Partners in Flight
Bird Conservation Plan

Lower Great Lakes Plain

(Physiographic Area 15)

American Bird Conservancy

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Partners In Flight
Landbird Conservation Plan:

Physiographic Area 15:
Lower Great Lakes Plain

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Prepared by Randy Dettmers
USFWS, Region 5

And

Kenneth V. Rosenberg

Address comments to:
Kenneth V. Rosenberg
PIF Northeast Regional Coordinator
Cornell Lab of Ornithology
159 sapsucker Woods Rd.
Ithaca, NY 14850

607- 254-2412

kvr2@cornell.edu

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LOWER GREAT LAKES PLAIN (Physiographic Area 15)

EXECUTIVE SUMMARY

Area - 4,770,500 ha
Description - The Lower Great Lakes Plain covers the low-lying areas to the south of Lake Ontario in New York and to the north of Lake Erie in southernmost Ontario in Canada. In addition to important lakeshore habitats and associated wetlands, this region was originally covered with a mixture of oak-hickory, northern hardwood, and mixed-coniferous forests. The Carolinian Forest element in Ontario harbors ecological communities, including bird species, that are considered unique and rare in Canada. Unlike in most physiographic areas in the Northeast U.S., roughly 74% of the land area is in agricultural production. In addition, several medium-sized cities (Syracuse, Rochester, Buffalo, Windsor, etc) comprise over 800,000 acres of urban land, or 7.1% of the physiographic area. Several important National Wildlife Refuges, including Montezuma, protect critical wetlands and associated bottomland forests in New York, and Pt. Pelee National Park and several provincial parks are important areas in Ontario.
Priority bird populations and habitats -

Grasslands/agricultural -
Henslow's Sparrow -- Endangered status in Canada; steeply declining in New York; requires dense, unmowed pastureland.
Bobolink -- Abundant, yet declining; sensitive to early mowing of pastures and conversion to cropland.
Upland Sandpiper -- Area sensitive; Threatened status in New York.

Objective: roughly 160,000 ha of grassland habitat is required to support entire habitat-species suite (e.g. 140,000 pairs of Bobolinks); of this, 10,000 ha should be maintained in patches large enough to support 800 pairs of Upland Sandpipers, and 800 ha should be managed specifically to support 400 pairs of Henslow's Sparrows.

Scrub-shrub -
Golden-winged Warbler -- Declining precipitously due to expanding Blue-winged Warblers and forest regeneration.
American Woodcock -- Shows steep population declines; requires combination of forest clearings, second-growth hardwoods, and moist soils for foraging.

Objective: Roughly 40,000 ha of shrub habitat is required to maintain the entire habitat-species suite (e.g., 60,600 pairs of Field Sparrow); of this, 12,000 ha of should be maintained in a condition suitable to support 3,000 pairs of Golden-winged Warblers.

Hardwood forest -
Cerulean Warbler -- Small but regionally important population, especially in Canada
Red-headed Woodpecker -- Declining nearly throughout its range; this is one of the few areas where this species persists in the Northeast

Objective: Roughly 375,000 ha of deciduous forest is required to support entire habitat-species suite (e.g. 113,000 Wood Thrush pairs); at least 1,500 ha should be protected or managed to support 1,200-1,500 pairs of Cerulean Warblers.

Conservation issues and recommendations -
Changing agricultural practices and urbanization are major conservation issues in this region. In particular, decline of dairy farming and conversion to cropland is detrimental to important grassland species such as Henslow's Sparrow. Agricultural abandonment may temporarily favor shrub-nesting species, such as Golden-winged Warbler, but increasingly agricultural land is being lost to urbanization. In addition, whereas this region was a stronghold for Golden-winged Warblers in recent decades, rapidly expanding Blue-winged Warblers have largely pushed the Golden-wingeds further to the north.

Remaining forest tracts in this area are extremely valuable to Cerulean Warblers, which also have expanded into the region in recent decades. Many of these forests are associated with wetland systems along the Erie Canal system or Great Lakes shorelines. In Canada, the Carolinian forest is a high national conservation priority. This physiographic area also is extremely important to stopover migrants, attracting some of the largest concentrations of migrant passerines, hawks, shorebirds, and waterbirds in eastern North America. Much of these concentrations are along threatened lakeshore habitats.

Specific conservation needs in this physiographic area include:

- intensive survey and monitoring for high-priority species to identify most important areas in need of protection;
- increased protection of forest and lakeshore habitats critical to Cerulean Warblers and migrant passerines;
- increased management on protected and private lands to provide habitat for Henslow's Sparrow and Golden-winged Warbler;
- integration of land bird population and habitat objectives with those for wetland species and game species such as American Woodcock.

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INTRODUCTION

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

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

A. Goal

The goal of each PIF Bird Conservation Plan is to ensure long-term maintenance of healthy populations of native landbirds. This document was prepared to facilitate that goal by stimulating a proactive approach to landbird conservation. The conservation plan primary addresses nongame landbirds, which have been vastly underrepresented in conservation efforts, and many of which are exhibiting significant declines that may be arrested or reversed if appropriate management actions are taken. The 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.

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

SECTION 1: THE PLANNING UNIT

A. Physical Features

The Lower Great Lakes Plain physiographic area is a relatively small planning unit, with a total area under consideration of roughly 47,700 square kilometers. This planning unit covers the low-lying areas to the south of Lake Ontario in New York and to the north of Lake Erie in southernmost Ontario in Canada (Fig. 1). In addition to important lakeshore habitats and associated wetlands, this region was originally covered with a mixture of oak-hickory, northern hardwood, and mixed-coniferous forests. The Carolinian Forest element in Ontario harbors ecological communities, including bird species, that are considered unique and rare in Canada. Unlike in most physiographic areas in the Northeast U.S., roughly 74% of the land area is in agricultural production. In addition, several medium-sized cities (Syracuse, Rochester, Buffalo, Windsor, etc) comprise over 800,000 acres of urban land, or 7.1% of the physiographic area. Several important National Wildlife Refuges, including Montezuma and Iroquois NWRs, protect critical wetlands and associated bottomland forests in New York, and Pt. Pelee National Park and several provincial parks are important areas in Ontario.

The Lower Great Lakes Plain, physiographic area 15, covering 4,770,500 ha (11,787,905 ac) across the state of New York and the province of Ontario.

Funding for the preparation of this map was provided by the National Fish and Wildlife Foundation, through a challenge grant to The Nature Conservancy, Wings of the Americas program. Matching funds for this grant were donated by Canon U.S.A., Inc.

Fig. 1.

B. Potential Vegetation

Historically, the U.S. portion of the planning unit was dominated by either northern hardwood forest or dry oak-hickory-ash forest. The Eastern Ontario Lake Plain sustained several unique vegetation types for the region, including northern white cedar forest and alvar grassland. Other nonforest alliances in the region included black oak-white oak woodland, chinquapin oak woodland, white cedar limestone woodland, and inland salt marsh (Appendix 1). Austen et al. (1994) describe pre-settlement vegetation in southern Ontario as mostly forested with much of it in an old-growth condition. The Carolinean area was dominated by deciduous forest with cedar and tamarack swamps in some of the low-lying areas. A more northern mix of tree species, including some conifers would have been present closer to the boundary of the Canadian Shield.

C. Natural Disturbances

Lorimer (1989, as cited in Austen et al. 1994) suggested that prior to settlement in southern Ontario, large-scale disturbances were relatively rare, with an estimated 1000 years between events that would destroy a given forest stand. With relatively little of the natural vegetation remains in this region, effects of natural disturbance processes are dwarfed by human-induced disturbance and change. Lightning caused fires are the most common disturbance, especially in areas with sandy soils and dry litter accumulation (Ricketts et al. 1999).

D. History and Land Use

The New York portion of the Lower Great Lakes Plain was not extensively settled by Europeans until after the American Revolution. Initial colonization was during the 1790s. A similar time frame for settlement probably applies for southern Ontario. The region was found to have large areas of productive farmland, and clearing of the pre-settlement forests generally took place during the first half of the 19th century. Forests were cleared both for agricultural purposes and for fuel wood. By the end of the 19th century, less than 20% of the original forest remained in many of the landscapes within this region (Zipperer et al. 1990). In many portions of southern Ontario and northwestern New York, forest cover remains very low (< 25%) today with agriculture and/or urban areas dominating these landscapes. However, forest cover has increased since the beginning of the 20th century in some areas, including the area north of the Carolinian Forest and south of the Canadian Shield in Ontario and the northeastern portion of this planning unit toward central New York. In 1990, forest cover in Onondaga County, New York, was estimated at about 35%. The city of Syracuse lies within this county, and it was also estimated that the existing forest cover was fragmented into more than 3,000 forest islands within the county (Zipperer et al. 1990). Wetland habitats experiences similar amounts of loss during the period of settlement and high agricultural land use. Thibault and Zipperer (1994) estimated that by 1926, the landscape around Syracuse was 80% agricultural, with the remaining 20% either in forest or wetland cover. Also similar to forest cover, wetland cover has increased during the past century in some portions of the planning area where agricultural land use has diminished. Thibault and Zipperer (1994) found that 50% of the wetlands that existed in 1964 were new compared to 1926, and another 32% of wetlands were new in 1988. These increasing amounts of forest and wetland cover in some portions of the Lower Great Lakes Plain are a result of the poorer agricultural value of the land and the resulting farm abandonment. A general shift away from intensive farming to more hobby farming and more urban/suburban land uses also contributes to these trends.

SECTION 2: PRIORITY BIRD SPECIES

A. General avifauna

Roughly 177 bird species have been documented as breeding within physiographic area 15 (Peterson 1980, various atlases). The landbird avifauna is typical of northern portions of North America, but includes many species that have the center of abundance in the Midwest. 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 quite distinct from other northeastern

physiographic areas. From a global perspective, this region (along with adjacent area 16) ranked high in terms of immediate conservation concern, based on relatively high atlas-block concentrations of Henslow's Sparrow, Golden-winged Warbler, and Cerulean Warbler (Rosenberg and Wells 1995).

Nine species (or widespread subspecies) were estimated to have $\geq$ 2% of their total population breeding in the planning unit (Appendix 2), indicating a disproportionately large breeding population in this small area (Appendix 3). In addition, many common species (e.g. American Goldfinch, Song Sparrow, Bank Swallow) occur here in higher relative abundance than in any other North American physiographic area.

Our primary measure of population trend at present is the Breeding Bird Survey (BBS), which provides data on 127 of the 177 species breeding within Area 15. For many species in this region, however, especially those of freshwater wetlands, 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 these trend.

Among the 27 declining species in this physiographic area (Appendix 2), the most precipitous declines are shown by species of grassland and freshwater marsh habitats (especially Henlsow's Sparrow, American Black Duck). Moderate declines are seen in species of other early successional habitats, including urban areas. Among the few species that can be considered forest birds, Black-billed Cuckoo is showing a particularly steep decline. Other forest-breeding species that are considered high priories throughout the Northeast (e.g. Wood Thrush, Eastern Wood-Pewee) have stable populations in this area. Although the grassland and early successional species that appear on this list are mostly not of high regional importance (relative to other regions of North America), many occur in the Lower Great Lakes Plain in higher abundance than in most other northeastern physiographic areas. Therefore, opportunities for conserving populations of these species are also high in this area, elevating their priority status for conservation action.

In contrast, 27 species show increasing population trends (Appendix 2), same as the number of species that are declining. A majority of these fall in two categories, either species associated with regenerating and mature forests (Pileated Woodpecker, Hairy Woodpecker, and Red-eyed Vireo), or species that have adapted particularly well to human activities or development such as those using bird feeders or nest boxes, as well as those that breed in urban wetlands. Several species, such as House Finch, Northern Mockingbird, and Tufted Titmouse have experienced widespread population increases throughout the Northeast. In addition, the phenomenal regional increase in Eastern Bluebirds is a direct result of conservation efforts over the last several decades.

B. Priority species pool

From among the breeding avifauna, a pool of species may be derived that represents priorities for conservation action within the physiographic area (Table 2.1). Note that a species may be considered a priority for several reasons, including global threats to the species, high concern for

regional or local populations, or responsibility for conserving large or important populations of the species. The different reasons for priority status are represented by categories or tiers in Table 2.1. Our primary means of identifying priority species is through the PIF species assessment process (Hunter et al. 1993, Carter et al. 2000) using scores generated by Rocky Mountain Bird Observatory. 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 Lower Great Lakes Plain region may be found at: <http://www.rmbo.org/pif/pifdb.html>.

Note: The parameter scores for all physiographic areas in the Northeast were updated in August 2003 to reflect and be consistent with methods used in the *PIF North American Landbird Conservation Plan* (Rich et al. 2004). The priority species pool presented below reflects these updated scores and a revised set of entry levels (i.e., Tiers). If you note changes in the priority species pool or individual scores from a previous version of this plan or those found at <http://www.rmbo.org/pif/pifdb.html>, they are likely due to the process of updating scores and entry levels to reflect the North American Plan.

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

Tier I. *High Continental Priority.* -- Species on the *PIF Continental Watch List* (Rich et al. 2004), which are typically of conservation concern throughout their range. These are species showing high vulnerability in a number of factors, expressed as any combination of high global parameter scores, with AI ≥ 2 (so that species without manageable populations in the region are omitted). High level conservation attention warranted.

> Tier IA. *High Continental Concern + High Regional Responsibility*. Species for which this region shares in major conservation responsibility; i.e., conservation in this region is critical to the overall health of this species. These species are on the *PIF Continental Watch List* with AI of 3 – 5 for this region, or a high percent population (above threshold in IIB).
>
> Tier IB. *High Continental Concern + Low Regional Responsibility*. Species for which this region can contribute to rangewide conservation objectives where the species occurs. Species on the *PIF Continental Watch List* with AI of 2 for this region.

Tier II. *High Regional Priority*. Species that are of moderate continental priority (not on *Continental Watch List)*, but are important to consider for conservation within a region because of various combinations of high parameter scores, as defined below; total of 7 parameter scores = ≥ 19.

> Tier IIA. *High Regional Concern*. Species that are experiencing declines in the core of their range and that require immediate conservation action to reverse or stabilize trends.

These are species with a combination of high area importance and declining (or unknown) population trend; total of 7 parameters ≥ 19, with AI + PT ≥ 8.

