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Partners in Flight: Mid-Atlantic Coastal Plain Bird Conservation Plan (Physiographic Area #44)

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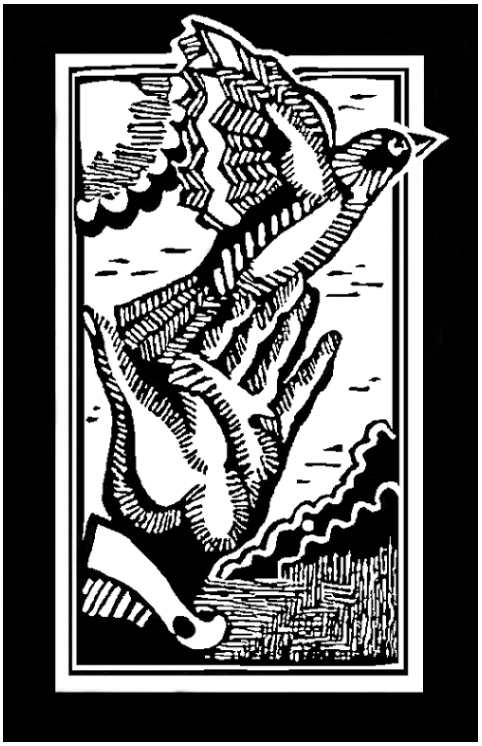

Center for Conservation Biology
College of William and Mary & Virginia Commonwealth University

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EXECUTIVE SUMMARY

Area - 5,460,600 ha
Description - The Mid-Atlantic Coastal Plain extends from the Atlantic Ocean, south of Long Island, to the Fall Line, where the hilly Piedmont begins. It is arbitrarily separated from the South Atlantic Coastal Plain at the Virginia-North Carolina border (which the exception of the Great Dismal Swamp in the southeast corner of Virginia, which is grouped in the southern area). The area was formed by shifting sea levels and alluvial deposition from rivers draining mountains to the west. Water continues to be a dominant feature of the landscape, creating forested wetlands and salt marsh and shaping barrier island and bay complexes. Upland forests on the remaining land graded in composition from pine dominated areas on the outer Coastal Plain (nearer the coast) to hardwood forests on the inner Coastal Plain. This was the site of the first successful English settlement in North America, and the natural landscape has been altered by European culture for nearly four centuries. The current human population approaches 11 million and is expected to continue to expand into the future, placing ever-increasing demands on the region's natural resources.

Priority bird species and habitats -
Pine savannah **-**
Red-cockaded Woodpecker -- Federally endangered; remnant population reduced to as few as three breeding clans.
Prairie Warbler -- Declining; native to open pine savannah; also in early succession habitat.
Bachman's Sparrow -- Northern edge of breeding range; requires open, grassy understory

Objective: Restore enough pine savannah to support 20-25 clans of Red-cockaded Woodpecker (pre 1970s population); maintain breeding population of 2,600 Brown-headed Nuthatches.

Salt marsh **-**
Salt-marsh Sharp-tailed Sparrow -- Large proportion of world population breeds here; requires high marsh with buffer, stable water levels.
Black Rail -- Status poorly known; requires high marsh with buffer.
Seaside Sparrow -- Large proportion of East Coast population; wider habitat tolerance than sharp-tailed sparrows
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 20,000 ha of marsh may be required to support 3,000 breeding pairs of American Black Ducks.

Forested wetlands **-**
Cerulean Warbler -- Poorly monitored; small populations along forested rivers;
Swainson's Warbler -- Disjunct population at northern edge of range; requires dense shrubby understory;
Prothonotary Warbler -- Good indicator species for permanently forested wetlands; cavity nester;
Acadian Flycatcher -- Habitat generalist in wet or moist deciduous forests with dense understory.

Objective: Rougly 300,000 ha of forested wetland is required to support entire habitat-species suite, including 100,000 pairs of Acadian Flycatchers and 16,000 pairs of Prothonotary Warblers.

Mixed upland forests -

Wood Thrush -- Prefers moist deciduous forest with dense with well-developed mid-story.

Worm-eating Warbler -- Expanding population; associated with dry, sloped forest with dense understory; ground nester.

Kentucky Warbler -- Requires moist deciduous forest with dense understory and ground cover.

Objective: Roughly 1 million ha of mature deciduous forest is required to support entire habitat-species suite (e.g. 300,000 pairs of Wood Thrush).

Early successional -

Henslow's Sparrow -- May be one of the few remnants of the Eastern subspecies. Occurs in variety of habitats including the high dry edges of salt marsh habitat, very young regenerating pines, and (formerly) grasslands.

Conservation issues and recommendations -

Managing human population growth while maintaining functional natural ecosystems is the greatest conservation challenge facing land managers in this region. The future of wildlife habitat depends on protection of patches of conservation significance and the manner in which inevitable continuing growth alters the environment. Retention of populations of the highest priority birds, including the Red-cockaded Woodpecker, Piping Plover, and Henslow's Sparrow, will require active protection and management of key sites. Forest habitat remains relatively abundant, but is very heavily fragmented. Identification and maintenance of those blocks large enough to support the full array of breeding birds should be a priority. Because of the close juxtaposition of coastal maritime, inland freshwater, and upland habitats, integrating the conservation objectives of priority land birds with those of waterfowl, shorebirds, and colonial-nesting waterbirds will be a high priority in the near future. Protection of critical sites for transient and wintering species also needs to be integrated with conservation plans for breeding habitats.

Specific conservation recommendations for this physiographic area include:

- Identify and restore tracts of pine-savannah habitat with the potential to support Red-cockaded Woodpecker clans within the next 20 years;
- Establish burning program to maintain structural conditions in understory of existing pine-savannah
- Continue strict protection of beach and barrier dune habitat to minimize productivity losses by priority species;
- Identify, prioritize, and protect all sites with > 50 ha of high marsh;
- Identify and protect forest blocks that support significant populations of Prothonotary, Cerulean, and Swainson's Warbler; or Wood Thrush;
- Identify, and either acquire, mange or restore open lands > 50 ha with potential to support Henslow's Sparrow.

ACKNOWLEDGMENTS

This draft plan was produced with funds provided by the Northern Neck Audubon Society, the Tennessee Conservation League, and the Center for Conservation Biology at the College of William and Mary. I thank Bob Ford and Ken Rosenberg for guidance throughout the planning process. Dana Bradshaw, Mike Wilson, and Marian Watts provided assistance with information and literature.

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 I: THE PLANNING UNIT

A. Background:

The mid-Atlantic Coastal Plain currently covers approximately 56,220 sq km. The areal extent of the region has changed dramatically on a geological time scale with shifts in global climate and sea level. The boundaries of the region are formed by the Atlantic Ocean to the east and the fall line to the west (Figure 1). Between these two boundaries the land slopes gently toward the fall line where it generally reaches an elevation of less than 80 m. A number of terraces and scarps have been recognized within the region that have been considered "high-water marks" formed by shifts in sea level during the Pleistocene (Cooke 1931). The surface of the land has been reworked considerably by fluvial processes over the past 2-3 million years. Rivers originating within the mountains and piedmont slow and release sediment as they move out across an increasingly flat landscape. As a result, topographic relief declines from the fall line to the Atlantic Ocean. Soils of the region are primarily derived from sediments washed from the Appalachian Mountains and from marine sources deposited during periods of high water.

Water is one of the most dominant features within the physiographic region accounting for nearly 20% of the total area. Water and water-associated habitats are essential to the

character of the regional avifauna. Over much of the region, subsidence of the basement rock has "drowned" the mouths of major rivers and lead to the formation of shallow bays. Approximately 1,000 permanently flooded rivers and streams come in close contact with virtually the entire upland surface area. Slowly draining soils have lead to the development of extensive wetlands of numerous types. Nearly 1,000,000 ha of wetlands occur within the region with dominant types including forested wetlands (58%) and salt marshes (28%).

Vegetation within the mid-Atlantic Coastal Plain is most closely associated with that of the southeastern Coastal Plain. More than 100 plant species that are centered in the southeast reach their northern range limit in coastal New Jersey. Many more species reach their limit further south within the region. Upland forests remain an important component of the regional landscape. Forests form a natural gradient in composition from pine-dominated forests on the outer Coastal Plain to hardwood-dominated forests on the inner Coastal Plain.

The mid-Atlantic Coastal Plain was the site of the first successful European settlement in North America. The natural landscape has been altered by European culture for nearly four centuries. By 1790, the region supported more than 600,000 people. In the intervening 200 years, the human population has grown to more than 10.5 million. Currently, the urban crescent from Baltimore south to Richmond and east to Norfolk is one of the fastest growing regions in North America. Growth is expected to continue into the foreseeable future, placing increasing demands on the regions natural resources.

B. Conservation Issues:

Managing human population growth while maintaining functional natural ecosystems is the greatest conservation challenge faced by land managers within the mid-Atlantic region. The living space and infrastructure required by the expanding human population has had a pervasive impact on the natural landscape, resulting in a direct change in the availability and distribution of habitats. Although the nature and extent of these impacts vary with habitat and location, every habitat type in the region has been affected to some extent. The pace of habitat loss within the region suggests that the future success of conservation initiatives will require 1) the swift identification and preservation of remaining habitat patches of conservation significance and 2) a fundamental shift in the way that jurisdictions manage growth.

The impacts of an expanding human population on regional bird populations extend beyond the direct loss of habitat. For example, the increased demand for recreational activity has lead people further afield to remote habitats that represent the only breeding areas for many species that are sensitive to human disturbance. Fire suppression programs have changed the vegetative structure of forested habitats and virtually eliminated pine savannahs from the region. Invasive plant species now threaten the remaining patches of high marsh that support one of the most threatened species suites within the region. The introduction and use of cool-season grasses has greatly reduced the availability of open lands to grassland-obligate species. Populations of predators associated with human development have reached historic highs and have likely reduced productivity for many species across all habitat types. In order to be successful, a conservation strategy must identify and address both the direct and indirect effects that influence population trends.

In addition to the issues associated with a growing human population, the region supports important industries that have had a direct impact on the status of bird populations. The development of modern silvicultural practices in the 1950's and 1960's and their widespread use

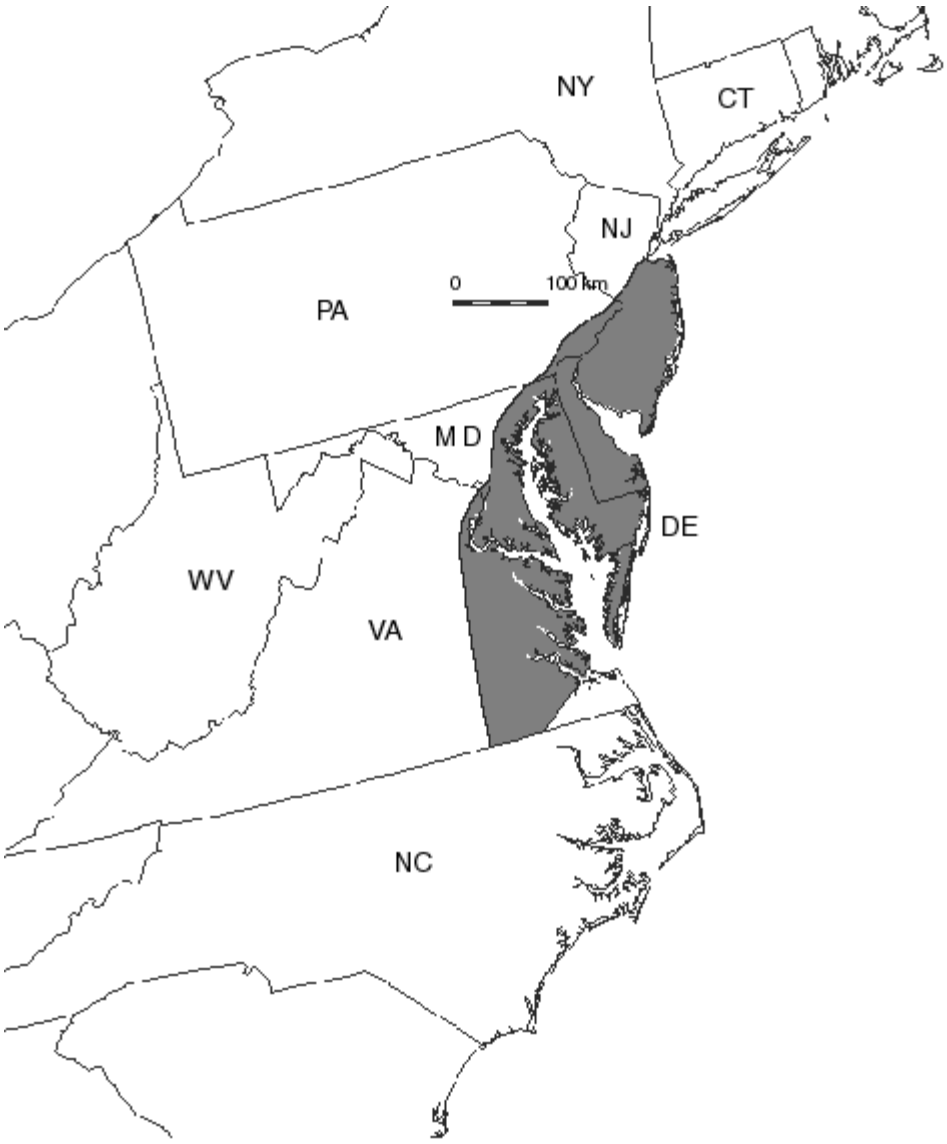
over the past 30 years has lead to a dramatic shift in forest structure and distribution. The conversion of extensive areas of upland mixed forest to short-rotation pine monocultures has reduced available habitat for many species. The impact has likely been greatest on species requiring hardwood-dominated forests or older forests. In a similar way, the development of modern agricultural practices over the past 40 years has reduced the availability of idle lands for grassland-obligate species.

Beyond the influence of humans, natural forces will likely cause shifts in habitat availability across the physiographic region. Global warming and the associated rise in sea level poses one of the greatest threats to salt marshes in the region. This problem may be exacerbated by the gradual subsidence of the underlying rock surface. Global warming may also influence the frequency and intensity of extra-tropical storms that are responsible for creating open habitats for beach-nesting birds. Although these forces may be beyond the control of the conservation community, land managers must be aware that these forces may change the backdrop on which conservation activities must take place.

C. Conservation Opportunities:

Despite the important conservation issues within the region and the fact that the dominant force (expanding human population) contributing to concerns will continue to operate, the potential for successful conservation of priority bird populations remains optimistic. This optimism stems from 1) the fact that a large number of lands critical to priority bird populations are currently protected or held by PIF partners, and 2) many priority species remain relatively abundant and widespread within the region.

A large portion of some priority habitats are protected either through legislation or through outright ownership by PIF partners. For example, wetland habitats are federally protected by the wetlands act of 1972. Primary dunes on barrier islands are protected within the region by various pieces of state legislation. Some riparian habitats are protected by state and/or federal legislation. In addition to legal protections, many significant parcels of priority habitats are owned by government agencies or nonprofit organizations (see APPENDIX I). This is generally the case for much of the remaining undeveloped barrier islands and remnant maritime pine savannahs. Some of the most significant forested tracts and managed grasslands within the region currently occur on military installations and wildlife refuges. In order to maximize the conservation benefit of protected lands, these lands need to be identified, inventoried, and integrated into the conservation planning process. Integration will require that landowners be informed of the priority habitats that they control and how these habitats fit within regional conservation objectives. Integration will also require that land managers be made aware of appropriate management strategies to maintain or improve priority habitats. Because many of the priority habitats within the region are important for reasons other than providing habitat for bird populations, there is tremendous opportunity to form synergistic relationships with other resource management programs. For example, the health of wetland habitats is important to the commercial and recreational fishing industries. Riparian habitats are important to the quality of the regional water supplies. Managers of conservation programs that focus on the restoration and maintenance of priority habitats should be made aware of the habitat requirements of priority species and the role that these habitats play in regional conservation objectives.



The Mid Atlantic Coastal Plain, physiographic area 44, covering 5,460,600 ha (13,493,143 ac) across Virginia, Delaware, Pennsylvania, Maryland, and New Jersey.

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

SECTION II: AVIFAUNAL ANALYSIS

A. General avifauna

The breeding avifauna of the mid-Atlantic Coastal Plain is diverse reflecting the geographic position of the physiographic region and the wide range of available habitats (APPENDIX II). In many ways, the mid-Atlantic avifauna is transitional containing a mix of species centered in the southeast or the northeast with some additional species spilling over from more inland physiographic regions. More than 25% of the species reach their southern (15.6%) or northern (10.5%) range limit within the physiographic region. These include southern species such as the Brown Pelican, Wilson's Plover, Red-cockaded Woodpecker, and Swainson's Warbler and northern species such as the Short-eared Owl, Bobolink, Swamp Sparrow, and Northern Oriole. An additional 3.3% of the species are associated with the piedmont and mountains but occur in low numbers east of the fall line. The majority (75%) of species breeding within the physiographic region are migratory. These include 79 (43.9%) neotropical migrants and 56 (31.1%) temperate migrants.

Our primary measure of population trends at present is the Breeding Bird Survey (BBS), which provides data on roughly 147 of 180 species breeding within Area-44 (N = 85 routes). However, for many species within this region (particularly those within spatially restricted habitats such as barrier islands and salt marshes) coverage is poor, and reported trends lack statistical significance. Nevertheless, a significant declining trend on existing BBS routes warrants management consideration.

Of the species sampled by BBS, 69 (38.3%) show significant ($P < 0.10$) population trends. Thirty of these species have declined with 18 declining between 1966 and 1996 and 12 declining between 1980 and 1996 (APPENDIX III). More than 50% of species with a declining trend are associated with early successional grassland/shrubland habitats. Remaining species are associated with forested habitats, wetland, or barrier and bay islands. A total of 39 species showed significant positive population trends with the majority (74.4%) increasing only after 1980 (APPENDIX IV). Increasing species include waterbirds and raptors that are recovering from contaminants, species associated with forested habitats, or species that have expanded their geographic ranges.

B. Priority Species

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 within the mid-Atlantic Coastal Plain

physiograhic region can be found in the Species Assessment Database at http://www.rmbo.org/pif/pifdb.html.

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 IIB).
>
> 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.

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

TABLE 2.1: Priority species pool generated for the mid-Atlantic Coastal Plain, Area 44. Species are presented in decreasing order of concern. The Partners in Flight total scores and regional scores were developed from Partners in Flight criteria (Hunter et al. 1994, Carter et al. 2000). The percent of population was calculated from the percent of range area, weighted by BBS relative abundance (Rosenberg and Wells 2000). Local status refers to migratory status. Codes are as follows: B - refers to species that breed within the region but do not winter (these species are primarily neotropical migrants but may also include some temperate migrants), D - refers to species that breed and winter in the region (but possibly different populations), E - refers to species reaching distributional limits, and R - refers to resident or nonmigratory species.

