Partners in Flight
Bird Conservation Plan
for
The South Atlantic Coastal Plain
(Physiographic Area 03)

American Bird Conservancy

Partners in Flight
SOUTH ATLANTIC COASTAL PLAIN PARTNERS IN FLIGHT BIRD CONSERVATION PLAN
(Physiographic Area #03)

Version 1.0
May 2001

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Front cover illustration from 'All the Birds of North America'
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SOUTH ATLANTIC COASTAL PLAIN BIRD CONSERVATION PLAN
EXECUTIVE SUMMARY

The South Atlantic Coastal Plain, one of four coastal plain divisions recognized by Partners in Flight, is an extensive area with a high diversity of habitat types and associated bird species. Although broadly similar to other coastal plain divisions, several key habitat features distinguish the South Atlantic Coastal Plain and provide unique opportunities for conservation measures. The South Atlantic Coastal Plain is home to the largest forested floodplains outside of the Mississippi Alluvial Plain and includes unique non-alluvial wetlands such as the Great Dismal Swamp, pocosins, and Carolina bays. In addition, the largest remnants of former longleaf pine ecosystems and the best remaining examples of "natural" barrier and sea islands and maritime forests and woodlands are found in the South Atlantic Coastal Plain.

Due to the diversity of habitat within the physiographic area, several habitat-planning units have been utilized in order to aid in conservation and management planning. Included in this report are Grasslands/Savannas/Pastures and Associated Wetlands, Managed and Palustrine Emergent Wetlands and Mudflats, Early-successional Shrub-scrub Habitat, Forested Wetlands, Maritime Communities, Southern Pine Forests, Oak/Hickory/Tulip Poplar/Pine Forests, Riparian/Mixed Mesic Hardwoods, and Urban/Suburban "Backyard" habitats.

Over 300 bird species occur annually in the South Atlantic Coastal plain as nesting, post nesting dispersers, transients, and /or wintering residents. Among these species, the South Atlantic Coastal Plain supports critically important populations for a number of extremely high priority bird species. Species in need of the greatest conservation attention include Henslow's Sparrow, Wood Stork, Bachman's Sparrow, Swallow-tailed Kite, Swainson's Warbler, Eastern Painted Bunting, Black-capped and Bermuda Petrels, Red-cockaded Woodpecker, Southeastern American Kestrel, Wayne's Black-throated Green Warbler, Saltmarsh Sharp-tailed Sparrow, Red Knot, Piping Plover, and Snowy Plover (Gulf Coast). Other priority species also of conservation interest include Florida Sandhill Crane, White Ibis, Loggerhead Shrike, Cerulean Warbler, Prothonotary Warbler, Seaside Sparrow, Brown-headed Nuthatch, American Woodcock, Northern Bobwhite, Common Ground-Dove, Yellow-throated Warbler, Rusty Blackbird, Black Skimmer, Least Tern, Black Rail, Peregrine Falcon, Bald Eagle, American Oystercatcher, Red-throated Loon, and most migrating and wintering shorebirds and rails, Brant, American Black Duck, Lesser and Greater Scaup, Tundra Swan, and Wood Duck.

Conservation objectives for the South Atlantic Coastal Plain revolve mostly around (1) stabilizing or increasing populations of high priority breeding bird species, (2) wintering species, (3) and increasing the quality and availability of stopover habitat for transient species. Although waterbirds are treated here, these species groups are mostly the subjects of other planning efforts. For landbird species, the primary habitat objectives proposed in this plan include the following:

1. Retain and restore 1.3 million acres of native warm season grass habitats, with as much associated with longleaf pine as feasible.

2. Provide at least 300,000 acres of 5-year idle lands, 300,000 acres of annuals, and 600,000 acres of 10-20 year idle lands.

3. Maintain and improve the habitat quality of 8 forested wetland sites for Swallow-tailed Kite, maintain and stabilize at least 1 forested wetland site for Cerulean Warbler, at least 10 sites for Wayne's Black-throated Green Warbler, and 30 sites for Swainson's Warblers, which requires 10 patches over 100,000 acres, 15 patches over 20,000 acres, 7 patches over 10,000 acres, and 30 patches over 6,000 acres.

4. Protect 100% of remaining maritime communities and increase acreage wherever restoration is possible.

5. Increase longleaf pine forest acreage from 1.5 million acres to over 2.2 million acres and improve conditions favoring warm-season grassy ground cover, on at least 650,000 acres by year 2025.

These objectives remain tentative and open for discussion. Furthermore, implementation of this plan is based on several assumptions that should be tested by an aggressive research design or adaptive management strategies. The vast majority of bird conservation recommendations should be integrated into traditional land management objectives that include agriculture, economics, forestry, and game management.

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Section I: The Planning Unit

Background:

The South Atlantic Coastal Plain, consisting of about 25 million acres, includes parts of Virginia, North Carolina, South Carolina, Georgia, Alabama and Florida. This physiographic area is one of four coastal plain divisions recognized by Partners in Flight. Although these coastal plain areas share many conservation issues, differences in key species and habitats exist. For instance, the South Atlantic Coastal Plain includes (1) the largest forested floodplains outside of the Mississippi Alluvial Plain, (2) unique non-alluvial wetlands (Dismal Swamp, pocosins, Carolina Bays, Okefenokee Swamp), (3) the largest remnants of the former longleaf pine dominated ecosystems (especially flatwoods and sandhills, and to a lesser extent savannas), (4) the best remaining examples of "natural" barrier and sea islands and maritime forests in the Southeast, and (5) biologically rich Apalachicola Bluff forests. Also present within this physiographic area are extensive tidal wetlands and commercial forests.

Physical characteristics include a predominantly flat, weakly dissected alluvial plain with active fluvial deposition and shore zone processes along coastlines. Elevation ranges from 0 feet increasing towards the fall line to 600 feet. Major blackwater rivers (with headwaters in the coastal plain) include Chowan, Waccamaw, Satilla, St. Mary's, Suwanee, and St. John's (originating in Peninsular Florida). Major brownwater rivers (with headwaters originating in the Southern Piedmont or Southern Blue Ridge) include Roanoke, Tar, Neuse, Cape Fear, Pee Dee, Santee-Cooper, Ashepoo-Combahee-Edisto (ACE), Savannah, Ogeechee, Altamaha, and Apalachicola (Chattahoochee and Flint). Average annual precipitation is 40-60 inches except on the Florida Gulf Coast where it is 52-64 inches.

Land conversion, for both agricultural and urban expansion, has resulted in a 40 percent loss of natural vegetation (closer to 65 percent along some coastlines) in this physiographic area. Potential natural vegetation (i.e., absent frequent disturbances) is referred to as "southern mixed" forests and oak/hickory/pine, with intervening southern floodplain forest and pocosins, as well as live oak/sea oats along coastlines. However,

disturbances are frequent and therefore, upland forests historically were characterized by open pine (predominantly longleaf) forests. Today, predominant vegetation remains slash (Florida) and longleaf pines, with loblolly pine becoming common nearer to the Southern Piedmont and the northern portions of this physiographic area. Oak/gum/cypress forest cover type is common along floodplains and prevalent species include laurel oak, water tupelo, swamp tupelo, swamp chestnut oak, cherrybark oak, and baldcypress. Pond pine and Atlantic white cedar become important within the Lower Coastal Plain, especially in pocosin and other non-alluvial wetland types. Live oak becomes important along coastal areas and frequently is included with other coastal pines and hardwoods in various types of "hammocks."

Within the South Atlantic Coastal Plain, fire is the single most important driving disturbance force. Natural burns occur over medium to large size areas between natural barriers (e.g., floodplains, other wetlands) with moderate frequency and low intensity. Fires most often occurred during the growing season, in many cases started by lightning, and were essential for supporting numerous plant communities and dependent animals, including many bird species. In addition to fire, hurricanes, tornadoes, and floods are frequent as disturbance agents. Ice storms, though rare, are devastating where they occur. Finally, southern pine beetles are important disturbance agents.

Conservation Issues

Conservation issues within the South Atlantic Coastal Plain include:

(1) management and conservation of forested floodplains and related wintering waterfowl and migratory landbird needs;

(2) monitoring and protection of colonially nesting terns and skimmers, as well as vulnerable shorebirds, especially in areas with increased human disturbance and habitat loss;

(3) research and protection of Wood Storks and White Ibises;

(4) conservation of nongame waterbird habitats (under the purview of other bird conservation groups such as the Western Hemispheric Shorebird Reserve Network, Waterbird Society, North American Waterfowl Management Plan, and the International Association of Fish and Wildlife Agencies' Migratory Shore and Upland Gamebird Subcommittees);

(5) best management practices for forested wetlands, maritime communities, southern pine forests, and upland hardwood (including riparian) forests;

(6) conservation and protection of vulnerable nearctic-neotropical migratory landbirds.

Conservation Opportunities*:*

The use of landowner incentives, education, and conservation easements are potential tools that can be used separately or in combination to help provide enough habitat to maintain healthy bird communities. Education that increases understanding of the region's natural history is perhaps the best step toward fostering the regional pride and conservation ethics necessary to conserve communities of birds and other organisms whose populations are distributed over entire landscapes. New partnerships among government agencies, private conservation organizations, landowner and citizens, as well as increased coordination between management needs and the private sector will be necessary to accomplish conservation goals on this landscape scale. Public and private land opportunities (including local roles and responsibilities) derived from data on forest type acreage, distribution of seral stages, and ownership trends will be necessary for achieving the habitat goals outlined below.

Section II: Habitats and Species of Concern

Species prioritization:

Over 300 bird species occur annually in the South Atlantic Coastal Plain as nesting, post-nesting dispersers, transients, and/or wintering residents. Over 160 of these species regularly nest in the physiographic area. Representative nesting species include Eastern Meadowlark, Northern Bobwhite, Eastern Towhee, Prothonotary Warbler, Red-bellied Woodpecker, Yellow-breasted Chat, Red-winged Blackbird, Indigo Bunting, and Great Crested Flycatcher. Breeding bird species richness varies across the landscapes of the South Atlantic Coastal Plain, increasing substantially nearer the coast proper. This pattern appears to hold constant for wintering species, waterbirds overall, and possibly transient landbirds (at least during southbound migration).

The Partners in Flight prioritization process was developed to assist in highlighting species needing the most conservation attention within any one physiographic area (or other defined geographical unit) and to eventually provide guidance on how best to allocate resources targeting inventory, monitoring, management, and research actions for all species among diverse birds and habitats (Hunter et al. 1993, Carter et al. in press). This system ranks each species (and some subspecies and populations identified specifically for conservation attention within the Southeast) based on 7 measures of conservation vulnerability: (1) global relative abundance, (2) global breeding distribution, (3) global non-breeding distribution, (4) threats during breeding season, (5) threats during non-breeding seasons, (6) population trend, and (7) area importance as a measure of relative density within physiographic area compared with densities in all other physiographic areas. The first three measures are held constant across the species range, the next three are subject to local data, while area importance is always a measure based on local information in comparison with continental (in many cases global) levels of maximum relative abundance. In addition, Rosenberg and Wells (in press) have developed a technique to calculate the percentage of a species total global breeding population may occur within each physiographic area based on Breeding Bird Survey data (which also serves to in the scoring of global relative abundance, population trend, and area importance for many

species, Carter et al. in press). To further refine species prioritization within a physiographic area, population trend and area importance are examined independently of total scores.

Birds were prioritized according to this process in the South Atlantic Coastal Plain (Table 1). Category I lists highest priority birds based on total scores of at least 22, with extremely high priority species scoring at least 28 (Category Ia.) and includes 18 taxa. High priority taxa score between 22-27 (Category Ib.) and includes 49 taxa. Habitat requirements for these species ranged widely from grassland and early-succession, to coastal beach and dunes, to forested wetlands and southern (particularly longleaf) pine. Representative breeding species in Category I include Red-cockaded Woodpecker, Bachman's Sparrow, Swallow-tailed Kite, Swainson's Warbler, Yellow-throated Warbler, Southeastern American Kestrel, Prairie Warbler, Eastern Painted Bunting, Brown-headed Nuthatch, Southeastern Wood Stork, Black Rail, Wilson's Plover, and Seaside Sparrow. Representative wintering species include Henslow's Sparrow, Yellow Rail, American Black Duck, Saltmarsh Sharp-tailed Sparrow, and Piping Plover. Transients among the highest priority species include Bicknell's Thrush and Black-throated Blue Warbler among landbirds and Stilt Sandpiper and Buff-breasted Sandpiper among waterbirds.

Category II (with 44 species) provides a list of moderate priority species based on slightly lower scores of 19-21 best characterized as (Category II.) relatively numerous but with uncertain to declining population trends or (Category II.) with very high percent of total breeding population based on BBS data. Species in Category IIa. include Northern Bobwhite, Common Ground-Dove, Eastern Towhee, Yellow-billed Cuckoo, Carolina Chickadee, Rusty Blackbird, Black Skimmer, Least and Gull-billed terns, American and Least bitterns, many species of shorebirds, Red-throated Loon, Greater and Lesser scaup. Many of these and other species remain common and widespread, but are showing some signs of vulnerability and should at least be monitored more closely and in some cases treated as higher priority species for conservation attention (*e.g.*, Northern Bobwhite, Common Ground-Dove, Rusty Blackbird, Least Tern, and Red-throated Loon). Category IIb. are moderate priority

species that are doing relatively well in this physiographic area, have a high percentage of total breeding population and include White-eyed Vireo, Orchard Oriole, Chuck-will's-widow, Acadian Flycatcher, Summer Tanager, Yellow-throated Vireo, and Prothonotary Warbler.

Category IIIa. include any regularly occurring species not already listed above that are on Partners In Flight's national WatchList. Only Kentucky Warbler is such a WatchList species occurring in the South Atlantic Coastal Plain. Category IIIb. are Federally listed taxa not otherwise meeting above criteria and only Bald Eagle is included within the South Atlantic Coastal Plain. Finally, in an addendum, are listed species that are of Local (e.g., state listed species) or Regional interest (i.e., they are frequently higher priority in other physiographic areas, but not here, or are of general management interest regardless of priority). Among Regional interest species are Loggerhead Shrike, Eastern Kingbird, Eastern Meadowlark, Whip-poor-will, Red-headed Woodpecker, Peregrine Falcon, most colonial long-legged wading birds, Wood Duck, Tundra Swan, and Northern Pintail. Local interest species highlighted here Mississippi Kite (in North Carolina), Limpkin (in Florida), and Common Tern (in North Carolina).

Conservation area size considerations:

Bingham and Noon (1997) advised that a key challenge for conservationists is to estimate in a scientifically-defensible manner the size and composition of habitats which will meet critical life history requirements for species of interest. They suggested focusing habitat conservation efforts on species with the largest area requirements. In so doing, a reasonable size estimate could be determined for a conservation preserve that would also provide sufficient habitat for other species with smaller area requirements.

In order to systematically and consistently estimate required habitat areas for the conservation of "source" populations, Twedt et al. (1997) used Hamel's (1992) estimates of mean densities of breeding birds taken from Breeding Bird Census data in developing the Mississippi Alluvial Plain Bird Conservation Plan. From these density

estimates and other pertinent data they extrapolated to estimate the area required for supporting 500 breeding pairs, then doubled that to approximate an area of suitable, interior habitat surrounded by 1 km buffer zone of similar habitat use (in the Mississippi Valley, interior and buffer habitat is composed of forested wetlands, but in coastal plain buffer may be pine or hardwood dominated forests). For consistency of application across physiographic areas and among bird conservation plans, the same procedure has been followed in this plan. For some species, a patch size has been estimated for suitable habitat that could support 500 pairs. We then doubled that acreage to define a total area encompassing the core area and approximately a km buffer zone (Table 2). In the South Atlantic Coastal Plain, the area requirements for two species supersede this analysis, with Swallow-tailed Kite in forested wetlands and Red-cockaded Woodpecker in southern pine forests, but smaller patches within these habitats may still be defined for conservation purposes (both in areas where kite and woodpecker conservation is considered and in areas where these species are absent).

Habitat maps in this report:

Figures in this plan depicting the location of contiguous tracts of each habitat type were developed from U.S.D.A. Forest Service FIA forest inventory data and shown at a 1 square km resolution. Although all states have been surveyed after 1990, data contained in the database cannot be expected to be fully current. Many areas shown as contiguous forest tracts may well be smaller and more fragmented than they appear in this report. Web access is http://www.cast.uark.edu/pif/main/southeast/3table.htm and http://www.cast.uark.edu/pif/main/maincont.htm is the project home page. The database upon which figures and hectare estimates used in this plan were derived was produced by analysis of satellite imagery and assignment of habitat type classification based on U.S.D.A. Forest Service forest inventory data at a 1 square km scale (Table 3). While that resolution is coarse, it represents a very useful first hierarchical level of identification of habitat tracts in the region. The potentially important large tracts of forest can be easily pinpointed on regional maps and follow-up actions the focused directly on those areas.

Management within the conservation unit:

The first step after a potential large tract is located should be a thorough survey of that area, either through an aerial reconnaissance or through consultation with local landowners. After a determination is made that a large tract of intact forest exists, land ownership patterns can be determined and contacts made to initiate bird conservation strategies. Within large areas of any habitat type managed for conservation, efforts must ensure that all seral stages and natural vegetative diversity occur in order to supply the entire range of needs of bird species using the area. In addition, extant forest remnants are often less than ideal for conservation; that is, a large contiguous forest tract may be quite elongate and narrow or well dissected and, effectively, fragmented, with a large linear edge and little buffered interior habitat. While recommended conservation areas for certain species may seem large for the maintenance of 500 breeding pairs, the high level of dissection of large forest parcels makes the number of recommended areas for habitat and species conservation conservative.

Field verification of forests my prove that tracts of some habitat types in the largest size classes no longer occur. Where large tracts of optimal habitat are no longer available, Robbins et al. (1989) have determined that smaller habitat patches in close proximity to other similar areas could serve to attract and retain area-sensitive species. However, they caution that core areas of protected habitats should be selected to maximize the critical microhabitat requirements of species requiring conservation attention.

Section III: Habitats and Objectives

Birds are grouped into 8 priority species-habitat suites for the South Atlantic Coastal Plain (Table 4). The habitats in this plan and the number of high priority species (Category I) in each habitat are:

Grasslands and associated habitats: 12 species
Managed and Palustrine Emergent Wetlands and Mudflats: 20 species
Early-succession, Shrub-Scrub: 8 species
Forested Wetlands
- Alluvial: 12 species
- Non-alluvial (including pond pine pocosins): 14 species

Maritime Communities
- Maritime forest/shrub-scrub: 14 species
- Estuarine emergent wetlands: 16 species
- Beaches and dunes: 6 species
- Open ocean: 7 species

Southern Pine
- Flatwoods, savanna, and sandhills: 10 species
- Mature loblolly-shortleaf: 10 species
- Short-rotation “rotation” pine: 3 species

Oak-Hickory/Tulip Poplar/Pine Forests: 7 species
Riparian/Mixed Mesic Hardwoods: 12 species

For each habitat type, this plan provides some background discussion, the current, known status of habitat acreage and quality, population and habitat objectives where possible, management recommendations and opportunities, and a list of important research topics to test assumptions of the plan.

