Partners in Flight
Bird Conservation Plan
for
The Southern New England
(Physiographic Area 09)

American Bird Conservancy

Partners In Flight
Landbird Conservation Plan:

Physiographic Area 9:

Southern New England

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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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EXECUTIVE SUMMARY

Area - 4,425,100 ha

Description - The Southern New England physiographic area covers parts of northern New Jersey, southern New York including Long Island, the majority of Connecticut, all of Rhode Island, most of eastern Massachusetts, the southeastern corner of New Hampshire, and south-coastal Maine. This area has experienced the greatest amount of urbanization of any part of the Northeast, including the entire Boston-to-New York City corridor. Urbanization and associated human activities severely threaten remaining high-priority habitats, especially maritime marshes and dunes, relict grasslands, and mature deciduous forests. Forest fragmentation, which is not a major issue in most parts of the Northeast, is a severe factor threatening forest bird populations. Currently, urban land covers roughly one-third of the physiographic area, with an additional 25 % of the region in agricultural production, primarily in the Connecticut River Valley, eastern Long Island, and northern New Jersey. Remaining forests are a mixture of oak-hickory and other hardwoods, white pine-red pine forest, and pine-oak woodlands or barrens.

Priority bird species and habitats -

Maritime marshes -

Salt-marsh Sharp-tailed Sparrow -- Large proportion of world population breeds here; requires high marsh with buffer, stable water levels.

Seaside Sparrow -- Large proportion of East Coast population; wider habitat tolerance than sharp-tailed sparrows

Black Rail -- Few known breeding sites; requires high marsh with buffer.

American Black Duck -- Important breeding and wintering populations

Objective: Numerical population and habitat-area objectives for priority marsh birds have not yet been determined. Roughly 10,000 ha of marsh may be required to support 1500 breeding pairs of American Black Ducks.

Mature deciduous forest -

Cerulean Warbler -- Recently expanding population in NJ Highlands, Hudson Valley, and CT; uses mature upland and riparian bottomland forests.

Wood Thrush -- Declining nearly throughout its range; breeds primarily in mid-successional forest with dense deciduous understory.

Worm-eating Warbler -- Requires mature upland forest with dense understory; ground-nester.

Louisiana Waterthrush -- Requires rocky, flowing streams in mature forest.

Objective: Roughly 600,000 ha of deciduous (and mixed) forest is required to support entire habitat-species suite (e.g. 170,000 pairs of Wood Thrush), with 11,000 ha suitable to support 4,700 pairs of Worm-eating Warblers and 500 pairs of Cerulean Warblers. In addition, 7,800 km of forested streams are required to support 5,700 pairs of Louisiana Waterthrush.

Early successional scrub/ pitch pine barren -

Golden-winged Warbler -- Important breeding sites at high-elevation wet areas in NJ and Hudson Highlands.

American Woodcock -- Shows steep population declines; requires combination of forest clearings, second-growth hardwoods, and moist soils for foraging.

Prairie Warbler -- Favors natural pine-oak barrens, as well as regenerating forest; declining in most of range.

Blue-winged Warbler -- Declining in this region, while populations spread elsewhere; encroaching on remaining Golden-winged Warbler breeding sites.

Objective: Roughly 85,000 ha of shrub habitat required to support habitat-species suite (e.g. 42,000 pairs of Blue-winged Warblers; at least 1,000 ha of suitable high-elevation habitat should be protected or managed to support 500 pairs of Golden-winged Warblers.

Grassland/agricultural -

Henslow's Sparrow -- Recently extirpated from this area; formerly occupied high-marsh margins and upland pastures.

Upland Sandpiper -- Area sensitive; very few breeding sites remaining in this region

Objective: Rougly 10,000 ha of grassland habitat is needed to support entire habitat-species suite (e.g. 15,000 pairs of Bobolinks; all known sites for Upland Sandpiper and Henslow's Sparrow need strict protection and management.

Conservation recommendations and needs -
In addition to many local threats to remaining breeding-bird habitats, this area contains numerous critical stopover sites for landbirds and shorebirds. The total value of these sites has not been fully assessed yet, and conservation strategies for priority species during stopover lag behind those for breeding species. Intensive studies and surveys of salt-marsh sparrows are ongoing in this region, as are complete inventories of grassland habitats, and an atlas of present Cerulean Warbler populations. Many important forested sites are privately owned, but state forest and "reservations" will contribute greatly to sustaining populations of priority forest birds, especially in Massachusetts. New York's Important Bird Areas program has identifies key sites on Long Island and is developing conservation strategies for these sites.

Specific conservation recommendations for this physiographic area include:

- complete intensive survey and monitoring for high-priority species to identify most important areas in need of protection;
- identify and designate Bird Conservation Areas (BCA), within which long-term sustainability of priority bird populations is a primary management objective
- protect and restore coastal wetland habitats to enhance breeding and wintering populations of American Black Duck and ensure long-term sustainability of marsh sparrow populations;
- Protection and management of remaining mature forests to maximize benefits to Cerulean Warbler; e.g., preserve tallest trees, encourage maturing of canopy species, prevent fragmentation of existing forests;
- Identify critical sites for migration stopover; integrate habitat objectives into local land-use planning and outreach efforts (Cape May model).

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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 Southern New England physiographic area is one of the smaller planning units in the northeastern U.S., with a total area under consideration of roughly 44,251 square kilometers. Landforms within the planning unit include the glaciated plains of coastal areas, open hills of the Hudson Highlands and Worcester-Monadnock Plateau, rolling broad lowlands with belts of ridges in the Newark Piedmont, and broad uplands separated by narrow ridges in the Reading Prong. The planning unit also contains a broad glacial valley with terraces in the lower Connecticut River valley and moraines on Cape Cod (terminal moraine) and Long Island (ground moraine). Roughly 75,500 ha of freshwater wetlands and 37,900 ha of estuarine wetlands have been identified in the planning unit.

Within the planning unit are 13 Ecological Units (Keys et al. 1995), all within the New England - Adirondack province (Appendix 1). Some of these Ecological Units are shared with adjacent physiographic areas, such as portions of the Hudson Highlands and the Gulf of Maine Coastal Plain units with Area 27 (Northern New England) and the Reading Prong unit with Area 17 (Northern Ridge and Valley). Average annual precipitation ranges from roughly 110 cm to 120 cm. Average growing season ranges from about 145 days on the coastal plains of MA, NH, and ME to 200 days on Long Island (climate data from Keys et. al. 1995).

B. Potential Vegetation

The predominant potential vegetation alliances for this planning unit include hemlock-white pine and northern red oak-white pine (Appendix 1). A variety of other mixed oak-hardwood alliances are also widely represented and distributed throughout the southern half of this unit. Patches of sugar maple-beech-birch (i.e., northern hardwood) commonly occur in many of the coastal plain and highland/hill areas, especially in the north. Current estimates suggest approximately 600,000 ha of conifer-dominated forest, 770,000 ha of oak-hardwood forest, and 330,000 ha of northern hardwoods in the planning unit.

Additional forest alliances include red maple-black ash swamp, white pine-red pine forest, red spruce transition forest, and Atlantic white cedar swamp. Nonforest alliances include maritime dune communities and tidal marshes.

C. Natural disturbances

Historically, fire likely played an important role in maintaining much of the oak-dominated forests of the southern portion of this planning unit, as well as the pine barron habitats throughout the area. Fire is an important factor in oak regeneration, and the fire suppression policies of the last half of the 20th century has had significant impacts on the natural processes and vegetation composition of deciduous forests and barrons. Insect outbreaks may also have had significant effect in the southern portions of Southern New England. Gypsy moths and wooly adelgids are examples of insect pests that are currently causing disturbances in natural forest communities (oaks and hemlocks, respectively). However, fire was probably not very important in the northern sections of this unit where northern hardwoods and conifer forests dominate the landscape. Weather events (e.g., hurricanes, tornadoes, ice and snow storms) probably played a more important role than fire in these areas.

D. History and land use

Human populations have impacted the pattern of land cover types in this region for thousands of years, beginning with native Americans. Current evidence suggests that Native American activities exerted detectable, if not crucial, ecological impact on the broad-scale pattern of vegetation in Southern New England. These forces were magnified into a crucial force with the changes brought about by increased population and agriculture after European settlement (Foster 1995). By the time of European settlement, portions of the eastern seaboard were already in the process of

being turned into a more open, park-like forest, primarily through Indian agriculture and their use of fire for clearing and hunting. The “natural” forest was also a heterogeneous mix with large areas of open woodlands where fire, disease, wind, and ice had affected it (Williams 1989). Agriculture expanded significantly in the region during the late 1800s, amounting to roughly 70% of the land being cleared during its maximum extent in the early 1900s (Foster 1995). Since that time, farm abandonment, urbanization, and some reforestation have been the dominant factors shaping the landscape. Today, agriculture still plays an important part in the region’s land use, but forestry is once again more common. Of course, human populations continue to grow throughout this region and urbanization is a major factor. Current estimates of land use in this physiographic region show approximately 40% forest cover, 35% urban/suburban, and 23% agriculture.

Table 1.1. Current land-use and ownership patterns in the Southern New England physiographic area. (number of hectares)

Land classification	Total area (ha)
Forested land	1,725,700
Public ownership	
State managed	
other public	
Private industrial	
Private non-industrial	
Agricultural land	983,500
Other "grassland"	57,600
Residential/ developed	1,452,500
Freshwater wetlands	75,500
Maritime	
Other nonforest lands	1,500

SECTION 2: PRIORITY BIRD SPECIES

A. General Avifauna

Roughly 205 bird species (Appendix 2) have been documented as breeding within physiographic area 9 (Peterson 1985, atlases). Of the nongame landbirds (140 species), the majority are migratory; these include roughly 73 Neotropical migratory species. The landbird avifauna is typical of northeastern North America, but includes many species of more southern affinity that are near the northern limits of their range. An analysis of all Neotropical migratory species in the Northeast U.S. (Rosenberg and Wells 1995) found the composition of breeding species in this area to be most similar to that of the Northern Ridge and Valley and quite distinct from that of Northern New England. From a global perspective, this region ranked moderately high in terms of long-term bird conservation in eastern North America.

Because of the small size of this physiographic area, very few species have a large percentage of their global population breeding within the planning unit. For 10 species, however, = 2% of the total population is estimated to occur, indicating disproportionately large populations breeding in this small area (Appendix 2). Of these, the Saltmarsh Sharp-tailed Sparrow is most significant, with possibly half of its very restricted population in this physiographic area. In addition, nearly 10% of all Blue-winged Warblers and 6% of Gray Catbirds are estimated to breed here.

Our primary measure of population trend at present is the Breeding Bird Survey (BBS), which provides data on 143 of the 205 breeding species (N = 59 routes). Of the species sampled by BBS, 38 have declined significantly ($P < 0.10$) since 1966, and 6 additional species have declined since1980 (Appendix 2). These include nearly all species associated with early successional and other disturbed habitats, which make up 12 of the 15 species showing the steepest declines (> 5 % per yr). In addition, at least 18 common species of hardwood or mixed forests have declined significantly; among these, Yellow-billed and Black-billed cuckoos and Broad-winged Hawk showed the steepest declines (> 5 % per year). The relatively large number of declining forest species in Southern New England parallels the pattern for Northern New England and is in contrast with many other northeastern physiographic areas, where few forest species are declining. Declining forest species, however, are primarily those associated with mid-successional forests or edges.

Forty-one species show increasing population trends (Appendix 2), roughly equal to the number of species that are declining. A majority of these fall in two categories, either species associated with mature forests, or species that have adapted particularly well to human activities or development. Increasing forest birds include several regionally important species such as Cerulean Warbler, Worm-eating Warbler (since 1980), and Yellow-bellied Sapsucker. Species associated with human activities include those using bird feeders or nest boxes, as well as those that breed in urban wetlands or conifer plantations (e.g. Pine Warbler, Hermit Thrush, Myrtle Warbler).

B. Priority species pool

From among the breeding avifauna, a pool of species may be derived that represents priorities for conservation action within the physiographic area (Table 2.1). Note that a species may be considered a priority for several different reasons, including global threats to the species, high concern for regional or local populations, or responsibility for conserving large or important populations of the species. The different reasons for priority status are represented by levels or tiers in Table 2.1. Our primary means of prioritizing species is through the PIF prioritization scores generated by Colorado Bird Observatory (Hunter et al. 1993, Carter et al. in press). This system ranks species according to seven measures of conservation vulnerability. These include four global measures (i.e., they do not change from area to area), as well as threats to breeding populations (TB), area importance (AI), and population trend (PT), which are specific to each physiographic area. A total rank score is then derived, which is a measure of overall conservation priority; scores for all breeding species in the Southern New England region are found in Appendix 2.

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

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

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

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

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

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

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

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

Table 2.1. Priority species pool for Southern New England, Area 9. Total scores were developed from Partners In Flight criteria (Hunter et al. 1994, Carter et al. in press), with regional and global scores provided by Colorado Bird Observatory. Percent of population was calculated from percent of range area, weighted by BBS relative abundance (see Rosenberg and Wells, in press), except where noted. Local status codes refer to migratory status: B – species that breed within the region but do not winter there, R – resident or nonmigratory species, E – species reaching distributional limits.

