation forests (K. McFarland, pers. com.). In addition, an unusual spacing and mating system in this species has been documented, including lack of male territoriality, high degree of promiscuity, and large movements of individuals within habitat patches. These factors contribute to the difficulty in monitoring population size and reproductive success. Finally, threats to winter habitat for Bicknell's Thrush in the Dominican Republic and elsewhere are severe, and long-term persistence of this species in its northern breeding areas may depend on effective partnerships with conservation organizations and agencies far outside this region.

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.

OBJECTIVE 2: Establish and maintain a breeding population of xx Peregrine Falcons and xx Golden Eagles, through protection of all known nesting sites and reintroduction efforts where desired.

Implementation strategy: A strategy for protecting high-elevation habitats and ensuring a stable population of Bicknell's Thrush and associated species should include the following elements (not necessarily sequential):

- identification and characterization (habitat size, quality, land ownership) of all potential habitat patches, using GIS (initial analysis by Judy Ross, Adirondack Park Agency)
- 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 availability 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 New York xxxxxx, and the Bicknell's Thrush is recently listed as a species of Special Concern in the state. Potential for strict protection of important habitat patches is highest on publicly owned lands within Adirondack Park. A vast majority of the land above 1000 m elevation is within the state Forest Preserve. 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.

The Adirondack High Peaks Wilderness Area has been nominated as an Important Bird Area (Wells 1998). This area includes 25 peaks above 1000 m, most of which support or potentially support Bicknell's Thrush. Additional Important Bird Areas in the Adirondacks include xxxxxx. Conservation plans for these areas are currently being developed and will include objectives for priority species such as Bicknell's Thrush.

A few peaks that potentially support Bicknell's Thrush are privately owned, including Boreas Mountain, near Elk Lake, Wakely Mountain, southeast of Raquette Lake, and isolated Lyon Mountain west of Dannemora. Bicknell's Thrush was found on Wakely and Lyon Mts. during the 1992-94 surveys, but not on Boreas Mt. (USFWS report 1994). Implementation of habitat objectives on private lands will be voluntary. Inaccessibility of most sites on private land, as well as the minimal commercial value of stunted conifers that dominate this habitat, should offer a moderate level of protection in the near future. Explicit recognition of important sites should be sought, however, with the goal of incorporating their protection, where possible, into timber-

harvest and other land-use plans. Designation within the Important Bird Areas program, if carried out properly and with great sensitivity to private landowners' concerns, could aid in meeting objectives on private lands.

Potential conflicts or threats at specific, important sites should be identified quickly and cooperative agreements sought. These threats may include ski-resort developments, inclusion in commercial timber sales, or agency policies that neglect or inadvertently threaten mountaintop sites. Ultimately, 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: At present, no specific management practices can be recommended to enhance high-elevation habitats for Bicknell's Thrush. If future monitoring and research efforts result in a greater understanding of limiting factors and threats to Bicknell's Thrush on its breeding grounds, then direct management to reduce these threats will be justified. Possible management opportunities might include control of recreational activities, predator control during years of high cone abundance, or manipulation of vegetation structure to maximize habitat suitability.

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 in the Adirondack Mountains
- 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
- studies of microhabitat structure requirements of Bicknell's Thrush, especially in relation to changes due to acid rain
- 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 proposed spatial method of monitoring population change involves repeated sampling of specific GIS polygons representing known Bicknell's Thrush breeding sites (K. McFarland, pers. com.). An additional technique for monitoring this species along its migration routes may employ the recording of distinct nocturnal flight calls (Evans 1994). 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 (Rimmer et al.).

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 the PIF state working group, as well as programs by NGOs such as National Audubon Society's Important Bird Areas Program. Increased awareness and recognition

within New York Department of Environmental Conservation is desirable, as this agency develops unit management plans for High Peaks Wilderness, and within Adirondack Park Agency as they review and approve these plans.

B. 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-community within the planning unit. As mature softwoods (especially white pine and red spruce) 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 at lower elevations in the Adirondack Foothills region, especially in the western and southern portions of the physiographic area.

The importance of this habitat type is great, because of the number of associated bird species with high priority scores in the planning unit. 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 the Adirondacks. 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: CANADA WARBLER, BLACK-THROATED BLUE WARBLER, Wood Thrush, Rose-breasted Grosbeak, Veery, Scarlet Tanager, etc. The total suite of 12 priority species in this habitat represents a cross section of the entire diverse breeding bird community.

[ecological information, microhabitats]

Habitat and population objectives: Based on extrapolations from BBS relative abundances (assuming each route samples approximately 2.5 km² of forest habitat; see Appendix 3), VERY ROUGH estimates of population size for priority species in this habitat suite can be derived (Table 4.2).