Entry Level	**Species**	**Total Score**	**% of Pop**	**AI**	**PT**	**Local Status**
I.						
A.	Piping Plover	30	??	5	4	B
	Saltmarsh Sharp-tailed Sparrow	29	??	5	3	D
	Black Rail	28	??	4	3	D
	Seaside Sparrow	26	27.1	5	3	D
	Prairie Warbler	25	5.9	5	5	B
	Wood Thrush	25	3.7	4	5	B
	Kentucky Warbler	25	1.6	3	5	B
	Worm-eating Warbler	24	2.9	3	3	B
	American Oystercatcher	24	??	4	3	D
	Clapper Rail	23	18.9	5	2	D
	Prothonotary Warbler	23	1.7	3	3	B
	Whip-poor-will	23	4.0	4	4	B
	Yellow-throated Vireo	23	< 1	3	5	B
	American Woodcock	23	< 1	3	5	D
	American Black Duck	22	1.6	4	2	D
	Field Sparrow	22	1.5	4	5	D
	Hooded Warbler	22	1.3	3	4	B
	Scarlet Tanager	22	2.4	4	4	B

	Black Skimmer	22	6.4	4	5	B
B.	Red-cockaded Woodpecker	29	< 1	2	5	R
	Henslow's Sparrow	27	< 1	2	5	B
	Cerulean Warbler	26	< 1	2	3	E
	Swainson's Warbler	26	< 1	2	3	B
	Bachman's Sparrow	24	< 1	2	3	E
	Wilson's Plover	24	??	2	3	B
	Blue-winged Warbler	23	1.1	2	4	B
	Brown-headed Nuthatch	23	< 1	2	3	R
	Upland Sandpiper	23	< 1	2	5	E
	Sedge Wren	23	< 1	2	5	B
II.						
A.	Eastern Wood-Pewee	21	2.2	5	4	B
	Marsh Wren	21	< 1	3	5	D
	Northern Bobwhite	21	1.4	4	5	R
	Gull-billed Tern (SC-VA)	21	??	3	5	B
	Brown Thrasher	20	< 1	4	4	D
	Chimney Swift	20	1.7	4	4	B
	Eastern Towhee	20	2.3	4	5	D
	Gray Catbird	20	2.7	4	5	B
	Virginia Rail	20	2.3	5	3	D
	Carolina Chickadee	19	2.4	4	4	R
	Eastern Kingbird	19	< 1	3	5	B
	Yellow-billed Cuckoo	19	1.1	4	4	B
B.	Acadian Flycatcher	21	4.6	4	2	B
	Willet	21	4.9	5	1	B
	Forster's Tern	19	3.0	3	2	B
	Pine Warbler	19	3.7	4	2	B
C.	Grasshopper Sparrow	20	< 1	2	5	B
	Short-eared Owl	19	< 1	2	3	D
III.						
B.	Chuck-will's-widow	20	1.2	3	2	B
	Dickcissel	20	< 1	1	3	B
	Red-headed Woodpecker	18	< 1	2	1	D
	Bobolink	18	< 1	1	3	B
IV.						
	Bald Eagle (T-US, E-DE,MD,NJ,PA,VJ)	16	< 1	2	1	D
V.						
	King Rail (E-PA, SC-NJ)	20	< 1	2	3	D

	Northern Parula (E-DE, SC-NJ)	20	1.3	4	2	B
	Least Tern (E-DE, NJ, PA, T-MD,SC-VA)	20	2.4	4	5	B
	Barn Owl (SC-NJ, VA)	20	< 1	2	5	R
	Yellow-breasted Chat (SC-NJ)	19	< 1	3	4	B
	Brown Pelican (SC-VA)	19	< 1	3	3	B
	Tricolored Heron (SC-VA, NJ)	19	< 1	2	5	B
	Least Bittern (T-PA, SC-MD,NJ)	18	3.6	2	3	B
	American Bittern (E-NJ, T-PA, SC-MD)	18	< 1	2	3	D
	Loggerhead Shrike (E-DE, NJ, PA, T-VA, SC-MD)	18	< 1	2	3	D
	Sandwich Tern (SC-VA)	18	< 1	3	3	B
	Vesper Sparrow (T-NJ)	18	< 1	2	5	B
	Common Tern (E-DE, SC-NJ)	17	1.2	4	4	B
	Royal Tern (E-MD)	17	<1	2	3	B
	Cooper's Hawk (E-DE, T-NJ)	17	< 1	3	3	R
	Northern Harrier (E-DE, NJ, SC-VA)	17	< 1	2	2	D
	Peregrine Falcon (E-MD, NJ, PA, VA)	17	< 1	2	3	D
	Sharp-shinned Hawk (SC-NJ)	17	< 1	3	3	D
	Little Blue Heron (SC-NJ, VA)	17	< 1	2	5	D
	Glossy Ibis (SC-VA)	17	38.7	5	2	B
	Eastern Meadowlark (SC-NJ)	17	< 1	2	5	B
	Black-crowned Night-Heron (E-DE, T-NJ, PA, SC-VA)	16	< 1	2	3	D
	Brown Creeper (E-DE, SC-VA)	16	< 1	2	3	R
	Pied-billed Grebe (E-NJ)	16	< 1	2	3	D
	Osprey (T-NJ)	16	3.7	4	1	B
	American Kestrel (SC-NJ)	16	< 1	2	2	R
	Red-shouldered Hawk (E-NJ)	16	1.1	3	1	D
	Yellow-crowned Night-Heron (T-NJ, SC-VA)	15	< 1	2	1	B
	Common Moorhen (SC-MD, VA)	15	< 1	2	3	D
	Great Blue Heron (SC-NJ)	15	1.5	4	1	D
	Broad-winged Hawk (SC-NJ)	15	< 1	2	3	B
	Spotted Sandpiper (SC-NJ)	15	< 1	2	3	B
	Common Nighthawk (SC-NJ)	15	< 1	2	3	B
	Savannah Sparrow (T-NJ)	14	< 1	2	3	D
	Barred Owl (T-NJ)	13	< 1	2	1	R
	Great Egret (T-PA, SC-VA)	13	1.5	3	1	D
	Cliff Swallow (SC-NJ)	12	< 1	2	3	B
	Horned Lark (SC-NJ)	12	< 1	2	2	D

VI.						
	Wayne’s Black-throated Green Warbler	19	???	2	3	B
	Ipswich Savannah Sparrow - Wintering	16 (W)	???	3 (W)	3	D

SECTION III: HABITATS AND OBJECTIVES

When species in the priority pool (TABLE 2.1) are sorted by habitat, the highest priority habitats and associated species can be identified (TABLE 3.1). 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 group but are associated with eight different habitats. The species with the highest concern score is the Red-cockaded Woodpecker, and by association, pine savannahs rank first in regional priority. Other habitats may be loosely ranked according to the highest-scoring species in the habitat suite.

TABLE 3.1: Priority species-habitat suites generated for the mid-Atlantic Coastal Plain, Area 44. TB (threats breeding), AI (area importance), and PT (population trend) scores are from CBO prioritization database (Carter et al. in press). Action levels are as follows: I - crisis recovery needed, II - immediate management or policy needed rangewide, III - management to reverse or stabilize populations, IV - long term planning is needed, V - monitor population changes only.

Habitat	Species	Total Score	TB	AI	PT	Action Level
Pine Savannah						
	Red-cockaded Woodpecker	29	5	2	5	I
	Prairie Warbler	25	3	5	5	III
	Bachman's Sparrow	24	4	2	3	IV
	Brown-headed Nuthatch	23	4	2	3	IV
	Eastern Wood-Peewee	21	3	5	4	III
	Red-headed Woodpecker	18	4	2	1	III
	Chuck-will's-widow	20	3	3	2	V
Barrier and Bay Islands						
	Piping Plover	30	4	5	4	IV
	Wilson's Plover	24	4	2	3	IV
	American Oystercatcher	24	3	4	3	III
	American Black Duck	22	4	4	2	III
	Black Skimmer	22	4	4	5	III
	Willet	21	3	5	1	V
	Gull-billed Tern	21	4	3	5	III
	Least Tern	20	4	4	5	IV
	Brown Pelican	19	4	3	3	V
	Forster's Tern	19	3	3	2	IV
	Tricolored Heron	19	3	2	5	IV
	Sandwich Tern	18	3	3	3	IV
	Glossy Ibis	17	3	5	2	V

Royal Tern	17	3	2	3	IV
Common Tern	17	2	4	4	IV
Northern Harrier	17	4	2	2	IV
Little Blue Heron	17	3	2	5	IV
Ipswich Savannah Sparrow	16 (W)	1(W)	3	3	V
Black-crowned Night Heron	16	3	2	3	V
Yellow-crowned Night Heron	15	3	2	1	V
Great Egret	13	2	3	1	V
Horned Lark	12	4	2	2	V

Salt Marsh

Salt Marsh Sharp-tailed Sparrow	29	3	5	3	IV
Black Rail	28	4	4	3	V
Prairie Warbler	25	3	5	5	IV
Henslow's Sparrow	27	4	2	5	V
Seaside Sparrow	26	3	5	3	IV
Sedge Wren	23	4	2	5	V
Clapper Rail	23	3	5	2	IV
American Black Duck	22	4	4	2	III
Willet	21	3	5	1	V
Short-eared Owl	19	4	2	3	V
Northern Harrier	17	4	2	2	IV
Bald Eagle	16	3	2	1	IV
Osprey	16	2	4	1	V

Forested Wetland

Cerulean Warbler	26	5	2	3	V
Swainson's Warbler	26	4	2	3	IV
Kentucky Warbler	25	3	3	5	IV
Yellow-throated Vireo	23	3	3	5	IV
Prothonotary Warbler	23	3	3	3	IV
Acadian Flycatcher	21	3	4	2	IV
Chimney Swift	20	3	4	4	IV
Wayne's Black-thr-green Warbler	19	3	2	3	IV
Red-shouldered Hawk	16	2	3	1	V
Great Blue Heron	15	2	4	1	V
Barred owl	13	2	2	1	V

Mixed Upland Forest

Cerulean Warbler	26	5	2	3	V
Wood Thrush	25	3	4	5	IV

Kentucky Warbler	25	3	3	5	IV
Worm-eating Warbler	24	3	3	3	IV
Scarlet Tanager	22	3	4	4	V
Hooded Warbler	22	3	3	4	IV
Acadian Flycatcher	21	3	4	2	IV
Eastern Wood-Pewee	21	3	5	4	IV
Carolina Chickadee	19	1	4	4	V
Red-headed Woodpecker	18	4	2	1	V
Cooper's Hawk	17	3	3	3	V
Red-shouldered Hawk	16	2	3	1	V
Broad-winged Hawk	15	2	2	3	V
Barred Owl	13	2	2	1	V

Early Successional

Henslow's Sparrow	27	4	2	5	II
Prairie Warbler	25	3	5	5	IV
Bachman's Sparrow	24	4	2	3	III
Blue-winged Warbler	23	3	2	4	IV
Upland Sandpiper	23	4	2	5	III
Field Sparrow	22	3	4	5	IV
Northern Bobwhite	21	3	4	5	IV
Brown Thrasher	20	3	4	4	IV
Eastern Towhee	20	3	4	5	IV
Gray Catbird	20	2	4	5	IV
Barn Owl	20	4	2	5	III
Grasshopper Sparrow	20	4	2	5	IV
Dickcissel	20	4	1	3	V
Loggerhead Shrike	20	5	2	5	III
Yellow-breasted Chat	19	3	3	4	IV
Short-eared Owl	19	4	2	3	V
Bobolink	18	4	1	3	IV
Vesper Sparrow	18	4	2	5	IV
Northern Harrier	17	4	2	2	IV
Eastern Meadowlark	17	3	2	5	IV
American Kestrel	16	4	2	2	IV
Common Nighthawk	15	3	2	3	IV
Savannah Sparrow	14	3	2	3	IV
Horned Lark	12	4	2	2	V

Pine Plantation

Prairie Warbler	25	3	5	5	IV
Bachman's Sparrow	24	4	2	3	III
Blue-winged Warbler	23	3	2	4	IV

Brown-headed Nuthatch	23	4	2	3	IV
Field Sparrow	22	3	4	5	IV
Eastern Wood-Pewee	21	3	5	4	IV
Northern Bobwhite	21	3	4	5	IV
Brown Thrasher	20	3	4	4	IV
Eastern Towhee	20	3	4	5	IV
Gray Catbird	20	2	4	5	VI
Carolina Chickadee	19	1	4	4	VI
Yellow-breasted Chat	19	3	3	4	VI
Fresh/Brackish Emergent Wetland					
American Black Duck	22	4	4	2	III
King Rail	20	3	2	3	V
American Bittern	18	3	2	3	V
Least Bittern	18	3	2	3	V
Bald Eagle	16	3	2	1	IV
Osprey	16	2	4	1	V
Pied-billed Grebe	16	3	2	3	VI
Common Moorhen	15	3	2	3	VI

A. Pine Savannahs

Status and Importance

Pine savannahs occur in two distinctly different situations within the mid-Atlantic Coastal Plain. These include 1) inland pine savannahs that occur on uplands throughout the southeast and 2) maritime pine savannahs that occur along the margins of large estuaries. These two savannahs have different recent histories and differ somewhat in floristics.

The mid-Atlantic Coastal Plain is the northern limit of distribution for the historic southeastern pine ecosystem (inland pine savannahs). Prior to European settlement, the Southeastern Coastal Plain was characterized by old-growth pine forests that covered more than 24 million ha (Croker 1979). This ecosystem was maintained by low-intensity ground fires caused by lightening strikes (Komarek 1964, 1974) and indigenous people (Bartram 1791, Ware et al. 1993). Fires occurred over vast areas on approximately 3-5 year intervals (Chapman 1932, Krusac et al. 1995) and maintained forests with an open midstory and dense cover of forbs and grasses (Platt et al. 1991). Land clearing for agriculture, exploitation of mature pines for the naval stores industry, and the suppression of wild-fires lead to severe declines in the abundance and distribution of inland pine savannahs by the early 1800's (Ashe 1894, 1915, Pinchot and Ashe 1897). Three centuries of fragmentation and fire suppression have led to the development of dense hardwood midstories and replacement of open pine forests with closed-canopy pine and pine-hardwood forests. Currently, pine savannahs occur on only about 1% of their former range (Ware et al. 1993).

Maritime pine savannahs historically occurred along the margins of extensive salt or brackish marshes and on barrier and bay islands. Structure within this forest type was maintained by fire and the underlying hydrology. As with inland pine savannahs, maritime forests have been fragmented by changes in landuse and have been degraded by hardwood encroachment.

Within the planning unit, mature pine savannahs occur only within relatively few small remnants of maritime forest. Because shoreline development has been pervasive over the past 30 years, the majority of remaining sites occur on government-owned lands. Although approximately 15,000 ha of mature pine occur in southern Virginia, no lands have been maintained as open savannah. Currently, no intact inland pine savannahs remain within the region. However, renewed interest in this ecosystem is leading to restoration efforts.

Restoration and maintenance of pine savannahs is important to the avifauna of the mid-Atlantic Coastal Plain. Four species are endemic to this habitat type including the Red-cockaded Woodpecker, Bachman's Sparrow, Brown-headed Nuthatch, and Chuck-will's-widow.

Priority species, species suites, and habitat requirements

Within the planning unit, pine savannahs support 5 species with high concern scores and 3 species with moderate to low concern scores (TABLE 3.1). Species with high concern scores include the Red-cockaded Woodpecker, Prairie Warbler, Bachman's Sparrow, Brown-headed Nuthatch, and Eastern Wood-Pewee. Species with moderate to low concern scores include the Red-headed Woodpecker, American Kestrel, and Chuck-will's-widow. Occupation of habitat patches by species within this suite varies according to different combinations of understory and overstory conditions.

The Red-cockaded Woodpecker is a federally endangered species (U.S. Fish and Wildlife Service 1979,1985) and has the highest concern score within the planning unit. This species excavates cavities within live mature (80+ years) pine trees and requires pine stands with open park-like understories. A single family group may require 100 ha of pine forest or more depending on site quality. Within the past 100 years Red-cockadeds have disappeared completely from the northern portion of the planning unit. Historically, this species bred throughout the mid-Atlantic Coastal Plain (Jackson 1978). As recently as the 1930's and 1940's resident birds were known from the open maritime forests of Maryland (Meanley 1943, Stewart and Robbins 1958). Since that time, the range has contracted to southeastern Virginia as northern breeding sites have been lost. In Virginia, breeding has continued to the present time but the number of both sites and birds has declined dramatically in the past 40 years. As recently as the late 1970's, 23 clans were known scattered across 5 counties. Currently, 3 clans with 14 individuals exist in a single county.

Both Bachman's Sparrows and Prairie Warblers are more sensitive to understory condition than to the age of overstory pine trees. Both of these species require open understories with dense grass cover and scattered woody vegetation. Preferred conditions occur in the first 1-4 years following a prescribed burn suggesting that burn frequency must be on a 3-5 year rotation to maintain habitat quality (Dunning and Watts 1990, Gobris 1992). When compared to the Red-cockaded Woodpecker, neither the Bachman's Sparrow nor the Prairie Warbler are as restricted to pine savannah habitats. The Prairie Warbler remains widespread throughout the region and the Bachman's Sparrow is restricted to Virginia. Compared to the other more ephemeral habitats used by both species within the region, properly managed pine savannahs may provide the most stable source of habitat.

Both the Brown-headed Nuthatch and the Chuck-will's-widow are distributed throughout the lower portion of the planning unit. Although these species occur in inland pine stands and mixed forests, both reach their highest densities within the maritime pine savannahs that occur along the Chesapeake Bay shoreline. Brown-headeds require standing snags for cavity excavation and stands with an open midstory (Wilson and Watts 1999). Like the Bachman's Sparrow and Prairie Warbler, Brown-headed Nuthatches appear to benefit from prescribed burns. In other regions, Brown-headeds have been shown to decline as understory vegetation recovers in the years following burn (Engstrom et al. 1984, Wilson et al. 1995). The Chuck-will's-widow requires forests with open understories for nesting and nearby open patches for foraging.

Habitat and Population Objectives

Due to the current lack of adequate savannah habitat to support target species and the condition of remaining patches, objectives should focus on the restoration and aggressive management of both inland and maritime pine savannahs. Most of the priority species are well represented on BBS surveys (species detected in >20% of routes) or have been the focus of targetted surveys within the region. However, the Brown-headed Nuthatch is poorly represented on BBS surveys. Currently, population estimates are inadequate to establish conservation objectives. A focused study is needed to better refine habitat requirements and breeding densities so that population estimates may be generated.

TABLE 3.2: Population estimates and targets (numbers represent individuals unless otherwise indicated) for priority species of pine savannah habitat in the Mid-Atlantic Coastal Plain. Estimates were extrapolated from BBS relative abundances unless otherwise indicated; they should be considered an index of relative population sizes and only a VERY APPROXIMATE estimate of true population sizes. Percent of BBS indicates the % of routes where species was detected 1966-1996, N = 85. Percent of atlas blocks based on number of blocks within physiographic region in which the species was reported (N = 1,100 for VA, 690 for MD....).