Grasslands/Savannas/Pastures, and Associated Wetlands

***Ecology and status**:*

Historical grass-dominated ecosystems of the Southeastern coastal plain, east of the tallgrass prairies of Texas and Oklahoma and the coastal prairies of Texas and Louisiana, consisted mostly of relatively small and isolated patches (exceptions identified below) within a forest-dominated landscape (including pitcher plant [*Sarracenia* sp.] bogs, prairies, sedgelands, barrens and glades, savannas, and the Everglades). Despite the loss of native grass-dominated ecosystems over the last two centuries, remnant southeastern grasslands remain centers of biological diversity, with many southeastern endemic species totally dependent upon these ecosystems (DeSelm and Murdock 1993). The uniqueness of grasslands and prairies warrants their restoration and management. Their conservation value is further enhanced because they harbor several federally listed grassland birds.

Also of importance to bird conservation within the South Atlantic Coastal Plain are the longleaf and slash pine savannas formerly found throughout the lower coastal plain and the dry and wet prairies of southern Georgia and northern Florida. The importance and status of pine savanna is treated in more detail below under the Southern Pine section. Focus here is placed on the grassland component of both sparsely forested savannas and treeless prairies within this physiographic area. The largest prairie complex, formerly stretching from the Ochlockonee River (with headwaters in southwestern Georgia) to the Florida Parishes of Louisiana, now exists as small fragments and as ecotones between titi swamps and pine plantations (Myers 1990). These large prairie habitats support species such as the Florida Sandhill Crane, now very local in the South Atlantic Coastal Plain. The largest remaining fragments of savannas specifically are found within the Apalachicola National Forest, Florida; Garcon Point, Florida; Grand Bay, Alabama; and Gautier, Mississippi. The status of prairie habitat complexes in Florida is the least secure of high priority habitats in existing conservation areas (Cox et al. 1994). However, the Okefenokee National Wildlife Refuge, Georgia, includes the largest prairie acreage remaining, with Grand Bay Wildlife Management Area in Georgia protecting the second largest acreage.

Of unknown value to birds, but of potentially high importance to plant and invertebrate biodiversity, are relict patches of blackland prairie, a tallgrass prairie type. The eastern most known patch is centered within Houston and adjacent Counties within Georgia. This patch is now disjunct from, but part of, the Black Belt Prairie, otherwise restricted to the East Gulf Coastal Plain of Alabama and Mississippi. All acreage is on private land, but part of this blackland prairie is on Oaky Woods Wildlife Management Area owned by Weyerhaeuser Corporation. This area is jointly managed with the Georgia Wildlife Resources Division. Unfortunately, lack of fire management is threatening this prairie, now described as a cedar glade, as it quickly succeeds to a dense, cedar-dominated woodland.

Elsewhere within this physiographic area, the proliferation of pastureland, airfields (both commercial and military), and other "artificially" created grasslands have provided much of the historical grassland bird habitat. Presently, there is much more crop and pastureland than native grasslands, compared to that likely occurring before European colonization. While remnant native grasslands still support the core habitats for more highly vulnerable species (e.g., Henslow's Sparrow, Florida Sandhill Crane), many species also benefit from cropland management and pasturelands. However, even these common grassland species (e.g., Eastern Meadowlark, Savannah Sparrow) are showing strong declining trends due to changes in pasture grasslands (from warm-season to cool-season grasses) and more efficient mowing practices.

***Priority species, species suites, and habitat requirements**:*

Henslow's Sparrow is perhaps the most vulnerable of grassland birds dependent upon southeastern grasslands within the South Atlantic Coastal Plain. Other priority species include the Florida Sandhill Crane and Loggerhead Shrike. In addition, of the 11 widespread grassland species found throughout the Southeast, all but 1 population is declining in North America (Table 5). Of these species, 8 species are decreasing in this physiographic area (4 significantly) while 3 are increasing (2 significantly, including Brown-headed Cowbird). The declining trends found in most of these widespread species likely reflect recent changes in agricultural practices, loss of suitable wildlife habitat in historical crop/pasturelands, and long-term loss of native grasslands and diversity of grasslands throughout the Southeast.

Henslow's Sparrow. -- Henslow's Sparrow is generally considered a grassland specialist while breeding, but could also classify as an extremely specialized early-successional species, as it usually occurs in rank grassland just prior to succession into the shrub-scrub seral stage (3-5 years after disturbance from fire or mowing). North Carolina supports the largest known breeding population east of the Appalachians, and along with scattered breeding birds in Virginia, constitutes the only breeding population now known along the Atlantic seaboard. Absolute numbers of breeding birds are unknown, though the population has appeared stable over the last 10 years (Harry LeGrand, pers. comm., Pruitt 1996). In the coastal plain, Henslow's Sparrows are found associated with cleared pocosins (Lynch and LeGrand 1985). However, Henslow's Sparrow likely were associated with what can be described as savannas and grasslands overlaying mineral soils,as well as in "maritime pine savanna" as described by Watts (1999, Mid Atlantic Coastal Plain Bird Conservation Plan). Similar appearing habitats ocurring on organic soils, such as "pocosin grasslands" resulting from stand replacement fires in pond pine dominated habitats (frequency of such high intensity fires are thought to have occurred once every 50-100 years), but do not seem to support this species (for unknown reasons). The ephemeral nature of suitable breeding habitat suggests that any one former occupied site is unlikely to support breeding birds for more than a couple of years without repeated disturbance. The most stable populations

are found on Voice of America Sites – former forests on mineral soils where periodic burning or mowing is conducted with the appropriate frequency to support up to 64 and 48 singing birds on respective sites (Pruitt 1996, John Wright, unpublished data, 1998).

Wintering populations of Henslow's Sparrow are dependent primarily on pine flatwoods and savannas, including pitcher plant bogs. In addition, anthropogenic grassy habitats also provide important wintering sites because Henslow's Sparrows use moist sites dominated by broomsedge grasses (i.e., power right-of-ways, marsh edges, fallow fields). No data exist on the specific numbers of Henslow's Sparrows wintering within the South Atlantic Coastal Plain. However, over one third of the known wintering range is within this region. Disturbance, through mowing or burning wintering sites, is also critical for maintaining suitable habitat.

Florida Sandhill Cranes. -- Florida Sandhill Cranes are perhaps the best representative bird species associated with expansive prairie habitats. Reduction and the near loss of Sandhill Cranes as a breeding species from Louisiana to west Florida during the 1900's attests to the decline of healthy grass-dominated ecosystems throughout the coastal plain. About 400 of the 4,000 Florida Sandhill Cranes are found within the Okefenokee National Wildlife Refuge in Georgia, effectively isolated from other major crane breeding populations (Bennett 1989, Nesbitt 1996, Rodgers et al. 1992). This is apparently the only healthy coastal plain breeding population (even considering the 100 or so Mississippi Sandhill Cranes persisting within the East Gulf Coastal Plain). The Okefenokee Swamp population is augmented by closely related Greater Sandhill Cranes during winter, and additional wintering Greater populations are found at Grand Bay Wildlife Management Area in Georgia.

Loggerhead Shrike. -- Loggerhead Shrike, dependent upon grasslands with hedgerows and/or perch sites, remains a fairly common to common resident species at least within the Lower Coastal Plain from South Carolina to Florida. Because the Loggerhead Shrike is a rather widespread and common species through the southern U.S. and occurs well into Mexico it is not a high ranking species in many physiographic areas. However, widespread declines and reduction in distribution during the latter part of this century have led to concern for this species throughout much of its eastern

range. Within this physiographic area, Virginia and North Carolina Loggerhead Shrike populations have suffered the most reduction in range. Breeding populations north of North Carolina into Canada generally are migratory and are considered the most highly vulnerable populations. It has been suggested that reasons for declines are probably tied to wintering grounds in the Southeast, though continuing loss of habitat is prevalent throughout the eastern range of this species.

Northern Bobwhite.--Although not as high priority as the above species, Northern Bobwhite is an extremely important species helping to drive habitat restoration efforts in the South Atlantic Coastal Plain. The Northern Bobwhite is also dependent on shrub-scrub and open southern pine habitats subject to frequent burns supporting grassy and herbaceous ground cover. Many of the suggested habitat objectives for grassland and shrub-scrub are to restore Northern Bobwhite to pre-1980 (mid 1970's preferred) population levels across the Southeast, which (with the exception of field borders, see next section) should help conserve other vulnerable grassland species.

Population and habitat objectives:

Population objectives

Grassland wildlife populations should be restored to pre-1980 levels (see Capel et al. 1994). Measures of success would be to support a minimum 1,000 pairs of Henslow's Sparrows in eastern North Carolina and southeastern Virginia and support a minimum of 500 pairs of Florida Sandhill Cranes in south Georgia and north Florida. Winter population objectives would be to support at least one third of all Henslow's Sparrows (shared with pine flatwoods). Both resident Loggerhead Shrike and Northern Bobwhite populations should be stabilized within 5 years and show increases within 20 years. Other species in need of monitoring are Bobolink (transient), Short-eared Owl (winter), Sedge Wren (winter), Barn Owl, Grasshopper Sparrow, and Northern Harrier.

Habitat objectives

On a regionwide scale, this would involve (1) retaining 4,000,000 acres of existing range dominated by native warm-season grasses and (2) restoring or

converting cool-season grass pastures to native warm-season grasslands on an additional 10,231,000 acres (Capel et al. 1994). Native warm-season grasses not only contribute significantly to future soil quality as the only rapid developer of topsoil in the A horizon, but also provide more reliable summer forage for livestock because of their drought-resistant properties.

On a regional scale, objectives for the South Atlantic Coastal Plain (again primarily driven through restoration of Northern Bobwhite habitat) include (1) retaining 300,000 acres of existing range (assuming this amount actually exists) and (2) restoring or converting 1,000,000 acres of native warm-season grasses. These objectives in part can be combined with objectives for longleaf restoration and maintenance and can be broken down on a state-by-state basis as follows: North Carolina, South Carolina, and Georgia each retaining 65,000 acres and restoring/ converting 250,000 acres in the next 25 years; Florida retaining 100,000 acres and restoring/converting 240,000 in the next 25 years; and Virginia (limited to the Dismal Swamp-Back Bay Areas) retaining 5,000 acres and restoring/converting 10,000 acres (Table 6)..

For grasslands and pastures, restoration of appropriate disturbance (e.g., fire, grazing) regimes and cooperation with private landowners to restore warm-season grasses are top priorities.

Implementation recommendations and opportunities*:*

Thorough inventories of present and projected future habitat availability, as well as investigation of Henslow's Sparrow breeding success, should be top priorities in both North Carolina and Virginia. Regional focus should be directed towards supporting research on fire ecology and providing optimal wintering habitat within pine flatwoods and savannas. Research is currently underway in Apalachicola National Forest to determine the most optimal burning regime to manage for Henslow's Sparrows and other grassland obligate species. In addition, ACE Basin National Wildlife Refuge is investigating the response of Henslow's Sparrows to management of fallow fields during winter.

Most grassland species of highest concern (e.g., Henslow’s Sparrow) do not use

crop and pastureland for breeding, regardless of the presence or absence of native grasslands. However, the foraging requirements of some breeding species (if enough native grassland is available nearby) and many migratory and wintering species can be provided by farmers and ranchers. Thus restoration of native grasses and cooperative agreements with private landowners to support compatible practices may have the greatest conservation benefit for the highest priority grassland species. State and local technical committees have been formed to implement the 1996 Farm Bill in order to identify priority conservation areas and target funding for private lands. State wildlife biologists are providing leadership in this undertaking, but specific objectives (acreages, locations, etc.) still need to be specified. Monitoring and documenting the response of grassland birds to habitat restoration through the Farm Bill will allow for improving landowner recommendations.

Smaller-scale restoration and management can provide benefits to vulnerable grassland birds in a limited manner. For example, when managed properly, utility right-of-ways in many areas allow excellent opportunities for maintaining grassland habitats (DeSelm and Murdock 1993). Conservation efforts on this small-scale will many times involve cooperative agreements with private or corporate landowners, and recommendations for implementing wildlife oriented management on these private lands have been developed by Terry Sharpe, North Carolina Wildlife Resources Commission.

Evaluation of assumptions:

1. Most important for grassland situations is testing the assumption that one third of all Henslow's Sparrows depend on South Atlantic Coastal Plain grasslands (including savannas and flatwoods) during winter.

2. Detailed studies needed to understand factors influencing occurrences and reproductive success of Henslow's Sparrow in northeastern North Carolina and southeastern Virginia.

Managed and Palustrine Emergent Wetlands and Mudflats

Ecology and status:

In addition to the natural and artificial grasslands discussed above, freshwater (palustrine) emergent wetlands or marshes are an important grassland habitat within the South Atlantic Coastal Plain. Although no net change in freshwater marsh acreage has occurred from the mid-1970's to the mid-1980's, there are clearly fewer marshes and these are of poorer quality due to extensive drainage and conversion than found prior to European colonization (Hefner et al. 1995). Today's freshwater marshes are mainly mitigation sites or are otherwise human influenced, and have replaced former forested wetlands especially at shallow ends of reservoirs and cutover areas. Mudflats exposed within and adjacent to marshes are also very important, especially to migrant shorebirds and long-legged waders. Unfortunately, these exposed mudflats away from coastal areas are now extremely limited during critical migration periods (early fall, late spring) due to changes in water management resulting in extreme flooding or complete desiccation at seasons differing with natural flows.

Priority species, species suites, and habitat requirements:

Rails. -- Freshwater marshes are important for supporting significant populations of rails, many species of which are increasingly considered vulnerable (Eddleman et al. 1988). In South Carolina, King Rails are of interest as a breeding species and Yellow Rails as a wintering bird in areas such as Santee National Wildlife Refuge. Although freshwater *Juncus* rushes may provide wintering habitat for Yellow Rails and breeding habitat for Black and King Rails, recent surveys in South Carolina did not detect any of these species in this habitat (Cely et al. 1993). Within the South Atlantic Coastal Plain, Least Bitterns are important breeders while American Bitterns are more of a wintering bird (Cely et al. 1993). Distribution and residency status of Black Rails within the region is poorly understood due to their secretive nature.

Shorebirds. -- Freshwater mudflats and shallow water habitats are important for some migrant shorebirds. Steady, if not increasing, numbers of juvenile Buff-breasted Sandpipers and American Golden Plovers along with several other species are being

found at inland sites within the South Atlantic Coastal Plain. Habitat requirements range from moist short grass (or plowed) fields for Buff-breasted Sandpipers and American Golden Plovers to very shallow water for small sandpipers and plovers to deeper water (<10 cm) for larger sandpipers (e.g., Stilt Sandpiper, dowitchers, yellowlegs). During migration periods, water should be drained gradually to provide new habitat for each of the above foraging groups every few days (see Helmers 1992 for more details). Rising concern for shorebirds and the clear limitation of freshwater mudflat habitat during peak migration times suggest close attention to these species continues to be warranted.

Wood Storks and White Ibis. -- Managing water levels in freshwater situations is important not only to migrant shorebirds, but also to breeding and foraging long-legged waders. The South Atlantic Coastal Plain may now support a third of all breeding Wood Stork and White Ibis in the United States. These two priority species are highly dependent upon prey from freshwater marshes. White Ibises are completely dependent upon feeding prey from low salinity habitats to their nestlings. For example, in 1990, after Hurricane Hugo raised salinity levels at formerly important freshwater foraging sites, 11,000 White Ibis pairs abandoned the Pumpkinseed Island colony, South Carolina (Bildstein, 1993).

Of even greater concern, the total number of White Ibises appears to have declined at least 50% from 1933 to 1991 (to 40-50,000 pairs) from North Carolina to Texas (Frederick et al. 1996). Specifically, rapid declines have occurred within the South Atlantic Coastal Plain's four major colonies since the mid-1970's: (1) Cedar Keys National Wildlife Refuge (actually in Peninsular Florida, but with most foraging occurring within the Lower Suwannee River National Wildlife Refuge), (2) Pumpkinseed Island (South Carolina), (3) Drum Island (South Carolina), and (4) Battery Island (North Carolina). Although at least three of these sites remain important, many pairs appear to have moved elsewhere out of the physiographic area since the late 1970's. Geographic shifts (recent declines in South Atlantic Coast coincide with increases in coastal prairies of Louisiana and Texas) of breeding White Ibis suggest most U.S. breeding pairs constitute a single large population, isolated from breeding populations south of the border and undertaking a nomadic strategy on a regionwide scale (Frederick et al.

1996). This finding, in concert with steep declines overall since the 1930's, raises serious concerns regarding the long-term stability of this species.

Freshwater marshes also have become increasingly important for ensuring the continued survival of the Federally endangered Wood Stork. Abandonment by Wood Storks of long important Peninsular and Subtropical Florida colonies, where estimates of 15-25,000 pairs are thought to have occurred prior to 1940, has resulted in increasing populations within the South Atlantic Coastal Plain. Recent statewide surveys in Florida (1993-1995) indicate between 26 and 33 colonies now contain 4-5,500 pairs. Three of these Florida colonies are within the South Atlantic Coastal Plain. Stork nesting colonies began forming in Georgia by 1976 and now consist of 1,661 pairs in 11 colonies (Mike Harris, Georgia DNR, pers. comm.), while colonies formed in South Carolina by 1981 and now consist of 806 pairs in 3 colonies (Tom Murphy, South Carolina DNR, pers. comm.). Studies through the Savannah River Ecology Lab on the Birdsville, Georgia colony have shown the most successful colonies are those that have a larger number of potential feeding sites that include both shallow and deep pools to allow for variation in yearly rainfall patterns (Coulter 1987; Ogden 1996; Rodgers et al. 1992).

Population and habitat objectives:

Population objectives

Due to poor breeding success of both White Ibises and Wood Storks within Peninsular and Subtropical Florida, maintaining high breeding success among South Atlantic Coastal Plain populations is of great importance. For shorebirds, about 2.4 million out of over 4.8 million transient shorebirds appear to use inland and managed wetland habitat in the Southeastern U.S. (Hunter et al. 2000). Specific population objectives will be developed by both U.S. shorebird and North American Colonial Waterbird planning efforts now underway.

Habitat objectives

All potential emergent wetland and mudflat management units should be

identified within the South Atlantic Coastal Plain. Presently, about 10,000 acres of managed wetlands for shorebirds ultimately are recommended for the South Atlantic Coastal Plain (Hunter et al. 2000). Flooding of allocated acreage should coincide with key shorebird migration periods and should additionally benefit breeding Wood Storks and White Ibises as well as wintering and breeding rails. Protection of remnant "savanna-type" Carolina bays and management of beaver ponds and millponds to increase *Juncus* rushes is also potentially important for breeding rails.

Implementation recommendations and opportunities*:*

An existing Joint Venture sanctioned under the North American Waterfowl Management Plan is charged with establishing targets along the Atlantic Coast to support migratory birds, in particular waterfowl. These targets are being expanded or modified to cover the conservation needs of all wetland dependent species within the South Atlantic Coastal Plain. The primary conservation objective within this region is to ensure adequate shallow-water habitat that meets or exceeds the foraging requirements of shorebirds during spring and fall migration. This water level management is critical since most formerly available habitats would not otherwise be made available as they are often extremely flooded or, in contrast, completely desiccated during critical migration periods. Water management targets are being established as part of the South Atlantic Migratory Bird Initiative, with trial total numbers of 3000 acres, with 1000 acres allocated among states with existing impoundments from (1) Virginia-North Carolina and (2) South Carolina-Georgia to (3) North Florida during respective fall and spring migrations (Bob Noffsinger pers. comm.). In addition to the above targets are areas of moist-soil or seasonally flooded agriculture that should be managed for late fall-early winter waterfowl.