Table 4.2. Population estimates for priority species of northern hardwood and mixed forest habitat in the Adirondack Mountains physiographic area. Percent of Atlas blocks based on number of 5-km blocks in which the species was reported (out of roughly 1,000 blocks) during the New York State breeding bird Atlas (Andrle and Carroll 1988)

Species	BBS population	% Atlas blocks
Canada Warbler	15,000	62
Black-throated Blue Warbler	52,000	90
Wood Thrush	106,500	80
Rose-breasted Grosbeak	38,000	80
Veery	126,000	80
Scarlet Tanager	28,800	80

Black-and-white Warbler	41,500	90
Eastern Wood-pewee	19,500	95?
American Redstart	111,500	90
Great Crested Flycatcher	20,500	65
Northern Goshawk	200	12
Cooper's Hawk	130	7

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. Many of these species are common and widespread. 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 Canada Warbler; maintaining long-term population of 15,000 - 20,000 breeding pairs distributed among 600-700 atlas blocks.

OBJECTIVE 2. Maintain stable population of (50,000 - 55,000) Black-throated Blue Warbler pairs throughout the physiographic area (5-6 birds per BBS route). Stabilize or reverse recent population declines.

OBJECTIVE 3. Maintain 200 pairs of Northern Goshawks as a stable regional population.

Assumptions: (1) maintaining suitable habitat for 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 Northern Goshawks will meet requirements of other potentially area-sensitive species.

Implementation strategy: Implementing the broad objectives for this habitat-species suite will require a comprehensive forest management plan for the entire Adirondack Mountains 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 structures, 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, such as hemlock, white pine, or 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
- setting maximum allowable levels of forest fragmentation due to forestry practices or planned development; e.g. do not allow any 10,000 km² 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 be responsible for sustaining these populations for the physiographic 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 Adirondack Mountains 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

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, 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.

If BCAs are being identified in another forest habitat type, then these processes should be coordinated, or perhaps combined. For example, in the Adirondack Mountains, BCAs can be identified for species of both northern hardwood and spruce-fir forests. 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, ms). EXPAND

Research and monitoring needs:

- GIS analysis of Forest Preserve and private lands to identify, catalog, and prioritize forest stands in terms of species composition, age structure, and amount of understory; possibly apply GAP analysis to Adirondack Park
- verify population declines of forest birds through independent measures; establish general causes of declines if possible (e.g., habitat loss? changing forest structure?)
- 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, wetlands, peatlands, snags.

Outreach: Involvement of private timber companies is essential; they should be invited to participate in forest stand prioritization analysis and discuss optimum practices for meeting priority bird population objectives. Outreach is needed also to NY DEC and Adirondack Park Agency to help guide the development of Unit Management Plans on state lands, as well as for prioritizing areas for possible purchase or conservation easement. National Audubon Society of New York can be instrumental in these outreach efforts, especially through their Important Bird Areas Program in this region.

C. Early successional forest/edge

Importance and conservation status: Early successional habitats within this region can be of three types, distinguished by their origins. Natural disturbance was undoubtedly responsible for maintaining local areas of successional habitat, following severe storms, landslides, beaver activity, or fire. These areas probably were important in sustaining populations of priority bird species, and they remain important today, especially in portions of Adirondack Park that are exempt from timber harvest. Other early successional habitats are created or maintained through the processes of agricultural abandonment and silviculture. The former takes place primarily on private lands at lower elevations, and is important for at least one priority species, the Golden-winged Warbler. Regenerating forests through silvicultural practices are an important component of the Adirondack landscape on extensive areas owned by private timber companies.

Associated priority species: GOLDEN-WINGED WARBLER, AMERICAN WOODCOCK, OLIVE-SIDED FLYCATCHER, Chestnut-sided Warbler, etc.

Chestnut-sided Warbler is by far the most abundant species in this suite, and its habitat requirements are the most general. This species is common in nearly any disturbed or successional forest, including stands up to xxx years old (refs). In contrast, Golden-winged Warbler is rare and probably has the most specific needs; shrubby habitats at lower elevations resulting from farmland abandonment or beaver activity. It was found in 25 atlas blocks during the period 1980-1985, scattered through the foothills completely surrounding the Adirondack Mts. and especially in the western Tug Hill region. It is not yet known whether this species will colonize clearcuts, beaver meadows, or other early successional habitats in this region.

American Woodcock was found breeding in 284 atlas blocks distributed rather uniformly within the physiographic area. The BBS indicates a significant, steep population decline, even with a small sample of six routes; the BBS does not adequately sample this largely nocturnal species. 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 (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 probably enhance habitat available for woodcocks, although a shift away from even-aged management (creating large areas of uniform shrub cover) may be detrimental to populations (Keppie and Whiting 1994).