Tier IIB. *High Regional Responsibility*. Species for which this region shares in the responsibility for long-term conservation, even if they are not currently declining or threatened. These are species of moderate overall priority with a disproportionately high percentage of their total population in the region; total of 7 parameters ≥ 19, with AI = 5 or % population > threshold (see Appendix 3).

Tier IIC. *High Regional Threats*. Species of moderate overall priority that are uncommon in a region and whose remaining populations are threatened, usually because of extreme threats to sensitive habitats. These are species with high breeding threats scores within the region (or in combination with high nonbreeding threats outside the region); total of 7 parameters ≥ 19 with TB + TN > 6, or local TB or TN = 5.

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

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

Tier V. *Additional Stewardship Responsibility*. Representative or characteristic species for which the region supports a disproportionately high percentage of the world population (see Appendix), but which did not meet any of the above criteria. Includes moderate- and low-scoring species for which the region has long-term stewardship responsibility, even if these species are not of immediate conservation concern.

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

Table 2.1 Priority breeding-species pool for Area 15. PIF regional and global scores from the PIF Species Assessment Database housed at Rocky Mountain Bird Observatory (Carter et al., 2000). Percent of population calculated from percent of range area, weighted by BBS relative abundance (see Rosenberg and Wells, 1999; Appendix 3). See text for definition and interpretation of entry levels. AI = Area Importance; PT = Population Trend. Species with AI = 1 are not included in this table as such a score indicates a peripheral population without manageable numbers in this area. Local status categories include species with breeding populations only (B) or species with at least part of the population found in the area year-round (R). Species that are federally or state listed are noted on the Priority Species Pool by country and/or state using the following codes: E = Endangered, T = Threatened, SC = Special Concern.

Entry level	Species	Total score	% of pop.	AI	PT	Local status
IA. *High Continental Concern + High Regional Responsibility*						
	American Woodcock	23	< 1	3	5	B
	Willow Flycatcher	20	?	5	3	B
	Wood Thrush	19	1.4	3	2	B
IB. *High Continental Concern + Low Regional Responsibility*						
	Henslow's Sparrow (CAN-E, NY-T)	27	< 1	2	5	B
	Golden-winged Warbler (NY-SC)	26	< 1	2	5	B
	Cerulean Warbler (CAN,NY-SC)	24	< 1	2	3	B
	Prothonotary Warbler (CAN-E)	22	< 1	2	3	B
	Upland Sandpiper (NY-T)	21	< 1	2	3	B
	Red-headed Woodpecker (CAN,NY-SC)	21	< 1	2	5	R
	American Black Duck	21	< 1	2	4	R
	King Rail (CAN-E, NY-T)	21	< 1	2	3	B
	Canada Warbler	20	< 1	2	3	B
	Short-eared Owl (CAN-SC, NY-E)	20	< 1	2	3	R
	Blue-winged Warbler	19	1.3	2	1	B
IIA. *High Regional Concern*						
	Bobolink	21	3.2	5	4	B
	Black-billed cuckoo	21	1.0	4	5	B
	Baltimore Oriole	19	2.5	5	3	B
	Field Sparrow	19	< 1	3	5	B
IIC. *High Regional Threats*						
	Louisiana Waterthrush (CAN-SC)	21	< 1	2	3	B
	Sedge Wren (NY-T)	20	< 1	2	3	B
	Loggerhead Shrike (CAN,NY-E)	20	< 1	2	5	B
III. *Additional Federally Listed*						
	Acadian Flycatcher (CAN-E)	20	< 1	2	3	B
	Hooded Warbler (CAN-T)	20	< 1	2	3	B
	Yellow-breasted Chat (CAN,NY-SC)	18	< 1	2	5	B
	Bald Eagle (US,NY-T; ON-E)	18	< 1	2	3	R
	Northern Bobwhite (CAN-E)	18	< 1	2	3	R
	Least Bittern (CAN,NY-T)	18	< 1	2	3	B
	Red-shouldered Hawk (CAN,NY-SC)	17	< 1	2	3	B
	Northern Goshawk (CAN-T, NY-SC)	17	< 1	2	3	R
	Barn Owl (CAN-SC)	16	< 1	2	3	R
VI. *Additional State/Provincial Listed*						
	Whip-poor-will (NY-SC)	19	< 1	2	3	B
	American Bittern (NY-SC)	19	< 1	2	4	B

Sharp-shinned Hawk (NY-SC)	18	< 1	5	3	R
Grasshopper Sparrow (NY-SC)	18	< 1	2	5	B
Black Tern (NY-E)	18	< 1	2	3	B
Northern Harrier (NY-T)	18	< 1	3	3	R
Vesper Sparrow (NY-SC)	17	< 1	3	4	B
Common Tern (NY-T)	18	1.3	5	3	B
Cooper's Hawk (NY-SC)	16	< 1	3	3	R
Pied-billed Grebe (NY-T)	16	< 1	2	3	B
Osprey (NY-SC)	15	< 1	2	3	B
Common Nighthawk (NY-SC)	15	< 1	2	3	B
Horned Lark (NY-SC)	12	< 1	2	2	R

Ten species on the PIF continental Watch List (Rich et al. 2004) have manageable populations within this planning unit (Table 2.1); these species are considered to be of high overall concern throughout their range. Four additional species considered to be high priorities by other bird conservation initiatives (American Woodcock, American Black Duck, Upland Sandpiper, King Rail) meet the same PIF watch list criteria. Of these 14 species, 3 have populations large enough for this area to be considered significant to their overall conservation, whereas an additional 11 species have smaller, more patchily distributed populations. Of these species, Henslow's Sparrow and Golden-winged Warbler received the highest scores in this planning unit. American Woodcock is the highest scoring of the continental priority species for which this planning unit has a high responsibility for conservation. The set of high continental concern species in this planning unit represent the full spectrum of habitats including grassland, shrubland, mature forest, and wetland. This reflects the highly human-altered nature of land cover types in this unit, which has been greatly influenced by agricultural practices for the past 200 years.

Seven additional species are considered to be of high regional importance. The 4 species in Tier IIA show a combination of high area importance and declining populations in the physiographic area. These are common species of grassland, shrubland and disturbed forest habitats. No species are identified as Tier IIB species. Tier IIC contains 3 additional species that are threatened within the physiographic area; all of these species have small breeding populations in the planning unit. These 3 species highlight the need to protect sensitive and threatened grasslands and riparian forest habitat in this planning unit.

Nine additional species are federally listed, with all but one of these species (Bald Eagle) coming from the Canadian federal list of Species at Risk. All of these species have very limited breeding populations in this planning unit.

Thirteen additional species are listed in the State of New York as endangered, threatened, or special concern. A majority of these state-listed species have small and locally-occurring breeding populations in this physiographic area. This tier primarily reflects concerns about threats to freshwater wetland habitats, but also early successional habitats and raptor species.

The overall priority pool of 43 species (25% of the breeding avifauna) is dominated by common forest-breeding and early-successional (grasslands and shrubland) species. Considering all

priority categories, the species of highest conservation concern include Henslow's Sparrow, Golden-winged Warbler, American Woodcock, and Cerulean Warbler. These may represent focal species that, along with more widespread and abundant species sharing the same habitats, help define conservation actions in their respective habitats (see Section 4). Regional concern for freshwater wetlands is also apparent from the appearance of numerous wetland-associated federal- and state-listed species.

SECTION 3: BIRD CONSERVATION ISSUES AND OPPORTUNITIES

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

Most of the Northeast region has undergone major changes in forest cover during the past two centuries, due to logging, clearing for agriculture, and in many places widespread recent reforestation. Therefore, 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. Early successional (especially grassland) birds have arguably been shown to be part of the original avifauna in many parts of the Northeast, and therefore worthy of conservation concern (Wells and Rosenberg 1999). As indicated by the avifaunal analysis above, many grassland species occur in higher abundances in the Lower Great Lakes Plain than in other physiographic areas of the Northeast. Although originally forested, this region has been dominated by agricultural production for about 200 years and today represents a largest area of agricultural grassland habitat in eastern Canada and the northeastern U.S. Therefore, unlike in most other parts of the region, grassland habitats and associated species may be of higher conservation priority than adjacent forested habitats and species.

In addition, early-successional shrub habitats that support populations of Golden-winged Warbler and American Woodcock must be considered a high priority within this physiographic area.

In this region, overlap exists between conservation goals for waterfowl and other nongame wetland birds, as well as the landbird species that are the primary focus of this plan. For example, regionally important populations of American Bittern and Northern Harrier use wetter portions within the grassland matrix, as well as emergent freshwater marshes. In addition, Golden-winged Warblers use wetland-shrub habitats. Finally, many of the wooded or forested habitats remaining in the are woodland swamps or riparian groves. The value of these forested wetlands for regionally important forest birds (e.g. Cerulean Warbler, Black-billed Cuckoo, Wood Thrush) should be recognized, and areas managed as forest can enhance breeding opportunities for these species.

B. Regional economics of agricultural production

Maintenance of productive grassland and wetland habitats is dependent on continuation of economically viable agricultural processes throughout the region. Current trends are towards

farmland abandonment, consolidation of farms into larger, more intensive operations, and increased acres planted to row crops. Further economic pressures include urban and other development at the expense of traditional farming practices, as is occurring nationally. These trends have resulted in increased old-field and shrub habitats and fragmentation of large grassland habitats. Continuation of these processes without active conservation planning may result in the loss of the area's value to grassland and open- wetland birds.

An overall bird conservation plan for this physiographic area should be compatible with economically viable agriculture and should include, where possible, incentives for continuation of active, private farming while providing maximum possible wildlife habitat. In this region, incentives for promotion of traditional (i.e. late) mowing schedules are particularly important, as well as practical. In New York, conversion of dairy farmland to hunting camps and hobby farms has served to maintain local economies as well as a grassland-dominated landscape.

Economic conditions and opportunities for incentive programs vary among different portions of the planning unit, and certainly vary between Canada and the U.S. In forested habitats, some similar options may be available to promote land uses that are compatible with priority bird-habitat needs. For example, in Ontario, Cerulean Warbler productivity is high in forests managed for maple syrup production (Jason Jones, in litt.)

C. Urbanization and habitat fragmentation

In portions of the Lower Great Lakes Plain, urban development, rather than farmland abandonment represents the largest threat to agricultural grassland and wetland habitats. Urbanization affects these habitats in two related ways -- direct loss through development, and rising economic pressures in surrounding areas that force private farmers to sell land to developers. These pressures are particularly acute in Canada, near major metropolitan areas of Toronto, Kingston, and Ottawa, and in New York, near Rochester, Syracuse, and Buffalo.

In areas affected by urbanization, fragmentation of large grassland habitats is a major factor. In these areas, establishment of core areas should be a priority to consolidate the best remaining habitats and minimize further fragmentation. Protection of riverine wetlands from industrial development is also a high priority, especially as stopover habitat for waterfowl and other wetland species. Growth of trees in urban areas has benefited certain woodland species and has undoubtedly improved habitat conditions as stopover for migrating passerines (relative to the recent past).

D. Integration of U.S. and Canadian planning efforts

Coordination of U.S. and Canadian conservation planning has just begun in the Northeast region. Because of the large portions of the planning unit within Canada, such coordinated efforts are vital for the success of any conservation plan.

E. Bird conservation opportunities and solutions

A strategy that uses existing federal programs such as Partners for Wildlife (USFWS) and provisions of the Farm Bill (NRCS) to promote traditional, economically viable farming while maximizing benefits to wildlife holds great promise. Many of these initiatives are already operating in western New York and are helping to create higher quality habitat for many birds, especially grassland and wetland species, in areas previously tied up in intensive agriculture.

It is perhaps fortuitous that as agricultural grassland reverts to old-field and shrub-scrub habitats, a second suite of high-priority bird species is benefited. In areas where farmland abandonment has already taken place, or is inevitable, regenerating habitats must be maintained in early shrub stages through active management to support Golden-winged Warblers and American Woodcock. State owned Wildlife Management Areas and federal refuges may play a large role in managing these habitats, many of which are also suitable as seasonal wetlands. Throughout the planning unit, a balance should be maintained between agricultural grassland and shrub habitats, taking advantage of local economic forces and land-ownership patterns. In both cases, largescale reversion to forest is not desirable.

To maximize the effectiveness of bird conservation strategies, we must focus on specific areas that are both most important for high-priority bird populations and have the greatest potential for management or protection. Identification of *Important Bird Areas* in the planning unit has recently begun, at least in New York (Wells 1998). Within the NY portion of the Lower Great Lakes Plain, twenty IBAs have been selected, primarily on the basis of documented populations of important grassland, wetland, and forest species. The NY IBA program is dedicated to developing sound conservation strategies for these sites, in cooperation with local landowner needs and existing programs such as Partners in Wildlife. Recent state legislation has recognized IBAs and has dedicated funds for state management and acquisition of important sites.

SECTION 4: PRIORITY HABITATS AND SUITES OF SPECIES

When species in the priority pool 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 grassland, shrub, forest, and wetland habitats. Given the current land-use of the region, and preponderance of high priority species with declining population trends (including Henslow's Sparrow, Upland Sandpiper, and Bobolink), agricultural grasslands constitute the habitat of highest conservation priority in the Lower Great Lakes Plain. The high continental concern for Golden-winged Warblers and significantly declining population of American Woodcock make shrub and early successional habitats another high priority. Similarly, high local densities of Cerulean Warblers in portions of the physiographic area and a relatively large proportion of the Baltimore Oriole population highlight the need to focus conservation attention on remnant and regenerating riparian-deciduous woodlands in areas that currently support these and 10 other high priority species. Other forest habitats (including northern hardwoods), although supporting a suite of regionally high-priority species, are of lower priority

than in other northeastern physiographic areas. Finally, the existing emphasis on waterfowl habitats (e.g., for American Black Duck), as well as the presence of several other wetland species on state, provincial, and local concern lists, make freshwater wetlands and their relationship to local agricultural a key conservation concern.

Table 4.1. Priority habitat-species suites for Area 15 (Lower Great Lakes Plain). TB (threats breeding), AI (area importance), PT (population trend) and Combined Score from RMBO prioritization database (Carter et al.2000), as updated for the Northeast (see note above in Sect. 2.B.). The focal species for each habitat are in bold type. Species are sorted within habitat types according to action level and then combined score. Scale of Concern indicates whether a species is of continental (C) or regional (R) concern. State-listed species are not included in this analysis because they may not be of concern in all states within a region.