Entry level	Species	Total score	% of pop.	AI	PT	Local status
I						
A.	Saltmarsh Sharp-tailed Sparrow	29	50?	5	3	R?
	Piping Plover	29	38?[a]	5	3	B
	Blue-winged Warbler	26	10.0	5	4	B
	Seaside Sparrow	25	??	4	3	R?
	Wood Thrush	24	2.2	4	4	B
	Worm-eating Warbler	24	1.7	3	3	B
	Prairie Warbler	24	1.3	4	5	B
	Baltimore Oriole	23	2.1	5	5	B
	Black-billed Cuckoo	23	< 1	4	5	B
	Scarlet Tanager	22	2.6	4	4	B
	Louisiana Waterthrush	22	2.2	4	2	B
	American Woodcock	22	< 1	3	5	B
	American Oystercatcher (CT-SC)	22	??	3	3	B
B.	Henslow's Sparrow	28	< 1	2	5	B, E
	Golden-winged Warbler	27	< 1	2	5	B (E?)
	Black Rail	26	< 1?	2	3	B
	Cerulean Warbler	25	< 1	2	3	B
	Black-throated Blue Warbler	23	< 1	2	3	B
	Kentucky Warbler	22	< 1	2	3	B, E
	Upland Sandpiper	22	< 1	2	5	B
II						
A.	Rose-breasted Grosbeak	21	< 1	4	5	B
	Chimney Swift	20	1.1	4	4	B
	Eastern Wood-pewee	20	1.0	4	4	B
	Black-and-white Warbler	20	1.1	4	4	B
	Hairy Woodpecker	19	< 1	4	5	R
	Eastern Towhee	19	1.0	3	5	B
	Purple Finch	19	< 1	3	5	R
C.	American Black Duck	21	< 1?	3	2	R
	Canada Warbler	21	< 1	2	3	B
	Blackburnian Warbler	21	< 1	2	4	B
	Sedge Wren	21	< 1	2	3	B, E
	Red-headed Woodpecker	20	< 1	2	3	B, E
	Short-eared Owl (MA,NJ-E; CT-T; NY-SC)	19	< 1	2	3	R, E
	Peregrine Falcon (F-T)	19	< 1	2	3	R
III						
	Chuck-will's-widow	20	< 1	2	3	B
	Bobolink	18	< 1	2	2	B
IV						
	Roseate Tern (F-E)	19	< 1	2?	3	B
V						
	Whip-poor-will (CT-SC)	19	< 1	2	3	B
	Northern Parula (MA,CT-SC)	19	< 1	2	3	B
	Grasshopper Sparrow (MA,RI,NJ-T; CT-E; NY-SC)	19	< 1	2	5	B
	Yellow-breasted Chat (CT-SC)	18	< 1	2	5	B
	Glossy Ibis (CT-SC)	18	1.0	5?	3	B
	American Bittern (MA,CT,RI-E; NJ-T)	18	< 1	2	4	B
	King Rail (NY-T)	18	< 1	2	3	B, E
	Northern Goshawk (NY-SC)	18	< 1	1	3	R, E

Tricolored Heron (CT-SC)	17	< 1	2	3	B
Red-shouldered Hawk (CT-SC; NY-T; NJ-E)	17	< 1	2	3	R
Northern Harrier (NY-T)	17	< 1	2	3	R
Vesper Sparrow (RI,CT,NJ-E; MA-T; NY-SC)	17	< 1	2	4	B
Least Bittern (CT-T; NY-SC)	17	< 1	2	3	B
Sharp-shinned Hawk (CT-T; MA-SC)	16	< 1	3	3	R
Yellow-crowned Night-Heron (CT-SC)	16	< 1	2	3	B
Barn Owl (RI,CT-T; MA,NY-SC)	16	< 1	2	3	R
Long-eared Owl (CT-E, NJ-T; MA-SC)	16	< 1	2	3	R
Pied-billed Grebe (MA,CT,NJ-E)	16	< 1	2	3	B
Common Tern (NH-E; NY-T; MA,CT-SC)	15	< 1	3	3	B
Least Tern (NY-E; NH,CT-T; MA-SC)	15	< 1	2	3	B
Black-crowned Night-Heron (CT-SC)	15	< 1	3	3	B
Barred Owl (NJ-T)	15	< 1	2	3	R
Cooper's Hawk (NY-SC)	15	< 1	2	3	R
Osprey (NY-T)	15	< 1	2	3	B
Purple Martin (CT-SC)	15	< 1	2	3	B
Great Egret (CT-T)	15	< 1	2	3	B
Savannah Sparrow (NJ-T; CT-SC)	15	< 1	2	4	B
Common Nighthawk (NH-T; CT,NY-SC)	15	< 1	2	3	B
Snowy Egret (CT-T)	14	< 1	2	3	B
Little Blue Heron (CT-SC; NJ-T)	14	< 1	2	3	B
Common Moorhen (CT-T; MA-SC)	14	< 1	2	3	B
Arctic Tern (NH-T; MA-SC)	13	< 1	1	3	B, E
Horned Lark (CT-T)	12	< 1	2	3	R
Great Blue Heron (CT-SC; NJ-T)	12	< 1	3	1	R
Cattle Egret (CT-SC)	11	< 1	2	3	B

[a] % population estimate from the North Atlantic regional plan of the U.S. Shorebird Conservation Plan.

Twenty species are considered to be high continental or global priority (Table 2.1). Of these, Salt-marsh Sharp-tailed Sparrow and Piping Plover score highest because of their restricted range and small total population. An unknown but significant proportion of the world's Salt-marsh Sharp-tailed Sparrows breed in coastal marshes in this physiographic area, making this species perhaps the highest priority for conservation planning. Seaside Sparrow is only slightly more widespread and shares a high-priority status with the previous species. Blue-winged Warbler, Prairie Warbler, Wood Thrush, Baltimore Oriole, Black-billed Cuckoo, Scarlet Tanager, and American Woodcock all show a combination of high regional importance (AI = 3 - 5) and significantly declining population trend. In contrast, Henslow's Sparrow, Golden-winged Warbler and Upland Sandpiper, although of high global priority, are rare or possibly extirpated in most of Southern New England, having declined precipitously in recent decades. Cerulean and Worm-eating warblers are uncommon and apparently stable or increasing in numbers.

Priority level II A. includes seven additional species with relatively large and/or declining populations in the physiographic area. These are primarily common birds of hardwood or mixed forest, but also include the Chimney Swift, which is adapted to urban areas. Another seven species are listed in II C. because their remaining populations in this region are highly threatened. Only two additional Watch List species are represented in the priority species pool, the Bobolink, which is a local breeder, and the Chuck-will's-widow, which has expanded it's population on the northern edge of its range.

Thirty-six additional species that are listed federally or in various states as either endangered, threatened or special concern have at least small breeding populations in the Southern New England physiographic area. As elsewhere in the Northeast, state-listed species are dominated by raptors, wetland, and grassland birds, many of which can be considered rare or peripheral in the region and otherwise score relatively low in the PIF prioritization process. This list draws special attention to coastal wetland habitats and especially the vulnerability of colonial waterbird species throughout the region.

The overall priority pool of 72 species (35% of the breeding avifauna) is dominated by common forest-breeding and early successional species, many of which are declining in Southern New England. Considering all priority categories, the species of highest conservation concern include Salt-marsh Sharp-tailed Sparrow and associated marsh species, and a suite of mature deciduous forest breeders. These may represent focal species that help define conservation actions in their respective habitats (see Section 4). Concern for common early successional species is considered secondary, even though many of these species score highly in the prioritization system. The rather large

group of federal and state-listed species may represent local priorities that often highlight the need to conserve uncommon and fragile habitats such as beaches or grasslands.

C. Nonbreeding species

Preliminary winter priority scores have been assigned by CBO (1999). In addition to small wintering population of Saltmarsh Sharp-tailed Sparrow and an augmented winter population of Am. Black Ducks, seven additional coastal species rank as conservation priorities in winter. These include important populations of wintering (and transient) Brant, Purple Sandpiper, Greater Scaup, Common Loons and Horned Grebes, as well as some local concentrations of wintering Sanderling. The local and distinct Ipswich race of Savannah Sparrow winters nearly exclusively in this region. These species further highlight the need to protect and enhance coastal dunes, estuaries, and offshore habitats for wintering water birds.

Table 2.2. Priority winter species for Area 9. PIF regional and global scores from CBO (Carter et al., in press); preliminary winter scores by Chip Chipley, American Bird Conservancy.

Entry level	Species	Total score	TN	AI (winter)	PT (global)	Local status
I						
	Saltmarsh Sharp-tailed Sparrow	27	4	2	3	R?
	Brant	25	3	5	5	W
	American Black Duck	24	3	5	5	R
	Purple Sandpiper	22	3	5	2	W
	Savannah (Ipswich) Sparrow	??	4	5	3	W
II						
	Greater Scaup	21	3	5	5	W
	Sanderling	20	2	3	5	W
	Common Loon	19	3	5	3	W
	Horned Grebe	19	2	4	5	W

Transients -- migration stopover.....

SECTION 3: BIRD CONSERVATION ISSUES AND OPPORTUNITIES

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

Because most of the Northeast region has undergone major changes in forest cover during the past two centuries, the relative importance placed on early- versus late-successional species and their habitats today depends in large part on the historical baseline chosen for comparison. This issue, which permeates bird-conservation planning throughout the Northeast, must be resolved before priority species and habitats are determined. Compared with elsewhere in the region, early successional species are well represented here, and the vast majority of these show declining population trends. The planning unit also supports many regionally and even globally important populations of forest birds, and many of these are declining too.

To some extent, deciding on the "value" of early-successional bird populations is subjective; for example, the fact that two of the species with significant declining trends in the region are European Starling and House Sparrow is hardly reason for concern. Other species such as Blue-winged Warbler, however, rank high in regional importance and have undoubtedly benefited from forest regeneration following harvesting. Similarly, American Woodcock is a species of regional and global concern that requires disturbed or managed habitats.

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

B. Urban and recreational development on private land

Urban/suburban areas cover a substantial proportion (~35%) of the Southern New England planning unit. This unit contains some of the largest urban areas and highest human densities in the northeastern United States (e.g., New York City, coastal Connecticut, Hartford, Providence, Boston). These large human populations and urban/suburban development obviously has a large effect on the physiographic area as a whole. Although urban habitats are often thought of as nonhabitat for most birds, several species in the priority pool for this unit are currently utilizing urban areas as their primary breeding habitat. In addition, because the trend for migration patterns to be more concentrated along coastal areas, the heavily urbanized coastal sections of this unit are located in extremely important migration stopover areas. Municipal parks and even wooded neighborhoods can provide suitable stopover habitat that is critically needed by migrating landbirds.

In addition to urbanization, recreational development, especially along coastal and other wetland areas, represent substantial impacts to be considered. Coastal development for recreation may not be as intensive of development as urbanization, but it still substantially alters the naturally occurring communities. However, the potential for retaining some suitable habitat amidst recreational development is certainly higher than with urbanization. Efforts should be made to inform and educate the developers and users of these areas as to how they can minimize impacts on the bird communities utilizing these areas.

C. Migration stopover sites -- importance?

xxxxx

D. Bird conservation opportunities and solutions

Several factors contribute to an optimistic assessment of future bird conservation planning in this region: (1) most priority bird species are still abundant and widespread, exemplifying the PIF objective of "keeping common birds common;" (2) biologists and land managers have developed good coordination for monitoring, managing, and sharing information on high priority species in a variety of habitats (e.g., beach./dune, grasslands, maritime marsh, shrublands) within this region; (3) although about one-third of the natural land cover in this physiographic area has already been converted to urban/suburban land uses, many of the remaining sites important to breeding birds in this area are already under protection or appropriate land management practices by government agencies or conservation organizations.

Identification of *Important Bird Areas* within the New York portion of this planning unit has recently been carried out by National Audubon Society's New York chapter (Wells 1998). These include 29 sites on Long Island or associated small islands. Conservation planning for these Important Bird Areas has begun and includes implementation of PIF plan objectives for high-priority landbirds. In addition, identification of IBAs in Connecticut and Massachusetts has begun. Specific areas will be referred to in greater detail under appropriate habitat sections, below.

TNC ecosystem planning....

Long-term research and monitoring efforts throughout the region have provided and will continue to provide crucial information for better understanding the needs of birds in this planning unit. All states within this unit have programs to closely monitored beach/dune habitat (including some active management to reduce predator threats) for the terns, plovers, and gulls that breed there, and information from these efforts are shared on a regional basis. Likewise, coordinated efforts to monitor grasslands have also been ongoing throughout the region since 1997 (Shriver et al. 1999). Significant research on disturbance-dependent birds of early successional habitats has recently been conducted on species such as golden-winged warblers, blue-winged warblers, chestnut-sided warblers, and yellow-breasted chats. Recently, efforts to establish a regional monitoring program for maritime marshes have also begun. Continuing these efforts to conduct monitoring and research on the critical habitats in this physiographic area with provide the information for adaptive management practices and landscape decisions based on the best available knowledge.

SECTION 4: PRIORITY HABITATS AND SUITES OF SPECIES

When species in the priority pool (Table 2.1) are sorted by habitat, the highest priority habitats and associated species can be identified (Table 4.1). These represent the habitats that are either in need of critical conservation attention or are critical for long-term planning to conserve regionally important bird populations. The highest priority species do not form a cohesive habitat group, but rather divide among nine different forest, early successional, and wetland habitats. The species of greatest importance, however, is Saltmarsh Sharp-tailed Sparrow, and by association, its maritime habitat ranks first in regional priority. Other habitats may be loosely ranked according to the highest-scoring species in the habitat suites. Within each habitat-species suite, certain species that represent particular limiting requirements (e.g., area sensitivity, snags) are considered focal species for setting population-habitat objectives and determining conservation actions.

Table 4.1. Priority habitat-species suites for Area 9. TB (threats breeding), AI (area importance), PT (population trend), and total PIF scores from CBO prioritization database (Carter et al. 2000). Focal species for each habitat are in boldface.