Olive-sided Flycatcher is listed here as a forest-edge species, although it also occurs in mature coniferous forest with natural openings, such as peatlands. In the Adirondacks, this species was found in roughly 450 atlas blocks, primarily between 170 m and 840 m elevation. Primary habitats were described as "small boggy ponds, swampy ends of lakes, marshy streams, wet backwaters of rivers, quaking bogs, and old beaver meadows." (Peterson, in Andrle and Carroll 1988). A common element of these habitats was the presence of dead standing trees (snags), which the birds used as singing and feeding perches. This species was much more abundant following widespread clearing and burning of the Adirondack forests in the last century.

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 - 6.3 km² of available habitat; see 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 early successional and forest-edge habitat in the Adirondack Mountains physiographic area. Percent of Atlas blocks based on number of 5-km blocks in which the species was reported (out of roughly 1,000 blocks) during the New York State breeding bird Atlas (Andrle and Carroll 1988)

Species	BBS population	% Atlas blocks
Golden-winged Warbler	300	3
Chestnut-sided Warbler	121,000	80
American Woodcock	???	29
Olive-sided Flycatcher	570	45

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 ????? American Woodcocks throughout the physiographic area.

OBJECTIVE 3. Stabilize or reverse declining population trend for Olive-sided Flycatcher; maintaining long-term population of (600-1,000) breeding pairs.

Assumption: maintaining suitable habitat for Golden-winged Warbler, American Woodcock, and Olive-sided Flycatcher will be sufficient to support sustainable populations of most other birds in this habitat suite. Chestnut-sided Warbler should continue to be monitored, and if populations continue to decline, management objectives should be developed to maintain stable populations.

Implementation strategy: It is unlikely that Bird Conservation Areas (BCA) need to be established specifically for early successional species in this physiographic area. Rather the needs of these species will most likely be met outside of forest-based BCAs, where a variety of land-use processes will continue to generate suitable habitat. An exception might be at specific locations where populations of Golden-winged Warblers are established, and where management to enhance or sustain these populations are necessary and possible. In addition, protection of existing snags and policies directed at retaining standing dead trees after harvesting may favor Olive-sided Flycatcher.

Implementing objectives for birds of successional habitats will require working with private landowners as well as public land management agencies. In particular, management strategies for American Woodcock may be suitable for maintaining populations of other priority species. Elements of implementation could include:

- mapping and tracking of suitable disturbance regimes on public lands;
- partnership with private timber companies to map and track early successional stands;
- mapping and tracking beaver activity; monitor for associated priority birds;

- direct management of known Golden-winged Warbler breeding sites to maintain beaver activity or other disturbance level;
- snag retention and protection to enhance Olive-sided Flycatcher populations;
- integration of traditional woodcock and other game species management (especially Ruffed Grouse, deer) with songbird objectives.

Research and monitoring needs:

- determine range of suitable habitats and identify present breeding sites for Golden-winged Warbler in this region.
- 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
- determine possible causes of population declines of Olive-sided Flycatcher; explore management practices that might enhance populations of this species
- study impacts of human development on early successional bird species

Outreach: Information on the importance and conservation status of early successional bird species should be disseminated to private landowners, as well as NY DEC and Adirondack park Agency. In particular, outreach to private timber companies will be important for meeting habitat objectives for this habitat suite. In addition, outreach to farmers regarding the importance of overgrown fallow fields may be important in promoting the expansion of Golden-winged Warbler in this region.

D. Mature conifer (spruce-fir) forest

Importance and conservation status: Cool coniferous forests, dominated by balsam fir and red spruce, represent one of two major forest types (along with northern hardwoods) that occur in a mosaic throughout the planning unit. Largest continuous areas of coniferous forest exist at higher elevations on the slopes of the higher peaks, and in the Central Tug Hill Plateau region. Stands dominated by spruces or firs also occur as islands throughout the mixed and hardwood-dominated forests lower elevations, depending on drainage and disturbance regimes. Total area of this forest type is estimated as 192,400 ha., or roughly 8% of the physiographic area.

Coniferous (i.e. softwood) tree species are currently preferred for commercial timber production (pulp and paper) in this region, and large acreages of coniferous forest are under management for commercial forestry. Total area of coniferous forest has increased in the region as mature hardwood and mixed forests were initially logged and replaced by regenerating softwoods. Because of shorter rotation cycles, however, age-class distribution of conifer forest is favoring younger and more even-aged stands. Unlike the patchily distributed mountaintop communities, where protection of specific sites is critical, conservation strategies for mature coniferous forest will need to focus on maintenance of minimum percentages of the landscape mosaic to prevent local loss of this habitat type and its associated dependent species. This goal may best be achieved through cooperative agreements with large landowners.

Associated priority species: BAY-BREASTED WARBLER, BLACKBURNIAN WARBLER, SPRUCE GROUSE, Olive-sided flycatcher, Sharp-shinned Hawk.