Habitat	Common Name	Scale of Concern	Action Level [a]	Combined Score	TB	AI	PT
Agricultural grassland							
	Henslow's Sparrow	C	IM, MO	27	4	2	5
	Loggerhead Shrike	R	IM, MO	20	5	2	5
	Upland Sandpiper	C	MA, MO	21	4	2	3
	Bobolink	R	MA	21	3	5	4
	Short-eared Owl	C	MA, MO	20	4	2	3
	Sedge Wren	R	MA, MO	20	4	2	3
	Barn Owl	R	PR, MO	16	3	2	3
Shrub-early successional							
	Golden-winged Warbler	C	IM	26	4	2	5
	American Woodcock	C	MA	23	3	3	5
	Willow Flycatcher	C	MA	20	2	5	3
	Field Sparrow	R	MA	19	3	3	5
	Northern Bobwhite	R	MA	18	4	2	3
	Yellow-breasted Chat	R	MA	18	3	2	5
	Blue-winged Warbler	C	PR	19	2	2	1
Riparian-deciduous (Carolinean) forest							
	Cerulean Warbler	C	MA	24	4	2	3
	Red-headed Woodpecker	C	MA	21	4	2	5
	Prothonotary Warbler	C	PR	22	3	2	3
	Black-billed Cuckoo	R	PR	21	2	4	5
	Louisiana Waterthrush	R	PR	21	3	2	3
	Acadian Flycatcher	R	PR	20	3	2	3
	Hooded Warbler	R	PR	20	3	2	3
	Wood Thrush	C	PR	19	2	3	2
	Baltimore Oriole	R	PR	19	2	5	3
	Red-shouldered Hawk	R	PR, MO	17	3	2	3

Northern hardwood-mixed forest						
Black-billed Cuckoo	R	PR	21	2	4	5
Canada Warbler	C	PR	20	3	2	3
Wood Thrush	C	PR	19	2	3	2
Northern Goshawk	R	PR, MO	17	3	2	3
Freshwater wetland						
American Black Duck	C	MA	21	3	2	4
King Rail	C	MA	21	4	2	3
Bald Eagle	R	PR	18	3	2	3
Least Bittern	R	PR, MO	18	3	2	3

[a] Action levels: IM = immediate management or policy needed to prevent regional extirpation; MA = management or other actions needed to reverse or stabilize declining populations or reduce threats (TB + PT ≥ 7 or =6 if continental action level=MA); PR = long-term planning to ensure stable populations (TB + PT < 7); MO = additional monitoring needed to better understand status or population trends.

A. Agricultural Grassland

Importance and conservation status: The suite of species associated with this habitat type has experienced one of the most widespread and persistent population declines of any bird group in North America (Askins 1993). Until recently, concern about grassland birds in the northeastern U.S. has been minimal because of the perception that grasslands were not a significant component in the well-forested landscape of eastern North America prior to European settlement. However, more recent reviews of the evidence suggest that open grasslands existed in the Northeast well before European settlers cleared the forests and that grassland-associated birds have long been a component of the avian diversity of the Northeast (Marks 1983, Askins 1993, 1999). Circumstantial evidence is provided by distinctive eastern subspecies or populations of Henslow's Sparrow, Savannah Sparrow, and Greater Prairie Chicken (the now-extinct Heath Hen). As indicated above, this physiographic area is an agriculture-dominated region, with over 70% in some form of agricultural land use and a history of nearly 200 years of forest clearing and open landscapes conducive to grassland-associated species. Although it is unclear what their historical status was in this planning unit prior to European settlement, three species of high continental concern maintain populations in this physiographic area, including a disproportionately high population of Bobolink for the size of this planning unit. Therefore, unlike the majority of northeastern physiographic areas where forest habitats remain highest priority, this plan recognizes agricultural grasslands as the most important habitat in the Lower Great Lakes Plain.

While the northeastern U.S. does not support large proportions of the total breeding populations of most grassland birds, Wells and Rosenberg (1999) recognized the potential importance of significant genetic diversity represented by distinctive subspecies in the Northeast. With large percentages (50-100%) of the total breeding populations of some of these subspecies (eastern Henslow's Sparrow and Savannah Sparrow) and substantial portions (10-15%) of others (eastern

Grasshopper Sparrow and Eastern Meadowlark) occurring in the Northeast region (Wells and Rosenberg 1999), conserving these populations within the physiographic areas where they exist will be a sound biological means of maintaining potentially significant genetic diversity for these species.

The future of grassland bird habitats in this area is dependent on global economic factors affecting traditional farming practices. Specific threats to productive grasslands include farmland abandonment, conversion to intensive farming practices that promote early haying practices, and urban development. Programs and incentives that promote traditional haying, such as the establishment of native, warm season grasses (although dense stands of switchgrass should be avoided), reclaiming of abandoned or marginal farmland, and encouragement of hobby farming have the greatest potential for grassland bird conservation.

Numerous federal and state natural resource agencies have been supporting creation of grassland habitat in the northeastern U.S. The U.S. Fish and Wildlife Service (FWS) is establishing grasslands on National Wildlife Refuges (NWRs). Federal programs for private landowners provide financial incentives to convert agricultural lands to permanent vegetative cover, to restore grassland wildlife populations and reduce nutrient loads to aquatic habitats. FWS establishes private grasslands through the Partners for Fish and Wildlife Program. Large quantities of private grassland habitats are also being created by the USDA Natural Resources Conservation Service (NRCS) under the Conservation Reserve Program (CRP) and the Wildlife Habitat Incentives Program (WHIP).

In the northeastern U.S. (FWS Region 5) and Canada, NRCS, in cooperation with DU Canada, has invested considerable resources in developing grassland establishment and management guidelines (Dickerson et al. 1998), often to meet grassland bird habitat objectives. Specifications have focused primarily upon tall, dense mixtures of warm season, “prairie”grasses (Dickerson et al. 1998). Guidelines stress establishing native warm season grasses and often discourage planting introduced, cool season grasses (Herkert et al. 1993, Jones and Vickery 1997). These grasslands are intended to provide habitat for declining grassland dependent species, especially grassland breeding birds (Jones and Vickery 1997, Norment 1999a), such as Eastern Meadowlark, Savannah Sparrow, and Bobolink.

Specifications for tall, dense grasslands, such as switchgrass stands, were developed in the Midwest to create nesting cover for waterfowl and pheasants, and to emulate midwestern tallgrass prairies. Seed mixtures intended to create passerine habitat were often developed in concert with midwestern grassland-breeding bird studies conducted in prairies (Herkert et al. 1996, Sample and Mossman 1997). Recently, grassland bird ecologists in the Midwest have reported that tall, dense grasslands, with low vegetative diversity, attract few nongame grassland birds (Sample and Mossman 1997), and may not be best for game birds (Gatti n.p, in Sample and Mossman 1997).

Much of the grassland landscape in the Northeast is composed of shorter, introduced and native cool season grasses. Bird researchers have suggested that northeastern grassland-breeding birds have adapted to cool season grasslands established by European settlers (Hurley and Franks 1976, Vickery and Dunwiddie 1997) and may have adjusted to structurally different habitats

from their midwestern counterparts (Norment 1999a). For example, Bobolinks have shown higher productivity in northeastern grasslands dominated by cool season grasses than in comparably sized midwestern prairie habitats (Bollinger and Gavin 1989).

Researchers have found grassland bird abundance to be high in introduced, cool season grasslands in the Northeast (Bollinger and Gavin 1989, Bollinger 1995, Mazur 1996, Smith 1997, and Norment 1999a). In extensive studies at Iroquois NWR, Montezuma NWR, and Wildlife Management Areas in NY, Norment (1999a) found that grassland bird abundance and species richness were consistently higher in cool season grasslands than in comparably sized warm season grasslands. Norment (1999a) typically found species such as Savannah, Bobolink, and Eastern Meadowlark nesting in cool season grasslands. In contrast, he found virtually no grassland birds, with the exception of Sedge Wren, in dense stands of switchgrass, a warm season grass. Vickery et al. (1994) generally found low abundances of grassland-breeding birds in naturally occurring, warm season grasslands in coastal Maine. It should be noted that these grasslands are xeric sites, and on the edges of the ranges for most species studied. In extensive studies in old fields of central New York, Bollinger (1995) found higher densities of species such as Henslow's Sparrow, Grasshopper Sparrow, and Upland Sandpiper in the largest, oldest (>10 yrs.) cool season fields, with "shorter, sparser, patchier, grass-dominated vegetation and greater litter cover."

In extensive studies on a variety of grasslands in NY, Norment (1999b) reported that grasslands with lower, less dense vegetation, had higher abundance and diversity of breeding grassland birds than fields with taller, dense vegetation. In general, grassland bird abundance was higher in cool season grasslands such as old fields and lightly grazed pastures than planted, warm season grasslands. The researcher found some grassland birds breeding in low, sparse areas of two fields planted to big bluestem and indiangrass; grassland birds avoided parts of the fields dominated by tall (>1m) vegetation (mainly dense switchgrass).

Associated priority species: HENSLOW'S SPARROW, UPLAND SANDPIPER, BOBOLINK; also Sedge Wren, Loggerhead Shrike, Northern Harrier, Grasshopper Sparrow, Vesper Sparrow, Short-eared Owl, Barn Owl, and Horned Lark.

HENSLOW'S SPARROW

Henslow's Sparrow is identified as a migratory nongame bird of management concern by the U.S. Fish and Wildlife Service (Smith 1992). Henslow's Sparrows historically bred throughout central New England, New York, and the more southern states of the region (Smith 1968, Boone and Dowell 1996). Breeding activity is sparse and localized in the Northeast (Veit and Petersen 1993, Smith 1992). The species historically expanded its range in the region as forests in the Northeast were cleared for agriculture (Boone and Dowell 1996, Smith 1997) and it is possible that the sparrows are still more abundant today than in the early 1900's (Smith 1997). Populations in the Northeast have decreased significantly as grassland habitats have declined (Smith 1992). Henslow's Sparrows are listed as endangered or threatened in at least 6 states in the Northeast.

Breeding Habitat Characterization:
Breeding habitats for Henslow's Sparrow in the Northeast have been described as: active and inactive pastures, wet meadows, old weedy fields, wet or damp fields and swales, abandoned strip mines, hayfields, wet and dry grassy fields with scattered shrubs and *Carex* spp.-*Deschampsia* spp. grasslands. Smith (1997) suggests that Henslow's Sparrows in the East probably historically occupied primarily the edges of inland wet meadows created by beaver activities and coastal saltmarshes.

In surveying Broome County, New York, Peterson (1983) found Henslow's Sparrow on 4 sites, 3 of which were ungrazed pasture. The fourth site was an agricultural field dominated by timothy. The mean grassland area for sites containing Henslow's Sparrows (66 ha) was significantly greater than the mean of unoccupied sites (19 ha). The smallest site containing the sparrow was about 36 ha. All four sites were dominated by grasses and forbs, and contained widely scattered, low shrubs.

Smith (1997) observed Henslow's Sparrows on grazed pastures in central New York. Of 5 pastures occupied by Henslow's Sparrows, 4 were lightly grazed and one was set aside for hay. Sparrow territories were found on pastures that had been mowed from one to six years previously, in late summer. Vegetation height in Henslow's Sparrow territories averaged 61.3 cm, and contained 12.5% goldenrod (*Solidago* spp) cover. The average size of the pastures was 51.7 ha, with a minimum of 33.2 ha. Pastures containing Henslow's Sparrows contained 25% goldenrod. Smith (1997) suggested that 30 ha may represent a breeding minimum field size for the species, since Henslow's Sparrows were absent from fields of similar vegetation and smaller size.

In central New York, Bollinger (1995) found Henslow's abundance to be positively correlated with hayfield age and size, and negatively correlated with vegetation height. The researcher found Henslow's in the largest, oldest (>10 yrs.) fields, with "shorter, sparser, patchier, grass-dominated vegetation and greater litter cover." Bollinger (1995) points out that hayfields in the Northeast are generally highly productive overall, and that older fields in the Northeast more likely resemble the structure of native midwestern grasslands than recently-established northeastern hayfields.

Graber (1968) characterized Henslow's Sparrow habitats in the Midwest as grassy fields and pastures, often poorly drained and sparsely vegetated with low shrubs. Studies in the Midwest indicate that Henslow's habitats contain thick litter and standing dead vegetation (Hands et al. 1989, Swanson 1996). Herkert (1994a, 1994b) reported that Henslow's Sparrows prefer tall herbaceous vegetation, dense vegetation, and high amounts of standing dead material. Zimmerman (1988) hypothesized that standing dead vegetation depresses aboveground grass productivity, resulting in an open subcanopy preferred by Henslow's Sparrows. Kahl et al. (1985) reported that high litter coverage (95%) was optimum for the species. In contrast, some researchers in the Northeast have found the sparrows on moderately grazed pastures, and recently mowed grasslands, containing little dead vegetation (Smith 1997).

UPLAND SANDPIPER

Upland Sandpipers are uncommon and local breeders in scattered locations throughout the Northeast. They tend to be loosely colonial while breeding and often return to the same nesting fields in successive years (Carter 1992). Nesting territories generally are grouped, with independent nesting sites but adjacent communal areas for feeding and loafing (Swanson 1996). Their maximum abundance was probably reached in the mid-19th century, but their numbers were severely depleted over the next half-century by a combination of habitat loss and market hunting (Veit and Peterson 1993, Bevier 1994).

Breeding Habitat Characterization:

Upland Sandpipers breed in extensive, open grasslands, which in the Northeast historically included old hayfields, pastures, wet meadows, sandplain grasslands, and blueberry barrens. A variety of vegetation structures are required by this species for breeding. They build their nests in areas of mixed, tall grasses and forbs (but not > 60 cm) and they forage in areas with short grasses (Swanson 1996, Jones and Vickery 1997). They generally do not occupy areas with uniform graminoid or forb cover (Buhnerkempe and Westmeier 1988, Swanson 1996). A variety of native and introduced grasses have been associated with Upland Sandpiper nesting fields, including timothy (*Phleum* spp.), bluegrass (*Poa* spp.), needlegrass (*Stipa* spp.), bluestem (*Andropogon* spp.), quackgrass (*Agropyron* spp.), Junegrass (*Koelera* spp.), and bromegrass (*Bromus* spp.) [Carter 1992].