For waterfowl, current land use and management will likely influence the targeted distribution of foraging habitats among management areas. For shorebirds, however, specific management guidelines, foraging-habitat units and refined targets for the distribution of shorebird habitats will be essential. Avian use of these managed areas should be monitored to track use and to provide insight into needed management

modifications.

Once shorebird population goals and subsequent habitat objectives are established for the entire physiographic area, each state within the South Atlantic Coastal Plain will receive and agree to a certain allocation of habitat to ensure a healthy geographic dispersion of shorebird habitat (Table 2). The available land base and the perceived ability of each state to achieve established shorebird habitat objectives will also be taken into consideration when determining state allocations. The next step in this process will be to allocate state habitat objectives to individual management units of public land.

Under most shorebird management strategies, and because of temporal vagaries in water conditions, only a portion of any managed shorebird habitat will be available to shorebirds at a given time. Management practices should be undertaken, however, that maximize the area of foraging habitat available within individual management units while simultaneously maximizing the duration that these habitats remain available to shorebirds between 15 July and 30 September (Helmers 1992). Biologists must also consider influences of management practices on prey availability. Research should focus on establishing baseline data of prey base in management units, documenting seasonal fluctuations in prey composition, and evaluating prey response to varied management schemes.

Focus areas for water level management should include old rice fields (Yawkey Wildlife Center, SC; ACE Basin, GA; Altamaha Wildlife Management Area, GA), borrow pits (Augusta brickyards), and turf and truck farms (also known as “muck” farms; e.g., Statesboro and Macon, GA and Winyah Bay, SC). Privately, landowners in the Carolina's and Georgia seem willing to work closely with State and Federal biologists as well as private conservation groups like Ducks Unlimited and The Nature Conservancy to achieve waterfowl conservation objectives. Shorebirds benefit from this management during the spring, but more attention is needed from July to early October for fall migrants. Late summer/early fall shorebird habitat would also benefit post-breeding colonial wading birds (e.g., Wood Storks, ibises, egrets, herons) and early migrant waterfowl (e.g., Blue-winged Teal).

While spring and fall drawdowns are required for shorebirds and long-legged waders, Cely et al. (1993) suggest maintaining higher water levels (or at least a diversity of water levels) within managed impoundments during summer months for rail breeding management. This summer management does conceivably fit into both shorebird and wintering waterfowl requirements, although considerable and frequent attention will be required by managers. In addition to water level manipulation, rails and bitterns require special survey techniques to gather population size and trend data to best track responses to management actions (flooding levels, marsh burning schedules, etc.).

Monitoring efforts should continue for White Ibis and breeding and foraging Wood Stork throughout the region. Periodic colonial waterbird breeding surveys ("atlases") need to be continued on at least a ten-year interval in each South Atlantic Coastal Plain State, with the next series of atlases starting no later than 2001. However, with current White Ibis population shifts, more frequent, coordinated surveys at a smaller scale may be required. Studies of age-related ibis mortality are a high priority to better predict demographic trends for this species. These and other issues well be treated in more detail in the North American Colonial Waterbird planning effort.

***Evaluation of assumptions**:*

Critical assumptions for establishing shorebird conservation goals include:

(1) about 4.8 million shorebirds pass through the Southeastern coastal plain during migration (based on International Shorebird Survey, Manomet Bird Observatory 1993);
(2) the average duration of migration, during which time shorebirds forage, is ten days (Collazo et al. 1995);
(3) foraging-habitat in freshwater habitats as opposed to estuarine situations limits the carrying capacity of the South Atlantic Coastal Plain with no greater seasonal limitation found during northward or southward movements (see data presented in Weber and Haig 1996; C. Marsh pers. comm.);
(4) a hectare of managed shorebird foraging-habitat provides about 20kg of

invertebrate forage;

(5) migrating shorebirds on average require about 8g of invertebrate forage per day; and

(6) managed habitats will attract and support migrating shorebirds. Research is needed to address each of these assumptions.

Early-Successional Shrub-Scrub Habitats

Ecology and status:

Early-successional shrub-scrub habitats originate and are maintained by natural disturbance phenomena including grazing by hoofed animals, tornadoes, hurricanes, ice storms, and most notably fire. Elimination of migrating bison and elk herds soon after European colonization in eastern North America, and an emphasis on fire suppression after the 1930's has led to the loss of most shrub-scrub habitats, as well as the longleaf pine forests from the Southeast. "Old-field" and "hedgerow" shrub-scrub habitats resulting from inefficient farming practices in the early 1900's are also quickly disappearing from the Southeast. Land conversion to more efficient "clean" farming with fewer maintained hedgerows, to housing subdivisions, or to successive mature forest stages all contribute to the loss of this shrub-scrub habitat.

Historically, the most stable shrub-scrub habitats in the Southeast were those areas subjected to frequent and large-scale disturbance regimes such as fire. Among the most important habitats is the shrub-scrub habitat is characterized by fire-prone vegetation under mature southern pine forests (including longleaf pine-southern scrub oak, wiregrass, bluestem, saw palmetto, cutthroat grass, ferns, gallberry, as well as pitcher plant bogs and remnant cedar glades. These areas are home to many vulnerable species most notably among birds Bachman's and Henslow's Sparrows (both treated under southern pine and grassland habitats respectively). The trend away from large clearcuts on both public land and non-industrial private lands in the South, the trend away from inefficient farming, and still too few efforts to restore natural ecosystem functions in those biotic communities requiring regular disturbance all point

to loss of birds dependent on shrub-scrub habitats.

***Priority species, species suites, and habitat requirements**:*

Species of concern in southeastern shrub-scrub habitat are Bachman's Sparrow, Henslow's Sparrow, Northern Prairie Warbler, Loggerhead Shrike, and Field Sparrow (all but the Prairie Warbler require a significant grassy component). Many of these species rank relatively high among species in need of conservation attention throughout the Southeast. Population trends for widespread breeding species associated with shrub-scrub habitats indicate overall decline of this fauna in the Southeast. Only 1 shrub-scrub species, the Blue Grosbeak, is definitely increasing in North America (Table 7). Blue Grosbeak along with Yellow-breasted Chat is also increasing in this physiographic area, but 6 of 12 species are decreasing (4 significantly).

Several shrub-scrub species warrant close management attention, some during both breeding and non-breeding portions of their annual cycle. Henslow's Sparrow populations require conservation attention on both breeding (coastal North Carolina) and wintering grounds (Lower Coastal Plain from North Carolina to Florida) in the Southeast (this species is treated above under grasslands and also under the Southern Pine section).

Northern Prairie Warbler. -- Some high priority shrub-scrub species such as Northern Prairie Warblers, are clearly more common today than they were at the turn of the century. However, this species still has a relatively small geographic distributions and are faced with rapid losses of stable shrub-scrub stands. In particular, the Prairie Warbler appears to have been a species largely associated with shrub-scrub understories of regularly disturbed loblolly-shortleaf pine as well as within South Atlantic Coastal Plain pocosins and maritime stands (Nolan 1978). The loss of these habitats through fire suppression and conversion to densely stocked pine plantations and agricultural super-farms during this century appeared to be compensated by the concurrent increase in old-fields and regeneration of forests through clearcutting. However, the overall loss of shrub-scrub in managed landscapes, including the suppression of natural fire regimes, is undoubtedly contributing to the decline of the

Northern Prairie Warbler (along with species such as Northern Bobwhite and American Woodcock).

Patch size is another consideration with shrub-scrub species. For example, Prairie Warblers are frequently absent from clearcuts less than 20 acres in size and appear to incrementally increase in densities, as do other shrub-scrub species, as clearcut size increases (to at least 100 acres in size; D. James, pers. comm.).

Bachman's Sparrow. -- Bachman's Sparrow appears to successfully use (*i.e.*, with high fecundity) early-successional habitats produced through clearcutting of both hardwoods and pine. However, unless there is a steady supply of these habitats over time, local populations will likely disappear within a few years. Bachman's Sparrows have been shown to move more frequently from one early-successional patch to another when an early successional corridor (tornado alleys, linear clearcuts) connects the two sites (Dunning et al. 1995). The same effect would most likely occur with appropriately managed powerline rights-of-way (i.e., infrequent mowing or use of herbicides). Specific management recommendations focusing on early-successional habitat are presented below. Otherwise, Bachman's Sparrows are best treated as a Southern Pine species and further discussion will be presented under the Southern Pine Section.

Field Sparrow. -- Field Sparrows are dependent upon scrub-shrub habitat while both breeding and wintering. Although common over most of the southeast region, this species is relatively uncommon in South Atlantic Coastal Plain except during winter. Nevertheless, Field Sparrows exhibit sharp declines in population numbers, and therefore is a species in need of some conservation attention in this area. Field Sparrows are a shrub-scrub species that may benefit from field borders and hedgerow management, especially during winter.

Northern Bobwhite. -- Northern Bobwhite is also a high priority species that will help drive habitat restoration, as discussed above under the Grasslands Section.

Other species.--Use of early-successional forest habitats by Loggerhead Shrikes and Henslow's Sparrows appears to be more specialized than for Prairie Warblers and Bachman's Sparrows, and are more closely associated with grass-dominated habitats as discussed above.

Population and habitat objectives:

Population objectives

Declines in Northern Bobwhite, Northern Prairie Warbler, and Field Sparrow should be halted within 5 years and populations stabilized to increasing within 20 years to pre-1975 levels.

Habitat objectives

Early-successional habitats should be reestablished in order to restore wildlife populations to pre-1980 levels (Capel et al. 1994). Regionwide goals include (1) establishing 2,625,000 acres of 5-year idled lands in native vegetation or grass-legume mixes, (2) establishing 2,625,000 acres of annual vegetation (forbs or annually established cover) and (3) establishing 4,550,000 acres of long-term (10-20 years) herbaceous/shrub cover. The last recommendation has the greatest potential for many nongame shrub-scrub species, especially if controlled burning is preferred over mowing as a management tool in these larger patches. Within the South Atlantic Coastal Plain region, habitat goals break down to (1) retaining 300,000 acres of 5-year idle lands, (2) 300,000 acres of annuals (forbs), and (3) 600,000 acres of 10-20 year herbaceous/shrub cover. These numbers serve as a starter for discussion, although existing range and acreage targeted for restoration within the South Atlantic Coastal Plain still needs to be determined. On a state-by-state basis, Georgia, South Carolina, and North Carolina each would retain 75,000 acres of 5-year idle lands, 75,000 acres of annuals, and 150,000 acres of long-term cover. Florida would retain 50,000 acres, 50,000 acres, and 100,000 acres respectively while Virginia's share (limited to the Dismal Swamp-Back Bay area) would be 25,000 acres, 25,000 acres, and 50,000 acres

of the above categories. The actual locations of these habitats would float across the landscape (Table 6).

Implementation recommendations and opportunities:

A common management recommendation for shrub-scrub habitats is to provide narrow shelterbelt (hedgerows) strips on farmland to reduce soil erosion from wind and to provide wildlife habitat for species like rabbits and Northern Bobwhite. Many wintering nongame bird species appear to do well in shelterbelts (e.g., sparrows). However, only one nongame breeding species (Blue Grosbeak) appears to successfully use shelterbelts, and this species is also the only shrub-scrub species now increasing in the Southeast. Most other species (e.g., Field Sparrow) show high susceptibility to breeding failure in shelterbelt-like habitat, even when present in high numbers (*i.e.*, illustrating an "ecological trap"). This breeding failure is undoubtedly due to the abundance of nest predators and brown-headed cowbirds associated with agricultural or highly fragmented landscapes. It is important to note that field borders are only a part of farmland management, and landowners should maintain other habitats (i.e., larger patches of fallow habitats, timber stands) to support breeding birds. Field borders alone may increase densities of wintering and breeding Field Sparrows, but may provide limited benefits for other birds (Marcus 1998). A continuing challenge for wildlife professionals will be to consider spatial arrangements and total coverage of 5-year idle lands and acres supporting annuals to minimize disruption of nesting success by nest predators.

If breeding shrub-scrub species are to benefit from Farm Bill and related programs, biologists must work with private landowners to restore appropriate habitat. Blocks of at least 50-100 acres in old-field or shrub-scrub condition would be of high priority. In addition, if strips are developed to diversify pine monocultures, target game species should benefit and these habitats would be expected to support healthier nongame bird populations as well.

Increasing concern for wintering American Woodcock also warrants close attention to providing early-successional habitats within the South Atlantic Coastal Plain.

Although forested wetlands are the dominant daytime habitat, many American Woodcock use (display, feed, roost) early-successional pine stands in the coastal plain of Georgia at night (Krementz et al. 1994, 1995).

Evaluation of assumptions:

Declining trends for many early-successional species in light of increasing clearcutting activity suggests that even-aged silviculture as now practiced (*e.g.*, heavy use of herbicides reducing hardwood shrub-scrub component supposedly "competing" with pines) may not be productive habitat for these species. Research focusing on site preparation after clearcutting and developing protocols leading to better bird habitat and still profitable pine regeneration is necessary.

Forested Wetlands: Floodplain (Alluvial)

Ecology and status:

Bottomland hardwood forests, alluvial forests, and swamp forests are among those biotic communities in the Southeast adapted to flooded conditions. Various combinations of oaks (especially, overcup, swamp chestnut, water, cherrybark, willow, and Shumard), water tupelo (gum), swamp tupelo, and baldcypress usually dominate the canopy of mature forests. Cottonwoods (eastern and swamp), willows (black and swamp), river birch, and elms dominate disturbed sites.

Major recognized wetland forest types within southeastern floodplains are: (1) cottonwood, (2) black willow, (3) overcup oak/water hickory, (4) sweetgum/willow oak, (5) sugarberry/American elm/green ash, (6) eastern sycamore/sweetgum/American elm, (7) willow oak/water oak/laurel oak, (8) swamp chestnut oak/cherrybark oak, (9) baldcypress, (10) baldcypress/water tupelo, (11) water tupelo/swamp tupelo, and (12) sweetbay/swamp tupelo/red bay (Sharitz and Mitsch 1993).

There has been extensive drainage and conversion of forested wetlands throughout the Southeast, from 45 million acres before the mid-1800's to 30 million acres in 1985, an overall decline of about 30% (Hefner et al. 1995). Almost all of the remaining 70% of forested wetland in the Southeast has been cutover at least once and frequently fragmented in the process. This fragmentation has been associated with greater losses of forest-interior and area-sensitive species (e.g., the now extirpated Ivory-billed Woodpecker and Bachman's Warbler) due to the almost complete elimination of large tracts of mature forest age-classes.

Outside the Mississippi Alluvial Plain, the largest remaining "relatively intact" forested wetland systems are all within the South Atlantic Coastal Plain. Protection of existing floodplain forested wetlands within the Roanoke, Winyah Bay (Pee Dee and Waccamaw), Francis Marion National Forest (Santee and Cooper), ACE Basin, Savannah, Altamaha, Lower Suwannee, and Apalachicola rivers should be top priority. Coupled with this should be the development of management guidelines that recognize the differing objectives of cooperating landowners within each system.

Priority species, species suites, and habitat requirements:

Species in need of conservation attention within the South Atlantic Coastal Plain in decreasing order of potential vulnerability include Swallow-tailed Kites**,** coastal populations of Black-throated Green Warblers, Swainson's Warblers, and Prothonotary Warblers. In addition, local populations of Cerulean Warblers and Florida Short-tailed Hawks occur as high priority breeding species in this area. Although Yellow-throated Warbler is not as high a priority species, it still warrants attention due to unclear population trends and association with very large and tall trees (fast disappearing from this physiographic area).

Despite encouraging population trends in some southeastern physiographic areas, the above species deserve continued attention because: (1) except for the Prothonotary Warbler, all are very local in distribution through much or most of their present range, (2) the Southeast is essential for continued stability throughout their entire distribution, (3) they are locally distributed within the greater landscape on breeding grounds, wintering grounds, or both; (4) a high level of threat is suspected or exists to their population health during breeding season, non-breeding seasons, or throughout the species annual cycle; and (5) there has been a widespread loss of suitable habitat during the last century.

Swallow-tailed Kite. -- The North American breeding subspecies of the Swallow-tailed Kite is clearly the most vulnerable nongame bird in the Southeast that is not presently Federally listed nor considered a candidate for listing. Total population size for this species is unknown but is certainly no more than 5000 individuals, and is possibly much lower (maximum of 1150 breeding pairs according to Meyer and Collopy 1990). This species was much more widespread and numerous at the turn of the century, suffering the most dramatic reduction of any still extant landbird species in eastern North America since then. Historically, the kite probably bred in 21 states, with concentrations in nine. It is now known to breed only in seven states, with concentrations only in peninsular and subtropical Florida (Meyer 1990, Meyer and Collopy 1990). In Florida, nesting and communal roost sites are key to the persistence of this species in North America (Meyer 1993). Between 45 and 65% of all Swallow-

tailed Kites can be found roosting during autumn migration at one site along Fish-eating Creek in south Florida.

Cerulean Warbler. -- In the Southeast's Upper Coastal Plain, the Cerulean Warbler is the most vulnerable neotropical migrant. This species persists in some numbers in the highlands and plateaus from the Southern Appalachians westward, but has been much reduced from its historical distribution as a breeding species in the southeastern coastal plain. Source populations of Cerulean Warblers require at least 10,000 acre tracts of mature forested wetlands (Hamel 1992b, Robbins et al. 1992). The only known South Atlantic Coastal Plain population persists along natural levee forests the Roanoke River in North Carolina. The population size is unknown, but could be 50 pairs today, with potential existing for 100 pairs (M. Lynch, 1996, TNC, pers. comm.).

Swainson's and Prothonotary Warblers. -- Swainson's and Prothonotary Warblers are the most highly ranked species occurring throughout the southeastern coastal plain. They also occur locally in riparian forests into the Piedmont and other more interior physiographic areas (Table 8). Within the coastal plain, source populations of these species probably require 6,000 acres of mature forested wetlands within forest dominated (10,000 acres in agriculturally-dominated) landscapes and 4,000 acres (7,000 in agriculturally-dominated areas) respectively. Forested wetland patches surrounded by pine-dominated forests are clearly superior to similar wetlands surrounded by other land uses (Kilgo et al. 1999)

Florida Short-tailed Hawks. -- Florida Short-tailed Hawks apparently are regular breeders within and around the Lower Suwannee River National Wildlife Refuge. This area, extending south into Citrus County (Peninsular Florida), is considered one of the six known important breeding locations of the species, although the number of pairs involved is unknown (Millsap et al. 1996). Florida Short-tailed Hawks may also occur and breed in the vicinity of St. Mark's National Wildlife Refuge between the Aucilla and St. Mark's Rivers.

Yellow-throated Warbler--This warbler is associated with very large, tall, and often old trees, especially cypress, loblolly pine, live oak and other hardwoods. With

past removal of most tall trees and future emphasis on shorter harvest rotations, this species may become more vulnerable than its present status suggests.

Population and habitat objectives:

Population objectives

Species-specific goals include (1) increasing kite nest site habitat to support at least 8 kite populations of at least 200 breeding-aged kites each and (2) increasing structural diversity to support a healthy Cerulean Warbler population of at least 100 pairs along the Roanoke River, and at least 30 Swainson's and 60 Prothonotary Warbler populations among all systems.