Habitat	Species	Total score	TB	AI	PT	Action level [a]
Maritime marshes						
	Saltmarsh Sharp-tailed Sparrow	29	3	5	3	II
	Black Rail	26	4	2	3	II
	Seaside Sparrow	25	3	4	3	IV
	American Black Duck	21	4	3	2	II
	American Bittern	18	3	2	4	IV
	Tricolored Heron	17	3	2	3	V
	Northern Harrier	17	4	2	3	IV
	Glossy Ibis	16	3	3	3	V
	Black-crowned Night -Heron	16	3	4	3	V
	Yellow-crowned Night-Heron	16	3	2	3	V
	Osprey	16	3	2	2	V
	Great Egret	15	3	2	3	V
	Snowy Egret	14	3	2	3	V
	Little Blue Heron	14	3	2	3	V
	Cattle Egret	12	3	2	3	V
	(Short-eared Owl -- NB)	??				
Beach/ dune						
	Piping Plover	29	4	5	3	II
	American Oystercatcher	22	3	3	3	IV
	Roseate Tern	19	4	2	3	II
	Short-eared Owl	19	4	2	3	IV
	Common Tern	15	3	3	3	IV
	Least Tern	15	3	2	3	IV
	Arctic Tern	14	2	1	3	V
	Horned Lark	12	3	2	3	V
	(Ipswich Sparrow - NB)	??				
Mature deciduous and mixed forest						
	Cerulean Warbler	25	3	2	3	II
	Wood Thrush	24	3	4	4	III
	Worm-eating Warbler	24	3	3	3	IV
	Baltimore Oriole	23	3	5	5	III
	Black-billed Cuckoo	23	3	4	5	III
	Black-throated Blue Warbler	23	3	2	3	IV
	Louisiana Waterthrush	22	3	4	2	IV
	Scarlet Tanager	22	3	4	4	III
	Kentucky Warbler	22	3	2	3	IV
	Rose-breasted Grosbeak	21	3	4	5	III

Blackburnian Warbler	21	3	2	4	III
Canada Warbler	21	3	2	3	IV
Eastern Wood-pewee	20	3	4	4	III
Black-and-white Warbler	20	3	4	4	III
Northern Parula	19	3	2	3	IV
Hairy Woodpecker	19	2	4	5	III
Purple Finch	19	3	3	5	III
Northern Goshawk	19	3	2	3	IV
Red-shouldered Hawk	17	3	2	3	IV
Long-eared Owl	16	3	2	3	IV
Sharp-shinned Hawk	16	3	3	3	IV
Cooper's Hawk	15	3	2	3	IV
Barred Owl	15	3	2	3	IV
Early successional shrub/ Pitch pine barren					
Golden-winged Warbler	27	4	2	5	II
Blue-winged Warbler	26	3	5	4	III
Prairie Warbler	24	3	4	5	III
American Woodcock	22	3	3	5	III
Chuck-will's-widow	21	3	2	3	IV
Red-headed Woodpecker	20	4	2	3	IV
Eastern Towhee	19	3	3	5	III
Whip-poor-will	19	3	2	3	IV
Yellow-breasted Chat	18	3	2	5	IV
Grassland/agricultural					
Upland Sandpiper	22	4	2	5	III
Grasshopper Sparrow	19	4	2	5	III
Bobolink	18	4	2	2	IV
Vesper Sparrow	17	4	2	4	III
Northern Harrier	17	4	2	3	IV
Barn Owl?	16	3	2	3	IV
Savannah Sparrow	15	3	2	4	V
Horned Lark	12	3	2	3	V
(Short-eared Owl)	??				
Urban/suburban					
Chimney Swift	21	3	4	4	III
Peregrine Falcon	18	4	2	3	II
Purple Martin?	15	3	2	3	IV
Common Nighthawk	15	3	2	3	IV
Freshwater wetland -- river/lake					
American Black Duck	21	4	3	2	II
King Rail	18	4	2	3	IV
American Bittern	18	3	2	3	IV
Least Bittern	17	3	2	3	IV
Northern Harrier	17	4	2	3	IV
Osprey	15	3	2	2	IV
Pied-billed Grebe	16	3	2	3	V
Common Moorhen	14	3	2	3	V
Great Blue Heron	13	3	3	1	V

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

A. Maritime Marsh

Importance and conservation status: This habitat type is tied with mature deciduous forest for harboring the largest number of high priority species in Southern New England. Because of the combination of this large number of priority species and the tremendous pressure from human development along the coastline, this habitat types is clearly the one most in need of immediate conservation attention in this planning unit. An estimated 38,000 ha of maritime marsh habitat exists in CT, RI, and MA alone, with significant additional habitat on Long Island, and the New Hampshire and Maine coasts. The largest contiguous saltmarsh in Maine (Scarborrough Marsh) is within this planning unit, as is the Great Bay system in New Hampshire.

Current protection for this habitat type includes marshes existing within the national seashores on Fire Island and Cape Cod, the national wildlife refuges along the coast, state-protected areas such as natural areas and wildlife management areas, and properties owned by conservation organizations or land trusts. Many of the most important site have been or will soon be identified through state and national Important Bird Areas (e.g., Wells 1998). Fortunately, many of the remaining large marshes are already under some form of protection from development. However, substantial threats still exist in the forms of human disturbance, pollution, increasing predator populations, and exotic species.

Associated priority species*:* SALT MARSH SHARP-TAILED SPARROW, SEASIDE SPARROW, AMERICAN BLACK DUCK, colonial waterbirds, etc.

[ecological information, microhabitats]

Habitat and population objectives*:* Based on extrapolations from BBS relative abundances (assuming each route samples approximately 6.3 - 25.0 km^2 of habitat; Appendix 3), VERY ROUGH estimates of population size for priority species in this habitat suite can be derived (Table 4.4).

Table 4.4. Population estimates for priority species of maritime marsh habitats in the Southern New England physiographic area. Percent of Atlas blocks based on number of 5-km blocks in which the species was reported within this physiographic area during the state Breeding Bird Atlases for New Jersey (N=±109; Walsh et al. 1999), New York (N=373; Andrle and Carroll 1988), Connecticut (N=550; Bevier 1994), Massachusetts (N=944; Veit and Peterson 1993), Rhode Island (N=165; Enser 1992), and Maine (N=25; Adamus 1987?).

Species	BBS population	% Atlas blocks					
		NJ	NY	CT	RI	MA	ME
Saltmarsh Sharp-tailed Sparrow	??		19	3	18	5	32
Black Rail	??		<1	0	0	0	0
Seaside Sparrow	??		13	2	8	<1	0
American Black Duck	1,400		51	29	36	44	72
American Bittern	75		5	4	3	8	36
Tricolored Heron	??		3	<1	0	<1	8
Northern Harrier	40		18	2	2	3	16
Glossy Ibis	??		13	1	2	<1	20
Black-crowned Night-Heron	??		38	10	4	1	35
Yellow-crowned Night-Heron	??		11	2	0	<1	0
Osprey	200		23	5	8	20?	24
Great Egret	??		17	2	2	<1	0
Snowy Egret	??		25	4	3	1	35
Little Blue Heron	??		5	1	2	<1	12
Cattle Egret	??		4	<1	1	<1	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. 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.

** 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 patches, should receive high conservation attention. An estimated 10,000 ha (25,000 ac) of maritime marsh will be required to support 1500 breeding pairs of American Black Ducks.

***Implementation strategy*:** It appears that within the Southern New England physiographic area, reducing threats from human disturbance, predator populations, invasive species, and pollution/contamination are the highest conservation concerns to be addressed for this habitat. While habitat loss through draining and development of marsh habitat continues to be a significant threat throughout the ranges of most maritime marsh species, many of the best remaining patches of coastal marsh are already protected from further development in this physiographic area. Existing marshes should be protected from development, but addressing these other threats is equally important within this planning unit. Marsh restoration efforts should also be important activities to consider where high marsh conditions have been eliminated through impoundments or other habitat alterations.

The Important Bird Areas identify critical sites where immediate conservation actions should be carried out and management guidelines applied. Such sites have been described on Long Island (Wells 1998) and are in the process of being selected through similar IBA processes in other states. A regional network of managers and biologists to coordinate monitoring, protection, and management activities in this habitat type for this physiographic area would be an efficient way to implement conservation actions. A regional monitoring program targeting coastal marshes is needed in order to track population trends and estimate population sizes. Massachusetts Audubon Society has begun an effort to survey all existing coastal marshes in New England. This initial effort should be completed and a long-term monitoring plan established.

Management guidelines:

- Reduce human disturbance , especially from marshes with known breeding sites for any of the priority species in this habitat type
- Protect marshes from chemical contamination, siltation, eutrophication, and other forms of pollution
- Restore high marsh areas that have been flooded for impoundments in order to provide additional habitat for Saltmarsh Sharp-tailed Sparrows,
- Secure adequate upland buffers (drier habitats adjoining wet marsh areas), especially for marshes near agricultural lands and human development
- Develop appropriate predator control programs, especially for smaller marshes and marshes near human population concentrations
- Control invasive species, especially *Phragmites*

Research and monitoring needs:

- Study how land-use practices such as ditching, impounding, dredging, open marsh water management, burning, and marsh restoration impact species in this suite (especially sparrows and rails) to determine optimal habitat management practices.
- Develop survey and monitoring programs targeted at maritime marsh species so that population estimates can be calculated and population trends tracked.
- Conduct studies of productivity and survival of sparrow and rail populations across the planning unit to understand factors regulating population size and persistence
- Investigate possible negative impacts that rising ocean levels from global climate change could have on marsh-nesting species

***Outreach*:** xxxxxxx

B. Mature deciduous Forest

***Importance and conservation status**:* Most of the priority species in this habitat suite are typically described as needing large tracts of mature deciduous forest. Although a fairly large the estimates of minimum forest area in which the different species are likely to breed, the landscape context and overall levels of forest cover on a regional basis are likely to be a more important factor than tract size in determining important parameters such as probability of occurrence and nest success. In general, most of the studies that have been done on these species suggest that within regions that have relatively high overall forest cover (e.g., $\geq$70%), negative impacts from edge effects, predation pressure, and parasitism are less than in less forested regions (e.g., Robinson et al. 1995, Gale et al.1997, Hoover and Brittingham 1993, Rosenberg et al. 1999).

The current estimates of land cover within the Southern New England physiographic area indicate it is about 40% forested, suggesting that impacts of forest fragmentation are a major concern within this planning unit. Urbanization and agricultural uses have reduced overall forest cover and tract size what historically was a well-forested area. Thus, conservation efforts for this habitat type within this physiographic area should be concentrated on maintaining

the existing large tracts of mature deciduous forest and well-forested landscapes, while also looking for ways to reduce edge effects and create larger forest blocks.

While these factors indicate significant conservation concerns within this planning unit, several other characteristics of this unit provide positive qualities from which to base conservation efforts. Southern New England is within the overall well-forest region of the northeastern U.S. Forest cover within many parts of this region has returned to levels near what existed at the time of European settlement. Also, within the Southern New England physiographic area, numerous landscapes with high overall forest cover exist and these landscapes apparently support stable or even increasing populations of some of the highest priority species in this habitat suite. Areas like southwestern Connecticut, the Hudson Highlands in southeastern New York, and the New Jersey Highlands in northeastern New Jersey are areas that all have relatively high forest cover and significant populations of species like Cerulean Warbler, Wood Thrush, Worm-eating Warblers, and Louisiana Waterthrush. These landscapes have the ability to provide source populations of these species and thereby supply individuals to potential sink populations in less forested landscapes throughout this physiographic area. These important areas need to be protected from development and the forests in these areas need to managed in such as way to promote the vegetation structure and composition most suitable for these species.

Associated priority species: CERULEAN WARBLER, WOOD THRUSH, WORM-EATING WARBLER, LOUISIANA WATERTHRUSH, etc. The total suite of 23 species represents a complete cross-section of this diverse northeastern forest bird community. *[split out northern hardwood/mixed forest species?]*

[ecological information, microhabitats]

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

Table 4.3. Population estimates for priority species of mature deciduous forest habitat in the Southern New England physiographic area. Percent of Atlas blocks based on number of 5-km blocks in which the species was reported within this physiographic area during the state Breeding Bird Atlases for New Jersey (N=±109; Walsh et al. 1999), New York (N=373; Andrle and Carroll 1988), Connecticut (N=550; Bevier 1994), Massachusetts (N=944; Veit and Peterson 1993), Rhode Island (N=165; Enser 1992), and Maine (N=25; Adamus 1987?).

Species	BBS population	% Atlas blocks					
		NJ	NY	CT	RI	MA	ME
Cerulean Warbler	225	34	5	6	2	0	0
Wood Thrush	162,600	100	71	95	77	88	88
Worm-eating Warbler	4,700	85	23	33	10	1	0
Baltimore Oriole	135,800	99	82	98	84	91	96
Black-billed Cuckoo	7,100	39	50	36	55	28	68
Black-throated Blue Warbler	2,100	17	1	13	0	12	32
Louisiana Waterthrush	5,700	93	24	52	19	6	4
Scarlet Tanager	61,500	99	54	87	65	84	84
Kentucky Warbler			10	3	0	0	0
Rose-breasted Grosbeak	27,100	95	54	89	59	48	84
Blackburnian Warbler			3	15	7	10	63
Canada Warbler			15	30	28	20	88
Eastern Wood-pewee	59,600	98	62	85	67	51	84
Black-and-white Warbler	48,000	96	47	87	66	51	92
Northern Parula			1	2	3	5	61
Hairy Woodpecker							
Purple Finch	7,900	24	12	44	46	48	84
Northern Goshawk	??						
Red-shouldered Hawk	165	36	8	28	16	13	44
Long-eared Owl	??						
Sharp-shinned Hawk	??						
Cooper's Hawk	50+	65	3	6	2	1	20
Barred Owl	??	39	8	35	21	9	44

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

OBJECTIVE 1. Sustain a regional population of 500 pairs of Cerulean Warblers distributed among the existing large forest blocks (e.g., $\geq$ 1700 ha; Hamel 1992) within this planning unit, including the Hamburg Mountain area of the New Jersey Highlands, the Sterling Forest and similar areas in the Hudson Highlands in southeastern New York, and Devil's Den and the surrounding area in southwestern Connecticut; encourage and support expansion of this species in New England.

OBJECTIVE 2. Halt population declines and maintain stable breeding population of 170,000 pairs of Wood Thrushes (10-13 birds per BBS route) distributed throughout the physiographic area.

OBJECTIVE 3. Maintain a sustainable population of 4,700 pairs of Worm-eating Warblers distributed across the region in a system of large forest blocks (e.g., $\geq$ 350 ha; Robbins et al. 1989) with minimal nonforest edge and a high probability of producing source populations. These large blocks should be in well-forested landscapes and have smaller forest blocks nearby with appropriate vegetation structure to attract breeding pairs for maintaining metapopulation dynamics.

OBJECTIVE 4. Maintain a sustainable population of 5,700 pairs of Louisiana Waterthrushes distributed among a large number of watersheds within well-forested landscapes.

Assumption: maintaining suitable habitat for these four priority species will be sufficient to support sustainable populations of most other birds in this habitat suite.