Vickery et al. (1994) found that in addition to grassland area, the only vegetation parameter that was a significant predictor of Upland Sandpiper abundance in Maine grasslands was patchiness of cover types. The density of this species was subsequently found to be positively associated with bare ground and negatively correlated with tall forbs and tall shrubs (Vickery et al. 1999). In New York, Bollinger (1995) found Upland Sandpiper abundance to be negatively associated with total vegetation cover and vegetation height.

In Wisconsin, mean vegetation characteristics of nesting habitat were 0.5% wood cover, 81% herbaceous cover, 4% bare ground, 15 % litter cover, and 45 cm maximum vegetation height. In Canada, mean characteristics of nesting sites were 75-95% grass cover, 0-5% forb cover, 5-25% litter cover, 5-25% bare ground, and 12 cm average vegetation height (Swanson 1996).

BOBOLINK

Bobolinks breed widely across Northeast and maintain high populations in the Lower Great Lakes and St. Lawrence Plains. Bobolink populations experienced severe declines in the mid-nineteenth century when they were slaughtered to prevent depredation of southeastern rice fields during fall migration (Dowell 1996). Kelling (1998) reports that breeding numbers of Bobolinks in New York had been reduced due to increased urbanization and losses of farmland.

Breeding Habitat Characterization:

In the Northeast, Bobolinks reportedly breed in: dairy farm hayfields, older hayfields dominated by grasses and legumes, poorly drained and well-drained hayfields, conservation hayfields cut in late summer, old agricultural fields, sandplain grasslands, and lightly grazed pastures.

Bollinger and Gavin (1989, 1992) and Bollinger (1995) found breeding Bobolinks were more abundant in older, active hayfields (not replanted in ≥8 yrs.) in New York. The birds were less abundant in young hayfields (disturbed within past 8 yrs.), oat fields, lightly grazed pastures, heavily grazed pastures, old agricultural fields (< 25% woody cover), and brushy fields (>25% woody cover). Bollinger and Gavin (1992) concluded that Bobolinks in eastern U.S. prefer vegetation dominated by tall grasses, i.e. older hayfields. Bollinger et al. (1990) reported Bobolink abundance to be highest in grasslands with low legume cover, high litter cover, and high grass/legume ratios.

Joyner (1978) reported that Bobolinks in Ontario, Canada, nested in grasses and weeds, including Canada goldenrod (*Solidago canadensis*), tufted vetch (*Vicia cracca*), and birdsfoot trefoil. Vegetation around nests was 33-41cm tall and dominated by forbs, although each nest had a canopy of dead grasses about 10 cm above the nest. In Illinois, Bobolink occurrence was positively associated with mean vegetation height, mean live forb composition, and mean grass height (Herkert 1994c). In Wisconsin, Bobolinks preferred treeless grasslands with dense vegetation (Sample and Mossman 1997). Mean grass height in Bobolink territories in Oregon was 51cm during June (Wittenberger 1980). Kantrud (1981) reported that Bobolink density was highest in tall, dense grasslands, versus grazed grasslands in North Dakota. In Nebraska, Delisle and Savidge (1997) found Bobolinks to be more abundant in moderately dense, cool season grasses versus fields containing denser, taller, native grasses, including big bluestem (*Andropogon gerardii*), switchgrass (*Panicum virgatum*), and indiangrass (*Sorghastrum nutans*). Relative abundance of Bobolinks was positively related to percent litter cover.

Habitat and population objectives: Based on extrapolations from BBS relative abundances, VERY ROUGH estimates of population size for priority species in this habitat suite can be derived (Table 3). These crude estimates are most useful in illustrating the relative population sizes of various species and, perhaps, giving order-of-magnitude figures for setting population objectives for the region.

Table 4.2. Population estimates (number of pairs) for priority species of grassland habitat in the Lower Great Lakes Plain physiographic area. Percent of Atlas blocks based on number of 5-km blocks in which the species was reported during the State breeding bird Atlas for New York (N=xxxx; Andrle and Carroll 1988) and Ontario (N=327; Cadman et al. 1987).

Species	BBS population	% lost Since 1966	Population target	% Atlas Blocks	
				NY	ON
Henslow's Sparrow	95	>50%	190	9	1
Upland Sandpiper	500	uncertain	550		17
Loggerhead Shrike	??			2	1
Bobolink	172,770	15-50%	241,875	90	87
Sedge Wren	340	??	370	2	8
Short-eared Owl	??				2
Barn Owl	??				2

For species that have declined significantly during the BBS period, a population target may be set to approximate pre-BBS population levels; an annual decline of 2.4% per year corresponds with a 50% loss over 30 years. For species suffering a 50% or greater loss since 1966 (PT=5), this plan calls for roughly a doubling of present-day populations as a practical objective. For species suffering a 15-50% loss since 1966 (PT=4), this plan calls for increasing the current population by 1.4. For species showing stable/possible increasing trends (PT=2) or unknown trends (PT=3), population targets are roughly rounded up from current population estimates by a factor of 1.1. Question marks indicate insufficient data to estimate a trend or population size. 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. For more details on methods used for calculating populations and targets, (see Appendix 3).

BBS data indicate that populations of both Bobolinks and Vesper Sparrows have declined at roughly 2%-3% per year since 1966, while populations of Henslow's and Grasshopper Sparrows have been declining 10-15% per year in this physiographic area. Northern Harrier and Upland Sandpipers populations appear not to have changed significantly during this time period. Based on this information, plus knowledge of specialization and area sensitivity within the grassland system and global threats to these species, the following overlapping habitat and population objectives may be derived:

> OBJECTIVE 1. Establish and maintain core or source populations of Henslow's Sparrow in New York and Ontario. Strive to double the regional population over next 10 years (to 240+ pairs?). Assumption: intensive management for Henslow's Sparrow at most important sites (IBAs or BCAs) will provide adequate habitat for all other priority species in this suite at and around those sites.
>
> OBJECTIVE 2. In areas where no Henslow's Sparrows occur, strive to maintain acreage of productive grassland habitat at or above current (2000) levels (no net loss), AND reverse and stabilize the area's BBS population trend for common indicator species (Bobolink, Eastern Meadowlark, Savannah Sparrow) over the next 10 years.

Based on published average density estimates of 9.1 Bobolinks per 10 ha, roughly 155,000 ha (382,000 ac) of suitable grassland habitat is required to support the entire habitat-species suite (e.g. 140,800 pairs of Bobolinks), with 10,000 ha (25,000 ac) maintained in large enough patches to support 800 pairs of Upland Sandpipers, and 800 ha (2,000 ac) intensively managed to support 400 pairs of Henslow's Sparrows in New York and Ontario.

Implementation strategy: An overall conservation strategy for grassland birds in this planning unit will include (1) thorough inventory of potential grassland habitats to determine the most important sites for priority species, especially areas currently supporting Henslow's Sparrows -- determine ownership patterns, economic and conservation status, potential threats; (2) identification and promotion of management practices that benefit grassland bird species; and (3) incentive programs that promote and encourage traditional farming practices, specifically late-season haying, and management of lands to benefit wildlife.

An inventory of grassland birds in New York and northern New England was completed during 1997-1999, under the direction of Massachusetts Audubon and the Northeast Grassland Working Group of PIF. The information from this inventory effort should be used to help identify the most significant locations for grassland conservation in the planning unit and as a basis for continued grassland bird monitoring efforts. Also beginning in 1997 was the designation of Important Bird Areas in this part of NY. Twenty sites were identified and documented within this planning unit, and conservation strategies for these sites will follow. Important sites for grassland birds are:

- Iroquois National Wildlife Refuge and Oak Orchard & Tonawanda Wildlife Management Areas -- 20,000 acres; ownership is a combination of US Fish and Wildlife Service and New York State DEC. Numerous large grassland fields support a diverse and abundant grassland avifauna. Inventories and conservation strategies currently underway by USFWS and NYSDEC.

- Nation's Road Grasslands -- 8,600+ acres; Private. Exceptional grassland and savanna habitats that support a diversity of breeding and wintering grassland-associated birds: Upland Sandpipers (8-12 pairs), Henslow's Sparrow (2-4 pairs), Bobolinks (up to 50 pairs), Vesper Sparrows, and Grasshopper Sparrows.

- Finger Lakes National Forest – 14,500 acres; U.S. Forest Service ownership. A large area of abandoned farmland which has reverted to mostly upland forest but with substantial grassland acreage kept open through grazing, mowing, and burning: Henlsow's Sparrows (30-40 pairs), Northern Harriers, Upland Sandpipers, Grasshopper Sparrows, Bobolinks, and others.

Management recommendations: Habitat area is clearly one of the most important characteristics to providing optimal habitat for grassland breeding birds. Numerous studies in the Northeast have revealed a positive relationship between grassland area and the diversity and abundance of breeding birds using a grassland (Bollinger and Gavin 1992, Smith and Smith 1992, Vickery et al. 1994, Norment et al. 1999). These clear results suggest that increasing grassland area is one obvious means of increasing grassland bird populations. Consideration should be given to consolidation of adjacent grassland fields, through the elimination of hedgerows, stone fences, or tree lines, in areas where open land occupies a considerable amount of the surrounding landscape and grassland management can be identified as a reasonable management alternative. Connecting adjoining fields could increase the overall abundance or diversity of grassland birds using an area above what the fields would accommodate separately. In general, fields < 10 ha in size should be considered low priorities for grassland maintenance or enhancement activities, while areas > 100 ha should be the highest priorities for such actions.

Prescribed fire can be an effective tool to prevent woody encroachment in grasslands. Used on a large scale, fire can be more cost-effective than mowing and herbicide treatments. Many Refuge managers and other wildlife managers in the region prefer to establish warm season instead of cool season grasses because of ease of maintenance with prescribed fire. Warm season grasses emerge late in the spring, creating a wide window of opportunity for conducting dormant-season prescribed burns, which stimulate warm season grass productivity. Studies in the Midwest have demonstrated that several species of grassland birds respond positively to prescribed fire in warm

season grasslands (Sample and Mossman 1997). Species such as Grasshopper Sparrow, Savannah Sparrow, and Bobolink have shown increases in breeding activity following prescribed burns (Herkert 1994, Johnson 1997). In contrast, recent studies have shown that dormant-season burns fail to increase grass cover (Howe 1995, Mitchell 2000) and often fail to reduce shrub cover (Euler 1974, Mitchell 2000) in cool season grasslands.

Fire alters the structure of grasslands by reducing woody species cover, decreasing litter, and removing dead, aboveground vegetation (DeBano et al. 1998). These effects could reduce vegetation density and overall community height in warm season grasslands, making them more attractive as nesting habitat for grassland birds. However, fire also has been shown to increase productivity of warm season grasses (Howe 1995, DeBano et al. 1998). Prescribed fire could increase height and density of live stems of tall grasses in warm season grass plantings, making them potentially less attractive to grassland breeding birds.

If current mixtures of warm season grasses fail to provide adequate habitat for grassland breeding birds in the Northeast, it may be advisable for managers to focus on cool season grasslands to meet habitat objectives. As described by Norment (1999b), "if the primary management goal is to create good habitat for grassland birds, then planting nonnative cool season grasses may be a more effective strategy, at least in cooler parts of the Northeast." As an alternative, different warm season grass mixtures may need to be developed. Work by Norment (1999a, 1999b) and Paton et al. (1999), and studies in Wisconsin (Sample and Mossman 1997, p. 65), indicate that alternative grassland mixes, such as shorter grasses, lower seeding rates, or mixes of warm and cool season grasses, may provide better grassland bird breeding habitat.

Mowing can also be an effective means of managing grassland habitat, although if done at the wrong time of the year, it can have detrimental effects on grassland birds. It also may not be totally effective in eliminating woody vegetation from shrub-dominated fields. Since many of the high priority grassland birds in this planning unit can raise two broods in a single breeding season, postponing mowing until after September 1 will allow these birds the greatest opportunity to maximize annual reproductive success. At a minimum, mowing should be delayed until late June to allow for young to fledge from first nesting attempts. Bollinger (1995) found that fields with early mowing dates the previous year had lower bird densities than fields with later mowing dates. He suggested that mowing-induced nest destruction was partially responsible for lower breeding densities in the following year. While some studies have shown that abundance of some grassland birds is reduced in the year following mowing (Bollinger 1995, Herkert 1994a, Mazur 1996), Norment (1999a) found high numbers of grassland birds in fields that had been mowed during late summer or fall of the previous year. If mowing every two or three years is sufficient to deter woody growth, such a schedule may be more beneficial to grassland bird than annual mowing. Warm season grassland do not need to be mowed as frequently as cool season grassland to control shrub invasion, so a three to four year schedule may be adequate for warm season grasses (Myers and Dickerson 1984). Thus, dividing fields and mowing sections on a rotational basis, where feasible, may be the most appropriate means of using mowing to manage grasslands for bird populations.

See Jones and Vickery (1997) for further details on managing grassland in the northeastern U.S.

Research and monitoring needs:

- Continue monitoring grassland habitats within the physiographic area as part of a regional effort within the Northeast to better assess grassland bird abundance trends
- Conduct demographic studies (productivity, survival, dispersal) of priority species to provide information needed for determining causes of population declines and understanding metapopulation dynamics
- Determine if differences exist in grassland breeding bird diversity and abundance in the Northeast between warm season and cool season grass types.
- Further research on different management techniques is needed to understand the appropriateness of prescribed burning, mowing, and other methods for maintaining suitable habitat for Northeastern grassland birds

Outreach: xxxxxxxx

B. Shrub - Early Successional

Importance and conservation status: Early successional shrub habitats in this physiographic area result primarily from farmland abandonment, and in some cases from maintenance of shrub-wetlands. Shrub habitats support several high priority species in this region, most notably Golden-winged Warblers, which are of high continental concern. In areas where farmland has already been abandoned, and in areas currently managed as woody habitats for wildlife, attention to the needs of Golden-winged Warbler and associated species is a high conservation priority. Because this habitat is shared by American Woodcock and in some cases important waterfowl species such as Wood Duck and American Black Duck, management for both game and nongame species in these areas may be particularly compatible.