About 100,000 acres of mature forested wetland in the coastal plain appear to be necessary to support between 80-100 kite pairs (Cely and Sorrow 1990). However, most known occupied areas in forested wetlands within the South Atlantic and East Gulf Coastal Plain physiographic areas are embedded within 400,000 acres or more of forest (much of which is pine). Maintenance of at least 200 breeding-aged kites in the 13 major southeastern coastal plain floodplains is necessary to lead towards a secure status of the Swallow-tailed Kite in the Southeast Region. Eight of these populations are expected to come from this physiographic area (Table 9). Focus areas include (1) Winyah Bay (Pee Dee and Waccamaw Rivers; small known population), (2) Francis Marion National Forest (Santee and Cooper Rivers; large population, at least prior to Hurricane Hugo), (3) ACE Basin (present, population size unknown), (4) Savannah (present, population size unknown), (5) Altamaha (including all other coastal Georgia drainages; present population unknown), (6) Okefenokee Swamp to Osceola National Forest (local status unclear), (7) Lower Suwannee to Aucilla (large population), and (8) St. Mark's to Apalachicola (present, population size unknown) Rivers. Desired densities for Swainson's Warblers in at least suitable forested wetland habitat should range 6-11 pairs per 100 acres and 11-19 for Prothonotary Warbler.

Among the 30 (including non-alluvial) sites to support 500 pairs of Swainson's Warbler, major (and often multiple) populations now exist in (1) Dismal Swamp, (2) Roanoke River, (3) Albemarle-Pamlico, (4) Croatan National Forest, (5) Pee Dee River,

(6) Santee-Cooper Rivers, (7) ACE Basin, (8) Savannah River, (9) Ocmulgee, (10) Oconee, (11) Altamaha, (12) Pinhook Swamp, and (13) Apalachicola.

Habitat objectives

Forested floodplain wetlands in the South Atlantic Coastal Plain should be maintained or restored to reach goals of predominantly mature forests in at least (1) 10 patches >100,000 acres, (2) 15 patches >20,000 acres, (3) 7 patches >10,000 acres, and (4) 30 patches >6,000 acres.

Implementation recommendations and opportunities:

Active management to improve Swallow-tailed Kite habitat conditions within existing forested wetland systems and restoration of other systems will improve the stability of this species. Specifically, management should focus on increasing kite nest sites, small (5-10 acres) stands of >100 foot tall loblolly pines (or other trees) overlooking surrounding woodlands. The importance of private lands for conserving American Swallow-tailed Kites should not be overlooked. In Florida, about 70% of all potential habitat for this species is found on private lands (Cox et al. 1994). Forest Stewardship/Incentive programs with private landowners in these floodplains should emphasize retention of scattered patches of mature and tall (70-90 ft) pine (loblolly along floodplain edges and slash in savannas) and sometimes hardwoods (often sweetgum) in addition to some open areas for foraging. These habitat requirements are conducive to several silvicultural options for regeneration, but only within a largely forested landscape context. Efforts should be made to monitor kite response to landowner practices and to establish better population estimates along the entire South Atlantic Coastal Plain. Surveys are currently completed or underway proposed for the Lower Suwannee River, Florida (Sykes et al. 1999) and Altamaha River, Georgia (Meyer et al. in prep.). Hopefully surveys will be underway soon for the Apalachicola River, Florida, Okefenokee Swamp and Upper Suwannee River, Georgia-Florida, Savannah River, Georgia-South Carolina, and Winyah Bay, South Carolina. Additional research and monitoring priorities are being prepared by Ken Meyer (Gainesville, Florida on behalf of the International Swallow-tailed Kite working group).

Cerulean Warblers require the largest stands of hardwoods in mature condition (Hamel 1992b, Robbins et al. 1992). However, this species persists on commercial forests in which harvests mimic tree fall gaps (Hamel 1992b). If timber volume targets are exceedingly high, uneven-aged management may result in excessive fragmentation when roads and surrounding landscapes are considered. In this case, larger regeneration cuts than used in group or single tree selections (e.g., 20-40 acres) along with long rotations (e.g., 150-200 years) may better achieve maintenance of large

mature hardwood stands over time, as long as intermediate cuts allow for big trees to emerge forming a complex canopy cover. Where bird conservation objectives are paramount over other forest management objectives, working toward complex canopy structure, patches of large super-emergent trees, and a patchy dense understory are preferred targets for future desired condition.

Swainson's Warbler habitat is best described as having extremely dense understories with moist exposed soil. Historically, old-growth conditions produced habitat among numerous tree-fall gaps and storm-damaged areas. The even-aged nature of most hardwood stands today generally lack understory structure suitable for this species after 20 years of growth. However, suitable structure can be produced in forested wetlands where medium-sized clearcut areas (e.g., 10-20 acres) are moving into pole stage and where thinning closed canopies allows for light to hit the ground. Thus, silvicultural options exist for managing this and associated species on public lands dedicated to wildlife, but some of these options may preclude supporting suitable habitat for species associated with complex canopy structure. Only old-growth like conditions can support enough habitat to support both understory and canopy associated specialists such as Swainson's an Cerulean warblers in proximity to each other (e.g., Roanoke River).

Issues other than silviculture are important in conserving forested wetland habitats suitable for Swainson's Warbler. Unfortunately, most of the historical sites not otherwise already protected supporting large Swainson's Warbler populations are now considered subject to development. Fortunately, large areas of private land remain in forest products industry ownership and many of these companies are active in managing bottomlands with birds in mind (e.g., International Paper, Weyerhauser, Westvaco, Georgia-Pacific [The Timber Company]) and often support healthy Swainson's Warbler populations. Other sites most conducive to restoration (less productive cropland, *i.e.*, more frequently flooded) may result in relatively narrow zones within a ridge and swale topography. However, the larger the forested wetland site, the more likely enough high ground will be included to support healthy Swainson's Warbler populations.

Prothonotary Warblers should be the most secure of these high priority species, generally numerous anywhere moderately large forested wetlands persist with flooding throughout the breeding season.

Florida Short-tailed Hawks spatial requirements should be met with Swallow-tailed Kite management, although specific management recommendations for nesting and foraging habitat may be different. This species is peripheral within the South Atlantic Coastal Plain. While the Lower Suwannee River population is important, it is treated more completely as part of the Peninsular Florida Bird Conservation Assessment. However, if Florida Short-tailed hawk is shown to be regular in the St. Mark's area, special consideration for its continued stability would be warranted.

Spatial requirements for source populations of Swallow-tailed Kites, Cerulean Warblers, Swainson's Warblers, and Prothonotary Warblers should be adequate to support source populations of less area-sensitive associates in mature forested wetlands. Habitat patches too small even for a source population of Prothonotary Warblers may still benefit these other species.

Spatial requirements above should support healthy Yellow-throated Warbler populations, but special attention to retaining very large, tall, often very old, cypress and loblolly pine in floodplains should be emphasized as much as possible. Again loblolly pine as a naturally occurring component of bluffs and floodplain ridges can double as present and future kite nest sites.

Evaluation of assumptions:

An assessment of habitat patches exceeding the hypothesized 10,000 acre minimum needed to support source populations should be undertaken. This would provide an estimate of the number of potential Cerulean Warbler source populations that could be supported within the coastal plain. If insufficient source populations are found, then additional habitat patches could be established through improved habitat management or reforestation. Research should focus on the extensive and complex canopy structure of the Roanoke River floodplain in order to assess similar structural qualities elsewhere.

Forested Wetlands: Pocosins, Carolina Bays, Other Non-Alluvial

Ecology and status:

Pocosins are made up of shrub-scrub ("low"), often dominated by pond pine, and forested ("high") dominated by bays, associated wetlands, and associated uplands (from canebrakes to Atlantic white-cedar). These areas are unique to the Southeast and are restricted mainly to Virginia and North Carolina (except for smaller areas in the Winyah Bay area of South Carolina). Seventy percent of a estimated 3.5 million potential pocosin acres are located in North Carolina (Richardson and Gibbons 1993). However, less than one third of the original acreage can now be considered intact, with about another one third irrevocably altered (Richardson and Gibbons 1993). In coastal North Carolina, nearly all of the forested wetlands, much of which were pocosin, were converted to non-wetlands uses (e.g., conversion to pine plantations; Hefner et al. 1995). Today, major timber companies own over 40% of pocosin habitats in North Carolina (Sharitz and Gibbons 1982). More dramatically, both canebrake and Atlantic white cedar (the two successional extremes within pocosin situations) have been reduced to one percent of their original pre-settlement occurrence (Frost 1995). Fire suppression led to the decline of canebrake and pond pine, while Atlantic-white cedar, occurring in pocosin areas with low fire frequency (usually over 100 years between fires), was converted for agriculture and timber production.

Carolina bays occur from extreme southeastern Virginia to south Georgia. Prior to European colonization, there were probably 10,000-20,000 Carolina bays, mainly found in South Carolina. Presently, few Carolina bays can be considered untouched by deleterious human activities. Both pocosins and Carolina bays have been converted to farmlands, pine (principally) or hardwood monocultures, or lost to peat mining. In addition, areas around Carolina bays are highly susceptible to commercial and residential development (Richardson and Gibbons 1993).

Priority species, species suites, and habitat requirements:

Black-throated Green Warblers, Swainson's Warblers, Prothonotary Warblers, and Worm-eating Warblers are among the species requiring attention in non-alluvial

wetlands. In addition, Ovenbirds, American Redstarts, and Black-and-white Warblers are locally important in pocosins and Carolina Bays. All of these species (except Prothonotary) are apparently isolated from Appalachian population centers. In pond pine dominated pocosins, a number of pine specialists may be supported, including Red-cockaded Woodpecker, Brown-headed Nuthatch, Red-headed Woodpecker, and Chuck-will's-widow. Interestingly, pocosins subject to frequent fire is one of the few habitat types that legitimately support both priority pine specialists (associated with the open pine canopy) and otherwise forested wetland specialists (associated with cane and/or dense shrub layer).

Wayne's Black-throated Green Warbler. -- Wayne's Black-throated Green Warbler populations in the South Atlantic Coastal Plain are found from the Dismal Swamp in southeastern Virginia south through Francis Marion National Forest in South Carolina. Black-throated Green Warblers appear to be restricted to largely forested areas, so estimates to support source populations are probably similar to those for Cerulean Warblers in alluvial systems. However, Black-throated Green Warbler populations are largely found within non-alluvial and transitional forest types, and are therefore best treated here under this section. Optimal habitat includes mature forested wetlands, associated mature upland forests on major floodplains, and remnant large pocosin and Carolina bays. Within these habitats, this species is most commonly associated with mature (older growth) cypress and Atlantic white-cedar. However, Black-throated Green Warblers can also be found in pure stands of hardwoods and mixed pine-hardwood areas in surrounding wetlands (Hamel 1992a).

In particular, the Albemarle-Pamlico area (Alligator River National Wildlife Refuge) and Croatan National Forest and surrounding areas still seem to support relatively large populations of Black-throated Green Warblers, while populations elsewhere appear to be in serious trouble. At least in this area, some researchers, knowing of this species' association in the Appalachians with high densities in late successional cold-temperate conifers (hemlock, spruce, eastern white pine) speculate that old-growth Atlantic white-cedar may have been important for maintaining the past relatively high abundance of this species in North Carolina and Virginia portions of this

physiographic area (B. Watts, pers. comm.).

Present use of cypress and transitional forested habitats may not represent optimal conditions. However, use of cypress and transitional forests (again older-growth conditions) is historically the primary conditions under which this species occurs within the Coastal Plain in South Carolina where the distribution of Atlantic white-cedar shifts westward into the Carolina sandhills, while the warbler remains mostly restricted to the lower coastal plain. Although still present, populations within the Francis Marion National Forest have apparently declined since Hurricane Hugo (J. Cely, C. Watson, pers. comm.) and the status of this species in South Carolina is now unclear.

Red-cockaded Woodpecker. -- A few Red-cockaded Woodpecker family groups persist where pond pine and relatively frequent fires (13-25 year) cycles occur. Alligator River National Wildlife Refuge may support up to 10 family groups, with additional groups perhaps occurring between Pamlico Sound and the North Carolina-Virginia border, with potential for expansion westward towards the Suffolk scarp. The Suffolk Scarp functionally serves as the western boundary of this most expansive non-alluvial forested wetland system, outside of the Okefenokee Swamp in Georgia, which also supports red-cockaded woodpecker on longleaf pine dominated islands within the swamp and longleaf-slash pine flatwoods surrounding the swamp.

Other pine-associated species. -- In well managed (i.e., subject to frequent burning) pond pine pocosin, Brown-headed Nuthatch, Red-headed Woodpecker, and Chuck-will's-widow are likely to be supported in good numbers. Maintaining some pocosin sites in grassy/cane condition (which represents the results of severe stand replacement fires prior to European settlement) may be important for breeding Henslow's Sparrow (but surveys are needed) and may be important for supporting healthy Northern Bobwhite populations as well.

Population and habitat objectives:

Population objectives

Habitat and population objectives for typically hardwood non-alluvial priority species are addressed in the previous discussion of Forest Wetlands (Alluvial), except

for Wayne's Black-throated Green Warbler with 10 populations between Dismal Swamp and the lower Edisto River, in Colleton-Dorchester-Charleston Counties.

For pine associated species, proposed population objectives (all for the southeastern Virginia, northeastern North Carolina area) are to have 250 groups of Red-cockaded Woodpecker, which should also support healthy populations of Brown-headed Nuthatch (densities in optimal habitat average 11 pairs per 100 acres). Sites in more grassy conditions should support at least an average of 7 coveys per 100 acres and more importantly support nesting Henslow's Sparrow populations. An objective for breeding sparrows of supporting at least 1000 pairs described in the Grasslands Section will need to mostly come from "grasslands," normally supporting pine (primarily pond pine).

The status of birds in formerly pocosin areas (i.e., commercial pine forests) should be assessed. Species appearing to be stable in commercial pine, former pocosin habitat, include Yellow-billed Cuckoos, Acadian Flycatchers, Worm-eating Warblers, Hooded Warblers, and Prairie Warblers. However, loblolly pine stands managed for sawtimber under these treatments are still less than 20 years old. The three highest priority species (Black-throated Green, Swainson's, and Prothonotary Warblers) dependent on large patches of tall pocosins and other forested wetlands have yet to show consistent use of commercial pine stands, but potential is there under certain conditions to support both hardwood understory species and pine overstory species (with the likely exception of Red-cockaded Woodpecker due to short harvest rotations on industry lands) as in pond pine pocosins (Watts 1999).

Habitat objectives

Efforts should focus on establishing patches of mature forested wetlands of at least 10,000 acres for Black-throated Green Warblers source populations; 6,000 acres for Swainson's Warblers (10,000 in agriculturally-dominated landscapes); and 4,000 acres for Prothonotary Warblers (7,000 in agriculturally-dominated landscapes). The spatial requirements of Black-throated Green, Swainson's, and Prothonotary Warblers should be adequate for source populations of less area-sensitive species.

General habitat objectives include (1) restoring and maintaining 47,000 acres of Atlantic white cedar in eastern North Carolina and Virginia, (2) minimizing further conversion of pocosins to other non-forest land uses, (3) maintain at least 5000 acres of pocosin "grassland," (4) improve 40,000 acres of pond pine through more aggressive prescribed fire and (5) encouraging habitat management recommendations provided under the Short-rotation Pine discussion in areas where pocosins have been converted to plantation pine.

Implementation recommendations and opportunities:

On drier sites within "natural" pocosin situations, forest management (e.g., burning to promote cane growth) providing for understory vegetation structure is important for Swainson's Warblers (e.g., Great Dismal Swamp; Gary Graves, Smithsonian Institution). Restoration of Atlantic white-cedar and other pocosin-related vegetation is underway within the Albemarle-Pamlico Bay Estuary Partnership (primarily within Pocosin Lakes National Wildlife Refuge) and through the Virginia Beach Agricultural Reserve (areas between Great Dismal Swamp and Back Bay National Wildlife Refuges). In addition, fire management to restore the range of structural and compositional diversity of pre-settlement pocosins is important. Frost (1995) provides information for the restoration of pre-settlement conditions based primarily upon organic matter (peat) depth and fire frequency. Of particular note, the national wildlife refuges (Dismal Swamp, Pocosin Lakes, and Alligator River) and national forests (Croatan) of eastern North Carolina are presently undergoing natural resource planning and these public lands support a large percentage of remaining pocosin habitat. However, a greater emphasis on both more aggressive prescribed burning in support of pond pine and more aggressive efforts at Atlantic white-cedar restoration (in sites unlikely to be burned in cycles of 100 years or more) must be the subject of effective site designations and allocation of resources.

Two very important and unique non-alluvial wetland systems now under protection are Dismal Swamp and Okefenokee National Wildlife Refuges, Virginia-North Carolina and Georgia respectively. Both these areas still require substantial

management attention especially through prescribed fire, as well as through appropriate silvicultural practices, the latter especially at Dismal Swamp where diversifying the structure and composition of hardwood stands and restoration of Atlantic white-cedar need to be high priorities for future action.

Management of pine for pulp-paper production or sawtimber, while not yet demonstrably beneficial to the highest priority species (i.e., Black-throated Green, Swainson's, and Prothonotary Warblers) could provide suitable habitat for many nearctic-neotropical migrants (e.g., Ovenbirds, Yellow-billed Cuckoos, Acadian Flycatchers) where hardwoods proliferate in the midstory. These nearctic-neotropical migrants would benefit from pine plantations with a dense hardwood understory and midstory (Johnston and Odum 1956, Meyers and Johnson 1978). In addition, optimum management of nearctic-neotropical migrants within pine plantations would include retention of some "natural" pocosin vegetation patches. Research should continue on converted pocosin-commercial pine communities (e.g., B. Watts - Weyerhauser, R. Lancia and J. Gerwin - International Paper and Westvaco). In contrast, removal of hardwoods and larger spacing of plantation loblolly pines is shown to increase pine associated priority species (especially, Brown-headed Nuthatch and Chuck-will's-widow, Wilson and Watts 1999, Watts 1999).

Evaluation of Assumptions:

Although concern for the future of remaining pocosin communities is justified, there is evidence that converting "natural" pocosin vegetation to loblolly pine can have neutral to positive results for some of the more vulnerable neotropical migrants. Conversion from hardwoods to pine or pine-hardwood mix, with appropriate management, is clearly better than no forested habitat at all. However, the benefits to nearctic-neotropical migrants in these habitats would seem less valuable than restoration and appropriate management of optimal forested wetlands.

Maritime Communities: Maritime Forest/Scrub-shrub

Ecology and Status:

Maritime communities are interconnected complexes of dunes and beaches, scrub-shrub, woodlands, estuaries, and open ocean. Each provides habitats for different subsets of vulnerable species. Emphasis here will be placed on maritime forest and shrub/scrub issues.