Based on published average density estimates of 3 pairs/10 ha for Wood Thrushes across their range (Roth et al. 1996), approximately 600,000 ha (1.45 million acres) of mature deciduous (and mixed) forest is needed to support this entire suite of deciduous forest passerines in Southern New England. Of this total, approximately 12,000 ha will need to be suitable for Worm-eating Warblers, based on the 3-4 pairs/10 ha reported in Connecticut (Hanners and Patton 1998). In addition, approximately 7,800 km of forested streams are required to support Louisiana Waterthrush.

Implementation strategy/management guidelines: A regional land use analysis should be conducted to identify all remaining large forest block (e.g., $\geq$ 350 ha) and landscapes with high % forest cover (e.g., > 70%) within this physiographic area. The largest forest blocks, especially those within well-forested landscapes, should be targeted for protection efforts. These large blocks represent the foundations from which conservation actions should begin for the mature forest suite of species in this physiographic area. Most the birds in this suite require large, contiguous forest patches for breeding and often occur at higher densities in large forests. They also generally have higher nesting success in landscapes with a high percentage of forest cover. Therefore, these areas should first be identified and then actions should be taken to preserve these forests from development or management activities that will negatively affect habitat suitability for these birds. Specific areas that currently meet the habitat/landscape characteristics described above and support relatively large breeding populations of high priority species the New Jersey Highlands of northeastern New Jersey (e.g., Hamburg Moutains, Wawayanda Mountain, Bearfort Moutain), the Hudson Highlands of southeastern New York (e.g., Sterling Forest, Ramapo Mountains, Bear Mountain), and southwestern Connecticut (e.g., Devil's Den preserve and contiguous forested areas).

Increasing the size of forest blocks should also be considered, especially in landscapes that are not highly forested (e.g., < 70% forest). Connecting smaller forest patches and improving area:perimeter ratios of narrow or oddly shaped patches should benefit the species in this habitat suite.

In addition to considering landscape characteristics, the vegetation structure should also be assessed to ensure that appropriate structural characteristics of the habitat are being maintained. Most 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, Worm-eating Warbler, Black-billed Cuckoo, and Black-throated Blue 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 large forest patches should be the targeted habitat. In smaller forest tracts, maintain at least a 100 meter buffer of mature forest cover along streamside and ravine habitat.

***Research and monitoring needs**:*

- Determine range of suitable habitats and identify present breeding sites for Cerulean Warbler in this region; develop better understanding of site conditions that attract these birds in this physiographic area.
- Determine factors limiting Wood Thrush populations in this region and causes of population declines.
- Conduct population ecology studies of species for which less is known, such as Louisiana Waterthrush, Black-billed Cuckoo, Black-and-white Warbler, and Purple Finch.
- Design and conduct targeted monitoring program to track population trends of forest interior species that are not well-covered by BBS in this physiographic area.
- Assess the effects of various logging practices (especially selection and shelterwood cuts) on occurrence, breeding density, and nesting success of the priority species in this habitat suite.
- Monitor reproductive success of this suite of species at different locations throughout region to better understand where forest fragmentation causes problems and where it does not.
- Determine relative importance and use of other habitat types during the post-fledging period prior to migration. Some information has now been collected on this topic for Wood Thrushes, but little is known for most species.
- Assess sensitivity of species in this habitat suite to pesticides currently being used to control gypsy moths and other insect pest species.
- 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, Barred Owl, and Red-shouldered Hawk.

***Outreach**:* xxxxxxxx

C. Early successional shrub/pitch pine barren

***Importance and conservation status**:* Many species of shrubland birds have been experiencing steep population declines in the Northeast over the last several decades, including in this planning unit. While many of these species are still fairly widespread and common, these steep declines warrant some attention on our behalf. In addition to the significant decreases in the high priority species listed under this habitat type, Brown Thrasher, Eastern Towhee, and Indigo Bunting have also undergone significant long-term population declines, as monitored through the Breeding Bird Survey (Sauer et al. 1999).

The evidence accumulated over time by researchers suggests that early successional shrub/scrub habitats were present in sufficient numbers and distributed widely enough throughout the northeastern United States to support long-term populations of early successional birds before Europeans or even Native Americans began changing the land cover composition (Litviatis 1999, Askins 1998). Askins (1998) speculated that the large herbivorous mammals of the Pleistocene, such as mastodons and ground sloths, created openings in the forests of eastern North America during much of the evolutionary history of the shrubland songbirds. Geologic formations as a result of glacial action also provided shrubland habitats, such as the areas of glacial outwash deposits along the Connnecticut River Valley and on Cape Cod that support scrub oak and pitch pine barrens (Hartshom 1969, Motzkin et al. 1999 as cited in Litvaitis 1999). In pre-settlement times, Askins (1998) suggested that fire likely maintained successional areas along sandy portions of coastal areas (additional locations of some of today's pine barrens), while major weather events, such as hurricanes, tornadoes, and ice storms, along with beaver activity, generated scattered thickets of shrubby habitat further inland.

Human settlement, beginning with Native Americans and followed by European colonization, brought increased disturbance to the region. Native Americans used fire to maintain and sometimes create early successional habitats, which improved conditions for agriculture and small game populations (Day 1953, Williams 1989 as cited in Litvaitis 1999). This use of fire occurred primarily along the coast and major river valleys. With European settlement, large-scale changes in land cover occurred, with widespread clearing of the inland forests for agriculture and wood products. By the mid 1800s, forest cover in New England had dropped from >90% to <50% (Litvaitis 1993, Litvaitis et al. 1999). A period of farm abandonment in the late 1800s and early 1900s due to better farm land

becoming available in the Midwest led to reforestation throughout much of the region. During this period of farm abandonment and reforestation, large amounts of early successional habitat became available and the suite of early successional bird species experienced a population boom in the Northeast. As the resulting second growth forests grew beyond the early seral stages used by shrubland birds, populations of these species began to decline with the reduction in amount of habitat available to them. Population declines within this shrubland suite of birds have continued through the end of the twentieth century (Sauer et al. 1999). Within this planning unit, urban/suburban development, habitat fragmentation, and lack of adequate disturbance events in remaining forested areas have now probably become some of the major reasons for these continuing declines.

In addition to general early successional shrubland habitats, Southern New England contains some of the largest remaining areas of the ecologically unique pine barren habitat in North America, including approximately 40,500 ha on Long Island and 20,200 ha in the Plymouth County/Cape Cod area of southeastern Massachusetts. These two areas are second in size to only the 303,500 ha of barrens along the eastern coast of New Jersey. An estimated 747,000 ha of pine barrens originally existed in the Northeast at the time of European settlement, but about half of that exists now, with most of it contained in the New Jersey, Long Island, and Cape Cod locations (Cryan 1985). Originally, eight locations existed with $\geq$10,000 ha of barrens, but now there are just these three large sites. Most of the remaining pine barrens in the Northeast are $\leq$2,000 ha, with only two other sites between 4,000 and 8,000 ha. These facts highlight the importance of the Southern New England physiographic area to maintaining and conserving the few remaining large tracts of pine barrens. Other locations in this planning unit with existing smaller acreages of barrens include the Rhode Island Pine Barrens, Nantucket/Martha's Vineyard, Montague Sand Plain (Massachusetts), and Springfield/Chicopee (Massachusetts). Threats to pine barren habitat include fire suppression, development pressures particularly for recreational activities, overuse associated with recreation, and over-extraction or pollution of groundwater.

Pine barrens occur on the well-drained, sandy outwash soils left behind by receding glaciers on coastal plains and river deltas. They are characterized by a three-tiered, savanna-like vegetation structure with widely-spaced pitch pines forming a fairly open upper canopy, scrub oaks in the mid-story, and a dense lower layer dominated by laurels, blueberries, huckleberries, and other members of the heath family. Two key features maintain this type of community: dry, nutrient-poor, drought-prone soils and frequent fires. Pitch pines and scrub oaks are two of the most fire-adapted trees in the Northeast. These factors combine to produce a vegetation structure suitable for many shrubland birds. Pine barren habitats can support high breeding densities of these birds, including Prairie Warblers, Blue-winged Warblers, Brown Thrashers, and Eastern Towhees (Morimoto and Wasserman 1991, Wells 1998). In addition to the bird component of these communities, pine barrens contain many other rare plant and wildlife species, many of which are of even greater conservation concern than the birds.

Associated priority species: GOLDEN-WINGED WARBLER, BLUE-WINGED WARBLER, AMERICAN WOODCOCK, Prairie Warbler, Eastern Towhee, Yellow-breasted Chat, etc.

GOLDEN-WINGED WARBLER

This species may be even closer to extirpation within this planning unit than suggested in Table 4.3. Since the publications of the breeding bird atlases, Golden-winged breeding populations in the Southern New England physiographic area portions of Connecticut, Massachusetts, and New Hampshire have continued to decline and have all but disappeared. The Golden-winged Warbler Atlas Project, an effort by the Cornell Lab of Ornithology to document all breeding populations of this species, was initiated in 2000 and should reveal what the true current breeding distribution is in this planning unit. Continued aging of early successional habitats has eliminated most of the suitable habitat from the areas in which this species previously bred in this physiographic area. However, a long term breeding population has coexisted with Blue-winged Warblers for perhaps as long as 100 years exists in the Sterling State Forest and surrounding areas of the Ramapo Mountains in southeastern New York, where alder swamps apparently provide good breeding conditions for Golden-wingeds. This area and nearby, adjacent locations in New Jersey may be the remaining strong-hold of breeding individuals in this physiographic area.

During the breeding season, Golden-winged Warblers occur in a variety of disturbed habitats 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 1992, 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 1992). In southern New York, Confer (1992) 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 (1992) 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. 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 1992, Klaus 1999).

BLUE-WINGED WARBLER

This species nests in overgrown fields or thickets in a variety of open country situations. Breeding habitat includes brushy hillsides, second growth, partly open settings with saplings, bogs, woodland edge and clearings, stream edges, overgrown pastures and swamps. Nests are placed close to or on ground, in bushes, weeds, or grasses, under bushes, or between exposed root stumps (Terres 1980). Almost 10 percent of the total population is found in the Southern New England physiographic area, indicating a need for extended monitoring and study. Blue-winged Warblers have been expanding their range northward into the Golden-winged Warbler's range, resulting in hybridization that may negatively impact that species. Blue-wingeds typically replace Golden-wingeds within 50 years (Gill 1980). Threats to Blue-wingeds include habitat loss due to suburban development of oldfields and shrublands, clearing/burning of successional shrublands for pasture/agriculture, succession of shrublands to forest, and brood parasitism by brown-headed cowbird.

Areas managed for this species should include dense vegetation in the herbaceous and shrub layers up to 1.5 meters in height, and little vegetation above 3 meters. Blue-winged Warblers will only use abandoned fields in which the canopy height does not exceed 7 meters (Ficken and Ficken 1968). They will nest in relatively young clearcuts with low canopy heights, preferably close to powerlines, roads, or other openings. The size of opening apparently not being a factor if larger than 1.0 hectare (Askins 1998). Foliage profiles of nest sites suggest that a more open area, with thicker grass and herb layer and fewer shrubs, are important components of a breeding territory. A constant supply of newly disturbed habitat is necessary to sustain populations in upland forest sites. Blue-wingeds nest successfully in small clearcuts (less than 5 hectares) and large expanses of continuous early successional habitat are not necessary (Askins 1998). Management of feral and domestic cat populations and shrubland habitat across breeding range will help most ground-nesting shrub species in many local areas to recover from decline (Gill et al., in prep). (This information is taken from the Species Information and Management Abstract series developed by The Nature Conservancy –
see http://www.tnc.org/wings/wingresource/SMAInd.htm)

YELLOW-BREASTED CHAT

Breeds in early successional stages of forest regeneration including second growth, shrubby old pastures, thickets with few tall trees, scrub, woodland undergrowth, and fence rows, including low wet places near streams, pond edges, or swamps. This species will commonly use sites close to human habitation. Nests are placed in bushes, brier tangles, vines, and low trees, generally in dense vegetation less than 2 m above ground.

Chats can be managed by creating and maintaining shrubby openings of at least 5ha. Abandoned agricultural fields left unmanaged for 10 years and the removal of trees and encouragement of a shrub layer in powerline rights-of-way will create suitable chat habitat. Wherever marginal cropland is abandoned, the species should benefit before canopy closure. Clear-cutting and shelterwood cutting that creates openings of 5ha or more will lead to the development of suitable habitat through natural succession. Selective logging in the form of either single-tree selection or group selection does not create openings large enough to attract chats. It is important that shrubs are left after clear-cutting, so clear-cuts should not be burned or treated in any way that results in the total loss of shrubs. Doing so will delay the development of suitable habitat. While chats will tolerate considerable amounts of open grass, some dense shrubbery is essential. Grazing among bushy patches does not seem to deter chats. Similarly, management of powerline rights-of-way should not discourage the development of dense shrubs. Maintenance and restoration efforts that encourage a shrubby transition from natural open habitats to surrounding forest (in contrast to a sharp transition) provide suitable chat habitat. (This information is taken from the Species Information and Management Abstract series developed by The Nature Conservancy – see http://www.tnc.org/wings/wingresource/SMAInd.htm)

***Habitat and population objectives**:* Based on extrapolations from BBS relative abundances (assuming each route samples approximately 2.5 - 6.3 km^2 of habitat), VERY ROUGH estimates of population size for priority species in this habitat suite can be derived (Table 4.3).

Table 4.3. Population estimates for priority species of early successional and pine barren habitat in the Southern New England physiographic area. Percent of Atlas blocks based on number of 5-km blocks in which the species was reported within this physiographic area during the state Breeding Bird Atlases for New Jersey (N=±109; Walsh et al. 1999), New York (N=373; Andrle and Carroll 1988), Connecticut (N=550; Bevier 1994), Massachusetts (N=944; Veit and Peterson 1993), Rhode Island (N=165; Enser 1992), and Maine (N=25; Adamus 1987?).

Species	BBS population	% Atlas blocks					
		NJ	NY	CT	RI	MA	ME
Golden-winged Warbler	300		8	3	0	5	0
Blue-winged Warbler	41,700		32	92	65	21	4
Prairie Warbler	18,100		43	50	63	37	40
Eastern Towhee	85,000		100	95	82	90	100
American Woodcock	??		50	32	27	32	48
Whip-poor-will	750		24	15	28	20	56
Yellow-breasted Chat	900		11	3	<1	1	0

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

OBJECTIVE 1. Sustain a regional population of Golden-winged Warbler by maintaining known breeding sites in suitable habitat condition and replicating these conditions wherever feasible; strive to maintain long-term population of 500+ breeding individuals.