Species	% BBS	Population estimate	% lost Since 1996	Population target	% Atlas Blocks NJ	DE	MD	VA
Red-cockaded Woodpecker	0.0	14[1]	??	??	0.0	0.0	0.0	0.4
Prairie Warbler	84.7	61,842	>50%	123,684				13.4
Bachman's Sparrow	0.0	<200[2]	??	200	0.0	0.0	0.0	0.2
Brown-headed Nuthatch	9.4	2,608	>50%	5,216				3.5
Eastern Wood-Pewee	97.6	111,316	45%	202,234				20.0
Red-headed Woodpecker	23.5	3,694	inc.	4,000				6.2
American Kestrel	55.3	3,516	inc.	3,800				5.0
Chuck-will's-widow	30.6	9,280	inc.	9,500				5.3
Whip-poor-will		10,244	47%	19,456				

[1]1998 direct population count (Bradshaw, pers. com.)
[2]Estimate from Virginia population (Fleming and Alstine 1994a, 1994b, Watts et al. 1998)

The rough estimates derived from BBS data 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. For species that have declined significantly during the BBS period, a population target may be set to approximate pre-BBS population levels; an annual decline of 2.4% per year corresponds with a 50% loss over 30 years. For species suffering a 50% or greater loss since 1966, this plan calls for roughly a doubling of present-day populations as a practical objective. For species showing stable or unkown trends, population targets are roughly rounded up from current population estimates. Note that the relative abundances used to for these estimates are averages across all BBS routes in the physiographic area using data from 1990-1999. For more details on methods used for calculating populations and targets based on BBS data, see Appendix 3. Also note that these methods have yet to undergo full peer review.

Objective 1: To restore enough pine savannah habitat to support 20-25 clans (60-80 individuals) of Red-cockaded Woodpeckers (pre-1980 population).

Justification: The Red-cockaded Woodpecker is in eminent danger of extinction within the planning unit. A recent comprehensive survey of the breeding range has failed to locate additional active breeding sites (Bradshaw, pers. comm.). Intensive management of extant clans along with extensive habitat restoration is needed to stabilize the population and bring it back to pre-1980 levels. Even so, it seems unlikely that a viable population may be maintained within the region without importing additional breeding stock from other populations.

Assumptions: It is assumed that restoration and management of old-growth pine savannahs and planning for future habitat needs will be adequate to stabilize and ultimately increase the Red-cockaded Woodpecker population. Success with projects further south support this position.

Objective 2: To manage pine savannahs to support >100 pairs of Bachman's Sparrows.

Justification: Though not as restricted in terms of habitat use as the Red-cockaded Woodpecker, the Bachman's Sparrow is also in eminent danger of extinction within the planning unit. A recent survey of the core of the species range in southeastern Virginia revealed a dramatic decline over the past 10 years (Watts et al. 1998). There are likely fewer than 50 breeding pairs remaining within the planning unit. Bachman's Sparrows are more sensitive to understory conditions than are Red-cockaded Woodpeckers. An understory management plan that is designed for Red-cockadeds may not be adequate to maintain habitat quality for Bachman's Sparrows. Understory vegetation within restored pine savannahs should be managed specifically for Bachman's Sparrows.

Assumptions: Managing savannah habitat with prescribed burn on a 3-5 year rotation will support Bachman's Sparrows, Prairie Warblers and the other species within the habitat suite. Several studies further south have documented the benefit of this management regime for Bachman's Sparrow. However, Bachman's Sparrows have never been documented in pine savannahs within the planning unit (likely due to the lack of such habitats in the recent past).

Objective 3: To maintain enough maritime pine savannahs to support xxx pairs of Brown-headed Nuthatches.

Justification: Trends from BBS data indicate that the Brown-headed Nuthatch has declined significantly throughout the region. However, the primary habitat within the region is poorly represented on BBS routes. Many observers within the region believe that this species has declined more sharply than has been indicated by BBS trends. The Brown-headed Nuthatch reaches its highest density within maritime pine savannahs and is the best indicator species for this ecosystem. Where they currently exist, maritime savannahs need to be identified and protected from further degradation. Where they have been lost, restoration should be considered where appropriate.

Assumptions: Restoring and maintaining adequate maritime savannahs for Brown-headed Nuthatches will have a significant positive influence on populations of Prairie Warblers, Chuck-will's-widows, and other species within the habitat suite.

Implementation Strategy

Actions: (Objective 1)

- identify lands with adequate timber to support clans now and/or lands with the potential to support clans within the next 20 years.

Background and Progress: A comprehensive survey of the entire southeastern portion of Virginia for lands with the potential to support Red-cockaded Woodpeckers has recently been completed (Bradshaw, unpub. data). Approximately 15 sites including approximately 3,500 ha of oldgrowth pine remain that seem to be adequate to meet the breeding requirements of Red-cockaded Woodpeckers if restored. Approximately 1,600 ha of this land is already under protection. However, only half is being managed. Remaining land is privately owned and neither protected or managed. An additional 15 sites occur including not more than 2,000 ha with conditions that might support woodpeckers in the next 20 years. A portion of these sites have historically been controlled by or have recently been acquired by PIF partners.

- where possible, acquire 1) lands with active Red-cockaded Woodpecker clans and 2) lands identified as having high potential for supporting clans now or in the near future.

Background and Progress: Over the past 20 years, land ownership has been an impediment to the management and recovery of the pine savannah community within the planning unit. All active clans of Red-cockaded Woodpeckers have occurred on private lands managed primarily for wood production. Within the past year, The Nature Conservancy has purchased just over 600 ha of oldgrowth pineland that supports the core of the remaining Red-cockaded Woodpecker population. The primary mission of this new reserve will be the restoration of pine savannah habitat. If successful, this project may be expanded to 3 other sites that occur on lands controlled by PIF partners. These sites include the Great Dismal Swamp National Wildlife Refuge, a Virginia Natural Heritage Reserve on the North Landing River and the Zuni Pine Barrens. Collectively, these lands may be adequate to support 20-25 woodpecker clans and other associated species.

- restore and manage pine savannah habitat.

Background and Progress: After the elevation of the Red-cockaded Woodpecker to endangered status at the federal level, and the institution of current monitoring programs, the loss

of active breeding sites due to logging of cavity trees has ended within the planning unit. The majority of breeding sites that have been lost over the past 15 years have been due to abandonment caused by hardwood encroachment and related problems. The difficulties of managing habitat on private lands has decimated the population. In addition, much of the remaining oldgrowth pine that represented potential future breeding sites was harvested in 1994 with the beetle scare of the century. In 1996 hardwood trees were removed from lands that form the core of the remaining population. Current management plans include the full restoration of these lands to pine savannahs by instituting a prescribed burning program.

-restore and manage Red-cockaded Woodpecker population.

Background and Progress: Restoration of the woodpecker population will require the aggressive use of techniques that have been successful further south. Ultimately, this will require the translocation of birds either to increase the small gene pool or to establish clans on new sites. Agencies within the planning unit have been slow to adopt management techniques that are well established further south. The use of cavity excluders was initiated in 1990 to reduce impacts by cavity competitors. A color-marking program was initiated in 1998 so that individual birds could be monitored with greater certainty. An agreement to drill supplemental cavities has been made and will begin in 1999.

Research and Monitoring Needs: (Objective 1)

$ genetic viability of the Red-cockaded Woodpecker population should be evaluated.

$ the Red-cockaded Woodpecker population has been monitored for nearly 20 years. Monitoring of productivity, cavity and habitat use, dispersal patterns, etc. should continue.

$ the health of pine stands should be monitored regularly to reduce losses to bark beetles and other possible hazards.

Actions: (Objective 2)

- maintain structural condition of understory vegetation by establishing a burn program.

Background and Progress: Bachman's Sparrows require a dense ground cover in the first meter layer and only scattered shrubs and trees in higher layers. This vegetation structure is best maintained by burning on a 3-4 year rotation. Over time such burning will select for fire-prone species that are part of the southern pine ecosystem. Lands currently occupied by Red-cockaded Woodpeckers have had a long history of hardwood growth. Most hardwoods were removed mechanically from these lands in 1996. Plans have been developed to initiate a burning program within the next year.

- restore understory plant community.

Background and Progress: Bachman's Sparrows typically require a significant coverage of bunch grasses and forbs for nesting. Restoration of open pine savannahs must consider floristics in addition to plant structure. Oldgrowth pine stands considered for restoration have supported a hardwood plant community for many years. Removal of hardwoods does not necessarily ensure regeneration of a savannah understory. Restoration of the savannah habitat may require overseeding with grasses or other appropriate plants.

Research and Monitoring Needs: (Objective 2)

$ restored pine savannahs should be monitored for colonization by Bachman's Sparrows and other species within the habitat suite.

$ composition and structure of understory vegetation should be monitored within restored pine savannahs.

Actions: (Objective 3)

- *determine the status and distribution of remaining maritime pine savannahs (particularly on partnership lands).*

Background and Progress: A large portion of the remaining maritime pine savannahs occur on lands controlled by PIF partners. These lands need to be surveyed to determine the extent and condition of remaining pine savannahs. A preliminary list of such lands has been compiled for the region (Appendix 4.1). However, further work is needed to quantify remaining habitat.

- *develop guidelines for the improvement of remaining savannahs and the restoration of lost savannahs where appropriate.*

Background and Progress: Many of the maritime pine savannahs that remain within the region have been degraded by hardwood encroachment or invasion by common reed (*Phragmites spp*.). Based on the inventory results, significant savannahs should be targeted for restoration. Guidelines that outline appropriate restoration techniques should be developed. No progress has been made on this action.

- *improve and restore maritime pine savannahs.*

Background and Progress: Once significant lands have been identified and restoration guidelines have been developed, habitats need to be restored and maintained. No specific progress has been made on this action. However, in an attempt to revegetate several hundred kilometers of shoreline to improve water quality, several government programs now provide incentives to private landowners to restore shoreline vegetation. Funds have been appropriated to several agencies to fund revegetation projects. Maritime pine savannahs should be included as a valuable target habitat within these programs.

Research and Monitoring Needs: (Objective 3)

$ habitat requirements of Brown-headed Nuthatches and Chuck-will's-widows in maritime pine savannahs need to be investigated.

$ Chuck-will's-widows are poorly represented on BBS surveys. Development and use of a different survey program may be required to assess future population trends.

$ influence of habitat restoration on colonization and breeding success of both Brown-headed and Chuck-will's-widow should be evaluated.

B. Barrier and Bay Islands

Status and Importance

Barrier islands are very widespread throughout the mid-Atlantic region protecting nearly the entire coastal shoreline. Barriers within the region vary from 4 to 40 km in length, range from less than 1 km to 5 km in width and are separated from the mainland by lagoons and bays up to 48 km wide (Kochel et al. 1985). Barrier islands along the Atlantic Coast are highly dynamic mosaics composed of beaches, dunes, shrublands, maritime forests and marshes. The primary agents of change within the barriers are succession that generates habitats from dunes to forests and winter storms that set back succession by disturbing islands and creating open habitats. Avian species that inhabit these islands exist within specific disturbance/successional niches that depend on both of these processes.

Due to their natural beauty, barrier islands have always been sought out by the human population for recreation and development. Between 1945 and 1975, 3,286 ha of barrier island habitat was lost to development within the planning unit (Lins 1980). By 1975, developed land represented 21.2% of the total land area within the island chain. Due to proximity to urban centers, most of this development has occurred within the northern reaches of the planning unit. A total of 47.4% of the island area in New Jersey is developed compared to 29.2%, 13.7% and only 1.2% for Delaware, Maryland, and Virginia respectively. Since the mid-1970's development rates have been greatly reduced within the physiographic region. Virtually all of the remaining undeveloped barriers are owned by the U.S. Fish and Wildlife Service, U.S. Park Service, respective state governments, or nonprofit conservation organizations. Maryland and Virginia currently contain one of the most pristine barrier island chains remaining along the Atlantic Coast.

In addition to the barrier islands, the region contains a large number of islands that occur within the lagoons behind barriers or within the Chesapeake and Delaware Bays and their tributaries. These islands vary considerably in size and structure from sand and shell bars to marshlands to complex uplands. Although a number of these islands have been formed by natural processes, the majority have likely been formed by deposition of spoil material from dredging operations or through other anthropogenic activities. The total collective area contained within bay islands is not currently known and likely changes on an annual basis due to the dynamics of the small depositional islands. However, many well-known sites within the region have been greatly reduced in size or have disappeared entirely in recent years due to erosion. .

Barrier and bay islands support a significant component of the regional avifauna. More than 20 species either breed exclusively on these islands or reach their highest densities there. Collectively, these islands support more than 90% of the colonial waterbirds within the region and a higher percentage of the non-colonial beach-nesting species.

Priority Species, species suites, and habitat requirements

Island habitats support 5 species with high concern scores and 6 species with moderate concern scores within the planning unit. Species with high concern scores include the Piping Plover, American Black Duck, Wilson's Plover, Black Skimmer, and American Oystercatcher. The occurrence Roseate Tern, a federally endangered species, is questionable within the region and is not addressed in this plan. Species with moderate concern scores include the Least Tern, Brown Pelican, Gull-billed Tern, Willet, Forster's Tern, and Tricolored Heron. Most of these species are ground nesters and tend to nest in isolated areas away from human disturbance and predator populations. In addition to species with relatively high PIF concern scores, an

additional 9 species are included in the suite because they are listed as species of concern by states within the region.

The beach-nesting birds are the most prominent suite of species supported by the islands including the Piping Plover, Wilson's Plover, American Oystercatcher, Least Tern, Gull-billed Tern and many other species. The Atlantic Coast population of Piping Plovers is federally threatened (U.S. Fish and Wildlife Service 1995). This species requires wide beaches with sparse vegetation in close proximity to preferred foraging areas. The population within the mid-Atlantic coast is very near the southern range limit for this species and has accounted for an average of 26.5% of the Atlantic Coast population between 1986 and 1994 (U.S. Fish and Wildlife Service 1995). The barrier islands of New Jersey and Virginia have accounted for approximately 85% of the regional population. The breeding population within the planning unit varies around 250 pairs.

Within the barrier islands, both the Wilson's Plover and Least Tern nest within habitats that are indistinguishable from that of the Piping Plover. Wilson's Plovers reach the northern limit of their breeding range within the physiographic region. This species once bred as far north as New Jersey. Virtually 100% of the regional population now breeds on the Virginia barrier islands with only erratic reports from Maryland (Robbins and Blom 1996). Between 1989 and 1995, the Virginia population averaged 40 pairs (Watts et al. 1996). In addition to the barrier islands, the Least Tern nests widely within major bays and tributaries on sandy islands, spoil areas, gravel roof tops, and parking lots. In Maryland, more than 50% of nesting colonies occur on artificial substrates. Least Terns are widely distributed throughout the planning unit. The regional population is estimated to contain less than 3,500 individuals.

The three remaining beach-nesting species include the American Oystercatcher, Gull-billed Tern, and Black Skimmer. All of these species nest primarily on coastal barrier islands but will also nest on shell piles within the lagoon systems, and sandy bay islands. American Oystercatchers will also nest on high berms along the edges of extensive marshes within the major bays. Between 300 and 500 pairs of oystercatchers breed within the planning unit. More than 75% of this population occurs on the Virginia Barrier Islands. This population has declined by more than 40% over the past 20 years (Williams et al. 1997). Like oystercatchers, Black Skimmers also nest primarily on the Virginia barrier islands. Within the planning unit, breeding populations of Black Skimmers and Gull-billed Terns have declined nearly 75% from highs in the late 1970's. Regional population estimates are 2,000 to 3,000 pairs for Black Skimmers and 500 to 1,000 pairs for Gull-billed Terns.

In addition to beach-nesting species, the islands support many species that utilize other habitat types. The Brown Pelican nests within dune-swale habitats. This species is restricted to island habitats within the southern portion of the physiographic region where it nests on the Virginia barrier islands and on isolated islands of the upper Chesapeake Bay. This species first nested within the region in 1987 (Williams 1989, Robbins and Blom 1996). Over the next 10 years the population became established and has grown to approximately 1,200 pairs.

Although American Black Ducks nest within a variety of habitats including uplands near water, duck blinds, freshwater marshes, and salt marshes (see below) they likely reach their highest densities on barrier and bay islands. On the barrier islands, this species nests in grasslands surrounding freshwater ponds. Within the major bays, Black Ducks nest on isolated grassy and marsh islands. This species nests throughout the region where the population has declined dramatically since the 1950's (Krements 1991).

Habitat and Population Objectives

The common characteristic that attracts nesting birds to both barrier and bay islands is isolation from human disturbance and mammalian predators. The expansion of the human population within the region has resulted in a dramatic increase in the visitation of both island types. Visitation may result in site abandonment or a reduction in productivity. Objectives should focus on maintaining the availability of island habitats and providing bird populations with disturbance and predator free locations for nesting.

Birds that depend on barrier and bay islands for breeding have been the focus of targetted surveys since the 1970's. For this reason, regional population estimates are comparitively good. However, the underlying reasons for observed population declines remain poorly understood. Research is needed that focuses on demographic patterns and the mechanisms that have resulted in population declines.

TABLE 3.3: Population estimates and targets (numbers represent individuals unless otherwise indicated) for priority species on island habitats in the Mid-Atlantic Coastal Plain. Estimates were extrapolated from BBS relative abundances unless otherwise indicated; they should be considered an index of relative population sizes and only a VERY APPROXIMATE estimate of true population sizes. Percent of BBS indicates the % of routes where species was detected 1966-1996, N = 85. Percent of atlas blocks based on number of blocks within physiographic region in which the species was reported (N = 1,100 for VA, 690 for MD....).

Species	% BBS	Population estimate	% lost Since 1996	Population target	% Atlas Blocks NJ	DE	MD	VA
Piping Plover	0.0	500[1]						1.2
American Black Duck	23.5	5,318	14%	6,200				4.3
Wilson's Plover	0.0	<100[2]						0.5
Brown Pelican	0.0	<1,500[3]						0.2
American Oystercatcher	0.0	<1,000[4]						3.1
Black Skimmer	10.6	<7,500[3]						3.3
Least Tern	5.9	<3,500[3]						3.7
Gull-billed Tern	0.0	<1,500[3]						1.3
Willet	21.2	56,648	inc.	57,000				4.4
Forster's Tern	18.8	<8,000[3]						4.7
Royal Tern	2.4	<10,000[3]						4.4
Tricolored Heron	0.0	<2,500[3]						1.9
Glossy Ibis	23.5	<10,000[3]						2.1
Northern Harrier	7.1	292	inc.	300				1.3
Little Blue Heron	9.4	<2,500[3]						2.6
Yellow-crowned Night Heron	0.0	<1,500[3]						2.3
Great Egret	31.8	<10,000[3]						7.5
Sandwich Tern	0.0	<100[3]						1.0
Ipswich Savannah Sparrow	0.0	??						0.0

[1] data from international Piping Plover survey.
[2] data from Watts et al. 1996
[3] data compiled from state waterbird surveys.
[4] data from Williams et al. 1997.

The rough estimates derived from BBS data 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. For species that have declined significantly during the BBS period, a population target may be set to approximate pre-BBS population levels; an annual decline of 2.4% per year corresponds with a 50% loss over 30 years. For species suffering a 50% or greater loss since 1966, this plan calls for roughly a doubling of present-day populations as a practical objective. For species showing stable or unkown trends, population targets are roughly rounded up from current population estimates. Note that the relative abundances used to for these estimates are averages across all BBS routes in the physiographic area using data from 1990-1999. For more details on methods used for calculating populations and targets based on BBS data, see Appendix 3. Also note that these methods have yet to undergo full peer review.

Objective 1. To achieve and maintain a population of 300 pairs of Piping Plovers with 50% in Virginia/Maryland and 50% in Delaware/New Jersey.