Unlike in the vast Eastern Spruce-hardwood Forest physiographic area to the north, relatively few coniferous-forest species are high priority in the Adirondack Mountains, and these tend to be uncommon and locally distributed. Bay-breasted Warbler, although of the highest global priority in this species suite, is rare and sporadic as a breeder in the Adirondacks. It favors mature spruce forests, but has been found in planted Norway spruce plantations, and it may be more prevalent in years of spruce-budworm outbreaks. It was found in only 32 atlas blocks during the period 1980-1985. Blackburnian Warbler is much more abundant and may better represent the spruce-fir warbler community in terms of long-term population objectives. This species, along with Black-throated Green Warbler and Northern Parula, show stable population trends at present. Olive-sided Flycatcher, a species of natural openings and forest edges, is experiencing a mysterious and precipitous population decline in this region (as it is nearly throughout its range). It was found breeding in roughly 450 atlas blocks during the 1980-1985 period.

A disjunct community of boreal species (e.g. Gray Jay, Boreal Chickadee) is of high local interest, and these are best represented by the state-listed Spruce Grouse. Spruce Grouse....[cite DEC recovery plan]

Habitat and population objectives: Based on extrapolations from BBS relative abundances (assuming each route samples approximately 2.5 -6.3 km² of forest 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 mature conifer forest habitat in the Adirondack Mountains physiographic area. Percent of Atlas blocks based on number of 5-km blocks in which the species was reported (out of roughly 1,000 blocks) during the New York State breeding bird Atlas (Andrle and Carroll 1988)

Species	BBS population	% Atlas blocks
Bay-breasted Warbler	450	3
Blackburnian Warbler	52,300	80
Olive-sided Flycatcher	570	45
Spruce Grouse	175 - 315 ¹	3
Sharp-shinned Hawk	250	15

¹ estimate by SUNY ESF (J. Ross pers. com.)

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 for these estimates are averages across all BBS routes in the physiographic area, using data from 1990-1998.

OBJECTIVE 1. Maintain sustainable population of 50,000 - 55,000 Blackburnian Warblers (5-6 birds per BBS route; = 800 occupied atlas blocks). 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 (300-500?) Spruce Grouse, within natural population cycles. Maintain regional distribution in =30 atlas blocks.

Assumption: sufficient habitat for Spruce Grouse will also be sufficient for other boreal-conifer bird species.

OBJECTIVE 3. Stabilize or reverse declining population trends for Olive-sided Flycatcher, over next 20 years, returning to early BBS population level of (600-1,000) breeding individuals. Maintain regional distribution of 450-500 occupied atlas blocks.

Implementation strategy: The first step in implementing population objectives for coniferous-forest species in the Adirondacks is to determine the extent and distribution of available habitat, ownership patterns (private vs. state), and age-structure projections for lands in active timber production.

A process for identifying and designating Bird Conservation Areas (BCA) for priority species of coniferous forest is recommended (see under northern-hardwood forest, above). It may be possible or desirable to combine a BCA process for both forest types where species' requirements are overlapping (e.g. Blackburnian Warbler), or it may be preferable to designate separate BCAs for specialized boreal-conifer species such as Spruce Grouse.

One model strategy for conserving mature forest species is based on a forest management plan for the province of New Brunswick (New Brunswick Department of Resources and Energy 1995) -- ensure that a minimum of 10%-20% of sub-regional planning units (commercial licenses, townships, etc.) involved in timber production be maintained as mature or overmature coniferous forest. This value is derived from estimates of minimum areas required by viable populations of American marten and adequate wintering habitat for white-tailed deer, and is assumed to be adequate for populations of forest landbirds. For publicly owned lands that support coniferous forest, maintenance of considerably larger percentages of land area in mature or overmature age classes is desirable. [ADD STUFF]

Management recommendations: xxxx

Research and monitoring needs:

- complete inventory of Spruce Grouse populations and habitats; determine conservation status and threats (already started -- DEC report)
- 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.
- determine possible causes of population declines of Olive-sided Flycatcher; explore management practices that might enhance populations of this species

Outreach: xxxxxxxx

E. Grassland and agricultural land

Importance and conservation status: Natural grasslands were not a major feature of the presettlement landscape of the Adirondack Mountains, and it is unlikely that other natural openings, such as peatlands or lake margins, supported many grassland birds (except Savannah Sparrows, possibly Northern Harrier). Today, agricultural land represents a minor and declining feature of the landscape, especially at lower elevations and along the boundary with the St. Lawrence Plain (including Lake Champlain valley).

Overall, grassland birds are a relatively low priority in this physiographic area, other than maintaining overall bird species diversity in the region. 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. Along the edges of the St. Lawrence Plain, such efforts may be considered an extension of the important grassland bird objectives in that physiographic area (see Area 18 PIF bird conservation plan).