Associated priority species: GOLDEN-WINGED WARBLER, AMERICAN WOODCOCK; also Field Sparrow, Willow Flycatcher, and Blue-winged Warbler.

Within this physiographic area, Golden-winged Warblers are most widespread in Ontario, especially along the edge of the Canadian Shield. They are patchily distributed in New York, with concentrations in the area between the southeastern shore of Lake Ontario and Oneida Lake and in the vicinity of Iroquois NWR. Golden-wings seem to favor wetter areas in relatively early stages of succession. These include abandoned agricultural fields, alder bogs and beaver-created wetlands.

Across their range, Golden-winged Warblers occur in a variety of disturbed habitats during the breeding season and utilize a wide range of plant communities for nesting, including regenerating hardwood clearcuts and stripmines, power line rights-of-way, young conifer sites, alder swamps, and tamarack bogs (Confer 1992a,b; Canterbury 1993). However, across these different macrohabitat types, some consistent microhabitat preferences for vegetation structure seem to be apparent. They typically use areas with dense patches of herbs and shrubs, sparse tree cover, and a forested edge or perimeter, and usually include some open areas with patches of grasses or sedges (Confer 1992a,b). In southern New York, Confer (1992a,b) typically found territories in brushy marshes between rocky hillsides, but farther north in New York they were

located in upland fields undergoing succession. While patches of dense shrubs covered about 50% of the territories Confer (1992a,b) studied, patches of dense herb growth without woody cover were also present on all territories. Klaus (1999) described territories as having "thick brushy habitat juxtaposed with patches of relatively open, herbaceous vegetation containing scattered small woody plants." Several territories will often be clustered close together in the fashion of a loose colony. Patches of 10-15 ha can support up to six pairs, and these may be preferred over smaller and larger habitat patches (Confer 1999). Nests are typically built on or very close to the ground, often supported by the base of a cluster of herbaceous plant material (e.g., clump of grass, goldenrod stems, or currant stems). Nests are often located along field-forest edges where brushy and herbaceous patches meet (Confer 1992b, Klaus 1999). Because of great variability in habitat use and population fluctuation throughout the Golden-winged Warbler's range, specific requirements and management options need to be studied and assessed within the Lower Great Lakes Plain.

American Woodcock require a mix of habitats, including forest openings or clearings for singing displays in spring, alder or other young hardwoods on moist soils for feeding and daytime cover, young second-growth hardwoods for nesting, and large fields for night-time roosts (Mendall and Aldous 1943; Connor, in Andrle and Carroll 1988). Although there have been many studies of seasonal habitat use, the relationship between specific habitat features and population demography remain unknown (Keppie and Whiting 1994). Silvicultural practices can enhance habitat available for woodcocks (Sepik et al. 1981), although a shift away from even-aged management (creating large areas of uniform shrub cover) may be detrimental to populations (Keppie and Whiting 1994).

Habitat and population objectives: Based on extrapolations from BBS relative abundances, VERY ROUGH estimates of population size for priority species in this habitat suite can be derived (Table 4.3). These crude estimates are most useful in illustrating the relative population sizes of various species and, perhaps, giving order-of-magnitude figures for setting population objectives for the region.

Table 4.3 Population estimates (number of pairs) for priority species of shrub habitat in the Lower Great Lakes Plain physiographic area. Percent of Atlas blocks based on number of 5-km blocks in which the species was reported during the State breeding bird Atlas for New York (N=xxxx; Andrle and Carroll 1988) and Ontario (N=320; Cadman et al. 1987).

Species	BBS population	% lost Since 1966	Population target	% Atlas blocks	
				NY	ON
Golden-winged Warbler	1,060	>50%	2,120	15	23
American Woodcock	??				90
Field Sparrow	30,300	>50%	60,600	95	67
Blue-winged Warbler	2,580	inc.	2,580	75	41
Willow Flycatcher	115,500	??	127,000	90	77
Yellow-breasted Chat	150	>50%	300	5	13
Northern Bobwhite	300	>50%	600		24

For species that have declined significantly during the BBS period, a population target may be set to approximate pre-BBS population levels; an annual decline of 2.4% per year corresponds with a 50% loss over 30 years. For species suffering a 50% or greater loss since 1966 (PT=5), this plan calls for roughly a doubling of present-day populations as a practical objective. For species suffering a 15-50% loss since 1966 (PT=4), this plan calls for increasing the current population by 1.4. For species showing stable/possible increasing trends (PT=2) or unknown trends (PT=3), population targets are roughly rounded up from current population estimates by a factor of 1.1. Question marks indicate insufficient data to estimate a trend or population size. 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. For more details on methods used for calculating populations and targets, (see Appendix 3).

Golden-winged Warblers and Brown Thrashers have declined by 6% per year since 1966 in this physiographic area (according to BBS), and Field Sparrows have declines almost 4% per year. In contrast, Blue-winged Warblers have increased in numbers and are expanding their distribution throughout this region. The following habitat and population objectives are suggested:

> OBJECTIVE 1. Increase acreage of early successional shrub habitats suitable for Golden-winged Warbler, using current population centers as core habitat units; reverse populations declines; encourage and assist GWWA population expansion, with goal of a stable population of 2,500 pairs. Assumption: enhancing habitat conditions for GWWA will also benefit most other priority species in this habitat suite.
>
> OBJECTIVE 2. Stabilize and reverse declining trend in American Woodcock population; strive to increase regional population significantly above current levels in next 10 years.

Based on published average densities of roughly 15 pairs per 10 ha (Walkinshaw 1978), an estimated 40,400 ha of early successional habitat is required to support 60,600 pairs of Field Sparrows and to maintain the entire habitat suite throughout the physiographic area. Published average densities of 4 pairs of Golden-winged Warblers per 10 ha (Gauthier and Aubry 1996) suggest that roughly 7,500 ha (18,500 ac) of the overall shrub habitat objective needs to be maintained specifically in a condition to support 3,000 pairs of Golden-winged Warblers.

Implementation strategy: Specific management strategies that will benefit shrub-nesting birds in this planning unit are less clear than are those for grassland species. A conservation plan for this suite will include the following elements:

- Identification of current population centers for priority species
- Exploitation of current patterns of farmland abandonment
- Active discouragement of woody succession
- Merging with conservation and management objectives currently employed for game and wetland species.

In contrast with grassland habitats and birds, conservation opportunities for shrub-nesting species may be greatest on public lands, particularly on state Wildlife Management Areas that already exist in areas with poorest drainage and marginal farming conditions. Active management of these areas for American Woodcock populations should be a highest priority, and where possible, opportunities to enhance Golden-winged Warbler habitats in areas managed for waterfowl and other wetland species should be encouraged.

Fortunately, most shrubland birds seem well adapted to locating and utilizing relatively small areas of disturbed habitat, even when these patches are dispersed across localized sites in a landscape. Golden-winged Warblers and Yellow-breasted Chats are often cited as two of the more "area sensitive" shrubland birds, but their minimum patch size requirements have been estimated at only 10 ha and 2 ha, respectively (Askins 1994). Compared to the minimum patch sizes required by some of the more area sensitive grassland and forest species, shrubland birds appear to be less dependent on very large patches of habitat.

Identification of Important Bird Areas in this region has focused on priority grassland, wetland, and forest species. Incorporation of shrub-nesting species into this process should be encouraged, in order to identify regionally important sites for Golden-winged Warbler and American Woodcock.

Management guidelines: Any management program for Golden-winged Warbler needs to address four concerns to be beneficial. First, the program must maintain or create sufficient amounts of appropriate habitat. Second, the management program needs to assess the impact of Blue-winged Warblers and may need to institute control measures. Third, a management program needs to assess the effect of nest parasitism by cowbirds and may need to institute control measures. Fourth, the effect of loss of winter habitat needs to be assessed and corrective efforts need to be considered (Confer 1999).

For upland sites, habitat can be created through succession following farming or fires, and sometimes logging. In New York, clearcutting is often followed by a dense and uniform growth of saplings without openings for patches of herbs. Such openings are rarely if ever used by golden-winged warblers in New York. Brushhogging, i.e., cutting woody stems of shrubs at their base, has not been followed by nesting bird occupancy in the few sites studied. Perhaps cutting shrubs stimulates regeneration of a dense growth of woody stems without the requisite herbaceous growth. Golden-winged warblers sometimes nest under powerline right-of-ways if maintenance produces the appropriate patches of shrubs. Frequent application of herbicides may prevent the development of the requisite shrubbiness (Confer 1992b).

The optimal management practice may be a rotation of burning or intermittent farming. A cycle of about 40 years with about 25% of the managed area burned once each decade could produce the following successional sequence. Golden-winged warbler habitat would begin to appear perhaps within ten years and last about 10-20 years, although these times are approximations and would be influenced by factors such as soil quality, the size and intensity of the burn, and proximity to seed sources. Allowing succession to continue for approximately 40 years would provide the forest edge that is used in almost all territories (Confer 1992b).

It is worth noting that many other species would use this habitat, including several priority species. For the first ten years after a burn, the successional habitat would favor field species including perhaps Henslow's Sparrow, American woodcock, and possibly the Upland Sandpiper. As shrubs invaded and a site became suitable for Golden-winged Warblers, such habitat would provide resources for other species, including winter browse for deer. Allowing aspen to develop would support many other species including Ruffed Grouse, which use aspen buds as a major winter food source (Confer 1999).

Any site that is managed specifically for Golden-wingeds also needs to assess the impacts of cowbird parasitism and interactions with Blue-winged Warblers. Golden-winged Warblers have historically declined and often disappeared from areas invaded by Blue-winged Warblers, although the mechanism for potential negative impacts of the presence of Blue-wingeds on Golden-wingeds is unclear. A recent study by Confer and Larkin (1998) provided evidence that interference competition is not the cause of the decline of Golden-wingeds. They found that Blue-wingeds generally do not dominate interspecific interactions and do not drive Golden-wingeds into inferior nesting habitat. Further research on how hybridization could cause a disproportionate decrease in Golden-wingeds compared to Blue-wingeds is needed. Coker and Confer (1990) found about 30% of Golden-winged Warbler nests were parasitized by Brown-headed Cowbirds. Confer (1992a) found that 61% of warbler eggs failed to hatch in parasitized nests, which would result in a 50% overall loss of breeding production from egg-laying to hatching. At this rate of nest parasitism and egg failure, the overall effect to a population would be a 17% reduction in the number of birds fledged. However a source/sink analysis would need to be done to determine if such an impact from parasitism was contributing to a population decline. Both cowbird and Blue-winged Warbler control have been proposed as possible measures to bolster Golden-winged populations in areas where declines are occurring. A careful examination of the limiting factors for such populations should be carried out before control measures are implemented.

Research and monitoring needs: Much less attention has been given to shrub-nesting birds in this area, compared with grassland and wetland species. Critical needs for this group include:

- Detailed inventory of most important sites for nesting Golden-winged Warblers, with estimates of population size and habitat requirements

- Study interactions of Golden-winged Warbler and Blue-winged Warbler (very recently expanding into this area) in areas of current overlap -- attempt to determine habitat-management options (e.g., successional stage, water regime) that will discourage Blue-winged Warblers and favor Golden-wings. Also, more research/monitoring is needed on effects of cowbird parasitism on shrubland birds, especially Golden-winged Warbler.

- Determine effects of current game and waterfowl management practices on priority nongame species -- especially the relationships between American Woodcock management and Golden-winged Warbler population expansion.

• Determine causes of population declines in American Woodcock and develop management strategies for reversing this decline.

Outreach:

C. Riparian-Deciduous Forest

Importance and conservation status: In portions of this physiographic area, remnant groves of floodplain and northern hardwood forest still exist or are regenerating. In addition, many areas are currently managed as forested wetlands to benefit waterfowl. These areas support several high-priority forest bird species, especially an apparently expanding population of Cerulean Warbler. In addition, existing floodplain and hardwood forest stands undoubtedly have a high (but unknown) value to transient species during migration periods. Around urban areas and some of the agricultural areas of southwestern Ontario, development continues to threaten remaining forest stands.

Associated priority species: CERULEAN WARBLER, also Black-billed Cuckoo, Red-headed Woodpecker, Prothonotary Warbler, Baltimore Oriole, Louisiana Waterthrush, Eastern Wood-Pewee, Wood Thrush, and Cooper's Hawk.

Cerulean Warblers are locally common in at least two general localities in the United States portion of this physiographic region: the Montezuma wetlands complex and vicinity, and the Iroquois National Wildlife Refuge/Oak Orchard Wildlife Management Area and vicinity. In both of these locations, the largest concentrations of Cerulean Warblers are found within contiguous blocks of palustrine forest having some unusually large trees including emergent cottonwoods and swamp white oaks (Rosenberg et al. 2000). More than 400 pairs were recorded in the vicinity of the Montezuma wetlands, and more than 100 pairs in the vicinity of Iroquois NWR. Smaller populations are scattered throughout this portion of the region. In Ontario, Cerulean Warblers breed in the Carolinian Forest region with concentrations at Rondeau Provincial Park, Long Point, and along the lower Grand River watershed on the northeastern shore of Lake Erie. A concentration also occurs north of Kingston along the edge of the Canadian Shield in the Frontenac Axis. During the Ontario breeding bird atlas, approximately 130 pairs of Ceruleans were estimated to nest in this area, and over 370 breeding pairs were estimated for all of Ontario (Austen et al. 1994).

Of the remaining priority forest species, Eastern Wood-Pewee, Wood Thrush, and Baltimore Oriole are the most common and widespread, occurring throughout the physiographic area. According to BBS data, populations of these three species have remained stable in this physiographic region over the last 30 years. The other priority species in this habitat suite are more patchily distributed and are not detected on many BBS routes. Black-billed cuckoo is the one exception, as it is detected on about 85% of the routes but at a very low abundance. BBS analysis suggests that this species has declined significantly since 1966, with population decreases of over 6% per year. Black-billed cuckoo is a species that should be studied more closely to understand the causes of these severe declines.

In Ontario, species such as Acadian Flycatcher, Hooded Warbler, and Louisiana Waterthrush are considered high priorities because they reach their northern range limits in the Carolinian Forest area south of the Canadian Shield, where forest cover is severely reduced. Populations of these species in southern Ontario are only a small fraction of their numbers prior to European settlement and are ranked as rare, threatened, or endangered based on their current population size (Austen et al. 1994).