Justification: The population of Piping Plovers along the Atlantic Coast is federally threatened. For this reason, there exists a recovery plan that includes the mid-Atlantic Coatal Plain. The known breeding population within the planning unit has increased from approximately 227 pairs in 1986 to 256 pairs in 1994 (U.S. Fish and Wildlife Service 1995). It is unlikely that the population would have stabilized within the region without specific plans to reduce the loss of breeding habitat, control human disturbance, and to reduce the impact of predation on productivity. Without continued active management the population would likely experience a dramatic decline. Even though the population has stabilized, it still represents only about 50% of the recovery goal of nearly 500 breeding pairs set for the region (value extrapolated from U.S. Fish and Wildlife 1995). However, it is debatable whether or not this recovery goal is attainable within the lower portion of the planning unit where carrying capacity appears to be lower than projections.

Assumptions: It is assumed that maintenance of beach habitat to support the Piping Plover population will ensure adequate habitat to support stable populations of the Wilson's Plover, American Oystecatcher, Least Tern and associated beach-nesting species. However, it is acknowledged that while the Piping Plover population has been stable to increasing in recent years, the populations of some of the other beach-nesting species have been in decline. Success with the Piping Plover population has, at least in part, been due to specific management techniques that have increased productivity by reducing losses to disturbance and predation. Similar techniques may be required for the other beach-nesting species in order to stabilize and restore populations.

Objective 2. Restore the Gull-billed Tern population to >1,000 breeding pairs (pre-1980 levels).

Justification: The planning unit represents the northern fringe of the breeding distribution of the Gull-billed Tern. The breeding population within the region has declined dramatically since the 1970's. Along the Virginia barrier islands (the historic core of the breeding population within the planning unit) counts have declined steadily from more than 2,200 adults in the late 1970's to 51 adults in 1998 (Williams et al. survey). Deliberate action is needed to maintain a breeding population within the planning unit.

Assumptions: It is assumed that maintenance of nesting habitat to restore and maintain the Gull-billed Tern population will ensure adequate habitat to support stable populations of Black Skimmers, Least Terns and other beach-nesting, colonial species. However, it is acknowledged that Gull-billed Terns and the other species forage on distinctly different resources and so may be subject to different limiting factors.

Implementation Strategy

Actions: (Objective 1)

- maintain integrity of beach habitat on barrier islands.

Background and Progress: The direct loss of barrier island habitats to urban development has nearly ended within the planning unit over the past 20 years as undeveloped areas have been acquired by government agencies and nonprofit organizations. However, due to their dynamic nature barrier islands are not independent from surrounding areas. Barrier islands depend on the longshore flow of sediment from distant locations to remain stable. Disruption in the free flow of sediment by the use of jetties and other engineering structures may result in the erosion of islands and the loss of open beach habitats. Several actions that are relavent to the protection of nesting habitat and related government programs are outlined in the revised Piping Plover recovery plan.

- minimize productivity losses due to human disturbance.

Background and Progress: In general, Piping Plovers and other beach-nesting birds are sensitive to humans such that recreational use of beaches is incompatible with nesting. After world war II human visitation of barrier island habitats has dramatically increased due to increases in the human population within coastal areas, increases in leisurely time for recreation, increased access to automobiles for travel to coastal areas, etc. This increase was one of the issues indicated as a rationale for federal listing. Within the planning unit, human disturbance is a larger problem within northern areas where barrier beaches are closer to population centers and more accessible. Within these areas, closure of beaches during the breeding season and the use of wardens to educate the public have proven to be successful technniques to minimize human impacts. These techniques have not typically been used south of Assateague island.

- minimize productivity losses due to predator populations.

Background and Progress: As the human population has increased within the planning unit, predator populations have increased to artificially high levels. The increased availability of refuse used as alternate food sources, the decline in the fur industry, changes in landscape pattern, etc have all lead to increases in both the status and distribution of mammalian predators.

Mammalian predators may be extremely detrimental to ground-nesting birds on barrier islands. Increasing evidence also suggests that the expansion of the Herring and Great Black-backed Gull populations within the region may be displacing beach-nesting birds from preferred breeding areas. Predator removal programs have been used in a few locations throughout the planning unit with mixed results. If successful, these programs could benefit all beach nesting species. These programs may be economically unfeasible and may only be sustainable on small islands. Predator exclosures have also been used throughout the region and have increased hatching success for targeted pairs.

Research and Monitoring Needs: (Objective 1)

$ the Piping Plover population has been monitored within the region since 1986. This program should continue into the foreseeable future.

$ Piping Plover productivity has been estimated for a portion of the population over the past several years. This work should continue for the foreseeable future.

$ the impact of Herring and Black-backed Gull populations on the distribution and productivity of beach nesting birds should be evaluated experimentally.

$ American Oystercatchers should be included in the monitoring program for Piping Plovers.

$ the relationship of landscape dynamics to the carrying capacity of beach nesting birds within the southern portion of the planning unit should be investigated.

Actions: (Objective 2)

- maintain predator-free nesting habitat for Gull-billed Terns.

Background and Progress: As indicated above, predator populations are believed to have increased within the planning unit. Over the past 10 years, an increasing portion of the Gull-billed Tern population has moved from the barrier islands to other substrates such as shell and sand bars. Similar movements have been observed for other beach-nesting colonial species. Movement from the islands to bars has occurred with no apparent reduction in open beach habitat suggesting that birds may be moving to escape predator populations. Many of the alternative nesting substrates such as natural bars are highly susceptible to washover during high tides. Without predator-free barrier islands, many of these species have very few natural alternatives. One solution is to augment natural bars such that they are less susceptible to tides or to create emergent islands for nesting that are removed from predator populations. The management of spoil islands and the creation of new islands for colonial waterbirds have been successful in other regions. A network of islands within carefully chosen locations may be the most viable approach to restore populations of beach-nesting colonial birds in the short term.

Research and Monitoring Needs: (Objective 2)

$ experimental work is needed to assess the feasibility and value of providing artificial islands for beach-nesting species.

$ further research is needed to determine the ecological requirements of Gull-billed Terns within the planning unit.
$ long-term work is needed to better characterize demographics within the regional population.

C. Salt Marshes

Status and Importance

Emergent wetlands are very diverse and widespread within the mid-Atlantic Coastal Plain. These wetlands vary according to salinity, soils, and position within the coastal landscape. The salt marsh is a common term for the wetland type classified as estuarine, intertidal, emergent (Cowardin et al. 1979). Salt marshes are abundant within this physiographic region and occur primarily within lagoon systems behind barrier islands, and along the shorelines of major bays and estuaries. This marsh type also extends up the lower reaches of major tributaries but ultimately gives way to brackish and tidal fresh wetlands within lower salinity waters.

Within the mid-Atlantic region, a substantial number of salt marshes have been lost over the past 200 years (Tiner 1984). Between 1954 and 1978, loss rates were extremely high primarily due to urban and industrial development (Gosselink and Baumann 1980). However, since the passage of protective legislation, loss rates have declined dramatically. For example, before the passage of the Wetlands Act in 1972, Delaware was losing nearly 450 acres of estuarine wetlands annually. After implementation of protective legislation, losses have declined to just 20 acres per year (Hadisky and Klemas 1983). Other mid-Atlantic states have experienced similar trends.

Elevation within the saltmarsh determines inundation frequency and the associated vegetation. These vegetation zones have distinctive breeding-bird communities and conservation concerns (Watts 1992, 1993). The low marsh is inundated daily by normal high tides and within the mid-Atlantic is dominated by smooth cordgrass (*Spartina alterniflora*) and black needlerush (*Juncus roemerianus*). The high marsh is inundated irregularly by spring tides and has a savannah-like structure. The high marsh zone is dominated by salt grass (*Distichlis spicata*) and salt meadow hay (*Spartina patens*) but also contains scattered shrubs (typically *Iva frutescens* or *Baccharis hamilifolia*).

One of the greatest future threats to salt marshes within the region is sea-level rise. If marshes are unable to accrete sediment at a rate that exceeds the rate of sea-level rise, vast areas of marsh may be lost to erosion and subsidence over the next century (Tiner 1984). Sea-level rise may be particularly detrimental to high marsh habitats because plants within this zone are very sensitive to inundation frequency. These habitats are already very limited within the region.

Another factor that threatens salt marshes is invasion by exotic species. Common reed (*Phragmites spp*.) is rapidly spreading throughout the planning unit and has already rendered vast areas of marsh unsuitable for many obligate species. Common reed is particularly detrimental to species such as Henslow's Sparrows and Sedge Wrens because it invades along the marsh-upland ecotone where these species occur. It is conceivable that this sensitive and very limited habitat could be lost entirely over the next few decades due to Phragmites alone.

Tidal salt marshes are one of the most characteristic habitats within the planning unit and are important to the regional avifauna. Several species are exclusive to this habitat type and

others reach their highest densities there. In addition to its habitat role, the salt marsh is one of the most productive ecosystems within the region and forms the base of the food chain for many bird communities throughout the year. Although patches of low marsh are abundant and widespread throughout the region, significant patches of high marsh are uncommon and spatially restricted. Significant patches of high marsh occur along the lower western shore of the Chesapeake Bay, within the middle reach of the eastern shore of the Chesapeake Bay, within Delaware Bay, and within the larger lagoon systems of the barrier islands.

Priority Species, species suites, and habitat requirements

Tidal salt marshes support 8 species with high concern scores and 1 species with a moderate concern score. Priority species with high concern scores that primarily use the low marsh include the Seaside Sparrow and Clapper Rail. Priority species with high concern scores that primarily use the high marsh include the Saltmarsh Sharp-tailed Sparrow, Black Rail, Prairie Warbler, Henslow's Sparrow, Sedge Wren, and American Black Duck. The Willet also utilizes the high marsh zone. In addition to species with relatively high PIF concern scores, an additional 2 species are included in the suite because they are listed as species of concern by states within the region.

Both the Seaside Sparrow and the Clapper Rail use the low and high marsh zones but reach their highest densities within the low marsh. Both of these species are common and widely distributed throughout the mid-Atlantic Coastal Plain in association with high salinity marshes (Robbins 1983, Eddleman and Conway 1998). The Seaside Sparrow requires nest sites above the height of spring tides to avoid flooding during the periods of incubation and brood rearing (Post and Greenlaw 1994) and openings within the vegetation where birds can forage on open mud or around plant roots (Post 1974). Clapper Rails prefer low marsh areas adjacent to tidal creeks or ditches with at least 25% of marsh area within 15 m of open water (Lewis and Garrison 1983). The Seaside Sparrow is area-sensitive within the Chesapeake Bay. It was found to have a 50% incidence rate within appropriated 3 ha marshes and a 100% incidence rate within marshes 5 ha or larger (Watts 1993). Clapper Rails were also area-sensitive having an incidence rate of 50% for 1 ha marshes and 100% for marshes 5 ha or larger (Watts 1993).

Remaining priority species within the salt marsh suite are primarily associated with the high marsh zone. Nearly all of these species have a very patchy and poorly known distribution within the region. This distribution appears to reflect the extreme area requirements for most of these species. Salt Marsh Sharp-tailed Sparrows, Black Rails, Henslow's Sparrows, and Sedge Wrens only occur within the largest salt marshes within the region. Some of these species may require marshes that are 100 ha or larger. However, the most important factor seems to be the size of the high marsh. For example, Sedge Wrens reached only a 50% incidence rate within marshes that were 60 ha in area (Watts 1992). Occupied marshes had extensive areas of high marsh. In contrast to the other 4 species, the Prairie Warbler had an incidence rate of 50% in 5 ha marshes (Watts 1992).

Within the mid-Atlantic Coastal Plain, the Salt Marsh Sharp-tailed Sparrow, Black Rail, Prairie Warbler, and Black Duck all breed within extensive stands of saltmeadow hay with scattered shrubs or clumps of black needlerush. The Prairie Warbler is widely distributed throughout the region and occurs within several other open habitats. The Sharp-tailed Sparrow and Black Rail are primarily distributed within the northern portions of the region though complete distribution within Virginia is poorly known.

Both the Henslow's Sparrow and Sedge Wren nest in the highest portion of the high marsh within the marsh/upland ecotone. This habitat is often linear and is characterized by stands of salt meadow hay interspersed with shrubs that grade into a band of switch grass (*Panicum virgatum*). Availability of switch grass or some other functional equivalent may be important to the distribution of Henslow's within this habitat type.

Habitat and Population Objectives

Species that require high-marsh habitats are the most threatened marsh-nesting species within the planning unit. These species appear to occur in relatively few sites and in low numbers. Their habitats also appear to be at the most risk within the region. Without deliberate action populations may continue to decline due to habitat degradation. By comparison, there is currently relatively little concern for species associated with low-marsh habitats. Objectives should focus on identifying and protecting remaining large blocks of high marsh habitat.

Most of the species that depend on high marsh habitats are poorly represented on BBS surveys (species detected in <20% of routes). Consequently, basic distribution and population information is lacking. Targetted surveys are needed to better refine habitat requirements and breeding densities so that adequate population estimates may be generated.

TABLE 3.4: Population estimates and targets (numbers represent individuals unless otherwise indicated) for priority species within salt marshes in the Mid-Atlantic Coastal Plain. Estimates were extrapolated from BBS relative abundances unless otherwise indicated; they should be considered an index of relative population sizes and only a VERY APPROXIMATE estimate of true population sizes. Percent of BBS indicates the % of routes where species was detected 1966-1996, N = 85. Percent of atlas blocks based on number of blocks within physiographic region in which the species was reported (N = 1,100 for VA, 690 for MD....).

Species	% BBS	Population estimate	% lost Since 1996	Population target	% Atlas Blocks NJ	DE	MD	VA
Salt Marsh Sharp-tailed Sparrow	3.5	???						0.8
Black Rail	0.0	<500[1]		500				0.1
Prairie Warbler	84.7	61,842	>50%	123,684				13.4
Henslow's Sparrow	0.0	<400[1]		400				0.1
Seaside Sparrow	15.3	15,848	20%	19,824				2.4
Sedge Wren	3.5	<500[1]		500				0.2
American Black Duck	23.5	5,318	14%	6,200				4.3
Clapper Rail	11.8	8,602	inc.	9,000				4.6
Willet	21.2	56,648	inc.	57,000				4.4
Short-eared owl	0.0	<50[1]		50				0.2
Northern Harrier	7.1	292		300				1.3

[1]Estimate based on available habitat and densities in Virginia (actual populations may be much lower).

The rough estimates derived from BBS data 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. For species that have declined significantly during the BBS period, a population target may be set to approximate pre-BBS population levels; an annual decline of 2.4% per year corresponds with a 50% loss over 30 years. For species suffering a 50% or greater loss since 1966, this plan calls for roughly a doubling of present-day populations as a practical objective. For species showing stable or unkown trends, population targets are roughly rounded up from current population estimates. Note that the relative abundances used to for these estimates are averages across all BBS routes in the physiographic area using data from 1990-1999. For more details on methods used for calculating populations and targets based on BBS data, see Appendix 3. Also note that these methods have yet to undergo full peer review.

Objective 1: To maintain enough high-marsh habitat to support 200 pairs of Henslow's Sparrows (goal of 400 shared with grassland habitats).

Justification: The Henslow's Sparrow is in danger of extinction within the planning unit. No systematic work has been conducted to determine specific resource requirements for this species within the region. Currently, its distribution and status within this habitat type are very poorly known. This species seems to require patches of high marsh that are 50-100 ha in area and that have a relatively undisturbed marsh-upland ecotone (it may also have been a component of the associated maritime pine savannah). It is unlikely that such sites were ever common within the physiographic region. However, remaining sites are threatened. Where they currently exist, patches need to be identified and protected from further degradation.

Assumptions: Maintaining high marsh habitat to support Henslow's Sparrows will provide adequate habitat to support populations of the Black Rail, Salt Marsh Sharp-tailed Sparrow, and Sedge Wren. Although each of these species require somewhat different components of the high marsh, all appear to be very area-sensitive. Extensive patches of high marsh are believed to provide requirements for the entire species suite.

Objective 2: Maintain enough salt marsh habitat to support 50,000 pairs of Seaside Sparrows with their current distribution.

Justification: All of the species most associated with low-marsh habitats are widespread and common to abundant within appropriate habitat. None of these species are threatened within the planning unit. However, anticipated losses of marsh habitat due to sea-level rise may result in population declines and contractions in distribution. Degradation of marshes around population centers may also lead to localized declines.

Assumptions: Maintaining adequate low-marsh habitat to support the Seaside Sparrow will also provide adequate habitat for the Clapper Rail and other associated species.

Implementation Strategy

Actions (Objective 1)

-*identify, assess, and prioritize sites with > 50 ha of high marsh.*

Background and Progress: As indicated above, all of the species requiring high-marsh habitat appear to be area-sensitive. Although a number of sites are known that support some of these species, no systematic work has been done to identify other sites that may support these species. A list of partnership lands that contain significant salt marshes and their respective composition is given in APPENDIX I. These sites need to be surveyed to determine the presence of high-marsh species. Sites also need to be surveyed to determine their current condition.

-*develop management and monitoring plan for priority sites.*

Background and Progress: Based on findings of above action, a management plan should be developed for sites that currently contain high-marsh species or that have the potential to do so. Plans may include steps to restore high-marsh habitat by eradicating invasive plant species or by instituting prescribed burn program. Plans should include a program to monitor site for priority species and invasive plants. Governmental programs to monitor and eliminate invasive plants are under development. Programs within the northern portion of the planning unit specifically targeting common reed have had mixed results.

Research and Monitoring Needs: (Objective 1)

$ habitat requirements of this species suite are poorly understood within the region. A dedicated study is required to better document requirements.

$ high-marsh species are poorly represented on BBS surveys. A targeted monitoring program is needed to better evaluate population trends.

$studies are needed to assess the potential impacts of sea-level rise and invasive plants on this species suite.

Actions (Objective 2)

-*minimize impacts to marshes >10 ha in area.*

Background and Progress: Although not as area-sensitive as high-marsh species, low-marsh species do seem to have area requirements within the region. A large portion of the populations of low-marsh species appear to occur within marshes >10 ha in area. Marshes > 10 ha in area should be considered significant to these populations when evaluating wetland permits.

Research and Monitoring Needs: (Objective 2)

$ investigation of the importance of landscape-level processes on the distribution of low-marsh species.

$ investigate the effectiveness of wetland restoration on low-marsh species.

D. Forested Wetlands

Status and Importance

Within the mid-Atlantic Coastal Plain, forested wetlands (system - palustrine, class - forested wetland) include a diverse gradient of forest types (Cowardin et al. 1979). These forests are dominated by woody species that are adapted to tolerate saturation of the root zone for various periods during the growing season. Because different plant species are adapted to different hydrologic regimes, the forest that forms within a given site is determined largely by hydrology (Huffman and Forsythe 1981). Cypress swamps form within areas that are saturated with water throughout most or all of the growing season. A complex gradient of other forest types form as the hydroperiod is decreased (Sharitz and Mitsch 1993). The boundaries of forested wetlands are frequently difficult to delineate because forests that form within areas with short hydroperiods are very similar to upland hardwood forests.

Within the United States, forested wetlands are experiencing dramatic reductions in area and changes in plant composition. Nationwide, forested wetlands account for the greatest amount of wetland loss. Between the 1950's and 1970's, nearly 2.5 million ha of forested wetland were lost. Much of this loss was due to the harvest of wetland forests or to filling or draining of forested wetlands for conversion to agriculture or urban development. In 1991, the mid-Atlantic Coastal Plain contained more than 550,000 ha of forested wetlands or nearly 7.4% of the nations total (Field et al. 1991). As with upland forests, occupation of forested wetlands by birds is influenced by a number of factors including patch size, vegetation structure, and hydrology.