OBJECTIVE 2. Maintain stable breeding population of American Woodcocks throughout the physiographic area; reverse recent population declines.

OBJECTIVE 3. Maintain a sustainable population of 50,000 Blue-winged Warblers, except in areas where competition and hybridization threatens populations of Golden-winged Warbler.

OBJECTIVE 4. Maintain a sustainable population of 85,000-100,000 Eastern Towhees throughout the physiographic area.

Assumption: maintaining suitable habitat for Golden-winged Warbler, American Woodcock, Eastern Towhee, and Blue-winged Warbler will be sufficient to support sustainable populations of most other birds in this habitat suite.

Confer (1992) suggested a habitat management strategy that would utilize 400 ha to sustain a population of 100 Golden-winged Warblers. Under this scenario, 2,000 ha (5,000 ac) are needed specifically for Golden-wingeds in this physiographic unit to meet their population objectives, preferably at 3-5 different sites with 400-800 ha each. Average territory sizes of Blue-winged Warblers tend to be fairly small in the Northeast (DeGraaf and Rudis 1986), suggesting that in good habitat, densities can be 1 pair/ha. However, not all habitat will ultimately sustain these high densities, and in the Midwest, densities are often closer to 0.5 pair/ha. Thus, a total of 80,000 – 100,000 ha (250,000 ac) of early successional habitat will be needed to meet the overall objectives for this habitat suite, including 85,000-100,000 pairs of Eastern Towhees. Prairie Warbler densities also averaged about 0.5 pair/ha in Connecticut, suggesting that approximately 40,000 ha of the total for this suite will be needed to meet the objective for this species. In addition, all of the remaining pine barren habitat in this physiographic area should be managed to reduce over-use from recreational activities and to ensure sufficiently frequent fires to maintain the habitat. Where appropriate and feasible, restoration efforts can be used to enlarge existing pine barren areas.

Implementation strategy: Providing sufficient shrubland habitat for this suite of birds involves both spatial and temporal dynamics. Shrubland habitats are temporal in nature, supporting the birds of this suite for 10-15 years, perhaps 20 years at a maximum, unless disturbances set back succession on a regular basis. In presettlement times, various combinations of severe weather events, animal-related disturbance such as beaver activity, and fire were probably the primary disturbance factors in this planning unit. During the last 50-100 years, fire suppression efforts have reduced the amount of land that burns on an annual basis. The large-scale forest clearing that occurred during

the late 19th and early 20th centuries within this physiographic area has resulted in forests that are now largely even-aged, heavily stocked, and mid-successional, which somewhat reduces their susceptibility to severe weather events and lowers the probability of large-scale disturbance (Askins 1994). Reforestation of abandoned farms resulted in large increases of early-successional habitat during the first half of the 20th century, but such a process has run its course and is no longer providing much shrubland habitat in this planning unit. Beaver populations had been severely suppressed during this time also, although they are now on the increase again and beginning to have noticeable effects on habitat conditions in some areas (Howard and Larson 1985). These factors suggest that active habitat management will typically be needed to maintain sufficient amounts of habitat for sustaining stable populations of shrubland birds.

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. A study in Connecticut of clearcut patches ranging in size from 0.6 to 21 ha found three common species of shrubland birds (Blue-winged Warblers, Chestnut-sided Warblers, and Prairie Warblers) to be no less common in small versus large clearcuts (Askins 1998). All three species occurred in clearcut patches smaller than 1 ha. In Maine, a survey of clearcuts ranging in size from 2 to 107 ha also found that several shrubland birds were equally likely to occur in large and small clearcuts (Runicky and Hunter 1993).

Most of the species in this habitat suite will utilize a wide range of alternative successional habitats, including regenerating clear-cuts, hedgerows, powerline rights-of-way, and pine barren shrublands. Some of these species will also utilize dense understory vegetation within forest patches. Maintaining and restoring naturally disturbed habitat, such as pine barrens, and natural disturbance cycles within forested ecosystems would be the preferred means of sustaining shrubland birds. However, the degree to which land use patterns have been altered by humans over the last several hundred years, especially within Southern New England, makes it unlikely that such natural processes can provide enough habitat to ensure the viability of shrubland birds in this physiographic area. While management directed specifically at maintaining shrubland species might be feasible at a few locations, Askins (1994, 1998) suggests that many of these species could be sustained most effectively through collaborative management of areas that already are subjected to frequent human disturbance from agriculture, forestry, or the maintenance of roads and rights-of-way. Although public support for clearcutting is fairly low at the current time, this method of forest regeneration does provide patches of early successional habitat used by many shrubland birds. Continuing use of this management tool should be considered as a means of providing shrub habitat on state forests within the planning unit. However, these cuts provide suitable shrub habitat for a limit time (typically 8-15 years), so careful planning of rotational harvest schedules needs to be done. Several studies have also demonstrated that powerline rights-of-way can be managed to provide habitat for shrubland birds and that the birds nesting in powerline corridors experienced relatively high nesting success (Chasko and Gates 1982, Bramble et al. 1994). These powerline corridors also have the added benefit of potenitally providing longer-lasting shrub habitats. It has been demonstrated that a dense and relatively stable shrub cover with little tree invasion can be maintained by selectively spraying herbicide on the base of tall-growing trees within a right-of-way (Niering and Goodwin 1974 and Dreyer and Neiring 1986 as cited in Askins 1998). Rights-of-way maintained in this manner support a greater diversity and density of birds than corridors maintained by mowing or herbicides (Bramble et al. 1992). This same method of basal spraying of herbicides to create stable shrublands can also potentially be used on publically owned land, such as state forests and natural areas or national parks. This may be especially appropriate where old field or thicket conditions already exist and the herbicide method could be used to retard succession and maintain a shrub-dominated community.

Note that the overall total habitat objective suggested for this species-habitat suite (60,000-80,000) is about 10% of what was suggested for the mature hardwood habitat (600,000 ha). Hence, the analyses presented in this plan suggest that collectively setting aside about 10% of all managed lands within Southern New England for early successional habitat would be sufficient to meet the population objects for the shrubland birds. However, also note that the total habitat objective is considerable less than the total amount of shrubland acreage that exists at the present time. Reliable numbers on the amount of early successional habitat currently existing in this planning unit were not available at the time of this draft, but rough estimates suggest the total amount could be well above this objective. Powerline corridors alone have the potential to provide a considerable amount of this total, if they are managed appropriately. Additional management on publicly owned state forests and natural areas and national wildlife refuges through timber harvesting, herbicide treatment, and restoring natural shrub communities should also contribute to this total. All remaining pine barren habitat should be a high priority for conservation and restoration efforts as these unique habitats are home to many rare species beyond the shrubland birds that use them. Pine barren

habitat alone could be close to 60,000 ha in this physiographic unit, with the two large barrens on Long Island and Cape Cod being the highest priorities for conservation efforts. These two areas need to be protected from over-use by recreational activities and ground water demand, as well as maintained through regular burning.

Choosing locations to create or restore disturbed habitats should be done with consideration for the landscape configuration of existing cover types. The concepts of only 10% of managed lands being needed for shrublands and the birds of this habitat type being less area sensitive than other habitat guilds, suggest that care should be taken in selecting locations for shrubland management that do not conflict with management for other habitat types. With the somewhat less restrictive needs of this species-habitat suite, there also may be more flexibility in where these habitats can be managed. Shrublands need not be placed in such a manner that they degrade or disrupt the large, contiguous patches of forest or grasslands that are required by the more area sensitive birds in those habitat types. Askins (1994, 1998) makes numerous recommendations on how shrublands could be fit into landscape configurations such that the needs of early successional species are met without disrupting the integrity of other habitat types. For instance, open corridors for new and existing roads, railroads, and utility rights-of-way could be consolidated into single, wide corridors that would benefit the shrubland birds that do need larger areas of habitat. However, large corridors should be placed along the periphery of forest patches whenever possible in order to limit the negative impacts of the open areas on the assemblage of forest birds. Putting new powerline corridors or roads through the center of existing large forest patches should be avoided whenever possible. An analysis of landscape cover types and patch sizes could also be used to identify small, isolated patches of second-growth woods that could be managed for shrubland species with little impact on forest-interior birds.

Golden-winged Warblers warrant special consideration and may need special management considerations if they are to be maintained as a breeding species in this planning unit. Confer (1992b) provides suggestions on a management strategy that could be used at local sites to provide habitat for 100+ pairs. Given the population objective of 500+ pairs of Golden-winged Warblers in this physiographic unit, 3-5 sites with 400-800 ha managed to support 100-200 pairs each will be needed. Confer suggests that optimal management for this species would include rotational burning or intermittent farming of a total area of 400-800 ha over a 40 year period. Logging might also be an option, but many sites that have been clearcut often grow back into dense stands of saplings without the open patches of herbs that seem to be required by this species. Perhaps a combination of logging and some other management technique could be used to create appropriate habitat. Under this rotational scenario, about 25% of the managed area would be burned or otherwise managed every 10 years. Golden-winged Warblers would likely start to inhabit the disturbed areas about 10 years after succession had been set back and would use them for another 10-20 years. Allowing areas to grow up for 40 years would provide some of the forest edge that is used in most Golden-winged territories. With a 40-year cycle and any given section of the management area being suitable for about 20 years, about half of the total area under management would be suitable at any one time. Thus, 400-800 ha would need to be managed to support 100-200 birds at the typical density of 5 pairs per 10 ha for Golden-wingeds.

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.

The largest existing population of Golden-winged Warblers in this physiographic unit, the population in the Ramapo Mountains in southern New York, should be studied more closely to understand why it has persisted as a stable population for almost a century while in the nearly continuous presence of Blue-winged Warblers. A relatively large and stable population of Golden-wingeds also appears to exist in the nearby Hamburg Mountains of the New Jersey Highlands. Together, these areas of the Hudson Valley and adjacent highlands should be one of the main focal regions within this planning unit for maintaining this species. Interestingly, this region is also a strong-hold for

Cerulean Warblers in this physiographic area, so careful planning will be required to accommodate the needs of both of these high priority species. Within this area, alder swamps seem to play a critical role in providing an appropriate vegetation structure for Golden-winged Warblers species. Habitat management activities in this area should be evaluated to understand what, if any, particular strategies are being employed that benefit this species. Powerline corridors can also provide suitable breeding habitat for this species, if managed appropriately. More work to describe the best methods for managing these rights-of-way in such a way to benefit Golden-wingeds is also needed.

Research and monitoring needs:

- Determine range of suitable habitats and identify present breeding sites for Golden-winged Warblers and Blue-winged Warblers. Present breeding sites are being survey through the Golden-winged Warbler Atlas Project by the Lab of Ornithology, with field work being conducted for this project beginning in 2000.
- Analyze the effects of Blue-winged Warblers on recruitment, habitat selection, and nesting success of Golden-winged Warblers. Further monitoring of cowbird parasitism rates and effects on reproductive success of Golden-winged Warblers is also needed.
- In general, more research/monitoring is needed on effects of cowbird parasitism on shrubland birds, especially in the Northeast.
- Compare early successional habitats resulting from natural disturbances vs. forestry practices vs. power line rights-of-way with regard to suitability for high-priority species, including breeding densities and nesting success.
- Determine if there is relationship between patch size and nesting success for shrubland birds, and between patch size and breeding density for the more area sensitive species (i.e., Yellow-breasted Chat).
- Determine effects of woodcock habitat management techniques on other priority, early-successional bird species.

Outreach*:* xxxxxxxx

D. Beaches/dunes

Importance and conservation status*:* This habitat type is home to two species covered under the Endangered Species Act: the endangered Roseate Tern and the threatened (along the Atlantic Coast) Piping Plover. Like other habitats associated with coastal areas in the eastern U.S. where dense human populations exist, most beach and dune ecological communities in Southern New England face tremendous pressures from humans, especially recreational activities. However, this habitat also supports some very large concentrations of colonially nesting waterbirds, such as Herring Gulls, which can grow to nuisance levels. Both of these situations (endangered species and nuisance-level concentrations) highlight the problems common in areas where large human populations exit along coastal areas. Human disturbance and loss of habitat are the main problems for the threatened and endangered species, while high probability of contact with people lead to increasing chances for common species to create nuisance situations or situations potentially harmful to human safety (e.g., gulls congregating around airports).

Many of the best remaining sites important to this suite of birds are currently under some kind of protection or cooperative management and are also being monitored on a regular basis to track population trends and breeding success. Conservation efforts along seashores and islands include actively monitoring breeding colonies to deter predators that could disrupt the colonies and establishing beach zones around plover territories where human disturbance and recreational activities are discouraged. Massachusetts has developed an extensive group of cooperating agencies and organizations to monitor all major breeding sites for terns, plovers, and oystercatchers. Similar efforts occur throughout much of this planning area. These efforts to reduce disturbance from humans and predators appear to be producing positive results, as populations of the priority species in this habitat suite have been fairly stable or slightly increasing in most states throughout Southern New England (e.g., Blodget 1996, 1999).

Associated priority species*:* PIPING PLOVER, ROSEATE TERN, AMERICAN OYSTERCATCHER, IPSWICH SPARROW, etc.

[ecological information, microhabitat requirements]

Habitat and population objectives:

Table 4.4. Population estimates for priority species of beach and dune habitats in the Southern New England physiographic area. Percent of Atlas blocks based on number of 5-km blocks in which the species was reported within this physiographic area during the state Breeding Bird Atlases for New Jersey (N=±109; Walsh et al. 1999), New York (N=373; Andrle and Carroll 1988), Connecticut (N=550; Bevier 1994), Massachusetts (N=944; Veit and Peterson 1993), Rhode Island (N=165; Enser 1992), and Maine (N=25; Adamus 1987?).