Maritime woodlands are found on the leeward side of shrub-scrub thickets or on the bay side of islands. Maritime woodlands are relatively tolerant of salt spray, bright sunlight, wind shear, drought conditions, and nutrient-poor soils. Most sites are dominated by oaks, pines, red bay, and numerous understory shrubs and are referred to as coastal hammocks or temperate broad-leaved evergreen forests, and are considered a part of southern mixed hardwood or temperate hardwood forest types (Platt and Schwartz 1990, Ware et al. 1993). Climax maritime woodlands are characterized by live and laurel oaks with sweetbay as a co-dominant. The presence and dominance of live oaks are indicative of the most advanced successional stage among maritime woodlands. These advanced woodlands are today largely restricted to the Atlantic Coast, especially on the Sea Islands. Alternatively, the presence and dominance of laurel oak, young loblolly, or slash pine is indicative of younger successional stands. Successional scrub-shrub on old stable dunes are frequently dominated by saw palmetto (North Florida Atlantic), yaupon holly, and wax myrtle growing in dense thickets.

Historical maritime communities, comprising about 1.6 million acres in the Southeast, have undergone dramatic changes since European/African colonization. Native Americans influenced the condition of maritime communities, but the permanent settlements and commerce centers of colonization changed the nature of human interaction in these areas. Today, the extent and rate of recovery of maritime communities from natural disturbances is dependent upon human history (both Native and European/African) as well as dredge and fill beach/dune operations and development pressure.

As of the mid-1970's, less than 10% of maritime landcover was in forest (most

remnants now in Sea Islands, N. Florida Atlantic, and Central Gulf). Wetlands made up over 50% of landcover, with smaller percentages in dunes and beaches, rangeland, agriculture, and urban areas. Although loss of coastal wetlands has slowed since the 1970's, development of coastal areas continues, to the detriment of upland maritime woodlands, dunes, and beaches (Culliton et al. 1990, Moore et al. 1993). Development is most obvious along the Florida Atlantic Barrier Islands (over 50% of present lands use) and least obvious among the Sea Islands (less than 10%). Almost all maritime woodlands that have not been removed completely have been altered.

Maritime forest and scrub-shrub habitat is perhaps most important for neotropical migratory landbirds moving to and from their Caribbean and Latin American wintering grounds. However, unpredictable factors (i.e., weather) have made it difficult to quantify the importance of specific areas at any one time. Thus, conservation must be measured in terms of decades with the assumption that all forest patches are potentially important, until better techniques provide resolution of concentration sites.

Priority species, species suites, and habitat requirements:

In maritime shrub-scrub and woodland habitats, Eastern Painted Buntings and several nearctic-neotropical migrants are high priority species. Maritime shrub-scrub can support small populations of Prairie Warblers, at least in North and South Carolina barrier islands. These habitats formerly were strongholds for Common Ground-Dove from South Carolina to Florida, but this species has undergone severe reductions in South Carolina and is suspected of declining elsewhere (John Cely, SC, pers. comm.). Mature maritime woodlands are important for breeding Yellow-throated Warbler and Northern Parula populations, especially where oaks are draped with Spanish moss that provides nest sites. Both habitats are necessary for migration of many neotropical species.

Eastern Painted Bunting. -- Along the South Atlantic coast, edges of maritime woodlands and shrub-scrub provide important habitat for Eastern Painted Bunting (presently treated as a subspecies, but better thought of as a full species, Thompson 1991), and probably support the vast majority of breeding pairs. Buntings are most

abundant around the Sea Islands of Georgia and South Carolina, but are fairly common in the adjacent mainland (roughly parallel to U. S. Highway 17 and eastward), north into coastal North Carolina (Brunswick to Carteret Counties), and south into northeast Florida (Nassau and Duval Counties within the South Atlantic Coastal Plain). Buntings become uncommon and local or occur sporadically farther inland along some river systems (most notably Savannah, Altamaha/Ocmulgee, and St. Mary's). More recently, Breeding Bird Atlas work in South Carolina has documented buntings as being more numerous and widespread than previous thought in fallow fields, woodland edges, and hedgerow habitat of the inner (upper) coastal plain, at least west of the Santee River (John Cely, pers. comm.). However, both Breeding Bird Surveys (-3%, $p<0.01$, n-27 routes) and Christmas Bird Counts (significant decrease in 12 of 25 counts, with one significant increase) show steep population declines since the early 1970's (Jim Cox pers. comm., Cox 1996). Despite documentation of a broader distribution, the Eastern Painting Bunting remains one of the most locally occurring high priority species within the Southeast.

Eastern Painted Buntings are associated with maritime shrub-scrub habitat mixed in a woodland setting. The species is mostly absent from forests with no understory development and from large patches of scrub-shrub habitat separated from large woodland patches (inland observations appear to contradict the above description). In addition, grassy fields may be important for post-breeding foraging adults and fledglings (D. Browning and L. Hartis, USFWS, pers. comm.). Because the Eastern Painted Bunting is an edge species, populations may be particularly vulnerable to increased nest parasitism by Brown-headed Cowbirds and increased nest depredation. Coastline development may contribute to higher levels of nest parasitism and nest predation; however, actual causes for Eastern Painted Bunting declines remain unclear.

Recent work has been initiated on eastern Painted Bunting demography on relatively well protected sea islands of Sapelo and St. Catherine's in Georgia (Duncan 1999, Springborn 1999). Preliminary results indicates few problems with nest predators or cowbirds in these protected areas, but variations in climate from year to year and the

lateness in which buntings breed suggest that buntings could be prone to global climate change. Climatic effects combined with suspected high nest parasitism and depredation in mainland populations occurring in areas of rapid development do not lead to optimism for the future of the species along the Atlantic coast away from sea islands**.**

Common Ground-Dove. -- Although not at present recognized as a high priority species, the documented steep declines of the southeastern subspecies in Florida (where still common) and range reducing declines on both the northern and western distributional extremes (South Carolina, Alabama and Mississippi, respectively) may warrant higher levels of conservation attention than this taxon is now afforded (Cely and Glover 2000). Suggestions have been made that where Common Ground-Doves are most common are in the same areas where beach front shrub-scrub has been most developed, exposing this species to heavy depredation by domestic cats and other predators.

Transients. -- Many nearctic-neotropical migratory landbirds orient southeastward during autumn migration to their tropical (primarily West Indian and South American) wintering areas. The South Atlantic coastline and Peninsular Florida, particularly maritime woodlands, appear to be critically important during this migration. The vast majority of Bicknell's Thrushes, Cape May, Black-throated Blue, Wayne's Black-throated Green (coastal populations), and Connecticut warblers in particular would appear almost totally dependent on the South Atlantic coastline and Peninsular Florida at some point during autumn migration. In addition, all Federally endangered Kirtland's Warblers presumably migrate to and from their Bahamian wintering grounds crossing the South Atlantic coastline (centered through the Sea Islands). Gulf Coast maritime woodlands are more important than South Atlantic woodlands for most spring migrants, and support large number of autumn migrants as well (Moore and Woodrey 1995). Despite these generalities, each nearctic-neotropical migrant species has its own distinctive seasonal pattern of migration during fall (August - October) and spring (late March-late May).

Population and habitat objectives:

Population objectives

Stabilizing or reversing population declines for eastern Painted Buntings and Common Ground-Doves should be achieved in 20 years. Of particular importance is demonstrating stability for Painted Bunting populations on sea islands, especially in Georgia and South Carolina. Measure of reproductive success should be used to gauge population health (e.g., average 4 young per successful nest). Autumn migration monitoring should be increased to reveal population trends of transients along the Atlantic coastline.

Habitat objectives

Existing high quality maritime woodland and shrub-scrub habitats should be maintained and protected. High quality habitat is defined as largely forested areas with some edge and forest openings for buntings, and stands exhibiting structural diversity and large amounts of fleshy fruit. Further determination of specific objectives requires a better understanding of present status information for both breeding and transient species. In the meantime, programs targeting both public land managers and private landowners to provide adequate cover, food (especially native fleshy-fruit bearing plants), and water in landscaping should be encouraged.

Implementation recommendations and opportunities:

Southeastern maritime communities can be divided into discrete conservation planning units (modified from Stalter and Odum 1993, Gosselink et al. 1979, Sandifer et al. 1980). Planning units within the South Atlantic Coastal Plain include (1) South Mid Atlantic Barrier Islands (Cape Henry, VA to North Island, SC), (2) Sea Islands (Cat-South Islands, SC to Cumberland Island, GA), (3) North Florida Atlantic Barrier Islands (Amelia Island to the St. Lucie Inlet, including St. Johns River), and (4) Central Gulf Barrier Islands and Coastline (Horseshoe Point, FL to Cat Island, MI, including St. Vincent Island).

Almost all eastern nearctic-neotropical migrants must pass through the

Southeast at least once annually. Their survival is dependent upon a healthy distribution of maritime or other near-coastal woodlands (Moore et al. 1993). Management and habitat restoration strategies for nearctic-neotropical migrants using coastal areas must consider both the extent and condition of maritime woodlands and inland forests (especially bottomlands). A separate conservation planning initiative that treats the entire southeast as a conservation unit for migratory landbirds is under development (Hunter and Woodrey, in prep.).

Because such varied management philosophies (e.g., hunting vs. no control over feral or game species; natural erosion/accretion vs. nourishment; grazing vs. fire management) exist in maritime communities, biologists and landowners need a more regional view of what is necessary to maintain vulnerable species. The Sea Islands of Georgia and South Carolina provide an excellent opportunity to work with a number of private and public lands operating under differing management philosophies. A cohesive and cooperative assessment of management techniques in these areas may provide insight into such a regional view.

Perhaps a healthy balance among the Sea Islands presently exists, or perhaps certain natural resource elements are in steep decline and none of the current management strategies adequately addresses the problem. In the latter case, the most flexible Sea Island managers may be able to make adjustments to better secure the resource in question. Other managers would continue with current practices to ensure the integrity of other important natural resources. This process would (1) bring together a group of experienced managers and landowners, (2) assess the health of the natural resources of common interest regionally (not one island at a time), (3) identify the natural resources most at risk, and (4) lead to a definition of roles and responsibilities based on opportunities consistent with differing management philosophies. The strengths of these considerations can lead to many conservation opportunities working with private landowners and local communities.

Evaluation of assumptions:

Research on migrating landbirds and nesting species (e.g., Eastern Painted

Bunting) as well as other priority species (e.g., Common Ground-Dove) should provide many opportunities for partnerships along the South Atlantic coast. For example, many fruiting plants are becoming increasingly known as important food sources for neotropical migrants. Restoration of habitats ranging from live oak woodland to residential backyards should include native fruit-bearing shrubs, vines, and trees.

More specifically, research on habitat selection, reproductive success, and taxonomy of Eastern Painted Buntings is critical in maintaining and improving populations. Presently, a study on the reproductive success of the bunting and other shrub-scrub maritime breeding species has been initiated (Joe Meyers, USDI Biological Resources Division, Athens, GA). Another study has been initiated to track bunting return rates to feeders in breeding areas from North Carolina to Florida, which includes also observations from feeders in the Bahamas and possibly work in Cuban wintering populations as well (Paul Sykes and Joe Meyers, BRD, in progress). In addition, public outreach programs such as Project Bunting Watch solicit observations of buntings and cowbirds from feeder watchers in Florida and now in Georgia. Similar programs may need to be initiated in South Carolina to complete coverage for this species.

Some attention to predator control (such as the “Cats Indoors” sponsored by the American Bird Conservancy) should be used to test the idea that Common Ground-Doves are declining due to high levels of nest depredation.

Finally, an extensive number of point counts have been established for monitoring breeding birds in Georgia maritime habitats (E.J. Williams, Georgia Wildlife Resources Division). Hopefully, similar efforts will be expanded to other South Atlantic Coastal Plain states.

Maritime Communities: Estuarine Emergent Wetlands

Ecology and status:

Estuaries, which include tidal flats and emergent wetlands, border maritime woodlands in many areas. Estuaries separate islands from each other or from the mainland and are well known for their importance to commercial fisheries and as

environmental filters. In addition, tidal flats are important foraging areas for many migratory and wintering waterbirds, colonial nesting birds, and raptors. Estuarine emergent vegetation provides cover and foraging for both nesting and wintering species such as rails, bitterns, wrens, and sparrows.

Priority species, species suites, and habitat requirements:

Saltmarsh and Nelson's Sharp-tailed Sparrow. -- The Saltmarsh Sharp-tailed Sparrow, Nelson's Sharp-tailed Sparrow, Seaside Sparrow complex, and both Black and Yellow Rails are species of concern in emergent wetlands.

The recent taxonomic decision to split the Sharp-tailed Sparrow complex into two species catapulted the Atlantic coast breeding Saltmarsh Sharp-tailed Sparrow into a extremely high priority category, due in large part to its limited breeding range (Greenlaw 1993). Two subspecies are recognized, with *A. c. caudacutus* breeding from the middle Maine coast to southern New Jersey, and *A. c. diversus* breeding from southern New Jersey to Virginia and possibly to North Carolina. Both subspecies winter primarily within the South Atlantic Coastal Plain, including the Gulf portion west to St. Vincent Island. Thus, this physiographic area represents the center of winter abundance for the entire species.

Nelson's Sharp-tailed Sparrow (which also has been elevated in priority by the split) breeds in three disjunct areas: northern Great Plains and Prairie Provinces (*A. nelsoni nelsoni*); southern end of James Bay (*A. n. alterus*); and in southern Quebec, the maritime Provinces, and eastern Maine (*A. n. subvirgatus*). The latter two subspecies are basically restricted to the South Atlantic Coast from North Carolina to northeastern Florida during the winter. In contrast, *A. n. nelsoni* is most abundant on the Gulf Coast west of St. Vincent Island. However, sizeable populations of *A. n. nelsoni* also occur along the Atlantic coast, the Big Bend Region of Florida, and south into Peninsular Florida.

Seaside Sparrows. -- The Seaside Sparrow is resident to partly migratory all along the South Atlantic coast. Although Atlantic coast populations are presently divided into three subspecies, evidence has accumulated that these should be

combined (McDonald 1988). *Ammodramus maritimus maritiums* breeds from the Albemarle Sound north to Massachusetts and winters south into northeast Florida; *A. m. macgillivraii* is a resident south of Albemarle Sound to Camden County, Georgia; and *A. m. pelonota* is a resident of northeast Florida. Another subspecies (*A. m. juncicola*) is represented in the Big Bend region of Florida west to St. Vincent Island, which similarly may be combined with other Gulf coast subspecies (principally *A. m. peninsulae*). Genetic analysis on the Seaside Sparrow complex suggests that the Gulf and Atlantic coast complexes may represent separate species (undoubtedly they would under the Phylogenetic Species Concept; Avise and Nelson 1989).

Seaside Sparrows along the Atlantic Coast are associated with extensive tidal marshes occurring behind barrier and sea islands and vegetated chiefly by saltmarsh cordgrass along with black needlerush. Seaside Sparrows (as well as Black Rails) seem to be tolerant of early invasions of shrubs (seep-willow, mangroves in Peninsular Florida). As shrubs become more dominant, sparrows and rails will abandon salt marshes (e.g., populations of seaside sparrows were lost between Mantanzas Inlet and Ponce inlet on the Atlantic by 1959).

Black Rail. -- Black rails have a complicated distribution, in large part due to their cryptic nature. However, the South Atlantic Coastal Plain is probably an important physiographic area overall for this species. Resident populations are known from North Carolina, South Carolina, and the Gulf Coast of Florida within this physiographic area. Black Rails may also be resident in appropriate habitat within Georgia, northeast Florida, and Virginia as well. Wintering populations of Black Rails from the midwest or from further north along the Atlantic seaboard are thought to move into these areas and areas where resident populations already exist. In unmanaged tidal marsh in South Carolina and Florida, Black Rails showed preferences for thick patches of black needlerush. In managed tidal marshes, this species was associated with infrequently flooded (water levels rarely exceed a few inches) "high" marsh with predominately clumps of shorter cordgrass, saltmarsh bullrush, glassworts, and salt grass (Cely et al. 1993, Eddleman 1996).

Yellow Rail. -- A large proportion of Yellow Rails presumably winter throughout

the South Atlantic Coastal Plain. However, because Yellow Rails are even more secretive than Black Rails, the true occurrence and distribution of this species is unknown.

Other species. -- Wood Storks, other long-legged colonial wading birds, shorebirds, and Sedge Wrens also depend upon estuarine emergent wetlands. These species were treated above under palustrine emergent wetlands and their conservation is the subject of parallel planning efforts.

Population and habitat objectives:

Population objectives

Population status and health for Sharp-tailed and Seaside Sparrows and all rail species is virtually unknown. Monitoring protocols need to be developed and widely implemented to determine baseline population status. Studies of contaminant effects on bird species dependent upon estuarine emergent wetlands should be conducted.

Habitat objectives

All potential habitat should be protected either by resource management agencies or through private-public partnerships. In addition, effects of management (e.g., burning, ditching) need to be assessed for sparrows and rails. Although no net loss of estuarine emergent wetlands has occurred since the mid-1970's, water quality and contaminant issues may still influence the quality of habitat.

Implementation recommendations and opportunities:

Despite an almost complete lack of information regarding status of priority species, a number of management practices are assumed to be compatible with or beneficial to these species. Management practices such as open marsh water management (e.g. ditching) and pothole blasting will enhance open water foraging habitat for many species (Hardin 1987, Martin and Marcy 1989, Meredith and Saveikis 1987, Wilson et al. 1987). In addition, such management may also retard eventual encroachment of some emergent wetlands by more terrestrial vegetation. However, too

much open water can adversely affect some marsh species, especially rails, which are not dependent upon open water. Thus, the effects of marsh hydrology dynamics and subsequent effects on sparrows and rails require investigation.

In addition to the above practices, fire management can help retard shrub-scrub encroachment, reduce overall vegetation cover, and increase diversity of emergent vegetation. Fire management can be beneficial to foraging waterfowl and long-legged waders. However, care should be taken on timing and extent of fire use. In marshes with high rail (especially Black and King) and bittern densities, extensive burning should not be conducted from May through July to avoid severe disruption of breeding. Alternatively, marshes burned to enhance foraging habitat for nesting long-legged waders (mostly February through May) can be patchy from one year to the next to support substantial nesting habitat concurrently for rails and bitterns. Care must be taken to keep the needs of priority species in mind as decisions are made on burning regimes and open water marsh management practices (e.g., ditching within extensive marsh systems may have little ultimate impact).

Evaluation of assumptions:

Studies have been recommended for several National Wildlife Refuges in Florida (St. Vincent, St. Marks, Lower Suwannee River), South Carolina (ACE Basin), and North Carolina (Swanquarter and Cedar Island) within this physiographic area to better determine when and under what conditions prescribed fires should be undertaken. Prescribed fires should provide the maximum benefit and least harm to all bird communities dependent upon estuarine habitats (Frank Cole, pers. comm., 1995). Frost (1995) provides information helpful for understanding plant species composition associated with salinity and fire frequency in marshes.

Although actions involving estuarine wetlands do come under Federal and State regulation, proactive restoration of estuarine habitats using incentives would be useful. Incentives would encourage adding habitat on private lands or adding to adjacent mitigation lands.

Specific management recommendations for high priority species involve

investigation of status and population trends. Techniques should be established for monitoring of King, Yellow, and Black Rails as well as Seaside, Saltmarsh Sharp-tailed, and Nelson's Sharp-tailed Sparrows in emergent wetlands throughout the South Atlantic Coastal Plain. The restricted distribution and microhabitat requirements of both Sharp-tailed Sparrows and Seaside Sparrows suggest monitoring should be conducted at least every 5-10 years. Furthermore, taxonomic clarification of the Seaside Sparrow complex needs to be pursued to best determine conservation priorities of each of the extant populations (including Cape Sable Sparrow in subtropical Florida). Similar taxonomic investigation of black rail populations may also be instructive. Eddleman et al. (1988) outline conservation strategies for rails in North America. While Black and Yellow Rails may require monitoring strategies now, King Rails may require a higher level of attention to determine reasons for decline and to implement corrective management as necessary.