Priority Species, species suites, and habitat requirements

The Swainson's Warbler, Cerulean Warbler, Kentucky Warbler, Acadian Flycatcher, Yellow-throated Vireo, and Prothonotary Warbler are all species that are primarily associated with forested wetlands and have high concern scores within the mid-Atlantic Coastal Plain. A number of other priority species with lower concern scores that appear on respective state lists are also included in the habitat suite.

Within the mid-Atlantic Coastal Plain, the Swainson's Warbler utilizes moist bottomland hardwoods and swamp forests (Brown and Dickson 1994). Understory conditions appear to be more important to habitat selection than overstory composition (Meanley 1966). This species requires a very high density of understory vegetation (> 5,000 stems/ha and more typically 20,000 stems/ha) such as cane (*Arundinaria spp*.) or sweet pepperbush (*Clethra alnifolia*). Within the mid-Atlantic Coastal Plain, the Swainson's Warbler is restricted to the Pocomoke River drainage in Maryland (Robbins and Blom 1996) and the Dismal Swamp and surrounding areas in Virginia.

The status and distribution of the Cerulean Warbler is not well documented in the mid-Atlantic Coastal Plain. Within Virginia, the species has been observed in northern Virginia very near the fall line and within the floodplain forests of the Chickahominy and Meherrin Rivers (BBA observations, Virginia Society of Ornithology). In Maryland, birds occur with considerable frequency along the fall line but very few have been detected within the Coastal Plain (Robbins and Blom 1996). Similar patterns have been observed in Delaware and New Jersey (Robbins et al. 1993). Further work is needed to clarify the status and distribution of this sensitive species within the region.

Although Yellow-throated Vireos utilize a diversity of forest types ranging from orchards to mature deciduous or mixed forests, in the mid-Atlantic region they appear to reach their highest densities in forested wetlands. Relative abundance is negatively related to percent of

canopy cover in pines (Robbins et al. 1989). This species does not generally breed in forest interiors but prefers forest edges and openings. However, Yellow-throated Vireos have been suggested to require a high percentage of the landscape in forest cover to breed successfully (Rodewald and James 1996). Relative abundance has been shown to respond to percentage of forest cover within 2 km. Yellow-throated Vireos breed throughout the physiographic region, particularly within large, riverine, wetland forests. Significant populations occur within the Pocomoke River drainage in Maryland and within the extensive tidal-fresh forests of the James, York, and Rappahannock Rivers of Virginia.

The Prothonotary Warbler inhabits mature deciduous floodplain, riverine, and swamp forests (DeGraaf et al. 1980, Christman 1984). Habitat characteristics include a relatively low, open canopy with a high density of small stems (Kahl et al. 1985). Although this species will utilize the drier portion of the forested wetland gradient, flooded habitats have been shown elsewhere to be preferred and of higher quality (Petit and Petit 1996). Prothonotary Warblers are secondary cavity nesters so cavity availability may serve as a constraint on habitat use. In Tennessee, flooded breeding areas have a greater number of available nest sites and greater prey densities. Prothonotary Warblers are widespread and common throughout the extensive swamps and riverine forested wetlands within the region.

Habitat and Population Objectives

Extensive forested wetlands currently exist within the planning unit. Many significant blocks of this habitat type are protected on government-owned lands or lands controlled by nonprofit conservation organizations. Objectives should focus on maintaining the current distribution and abundance of significant forested wetland blocks.

Most of the priority species associated with forested wetlands are well represented on BBS surveys (species detected in >20% of routes). However, Swainson's and Cerulean Warblers have not been detected on any of the 85 BBS routes. Targetted survey programs are needed to better refine the distribution and population status of these high-priority species.

TABLE 3.5: Population estimates and targets (numbers represent individuals unless otherwise indicated) for priority species within forested wetlands in the Mid-Atlantic Coastal Plain. Estimates were extrapolated from BBS relative abundances unless otherwise indicated; they should be considered an index of relative population sizes and only a VERY APPROXIMATE estimate of true population sizes. Percent of BBS indicates the % of routes where species was detected 1966-1996, N = 85. Percent of atlas blocks based on number of blocks within physiographic region in which the species was reported (N = 1,100 for VA, 690 for MD....).

Species	% BBS	Population estimate	% lost Since 1996	Population target	% Atlas Blocks NJ	DE	MD	VA
Cerulean Warbler	0.0	<500[1]	??	500				0.5
Swainson's Warbler	0.0	<1,000[1]	??	1,000				0.2
Kentucky Warbler	68.2	36,206	>50%	72,412				5.2
Acadian Flycatcher	75.3	176,350	inc.	177,000				15.5
Yellow-throated Vireo	57.6	25,276	>50%	50,552				6.7

Prothonotary Warbler	47.1	31,528	25%	41,786	7.6
Louisiana Waterthrush	37.6	3,694	inc.	4,000	4.5
Chimney Swift	100	96,002	42%	164,352	19.7
Red-shouldered Hawk	37.6	7,104	inc.	7,500	7.3
Great Blue Heron	72.9	51,046	inc.	51,500	20.0
Barred Owl	21.2	1,928	inc.	2,000	5.8
Wayne's Black-thr-green Warbler	0.0	??			0.4

[1]guestimate based on available habitat (actual population may be much smaller).
[2] data compiled from state waterbird surveys.

The rough estimates derived from BBS data 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. For species that have declined significantly during the BBS period, a population target may be set to approximate pre-BBS population levels; an annual decline of 2.4% per year corresponds with a 50% loss over 30 years. For species suffering a 50% or greater loss since 1966, this plan calls for roughly a doubling of present-day populations as a practical objective. For species showing stable or unkown trends, population targets are roughly rounded up from current population estimates. Note that the relative abundances used to for these estimates are averages across all BBS routes in the physiographic area using data from 1990-1999. For more details on methods used for calculating populations and targets based on BBS data, see Appendix 3. Also note that these methods have yet to undergo full peer review.

Objective 1: Maintain a population of 500 breeding pairs of Swainson's Warblers.

Justification: The Swainson's Warbler population within the planning unit is disjunct from other populations and is spatially restricted. Populations are known from the Pocomoke River drainage in Maryland and the Great Dismal Swamp in Virginia. Status is poorly known within and beyond these two locations. It is likely that low density populations occur along the coastal rivers of southeast Virginia. Populations need to be identified so that habitat may be protected from further loss.

Assumptions: It is assumed that maintaining habitat to support 500 breeding pairs of Swainson's Warblers will provide habitat to support the Black-throated-green Warbler and supplement habitat for many of the other priority species requiring forested wetlands.

Objective 2: Maintain a population of 40,000 Prothonotary Warblers.

Justification: The Prothonotary Warbler is a good indicator species for permanently flooded forested wetlands. The species is currently widespread and common throughout most of the planning unit.

Assumptions: It is assumed that providing enough habitat to support a population of 40,000 Prothonotary Warblers will provide significant habitat for other priority species such as the Yellow-throated Vireo, Great Blue Heron, Red-shouldered Hawk, and Barred Owl.

Objective 3: Maintain a population of 300,000 Acadian Flycatchers.

Justification: The Acadian Flycatcher is a good indicator species for forested habitats positioned within the drier end of the hydrologic gradient. The species is currently widespread and common throughout the planning unit.

Assumptions: It is assumed that providing enough habitat to support a population of 300,000 Acadian Flycatchers will provide significant habitat for other priority species such as the Kentucky Warbler and Louisiana Waterthrush.

Implementation Strategy

Actions (Objective 1)

-locate and estimate size of current breeding populations of Swainson's Warblers

Background and Progress: Although recent work with Swainson's Warblers within the Great Dismal Swamp has begun to investigate breeding ecology (Graves unpubl. data) estimates of population size remain poor. Further work is needed to extrapolate densities within small study areas to the greater Dismal Swamp population. The status of the isolated Pocomoke population appears tenuous. Surveys within the Pocomoke drainage has been limited to a few isolated areas. Systematic survey work is needed to determine the current status of this population. Targetted survey work is needed throughout the region within appropriate habitat to locate any additional and currently unknown populations.

Research and Monitoring Needs: (Objective 1)

$ monitoring program is needed for known breeding populations.
$ research is needed to determine habitat requirements.
$ research is needed to generate information on population demographics

Actions (Objective 2)

-identify blocks of forested wetlands that support significant (>200 prs) populations of Prothonotary Warblers.

Background and Progress: Prothonotary Warblers are abundant and widespread throughout the planning unit. A large number of significant populations (some exceeding 500 prs) are distributed within extensive swamps and along major river drainages. Many significant populations currently occur on lands owned by PIF partners. However, no attempt has been made to identify and catalog populations. Signitures could easily be developed to remotely sense large habitat blocks.

-protect and manage significant forested wetland blocks to prevent further loss and degradation.

Background and Progress: Although jurisdictional wetlands are protected by federal legislation, these laws are generally not extended to silvicultural activities. For this reason, large tracts of forested wetlands that are critical to bird populations are vulnerable to being harvested. A large number of such tracts are currently under ownership by PIF partners. Remaining tracts considered to be significant should be considered for acquisition.

E. Upland Mixed Forest

Status and Importance

Upland forests within the mid-Atlantic Coastal Plain are generally considered a mixture of pine and hardwood species (Greller 1988). The relative contribution of these forest components shifts from the coast to the fall line such that pine-dominated forests are primarily on the outer Coastal Plain and hardwood-dominated forests are primarily on the inner Coastal Plain. However, this natural gradient has been highly modified by the conversion of hardwoods to pine plantations and the suppression of fire within the outer Coastal Plain.

Currently, upland forests are widely distributed throughout the physiographic region. However, different patterns of landuse have altered these forests in different ways and to different extents. Within the southern portion of the physiographic region, uplands are primarily owned by the wood products industry and have been converted to intensively managed pine monocultures. Pine-dominated forests within the Delmarva Peninsula and along the lower western shore of the Chesapeake Bay have been highly fragmented and dissected for over 200 years within these agriculturally dominated landscapes. Expansion and coalescence of the urban centers along the fall line (Baltimore, Washington, D.C., Fredericksburg, Richmond, and Petersburg) has resulted in the fragmentation and degradation of critical hardwood-dominated forests. The significant blocks of hardwood-dominated forest that remain have become increasingly isolated within an urbanized landscape. Similar patterns now occur for pine-dominated
forests within urban centers on the coasts of all 4 states within the region.

One factor that has an influence on the use of forests by priority species is forest composition. Within coastal Virginia, incidence rates and breeding densities of several priority species changed with forest composition (Watts 1999). For the majority of these species, both of these indicators were positively related to the degree of domination by hardwoods at the stand level. This pattern along with the geographic distribution of hardwood-dominated forests suggests that upland forests within the inner Coastal Plain may hold high conservation significance for many of these species. Continued conversion of these forests to pine plantations may be detrimental to priority species.

A second factor that has an influence on the use of forests by priority species is vegetational structure. Both the vertical and horizontal complexity of vegetation have been shown repeatedly within many geographic areas to influence breeding bird diversity (e.g. MacArthur and MacArthur 1961, Karr 1971, Roth 1976). However, because species utilize vegetational components in different ways, management practices that promote particular components of the vegetation will almost invariably benefit some species to the detriment of others (Lynch and Whigham 1984). Even so, some changes in vegetation structure may be detrimental to a large portion of the bird community. Overpopulation of the white-tailed deer

herd often leads to destruction of understory vegetation required by many priority species. This problem is particularly evident around the periphery of urban areas along the fall line and within the agricultural landscapes of the Delmarva Peninsula. Closed canopy forest management practices may also eliminate understory vegetation.

A third factor that has an influence on the use of forests by birds is patch size (e.g. Forman et al. 1976, Robbins et al. 1989). Several of the priority species that utilize forests within the mid-Atlantic Coastal Plain appear to require forest patches of a particular size to successfully reproduce. Forest fragmentation has rendered many areas unsuitable for these species (Bushman and Therres 1988). Fragmentation is of particular concern within the inner Coastal Plain because urbanization will likely have an irreversible impact on important hardwood-dominated forests.

Priority Species, species suites, and habitat requirements

Cerulean Warbler, Wood Thrush, Kentucky Warbler, Acadian Flycatcher, Worm-eating Warbler, Eastern Wood-Pewee, and Louisiana Waterthrush all have high partners-in-flight concern scores for the mid-Atlantic Coastal Plain physiographic region. Species with moderate to low scores include Red-headed Woodpecker, Carolina Chickadee, and Scarlet Tanager. Several of these species also occur within forested wetlands and may reach higher densities there. In addition, several species such as Brown Thrasher, Eastern Towhee, and Gray Catbird that were included in the shrubland assemblage may also occur within upland forests depending on understory conditions (see early successional below).

Several of the priority species including the Cerulean Warbler, Eastern Wood-pewee, and Scarlet Tanager occupy the upper strata of the vegetation and are influenced by the condition of the forest canopy. The Cerulean Warbler requires extensive mature hardwood forests. Coastal Plain populations typically use mature hardwoods associated with the floodplain (Lynch 1981, Robbins and Blom 1996). This species nests and forages within the upper portions of the canopy, utilizes some of the largest trees available, and appears to have one of the largest forest area requirements among the priority species (Robbins et al. 1992). In Maryland, Robbins et al. (1989) found that maximum Cerulean densities occurred in forests of at least 3,000 ha and predicted that occurrence would reach 50% of maximum in patches of 700 ha. Suggested forest area requirements have been even larger for other regions.

The status and distribution of the Cerulean Warbler is not well documented in the mid-Atlantic Coastal Plain. Within Virginia, the species has been observed in northern Virginia very near the fall line and within the floodplain forests of the Chickahominy and Meherrin Rivers (BBA observations, Virginia Society of Ornithology). In Maryland, birds occur with considerable frequency along the fall line but very few have been detected within the Coastal Plain (Robbins and Blom 1996). Similar patterns have been observed in Delaware and New Jersey (Robbins et al. 1993). Further work is needed to clarify the status and distribution of this sensitive species within the region.

The Scarlet Tanager prefers mature deciduous forests with closed canopies but will utilize a wide range of deciduous forests from dry uplands to floodplain forests (Robbins 1978, DeGraaf et al. 1980). Density in Virginia was negatively related to the proportion of pine in the canopy (Watts 1999). Consequently, Scarlet Tanagers are observed in higher densities within the inner Coastal Plain. Birds prefer forests with larger sized trees, diverse midstories and understories with open ground covers (Conner and Adkisson 1975, Lynch and Whigham 1984). Scarlet

Tanagers are generally less area-sensitive than many other forest species. In Maryland, 50% occurrence was reached for forests of 12 ha (Robbins et al. 1989) but 100 ha has been suggested to be optimal (Robbins 1979, 1980).

The Eastern Wood-Pewee may be found within the entire gradient of forestlands that occur within the mid-Atlantic Coastal Plain. Across their entire range, pewees have been shown to reach higher densities within dry compared to moist forests (Bond 1957, Robbins et al. 1989, Murray and Stauffer 1995). Generally does not prefer closed canopy situations but found within forest stands with relatively low tree density (Best and Stauffer 1986) and with relatively low shrub cover (Crawford et al. 1981). Patch size does not appear to be an important factor in habitat selection (Blake and Karr 1987, Robbins et al. 1989).

Another suite of species within upland forests requires well developed subcanopy and midstory vegetation. A priority species within the mid-Atlantic Coastal Plain that fits this assemblage is the Wood Thrush. The Wood Thrush utilizes the full range of upland forests within the region but prefers moist deciduous forests. Wood Thrushes also breed commonly within residential areas and parks with deep forests. The species requires moderate densities of subcanopy and midstory saplings but a relatively open understory with decaying leaf litter (James et al. 1984, Roth 1987, Roth et al. 1996). Probability of occurrence appears to increase with forest patch size to a maximum at 500 ha (Robbins et al. 1989). However, this species is a common inhabitant of small forest fragments of 1 ha or less.

A third suite of species within upland forests are influenced to a greater degree by groundcover and understory conditions. Priority species within this group include the Kentucky Warbler and Worm-eating Warbler. Kentucky Warblers require moist deciduous forests with a well developed understory and dense ground cover (McDonald 1998). Pairs are frequently associated with streams and appear to avoid agricultural areas. Consequently, distribution within the mid-Atlantic region is largely along major drainage basins and swamplands. Densities are low within the extensive agricultural areas of the Delmarva Peninsula. The species is also nearly absent within the expanding urban centers of the region. Forest area appears to be one of the most important habitat attributes for this species within the region (Lynch and Whigham 1984). Kentucky Warblers were predicted to reach their highest probability of occurrence within patches of 300 ha and 50% occurrence within 17 ha patches (Robbins et al. 1989).

Like the Kentucky Warbler, the Worm-eating Warbler requires dense understory vegetation for breeding. Unlike the Kentucky Warbler, this species is generally associated with dry, well drained hardwood forests with steep slopes (typically > 20 degrees) (Hall 1983, Greenberg 1987). Within the inner Coastal Plain where topographic relief is high, Worm-eating Warblers occur in typical habitat (i.e. densely vegetated slopes within dry hardwood forests). On the outer Coastal Plain, this species uses less typical habitats including low-relief floodplain forests and swamps (Robbins and Blom 1996). An atypical but significant population occurs from southeastern Virginia through northeastern North Carolina that occurs within swamp forests, pocosins, and where these habitats have been converted to pine plantations (Meanley 1979, Terwilleger 1987, Karriker 1993, Watts and Wilson 1999). Worm-eating Warblers are sensitive to forest area. In Maryland, Worm-eating Warblers reached their highest probability of occurrence within patches of 3,000 ha with a 50% reduction in this probability predicted for patches of 150 ha (Robbins et al. 1989). Minimum area requirements within other populations generally fall around 20 - 25 ha (Wenny et al. 1993, Gale et al. 1997)

A forth assemblage of species is associated with streams. Priority species associated with woodland streams include the Acadian Flycatcher and the Louisiana Waterthrush. The Acadian Flycatcher typically occupies moist deciduous forests along streams or rivers. This species also reaches high densities within the entire gradient of forested wetlands. It is generally associated with closed-canopy forests with an open understory. Nests are often placed near or over water. Acadians have been shown to be area-sensitive with populations only reaching 44% of maximum densities in patches below 70 ha (Whitcomb et al. 1981).

Like the Acadian Flycatcher, the Louisiana Waterthrush typically occupies moist deciduous forests along streams and will also utilize forested wetlands. The species also requires dense understory vegetation along moving water. Robbins et al. (1989) predicted maximum probability of occurrence within 3,000+ has forest patches and a 50% reduction in probability within 350 ha patches.

Habitat and Population Objectives

Upland forests and the birds that depend on them are currently abundant and widespread within the planning unit. Objectives should focus on identifying and maintaining remaining forest blocks large enough to support the full compliment of forest birds and source populations of declining species.

TABLE 3.6: Population estimates and targets (numbers represent individuals unless otherwise indicated) for priority species within mixed upland forests in the Mid-Atlantic Coastal Plain. Estimates were extrapolated from BBS relative abundances unless otherwise indicated; they should be considered an index of relative population sizes and only a VERY APPROXIMATE estimate of true population sizes. Percent of BBS indicates the % of routes where species was detected 1966-1996, N = 85. Percent of atlas blocks based on number of blocks within physiographic region in which the species was reported (N = 1,100 for VA, 690 for MD....).