Species	population	% Atlas blocks					
		NJ	NY	CT	RI	MA	ME
Piping Plover	2,300		13	2	4	6	0
Roseate Tern	??		5	1	2	<1	12
American Osytercatcher	??		12	2	5	1	0
Short-eared Owl	??		2	0	0	1	0
Common Tern	??		23	5	14	2	35
Least Tern	??		23	4	7	1	12
Arctic Tern	??		0	0	0	1	4
Horned Lark	??		27	2	5	8	20

* 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 patches, should receive high conservation attention. More detailed analyses of population estimates and objectives as being developed for many of these species through the North American Colonial Waterbird Conservation Plan.

**Massachusetts estimated its populations of Roseate Terns at 1,810 pairs, Least Terns at 3,416 pairs, Common Terns at 13,979 pairs, and Arctic Terns at 9 pairs in 1999. All of these estimates were increases over previous years, except for Arctic Terns. A total of 483 pairs of Piping Plovers were reported breeding in Massachusetts during 1997.

Implemention strategy/management guidelines:

- Continue monitoring efforts where these currently exist and begin monitoring important sites that are not yet covered, including actively deterring predators and preventing human disturbance from important breeding sites.
  – Restrict access to nesting beaches during late May to late July
  – Prohibit free-running dogs
  – Post signs to alert and educate public to presence of nesting birds
  – Use fences and other barriers to reduce predator impacts
  – Protect breeding sites from habitat alteration and overuse from recreational activities, including nighttime activities
- Dredge material has been successfully used in some instances to create new habitat, especially for Least Terns and Common Terns, although all habitat alterations should be conducted with caution and after consultation with experts; new substrates should not be overly silty and depositions with over 20% shell material could interfere with nest construction.
- Vegetation encroachment can degrade habitat for terns and should be prevented at important nesting sites. Addition of dredge spoils on vegetated beach areas may impede succession.
- The Roseaste Tern recovery plan calls for restoration of historic nesting sites for this species through removal of gull populations and increased protection for existing nesting sites from disturbance and predators.
- Begin implementing Important Bird Area conservation efforts for sites already identified in New York and continue efforts in other states (Connecticut and Massachusetts have on-going IBA programs) to identify IBAs, which will include many of the most important sites for this species-habitat suite.

Research and monitoring needs:

- Continue to evaluate factors that limit populations of the priority species from this habitat suite and impede recovery, including studies of (a)habitat requirements for breeding, foraging, and staging, (b) demographics, (c) causes of mortality, and (d) factors limiting growth and survival of young
- Investigate the behavior and population ecology of predators impacting the priority bird species to provide a better understanding of how to protect the birds from depredation.

- Investigate potential threats from pesticide and heavy metal accumulation

Outreach:
- Develop public education and involvement programs to encourage public support and active participation in monitoring and protection activities.

E. Grassland and agricultural land

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 (Askins 1993). Until recently, concern about grassland birds in the Northeast 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 (especially along the East Coast) 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). The Southern New England physiographic area encompasses a large coastal area as well as portions of several major river systems (e.g., Connecticut, Hudson), which are some of the most likely locations for grasslands in pre-European times. Thus, sufficient evidence exists to suggest that Southern New England has supported a small but significant grassland bird community for a long period of time (well before European settlement) and that this grassland component had contributed to the ecological diversity of this planning area for some time. 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.

While little naturally maintained grassland habitat currently exists in this unit, the combination of agricultural and grass lands accounts for nearly 1 million hectares across Southern New England, representing a substantial base of open land with the *potential* for providing suitable habitat for grassland birds. The strongest emphasis should be placed on preserving or restoring naturally occurring habitat for sustaining grassland bird populations. However, given the paucity of these natural communities, identifying and properly managing human-influenced locations supporting significant grassland bird populations will be needed if this suite of species is to remain a component of the avian diversity of Southern New England.

The greatest threat to this habitat type in this planning unit is the loss of open land associated with declining farm practices. The amount of farmland decreased approximately 23% from 1982 to 1997 (U.S. Census Bureau). The continuing loss of farmland to residential development and reversion to forest undermines the reservoir of available habitat for this suite of species. Open lands converted to residential or commercial development is, in practical terms, habitat permanently removed from possible restoration. Likewise, it is unlikely that forested land would be converted to grassland because of the historical precedent associated with forests in this region and because of current land use trends. Thus, even though all farmland does not provide quality habitat for grassland birds, lands remaining in farms at least retain the potential to provide suitable habitat given restoration or enhancement efforts in the future.

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) (see Table 1). 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 (*Sturnella magna)*, Savannah Sparrow (*Passerculus sandwichensis*), and Bobolink (*Dolichonyx oryzivorus).*

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, bobolink (*Dolichonyx oryzivorus*), has 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.

In studies at the Rhode Island National Wildlife Refuge Complex, Paton et al. (1999) found grassland birds breeding in fields in which planted big bluestem was codominant with cool season grasses such as timothy (*Phleum pratense*) and smooth brome (*Bromus inermis*), and vegetation was relatively short (< 1m). Fields dominated by planted big bluestem or big bluestem and goldenrod (*Solidago* sp.), with tall vegetation (>1 m), generally did not contain breeding grassland birds. Paton et al. (1999) recommended that the refuge plant some fields in a short-grass (<1m) combination of warm/cool season grasses and graminoids, such as little bluestem (*Scizachyruim scoparium*), poverty grass (*Danthonia spicata*), Pennsylvania sedge (*Carex pennsylvanica*), Kentucky bluegrass (*Poa pratensis*) and switchgrass (*Panicum virgatum*).

Observations made by biologists at the Rhode Island Refuge Complex (N. Kline, Rhode Island NWR), and environmental consultants in Maryland (N. Gerber, Chesapeake Wildlife Heritage) have corroborated these findings. Biologists have noted lower density and diversity of grassland birds in tall, dense stands of planted warm season grasses than in shorter, cool season grasslands, especially diverse old fields.

Associated priority species*:* HENSLOW'S SPARROW, UPLAND SANDPIPER, GRASSHOPPER SPARROW, BOBOLINK, Savannah Sparrow, Northern Harrier, Vesper Sparrow, etc..

GRASSHOPPER SPARROW

This sparrow breeds from central New England south, and was once considered abundant at lower elevations across New England (Jones and Vickery 1997, Salzman and Smith 1998). Grasshopper Sparrow abundance has declined as agricultural grasslands have been abandoned or converted to row-crops or urban developments (Jones and Vickery 1997, Salzman and Smith 1998). Within the Southern New England physiographic area, Grasshopper Sparrows are listed as endangered in Connecticut and Maine; threatened in Rhode Island, Massachusetts, and New Jersey; and a species of concern in New York.

Breeding Habitat Characterization:

Grasshopper Sparrows have been observed breeding in the following habitats in the Northeast: lightly grazed pasture, reclaimed surface mines, old hayfields, moderately grazed pastures, coastal grassland barrens, airfields and conservation, cool season grasslands.

Whitmore and Hall (1978) found Grasshopper Sparrows to be abundant on reclaimed surface mines in West Virginia: up to 17 pairs per 10 ha. Dominant vegetation was fescue (*Festuca* sp.), birdsfoot trefoil (*Lotus corniculatus*), red top (*Agrostis gigantea*), timothy (*Phleum pratense*), and oats (*Avena* sp). Whitmore (1979a) reported average heights of vegetation in breeding territories between 22-36 cm. Sparrow breeding activity increased as vegetation height and grass cover decreased, and bare ground increased, over time. Conversely, sparrow pairs decreased as grass cover increased, and bare ground declined. Wray et al. (1982) also found that Grasshopper Sparrow abundance declined as grass density increased.

During peak breeding periods, Whitmore (1979b) observed that Grasshopper Sparrow territories had average litter depths of 1.5 cm. Whitmore (1979a) concluded that the sparrows require sparsely vegetated grasslands with at least 24% bare ground, 74% litter cover, and 27% grass cover, at the time of spring arrival. Whitmore (1981) found lower values for the following variables in Grasshopper Sparrow territories vs. non territories: grass/forb/shrub/litter cover and litter depth. Mean bare ground in territories was 29%, while mean grass cover was 25.7%. The researcher pointed out that Grasshopper Sparrows prefer to nest in bunchy grasses, and forage in openings or gaps between bunches. Wray et al. (1982) reported that increased litter and grass density inhibits Grasshopper Sparrow foraging efficiency.

Vickery et al. (1994, 1999) evaluated Grasshopper Sparrows on Maine grassland barrens. The researchers identified area, short graminoid cover, and forb cover as significant, positive predictors of Grasshopper Sparrow relative abundance, with litter cover and blueberry cover negatively associated with this species. Bollinger (1995), in sampling 90 hayfields in New York, found Grasshopper Sparrows breeding on older fields (had not been replanted in ≥15 yrs). Grasshopper Sparrow abundance was positively related to plant richness, field size, and vertical patchiness, and negatively related to litter depth. According to Bollinger, Grasshopper Sparrows "prefer the lowest and sparsest fields" (Bollinger 1991) with short, patchy, grass-dominated vegetation (Bollinger 1995).

Smith (1997) observed Grasshopper Sparrows breeding in pastures in central NY. The minimum pasture area containing Grasshopper Sparrows was 16.2 ha, with an average size of 49.1 ha. On average, Grasshopper Sparrows occupied the least productive of the pastures studied. The researcher recorded the following habitat characteristics: mean grass height/territory of 54 cm; mean percent goldenrod/territory of 9.4%; and mean percent goldenrod/pasture of 38.5%. Grasshopper Sparrows bred on fields that had been mowed 1 to 6 years earlier. Smith noted that the Grasshopper Sparrows appeared to prefer shorter vegetation than Henslow's Sparrows (Smith 1997).

Minimum Grasshopper Sparrow breeding habitat in the Northeast is characterized by large areas (20-30 ha) with abundance increasing with habitat size. Preferred habitats contain bare ground (about 25%), grasses of short to medium height (20-50 cm), and shallow litter (0-2 cm). Suitable habitats are found in old hayfields (Bollinger 1995), although the birds also breed in moderately grazed pastures (Smith 1997) and ungrazed, cool season grasslands (Norment 1999a). In the Midwest, Grasshopper Sparrows reportedly nest in low, sparse, grass-dominated habitats, with shallow litter (Cody 1968, Wiens 1969), including hayed and burned sites (Swengel 1996). Kahl et al. (1985) report optimum vegetation height of 20-30 cm and litter depth of 0.1-1.0 cm for the species in Missouri.

BOBOLINK

Bobolinks breed widely across Northeast, including coastal and inland locations in New England. 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). Bent (1958) noted declines in

Bobolinks in New England in the 1950's. Kelling (1998) reports that breeding numbers of Bobolinks in New York had been reduced due to increased urbanization and losses of farmland. Bobolinks are listed as threatened in New Jersey.

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 1994). 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.

SAVANNAH SPARROW

Along with Bobolinks and Eastern Meadowlarks, Savannah Sparrows are one of the most common grassland breeding birds in the Northeast. Breeding sites are scattered throughout this planning unit, with the majority of sites near coastal areas but they also occur at scattered inland sites with appropriate habitat, including areas in northeastern Massachusetts and along the Connecticut River valley. This species exhibits strong philopatry, with adults and juveniles typically returning to the same breeding sites in subsequent years. This behavior has resulted in substantial geographic variation and genetic separation, with 17 subspecies recognized across its breeding range. Like many grassland bird species in the Northeast, this species has experienced long-term population declines during the twentieth century, primarily attributed to loss of habitat through reversion of farmland to forest, urban development, and changes in agricultural practices that have led to earlier mowing of hayfields (Clark 1994, Jones and Vickery 1997). Savannah Sparrows are listed as threatened in New Jersey and a species of concern in Connecticut.

Breeding Habitat Characterization:

Savannah Sparrows are grassland generalists, occupying a variety of grassland habitats of all ages. These habitats include hayfields, pastures, grassy meadows, coastal grasslands, and blueberry barrens. While these sparrows will tolerate some successional growth and often use small trees, shrubs, and fence posts as singing perches, their presence is negatively associated with total amounts of woody cover (Vickery et al. 1994, 1999; Bollinger 1995; Jones and Vickery 1997). Clark (1994) indicated that in Connecticut this species is most often found in grassy fields with damp soil and of the grassland sparrows in that state, it tends to occupy the wettest sites.

The relative abundance of Savannah Sparrows was positively associated with grassland area and negatively associated with bare ground, blueberry cover, and high shrub cover in Maine grasslands (Vickery et al. 1994). Occupied territories of Savannah Sparrows tended have more graminoid and short forb cover but less litter, blueberry, short shrub, and tall shrub cover than unoccupied areas in the same grasslands (Vickery et al. 1999). In New York, Norment (1999) found Savannah Sparrow abundance to be positively correlated with legume cover and live grass cover but negatively correlated with total vegetation height, shrub height, and dead grass cover. While these studies indicate a negative association with amount of litter, dense ground cover and some litter is required by nesting Savannah Sparrows (Swanson 1996).

Wiens (1969) characterized Savannah Sparrows as nesting in areas with intermediate amounts of grass and forb cover, vegetation density, litter cover and depth, and vegetation height. In Wisconsin, mean vegetation characteristics of occupied habitats were 75% herbaceous cover, 16% litter cover, 9% bare ground, and 54 cm vegetation height (Sample and Mossman 1997). Nesting territories on reclaimed strip mines in West Virginia were characterized by 7% grass cover, 11% forb cover, 58% litter cover, 24% bare ground, and 66 cm vegetation height (Whitmore 1979). Vickery et al (1994) found a 50% incidence of occurrence in grasslands of about 10 ha, and Norment (1999) estimated the 50% incidence at about 8 ha.

UPLAND SANDPIPER

Upland Sandpipers are uncommon and local breeders in scattered locations throughout the Northeast. They are rare breeders in the Southern New England physiographic area, with many of the existing breeding sites on commercial or military airfields. 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).

Habitat and population objectives*:* Based on extrapolations from BBS relative abundances (assuming each route samples approximately 6.3 km^2 of habitat; Appendix 3), VERY ROUGH estimates of population size for priority species in this habitat suite can be derived (Table 4.3).