Habitat and population objectives: Based on extrapolations from BBS relative abundances, VERY ROUGH estimates of population size for priority species in this habitat suite can be derived (Table 4.4). 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.

Table 4.4. Population estimates (number of pairs) and targets (number of pairs) for priority species of riparian-deciduous forested habitat in the Lower Great Lakes Plain physiographic area. Percent of Atlas blocks based on number of 5-km blocks in which the species was reported during the State breeding bird Atlas for New York (N=xxxx; Andrle and Carroll 1988) and Ontario (N=320; Cadman et al. 1987).

Species	BBS population	% lost Since 1966	Population target	% Atlas blocks	
				NY	ON
Cerulean Warbler	1,035	uncertain	1,150	15	15
Black-billed Cuckoo	6,380	>50%	12,760	45	69
Red-headed Woodpecker	2,210	>50%	4,420		86
Prothonotary Warbler	200?	??	220	0	4
Louisiana Waterthrush	70	??	80	5	12
Baltimore Oriole	75,180	uncertain	82,700	100	93
Acadian Flycatcher	460	??	505	2	9
Wood Thrush	102,780	poss. inc.	113,000	97	91
Hooded Warbler	2,345	uncertain	2,580	5	7
Red-shouldered Hawk	120	uncertain	130		43

For species that have declined significantly during the BBS period, a population target may be set to approximate pre-BBS population levels; an annual decline of 2.4% per year corresponds with a 50% loss over 30 years. For species suffering a 50% or greater loss since 1966 (PT=5), this plan calls for roughly a doubling of present-day populations as a practical objective. For species suffering a 15-50% loss since 1966 (PT=4), this plan calls for increasing the current population by 1.4. For species showing stable/possible increasing trends (PT=2) or unknown trends (PT=3), population targets are roughly rounded up from current population estimates by a factor of 1.1. Question marks indicate insufficient data to estimate a trend or population size. 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. For more details on methods used for calculating populations and targets, (see Appendix 3).

BBS data and recent intensive surveys of Cerulean Warblers throughout the region have documented an expanding population in southeastern Ontario and adjacent northeastern NY.

Eastern Wood-Pewee, Wood Thrush, and Baltimore Oriole populations have been fairly stable, as tracked by BBS. Acadian Flycatcher, Hooded Warbler, and Louisiana Waterthrush are no longer common enough to be monitored by BBS. Black-billed Cuckoo and Red-headed Woodpecker are the two priority species showing long-term declines of 5%-6% per year. The primary habitat and population objectives for this suite are:

> OBJECTIVE 1. Encourage and assist population expansion of Cerulean Warbler. Strive to maintain a stable regional population of 1,200-1,500 pairs.
>
> OBJECTIVE 2. In areas that do not support Cerulean Warblers, prevent further loss of remnant forests and continue to maintain stable populations of priority forest species. In particular, manage habitat to benefit Eastern Wood-Pewee, Baltimore Oriole, and declining Black-billed Cuckoo. [NOTE: A Canadian perspective on this conservation objective may be different, because a number of species using these forest in southern Ontario are near the northern limits of their range (e.g. Louisiana Waterthrush, Prothonotary Warbler, Hooded Warbler) and therefore may be of greater national significance.]

Based on published average densities of 3 pairs of Wood Thrush per 10 ha (Gauthier and Aubry 1996), roughly 375,000 ha (925,000 ac) of mature forest habitats need to be maintained to support 113,000 pairs of Wood Thrush and other species in this habitat suite. Roughly 1,500 ha (3,700 ac) should be managed to support 1,200-1,500 pairs of Cerulean Warblers in areas where they occur.

Implementation strategy/Management guidelines: Within this physiographic area, a conservation strategy for forest birds should not be in direct conflict with plans for other habitats; ie, regeneration of mature forest from relatively large grassland and shrub habitats is not generally recommended. A comprehensive conservation strategy is needed that identifies an optimal landscape design to accommodate the diverse needs of high priority birds in grassland, shrubland, and forest habitats.

For the riparian-deciduous forest suite, vegetation structure should be assessed to ensure that appropriate structural characteristics of the habitat are being maintained. Many of the priority species from this habitat suite respond positively to structural diversity at different heights, including dense nesting cover at the shrub and/or low-canopy levels and small canopy openings. Selective logging and thinning of "overmature" trees may create favorable vegetation conditions for species such as Wood Thrush, Black-billed Cuckoo, and Hooded Warbler. If forest stands have reached a late-successional stage but have little shrub or mid-canopy vegetation and few breaks in the canopy, low-level management through selective cuts or thinning may improve habitat conditions. For Louisiana Waterthrush, headwater streams and wetlands of high water quality within the larger forest patches should be the targeted habitat. In smaller forest tracts, maintain at least a 100-meter buffer of mature forest cover along streamside habitat.

Achieving the primary objectives for this habitat suite will entail:

- Completion of inventory for most important sites that support or potentially support Cerulean Warblers

- Protection and management of existing sites to maximize benefits to CEWA; e.g., preserve tallest trees, encourage maturing of canopy species, prevent fragmentation of existing forests.

- Allow and encourage canopy development in other potential sites that currently exist as forest patches or are managed as forested wetlands, to enhance the possibility of further population expansion.

- Develop multiple-use strategies (e.g. production of maple syrup, shelterwood silviculture) that are compatible with priority species habitat needs on private lands.

Ricketts et al. (1999) have identified the largest intact patches of forest and woodlands in the region. Also in New York, the several of the designated Important Bird Areas (Wells 1998) include large acreages of deciduous or mixed forest. Inventories are needed to assess the populations of priority species in this habitat type that are found at these sites.

Research and monitoring needs: Ongoing research in southeastern Ontario and northern New York is aimed at determining population status and habitat requirements of Cerulean Warblers at this northern edge of their range. This research should be strongly supported. Future research needs for forest habitats in this physiographic area include:

- Careful monitoring of known Cerulean Warbler breeding sites

- Determining habitat and area requirements for other priority forest birds, especially in relation to current management practices for forested wetlands and current land-use trends.

- Determining use of forest patches, including urban greenbelts, by transients in spring and fall.

Outreach:

D. Northern Hardwood - Mixed Forest

Importance and conservation status: This habitat type supports several species of regional priority, but overall is of lower conservation concern than the preceding habitats. Northern hardwood-mixed forests occupy approximately 560,000 ha (or about 30%) of the U.S. portion of this physiographic area and perhaps about half that amount on the Canadian side. Much of the existing forests of this type are in fairly small patches and woodlots in landscapes dominated by agriculture and/or urban areas. The exceptions are the area around the southeastern shore of Lake Ontario over to Oneida Lake in New York and the northern portions of this physiographic area along the Canadian Shield in Ontario. Most of the priority species in this habitat suite are common to uncommon breeders in this planning unit. According to BBS data, populations of all the priority species have remained fairly stable in the Lower Great Lakes Plain since 1966, except Black-billed Cuckoo, which has declined significantly.

Habitat and population objectives: Based on extrapolations from BBS relative abundances, VERY ROUGH estimates of population size for priority species in this habitat suite can be derived (Table 4.5). 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.

Table 4.5. Population estimates (number of pairs) for priority species of northern hardwood-mixed forest in the Lower Great Lakes Plain physiographic area. Percent of Atlas blocks based on number of 5-km blocks in which the species was reported during the State breeding bird Atlas for New York (N=xxxx; Andrle and Carroll 1988) and Ontario (N=320; Cadman et al. 1987).

Species	BBS population	% lost Since 1966	Population target	% Atlas blocks	
				NY	ON
Black-billed Cuckoo	6,380	>50%	12,760	45	69
Canada Warbler	1,375	uncertain	1,510	5	19
Wood Thrush	102,780	poss. inc.	113,000	97	91
Northern Goshawk	??				

For species that have declined significantly during the BBS period, a population target may be set to approximate pre-BBS population levels; an annual decline of 2.4% per year corresponds with a 50% loss over 30 years. For species suffering a 50% or greater loss since 1966 (PT=5), this plan calls for roughly a doubling of present-day populations as a practical objective. For species suffering a 15-50% loss since 1966 (PT=4), this plan calls for increasing the current population by 1.4. For species showing stable/possible increasing trends (PT=2) or unknown trends (PT=3), population targets are roughly rounded up from current population estimates by a factor of 1.1. Question marks indicate insufficient data to estimate a trend or population size. 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. For more details on methods used for calculating populations and targets, (see Appendix 3).

The primary habitat and population objectives for this suite are:

OBJECTIVE 1. Stabilize populations and reverse declines of Black-billed Cuckoos; strive to achieve a regional population of 15,000 pairs (or an average of 0.75 birds per BBS route) within 10 years.

OBJECTIVE 2. Manage habitat to benefit and maintain stable populations of Wood Thrush (approximately 113,000 pairs), and woodland hawks.

Based on published average densities of 3 pairs of Wood Thrush per 10 ha (Gauthier and Aubry 1996), roughly 375,000 ha (925,000 ac) of mature forest habitats need to be maintained to support 113,000 pairs of Wood Thrush and other species in this habitat suite. This would include a combination of this habitat type and the riparian-deciduous forest type.

Implementation strategy/Management guidelines:
Achieving the primary objectives for this habitat suite will entail:

- Protection and management of existing sites to maximize benefits to priority species in this suite; e.g., encourage maturing of canopy species and development of understory vegetation layers, prevent fragmentation of existing forests.

- Allow and encourage canopy development and structural vegetation diversity in other potential sites that currently exist as forest patches or are managed as forested wetlands, to enhance the possibility of further population expansion.

- Develop multiple-use strategies (e.g. production of maple syrup, shelterwood silviculture) that are compatible with priority species habitat needs on private lands.

Research and monitoring needs:

- Determining habitat and area requirements for priority species in the landscape contexts of this planning unit, especially in relation to current management practices for forested wetlands and current land-use trends.

- Determining causes of Black-billed Cuckoo declines and factors limiting population growth.

- Determining use of forest patches, including urban greenbelts, by transients in spring and fall.

- Studies of reproductive success, lingering impacts of pesticide use, prey population levels, habitat characteristics of nest sites and preferred foraging areas, and interactions with competitors are needed for most woodland raptors, including Cooper's Hawk, Sharp-shinned Hawk, and Red-shouldered Hawk

Outreach:

E. Freshwater Wetland

Importance and conservation status: This habitat suite represents a continued continental concern for wetland habitats and their potentially vulnerable species, even though most of these species do not rank highly in the global PIF prioritization system. The amount of freshwater wetlands that have been lost or degraded during the last century is large. The greatest threats to most species in this habitat suite are continuing loss and alteration of wetland habitat through draining, dredging, filling, pollution, acid rain, agricultural practices, and siltation. Various contaminants (e.g., pesticides, insecticides, heavy metals, acid deposition, etc.) from industrial, agricultural, and urban/suburban sources can degrade wetland ecosystems and impair reproductive abilities of the birds. The size of wetlands is also an important consideration for some of the priority species in this habitat suite. Many of these species occur more often and at higher abundance in larger wetlands. Loss of wetland habitat continues to be the primary

concern for the species of this habitat suite, and preservation of existing wetland sites should be the first priority for conservation actions in this habitat type.

Associated priority species: AMERICAN BLACK DUCK, American Bittern, etc. Most species in this suite are considered a priority because of their Watch List status (American Black Duck) or special concern listing in various states and provinces. This habitat suite therefore represents continued nationwide concern for wetland habitats and their potentially vulnerable species, even though they do not rank highly in the global PIF prioritization system.

Habitat and population objectives: Based on extrapolations from BBS relative abundances, VERY ROUGH estimates of population size for priority species in this habitat suite can be derived (Table 4.6). 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.

Table 4.6. Population estimates (number of pairs) for priority species of freshwater wetland habitat in the Lower Great Lakes Plain physiographic area. Percent of Atlas blocks based on number of 5-km blocks in which the species was reported during the State breeding bird Atlas for New York (N=xxxx; Andrle and Carroll 1988) and Ontario (N=320; Cadman et al. 1987).

Species	BBS population	% lost Since 1966	Population target	% Atlas blocks	
				NY	ON
American Black Duck	200	15-50%	280		36
King Rail	??				5
Least Bittern	130	??	145		16
Bald Eagle	50	??	55		3

For species that have declined significantly during the BBS period, a population target may be set to approximate pre-BBS population levels; an annual decline of 2.4% per year corresponds with a 50% loss over 30 years. For species suffering a 50% or greater loss since 1966 (PT=5), this plan calls for roughly a doubling of present-day populations as a practical objective. For species suffering a 15-50% loss since 1966 (PT=4), this plan calls for increasing the current population by 1.4. For species showing stable/possible increasing trends (PT=2) or unknown trends (PT=3), population targets are roughly rounded up from current population estimates by a factor of 1.1. Question marks indicate insufficient data to estimate a trend or population size. 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. For more details on methods used for calculating populations and targets, (see Appendix 3).

* OBJECTIVES: due to lack of reliable population estimates for most of the species in this habitat suite, numerical population and habitat-area objectives have not been determined. Protecting all remaining habitat, especially the largest wetlands, should receive high conservation attention. More information on population objectives and management guidelines for American Black Duck can be found in the North American Waterfowl Management Plan.

Implementation strategy/management guidelines:

- Wetlands used as breeding sites for these species should be protected from chemical contamination, siltation, eutrophication, and other forms of pollution/contamination that could directly harm breeding birds or their food supply.
- Preserve all large (> 10 ha) freshwater wetlands from development, draining, and other forms of habitat loss.
- Design a regional management program for these wetland species that continue to be threatened by habitat loss, including increased coordination among managers and biologists to prevent duplication of research efforts and to share current information.
- Hemi-marsh conditions favored by grebes and ducks need to be maintained by periodic reversal of vegetation succession to open up some of the extensive stands of emergent vegetation, but suitable habitat for nesting needs to maintained in nearby areas during wetland management.
- Creation of new nesting habitat may be needed for some species in this physiographic area. Minor alterations to existing management activities for waterfowl, such as leaving some dense stands of cattail and bulrush for nesting sites and maintaining fairly stable water levels during the nesting season, should benefit many of these species. Complete drying of impoundments during drawdowns should be avoided to prevent the die-off of small fish, amphibians, and dragonflies, which are a major food sources for many of these bird species. Slow drawdowns should benefit bitterns by providing suitable foraging habitat and encouraging dense stands of emergent vegetation for nesting.