Species	% BBS	Population estimate	% lost Since 1996	Population target	% Atlas Blocks NJ	DE	MD	VA
Cerulean Warbler	0.0	<500[1]	??	500				0.5
Wood Thrush	97.6	226,612	>50%	453,224				19.2
Kentucky Warbler	68.2	36,206	>50%	72,412				5.2
Acadian Flycatcher	75.3	176,350	Inc.	177,000				15.5
Worm-eating Warbler	44.7	16,146	Inc.	16,500				1.4
Eastern Wood-Pewee	97.6	111,316	45%	202,234				20.0
Louisiana Waterthrush	37.6	9,310	Inc.	10,000				4.5
Red-headed Woodpecker	23.5	3,694	Inc.	4,000				6.2
Carolina Chickadee	97.6	344,741	45%	621,910				21.1
Scarlet Tanager	91.8	46,494	49%	91,570				11.0
Cooper's Hawk	3.5	1,844	Inc.	2,000				1.1
Red-shouldered Hawk	37.6	7,104	Inc.	7,500				7.3
Barred Owl	21.2	1,928	Inc	2,000				5.8

Hooded Warbler	41,154	45%	75,220

[1]guestimate based on available habitat (actual population may be much smaller).

The rough estimates derived from BBS data 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. For species that have declined significantly during the BBS period, a population target may be set to approximate pre-BBS population levels; an annual decline of 2.4% per year corresponds with a 50% loss over 30 years. For species suffering a 50% or greater loss since 1966, this plan calls for roughly a doubling of present-day populations as a practical objective. For species showing stable or unkown trends, population targets are roughly rounded up from current population estimates. Note that the relative abundances used to for these estimates are averages across all BBS routes in the physiographic area using data from 1990-1999. For more details on methods used for calculating populations and targets based on BBS data, see Appendix 3. Also note that these methods have yet to undergo full peer review.

Objective 1: Maintain enough upland forest to support a population of 800,000 Wood Thrushes.

Justification: The Wood Thrush is one of the best indicator species for the entire gradient of upland forests from hardwood-dominated to pine-dominated. This species is common and widespread and co-occurs with all of the other priority species within this habitat type.

Assumptions: It is assumed that maintaining enough upland forest to support 800,000 Wood Thrushes will provide significant habitat for all other priority species associated with upland forests.

Implementation Strategy

Actions (Objective 1)

-Identify large blocks of upland forest for conservation action.

Background and Progress: Large blocks of upland forest are becoming increasingly uncommon within the planning unit as urbanization continues to penetrate the landscape. Many of the more extensive tracts now exist on government-owned lands. Remaining significant tracts need to be identified for conservation planning. Efforts have been initiated in both Maryland and New Jersey to identify blocks of forest considered to be of siginificance to breeding birds. No such efforts have been initiated in Virginia or Delaware.

-reduce rate of hardwood conversion.

Background and Progress: Over the past 2 decades, large tracts of mixed upland forest have been converted to pine plantations for the production of wood products. Early in this period, forest conversion was primarily restricted to the outer Coastal Plain in areas with natural pine-dominated forests. Hardwood-dominated forests near the fall line are of particular

conservation significance to a diverse breeding- bird community. In more recent years, many tracts of hardwood-dominated forest have been converted to pine plantations. This has been the case on both private and government land. It is important that managers of government-owned land begin to consider the habitat value of hardwood-dominated forest. No targetted educational programs have been initiated.

Research and Monitoring Needs: (Objective 1)

$ Research is needed on the demographics of forest birds within the region so that significant source populations may be identified.
$ research is needed to better refine what is known about requirements for species within the habitat suite.

F. Early Successional

Status and Importance

Prominent grassland habitats within the mid-Atlantic Coastal Plain are primarily derived from agricultural fields and pasturelands. Some of the most productive grassland habitats within the region are fallow agricultural fields in the early stages of oldfield succession. Without regular maintenance to set back succession, these fields will proceed from a mixed stand of grasses and forbs with no woody vegetation to a shrubland dominated by woody shrubs and saplings and eventually to forest. The specific form of these early successional grasslands is influenced by agricultural history, moisture, and soils. In addition to oldfields, active farm operations may provide significant breeding habitat for open habitat species particularly when agricultural practices include habitat buffers or rotations with idle fields. Grain and hay crops may provide breeding habitat directly when harvest intervals do not disrupt nesting. Other managed grasslands within the physiographic region include pasturelands, airports, golf courses, military training areas, parks, and recreational fields.

The current status, distribution, and importance of grasslands and their relationship to the conservation of open-habitat bird populations must be viewed in the appropriate historical context. Prior to European settlement, open grassland habitats were uncommon within the mid-Atlantic Coastal Plain. Such habitats were maintained as relatively small patches within a forested landscape by populations of native Americans (Pyne 1982). In the years following European settlement, open lands likely increased with the expansion of land development for agricultural use. However, throughout the nineteenth century, broadscale clearing of forested lands occurred throughout northeastern North America that resulted in a significant wave of open lands. Subsequently, the availability of open lands has declined dramatically throughout the twentieth century. This decline was due initially to secondary succession on lands cleared during the previous century and more recently due to the conversion of remaining farm lands to other human uses.

The suite of species that currently occupies open habitats within the mid-Atlantic Coastal Plain appears to be an assemblage that has formed in response to the wave of habitat availability that followed broad-scale land clearing. Many of these species were historically exclusive to other physiographic regions but underwent large range expansions into the northeast during the

mid to late 1800's. Populations of other species that were components of the Coastal Plain avifauna historically, are suggested to have increased during this same time period. As availability of open habitats has waned in the twentieth century, these species have retreated back toward the core of their ranges or have experienced population declines and are now considered among the most threatened species within the physiographic region. The Bachman's Sparrow, Loggerhead Shrike, and White-eyed Vireo have all undergone documented range expansions and contractions within the northeast in response to shifts in landuse over the past 150 years (Dunning and Watts 1990, Yosef 1996, Hopp et al. 1995). Populations of Henslow's Sparrow, Bobolinks, Eastern Towhees, Barn Owls, and Grasshopper Sparrows have all been suggested to have experienced expansions in response to land clearing followed by declines within the region (Colvin 1985, Martin and Gavin 1995, Greenlaw 1996, Boone and Dowell 1996, Holmes 1996).

Priority Species, species suites, and habitat requirements

The early "oldfield" or open country bird community supports a large number of PIF priority species within the mid-Atlantic Coastal Plain physiographic region (Table 2). This habitat complex supports 6 species with high concern scores and 10 species with moderate to low concern scores. Species with high concern scores (total score > 22) include Henslow's Sparrow, Bachman's Sparrow, Prairie Warbler, Blue-winged Warbler, Upland Sandpiper, and White-eyed Vireo. Species with moderate to low concern scores are Northern Bobwhite, Brown Thrasher, Eastern Towhee, Field Sparrow, Barn Owl, Grasshopper Sparrow, American Kestrel, Gray Catbird, Yellow-breasted Chat, and Dickcissel. An additional 6 species are included in the suite because they appear on one or more state list of species of conservation concern. Although several of these species are exclusive to this habitat complex, the majority also occur within alternate habitats where their respective requirements are met (Table 3.1).

Open Grasslands

The two most vulnerable species associated with this habitat type are the Bachman's and Henslow's Sparrows. The Bachman's Sparrow requires savannah-like habitat with dense stands of forbs and bunch grasses within the first meter layer above the ground, sparse vegetation above the first meter layer, and scattered woody plants for singing perches (Dunning and Watts 1990). Earlier in the twentieth century, Bachman's utilized abandoned farmlands and pasturelands within this physiographic region. However, since the early 1960's, this species has retreated from the northern portion of this physiographic region (Robbins and Blom 1996) and now is known only from coastal Virginia. Bachman's Sparrows appear to be area-sensitive within the region typically requiring open patches greater than 50 ha but occasionally observed within patches as small as 10 ha (Watts et al. 1998). The two most stable populations of the species in this region now occur within military bombing ranges where frequent fires from artillery maintain large patches of open savannah-like habitat (Fleming and Alstine 1994a, 1994b, Haas and Titus 1998).

Henslow's Sparrows require extensive patches of tall, dense grass with a thick litter layer and high coverage of standing dead vegetation. Breeding areas are often wet and contain scattered woody shrubs but areas will be abandoned if invasion of shrubs is allowed to proceed. Henslow's appear to be restricted to large habitat patches but no quantitative work has been conducted in the region. In Illinois, 56 ha has been reported as a minimum area requirement (Herkert 1994). Although found regularly in open grasslands earlier in this century (Robbins and

Stewart 1958), this species has disappeared from such habitats over the past 30 years. No recent records within this physiographic region report the use of grassland habitats.

The Loggerhead Shrike has never been considered more than a rare to uncommon breeding species within the mid-Atlantic Coastal Plain. However, over the past 40 years this species has disappeared from the region (Luukkonen and Frazer 1987, Davidson 1996) and currently breeds within a single remnant site on the inner Coastal Plain of Virginia (Watts and Scholl, in press). Loggerhead Shrikes require grazed pastures or early successional oldfields with scattered trees or fence rows used for nesting (Yosef 1996). The species is generally not suggested to be sensitive to patch area, however, no investigation of this relationship has been conducted within this region.

The mid-Atlantic Coastal Plain appears to be one of the last remaining strongholds for the Grasshopper Sparrow in the northeast. This species is widely distributed throughout the region, particularly around areas with concentrations of agricultural activity. Grasshoppers prefer dry grasslands with some bare ground and will tolerate only small amounts of intrusion by woody shrubs. Within the region, this species breeds in oldfield patches with dense grasses, fallow agricultural lands, airport buffers, lightly grazed pasturelands, hay and grain crops, and some row crops. Both incidence rates and breeding density are higher in patches larger than 10 ha (Watts et al. 1997).

Barn Owls require secure nest sites in close proximity to extensive complexes of open habitats for breeding. In coastal Virginia (Rosenburg 1986) and in New Jersey (Colvin 1984) this species has been shown to have home ranges of several hundred ha that contain nearly 100 ha of grasslands. For foraging, Barn Owls require dense grass, lightly grazed pastures, and hayfields (Colvin 1984, Rosenburg 1986). Cultivated fields with the exception of small grain fields, are of little value because of low prey populations or dense protective cover. The decline of this species within the region has been attributed to the loss of idle grasslands required for foraging, the transition to more intensive farming practices, and the loss of nesting substrate. Remaining strongholds for this species within the region correspond to the distribution of agricultural lands on the Delmarva Peninsula, inner Coastal Plain of New Jersey and the western shore of the Chesapeake Bay away from urban centers.

Like the Barn Owl, American Kestrels require secure nest sites associated with complexes of open habitats. However, due to their broader diet and smaller home ranges, habitat requirements are less restrictive. Currently, Kestrels within the region are associated with concentrations of agricultural areas and urban centers. In coastal Virginia, a large portion of the population appears to occur within "brown zones" of urban cities where they nest in buildings and forage within vacant lots and railroad right-of-ways (Hardesty and Watts, unpub. data). Recent declines in this species within the physiographic region are likely associated with the loss of farmlands and the revitalization of inner cities and industrial complexes.

The Northern Bobwhite requires patches of bare ground interspersed with standing vegetation. Within this physiographic region, bobwhites utilize active agricultural fields, early successional oldfields, lightly grazed pastures, and recent clearcuts. Recent population declines have been attributed to the loss of open lands to development, the transition to "cleaner" agricultural practices, and to increased predation pressures.

Dickcissels require patches of dense, tall grasses and forbs with scattered shrubs or trees for song perches. Within the mid-Atlantic physiographic region, they primarily use fallow fields within the early stages of oldfield succession, buffer strips within agricultural areas and

occasionally open croplands with hedgerows. Principal populations now occur within the upper Delmarva Peninsula and the lower Coastal Plain of Virginia.

Shrublands

All of the priority species within the shrubland complex require later stages of oldfield succession with moderate to substantial intrusion by woody shrubs and saplings. Within this physiographic region, all of these species show a positive response to the density of shrub cover (Watts et al. 1997) but differ somewhat in the specific successional stage preferred. Most of these species will utilize a wide range of of alternative habitats including hedgerows, recent clearcuts, and maritime shrublands. Most will also utilize dense, understory vegetation within forest patches. In general, these species are not area-sensitive within this physiographic region (Watts et al. 1997). All of these species remain common and widely distributed throughout the physiographic region. However, the general loss of late stage oldfields and pasturelands to development along with the elimination of hedgerows within agricultural landscapes has likely had an influence on the decline of these species within the region. The two species within the shrubland suite with high concern scores are the Prairie Warbler and the White-eyed Vireo.

All of the priority shrubland species utilize oldfields with slightly different levels of woody intrusion. Prairie Warblers and Field Sparrows utilize relatively young oldfields with scattered shrubs and trees to older fields with moderate shrub cover. Neither of these species prefer later successional stages where shrubs and samplings form dense continuous tangles. Field sparrow numbers generally decline as woody plants begin to form continuous cover (Carey et al. 1994). By comparison, Yellow-breasted Chats prefer later stage oldfields with moderate to dense shrub cover. Remaining shrubland species including Brown Thrashers, Eastern Towhees, and White-eyed Vireos, generally utilize later successional oldfields with dense tangles of shrubs and saplings. Brown Thrashers, Gray Catbirds, and Eastern Towhees all nest frequently within urban settings. By comparison, Prairie Warblers, Field Sparrows, Yellow-breasted Chats, and White-eyed Vireos typically utilize patches away from human development.

Habitat and Population Objectives

Species that rely on open grasslands and shrublands for breeding are among the species with the highest rates of population decline in the planning unit (Appendix III). Species associated with open grasslands tend to be area sensitive while species associated with shrublands do not. Objectives should focus on identifying large patches of open grassland for conservation planning and educating land managers about appropriate area-specific management strategies.

TABLE 3.7: Population estimates and targets (numbers represent individuals unless otherwise indicated) for priority species within early successional habitats in the Mid-Atlantic Coastal Plain. Estimates were extrapolated from BBS relative abundances unless otherwise indicated; they should be considered an index of relative population sizes and only a VERY APPROXIMATE estimate of true population sizes. Percent of BBS indicates the % of routes where species was detected 1966-1996, N = 85. Percent of atlas blocks based on number of blocks within physiographic region in which the species was reported (N = 1,100 for VA, 690 for MD....).

Species	% BBS	Population estimate	% lost Since 1996	Population target	% Atlas Blocks NJ	DE	MD	VA
Prairie Warbler	84.7	61,842	>50%	123,684				13.4
Bachman's Sparrow	0.0	<200[1]	??	200				0.2
Henslow's Sparrow	0.0	<400[1]	??	400				0.1
Blue-winged Warbler	17.6	8,816	>50%	17,632				0.5
Upland Sandpiper	0.0	0??						0.0
White-eyed Vireo	92.9	179,094	38%	287,978				18.2
Northern Bobwhite	98.8	69,852	>50%	139,704				25.5
Brown Thrasher	98.8	47,564	>50%	95,128				17.0
Eastern Towhee	100	196,680	>50%	393,360				10.9
Field Sparrow	96.5	111,690	>50%	223,380				16.5
Barn Owl	0.0	???	??					2.9
Grasshopper Sparrow	75.3	44,994	>50%	89,988				4.3
American Kestrel	55.3	3,516	Inc.	4,000				5.0
Gray Catbird	96.5	173,782	>50%	347,564				15.5
Yellow-breasted Chat	80.0	62,164	25%	83,050				16.7
Dickcissel	3.5	446	Inc.	500				0.5
Loggerhead Shrike	2.4	<50[2]	??	50				0.4
Short-eared Owl	0.0	<50[2]	??	50				0.2
Bobolink	3.5	???						1.0
Vesper Sparrow	28.2	3,356	>50%	6,712				0.2
Northern Harrier	7.1	292	Inc.	300				1.3
Savannah Sparrow	0.0	???						0.0
Whip-poor-will		10,244	47%	19,456				

[1]Estimate from Virginia population (Fleming and Alstine 1994a, 1994b, Watts et al. 1998)
[2]Guestimate based on available habitat (actual population may be lower).

The rough estimates derived from BBS data 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. For species that have declined significantly during the BBS period, a population target may be set to approximate pre-BBS population levels; an annual decline of 2.4% per year corresponds with a 50% loss over 30 years. For species suffering a 50% or greater loss since 1966, this plan calls for roughly a doubling of present-day populations as a practical objective. For species showing stable or unkown trends, population targets are roughly rounded up from current population estimates. Note that the relative abundances used to for these estimates are averages across all BBS routes in the physiographic area using data from 1990-1999. For more details on methods used for calculating populations and targets based on BBS data, see Appendix 3. Also note that these methods have yet to undergo full peer review.

Objective 1: Maintain enough open grasslands (in combination with high-marsh habitat) to support 200 pairs (goal of 400 shared with salt marshes) of Henslow's Sparrows.

Justification: The Henslow's Sparrow is in danger of extinction within the planning unit. As indicated above, this species has disappeared from grassland habitats over the past 30 years within the planning unit. Because this species is very area-sensitive and has specialized habitat requirements, a dedicated effort will be required to restore habitat for this species.

Assumptions: Restoring and maintaining habitat for the Henslow's Sparrow will provide nesting habitat for other priority grassland species such as the Bachman's Sparrow, Northern Bobwhite, and Dickcissel and foraging habitat for other priority species such as the American Kestrel, Common Barn Owl, and Loggerhead Shrike.

Objective 2: Maintain enough open grassland to support 100,000 pairs of Grasshopper Sparrows distributed across the planning unit.

Justification: The Grasshopper Sparrow is not currently in danger of extinction within the region. This species remains widely distributed and common within appropriate habitat. However, Grasshopper Sparrows are area-sensitive and the availability of grassland patches of appropriate size is declining within the planning unit. This decline is particularly evident around urban centers and away from the Delmarva Peninsula and inner Coastal Plain of New Jersey. Maintaining this species within all portions of the physiographic region will require a dedicated effort to manage available patches.

Assumptions: Restoring and maintaining habitat for the Grasshopper Sparrow will provide nesting habitat for other priority species such as the Horned Lark and foraging habitat for other priority species such as the American Kestrel, Common Barn Owl, and Loggerhead Shrike.

Objective 3: Shift the management of open lands <10 ha in size from high-intensity grassland management to low-intensity shrubland management.

Justification: All of the grassland-obligate species within the planning unit reach their highest density and probability of occurrence within patches >10 ha in area. Because of this requirement, idle open lands that are managed as grasslands and are <10 ha are "ecological dead zones". These patches do not support grassland obligate species (due to size requirements) or shrubland species (due to habitat requirements). None of the priority shrubland species are area-sensitive. From the perspective of shrubland bird management, these patches represent "lost opportunities". Shifting the management of these lands from grasslands to shrublands would greatly increase the availability of habitat for shrub-dependent birds within the region.

Assumptions: Management of small fragments of open land for shrubland species would provide adequate habitat to support stable populations of priority shrub-dependent species within the planning unit.

Implementation Strategy

Actions: (Objective 1)

-*identify open lands >50 ha in area that have the potential to support Henslow's Sparrows.*

Background and Progress: The primary factor that appears to be limiting the Henslow's Sparrow population within the region is the availability of suitable grassland patches. Henslow's Sparrows require grassland patches >50 ha in area. No comprehensive survey has been conducted within the planning unit to identify idle patches that are large enough to potentially support this species. A list of partnership lands that contain significant open patches is given in APPENDIX I. A full assessment of patches currently contained on partnership lands, as well as, those contained on private lands needs to be conducted to identify potential management areas.