Associated priority species: BOBOLINK, UPLAND SANDPIPER, Northern Harrier, Vesper Sparrow. The Bobolink is a national Watch List species (Moderate priority), and thus all populations of this species may be considered important. The remaining species in this suite are all on New York's endangered, threatened and special concern list, highlighting the importance of grassland habitats statewide.

Habitat and population objectives: Based on extrapolations from BBS relative abundances (assuming each route samples approximately 6.3 - 25.1 km² of 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 conifer forest habitat in the Adirondack Mountains physiographic area. Percent of Atlas blocks based on number of 5-km blocks in which the species was reported (out of roughly 1,000 blocks) during the New York State breeding bird Atlas (Andrle and Carroll 1988)

Species	BBS population	% Atlas blocks	Local density
Bobolink	2,800	10	
Upland Sandpiper	50	2	
Northern Harrier	75	10	
Vesper Sparrow	60	5	

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 for these estimates are averages across all BBS routes in the physiographic area, using data from 1990-1998.

Bobolink is the most common and widespread species and also the least area-sensitive; the BBS shows a nonsignificant declining trend. Upland Sandpiper is probably the most specialized and area-sensitive species in the suite and most or all sites supporting this species would also support one or more of the other species.

OBJECTIVE 1: Maintain stable breeding population of 2,500 - 3,000 Bobolinks on lands in active agricultural production (including pastureland).

OBJECTIVE 2: Maintain existing population of 50 Upland Sandpipers, ensuring the long-term representation of the habitat-species suite in this region.

Implementation strategy: Meeting objectives for grassland birds in this region requires partnership with the agricultural community. This includes working with private farmers, the Farm Bureau, NRCS, Adirondack Land Trust Program, and Partners for Wildlife Program. The Adirondack Park Agency can also be involved when reviewing proposed developments on farmlands. Key elements in providing suitable habitats for priority grassland birds are the encouragement of delayed mowing practices and rotation of pastureland to ensure adequate areas for bird reproduction.

Research and monitoring: needs xxxxxxxx

Outreach: xxxxxxxx

F. Boreal peatlands

Importance and conservation status: xxxx

Associated priority species: SPRUCE GROUSE, Olive-sided Flycatcher, American Bittern?, (Palm Warbler, Lincoln's Sparrow, Rusty Blackbird).

Habitat and population objectives: xxxxxxxx

Implementation strategy: xxxxx

Research and monitoring needs:

- develop monitoring protocol for patchily distributed bird species in peatlands
- develop a method to remotely sense and locate optimum peatland habitats
- monitor "health" and succession of important peatland sites
- Study beaver activity, meadow succession, and their role in creating or maintaining peatlands

Outreach: xxxxxxxx

G. Freshwater wetlands

Importance and conservation status: xxxx

Associated priority species: AMERICAN BLACK DUCK, AMERICAN BITTERN, etc. As with the grassland habitat suite, most species are considered a priority because of their Watch List status (American Black Duck) or special concern listing in New York. Only American Bittern met the criteria for the priority species pool, based on its high relative abundance (hence high AI) and uncertain population trend. This habitat suite therefore represents continued nationwide concern for wetland habitats and their potentially vulnerable species, even though they do not rank highly using the global PIF prioritization system.

Habitat and population objectives: Based on extrapolations from BBS relative abundances (assuming each route samples approximately 6.3 - 25 km² of habitat for these species; 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 freshwater wetland habitats in the Adirondack Mountains physiographic area.

Species	BBS population	% Atlas blocks
American Black Duck	540	28
American Bittern	600	18
Northern Harrier	75+	10
Bald Eagle	??	1.6
Common Loon	400	33
Osprey	40+	18
Pied-billed Grebe	30	1.5

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 for these estimates are 30-year averages across all BBS routes in the physiographic area.

Implementation strategy: xxxxx

Research and monitoring needs:

- Monitor American Black Duck abundance and reproductive success
- Develop protocol for monitoring patchily distributed bird species in wetlands
- Determine microhabitat needs of priority bird species breeding in this habitat
- Map and monitor health of important wetland sites

Outreach: xxxxxxxx

LITERATURE CITED

Andrle, R. F., and J. R. Carroll. 1988. The Atlas of breeding birds in New York State. Cornell University Press, Ithaca, NY.

American Ornithologists Union. 1995. Fortieth supplement to the American Ornithologists Union checklist of North American birds. *Auk* 112:819-830.

Atwood, J. L., C. C. Rimmer, K. P. McFarland, S. H. Tsai, and L. R. Nagy. 1996. Distribution of Bicknell's Thrush in New England and New York. *Wilson Bull.* 108:650-661.