Table 4.3. Population estimates for priority species of grassland and agricultural habitat in the Southern New England physiographic area. Percent of Atlas blocks based on number of 5-km blocks in which the species was reported within this physiographic area during the state Breeding Bird Atlases for New Jersey (N=±109; Walsh et al. 1999), New York (N=360; Andrle and Carroll 1988), Connecticut (N=550; Bevier 1994), Massachusetts (N=944; Veit and Peterson 1993), Rhode Island (N=165; Enser 1992), and Maine (N=25; Adamus 1987?).

Species	BBS population	% Atlas blocks					
		NJ	NY	CT	RI	MA	ME
Henslow's Sparrow	Extinct?		0	0	0	0	0
Upland Sandpiper	200		3	<1	4	1	28
Grasshopper Sparrow	700?		14	1	3	4	12
Bobolink	14,000		13	29	24	24	96
Vesper Sparrow	200		5	1	2	5	40
Northern Harrier	40		18	2	2	3	16
Barn Owl?	??		15	3	2	1	0
Savannah Sparrow	760		17	11	10	19	76
Horned Lark	200		27	2	5	8	20

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

OBJECTIVE 1. Reverse population declines and sustain a population of 250 breeding pairs of Upland Sandpipers within the planning unit.

OBJECTIVE 2. Halt population declines and support a population of 800 Grasshopper Sparrows distributed among current and additional newly managed grasslands throughout the physiographic area.

OBJECTIVE 3. Maintain stable population of at least 15,000 Bobolinks throughout the physiographic area.

Assumption: maintaining suitable habitat for these three priority species will be sufficient to support sustainable populations of most other birds in this habitat suite.

Roughly 10,000 – 15,000 ha (45,000 ac) of grassland habitat is needed to support the entire grassland habitat-species suite in this physiographic area, based on the estimated densities of 9-12 bobolink/10 ha reported by Bollinger and Gavin (1992).

Implementation strategy: To meet the objectives for this habitat-suite of species, a comprehensive grassland management plan for the entire New England region will need to be developed. Key areas, especially large grasslands, should be identified for immediate conservation efforts, as these areas will provide source populations for many of the priority species in this suite. Appropriate habitat management prescriptions should be identified for each site. Mowing, burning, and controlled grazing can be used to maintain grasslands, but the most appropriate methods for each site must be carefully considered and input from regional grassland experts is strongly encouraged.

Massachusetts Audubon Society has undertaken a grassland bird survey program for New England and New York, with approximately 130 grassland sites in the Southern New England physiographic area surveyed between 1997-1999 (G. Shriver, Massachusetts Audubon Society Grassland Bird Program). These efforts have helped to identify most of the large grasslands that support the largest and most diverse populations of grassland birds in New England and this planning unit. Plans are being discussed for continuing to monitor a selected number of sites across New England and New York in such a manner as to allow for tracking of regional grassland bird population trends. Sites that are selected for monitoring should become priorities by the various cooperators within this planning area to ensure that they continue to be surveyed on a regular basis according to the plans that are developed. These sites will likely include most of the significant large grasslands identified within this planning, which also should continue to be monitored regularly.

Results from the surveys coordinated by Massachusetts Audubon Society indicated that areas with important concentrations of grassland habitat and abundance of grassland birds in this planning unit include eastern Long Island, coastal Rhode Island, the Connecticut River valley in west-central Massachusetts, northeastern Massachusetts

(including Fort Devens, Hanscomb Air Force Base, and areas near the coast in Essex County), southeastern New Hampshire near the coast (including Pease Air Force Base), and southeastern Maine near the coast (especially the area around Kennebunk Plains). Continued management and maintenance of sites in these general areas should be a high priority. Efforts to restore or enhance grassland habitats are encouraged in the proximity of these areas, because metapopulation theory and research on bird populations in other habitats suggests that grassland bird populations will benefit from landscape configurations in which appropriate habitat patches are grouped close to one another (Bollinger 1995, McCullough 1996, Norment 1999).

The grassland surveys also have pointed out the importance of military installations and airports to the conservation of grassland birds in the Northeast. Many of the largest areas of contiguous grassland habitat and largest concentrations of grassland birds in this planning unit are contained on such sites and coordination of management of these sites should be encouraged between site managers and wildlife managers. See Melvin 1994 for an example.

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 (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 1995, Mazur 1996), Norment (1999) 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 Dickson 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 New England 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

F. Urban/suburban

Importance and conservation status: The diversity of breeding birds is usually lower in urban areas than in natural environments, although breeding densities are often higher (Bolen and VanDruff 1987, DeGraaf 1987). Introduced exotic species often dominate, such as the house sparrow and Eurporean starling, and seed-eaters (finches, sparrows, doves) are more common than insectivores. Ground-nesting species are often very rare or absent (Emlen 1974). However, urban/suburban habitat do provide suitable habitat for a number of species for which historical habitat(s) have been significantly altered or reduced. The original natural nesting habitat of Common Nighthawks was open ground, including coastal dunes and beaches, woodland openings, grasslands, and rock outcrops. However, throughout southern New England, this species has adapted to and now mostly breeds on flat rooftops covered with gravel or similar materials in urban/suburban areas (Andrle and Carroll 1988, Veit and Petersen 1993, Bevier 1994). Likewise, Chimney Swifts have shifted their distribution from forested habitats where they used to nest in tree cavities or cave walls to urban/suburban settings where they now nest almost exclusively in chimneys and building walls. Changes in modern building construction as well as the use of pesticides for mosquito control have been suggested as possible causes in declines of both these species. Sloping or smooth (rubberized) roof tops and narrow chimneys with screens to keep unwanted wildlife out are two examples of modern building practices that lead to reduce nesting sites for these birds. Heavy pesticide use to control mosquitoes in many urban areas probably has a detrimental effect on the prey base for these aerial insectivores and unknown effects from direct exposure. Decreases in some Common Nighthawk populations have coincided with increases in this type of pesticide use (Wedgwood 1991). The decreasing number of suitable nesting sites and possible decrease in the prey base may be the most important limiting factors for these species, but little is know about nesting success and the impact of urban/suburban-associated predators (e.g., domestic cats, raccoons, dogs, squirrels) on reproductive success.

Cities have also become the most commonly occupied habitat for eastern populations of Peregrine Falcons, which have been reintroduced through hacking programs in many cities in the East. Urban habitats provide an abundance of nesting sites on buildings and bridges, as well as an abundance of prey, such as rock doves, morning doves, and other common urban birds.

Associated priority species: CHIMNEY SWIFT, Peregrine Falcon, Common Nighthawk, Purple Martin.

Habitat and population objectives: Based on extrapolations from BBS relative abundances (assuming each route samples approximately 25 km^2 of habitat; Appendix 3), VERY ROUGH estimates of population size for priority species in this habitat suite can be derived (Table 4.3).

Table 4.3. Population estimates for priority species of urban/suburban habitats in the Southern New England physiographic area. Percent of Atlas blocks based on number of 5-km blocks in which the species was reported within this physiographic area during the state Breeding Bird Atlases for New Jersey (N=±109; Walsh et al. 1999), New York (N=373; Andrle and Carroll 1988), Connecticut (N=550; Bevier 1994), Massachusetts (N=944; Veit and Peterson 1993), Rhode Island (N=165; Enser 1992), and Maine (N=25; Adamus 1987?).

Species	BBS population	% Atlas blocks					
		NJ	NY	CT	RI	MA	ME
Chimney Swift	170,000		43	84	69	58	92
Peregrine Falcon	20*		1	<1	0	<1	<1
Purple Martin	9,600		14	10	15	3	20
Common Nighthawk	**		11	11	2	4	40

* This represents the number of nesting pairs reported as of 1998 for the Southern New England and Central Appalachian recovery unit as published by the U.S. Fish and Wildlife Service in the Final Rule to remove Peregrine Falcon from the Federal Endangered and Threatened Wildlife list.
** BBS typically does not cover this species well and under-represents this species since the point count techniques used by BBS target diurnal species and are inappropriate for accurate assessments of presence or abundance for nocturnal species.

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

> OBJECTIVE 1: increase the number of nesting Peregrine Falcons to 25 in Southern New England. The recovery plan for the Eastern Population of the Peregrine Falcon established a recovery objective of a minimum of 20-25 nesting pairs in each of the Eastern recovery units. The Southern New England and Central Appalachian unit met the minimum standard with 20 nesting pairs. Increasing the number of nesting pairs to 25 in the Southern New England physiographic area will help ensure the long term viability of this species in the region.
>
> OBJECTIVE 2: maintain a stable population of at least 170,000 Chimney Swifts throughout the physiographic area.
>
> OBJECTIVE 3: maintain a population of at least 10,000 Purple Martins in this planning unit through increased active monitoring of breeding colonies and actively encouraging colonization of new sites by providing more nest boxes/gourds and using tapes of dawn song to attract dispersing birds.

Implementation strategy: To meet the objectives for these urban species, a coordinated and species specific monitoring and assessment program needs to be implemented. Key breeding locations within this physiographic area for Purple Martins, Chimney Swifts, and Common Nighthawks should be identified for immediate conservation efforts, as these areas will provide source populations for colonizing new areas and establishing new breeding sites. Landowner contacts should be made at each site to encourage proper management for these species.

Population trends and status of Common Nighthawks are poorly known because these birds are most active during the dusk and dawn periods. These crepuscular activity patterns make standard surveying techniques inappropriate for these birds. The commonly used surveying methods, such as diurnal point counts, are likely to underestimate the presence of nighthawks and produce poor estimates of abundance. Surveys that are more appropriate for species that are active at night and dusk/dawn periods are needed in order to monitor Common Nighthawks and other crepuscular/nocturnal species. The Species Inventory Unit of the British Columbia provincial government has developed a survey protocol for sampling Nighthawks and other goatsuckers. This protocol is available at the web site http://www.for.gov.bc.ca/ric/Pubs/teBioDiv/poorw/index.htm, and it recommends evening point counts, beginning at sunset and continuing until the end of the dusk crepuscular period (about 1.5 hours). This method or a similar one should be developed for monitoring goatsuckers within the Southern New England physiographic area.

A network of managers, biologists, and researchers are needed across Southern New England to more effectively address the needs and coordinate conservation efforts for the high priority urban birds, especially nighthawks, swifts,

and martins. Surveying efforts, identification of significant breeding locations, and public education/outreach should be coordinated on a regional basis. Conservation efforts for Purple Martins should also be done in cooperation with the Purple Martin Conservation Association, which has developed guidelines for attracting and managing for this species. Peregrine Falcons already have a well-established regional network because of their previous federal status as an endangered species.

Management Recommendations:

- Purple Martin: populations in Southern New England are entirely dependent on human-provided nest sites through nest boxed and gourds; management efforts should include efforts to attract birds to new breeding sites through providing additional nest boxes/gourds and use of tapes of dawn songs; breeding sites need to be actively monitored, including maintaining open habitat and controlling starlings and house sparrows.
- Common Nighthawk: develop guidelines for rooftop nest box designs and other rooftop habitat enhancements appropriate for the increasing number of rubber-based rooftops and decrease in gravel rooftops.
- Peregrine Falcon: work with and educate transportation agencies and urban property owners on enhancing bridges and buildings to support Falcons; also work with these agencies and owners to establish nest monitoring programs on their properties.

Research and monitoring needs:

- Investigate factors affecting decreasing nesting success of Common Nighthawks on gravel rooftops.
- Develop an appropriate survey method for tracking populations of Chimney Swifts and Common Nighthawks and conduct a thorough status assessment of these species.
- Understand impacts of pesticides (e.g., urban/suburban mosquito spraying) on this suite of species, including links to the current outbreak of West Nile virus. Pesticide use on the wintering grounds could also be an import threat to these species.
- Compile better life history information on these species, such as kinds of nest predators and levels of nest depredation, breeding longevity and reproductive effort over time, characteristics of preferred nesting requirements, fidelity to breeding and wintering sites, and better assessment of migration routes and destinations.
- Research factors that promote population expansions of Purple Martins and methods to encourage Martins to colonize new areas.

Outreach:

- Purple Martin: distribute informational materials and fact sheets on building plans for Martin houses and methods to encourage colonization of new sites; develop educational materials to help the public identify and distinguish Martins from other swallows and starlings.
- Common Nighthawk and Chimney Swift: distribute information materials on the use of rooftops and chimneys as nesting sites by these species and on Nighthawk nest box designs/ rooftop habitat improvement.
- public education programs to encourage reports of Common Nighthawks, Chimney Swifts, and Peregrine Falcons; develop urban public education in schools to aid in the monitoring and assessment of populations of these species.

G. Freshwater wetlands

Importance and conservation status*:* This habitat suite represents a continued nationwide 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 huge. 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 abundances 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. As with the grassland habitat suite, most species are considered a priority because of their Watch List status (American Black Duck) or special concern listing in various states. This habitat suite therefore represents continued nationwide concern for wetland

habitats and their potentially vulnerable species, even though they do not rank highly in the global PIF prioritization system.

Habitat and population objectives: Based on extrapolations from BBS relative abundances (assuming each route samples approximately 6.3 - 25.0 km^2 of habitat; Appendix 3), VERY ROUGH estimates of population size for priority species in this habitat suite can be derived (Table 4.4).

Table 4.4. Population estimates for priority species of freshwater wetland habitats in the Southern New England physiographic area. Percent of Atlas blocks based on number of 5-km blocks in which the species was reported within this physiographic area during the state Breeding Bird Atlases for New Jersey (N=±109; Walsh et al. 1999), New York (N=373; Andrle and Carroll 1988), Connecticut (N=550; Bevier 1994), Massachusetts (N=944; Veit and Peterson 1993), Rhode Island (N=165; Enser 1992), and Maine (N=25; Adamus 1987?).

Species	BBS population	% Atlas blocks					
		NJ	NY	CT	RI	MA	ME
American Black Duck	1,400		51	29	36	44	72
King Rail	??						
American Bittern	75		5	4	3	8	36
Least Bittern	??		5	3	0	1	4
Northern Harrier	40		18	2	2	3	16
Osprey	200		23	5	8	20?	24
Pied-billed Grebe	??		4	4	0	1	16
Common Moorhen	??		5	1	2	1	4
Great Blue Heron	3,100		13	24	<1	6	68

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

> * 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.