-*where possible 1) acquire lands with potential to support Henslow's Sparrows or 2) develop agreements with landowners (PIF partners or others) to manage appropriate patches for Henslow's Sparrows.*

Background and Progress: A large portion of patches remaining in the planning unit that have the potential to support Henslow's Sparrows appear to occur on lands presently controlled by PIF partners. However, these lands are not currently under management that is conducive to use by Henslow's Sparrows. No program is in place to convey to appropriate partners how changes in current land management may benefit Henslow's Sparrows. No agreements are in place to manage specific patches for Henslow's Sparrows.

-restore and manage grassland patches.

Background and Progress: Henslow's Sparrows require a dense litter layer that is built up as patches are managed as grasslands over a period of several years. Remaining patches that are large enough to support this species do not meet this requirement due to the way they are managed. Many of these patches contain sod-forming grasses or small grain crops (grain for small game or waterfowl management). Current management objectives need to be evaluated for compatibility with management for Henslow's Sparrows. Appropriate patches need to be converted to warm-season grasses and maintained via burning or mechanical methods to provide the conditions required by Henslow's Sparrows.

Actions (Objective 2)

-identify open lands 10-50 ha in area that have the potential to support Grasshopper Sparrows.

Background and Progress: Grasshopper Sparrows reach their highest densities in patches >10 ha in area. Management of idle patches >50 ha should conform to requirements of Henslow's Sparrows. Lands currently controlled by PIF partners are widely distributed throughout the planning unit and contain some of the most significant open lands remaining in the region. These lands appear to have the potential to support a widely distributed, stable population of Grasshopper Sparrows (if managed appropriately). No comprehensive survey has been conducted within the planning unit to identify specific open patches with the potential to support Grasshopper Sparrows. A partial list of lands presently controlled by PIF partners that contain significant open lands is given in APPENDIX I.

-*develop agreements with PIF partners to manage appropriate patches for Grasshopper Sparrows.*

Background and Progress: As indicated above, many lands that have the potential to support Grasshopper Sparrows are currently controlled by PIF partners. However, many of these lands are not currently under management that is conducive to use by Grasshopper Sparrows. No program is in place to convey to appropriate partners how changes in current land management may benefit Grasshopper Sparrows. No agreements are in place to manage specific patches for Grasshopper Sparrows.

-*restore and manage grassland patches.*

Background and Progress: In terms of habitat use, Grasshopper Sparrows are less selective than Henslow's Sparrows. Grasshoppers will readily breed within cover crops, buffer strips, and pasturelands, as well as, traditional grasslands. However, management activities need to be timed so as not to reduce productivity. Within appropriate lands, current management objectives need to be evaluated for compatibility with management for Grasshopper Sparrows. Specific management guidelines have not been developed for the planning unit.

Actions (Objective 3)

-*develop guidelines for the management of open patches <10 ha in area).*

Background and Progress: The most abundant and widespread patches of open land within the planning unit are <10 ha in area. Collectively, these patches account for a significant amount of land area. Conversion of even a small portion of these patches to shrublands would have a significant positive impact on shrubland species within the region. A number of government programs currently promote conversion and maintenance of patches as small as 1 ha to warm-season grasses. This practice produces patches that are virtually unusable by the open-habitat bird community and should be discouraged. Recommendations and guidelines for the conversion of these patches to shrublands have not been developed for the region.

G. Pine Plantation

Status and Importance

The development of modern silvicultural practices in the 1950's has lead to a dramatic increase in the abundance and distribution of pine plantations over the past 3 decades. Pine plantations are distributed throughout the physiographic region but are most concentrated within the southern portion of the planning unit. Conversion of natural forests to plantations is continuing within the region as second growth forests are reaching harvestable age. Much of this conversion has taken place on the outer Coastal Plain where plantations have replaced natural pine-dominated forests. However, an increasing number of hardwood-dominated forests closer to the fall line are being converted as these forests are harvested. The majority of pine plantations within the region are currently owned and managed by the forest products industry.

However, the amount of private and government-owned lands being converted to plantations is increasing. With the continuing world demand for wood products it seems likely that further conversion will occur within the region.

Within a typical growing cycle, pine plantations proceed through a predictable series of successional stages. After planting, plantations enter a grass stage followed by a shrub/sapling stage. These early successional stages support a diverse community of shrub-dependent bird species. The length of this early stage depends on the time to closure of the pine canopy which in turn depends on factors such as stocking rate and site quality. By year 7 or 8, pine seedlings begin to dominate young plantations, forming a complete canopy by age 9 or 10. Canopy closure results in the decline of understory vegetation. Within the framework of traditional pulp production, canopy closure would be maintained until harvest when the plantation is 20-25 years old. Under such management conditions, bird diversity and density generally declines due to the loss of understory vegetation. More modern techniques of open-canopy management that utilize commercial thinning maintain understory vegetation for a much longer portion of the growing cycle and maintain diverse bird communities that are traditionally associated with natural forests (Wilson and Watts 1999).

As idle grasslands and shrublands have disappeared, early successional pine plantations have become increasingly important to the regional avifauna. Young clearcuts now represent the primary habitat for many shrub-dependent species. Older plantations also provide habitat for a number of forest species.

Priority Species, species suites, and habitat requirements

Pine plantations support 6 species with high concern scores and 7 species with moderate to low concern scores. Species with high concern scores include the Prairie Warbler, Bachman's Sparrow, Blue-winged Warbler, Brown-headed Nuthatch, Eastern Wood-Pewee, and White-eyed Vireo. Species with moderate to low concern scores include the Northern Bobwhite, Carolina Chickadee, Brown Thrasher, Eastern Towhee, Field Sparrow, Gray Catbird, and Yellow-breasted Chat. Throughout the growing cycle, pine plantations provide early successional, shrub-dominated habitats and forest habitats. Priority species associated with plantations are primarily shrub-dependent species. Habitat requirements for shrub-dependent species have been described above (see early successional habitat).

Habitat and Population Objectives

Young clearcuts now represent the primary habitat for many early successional species within the planning unit. Because shrublands have declined dramatically in recent decades, maintenance of significant land area in plantations may be the only option for stabilizing and maintaining these populations. Objectives should be focused on reaching some stable land area in plantations within the outer Coastal Plain. Conversion of hardwood-dominated forests to pine plantations on the inner Coastal Plain should be minimized due to negative impacts on hardwood-associated species. Objectives should also focus on shifting silvicultural practices to open-canopy management.

TABLE 3.8: Population estimates and targets (numbers represent individuals unless otherwise indicated) for priority species within pine plantations in the Mid-Atlantic Coastal Plain. Estimates were extrapolated from BBS relative abundances unless otherwise indicated; they

should be considered an index of relative population sizes and only a VERY APPROXIMATE estimate of true population sizes. Percent of BBS indicates the % of routes where species was detected 1966-1996, N = 85. Percent of atlas blocks based on number of blocks within physiographic region in which the species was reported (N = 1,100 for VA, 690 for MD....).

Species	% BBS	Population estiamte	% lost Since 1996	Population target	% Atlas Blocks NJ	DE	MD	VA
Prairie Warbler	84.7	61,842	>50%	123,684				13.4
Bachman's Sparrow	0.0	<200[1]	??	200				0.2
Blue-winged Warbler	17.6	8,816	>50%	17,632				0.5
Brown-headed Nuthatch	9.4	2,608	>50%	5,216				3.5
Eastern Wood-Pewee	97.6	111,316	45%	202,234				20.0
White-eyed Vireo	92.9	179,094	38%	287,978				18.2
Northern Bobwhite	98.8	69,852	>50%	139,704				25.5
Carolina Chickadee	97.6	344,742	45%	621,910				21.1
Brown Thrasher	98.8	47,564	>50%	95,128				17.0
Eastern Towhee	100	196,680	>50%	393,360				10.9
Field Sparrow	96.5	111,690	>50%	223,380				16.5
Gray Catbird	96.5	173,782	>50%	347,564				15.5
Yellow-breasted Chat	80.0	62,164	25%	83,050				16.7

[1]Estimate from Virginia population (Fleming and Alstine 1994a, 1994b, Watts et al. 1998)

The rough estimates derived from BBS data 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. For species that have declined significantly during the BBS period, a population target may be set to approximate pre-BBS population levels; an annual decline of 2.4% per year corresponds with a 50% loss over 30 years. For species suffering a 50% or greater loss since 1966, this plan calls for roughly a doubling of present-day populations as a practical objective. For species showing stable or unkown trends, population targets are roughly rounded up from current population estimates. Note that the relative abundances used to for these estimates are averages across all BBS routes in the physiographic area using data from 1990-1999. For more details on methods used for calculating populations and targets based on BBS data, see Appendix 3. Also note that these methods have yet to undergo full peer review.

Objective 1: Maintain enough young plantations to support 250,000 Prairie Warblers (goal includes contributions from other appropriate priority habitats) distributed across the physiographic region.

Justification: Prairie Warblers are a good indicator species for young pine plantations. Currently, this species is common and widespread within the planning unit.

Assumptions: It is assumed that providing enough pine plantations to support a large stable population of Prairie Warblers will provide significant habitat for other pine plantation species. Although many of the species utilize different portions of the growing cycle, maintaining a sustainable amount of land in young plantations will by association also provide a sustainable amount of land in all periods of the growing cycle.

Objective 2: Shift silvicultural practices toward open-canopy management.

Justification: Traditional plantation management supports diverse bird communities within the first 7-8 years of the growing cycle but very few birds after this period. The loss of bird density and diversity after the first 8 years is due to canopy closure and associated loss of understory vegetation. By instituting 1-2 commercial thins throughout the growing cycle, the canopy may be maintained in an open condition. Open-canopy pine stands maintain understory density and support a diverse bird community (Wilson and Watts 1999). Under appropriate conditions, it may be possible to increase the proportion of the growing cycle that is productive for birds from 1/3 to 2/3.

Assumptions: It is assumed that shifting to open-canopy forest management techniques will greatly increase the availability of habitat for both early successional species and some forest species.

Implementation Strategy

Actions (Objective 1)

-develop regional forest management plan.

Background and Progress: Currently, silvicultural lands within the planning unit are divided among a diversity of landowners with a diversity of land objectives. This condition makes the development of any comprehensive, regional plan difficult. However, many lands being managed as plantations are under government ownership. Management of these lands should reflect not only local interests but also regional objectives. No regional forest management plan exists for government-owned lands.

Research and Monitoring Needs: (Objective 1)

$ research is needed within the planning unit on the influence of clearcut size on breeding bird communities.
$ research is needed on the influence of site preparation techniques, stocking levels, and other sylvicultural practices on breeding bird communities.
$ research is needed on the influence of timing and techniques of tree harvest on breeding bird communities.

Actions (Objective 2)

- produce educational materials about the wildlife and economic benefits of open-canopy forest management.

Background and Progress: Historically, a large portion of the plantation growing cycle provided little bird habitat due to the lack of understory vegetation. With the development of new open-canopy management techniques it has become increasingly clear that the production of wood products is compatible with providing habitat for breeding birds. However, open-canopy management is used on only a small portion of silvicultural lands. The current lack of open-canopy management appears to be a problem of education.

Research and Monitoring Needs: (Objective 2)

$ research is needed to examine the economic/wildlife tradeoffs in open-canopy management.
$ research is needed to evaluate the influence of 1) stocking rates, 2) time to first commercial thin, and 3) time to final harvest on wildlife value of pine plantations.

H. Coastal Fresh/Brackish Marsh

Status and Importance

Within the mid-Atlantic Coastal Plain, freshwater, emergent marshes are diverse and occur in both tidal and nontidal areas. Nontidal marshes are found surrounding inland lakes and ponds and along rivers beyond the reach of tides. These marshes are dominated by emergent plants such as cattail (*Typha latifolia*) and various rushes (*Juncus spp*.) and sedges (*Carex spp*.). Tidal fresh marshes are located directly inland of salt marshes, in areas where water movement is influenced by tidal fluctuations but salinity levels are below 0.5 ppt (Maltby 1986). These marshes are dominated by emergent plants such as pickerelweed (*Pontederia cordata*), wild rice (*Zizania aquatica*), and arrow arum (*Peltandra virginica*). Brackish marshes occur along tidal tributaries within the transition zone between outer salt marshes and tidal fresh marshes. These marshes are dominated by big cordgrass (*Spartina cynosuroides*).

Freshwater marshes are widespread within the planning unit but are much less abundant than other wetland types (Field et al. 1991). Nontidal marshes are distributed throughout the region in association with impounded water and the upper reaches of small tributaries. These marshes have increased over the past 20 years due to an increase in reservoir and pond construction. Within the planning unit, tidal fresh marshes reach their highest abundance within the tributaries along the western shore and upper eastern shore of the Chesapeake Bay. Big Cordgrass marshes occur throughout the planning unit where salinity is appropriate.

Maintenance of fresh/brackish marshes is important to the avifauna of the mid-Atlantic Coastal Plain. These marshes provide the primary breeding habitat for several species of waterbirds. In addition, these marshes serve as nursery habitats for a significant portion of the fisheries within the region on which many other species depend.

Priority Species, species suites, and habitat requirements

Within the planning unit, fresh/brackish marshes support 2 species with high concern scores and 4 species with moderate to low concern scores. Species with high concern scores include the American Black Duck and the King Rail. Species with moderate to low scores include the American Bittern, Least Bittern, Pied-billed Grebe, and Common Moorhen.

The King Rail is the fresh/brackish counterpart to the Clapper Rail of tidal salt marshes. This species requires wetland complexes that contain dense stands of tall, emergent vegetation for nesting (Meanley 1992). Plant species within the planning unit that provide such habitat include cattail, wild rice, and especially big cordgrass. Like the King Rail, both the American Bittern and the Least Bittern require dense stands of tall, emergent vegetation for nesting. Although both species utilize the full range of marsh types, American Bitterns tend to be more associated with freshwater marshes and Least Bitterns more associated with brackish marshes. Pied-billed Grebes and Common Moorhens require shallow water with dense emergent vegetation. These species often nest around the edges of shallow impoundments. The American Black Duck nests widely throughout the region within a number of the priority habitats (see barrier and bay islands, salt marshes).

Habitat and Population Objectives

The status, distribution, and requirements of priority species associated with fresh/brackish wetlands are poorly known within the region. This is primarily due to the difficulty of surveying this habitat type and the secretive nature of the priority species. Before any specific objectives may be formulated, it is first necessary to collect basic status and distribution information on these species. However, general objectives should focus on identifying and maintaining lands that contain significant complexes of fresh/brackish wetlands that have the capacity to support this species suite.

TABLE 3.9: Population estimates and targets (numbers represent individuals unless otherwise indicated) for priority species within fresh/brackish marshes in the Mid-Atlantic Coastal Plain. Estimates were extrapolated from BBS relative abundances unless otherwise indicated; they should be considered an index of relative population sizes and only a VERY APPROXIMATE estimate of true population sizes. Percent of BBS indicates the % of routes where species was detected 1966-1996, N = 85. Percent of atlas blocks based on number of blocks within physiographic region in which the species was reported (N = 1,100 for VA, 690 for MD....).

Species	% BBS	Population estimate	% lost Since 1996	Population target	% Atlas Blocks NJ	DE	MD	VA
American Black Duck	23.5	5,318	14%	6,200				4.3
King Rail	2.4	??						0.7
American Bittern	2.4	??						0.1
Least Bittern	5.9	2,878	Inc.	3,000				3.7

Pied-billed Grebe	0.0	???	1.0
Common Moorhen	0.0	???	0.5

The rough estimates derived from BBS data 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. For species that have declined significantly during the BBS period, a population target may be set to approximate pre-BBS population levels; an annual decline of 2.4% per year corresponds with a 50% loss over 30 years. For species suffering a 50% or greater loss since 1966, this plan calls for roughly a doubling of present-day populations as a practical objective. For species showing stable or unkown trends, population targets are roughly rounded up from current population estimates. Note that the relative abundances used to for these estimates are averages across all BBS routes in the physiographic area using data from 1990-1999. For more details on methods used for calculating populations and targets based on BBS data, see Appendix 3. Also note that these methods have yet to undergo full peer review.

Objective 1: Restore and maintain a stable population of King Rails.

Justification: Although their status is not well known within the region, there are indications that King Rails are declining within the planning unit. This species is a good indicator for the tall emergent habitat that is shared with American and Least Bitterns.

Assumptions: Providing and maintaining habitat to restore the King Rail population will provide adequate habitat to stabilize and maintain American and Least Bitterns.

Implementation Strategy

SECTION IV: Implementation recommendations and Summary

The following summary includes habitats, species within the highest tier of concern, and objectives for the mid-Atlantic Coastal Plain physiographic area.

Pine Savannah: Red-cockaded Woopecker, Prairie Warbler, Bachman's Sparrow, Brown-headed Nuthatch.

Objectives - Restore enough pine savannah habitat to support 20-25 clans (60-80 individuals) of Red-cockaded Woopeckers (pre-1980 levels); manage pine savannahs to support >100 pairs of Bachman's Sparrows; restore and maintain enough maritime pine savannah to support xxx pairs of Brown-headed Nuthatches.

Barrier and Bay Islands: Piping Plover, American Black Duck, Wilson's Plover, Brown Pelican, American Oystercatcher, Black Skimmer, Least Tern, and Gull-billed Tern.

Objectives - To achieve and maintain a population of 300 pairs of Piping Plovers with 50% in Virginia/Maryland and 50% in Delaware/New Jersey; restore the Gull-billed Tern population to >1,000 breeding pairs (pre-1980 levels).

Salt Marsh: Salt Marsh Sharp-tailed Sparrow, Black Rail, Prairie Warbler, Henslow's Sparrow, Seaside Sparrow, Sedge Wren, American Black Duck, and Clapper Rail.

Objectives - To maintain enough high-marsh habitat to support 200 pairs of Henslow's Sparrows; maintain enough salt marsh habitat to support 50,000 pairs of Seaside Sparrows with their current distribution.

Forested Wetland: Cerulean Warbler, Swainson's Warbler, Kentucky Warbler, Acadian Flycatcher, Yellow-throated Vireo, Prothonotary Warbler, and Louisiana Waterthrush.

Objectives - Maintain 500 breeding pairs of Swainson's Warblers; maintain a population of 40,000 Prothonotary Warblers; maintain a population of 300,000 Acadian Flycatchers.

Mixed Upland Forest: Cerulean Warbler, Wood Thrush, Kentucky Warbler, Acadian Flycatcher, Worm-eating Warbler, Eastern Wood-Pewee, and Louisiana Waterthrush.

Objectives - Maintain enough upland forest to support a population of 800,000 Wood Thrushes.

Early Successional: Prairie Warbler, Bachman's Sparrow, Henslow's Sparrow, Blue-winged Warbler, Upland Sandpiper, and White-eyed Vireo.

Objectives - Maintain enough open grasslands to support 200 pairs of Henslow's Sparrows; maintain enough open grasslands to support 100,000 pairs of Grasshopper Sparrows distributed across the planning unit; shift the management of open lands < 10 ha in size from high-intensity grassland management to low-intensity shrubland management.

Pine Plantation: Prairie Warbler, Bachman's Sparrow, Blue-winged Warbler, Brown-headed Nuthatch, Eastern Wood-Pewee, and White-eyed Vireo.