Bonney, R. E., D. Pashley, R. J. Cooper, and L. Niles (Eds.). Strategies for bird conservation: The Partners in Flight planning process. Cornell Lab of Ornithology.

Carter, M. F., W. C. Hunter, D. N. Pashley, and K. V. Rosenberg. (in press). Setting conservation priorities for landbirds in the United States: the partners in flight approach. *Auk*.

Commission on the Adirondacks in the 21st Century (1990). The Adirondack Park in the twenty-first century. 97 pp.

Emlen, J. T., and M. J. DeJong. 1981. The application of song detection threshold distance to census operations. Pp. 346-352 in Ralph, C. J., and J. M. Scott (Eds.), Estimating numbers of terrestrial birds. *Studies in Avian Biology* 6.

Erskine, A. J. 1992. Atlas of breeding birds of the Maritime Provinces. Nova Scotia Museum.

Evans, W. R. 1994. Nocturnal flight call of the Bicknell's Thrush. *Wilson Bull.* 106:55-61.

Keys, Jr., J., C. Carpenter, S. Hooks, F. Koenig, W.H. McNab, W. Russell, and M. L. Smith. 1995. Ecological units of the Eastern United States - first approximation, Atlanta, GA: U.S. Department of Agriculture, Forest Service.

Keppie, D. M. and R. M. Whiting, Jr. 1994. American Woodcock. *The Birds of North America*, No. 100. A. Poole and F. Gill Eds.

Finch, D. and P. Stangel (eds.). 1993. Status and management of Neotropical migratory birds. U.S.D.A. General Technical Report RM-229, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

Hunter, W. C., M. F. Carter, D. N. Pashley, and K. Barker. 1993. The Partners In Flight prioritization scheme. Pp. 109-119 in D. Finch and P. Stangel (eds.), Status and management of Neotropical migratory birds. U.S.D.A. General Technical Report RM-229, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

Lambeck, R. J. 1997. Focal species: a multi-species umbrella for nature conservation. *Conservation Biology* 11:849-856.

Miller-Weeks, M. and D. Smoronk. 1993. Aerial assessment of red spruce and balsam fir condition in the Adirondack region of New York, the Green Mountains of Vermont, the White

Mountains of New Hampshire, and the mountains of western Maine 1985-1986. Forest Service Northeastern Region. U.S. Department of Agriculture NA-TP-16-93.

New Brunswick Department of Natural Resources and Energy. 1995. Management of forest habitat in New Brunswick. Forest Habitat Program, Fish and Wildlife Branch, Fredericton, NB.

Ouellet, H. 1993. Bicknell's Thrush: taxonomic status and distribution. *Wilson Bull.* 105:545-572.

Peterson, R. T. 1980. A field guide to the birds. 4th Edition. Houghton Mifflin Co., Boston.

Rimmer, C. C., J. L. Atwood, K. P. McFarland, and L. R. Nagy. 1996. Population density, vocal behavior, and recommended survey methods for Bicknell's Thrush. *Wilson Bull.* 108:639-649.

Robbins, C. S., D. Bystrak, and P. H. Geissler. 1986. The Breeding Bird Survey: its first fifteen years, 1965-1979. U.S. Fish and Wildlife Service Resource Publication 157, Washington, D.C.

Rosenberg, K. V., and J. V. Wells. 1995. Final Report: importance of geographic areas to Neotropical migrants in the Northeast. Prepared for U.S. Fish and Wildlife Service, Region-5; July 1995.

Rosenberg, K. V. and J. V. Wells. (in press). Global perspectives on Neotropical migrant conservation in the Northeast: Long-term responsibility vs. immediate concern. *In* R. E. Bonney, D. Pashley, R. J. Cooper, and L. Niles (Eds.). *Strategies for bird conservation: The Partners in Flight planning process.* Cornell Lab of Ornithology.

Sauer, J. R., J. E. Hines, I. Thomas, J. Fallon, and G. Gough. 1999. The North American Breeding Bird Survey, Results and Analysis 1966 - 1998. Version 98.1, USGS Patuxent Wildlife Research Center, Laurel, MD

Smith, D. S. 1990. Forest Resources of the Adirondacks. Technical Report 20, Commission on the Adirondacks in the twenty-first Century. Pp.546-589.

Thompson 1966

U.S. Fish and Wildlife Service report. 1994. Status and biology of Bicknell's Thrush in the Northeastern U.S. Manomet Observatory for Conservation Sciences and Vermont Institute of Natural Science.

Wallace, G. H. 1939 Bicknell's Thrush, its taxonomy, distribution, and life history. *Proc. Boston Soc. Nat. Hist.* 41:211-402.

Wells, J. V. 1998. Important Bird Areas in New York State. National Audubon Society, New York.