H. Stopover Habitat

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APPENDIX 1: ECOLOGICAL UNITS AND VEGETATION ALLIANCES

Appendix 1. Ecological Units and associated vegetation alliances within the Southern New England PIF planning unit (physiographic area 9). 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)	Description	Vegetation	Human use
221Aa (MA)	Boston Basin	Hemlock-white pine and n. red oak-white pine forests, maritime dune communities	U, RS, F
221Ab (MA)	Cape cod coastal Lowland and Islands	Hemlock-white pine and oak-pine xeric forests, maritime dune communities	RS, F
221Ac (MA, RI)	Narragansett/Bristol Lowland and islands	Hemlock-white pine and oak-heath dry forest, maritime dune communities	F, D, A
221Ad (RI, CT)	Southern New England Coastal Lowland	Hemlock-white pine-oak and red oak-hardwood forest, maritime dune communities	F, A, D
221Ae (NJ, NY, CT, MA)	Hudson Highlands	Hemlock-white pine, red oak-white pine, sugar maple-chinquapin oak forests	F, A, RS, M
221Af (MA, CT	Lower Connecticut River Valley	Hemlock-white pine-oak, SM-B-B, white pine-red pine forest	A, R, F
221Ag (MA, RI, CT)	Southeast New England Coastal Hills and Plains	Hemlock-white pine-oak, SM-B-B	F, A, RS
221Ah (MA, CT)	Worcester/Manadnock Plateau	Hemlock-white pine, SM-B-B, red spruce transition forest	F, RS, A
221Ai (ME, NH, MA)	Gulf of Maine Coastal Plain	Hemlock-white pine-oak, SM-B-B, red oak-hardwood mesic forests	F, A, RS
221Ak (ME, NH, MA)	Gulf of Maine Coastal Lowland	Hemlock-white pine, n. oak-white pine forest, Atlantic white cedar swamp, maritime dune community	F, R, A
221Am (NJ, PA)	Reading Prong	Sugar maple-chinquapin oak forest, oak-heath dry forest, SM-B-B, oak pine dry forest	A, U
221Dc (NY, NJ)	Newark Piedmont	Oak-heath dry forest, sugar maple-chinquapin oak forest, red maple-black ash swamp, freshwater tidal marsh	U, I
232Aa (NY)	Long Island Coastal Lowland and Moraine	Hemlock-white pine forest, pine dry forest, maritime dune complexes	U, RS, A, F

APPENDIX 2: AVIFAUNAL ANALYSIS

Roughly 202 bird species (Appendix 2) have been documented as breeding within physiographic area 09 (Peterson 1980, various atlases). Of the nongame landbirds (135 species), the majority are migratory; these include 70 Neotropical migratory species. The landbird avifauna is typical of northern portions of North America, but includes many species of more southern affinity that are at the northern limits of their range. An analysis of all Neotropical migratory species in the Northeast U.S. (Rosenberg and Wells 1995) found the composition of breeding species in this area to be distinct from nearby Northern New England and Allegheny Plateau areas and most similar to the mid-Atlantic Ridge and Valley and Piedmont physiographic areas. Because of its small size, this area does not support the highest proportion of the total population for any of the high-priority species in the Northeast region; however, it ranks second in importance for one species (Blue-winged Warbler) and supports the highest BBS relative abundance for four species (see below).

Species of regional importance

Species are prioritized initially according to the importance of this planning unit to their total species population. Species with relatively 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, 1999). Because of the small size of this physiographic area, we consider a species to be important if the area supports $\geq$ 2% of its total population. Despite its small size, this planning unit is estimated to support >50%? Of the world breeding population of Saltmarsh Sharp-tailed Sparrow, as well as a sizable chunk of the introduced Mute Swan population (Table 1). In addition, the area supports > 10% of the total population breeding of Blue-winged Warbler, the second highest total for any physiographic area, and > 5% of the world population for Gray Catbird. Altogether, 10 species have at least 2% of their population in this area.

Table 1. Species with high proportions of their total population in Area-9. Percent of population calculated from percent of range area, weighted by BBS relative abundance (see Rosenberg and Wells, 1999). Population trend from BBS data (% change per year from 1966-1996). PIF regional and global scores from CBO (Carter et al., in press).

Species	% of pop.	rel. abun.	Pop. trend		AI (reg)
Saltmarsh Sharp-tailed Sparrow	50+?	0.03 [1]			5
Mute Swan	42.4	1.56 [1]			5
Blue-winged Warbler	10.0	2.40	**-1.9**	0.00	5
Gray Catbird	5.5	26.13 [1]	0.6	0.01	5
Black-capped Chickadee	2.2	16.57	0.3	ns	5
Scarlet Tanager	2.2	4.05	-1.0	ns	4
Louisiana Waterthrush	2.2	0.35	2.3	ns	4
Wood Thrush	2.2	13.40	**-1.9**	0.01	4
Baltimore Oriole	2.1	11.99	**-3.0**	0.00	5
Tufted Titmouse	2.0	8.97	5.3	0.00	4

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

Species of immediate concern

The assessment of regional importance of bird species did not take into account whether those species were declining within the planning unit or elsewhere. Species of high regional importance, that are also declining, are of greatest concern in terms of short-term conservation action (Rosenberg and Wells 1999). Our primary measure of population trend at present is the Breeding Bird Survey (BBS), which provides data on 143 of the 202 species breeding within Area-09 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 10 species with $\geq$2% of their total population in the planning unit, 3 have declined significantly ($P < 0.10$) since 1966 (Table 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. The list of species with significant declining trends in Area-09 is very different from the regional importance list (Table 2). Of the 44 declining species, 27 are associated with grassland and other early successional habitats, including urban areas. These include 12 of the 15 species showing the steepest declines (> 5 % per yr). Two shrub-scrub nesting species (Golden-winged Warbler and Yellow-breasted Chat) may be extirpated as breeders, and these along with other steeply declining species (e.g. Brown Thrasher, Northern Bobwhite, Field Sparrow) form a high-priority species suite with Blue-winged Warbler and associated species mentioned above.

The remaining 17 declining species are associated with forests. The most steeply declining forest species, such as Whip-poor-will, cuckoos, Purple Finch, Least Flycatcher, Yellow-shafted Flicker, Baltimore Oriole, are primarily associated with regenerating forests and edges. The 10 species breeding in more mature forests include several that show significant declines only for the 1980-1996 period (e.g. Yellow-throated and Red-eyed Vireo, Eastern Wood-pewee), as well as several common species showing small, but significant, long-term declines (e.g. Wood Thrush, Great Crested Flycatcher). The relatively large number of declining forest species in Southern New England parallels the trend for Northern New England and is in contrast with many other northeastern physiographic areas, where few forest species are declining.

Table 2. Species showing large or significant population declines within Physiographic Area 09, based on Breeding Bird Survey, 1966-1999 trends (N = 59 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
Golden-winged Warbler	-20.8	6	0.08	0.03	ES
Yellow-breasted Chat	-16.0	5	0.02	0.09	ES
Whip-poor-will	-14.2 [a]	8	0.04	0.23	ES, HF
Yellow-billed Cuckoo	-13.2	34	0.00	0.47	HF
Snowy Egret	-12.7 [a]	5	0.09	0.11	W
Northern Bobwhite	-11.8	22	0.00	2.32	ES
Vesper Sparrow	-10.4	6	0.06	0.03	GR
White-throated Sparrow	-10.4	23	0.00	0.75	ES, CF
American Kestrel	-10.1	31	0.00	0.28	GR
Brown Thrasher	-10.0	47	0.00	1.74	ES
Eastern Meadowlark	-10.0	45	0.00	2.27	GR
Black-billed Cuckoo	-8.5	42	0.00	0.68	HF
Brown Creeper	-8.2 [a]	25	0.00	0.26	HF, CF
Field Sparrow	-8.1	47	0.00	2.37	ES
Eastern Towhee	-7.1	50	0.00	11.99	ES
Bank Swallow	-6.9	21	0.02	1.56	W, GR
Savannah Sparrow	-6.7	11	0.05	0.20	GR
Purple Finch	-5.9	39	0.00	1.04	CF, HF
American Bittern	-5.8	6	0.03	0.03	W
Broad-winged Hawk	-5.7	34	0.00	0.17	HF
Ring-necked Pheasant	-5.7	33	0.00	1.22	GR
Double-crested Cormorant	-5.7 [a]	12	0.05	0.50	W
Yellow-throated Vireo	-4.8 [a]	32	0.04	0.90	HF
Indigo Bunting	-4.7	49	0.00	2.49	ES
Least Flycatcher	-4.1	43	0.00	1.36	HF
Yellow-shafted Flicker	-3.6	50	0.00	5.41	HF
Red-winged Blackbird	-3.5	49	0.00	32.76	ES
Prairie Warbler	-3.2	43	0.00	1.47	ES
Baltimore Oriole	-3.2	49	0.00	12.01	HF
Blue Jay	-2.9	50	0.00	23.27	HF, U
Hairy Woodpecker	-2.8	45	0.00	0.81	HF, CF
European Starling	-2.7	50	0.00	66.80	U, ES
Eastern Kingbird	-2.6	49	0.00	5.53	ES

Herring Gull	-2.4	28	0.07	14.97	W
Rose-breasted Grosbeak	-2.4	49	0.04	3.43	HF
Blue-winged Warbler	-2.3	43	0.00	2.68	ES
Wood Thrush	-2.2	50	0.01	14.84	HF
Eastern Wood-pewee	-2.1 [a]	43	0.03	3.91	HF
Common Grackle	-1.9	50	0.00	36.78	ES
Song Sparrow	-1.8	50	0.00	23.61	ES
Killdeer	-1.7	43	0.02	1.07	GR
Great Crested Flycatcher	-1.7	50	0.00	3.05	HF
House Wren	-1.6	50	0.04	11.46	ES, U
Chimney Swift	-1.4	49	0.05	9.73	U
House Sparrow	-1.3	49	0.05	27.30	U
Common Yellowthroat	-1.0	50	0.02	16.95	ES, W
Black-capped Chickadee	-0.9 [a]	49	0.09	16.75	HF, U

[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 Southern New England, 41 species show increasing population trends (Table 3), roughly equal to the number of species that are declining. A majority of these fall in two categories, either species associated with mature forests, or species that have adapted particularly well to human activities or development. About as many forest species (10) are increasing in this region as are declining, including several regionally important species such as Cerulean Warbler, Worm-eating Warbler (since 1980), and Yellow-bellied Sapsucker.

Species associated with human activities include those using bird feeders or nest boxes, as well as those that breed in urban wetlands or conifer plantations (e.g. Pine Warbler, Hermit Thrush, Myrtle Warbler). Several species, such as House Finch, Red-bellied Woodpecker, Carolina Wren, Tufted Titmouse, and Northern Cardinal have experienced widespread population increases throughout the Northeast. In contrast with those in Table 2, early successional species that are increasing tend to be those that have adapted well to suburban and urban habitats (e.g. Cedar Waxwing, Eastern Phoebe, American Goldfinch, Chipping Sparrow, American Crow).

Table 3. Species showing large or significant population increases within Physiographic Area 09, based on Breeding Bird Survey, 1966-1999 trends (N = 59 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
Wild Turkey	30.1	11	0.01	0.22	HF
Common Raven	29.5	3	0.07	0.22	CF, HF
Red-bellied Woodpecker	21.1	25	0.00	0.83	HF, U
Carolina Wren	20.9	31	0.00	0.88	HF, U
Red-shouldered Hawk	18.6 [a]	9	0.05	0.04	HF
Osprey	16.6	3	0.01	0.07	W
Ruby-throat. Hummingbird	16.5	15	0.01	0.09	HF, U
Pine Warbler	13.1	34	0.00	1.46	CF
Purple Martin	11.2 [a]	6	0.06	0.35	GR, W
Turkey Vulture	10.1	21	0.00	0.34	ES, HF
House Finch	9.7	49	0.00	12.61	U
Mute Swan	9.1	8	0.02	0.94	W, U
Great Blue Heron	8.0	28	0.05	0.32	W
Yellow-bellied Sapsucker	8.0	8	0.04	0.53	HF, CF
Worm-eating Warbler	7.6 [a]	16	0.07	0.22	HF
Blue-gray Gnatcatcher	7.3	23	0.00	0.41	HF
Eastern Bluebird	6.3	34	0.00	0.45	ES
Myrtle Warbler	6.3	18	0.00	0.38	CF

Willow/Alder Flycatcher	6.1	35	0.00	0.61	ES, W
Canada Goose	5.5	39	0.00	5.22	W, U
Pileated Woodpecker	5.3	23	0.03	0.21	HF
American Goldfinch	5.3 [a]	49	0.00	8.22	ES, U
Tufted Titmouse	5.1	50	0.00	11.10	HF, U
Hermit Thrush	5.0 [a]	24	0.09	0.90	CF, HF
Mallard	4.0	42	0.09	2.10	W, U
Black-thr. Green Warbler	4.0	31	0.00	0.63	CF, HF
Red-tailed Hawk	3.6	29	0.09	0.19	HF, GR
Northern Cardinal	3.3	50	0.00	12.56	ES, U
Eastern Phoebe	2.7 [a]	48	0.00	6.38	ES, U
American Crow	2.6	50	0.00	34.12	ES, U
Tree Swallow	2.5 [a]	46	0.06	5.22	W
Cedar Waxwing	2.3	45	0.01	3.90	ES, U
Northern Mockingbird	2.2	50	0.04	7.97	ES, U
American Redstart	2.0	46	0.02	3.14	HF
Yellow Warbler	1.7	49	0.00	8.52	ES
Mourning Dove	1.4	50	0.00	22.28	ES, U
Chipping Sparrow	1.2	50	0.01	18.14	ES, U
Gray Catbird	1.1	50	0.00	23.46	ES

[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 1998 (J.R. Sauer, pers. com.). These same Relative Abundance values are used to calculate Area Importance (AI) scores in the PIF species prioritization database (see Carter et al. in press). Note that prior to July, 1999 BBS Relative Abundance was calculated differently; so any previously presented or published population estimates using these values will differ from those calculated after July 1999 (J.R. Sauer, pers. com.).

Percent of Population

The percent of total or global population (% pop) for a species is calculated according to the methods originally described by Rosenberg and Wells (1999). For species sampled by the BBS, the Relative Abundance value for each physiographic area is multiplied by the size of that area (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:

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

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.