Research and monitoring needs:

- Investigate wetland management alternatives that can provide a variety of wetland habitat conditions that are suitable to the various needs of the priority species in this habitat suite.
- A regional monitoring program to provide better abundance and population trend information is needed for the secretive wetland birds. Standard methods for conducting point-counts using tape-recorded vocalization playback have been developed and should be used in monitoring efforts. The status of the raptor species (Northern Harrier and Osprey) should also be monitored more closely and in a coordinated fashion across the region.
- Evaluate habitat requirements, including nest site characteristics, water quality, and minimum wetland area needed during both the breeding and nonbreeding seasons.
- Determine causes of breeding failure and mortality of young and adults.
- Evaluate effects of invasive plants such as *Phragmites* and purple loosestrife.

Outreach:

Literature Cited

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

Askins, R. A. 1993. Population trends in grassland, shrubland, and forest birds in the eastern North America. Current Ornithology 11:1-34.

Askins, R.A. 1994. Open corridors in a heavily forested landscape: impacts on shrubland and forest-interior birds. Wildlife Society Bulletin 22:339-347.

Askins, R. A. 1999. History of grassland birds in eastern North America. Studies in Avian Biology 19:60-71.

Austen, M. J. W., M. D. Cadman, and R. D. James. 1994. Ontario birds at risk: status and conservation needs. Federation of Ontario Naturalists, Don Mills, Ontario.

Bevier, L. R., editor. 1994. The Atlas of breeding birds of Connecticut. State Geological and Natural History Survey of Connecticut, Hartford, CT.

Bollinger, E. K. and T. A. Gavin. 1992. Eastern Bobolink populations: ecology and conservation in an agricultural landscape. Pages 497-506 *in* J. M. Hagan III and D. W. Johnston, eds. Ecology and conservation of neotropical migrant landbirds. Smithsonian Institution Press, Washington D.C.

Bollinger, E. K. 1995. Successional changes and habitat selection in hayfield bird communities. Auk 112:720-730.

Bollinger, E. K. and T. A. Gavin. 1989. The effects of site quality on breeding-site fidelity in Bobolinks. Auk 106:584-594.

Bollinger, E. K., Bollinger, P. B., and T.A. Gavin. 1990. Effects of hay-cropping on eastern populations of Bobolink. Wildlife Society Bulletin 18:142-150.

Bonney,R. E., D. Pashley, R. J. Cooper, and L. Niles (Eds.). 1999. Strategies for bird conservation: The Partners in Flight planning process. Cornell Lab of Ornithology.

Boone, D. D. and B. A. Dowell. 1996. Henslow's Sparrow. In: *Atlas of Breeding Birds of Maryland and the District of Columbia* (Robbins, C. S., senior ed.), pp. 400-401. University of Pittsburgh Press. ISBN 0-8229-3923-1.

Buhnerkempe, J. E., and R. L. Westmeier. 1988. Breeding biology and habitat of upland sandpipers on prairie chicken sanctuaries in Illinois. Transactions of the Illinois State Academy of Science 81:153-162.

Cadman, M. D., P. F. J. Eagles, and F. M. Helleiner. 1987. Atlas of the breeding birds of Ontario. University of Waterloo Press, Waterloo, Ontario.

Canterbury, R. A. 1993. Golden-winged warblers are common residents of abandonded surface mines in southern West Virginia. The Redstart. p46.

Carter, J. W. 1992. Upland Sandpiper. Pp. 235-252 *In* Migratory Nongame Birds of Management Concern in the Northeast (K. J. Schneider and D. M. Pence, editors). U.S. Fish and Wildlife Service, Newton Corner, MA.

Carter, M. F., W. C. Hunter, D. N. Pashley, and K. V. Rosenberg. 2000. Setting conservation priorities for landbirds in the united states: the partners in flight approach. Auk 117:541-548.

Coker, D. R, and J. L. Confer. 1990. Brown-headed cowbird parasitism on golden-winged and blue-winged warblers. Wilson Bulletin 102:550-552.

Confer, J. L. 1992a. Golden-winged Warbler. No. 20 *In* The Birds of North America (A. Poole, P. Stettenheim, and F. Gill, editors). The Birds of North America, Inc., Philadelphia, PA.

Confer, J.L. 1992b. Golden-winged Warbler. Pp. 369-383 *In* Migratory Nongame Birds of Management Concern in the Northeast (K. J. Schneider and D. M. Pence, editors). U.S. Fish and Wildlife Service, Newton Corner, MA.

Confer, J.L. and J.L. Larkin. 1998. Behavioral interactions between golden-winged and blue-winged warblers. Auk 115:209-214.

Confer, J.L.(revisions by G. Hammerson and D.W. Mehlman.) 1999. Golden-winged Warbler (Vermivora chrysoptera). Wings Info Resources / Species Information and Management Abstracts. The Nature Conservancy-Wings of the Americas Program. http://www.tnc.org/wings/

DeBano, L. F., D. G. Neary, and P. F. Ffolliott. 1998. Chapter 9: Vegetation. *In* Fire's Effects on Ecosystems. John Wiley & Sons, Inc. New York, NY.

Delisle, J. M. and J. A. Savidge. 1997. Avian use and vegetation characteristics of conservation reserve program fields. Journal of Wildlife Management 61:318-325.

Dickerson, J., D. , B. Wark, D. Burgdorf, R. Maher, T. Bush, B. Poole, and C, Miller. 1998. Vegetating with Native Grasses in Northeastern North America. A Manual published by U.S. Department of Agriculture, Natural Resources Conservation Service, Plant Materials Program and Ducks Unlimited Canada.

Dowell, B. A. 1996. Bobolink. Pp. 412-413 *In* Atlas of Breeding Birds of Maryland and the District of Columbia (C. S. Robbins, senior editor). University of Pittsburgh Press, Pittsburgh, PA.

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.

Euler, D. L. 1974. The ecology of fire in upstate NY. PhD Thesis. Cornell University. Ithaca, NY.

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.

Gauthier, J. and Y. Aubry. 1996. The breeding birds of Québec: Atlas of the breeding birds of southern Québec. Association québécoise des groupes d'ornithologues, Province of Quebec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada, Québec Region, Montréal, 1302 pp.

Hands, H. H., R. D. Drobney, and M. R. Ryan. 1989. Status of the Henslow's Sparrow in the northcentral United States. A report by the Missouri Cooperative Fish and Wildlife Research Unit, School of Forestry, Fisheries and Wildlife, University of Missouri, Columbia, Missouri.

Herkert, J. R. 1994a. Breeding bird communities of midwestern prairie fragments: the effects of prescribed burning and habitat-area. Natural Areas Journal 14(2): 128-135.

Herkert, J. R. 1994b. Status and habitat selection of the Henslow's Sparrow in Illinois. Wilson Bulletin 106:35-45.

Herkert, J. R. 1994c. The effects of habitat fragmentation on midwestern grassland bird communities. Ecological Applications 4(3):461-471.

Herkert, J. R. R. E. Szafoni, V. M. Kleen, and J. E. Schwegman. 1993. Habitat establishment, enhancement and management for forest and grassland birds in Illinois. Natural Heritage Technical Publication #1. Illinois Department of Conservation, Springfield, IL.

Herkert, J. R. , D.W. Sample, and R. E. Warner. 1996. Management of midwestern grassland landscapes for the conservation of migratory birds. *In* Managing midwestern landscapes for the conservation of neotropical migratory birds (F.R. Thompson III, editor). U.S. Dept. of Agriculture Forest Service, North Central Forest Experiment Station, St. Paul. General Technical Report GTR-NC-187.

Howe, H. F. 1995. Succession and fire season in experimental prairie plantings. Ecology 76:1917-1925.

Hurley, R. L. and E. W. Franks. 1976. Changes in the breeding ranges of two grassland birds. Auk 93:108-115.

Johnson, D. H. 1997. Effects of fire on bird populations in mixed-grass prairie. *In* Ecology and Conservation of Great Plains Vertebrates (F. L. Knopf and F. B. Samson, editors). Springer-Verlag, New York, NY.

Jones, A. L. and P. D. Vickery. 1997. Conserving grassland birds: managing agricultural lands including hayfields, crop fields, and pastures for grassland birds. Massachusetts Audubon Society and U.S. Fish and wildlife Service. 17pp.

Joyner, D. E. 1978. Use of an old-field habitat by Bobolinks and red-winged blackbirds. The Canadian Field-Naturalist 92:383-386.

Kahl, R. B., T. S. Baskett, J. A. Ellis, and J. N. Burroughs. 1985. Characteristics of summer habitats of selected nongame birds in Missouri. University of Missouri-Columbia, College of Agriculture, Agricultural Experiment Station. Research Bulletin 1056.

Kantrud, H. A. 1981. Grazing intensity effects on the breeding avifauna of North Dakota native grasslands. Canadian Field-Naturalist 95:404-417.

Kelling, S. 1998. Bobolink. *In* Bull's Birds of New York State (E. Levine, editor). Cornell University Press, Ithaca, NY.

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

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.

Klaus, N. A. 1999. Effects of forest management on songbird habitat on the Cherokee National Forest, with a special emphasis on Golden-winged Warblers. MS Thesis. University of Tennessee, Knoxville, TN.

Lorimer, C. G. 1989. Relative effects of small and large disturbances on temperate hardwood forests structure. Ecology 70:565-567.

Marks, P. L. 1983. On the origin of the field plants of the northeastern United States. American Naturalist 122:210-228.

Mazur, R. 1996. Implication of field management for Henslow's Sparrow habitat at Saratoga National Historic Park, New York. MS Thesis. University of New York, Syracuse, NY.

Mendall, H. L. and C. M. Aldous. 1943. The ecology and Management of the American Woodcock. Maine Cooperative Wildlife Research Unit, University of Maine, Orono, ME. 201pp.

Mitchell, L. R. 2000. Use of prescribed fire for management of old fields in the Northeast. MS Thesis. Cornell University, Ithaca, NY.

Myers, R. E., and J. Dickerson. 1984. How to plant and maintain switchgrass. USDA Soil Conservation Service Information Sheet NY-63.

Norment, C. 1999a. Effects of grassland bird management on nongame bird community structure and productivity. Final report to the U.S. Fish and Wildlife Service and the Research Foundation of State University of New York. Department of Biological Sciencies, SUNY College at Brockport, Brockport, NY.

Norment, C. 1999b. Effects of habitat manipulations on grassland bird populations. Final report to the U.S. Fish and Wildlife Service and the Research Foundation of State University of New York. Department of Biological Sciencies, SUNY College at Brockport, Brockport, NY.

Norment, C. J., C. D. Ardizzone, and K. Hartman. 1999. Habitat relations and breeding biology of grassland birds in New York. Studies in Avian Biology No. 19:112-121.

Paton, W. C., W. Yang, and K. Frazer. 1999. Evaluating the effects of grassland restoration on the avian community at Rhode Island National Wildlife Refuge Complex. Final report to the U.S. Fish and Wildlife Service and the University of Rhode Island, Department of Natural Resources Science, Kingston, RI.

Peterson, A. 1983. Observations on habitat selection by Henslow's Sparrow in Broome County, New York. Kingbird 33:155-164.

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

Rich, T.D., C.J. Beardmore, H. Berlanga, P.J. Blancher, M.S. Bradstreet, G.S. Butcher, D.W. Demarest, E.H. Dunn, W.C. Hunter, E.E. Iñigo-Elias, J.A. Kennedy, A.M. Martell, A.O. Panjabi, D.N. Pashley, K.V. Rosenberg, C.M. Rustay, J.S. Wendt, T.C. Will. 2004. Partners In Flight North American Landbird Conservation Plan. Cornell Lab of Ornithology, Ithaca, NY.

Ricketts, T. H., E Dinerstein, D. M. Olson, C. J. Loucks, W. Eichbaum, D. DellaSalla, K. Kavanagh, P. Hedao, P. T. Hurley, K. M. Carney, R. Abell, and S. Walters. 1999. Terrestrial ecoregions of North America: a conservation assessment. Island Press, Washington, D. C.

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. 1999. 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.

Rosenberg, K. V., S. E. Barker, and R. W. Rohrbaugh. 2000. Final Report: an atlas of Cerulean Warbler populations. Prepared for U.S. Fish and Wildlife Service, Region 5, Hadley, MA; November 2000.

Sample, D. W. and Mossman, M. J. 1997. Managing habitat for grassland birds: a guide for Wisconsin. Wisconsin Department of Natural Resources Publication No. SS-925-97.

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

Sepik, G. F., R. B. Owen, Jr., and M. W. Coulter. 1981. A landowner's guide to woodcock management in the northeast. Life Sciences and Agriculture Experiment Station Miscellaneous Report 253. USFWS Moosehorn National Wildlife Refuge and University of Maine, Orono, ME. 23pp.

Smith, C.R. 1992. Henslow's Sparrow. In*: Migratory Nongame Birds of Management Concern in the* Northeast (Schneider, K. J., and D. M. Pence, eds.), pp. 315-330. U.S. Department of the Interior, Fish and Wildlife Service, Newton Corner, Massachusetts. 400 pp.

Smith, C. R. 1997. Use of public grazing lands by Henslow's Sparrows, Grasshopper Sparrows, and associated grassland birds in central New York State. In: *Grasslands of Northeastern North America* (Vickery, P. D. and P. W. Dunwiddie, eds)*,* pp. 171-186. ISBN 0-932691-25-0.

Smith, W. P. 1968. Eastern Henslow's Sparrow. In: *Life Histories of North American Cardinals,Grosbeaks, Buntings, Towhees, Finches, Sparrows and Allies* (A. Bent, author, O.L. Austin, ed.), pp. 776-778. Smithsonian Institution Museum of National History, Bulletin 237, Part 2.

Smith, C. R. 1997. Use of public grazing lands by Henslow's Sparrows, Grasshopper Sparrows, and associated grassland birds in central New York State. *In* Grasslands of Northeastern North America (P. D. Vickery and P. W. Dunwiddie, editors). Massachusetts Audubon Society, Lincoln, MA.