Appendix 1: Ecological units and vegetation alliances

Appendix 1. Ecological Units and associated vegetation alliances within the Adirondack Mountain PIF planning unit (physiographic area 26). 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,

Subunit (state)	Description	Vegetation	Human use
M212Da (NY)	Adirondack Hills and Flats	RS-BF; SM-B-B; RS-BF swamp	F
M212Db (NY)	Western Adirondack Foothills	Oak-hickory-ash dry forest; SM-B-B	F
M212Dc (NY)	Adirondack Highlands and Lakes	SM-B-B; RS-BF; red spruce and cedar bogs	F
M212Dd (NY)	Central Adirondack Mountains	RS-BF; SM-B-B; alpine communities	F
M212De (NY)	Eastern Adirondack Low Mountains	SM-B-B; RS-BF; n. talus slope woodland	F
M212 Df (NY)	Adirondack Peaks	RS-BF; SM-B-B; alpine communities	F
M212 Fa (NY)	Tug Hill Plateau	SM-B-B; paper birch-red spruce transition forest; RS-BF	F
M212 Fb (NY)	Tug Hill Transition	SM-B-B; paper birch-red spruce transition forest; red cedar-white ash woodland	F,A

Appendix 2: Avifaunal analysis

[needs updated numbers from 1998 BBS analyses] In this section we provide additional details on the status of the roughly 176 species known to breed in the physiographic area. Global and area scores for all species from the PIF prioritization database (Carter et al. in press) are provided in Table A2.1.

Species can be 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

Table A2.2. Species with high proportions of their total population in Area-26. Percent of population calculated from percent of range area, weighted by BBS relative abundance (see Rosenberg and Wells 1999). Population trend from BBS data (% change per year from 1966-1998). Relative abundance is number of birds per BBS route from 1990 to 1998 (Sauer et al. 1999).

Species	% of pop.	rel. abund.	Pop. trend	N
Bicknell's Thrush	50?	?	?	0
Black-throated Blue Warbler	5.1	5.18	-0.7 ns	24
Blue-headed Vireo	3.6	8.54 a	3.7 0.00	21
Yellow-bellied Sapsucker	3.2	7.48 a	2.3 ns	23
Blackburnian Warbler	2.6	5.14 a	0.4 ns	22
Black-throated Green Warbler	1.8	7.20	0.8 ns	24
Chestnut-sided Warbler	1.7	11.92	-2.0 0.00	25
Veery	1.7	12.56	-2.7 0.00	25
Red-eyed Vireo	1.7	71.85 a	3.2 0.01	25
Wood Thrush	1.4	10.66	-3.9 0.00	25
Purple Finch	1.4	4.35 a	-0.9 ns	24
Brown Creeper	1.3	1.05	0.6 ns	18
Black-capped Chickadee	1.3	17.55	2.1 0.01	25
Canada Warbler	1.2	1.46 a	-5.1 0.00	23
American Redstart	1.2	11.16	-3.0 0.00	25
Broad-winged Hawk	1.2	0.31	7.8 ns	16
Ovenbird	1.2	24.06	1.4 ns	25
Scarlet Tanager	1.1	2.87	-3.2 0.00	25
Cedar Waxwing	1.1	16.23 a	-0.7 ns	25
Rose-breasted Grosbeak	1.0	3.80	-2.9 0.00	25

^a Relative abundance is the highest recorded for any physiographic area

greatest responsibility for the long-term maintenance of their populations (Rosenberg and Wells 1995, 1999). Because of the very small size of this planning unit, we consider a species to be of regional importance if = 1% of its population occurs in the unit (see Rosenberg and Wells 1995,

1999 for methods). Seven species occur in the highest relative abundance on BBS routes of any physiographic area in North America.

Declining species

Of the 20 species with =1% of their total population in the planning unit, 7 species have declined significantly ($P < 0.10$) since 1966 (Table A2.1). In addition the population trend for Bicknell's Thrush is unknown. 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.

Table A2.3. Species showing large or significant population declines within Physiographic Area 26, based on Breeding Bird Survey, 1966-1998 trends (N = 25 routes). BM = boreal-mountaintop forests; CF = conifer forests; HF = hardwood or mixed forests; ES = early successional; GR = grassland; W = wetlands; MA = maritime; UR = urban areas