As mentioned in the Forested Wetlands discussion, the South Atlantic Coastal Plain represents a very important area for wintering American Black Duck population (some breeding in estuarine emergent wetlands in northeastern North Carolina). Ideal management of estuarine emergent wetlands should integrate the needs of Black Rails, Seaside and Sharp-tailed Sparrows, and Black Ducks into a comprehensive management plan, and monitoring is required to steer these efforts.

Maritime Communities: Beaches and Dunes

***Ecology and status**:*

Beaches and overwash areas provide important foraging habitat for migratory and wintering shorebirds, resident colonial nesting water birds, and migratory raptors. Beaches above the high tide line and dunes provide nesting habitat specifically for several high priority shorebirds. In addition to avian communities, beaches and dunes are important for federally listed plants and animals including seabeach amaranth, nesting sea turtles, and oldfield (beach) mice. The popularity of beaches, particularly during the summer, has resulted in numerous conflicts between beach nesting species and humans. As of the mid-1970's, less than 15% of maritime land cover was in

beaches and dunes, and coastal development is accelerating in many areas (Culliton et al. 1990, Moore et al. 1993).

Priority species, species suites, and habitat requirements:

Priority shorebird species within this physiographic area include the South Atlantic wintering populations of Red Knots, Piping Plovers, Cuban (southeastern) Snowy Plovers, and Wilson's Plover. Least Terns, Roseate Terns, Black Skimmers, American Oystercatchers, and Reddish Egrets are also of priority interest in the South Atlantic Coastal Plain.

Red Knot. -- Beaches and adjacent dunes provide for both important foraging habitat in the washover zone and roost sites in protected areas for migratory and wintering shorebirds. The Red Knot is the highest priority non-breeding shorebird associated with beaches and shorelines. Although the South Atlantic Coast pales in comparison with Delaware Bay as an important stopover site, a small population (10,000?) regularly spends the winter in this region. This population may be isolated from the 250,000 (± 100,000) birds annually traveling to and from the Canadian Arctic to Tierra del Fuego (Harrington 1996).

Piping Plover. -- The federally endangered Piping Plover occurs at the southern extreme of its breeding range in this physiographic area from Currituck National Wildlife Refuge south at least to the North Carolina/South Carolina border. About 30-55 pairs occur in North Carolina, with most at Currituck National Wildlife Refuge (up to 5 pairs, none at present), Cape Hatteras National Seashore (11-12 pairs), and Cape Lookout National Seashore (45-50 pairs) (Collazo et al. 1995). Piping plovers are more numerous and occur throughout the winter in appropriate habitat (including St. Vincent Island, Gulf County to Bald Point Franklin County, Florida along the Gulf Coast section included in the Southeast Coastal Plain). The 200-300 wintering birds constitute 5-10 percent of all birds counted during international winter surveys (Nicholls and Baldassarre 1990; Haig and Plissner 1993; Plissner and Haig 1997). Birds arrive from both north Atlantic and Great Plains breeding populations (Haig and Oring 1988).

Cuban Snowy Plover. -- Cuban (Southeastern) Snowy Plovers occur only along

the Gulf Coast and Playa Lakes region (southern Great Plains), the Bahamas, and on a few Caribbean islands (Puerto Rico, Hispaniola, Cuba; e.g., Lee 1991). Within the South Atlantic Coastal Plain, Snowy Plovers are restricted as a resident species along the coastline and islands of Gulf, Franklin, and Wakulla Counties in Florida.

Wilson's Plover. -- Although a high priority species, Wilson's Plovers are more secure than either Piping or Snowy Plovers. Wilson's Plovers breed in appropriate habitat on most barrier and sea islands but become local in Florida (Duval County on the Atlantic side and St. George and Dog Islands on the Gulf side). Nesting birds face disturbance from both natural predators and recreationists (e.g., ATV's) on heavily used beaches.

Colonial Nesting Larids. -- All colonially nesting larids are of conservation interest along the South Atlantic Coast (except Laughing Gulls other than as a nest predator). Within this physiographic area, the federally endangered Roseate Tern has been found to nest at least once near Morehead City, Carteret County. Least Terns and Black Skimmers are now being found nesting on graveled rooftops (as do Roseate Terns in Florida) *in lieu* of beaches. This shift appears to reflect loss of suitable natural habitat rather than expansion of opportunities *per se* by this species. Other nesting terns are mostly restricted to nesting on small isolated islands where mammalian predators are absent.

Other Species. -- Of at least local conservation interest are American Oystercatchers and Reddish Egrets. American Oystercatchers have major concentrations along the South Carolina coast, while Reddish Egrets seem to be slowly reoccupying their range northward toward the South Atlantic Coastal Plain (on both coasts). The Reddish Egret is now regular throughout the year into south Georgia, but as yet there is no sign of local breeding.

Population and habitat objectives:

Population objectives

Recreation pressures and predation should be controlled from April – October for the benefit of nesting beach birds or resting migratory shorebirds. Other specific

objectives are under development through parallel bird conservation planning efforts for shorebirds and colonial waterbirds.

Habitat objectives

All potential habitat should be protected either by resource management agencies or through private-public partnerships.

Implementation recommendations and opportunities:

Recreation is a serious problem on public lands where beach nesting birds are repeatedly disturbed. For example, most nesting pairs of Piping Plovers occur on National Park Service and U.S. Fish and Wildlife Service lands, and most nesting Snowy Plovers occur on Florida State Park and Federal lands. These agencies must do the best that they can to minimize conflicts between nesting birds and recreationists.

Evaluation of assumptions:

High levels of predation (both natural and human induced) and inclement weather can both be detrimental to small breeding populations. In some areas, where recreation is already minimal, predators are the most serious problem. These cases may call for some localized predator control devices.

When called for by local communities, beach nourishment can accommodate nesting animals by being conducted in the winter (specific guidelines for sea turtles, Piping Plovers, and other listed species can be obtained from local Fish and Wildlife Service offices). However, some questions regarding long-term disruption of food resources for shorebirds on recently re-nourished beaches requires more attention. Additional private-public partnerships could be utilized in protecting beach-nesting birds that are using artificial structures (gravel roofs) or in educating the public about protecting nesting colonies.

Maritime Communities: Open Ocean (Gulf Stream)

Ecology and status:

Waters within or near the Gulf Stream section paralleling the South Atlantic Coastal Plain constitute the open ocean portion of this physiographic area. These open waters are the major feeding grounds for Black-capped Petrels. In addition, many other species of wholly or partially pelagic birds occur in large numbers as transients or non-breeding residents (e.g., White-tailed Tropicbirds, Audubon's Shearwaters). Imminent threats at this time appear to be few except for the constant possibility of take from longline fisheries and from oils spills that can result in the death of many pelagic birds. Periodic resurgence of interest in exploration for oil deposits within the outer continental shelf, especially off the North Carolina coast, continues to be cause for concern.

Priority species, species suites, and habitat requirements:

Black-capped and Bermuda Petrels. -- The Black-capped Petrel was thought to be very near extinction throughout much of the twentieth century. Numbers of birds may be as low as 2,000 and no more than 20,000 pairs (Wingate 1964), with known declines since Wingate's study (Lee and Vina 1993). All evidence at present indicates that waters in or adjacent to the Gulf Stream between north Florida and southern Virginia provide for the primary non-breeding range of Black-capped Petrels. Concentrations of birds can be found along the Gulf Stream in U.S. waters throughout the year, but particularly in May, August, and late December through early January. The main foraging area appears to be along the Gulf Stream directly east of Cape Hatteras National Seashore, North Carolina. However, some birds are found with regularity off the coasts of South Carolina and Georgia. Concentrations occurring during winter, when peak breeding activity is underway, is suggestive of breeding birds foraging along the Gulf Stream moving to and from breeding colonies (Lee 1987). These long-distance foraging bouts, if verified, would not be unreasonable for species of the Genus *Pterodroma*.

Breeding Black-capped Petrels are thought to be restricted to steep sea and inland cliffs along the La Selle Ridge in Hispaniola (mostly in Haiti). This species is

almost certainly extirpated from all other previously known nesting areas (Lee and Vina 1993, Wingate 1964, Haney 1987, Lee 1979, Lee 1984). Because of the Haitian social-economic instability, as well as possible use of petrel adults and young for food, it is not unreasonable to assume further declines to the global populations and thus greater vulnerability of the species to extinction.

Gulf Stream waters may also provide foraging area for the Federally endangered Bermuda Petrel. This species was thought to be extinct for 300 years before its rediscovery in 1935. No more than 50 Bermuda Petrel pairs are known today, but this is a significant improvement over a few decades ago. Recent documentation (several sight records and photographs) provides evidence for previous notions that foraging areas from Bermuda include the Gulf Stream waters off of North Carolina (Wingate, pers. comm., Lee 1984; Lee 1987).

Potential threats to both Black-capped and Bermuda Petrels include human encroachment (e.g., egg robbing) at breeding sites and offshore oil and gas exploration at Gulf Stream foraging sites. Increased mercury levels associated with oil spills also poses a potential threat. The Black-capped Petrel seems to be rather exceptional in its high levels of accumulated mercury (Whaling and Lee 1982). The source of mercury appears natural (through food, primarily squid), but effects from an additional increase of mercury through shipping spills or future oil exploration requires investigation. A final threat to both petrel species concerns lighted ships and platforms that attract birds at night, leading to collisions with wires or other structures. The documented presence of Bermuda Petrels would seem to require consideration of corrective lighting where conflicts are likely to occur.

Other Pelagic Species. -- Other priority species at least for monitoring attention include White-tailed Tropicbirds, Audubon's Shearwaters, and Federally threatened Roseate Terns. Caribbean populations of White-tailed Tropicbirds are at least regular in small numbers off the South Atlantic coast and are considered by some authorities as vulnerable where they breed (Lee, pers. comm.). Only 7,000 pairs persist within the West Indies (plus another 3,000 pairs in Bermuda). This number is low for seabirds, particularly for a regionally endemic subspecies. This subspecies appears stable at

present, but is greatly reduced from former population levels. Caribbean populations of Audubon's Shearwaters appear to be more secure and more common in South Atlantic waters. Roseate Terns breeding from New York northward become highly pelagic offshore of the South Atlantic Coastal Plain when moving to and from the southern Caribbean Sea and northeastern South America.

Population and habitat objectives

Population objectives and Habitat objectives

Foraging gadfly (*Pterodroma*) petrels and other seabirds should be protected from contaminants (e.g., mercury and oil spills from ships, potential from future off-shore exploration drilling), longline fisheries (where known concentrations overlap heavily fished areas), and from collisions with night lights. In addition, work should begin on a range-wide conservation strategy for both gadfly petrels, Caribbean breeding White-tailed Tropicbirds and Audubon's Shearwaters, and other South Atlantic Seabirds. Conservation plans would require international partnerships with Caribbean nations and Bermuda.

Implementation recommendations and opportunities/Evaluation of Assumptions:

Effective strategies for black-capped and Bermuda petrel conservation will require much survey and monitoring work at an international scale (Bermuda, Hispaniola, Southeast U. S., Lesser Antilles). The following items should be considered in conservation plans (from discussions among D. Lee, D. Wingate, and C. Hunter):

(1) Publishing an existing manuscript (monograph, Lee and Haney) on the Black-capped Petrel ($1,000);

(2) Conducting breeding population censusing on Haiti and Beata Island (Dominican Republic) and documenting human encroachment on colonies ($10,000 one year, but less with U.S. military help in Haiti and Dominican Republic help on Beata);

(3) Surveying at sea off the Southeast U.S. to fine tune distribution, especially where heavy ship traffic or potential for future oil exploration occurs ($35,000, 3 years);

(4) Increasing nesting habitat for Bermuda Petrels (artificial structures, $20,000, 3 years) and researching foraging and nesting biology of the species (radio telemetry, $30,000; nesting, $15,000, 1 year);

(5) Confirming lack of breeding of Black-capped Petrels in Lesser Antilles through a good international cooperative program ($30,000, 3 years) and determining foraging range around Lesser Antilles (sea survey, $5,000, one intense period);

(6) Conducting sea surveys in Sargasso Sea and around the Greater Antilles (free with military support);

(7) Conducting statistical analysis of 20+ year of data from the point-offshore drilling areas to determine what local oceanographic factors drive distribution and densities ($2,000-$5,000, perhaps with support from U.S. Minerals Management Service).

Total estimated expenses would run around $151,000 over a 3-4 year period. This price would be substantially less if the military can provide transportation assistance in Haiti, Beata Island, Greater Antilles, and the southeast U.S. coast.

A second priority project would be to follow through on all South Atlantic-Caribbean seabird connections such as outlined in the forthcoming publication, “Atlas of Breeding Seabirds of the West Indies -- an International Workshop.” This workshop fulfills a desperate need for seabird conservation priorities throughout the West Indies and surrounding continental islands. Priorities would be generated locally, and through the international workshop setting, would then be used to set regional priorities for the entire West Indies. Published workshop proceedings would be of both local and regional importance, as determined by West Indian conservationists, not “outsiders.” Information would include taxonomy and identification of key nesting sites (present status and protective status), local problems (predators, lack of protective status), and local needs (inventory/monitoring, enforcement, education). Such a document could be used by organizations (e.g., Society of Caribbean Ornithology) as a lever for foundation funding to resolve problems as desired.

A third project that would require international cooperation is a “Housing Grant” for White-tailed Tropicbirds within the West Indies. While it is clear that tropicbirds

cannot be restored to their former levels of abundance, the use of transportable artificial nesting structures can increase their numbers and even attract nesting tropicbirds to islands where they no longer nest. An additional advantage to this technique is that the structures can bring nesting tropicbirds into view of the more inhabited portions of the West Indies. Tropicbirds can serve as a "signature" species for tropical marine ecosystem conservation and awareness can foster public involvement in conservation strategies. The success of this effort depends on (1) fine-tuning an existing artificial burrow design, (2) using seed money to locally fund and implement multiple and simultaneous nest burrow construction (six countries have already expressed interest), and (3) expanding educational efforts as nesting burrows bring in tropicbirds. A fourth phase would include program evaluation as desired. The total budget for this expected 6-year program comes to $62,000 with no salaried time or overhead.

Along the South Atlantic Coastal beaches, research into the rates of and reasons for wintering Common Loon mortality should help provide for a better understanding of the risks to seabird populations in this area (T. Augsburger, USFWS, pers. comm.). Specifically, coastal gillnets are now suspected as a major cause of mortality for Red-throated Loons, which are heavily concentrated in North Carolina waters during winter, and many other pursuit diving seabirds (Forsell 1999). Better monitoring of beach birds especially in North Carolina could help to develop better fishery regulations to eliminate this conflict and should be a high priority.

Also, the increasing popularity of pelagic birding (and whale-watching) boat trips is an important aspect of public outreach. Such trips help encourage conservation of offshore bird habitats through economic enrichment of local coastal communities. At least occasional pelagic trips originate from every state within the South Atlantic Coastal Plain physiographic area.

Southern Pine Forests: Longleaf/Slash Flatwoods and Savannas, and Longleaf Sandhills

Ecology and status:

Although southern pine forests remain a very important part of the southern economy, the pine forests of today's South are very different from those found by European colonists and harvested for naval stores and building materials in the 19th century. Southern pine forests, with longleaf pine occurring at least as a co-dominant, covered an estimated 92 million acres at the time of European settlement (about 75 million acres where longleaf was dominant). Forests stretched from southeast Virginia (where now reduced to a few remnant trees) to east Texas, interrupted only by major floodplain forested wetlands and occasional prairies (Frost 1993). Along or near coastlines slight shifts in hydrology and salinity favor slash pine over longleaf in flatwoods and savannas, but for all practical purposes, bird species responding more to age and structural characteristics than dominant pine species (though longleaf is still preferred where site conditions allow). Pre-settlement estimates place longleaf dominated forests at 52% of all uplands and 36% of the entire southeastern landscape. By the 1930's, most of the 92 million acres had been cut, with about two thirds regenerated to other pine species or converted to other land uses (Croker 1987, Walker 1991, Frost 1993).

Today, less than 3% of the original longleaf (less than 2% of the southeastern landscape) forests remain. If systems drastically altered by fire suppression are excluded, less than 1% (or 674,000 acres) remain (Frost 1993). The conversion of many natural pine and hardwood stands to short-rotation pine plantation (mostly loblolly or slash) during this century has resulted in an almost complete elimination of functioning longleaf pine ecosystems, as well as the breakup of large stands of forested wetlands discussed earlier (Croker 1987, Ware et al. 1993). The loss of longleaf pine ecosystems has led to the rarity and endangerment of at least 70 plant taxa, particularly in the Coastal Plain and Florida peninsula but also in the Southern Piedmont and other physiographic areas in the Southeast (Noss et al. 1995). Among vertebrate animals, the future successful conservation of flatwoods salamander, gopher frog, indigo snake,

gopher tortoise, coastal plain fox squirrel populations, and many other species may well depend in part on the restoration of longleaf pine ecosystems and the reinstitution of fire as a management tool.

Unlike other temperate forest ecosystems, the high level of biodiversity found in natural longleaf pine forests is mostly restricted to one structural layer, that is, the condition of the ground layer. Frequent growing-season fires are essential for maintaining the density of bunch grasses (principally wiregrasses in the east and bluestems towards the west), forbs, and vines, while keeping the shrub layer to a minimum over a burning cycle of a few years (Frost 1993). In turn, it is this ground layer composition that supports many of the plant and animal species unique to longleaf pine ecosystems.

Priority species, species suites, and habitat requirements:

Priority species within the Southern Pine Forests include the Red-cockaded Woodpecker, Bachman's Sparrow, Henslow's Sparrow (savannas/flatwoods), Brown-headed Nuthatch, Prairie Warbler (sandhills/scrub oak, GA, NC), Southeastern American Kestrel (savannas/sandhills/sand pine-scrub oak), and Loggerhead Shrike (savannas).

Although a large number of species are dependent on mature southern pine forests, especially longleaf, most attention has been focused on one species, the Red-cockaded Woodpecker. The pine savanna forest type provides the primary habitat for several species of high concern, many of which were covered under grasslands or shrub-scrub. Although usually considered a grassland or shrub-scrub species, Loggerhead Shrikes do occur in pine savanna in good numbers. Other species that may be found in shrub-scrub, but optimally use sparsely-stocked pine savanna, include Northern Bobwhites, Bachman's Sparrows and Henslow's Sparrows (winter only). Southeastern American Kestrels, Red-cockaded Woodpeckers, and Brown-headed Nuthatches may be found if longleaf or slash pines are old enough for cavities. Among high priority neotropical migrants, only Northern Prairie Warblers unequivocally benefit from management favoring Red-cockaded Woodpeckers. Both species were most

closely associated historically with fire-maintained pine ecosystems (Nolan 1978).