Smith, D. J., and C. R. Smith. 1992. Henslow's Sparrow and Grasshopper Sparrow: a comparison of habitat use in Finger Lakes National Forest, New York. Bird Observer 20:187-194.

Swanson, D. A. 1996. Nesting ecology and nesting habitat requirements of Ohio's grassland-nesting birds: a literature review. Ohio Fish and Wildlife Report 13:1-60.

Thibault, P. A., and W. C. Zipperer. 1994. Temporal changes of wetlands within an urbanizing agricultural landscape. Landscape and Urban Planning 28:254-251.

Veit, R. R., and W. R. Petersen, editors. 1993. Birds of Massachusetts. Massachusetts Audubon Society, Lincoln, MA.

Vickery, P. D., and P. W. Dunwiddie, editors. 1997. Grasslands of Northeastern North America. Massachusetts Audubon Society, Lincoln, MA.

Vickery, P.D., M. I. Hunter, Jr., and S. M. Melvin. 1994. Effects of habitat area on the distribution of grassland birds in Maine. Conservation Biology 8:1087-1097.

Vickery, P.D., M. L. Hunter, Jr., and J. V. Wells. 1999. Effects of fire and herbicide treatment of habitat selection in grassland birds in southern Maine. Studies in Avian Biology 19:149-159

Walkinshaw, L. H. 1978. Life history of the eastern Field Sparrow in Calhoun Country, Michigan. University Microfilms International, Ann Arbor.

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

Wells, J. V. and K. V. Rosenberg. 1999. Grassland bird conservation in eastern North America. In Vickery, P and J. Herkert (Eds.). Ecology and conservation of grassland birds in the western hemisphere. Studies in Avian Biology 19.

Wittenberger, J. F. 1980. Vegetation structure, food supply, and polygyny in bobolinks (*Dolichonyx oryzivorus*). Ecology 61:140-150.

Zimmerman, J. L. 1988. Breeding season habitat selection by the Henslow's Sparrow (*Ammodramus henslowii*) in Kansas. Wilson Bulletin 100:17-24.

Zipperer, W. C., R. L. Burgess, and R. D. Nyland. 1990. Patterns of deforestation and reforestation in different landscape types in central New York. Forest Ecology and Management 36:103-117.

APPENDIX 1: ECOLOGICAL UNITS AND VEGETATION

Appendix 1. Ecological Units and associated vegetation alliances within the Lower Great Lakes Plain PIF planning unit (physiographic area 15). Modified from Keys et al. (1995). SM-B-B = Sugar Maple-beech-birch forest. Human use categories: F = forestry, A = agriculture, R = recreation, RS = residential, U = urban, D = development, M = mining.

Subunit (state/province)	Description	Vegetation	Human use
221Ia (NY)	Lake Erie Plain	N. hardwood and oak-hickory-ash forests, black oak-white oak woodland, beechgrass drune	A, F
221Ib (NY)	Erie/Ontario Lake Plain	N. hardwood and oak-hickory-ash forests, chinquapin oak and white cedar limestone woodlands	A, U
221Ic (NY)	Eastern Ontario Till Plain	Oak-hickory-ash and northern hardwood forests, chinquapin oak woodland, inland salt marsh	A, D, F
221Id (NY)	Cattaraugus/Finger Lakes and Moraine and Hills	Oak-pine, oak-hickory-ash, and northern hardwood forests	A, R, F
221Ie (NY)	Eastern Ontario Lake Plain	Oak-hickory-ash, northern hardwood, and northern white cedar forests, alvar grassland	A, F

APPENDIX 2: THE AVIFAUNA

Roughly 177 bird species have been documented as breeding within physiographic area 15 (Peterson 1980, various atlases). The landbird avifauna is typical of northern portions of North America, but includes many species that have the center of abundance in the Midwest. 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 quite distinct from other northeastern physiographic areas. From a global perspective, this region (along with adjacent area 16) ranked high in terms of immediate conservation concern, based on relatively high atlas-block concentrations of Henslow's Sparrow, Golden-winged Warbler, and Cerulean Warbler (Rosenberg and Wells 1995).

Species of regional importance

Species with high proportions of their total populations in this region are considered of greatest importance for long-term conservation planning; ie., this region has the greatest responsibility for the long-term maintenance of their populations (Rosenberg and Wells 1995, 2000). Because of the small size of this planning unit, we consider a species to be of regional importance if $\geq$ 2% of its world population occurs in the unit (see Appendix 3).

Nine species (or widespread subspecies) were estimated to have $\geq$ 2% of their total population breeding in the planning unit (Table A2.1). These include probably 11% of the eastern race of Willow Flycatcher and over 7% of all breeding Ring-billed Gulls. In addition, exceptionally high relative abundances of Warbling Vireo (eastern), Song Sparrow, American Goldfinch, and Bank Swallow are recorded in this area, as well as over two-thirds of all Vesper Sparrows and Horned Larks estimated to occur in the 12 northeastern physiographic areas. The Lower Great Lakes Plain also boasts the highest relative abundance of introduced European Starlings in North America, as well as the largest northeastern abundances of Red-winged Blackbird and Brown-headed Cowbird.

Table A2.1. Species with high proportions of their total population in Area-15. Percent of population calculated from percent of range area, weighted by BBS relative abundance (see Rosenberg and Wells 2000; Appendix 3). Population trend from BBS data (% change per year from 1966-1999).

Species	% of pop.	rel. abun.	Pop. trend		N
Willow Flycatcher (eastern)	11.4	5.68 [a]	-0.1	ns	33
Ring-billed Gull	7.7	47.41 [a]	8.4	0.02	29
Warbling Vireo (eastern)	3.3	6.79 [a]	2.5	0.02	33
Bobolink	3.2	21.98	**-2.4**	0.05	34
Baltimore Oriole	2.5	9.49	-0.7	ns	33
European Starling	2.5	186.49 [a]	**-2.5**	0.00	34
American Goldfinch	2.4	25.63 [a]	-0.2	ns	34
Song Sparrow	2.1	51.38 [a]	0.3	ns	34
Gray Catbird	2.0	8.30	0.7	ns	33

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

Species of immediate concern

Species of high regional importance, that are also declining, are of greatest concern in terms of short-term conservation action (Rosenberg and Wells 2000). Our primary measure of population trend at present is the Breeding Bird Survey (BBS), which provides data on 127 of the 177 species breeding within Area-15. For many species in this region, however, especially those with patchy distributions, 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 these trend.

Of the nine species with $\geq$ 2% of their total population in the planning unit, only two have declined significantly ($P < 0.10$) since 1966 (Table A2.1). 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. Among the 27 declining species (Table A2.2), the most precipitous declines are shown by species of grassland and freshwater marsh habitats. Moderate declines are seen in species of other early successional habitats, including urban areas. The only declining species that can be considered forest birds are Black-billed Cuckoo, Yellow-shafted Flicker, Rose-breasted Grosbeak, and Least Flycatcher; all these are associated either with successional forest or edges.

Although the grassland and early successional species that appear on this list are mostly not of high regional importance (relative to other regions of North America), many occur in the Lower Great Lakes Plain in higher abundance than in most other northeastern physiographic areas. Therefore, opportunities for conserving populations of these species are also high in this area, elevating their priority status for conservation action.

Table A2.2. Species showing large or significant population declines within Physiographic Area 15, based on Breeding Bird Survey, 1966-1999 trends (N = 34 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
Henslow's Sparrow	-15.5	9	0.01	0.14	GR
American Black Duck	-15.4	7	0.04	0.14	W
Blue-winged Teal	-11.0	9	0.06	0.17	W
Grasshopper Sparrow	-9.7	22	0.01	0.91	GR
American Bittern	-9.6	9	0.09	0.14	W
Common Snipe	-7.9	6	0.03	0.16	W
Spotted Sandpiper	-6.8	29	0.00	0.81	W
Black-billed Cuckoo	-6.8	30	0.01	0.63	HF

Eastern Meadowlark	-6.3	33	0.00	14.53	GR
Brown Thrasher	-6.0	32	0.00	1.97	ES
Great Horned Owl	-5.7	13	0.03	0.13	HF, UR
Red-headed Woodpecker	-5.3	21	0.00	0.07	HF, GR
Ring-necked Pheasant	-4.9	29	0.01	7.91	GR
Belted Kingfisher	-4.3	26	0.10	0.33	W
Field Sparrow	-3.8	33	0.00	4.62	ES
Bank Swallow	-3.4 [a]	28	0.07	19.52	W
Common Grackle	-3.4	34	0.00	96.34	ES, UR
Yellow-shafted Flicker	-3.3	33	0.00	3.80	HF
Red-tailed Hawk	-3.0	33	0.00	1.37	HF, GR
Savannah Sparrow	-2.8	33	0.02	33.25	GR
House Sparrow	-2.8	34	0.00	77.89	UR
European Starling	-2.5	34	0.00	186.49	UR
Bobolink	-2.4	34	0.05	21.98	GR
Rock Dove	-2.1	33	0.01	24.32	UR
Rose-breasted Grosbeak	-2.0 [a]	33	0.01	3.18	HF
Least Flycatcher	-1.7	30	0.00	1.60	HF
Red-winged Blackbird	-1.6	34	0.05	137.23	GR, W

[a] Significant declining trend for period 1980-1999 only.

Increasing species

It is informative to also examine the species that are increasing significantly in a physiographic area. In the Lower Great Lakes Plain, 27 species show increasing population trends (Table A2.3), same as the number of species that are declining. A majority of these fall in two categories, either species associated with regenerating and mature forests, or species that have adapted particularly well to human activities or development. In the first group are Pileated Woodpecker, Hairy Woodpecker, and Red-eyed Vireo.

Species associated with human activities include those using bird feeders or nest boxes, as well as those that breed in urban wetlands. In particular, the phenomenal regional increase in Eastern Bluebirds is a direct result of conservation efforts over the last several decades. Several species, such as House Finch, Northern Mockingbird, and Tufted Titmouse have experienced widespread population increases throughout the Northeast. In contrast with those in Table A2.2, many of the early successional species that are increasing tend to be those that have adapted well to suburban and urban habitats (e.g. Eastern Phoebe, Cedar Waxwing, American Robin).

Table A2.3. Species showing large or significant population increases within Physiographic Area 15, based on Breeding Bird Survey, 1966-1999 trends (N = 34 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 Mockingbird	21.0	17	0.01	0.65	ES, UR
Tufted titmouse	19.3	13	0.05	0.46	HF, UR
Eastern Bluebird	18.1	30	0.00	0.68	ES
Turkey Vulture	16.8	25	0.0	1.83	ES
Blue-winged Warbler	13.2	14	0.01	0.15	ES
House Finch	11.4	33	0.03	10.01	UR
Pileated Woodpecker	9.9	11	0.04	0.11	HF
Canada Goose	8.4	25	0.04	7.80	W, UR
Ring-billed Gull	8.4	29	0.02	47.41	W, UR
Orchard Oriole	6.8	8	0.01	0.17	ES
Black-capped Chickadee	5.9	32	0.00	4.28	HF, UR
Mallard	5.5 [a]	34	0.75	8.46	W, UR
Hairy Woodpecker	5.2	20	0.09	0.21	HF
Eastern Phoebe	3.6	32	0.10	1.51	ES, UR
Tree Swallow	3.1	34	0.05	7.00	ES, UR
Cedar Waxwing	3.1	33	0.03	10.87	ES, UR
Northern Cardinal	3.0	34	0.00	13.32	ES, UR
American Crow	3.0 [a]	34	0.42	38.71	ES, UR
Blue Jay	2.8	34	0.00	7.34	HF, UR
Warbling Vireo	2.5	33	0.02	6.79	HF
Mourning Dove	2.1	34	0.01	37.07	ES, UR
Great Blue Heron	2.0	32	0.06	2.36	W
Common Yellowthroat	2.0	33	0.00	9.48	ES
American Robin	1.9	34	0.01	74.50	ES, UR
Red-eyed Vireo	1.8	33	0.06	4.55	HF
Yellow Warbler	1.7	33	0.01	18.34	ES
Chipping Sparrow	1.5	34	0.04	20.87	ES, UR

[a] Significant increasing trend for period 1980-1999 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 1999 (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. 2000). Note that prior to July, 1999 BBS Relative Abundance was calculated differently; so any previously presented or published population estimates using these values will differ from those calculated after July 1999 (J.R. Sauer, pers. com.).

Percent of Population

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

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

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 km^2). An analysis of North American bird species' distribution and abundance (K. V. Rosenberg, unpublished data) resulted in the % Pop thresholds listed in Table A3.1.

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

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

Absolute population estimates

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

Because BBS route locations are selected at random (ref), the first assumption is reasonable. Furthermore, several studies have shown that common habitat types are represented along secondary roads used as BBS routes in roughly the same proportions as in the overall landscape (refs). The third assumption is the most problematic; although most species probably do have a fairly constant average detection distance, selecting that distance is difficult and has a large effect on total population estimates. For example, an entire BBS route composed of 50 stops, each consisting of a 0.25 mi. (400 m)-radius circular count, potentially surveys roughly 25 km^2 of heterogeneous landscape. For a species that is detected routinely only out to 200 m at each stop, the effective area surveyed is reduced to 6.3 km^2; for a species detected only out to a distance of 100 m, the BBS route surveys 1.6 km^2. A simple method of extrapolating avian

density from counts of singing males using detection threshold distances was proposed by Emlen and DeJong (1981), who also provided average maximum detection distances for 11 species of common forest birds. These distances ranged from 72 m (Blue-gray Gnatcatcher) to 186 m (Wood Thrush) and averaged 128 m for the 11 species. Emlen and DeJong (1981) further proposed that numbers of singing males be doubled to obtain a total population estimate and that a correction factor be applied to account for variable singing rate (i.e. birds that were missed because they didn't sing during the survey period).

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

Population estimates for a physiographic area are then calculated as the average landscape-level density (number of birds per route * effective area sampled by each route) multiplied by the size (km^2) of the physiographic area. Note that landscape-level densities are not assumed to be similar to species densities in uniform optimum habitats, but rather reflect habitat heterogeneity at larger scales as sampled by BBS routes. Because the great majority of detections on typical BBS routes are of singing or displaying males, the population estimate derived from this method is assumed to represent number of breeding pairs, unless specifically noted otherwise.

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