Species	Trend (% per year)	N	Significance	Relative abundance	Primary habitat
Bay-breasted Warbler	-13.1	6	0.06	0.03	CF
Ruffed Grouse	-10.0 ^a	9	0.06	0.15	HF,ES?
Field Sparrow	-9.8	20	0.00	1.67	ES
Bank Swallow	-9.2	21	0.01	5.12	W, ES
Brown Thrasher	-8.0	20	0.00	1.18	ES
Olive-sided Flycatcher	-8.0	19	0.00	0.61	CF, edge
House Sparrow	-6.3	16	0.01	2.68	UR
American Woodcock	-6.0	6	0.09	0.11	ES
Savannah Sparrow	-5.8	16	0.01	2.35	GR
Ruby-crowned Kinglet	-5.7	14	0.10	0.33	CF
Chimney Swift	-5.3	20	0.00	1.36	UR
Canada Warbler	-5.1	23	0.00	2.39	HF
Eastern Towhee	-5.1	19	0.02	1.99	ES
Gray Catbird	-4.9	25	0.00	5.26	ES
Brown-headed Cowbird	-4.1	24	0.00	8.00	GR
Barn Swallow	-4.1	25	0.01	18.91	GR
Wood Thrush	-3.9	25	0.00	15.22	HF
Yellow-shafted Flicker	-3.8	25	0.03	2.38	HF, ES?
Cedar Waxwing	-3.8 ^a	22	0.01	19.07	ES, UR
Red-winged Blackbird	-3.4	25	0.00	29.30	GR, W
Eastern Wood-pewee	-3.4	23	0.01	2.53	HF
Baltimore Oriole	-3.3	21	0.01	1.72	HF, UR
Scarlet Tanager	-3.2	25	0.00	5.07	HF
Great Crested Flycatcher	-3.1	25	0.03	2.66	HF
American Redstart	-3.0	25	0.00	15.08	HF
Rose-breasted Grosbeak	-2.9	25	0.00	7.08	HF
Eastern Kingbird	-2.8	22	0.03	2.25	GR
Common Yellowthroat	-2.8	25	0.00	16.93	ES, W
Veery	-2.7	25	0.00	17.21	HF
American Goldfinch	-2.6	25	0.00	10.06	ES, UR
"Slate-colored" Junco	-2.4	22	0.03	5.85	ES

Song Sparrow	-2.4	25	0.00	12.56	ES
Black-throated Blue Warbler	-2.0 ^a	22	0.08	5.19	HF
Chestnut-sided Warbler	-2.0	25	0.01	15.59	ES
House Wren	-1.8	22	0.00	2.60	ES, UR

^a Significant decreasing 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 the Adirondack Mountains, 25 species show significantly increasing population trends (Table A2.3). A majority of these are species that have adapted particularly well to human activities or development. Species associated with human activities include those using bird feeders (e.g. Evening Grosbeak, Black-capped Chickadee), as well as those that breed in urban wetlands (e.g. Mallard). Several species, such as House Finch and Northern Cardinal have experienced widespread population increases throughout the Northeast. Another group of species that has benefited from human activities are those associated with conifer plantations; these include Hermit Thrush, Magnolia Warbler, Myrtle Warbler, and Winter Wren.

Table A2.3. Species showing large or significant population increases within Physiographic Area 28, based on Breeding Bird Survey, 1966-1996 trends (N = 25 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
Northern Cardinal	24.7 ^a	7	0.07	0.11	UR
House Finch	16.3	13	0.00	0.67	UR
Evening Grosbeak	11.7	19	0.01	1.95	CF
Common Raven	11.6	18	0.00	1.27	CF
Mourning Dove	10.0	20	0.00	2.20	ES,UR
Common Merganser	8.9	8	0.01	0.11	W
American Bittern	8.3	10	0.05	0.25	W
Pileated Woodpecker	7.3	18	0.00	0.77	HF
Hermit Thrush	6.3	25	0.00	9.25	CF
Great Blue Heron	6.0	14	0.03	0.27	W
Mallard	5.8	13	0.04	0.56	W, UR
Winter Wren	5.7 ^a	21	0.00	5.41	CF, HF
Ruby-throated Hummingbird	5.3	20	0.01	0.65	HF, UR
Yellow-bellied Flycatcher	5.3	9	0.10	0.18	CF
Yellow-bellied Sapsucker	4.3 ^a	21	0.05	6.95	HF, CF
Blue-headed Vireo	3.7	21	0.00	6.45	HF, CF
Alder Flycatcher	3.3	23	0.01	2.55	ES (W)
Red-eyed Vireo	3.2	25	0.01	63.92	HF
American Crow	3.1	25	0.00	15.30	ES, UR
Ovenbird	3.0 ^a	21	0.01	18.38	HF
Hairy Woodpecker	2.8	21	0.06	1.56	CF, HF
Yellow-rump. (Myrtle) Warbler	2.4	23	0.01	9.45	CF
Eastern Phoebe	2.1 ^a	22	0.07	3.74	ES, UR

Black-capped Chickadee	2.1	25	0.01	14.74	HF, UR
Magnolia Warbler	2.0	21	0.01	5.03	CF, 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, 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. in press). 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 (km²) 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:

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

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 km²). 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 km² 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 km²; for a species detected only out to a distance of 100 m, the BBS route surveys 1.6 km². 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 km². 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; i.e., 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 km². A