Bachman's Sparrow. -- The most characteristic bird associated with mature pine forests, other than the Red-cockaded Woodpecker, is the Bachman's Sparrow, formerly called Pinewoods Sparrow. The core of this species' distribution probably coincided closely with the distribution of Red-cockaded Woodpeckers within predominately longleaf pine and, secondarily, within shortleaf pine at the time of first European colonization. During the early 1900's, Bachman's Sparrow range expanded well to the north (e.g., Interior Low Plateaus and Highlands and Southern Appalachians) in response to widespread clear cutting of mature forests (Brooks 1938, Dunning and Watts 1990). The maturing of these interior forests late in the twentieth century led to the retraction seen today to the probable distribution of this species at the time of European colonization. Interestingly, the listing of this species as state endangered or threatened in many areas is now best regarded as attempting to protect this species on the periphery of its most recent distribution.

The secretive habits of the Bachman's Sparrow, except during spring when males sing from exposed perches, may suggest the species is less numerous and widespread than it actually is. Nevertheless, this species undoubtedly occurs now in greatly reduced numbers within the core of its distribution with the loss of most longleaf forests during this century and should remain a species in need of conservation attention overall. The migratory habits of the Bachman's Sparrow are also poorly understood, but the more northern breeding populations likely retreat to join locally breeding populations within The Lower Coastal Plain from North Carolina to Texas, and south into Peninsular Florida.

Despite dramatic expansions and contractions of Bachman's Sparrow distribution this century, and the frequent lack of understanding of its true abundance, the species is a fairly strict habitat specialist. The highest numbers of birds are consistently associated with high volumes of grasses and forbs within the ground layer, and with low volumes of vegetation within the understory and midstory layers (Dunning and Watts 1990). These conditions are most likely provided in open pinewoods subject to frequent growing-season burning and during the first few years after a regeneration cut. The

specific habitat characteristics most optimal for Bachman's Sparrows can be duplicated in other anthropogenic associated habitats (*e.g.*, clearcuts, powerline rights-of-way), at least on a temporary basis.

Henslow's Sparrow. -- Henslow's Sparrows during winter are apparently most common in moist to wet, grassy dominated savannas and flatwoods. However, the specific habitat requirements of this species wintering within the coastal plain are even more poorly known than the Bachman's Sparrow. Nevertheless, several studies on this species during winter are in progress within Mississippi Sandhill Crane National Wildlife Refuge, Mississippi, and International Paper lands, Alabama (within the East Gulf Coastal Plain), as well as in Apalachicola National Forest, Florida (within this physiographic area). Early results suggest Henslow's Sparrows are most numerous on sites burned during the previous growing season, though birds also occur on sites burned during the dormant season up to two years previously (McNair 1998, Plentovich et al. 1998a, 1999, Chandler and Woodrey 1995). This species is treated in more detail under the grasslands section as nearly treeless savannas appear to represent optimal habitat, possibly along with moist grassy dominated powerline rights-of-way and oldfields. The use of moist pine flatwoods also appears to be at least widespread, if not extensive, where moist grasses dominate the ground cover.

Northern Prairie Warbler. -- The Northern Prairie Warbler is associated with slightly longer burning cycles than the Bachman's and Henslow's Sparrows. Northern Prairie Warblers are arguably more widespread and perhaps more common than they were at the time of European colonization. In spite of this, Prairie Warblers and other early-successional specialists have undergone long-term and steep regional population declines during the last 25 years. These declines are apparently continuing despite the proliferation of short-rotation pine plantations that have resulted in an abundance of early-successional habitat during the last 30 years (Meyers and Johnson 1978, Hunter et al. 1993b). This pattern is reminiscent of that described for Bachman's Sparrow. However, the Northern Prairie Warbler is more easily detected and therefore the population trends for the warbler may be a better indicator of what is happening with the more shy sparrows than data for the sparrows themselves.

Throughout much of its breeding distribution today, the Northern Prairie Warbler is associated most closely with early-successional habitat such as the seedling-sapling seral stage produced under even-aged silviculture and by retarding succession in old-fields. As with Bachman's Sparrow, early-successional habitats may be used by Prairie Warblers but may not represent optimal and relatively long-term optimal habitat. Prairie Warblers also appear to be absent from much of the South Atlantic coastal plain outside of pocosins. This is not easily explained given a higher abundance for this nearctic-neotropical migrant in both mature pine and early-successional habitat within the Piedmont and other Coastal Plain physiographic areas.

Southeastern American Kestrel. -- Although Red-cockaded Woodpeckers are the highest priority cavity nesting species within the South Atlantic Coastal Plain, three other cavity-dependent species also require some degree of attention within pine and pine-hardwood habitats. Of these three, the breeding species requiring the most attention is the American Kestrel. The southeastern subspecies (or ecologically identical equivalents) formerly ranged from the Carolina sandhills, west across the coastal plain to Louisiana and presumably Texas, and south through Peninsular Florida to the Everglades (Long Pine Key). This subspecies has greatly declined from most of its range throughout the Coastal Plain, with very few nesting in natural cavities in South Carolina and over most of Georgia (including adjacent Piedmont sites above the Fallline), and with a small population persisting along the Mississippi Gulf Coast again presumably west into the Texas piney woods (Collopy 1996). These declines are attributed to (1) reduced number of longleaf pine snags left standing in agricultural areas and open pine woods, and (2) the increasingly intense nature of agriculture and urban development, reducing most suitable foraging habitat (Hoffman and Collopy 1988). Within this physiographic area, Southeastern American Kestrels are still most frequently found in longleaf/turkey oak sandhills, sand pine scrub, and pastures with standing snags (Bohall-Wood and Collopy 1986).

In Florida, this subspecies remains widely distributed, though rare, throughout much of north and north-central Florida, with only a few scattered observations today from south-central Florida (Hoffman and Collopy 1988). Within the South Atlantic

Coastal Plain vicinity of Levy, Gilchrist, and Alachua Counties, it has been estimated that American Kestrels have declined 82% since 1940 (Hoffman and Collopy 1988). In north Florida, the kestrel likely increased with the clearing of longleaf flatwood forests about 1900, which were replaced by farmlands with standing pines around 1940. The increased use of tractors after World War II led to improved farming and the removal of most nest trees as well as reduction in foraging habitat quality. Bohall-Wood and Collopy (1987), working in the same region of Florida, found that kestrels nesting in longleaf sandhills were more productive than kestrels nesting in agricultural areas due in large part to the abundance and quality of food being brought to the nest by males. A final consideration is the source of the cavities used by American Kestrels and in longleaf pine at least, Pileated Woodpeckers blasting out Red-cockaded Woodpecker cavities is apparently important (Saenz et al. 1998).

A temporary solution to a long-term problem is the use of artificial nests for American Kestrel management. Use of kestrel next boxes has led to increased nesting of the subspecies in Florida (Duval and Clay Counties), South Carolina (Fall-line, sandhills), and Georgia (Fall-line, Fort Gordon) (Collopy 1996, Cely and Sorrow 1988, Breen 1995). In addition, Saenz et al. (1998) recommend judicious use of cavity restrictors where American Kestrels are breeding and the Red-cockaded Woodpecker population present is in relatively good shape.

Other Cavity Nesters. -- Along with Southeastern American Kestrels, Red-headed Woodpeckers and Brown-headed Nuthatches are important cavity nesters. Populations of Red-headed Woodpeckers and Brown-headed Nuthatches are more secure than Southeastern American Kestrels because they use a broader range of habitats and are generally more common throughout their distributions. The Brown-headed Nuthatch, though still locally common, is only slightly less restricted in overall distribution than the Red-cockaded Woodpecker and has shown signs of steeply declining populations within the South Atlantic Coastal Plain, corresponding closely with the decline of longleaf acreage since the 1960's and the corresponding shortening of rotation in commercial pine forests. The continuing reduction of longleaf pine acreage and the trend towards shorter harvest rotations with the South Atlantic Coastal Plain

commercial pine forests may be particularly affecting the Brown-headed Nuthatch as this species excavates its own cavities in both older live pines (often with dead limbs) and pine snags. However, thinning commercial pines destined for sawtimber production early and maintaining a sparse midstory appears to support Brown-headed Nuthatches better than what is typical found in commercial pine plantations (Wilson and watts 1999). It is unknown whether Brown-headed Nuthatches use nest boxes, but if they do, then boxes may help this species use short-rotation pine plantations at a higher frequency.

Population and habitat objectives

Population objectives

Recovery goals for Red-cockaded Woodpecker populations have been established for 8 areas within the South Atlantic Coastal Plain Physiographic Area. Agency personnel and (in most areas) private landowners are working to establish specific population and habitat goals to achieve long-term viable Red-cockaded Woodpecker populations. In addition, most cooperators are dedicated to restoring longleaf pine ecosystem functions and values in order to stabilize associated longleaf pine communities. The Red-cockaded Woodpecker recovery areas are (1) Fort Bragg Military Reservation and surrounding properties (including Camp Mackall, Sandhills Game Land, and Weymouth Woods State Park) in the North Carolina Sandhills, (2) the lower coastal plain of North Carolina (presumably to include Croatan National Forest, Camp Lejeune Marine Corps Base, and Holly Shelter Game Land), (3) Carolina Sandhills National Wildlife Refuge and Sandhills State Forest (and Cheraw State Park) in South Carolina, (4) Francis Marion National Forest and surrounding properties in the lower coastal plain of South Carolina, (5) Fort Stewart Military Reservation and surrounding properties in the lower coastal plain of Georgia, (6) Fort Benning Military Reservation in both the upper coastal plain and Southern Piedmont in Georgia, (7) Osceola National Forest in the lower coastal plain of Florida, and (8) Apalachicola National Forest and surrounding properties (including St. Marks National Wildlife Refuge and Ochlockonee River State Park) in the lower coastal plain of Florida.

Other properties or cooperatives within the South Atlantic Coastal Plain with substantial existing or proposed longleaf pine acreages include (1) Lower Suwannee National Wildlife Refuge (with proposed restoration), (2) the Red Hills Conservation Association (in association with Tall Timbers Research, Inc. and The Nature Conservancy) in southwest Georgia and adjacent Florida (a sizeable red-cockaded woodpecker population also occurs here), (3) Ichauway Plantation (Joseph W. Jones Ecological Research Center) in upper coastal plain of Georgia, (4) International Paper Southlands Research Station in the lower coastal plain of Georgia, (5) St. Catherine's Island (St. Catherine's Foundation) in coastal Georgia, (6) Sapelo Island Wildlife Management Area in coastal Georgia, (7) Grand Bay Wildlife Management Area and Moody Air Force Bay in lower coastal plain Georgia, (8) Okefenokee National Wildlife Refuge and Greater Okefenokee Landowners Group in lower coastal plain Georgia, (9) Fort Gordon Military Reservation in upper coastal plain of Georgia, (10) DiLane Wildlife Management Area in Georgia, (11) Yuchi Wildlife Management Area (proposed for restoration) in Georgia, (12) Cumberland Island National Seashore in coastal Georgia, (13) Fort Jackson Military Reservation in upper coastal plain South Carolina, (14) Savannah River Site (Department of Energy in cooperation with U.S.D.A. Forest Service), (15) ACE Basin National Wildlife Refuge in lower coastal plain South Carolina, (16) Woodbury Tract owned by International Paper along the Pee Dee River in South Carolina where restoration is underway, and (17) The Suffolk Scarp forming the western boundary of Dismal Swamp National Wildlife Refuge in Virginia south into northeastern North Carolina. Each of the above properties and cooperatives should be encouraged, through policy and/or incentives, to restore longleaf pine communities to the maximum extent possible, if they have not already.

All of these efforts, plus efforts in pocosin and early-successional habitats should be considered successful when population sizes (as measured by BBS) reach pre-1975 levels for Northern Bobwhite, Brown-headed Nuthatch, Prairie Warbler, Bachman's and Field Sparrows. Population objectives that can be measured locally would be to support on average 11 pairs per 100 acres of at least suitable habitat for Brown-headed Nuthatch, 7 coveys of Northern Bobwhite, and 6 pairs of Bachman's Sparrow.

Habitat objectives

Emphasis should be placed on late successional stands, especially on public lands. Disturbance regimes (e.g., growing season fire) should be increased to establish ground cover/understory habitat quality. In addition, policies and incentives should be used to (1) double the number of longleaf pine acres on private land by the year 2025 (returning to 1975 levels), and (2) encourage appropriate management on both public and private land to include not only Red-cockaded Woodpeckers (where appropriate), but also Bachman's and Henslow's Sparrows, Southeastern American Kestrels, Brown-headed Nuthatches, and other priority species.

Although it is not as clear whether these pine specialists require large patches to maintain healthy populations as is suggested for forested wetland species, the acreage to support a theoretical 500 pairs/coveys for Northern Bobwhite would be 15,000 acres, Bachman's Sparrow about 19,000 acres, and Brown-headed Nuthatch over 22,000 acres, respectively (Table 11).

More specifically, by the year 2025, over 700,000 acres of at least 5-year old stands of longleaf pine should be established. Presently, approximately 1.5 million acres exist within the South Atlantic Coastal Plain. Ownership of pine forests with longleaf occurring as at least a codominant is divided as 32 percent in public ownership (25 percent federal, 7 percent state and local), 22 percent in industrial or corporate ownership, and 46 percent in non-industrial private ownership (Table 8).

On a state-wide basis, Florida supports 25 percent of the South Atlantic longleaf pine (12 percent of total rangewide), Georgia 34 percent (16 percent of total), South Carolina 24 percent (12 percent of total) and North Carolina 17 percent (8 percent of total). Longleaf pine in Virginia has been reduced from 1 million acres to a few remnant trees (most in Mid-Atlantic Coastal Plain and Zuni Pine Barrens) (D. Bradshaw, pers. comm., 1997; Frost 1993). The feasibility of converting or restoring (1) 90,000 acres in Florida, (2) 330,000 acres in Georgia, (3) 165,000 acres in South Carolina, and (4) 105,000 acres in North Carolina should be determined and adjusted appropriately. In Virginia, it should be determined whether the possibility exists of restoring 30,000 acres

of longleaf pine to include both South Atlantic and Mid Atlantic physiographic areas in the southeast portions of the state. It is assumed here that most or all acreages on private land would be managed primarily for timber production, at rotations not likely to support red-cockaded woodpeckers unless by prior agreement. Hopefully, however, most of this acreage will attain conditions or management status that would support the many other longleaf pine associated species that do not impinge upon normal sawtimber harvesting practices.

Frost (1993) estimates that about 674,000 acres of longleaf forest is in good condition rangewide. Assuming this figure is proportionately correct within the South Atlantic Coastal Plain, then about 325,000 acres of functioning longleaf pine ecosystems are spread across this physiographic area. The goal should be to have all 485,000 acres of longleaf on public lands meeting Frost's definition of good condition by year 2025, with an additional 165,000 acres improved to good condition on private lands (both corporate/industrial and non-industrial) for a total of 650,000 acres by year 2025.

Implementation recommendations and opportunities:

Recovery of Red-cockaded Woodpecker populations will be accomplished only where large patches include mature pine forests managed for the special foraging and nesting habits of this species (U.S. Fish and Wildlife Service 1985). Guidelines for protecting and allowing for Red-cockaded Woodpecker population expansion by providing more than adequate nesting and foraging habitat are delineated in the Recovery Plan (U.S. Fish and Wildlife Service 1985). However, increasingly detailed studies of different populations are allowing for refinement of existing guidelines for more effective and efficient local conservation efforts (from the standpoint of balancing with other "competing" resource needs; *e.g.*, Costa 1996, Beyer et al. 1996, Conner et al. 1996, Jones and Hunt 1996). With a few notable exceptions, public lands provide the greatest opportunity for the species' recovery, especially in managed areas exceeding 125,000 acres (Reed et al. 1988, U.S.D.A. Forest Service 1995).

This habitat patch size assures that enough appropriately-managed pine habitat will be available at all times to support a recovered (viable) population. A patch size

figure of 125,000 acres or more was established assuming pine regeneration sites within a given patch will be temporarily unavailable to woodpeckers. However, inclusions within a patch, such as non-pine stands (*e.g.*, bottomland and upland hardwood sites) and other landscape features, not prohibiting normal dispersal behavior, would need to be added to the 125,000-acre figure. Smaller pine-dominated forests under public or cooperating private land management also support important woodpecker populations. These smaller populations need to be maintained as the species is recovered (U.S.D.A. Forest Service 1995).

Cooperating private landowners in the North Carolina sandhills and the quail plantations of southwestern Georgia, where timber production is not necessarily the highest priority land use, play crucial roles in maintaining relatively healthy (and likely recoverable) Red-cockaded Woodpecker populations. However, developing cooperative relationships with private landowners who manage mature southern pine, whose priority land use objectives include timber production, require much care and compromise from all parties (especially government agencies) to be successful. Many stands of mature southern pine (including longleaf) have been cut and converted to other tree species or land uses earlier than originally planned by landowners supposedly in fear of government regulation involving Red-cockaded Woodpeckers. In these instances, opportunities have been lost to manage cooperatively for the many other vulnerable species associated with southern pine ecosystems due to perceived rather than real threats to private landowner rights. In only a very few instances have Red-cockaded Woodpeckers actually been found on non-industrial private lands slated for harvest. In most of these instances, only one or a very few isolated woodpeckers may have been involved. Further, these birds were not likely to contribute directly to recovery.

Techniques recently-developed and used by the U.S. Fish and Wildlife Service and U.S.D.A. Forest Service allow successful transport of Red-cockaded Woodpeckers from isolated areas to recovery populations. In addition, the U.S. Fish and Wildlife Service is working with several corporate landowners to develop management plans consistent with timber harvest objectives and maintenance of woodpecker foraging and

nesting sites on their lands. The U.S. Fish and Wildlife Service is also working through State forestry and wildlife agencies on state-wide Habitat Conservation Plans to relieve non-industrial private landowners from culpability when woodpeckers are found on non-industrial private lands. These latter efforts would encourage maintenance of woodpeckers on private lands until the landowner decides to harvest habitat that may result in loss of the birds. At this time the State, with an approved Habitat Conservation Plan, would move the birds to help in the recovery of other populations (*e.g.*, J. Ozier, Georgia Wildlife Resources Division, and J. Helms, Stone Container Corporation, in association with South Carolina Department of Natural Resources). In areas where recovery populations have been identified and include private lands, another concept known as "Safe Harbor" allows landowners to increase habitat quality with the understanding that a landuse in the future could allow for a return to the original baseline population level at the time of the original agreement (North Carolina Sandhills population recovery in part depends on Safe Harbor agreements with cooperating landowners).

All of these efforts and others should ease concerns and encourage partnerships despite the possible presence of Red-cockaded Woodpeckers. These efforts should allow mature southern pine, and longleaf in particular, to remain until the landowner is ready to cut. Perhaps these efforts can be used to encourage private landowners, along with Forest Stewardship/Incentives programs, to regenerate longleaf sites back to longleaf, instead of converting to another pine species. In this way private lands can be managed for the benefit of many rare species without the landowner fearing preclusion from future management options.

Fortunately, forests managed for Red-cockaded Woodpecker recovery exceed spatial requirements for all other high priority species optimally using longleaf/slash pine flatwoods, longleaf sandhills, and loblolly/shortleaf forest types. Supporting source populations for other pine-dependent bird species such as Northern Bobwhite, Brown-headed Nuthatch, and Bachman's Sparrows also may require attention to spatial requirements. All of these pine specialists, in addition to wintering Henslow's Sparrow populations, are especially common in longleaf pine habitats within which frequent

warm growing season fires reduce hardwoods and encourage a dense and diverse grassy ground cover (Abrahamson and Hartnett 1990, Myers 1990). Careful management of other southern pine forest types, including a combination of cool and warm season burning and mechanical removal of hardwoods, can also provide optimal habitat for many of these same species.