Objectives - Maintain enough young pine plantations to support 250,000 Prairie Warblers distributed across the planning unit; shift the silvicultural practices toward open-canopy management.

Fresh/Brackish Emergent Wetland: American Black Duck, King Rail.

Objectives - Restore and maintain a stable population of King Rails.

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APPENDIX I: Table of lands owned by PIF partners that contain priority habitats.

Habitat codes are as follows: I - pine savannah, II - barrier and bay islands, III - salt marsh, IV - forested wetland, V - upland forest, VI - early successional, VII - pine plantation, VIII - fresh/brackish marsh.

Property	**Owner**	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**V**
New Jersey ???									
Delaware ???									
Maryland ???									
Virginia									
Craney Island Disposal Area	ACE						X		
Gradview Beach Park	CITY		X	X					
West Point Municipal Airport	CITY						X		
Newport News Park	CITY				X	X			
Fort Eustis	DOD	X		X		X	X	X	
Fort Monroe	DOD			X					
Camp Perry	DOD				X	X	X	X	
Langley Air Force Base	DOD			X		X	X		
Naval Supply Center (Cheatham Annex)	DOD			X		X			
Fentress Naval Reservation	DOD				X	X	X		
Oceana Naval Air Station	DOD					X	X		
Norfolk Naval Air Station	DOD						X		
Fort Lee Military Reservation	DOD				X	X	X	X	
Fort AP Hill	DOD				X	X	X	X	
Quantico Marine Base	DOD				X	X	X	X	
Fort Belvoir	DOD				X	X			
Surface Weapons Station (Dahlgren)	DOD				X	X	X		
Plum Tree Island NWR	FWS	X		X					
Fisherman’s Island NWR	FWS		X	X					
Eastern Shore of Virginia NWR	FWS	X		X		X	X		

Chincoteague NWR	FWS	X	X	X		X			
Harry Diamond Lab	FWS						X		
Great Dismal Swamp NWR	FWS				X	X			
Presquile NWR	FWS				X		X		
James River NWR	FWS					X		X	
Mason Neck NWR	FWS				X	X			
Back Bay NWR	FWS								
Huntley Meadows Park	MUN				X	X			
Prince William Forest Park	MUN					X			
NASA Wallops	NOAA	X	X	X		X	X		
Petersburg National Battlefield	NPS				X	X	X	X	
Mount Vernon	NPS					X			
George Washington Birthplace Nat. Mon.	NPS				X	X	X		
Fredericksburg Battlefield	NPS				X		X		
Fred. and Spotsylvania Nat. Mil. Park	NPS				X		X		
Colonial National Historic Park	NPS	X			X	X	X		
Dameron Marsh	TNC			X					
Virginia Coast Reserve	TNC	X	X	X	X	X			
Piney Grove Preserve	TNC	X				X			
Cumberland Marsh Preserve	TNC				X				
Vorhees Preserve	TNC					X			
Newpoint Preserve	TNC	X		X					
Northwest River Preserve	TNC				X				
Ragged Island WMA	VA	X		X					
Goodwin Island	VA	X		X					
Belle Isle State Park	VA					X	X		
Mason Neck State Park	VA				X	X			
Bethel Beach Natural Area	VA	X	X	X					
Mockhorn Island WMA	VA			X					
Virginia Common Lands	VA			X					
Wreck Island Natural Area	VA		X	X					
Parkers Marsh Natural Area	VA	X		X					
Saxis WMA	VA	X		X		X			
Hog Island WMA	VA	X				X	X		
Chippokes Plantation State Park	VA					X	X		
Kiptopeke State Park	VA					X	X		
Lands End WMA	VA				X	X	X		
York River State Park	VA				X	X			
Seashore State Park	VA	X		X	X				
Westmoreland State Park	VA					X			
Caledon Natural Area	VA				X	X			
False Cape State Park	VA								
Trojan-Pocahontas WMA	VA								

Northlanding River Natural Area	VA				X				

APPENDIX II: List of species known to breed within mid-Atlantic Coastal Plain physiographic region.

Local status refers to migratory status within the region. Codes are as follows: B - refers to species that breed within the region but do not winter (these species are primarily neotropical migrants but may also include some temperate migrants), D - refers to species that breed and winter in the region (but possibly different populations), E - refers to species reaching distributional limits, and R - refers to resident or nonmigratory species.

Common Name	**Species Name**	**Local Status**
Pied-billed Grebe	*Podilymbus podiceps*	D
Brown Pelican	*Pelecanus occidentalis*	D
Double-crested Cormorant	*Phalacrocorax auritus*	D
American Bittern	*Botaurus lentiginosus*	D
Least Bittern	*Ixobrychus exilis*	B
Great Blue Heron	*Ardea herodias*	D
Great Egret	*Casmerodius albus*	B
Snowy Egret	*Egretta thula*	B
Little Blue Heron	*Florida caerulea*	B
Tricolored Heron	*Hydranassa tricolor*	B
Cattle Egret	*Bubulcus ibis*	B
Green Heron	*Butorides striatus*	B
Black-crowned Night Heron	*Nycticorax nycticorax*	D
Yellow-crowned Night Heron	*Nyctanassa violacea*	B
White Ibis	*Eudocimas albus*	E (VA)
Glossy Ibis	*Plegadis falcinellus*	B
Mute Swan	*Cygnus olor*	R
Canada Goose	*Branta canadensis*	R
Wood Duck	*Aix sponsa*	D
American Black Duck	*Anas rubripes*	D
Mallard	*Anas platyrhynchos*	R
Blue-winged Teal	*Anas discors*	B
Northern Shoveler	*Anas clypeata*	B
Gadwall	*Anas strepera*	D
Hooded Merganser	*Lophodytes cucullatus*	D
Black Vulture	*Coragyps atratus*	D
Turkey Vulture	*Cathartes aura*	D
Osprey	*Pandion haliaetus*	B
Mississippi Kite	*Ictinia mississippiensis*	E (VA)
Bald Eagle	*Haliaetus leucocephalus*	R
Northern Harrier	*Circus cyaneus*	D
Sharp-shinned Hawk	*Accipiter striatus*	D
Cooper’s Hawk	*Accipiter Cooperii*	D
Red-shouldered Hawk	*Buteo lineatus*	R
Broad-winged Hawk	*Buteo platypterus*	B
Red-tailed Hawk	*Buteo jamaicensis*	D

American Kestrel	*Falco sparverius*	D
Peregrine Falcon	*Falco peregrinus*	R?
Ring-necked Pheasant	*Phasianus colchicus*	R
Ruffed Grouse	*Bonasa unbellus*	E (NJ)
Wild Turkey	*Meleagris gallopavo*	R
Northern Bobwhite	*Colinus virginianus*	R
Black Rail	*Laterallus jamaicensis*	B
Clapper Rail	*Rallus longirostris*	D
King Rail	*Rallus elegans*	D
Virginia Rail	*Rallus limicola*	D
Sora	*Porzanna carolina*	D
Purple Gallinule	*Porphyrula martinica*	B
Common Moorhen	*Gallinula chloropus*	B
Wilson's Plover	*Charadrius wilsonia*	B
Piping Plover	*Charadrius melodus*	B
Killdeer	*Charadrius vociferus*	D
American Oystercatcher	*Haematopus palliatus*	B
Black-necked Stilt	*Himantopus mexicanus*	B
Willet	*Catoptrophorus semipalmatus*	B
Spotted Sandpiper	*Actitis macularia*	B
Upland Sandpiper	*Bartramia longicauda*	B
American Woodcock	*Philohela minor*	B
Laughing Gull	*Larus atricilla*	B
Herring Gull	*Larus argentatus*	D
Great Black-backed Gull	*Larus marinus*	D
Gull-billed Tern	*Gelochelidon nilotica*	B
Caspian Tern	*Sterna caspia*	B
Royal Tern	*Sterna maxima*	B
Sandwich Tern	*Sterna sandvicensis*	E (VA)
Roseate Tern	*Sterna dougallii*	E (NJ)
Common Tern	*Sterna hirundo*	B
Forster's Tern	*Sterna forsteri*	D
Least Tern	*Sterna albifrons*	B
Black Skimmer	*Rhnchops niger*	B
Rock Dove	*Columba livia*	R
Mourning Dove	*Zenaida macroura*	R
Black-billed Cuckoo	*Coccyzus erythropthalmus*	B
Yellow-billed Cuckoo	*Coccyzus americanus*	B
Barn Owl	*Tyto alba*	R
Eastern Screech-Owl	*Otus asio*	R
Great Horned Owl	*Bubo virginianus*	R
Barred Owl	*Strix varia*	R
Short-eared Owl	*Asio flammeus*	R?
Common Nighthawk	*Chordeiles minor*	B
Chuck-will's-widow	*Caprimulgus carolinensis*	B
Whip-poor-will	*Caprimulgus vociferus*	B
Chimney Swift	*Chaetura pelagica*	B

Ruby-throated Hummingbird	*Archilochus colubris*	B
Belted Kingfisher	*Megaceryle alcyon*	D
Red-headed Woodpecker	*Melanerpes erthrocephalus*	R
Red-bellied Woodpecker	*Melanerpes carolinus*	R
Downy Woodpecker	*Picoides pubescens*	R
Hairy Woodpecker	*Picoides villosus*	R
Red-cockaded Woodpecker	*Picoides borealis*	E (VA)
Northern Flicker	*Colaptes auratus*	D
Pileated Woodpecker	*Dryocopus pileatus*	R
Eastern Wood-Pewee	*Contopus virens*	B
Adadian Flycatcher	*Empidonax virescens*	B
Willow Flycatcher	*Empidonax traillii*	B
Eastern Phoebe	*Sayornis phoebe*	D
Great-crested Flycatcher	*Myiarchus crinitus*	B
Eastern Kingbird	*Tyrannus tyrannus*	B
Horned Lark	*Eremophila alpestris*	D
Purple Martin	*Progne subis*	B
Tree Swallow	*Iridoprocne bicolor*	B
Northern Rough-winged Swallow	*Stelgidopteryx ruficollis*	B
Bank Swallow	*Riparia riparia*	B
Cliff Swallow	*Petrochelidon pyrrhonota*	B
Barn Swallow	*Hirundo rustica*	B
Blue Jay	*Cyanocitta cristata*	D
American Crow	*Corvus brachyrhynchos*	R
Fish Crow	*Corvus ossifragus*	R
Carolina Chickadee	*Parus carolinensis*	R
Tufted Titmouse	*Parus bicolor*	R
White-breasted Nuthatch	*Sitta carolinensis*	R
Brown-headed Nuthatch	*Sitta pusilla*	R
Brown Creeper	*Certhia familiaris*	D
Carolina Wren	*Thryothorus ludovicianus*	R
House Wren	*Troglodytes aedon*	B
Sedge Wren	*Cistothorus platensis*	B
Marsh Wren	*Cistothorus palustris*	D
Blue-gray Gnatcatcher	*Polioptila caerulea*	B
Eastern Bluebird	*Sialia sialia*	D
Wood Thrush	*Hylocichla mustelina*	B
American Robin	*Turdus migratorius*	D
Gray Catbird	*Dumetella carolinensis*	B
Northern Mockingbird	*Mimus polyglottos*	R
Brown Thrasher	*Toxostoma rufum*	D
Cedar Waxwing	*Bombycilla cedrorum*	D
Loggerhead Shrike	*Lanius ludovicianus*	E (VA)
European Starling	*Sturnus vulgaris*	R
White-eyed Vireo	*Vireo griseus*	B
Yellow-throated Vireo	*Vireo flavifrons*	B
Warbling Vireo	*Vireo gilvus*	B

Red-eyed Vireo	*Vireo olivaceus*	B
Blue-winged Warbler	*Vermivora pinus*	B
Northern Parula	*Parula americana*	B
Yellow Warbler	*Dendroica petechia*	B
Black-throated Green Warbler	*Dendroica virens*	B
Yellow-throated Warbler	*Dendroica dominica*	B
Pine Warbler	*Dendroica pinus*	D
Prairie Warbler	*Dendroica discolor*	B
Cerulean Warbler	*Dendroica cerulea*	E
Black-and-white Warbler	*Mniotilta varia*	B
American Redstart	*Setophaga ruticilla*	B
Prothonotary Warbler	*Protonotaria citrea*	B
Worm-eating Warbler	*Helmmitheros vermivorus*	B
Swainson's Warbler	*Limnothlypis swainsonii*	B
Ovenbird	*Seiurus aurocapillus*	B
Louisiana Waterthrush	*Seiurus motacilla*	B
Kentucky Warbler	*Oporornis formosus*	B
Common Yellowthroat	*Geothlypis trichas*	B
Hooded Warbler	*Wilsonia citrinia*	B
Yellow-breasted Chat	*Icteria virens*	B
Summer Tanager	*Piranga rubra*	B
Scarlet Tanager	*Piranga olivacea*	B
Northern Cardinal	*Cardinalis cardinalis*	R
Blue Grosbeak	*Guiraca caerulea*	B
Indigo Bunting	*Passerina cyanea*	B
Dickcissel	*Spiza americana*	B
Eastern Towhee	*Pipilo erythrophthalmus*	D
Bachman's Sparrow	*Aimophila aestivalis*	E (VA)
Chipping Sparrow	*Spizella passerina*	D
Field Sparrow	*Spizella pusilla*	D
Vesper Sparrow	*Pooecetes gramineus*	E (NJ)
Grasshopper Sparrow	*Ammodramus savannarum*	B
Henslow's Sparrow	*Ammodramus henslowii*	B
Saltmarsh Sharp-tailed Sparrow	*Ammospiza leconteii*	D?
Seaside Sparrow	*Ammospiza maritima*	B
Song Sparrow	*Melospiza melodia*	D
Swamp Sparrow	*Melospiza georgiana*	D
Bobolink	*Dolichonyx oryzivorus*	B
Red-winged Blackbird	*Agelaius phoeniceus*	D
Eastern Meadowlark	*Sturnella magna*	D
Boat-tailed Grackle	*Quiscalus major*	B
Common Grackle	*Quiscalus quiscula*	D
Brown-headed Cowbird	*Molothrus ater*	D
Orchard Oriole	*Icterus spurius*	B
Northern Oriole	*Icterus galbula*	B
House Finch	*Carpodacus mexicanus*	R
American Goldfinch	*Carduelis tristis*	D

House Sparrow	*Passer domesticus*	R

APPENDIX III: Species showing large or significant population declines

Species showing large or significant population declines within physiographic area 44, based on Breeding Bird Survey, 1966-1996 trends (N = 85 routes).

Species	**Trend (% per year)**	**N**	**Significance**	**Relative Abundance**
Bobolink	-16.5[a]	3	0.05	0.02
Loggerhead Shrike	-7.6[a]	2	0.08	0.12
Vesper Sparrow	-6.8	24	0.03	0.16
Blue-winged Warbler	-6.2[a]	15	0.00	0.30
Marsh Wren	-5.6[a]	18	0.00	0.82
Grasshopper Sparrow	-4.4	64	0.01	1.88
Eastern Towhee	-4.4	85	0.00	12.73
House Sparrow	-4.4	82	0.00	46.33
Field Sparrow	-3.8	82	0.00	8.12
Yellow-throated Vireo	-3.7	49	0.00	1.30
Northern Bobwhite	-3.3	84	0.00	29.69
Prairie Warbler	-3.2	72	0.01	4.29
Common Tern	-3.1[a]	8	0.01	0.33
Eastern Kingbird	-2.7	84	0.01	3.41
Eastern Meadowlark	-2.4[a]	75	0.00	5.83
Gray Catbird	-2.4	82	0.00	7.18
Brown Thrasher	-2.4	84	0.00	3.78
Wood Thrush	-2.3[a]	83	0.00	14.05
Common Yellowthroat	-2.2[a]	85	0.00	12.32
Carolina Chickadee	-2.2	83	0.00	7.70
Yellow Warbler	-2.1[a]	56	0.09	1.05
Chipping Sparrow	-1.9	84	0.00	15.77
Blue Jay	-1.8	85	0.00	12.04
Scarlet Tanager	-1.6[a]	78	0.01	2.63
Eastern Wood-Pewee	-1.5	83	0.02	6.33
White-eyed Vireo	-1.4[a]	79	0.02	4.58
Downy Woodpecker	-1.3	83	0.06	3.32
Great-crested Flycatcher	-1.0[a]	82	0.00	4.39
Northern Cardinal	-1.0	85	0.02	25.83
Red-eyed Vireo	-0.8	83	0.06	19.34

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

APPENDIX IV: Species showing large or significant population increases

Species showing large or significant population increases within physiographic area 44, based on Breeding Bird Survey, 1966-1996 trends (N = 85 routes).

Species	Trend (% per year)	N	Significance	Relative Abundance
Wild Turkey	75.0[a]	13	0.01	0.10
Canada Goose	36.4[a]	46	0.00	1.87
Solitary Vireo	30.2[a]	2	0.01	0.03
Mute Swan	28.4[a]	3	0.04	0.03
Willow Flycatcher	22.4[a]	13	0.00	0.08
House Finch	17.7[a]	74	0.00	7.03
Bald Eagle	15.9[a]	13	0.03	0.10
Mallard	13.0	60	0.00	1.30
Cedar Waxwing	11.7[a]	54	0.00	1.00
Black Vulture	10.7	36	0.00	0.47
Double-crested Cormorant	10.0[a]	10	0.09	0.63
Herring Gull	9.9[a]	26	0.00	6.64
Great-horned Owl	8.3[a]	34	0.00	0.13
Osprey	8.0[a]	32	0.00	0.56
Red-headed Woodpecker	7.6[a]	20	0.01	0.26
Great Egret	7.5[a]	27	0.00	1.25
Clapper Rail	7.2[a]	10	0.01	0.18
Wood Duck	7.1[a]	41	0.00	0.51
Barred Owl	6.7[a]	18	0.02	0.12
Eastern Bluebird	6.5[a]	63	0.00	3.71
Boat-tailed Grackle	6.4[a]	11	0.00	12.95
Great Blue Heron	5.7[a]	62	0.00	1.51
Northern Harrier	5.5[a]	6	0.02	0.03
Cattle Egret	5.3	35	0.06	1.88
Turkey Vulture	5.0[a]	77	0.00	5.60
Killdeer	4.9	78	0.00	2.18
Red-tailed Hawk	4.9[a]	62	0.00	0.60
Orchard Oriole	4.7[a]	80	0.00	2.81
Fish Crow	4.6	79	0.00	5.46
Pileated Woodpecker	4.4	38	0.01	1.40
Red-shouldered Hawk	4.0[a]	32	0.01	0.53
Purple Martin	3.8[a]	83	0.00	9.83
Blue Grosbeak	3.2	71	0.00	6.73
American Crow	2.3	85	0.00	41.84
Carolina Wren	1.9	80	0.00	14.67
American Robin	1.9	85	0.00	35.46
Brown-headed Cowbird	1.4[a]	85	0.03	9.11

Red-winged Blackbird	1.4[a]	85	0.01	36.60
Tufted Titmouse	0.7[a]	83	0.08	13.99

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

APPENDIX V: Populations 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. 2000). Note that prior to July, 1999 BBS Relative Abundance was calculated differently; so any previously presented or published population estimates using these values will differ from those calculated after July 1999 (J.R. Sauer, pers. com.).

Percent of Population

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

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

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

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

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

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

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

Absolute population estimates

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

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

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