More specific to Bachman's Sparrows is management that utilizes burning as site preparation prior to planting. In contrast, drumchopping as part of site-preparation after clearcutting greatly reduces site quality for Bachman's Sparrows as little projecting deadwood is available for song perches (Dunning and Watts 1990). Clearcuts planted in longleaf pine are suitable for Bachman's sparrows for 7-8 years, while faster growing pines such as loblolly or slash are suitable for no more than 5 years under above average growing conditions. Stands in the pole stage and between 50-80 years ("middle-aged") old that are thinned and burned may become more suitable for Bachman's Sparrows much earlier than usually would be found in commercially planted pine that is allowed to reach "sawtimber" conditions. In summary, operations emphasizing drumchopping, fire suppression, dense stocking, and early harvest are not likely to support healthy Bachman's Sparrow populations. Operations emphasizing frequent burning, early thinning, retention of at least some mature pine stands, and less drastic site preparation should support the largest and healthiest sparrow populations.

Although regeneration clearcuts can and do provide suitable to optimal habitat for Bachman's Sparrows, evidence exists that this species is a poor disperser and unable to quickly colonize from one suitable site to another without early-successional linkages (*e.g.*, powerline rights-of-way, tornado alleys), nearby mature stands in optimal condition, or placement of new clearcuts adjacent to older clearcuts (Dunning et al. 1995). Dunning *et al.* (1995) observed very few Bachman's Sparrows in otherwise suitable clearcuts that were widely scattered and isolated within a landscape (the Sumter National Forest within the South Carolina Piedmont) dominated by agricultural fields and forests of unsuitable composition or age class. Use of clearcuts appears to be greatest in areas where at least a few suitable mature pine stands are available

(*e.g.*, Savannah River Site within the South Carolina's upper coastal plain). However, use of clearcuts declines in landscapes where mature pine stands dominate the landscape (*e.g.*, Francis Marion National Forest within South Carolina's lower coastal plain). Thus, mature longleaf stands appear to be the most preferred habitat type and certainly provides for decades of relative stability in habitat quality under long rotations and frequent growing-season fire management (Dunning and Watts 1991). Data on Bachman's Sparrow reproductive success between clearcuts and "recruitment" stands for Red-cockaded Woodpecker suggest success rates are similar, at least at Savannah River Site where suitable mature sites are still relatively few and far between but where grassy-herbaceous ground cover must be maintained through the life of the stand or readily available nearby as regeneration sites succeed into a less grassy condition (Krementz and Christi 1999, Dunning et al. 1995).

As there is danger in stating "what is good for game species is also good for nongame species," so is there danger in promoting the needs of one keystone species, such as Red-cockaded Woodpecker, as providing for the habitat requirements of all other associated priority species. Such is the case for providing Bachman's Sparrow habitat requirements where a management focus is singly placed on the recovery of Red-cockaded Woodpeckers. Bachman's Sparrows are more characteristic of the majority of species strongly associated with longleaf pine ecosystems because of association with a grassy dominated ground layer with little understory or midstory structure. In contrast, Red-cockaded Woodpeckers only require a reduction of hardwoods in the midstory, especially within clusters of cavity trees. This method may or may not satisfy the requirements of most longleaf associated species. Where short-term improvements must be made to stabilize and increase relatively large woodpecker populations, judicial use of mechanical hardwood removal, use of herbicides, and dormant season burns should accomplish the nesting habitat requirements of Red-cockaded Woodpeckers. However, in those areas where long-term goals are for ecosystem restoration, the above practices do not lead efficiently to a grassy dominated groundcover required of not only Bachman's Sparrow but other birds, reptiles, amphibians, and plants associated with healthy longleaf ecosystems within the coastal

plain (*e.g.*, Eglin Air Force Base, Florida; Plentovich et al. 1998b).

In other areas where few mature pine stands now occur for Red-cockaded Woodpeckers (*e.g.* Savannah River Site), long-term planning to provide for increasing habitat quality, such as lengthening harvest rotation, may result in dramatic short-term population declines for Bachman's Sparrows. As pine harvest rotations are lengthened, availability of suitable early-successional habitats is lessened with at least some population models predicting local extirpation for Bachman's Sparrows (Liu et al. 1995). In such situations, increased thinning and burning within middle-aged stands, and even stands in the pole stage, should effectively mitigate habitat losses associated with the reduction of early-successional habitats.

Although frequent growing season burns are clearly preferable from an ecosystem perspective for managing longleaf pine communities, there do exist concerns for nesting sparrows and other ground and shrub-scrub nesting birds in that some nests and young birds may suffer losses. However, these birds evolved within an ecosystem driven by frequent fires overlapping peak breeding seasons. Therefore, short-term losses to productivity should be more than compensated for with long-term improvement of habitat conditions across the greater landscape. Ecosystem management should be seen as managing for habitat conditions that favor overall population health rather than for survival for individual birds, with most of the surviving adults renesting upon the quick recovery of the grassy understory. Nevertheless, setting a patchwork of burn sites within compartments, alternating among the 3 to 5 years usually employed within a growing season burning cycle, should avoid any widespread losses within any one year within any one landscape. Another alternative employed in at least one area, the quail plantations of the Redhills of southwestern Georgia and adjacent Florida, involves management specifically for Northern Bobwhite with almost yearly burns in the late winter-early spring period. This management maintains nearly the same ecosystem values as longleaf pine forests managed with growing-season fires (Leon Neel, pers. comm., 1995), but with somewhat lower overall plant diversity (*e.g.*, wiregrass and other herbaceous plants are present and vigorous but reproduction and spreading rates are low). The managers involved with intensive

Northern Bobwhite management must pay very close attention to the vegetative condition on every acre under their care every year to avoid deterioration of the quality habitat now being maintained. Thus, there are a variety of options a manager can employ to provide quality habitat through judicious use of fire, while being responsible for managing breeding populations of priority species dependent upon these habitats.

In other cases, overly strict adherence to some practices for the benefit of Red-cockaded Woodpecker may come into direct conflict with other vulnerable species also dependent upon cavities in mature pine habitats. Cavity restrictors used to minimize damage from Pileated Woodpeckers may result in a reduction of cavity availability to other species, particularly American Kestrels in sandhills and savannas (apparently not in flatwoods). More discriminate placement of cavity restrictors may allow benefits for both woodpeckers and kestrels and certainly when cavity trees are no longer usable for Red-cockaded Woodpeckers then removal of the restrictor is recommended (Saenz et al. 1998).

Among other nearctic-neotropical migrants, restoring fire to reduce hardwoods and encourage grassy to shrub-scrub ground cover/understory in pine-dominated stands may reduce habitat for many hardwood-dependent species. This loss has led to some debate about the wisdom of removing hardwoods from pine stands. However, opening mature pine stands should better secure source populations for Prairie Warblers and most high priority temperate migrant and resident species of the southeastern coastal plain now dependent on this type of management. In addition, other priority nearctic-neotropical migrants within the coastal plain are best taken care of in mature forested wetlands, while other species are peripheral in occurrence or otherwise of low priority status (similar to an analysis of the East Gulf Coastal Plain; Hunter *et al.* 1994; also see Wilson et al. 1995 for similar analysis of shortleaf pine in the Ouachita Mountains). Nevertheless, some retention of large individual mast producing oaks or patches of smaller oaks, where fire may naturally be less frequent (certainly well below 10 percent of stocking) is desirable to maintain overall ecosystem functions (for fox squirrels, etc.)

The single greatest outreach need is to work with consulting foresters and wildlife

biologists, extension services, state wildlife and forestry departments, and the U.S.D.A. Natural Resources Conservation and Forest Services to recognize opportunities for where and when restoration of or conversion to longleaf pine is a viable alternative to achieve a landowner's objectives. In 1998, U.S.D.A. NRCS established the Regional Longleaf Pine Ecosystem Conservation Priority Area which allows Farm Bill money to be spent on longleaf restoration on private lands, even on non-erodible sandy substrates. In addition, developing a management plan that focuses on use of longleaf habitats by both game and nongame species, assuming this is a priority objective of the landowner, should keep the above considerations in mind and adjust accordingly to the specifics of the landowner.

Landers *et al.* (1995) outline a strategy for working with private landowners who may be convinced that restoration and conversion to longleaf pine can be profitable. Longleaf should be grown because it (1) is a high-quality timber tree that provides numerous products, (2) produces more dry weight per unit volume of any southern pine, (3) produces more poles (30-80% of trees in a stand) than sawlogs, (4) is a low-risk species to manage, (5) is more resistant to fire, diseases, and pests than other southern pines, (6) is more resistant than slash pine to breakage from ice storms, (7) develops a massive taproot to reduce the risk of windthrow, (8) is suited to a wide range of management and silvicultural practices, (9) grows as well or better than other southern pines after its grass stage, and (10) produces poles and logs in 40 to 50-year rotations (Landers et al. 1995).

The only potential negative factor is that both the diameter and height growth of young longleaf pines are reduced by regular burning, but many landowners may be willing to accept lower yields in return for the natural beauty and enhanced biodiversity of open, regularly burned, longleaf forests.

Game species from deer to turkey, but especially northern bobwhite, thrive in longleaf pine forests maintained in open condition by frequent thinning and prescribed fire, allowing for developing valuable hunting opportunities for those willing to pay for lease access to private land. As stated earlier, many nongame species dependent on this habitat also thrive under these conditions and as nature tourism continues to

expand, high quality wildlife viewing opportunities may also become profitable. Woodland grazing for beef cattle is in many ways compatible with burning, primarily late winter or early spring on a one- to two-year rotation, and maintaining a grassy dominated ground cover under an open longleaf pine canopy.

Growing concerns about air quality and burning near communities ("Smoky Bear" syndrome) is making it more difficult to efficiently manage southern pines in general, and longleaf-grass communities especially. Landers *et al.* (1995) reports on the 1990 Prescribed Burning Act in Florida which authorizes and promotes prescribed burning for ecological and other purposes. In sum, longleaf forests can be both profitable and ecologically sensitive, the challenge is to find the right formula to bring private landowners in to be voluntary partners to accomplish the restoration goals discussed above. Longleaf restoration should not be viewed as competitive with intensive pine plantation management, but should be encouraged where intensive plantation management produces high yields, thus reducing pressure on other parts of the landscape more suitable for growing and managing longleaf pine ecosystems. As Landers *et al.* (1995, page 44) conclude:

> Restoring the longleaf pine ecosystem could serve as a prime example of forest ecosystem management--how a once diminished ecosystem was restored at a sustainable, functioning paradigm through wise stewardship.

Recently, the Longleaf Alliance (co-directed by Dean H. Gjerstad, Auburn University, Alabama, and Rhett Johnson, Solon Dixon Forestry Education Center, Andalusia, Alabama) has formed to address the above outreach and education need to promote sustainable management of longleaf pine working with private landowners. The Longleaf Alliance has already developed a strategic plan to promote the ecological and economic values of longleaf pine ecosystems and define goals for educational and outreach, research, and recovery of these ecosystems on private lands. In addition, the Southern Group of State Foresters has begun a process to develop a regional longleaf pine restoration/regeneration strategy and have circulated a questionnaire to landowners and land managers to implement this strategy working with the private

forestry sector. For more information contact Dr. Rhett Johnson, The Longleaf Alliance, Rt. 7 Box 131, Andalusia, Alabama 36420 (334/222-7779).

Evaluation of assessments:

Reviewing and adjusting habitat restoration objectives given above is in itself a high priority. In order to make sure that longleaf pine associated biota are able to benefit to the maximum extent possible, several issues need to be address:

(1) How much of existing longleaf ecosystems is considered functioning properly and how much can forseeably be restored to functioning condition within each focus area (including those listed above, but expanded to all ownerships);

(2) How large should patches be to support various components of the longleaf ecosystem (establish different thresholds similar to those established for forested wetlands?)--establish desired average patch size recommendations for non-industrial, industrial, and public lands to accommodate differing landuse objectives ;

[Note: Walter Rosene wrote in his book *The Bobwhite Quail* (1969) that 5000 acres of well managed habitat were required to support a sustainably hunted population of Northern Bobwhite; a simple extrapolation of average pairs per 100 acres leads to an estimate of 7500 acres or more to support 500 pairs/coveys which may be closer to what small-game biologists such as Carl Betsill, North Carolina Wildlife Resources Commission, would recommend today]

(3) How should longleaf forests be ideally distributed--matching suitable site conditions and opportunities among states and cooperating landowners and public land managers?

Research focusing on understanding the role of fire in pine ecosystems, especially longleaf, is underway through most southern universities, several non-governmental organizations (*e.g.*, Tall Timbers Research, Inc., Joseph W. Jones Ecological Research Center), and through governmental agencies (*e.g.*, National Forests, Experimental Forests [most notably Escambia Forest in Alabama], military installations [most notably Eglin Air Force Base, Fort Stewart and Fort Benning], and national wildlife refuges [most notably Carolina Sandhills, Okefenokee, and St. Marks]). Very important in these efforts, especially for the South Atlantic Coastal Plain, is

understanding the conditions and requirements under which wiregrass and other herbaceous plants best reproduce and spread within longleaf ecosystems.

In addition to research on longleaf pine ecosystems, research is required for understanding specific factors influencing survival and reproduction of high priority birds. Demographic and foraging studies are beginning to proliferate for various Red-cockaded Woodpecker populations, allowing for taking general recovery guidelines and customizing these for the local conditions, whether they be landuse patterns or relative quality of existing habitat. Particularly well known are the demographics and habitat use of North Carolina Sandhills (Fort Bragg and surrounding properties; J. Walters, P. Doerr, and colleagues at North Carolina State University) and Apalachicola National Forest (R. Costa and colleagues with U.S.D.A. Forest Service and F. James and colleagues at Florida State University) populations. Similar studies are needed for other longleaf pine associated species and some are now underway at Savannah River Site (D. Krementz and colleagues at University of Georgia, K. Franzreb and colleagues at Clemson university and U.S.D.A. Forest Service) and in the North Carolina Sandhills (C. Hardy and colleagues with North Carolina Wildlife Resources Commission, Department of the Army, Tall Timbers Research, Inc., Mississippi State University, and U.S.D.A. Forest Service).

Southern Pine: Mature Loblolly-Shortleaf

Ecology and status:

Although longleaf pine is ecologically the most important of the southern pines within the coastal plain, other species have replaced the longleaf as more economically important. In the South Atlantic Coastal Plain, faster growing slash and loblolly pines are of more economic importance. At the time of European colonization, approximately 36 million acres of southeastern forests estimated to support longleaf were mixed with other pine and hardwood trees (Frost 1993). During pre-settlement times, about 18 million acres of mixed pine-hardwood forests with longleaf as a minor component occurred throughout the southeast. These forests occurred in transitional

areas with shortleaf and loblolly pines becoming more dominant north in the Mid Atlantic Coastal Plain of Virginia and west to the fall-line and into the Southern Piedmont. To the south, slash pine becomes the co-dominant to dominant pine into Peninsular and Subtropical Florida respectively.

Loblolly pine is an excellent natural invader of disturbed sites and today is the most frequent pine found in old field successional stages. Even in areas where longleaf is still a numerically important species, disturbance and fire suppression during the last two centuries have led to an increase of loblolly pine (e.g., most population and area goals in the longleaf discussion take into account the prevalence and use in many areas of loblolly, even for Red-cockaded Woodpeckers). Nevertheless, small patches of mature loblolly pines prior to European settlement may have played important roles for some species and certainly are important today (e.g., Swallow-tailed Kite nest requirements under Forest Wetlands section).

In addition to loblolly, shortleaf pine is also associated with oldfields within the South Atlantic Coastal Plain; however, shortleaf pine is relatively rare away from the fall-line. Shortleaf pine is more like longleaf in that it is very long-lived and better adapted to growing season fires. Shortleaf becomes more important in hilly upland areas, most prevalent within coastal plain sites west of the Mississippi River and into the Ozark-Ouachita Highlands.

During this discussion, rotation length where Red-cockaded Woodpeckers are under active management is assumed to be between 80-120 years and 100-200 years (depending on site index) for loblolly and shortleaf stands respectively (USDA Forest Service 1995). Where Red-cockaded Woodpecker recovery is not an issue, loblolly and shortleaf in this section are assumed to be on at least a 50 year rotation.

Priority species, species suites, and habitat requirements:

Other than pure stands of longleaf and mature slash pine, mature loblolly and shortleaf pines (often with longleaf mixed in) provide perhaps the most stable habitat within the South Atlantic Coastal Plain for Brown-headed Nuthatch, Bachman's Sparrow, Field Sparrow, and Prairie Warbler. Season and frequency of burning dictate the abundance of these species. Additionally, Red-cockaded Woodpeckers make frequent use of the older loblolly and shortleaf pines for creating cavities.

Patches of at least 20,000 acres of appropriately managed pine-dominated ecosystems provide habitat for many vulnerable species. Northern Bobwhites, Bachman's Sparrows, and Field Sparrows (at least during winter) may be found in shrub-scrub but optimally use a grassy dominated ground layer. Regularly burned stands provide the most optimal habitat for all bird species associated with mature pine. Breeding Field Sparrows and Prairie Warblers are most often associated with a dense shrub-scrub layer, occurring during the latter half of a normal burning cycle (3-10 years, depending on other management objectives and landscape factors.) Brown-headed Nuthatches and other cavity-nesting species may be found if pines are old enough for cavities.

Red-cockaded Woodpecker. -- A patch size of 125,000 acres or more has been established to support viable Red-cockaded Woodpecker populations (Reed et al. 1988). Few shortleaf and fewer loblolly dominated systems will ever support recovered populations, but can nevertheless support sizeable "short-term" viable populations. In the South Atlantic Coastal Plain proper, loblolly is often mixed in with longleaf areas and greatly contribute to overall population stability in many designated recovery areas, but only in the adjacent Southern Piedmont does loblolly or shortleaf pine stands become the most important pine to existing Red-cockaded Woodpecker populations (Piedmont National Wildlife Refuge, Fort Benning, both in Georgia). This number assumes pine regeneration sites within a given patch will be temporarily unavailable to woodpeckers. However, smaller pine-dominated forests under public or cooperating private land management also support important woodpecker populations. Within these patches,

late successional stands are important for breeding birds.

Population and habitat objectives:

Population objectives

As with longleaf pine, increasing quality of these southern pine habitats should contribute to achieving pre-1975 population levels for the same priority species described under longleaf and slash dominated pine stands. Similarly, densities for Brown-headed Nuthatch should be similar to that described in the previous section. However, average densities are likely to be lower in loblolly stands where burning regimes may not allow for long-term maintenance of grassy conditions, whereas shortleaf forests are likely more similar to longleaf communities in supporting grassy-herbaceous dependent species. Prairie warblers and Field Sparrows may be more prevalent in mature loblolly and possibly shortleaf as well when compared to very frequently burned longleaf communities.

Habitat objectives

Emphasis on late successional stands, especially on public lands, should continue, if not increase. In addition, initial stocking rates on private lands managed for sawtimber should be lowered. Disturbance regimes (e.g., judicious use of fire, herbicides) should be increased to enhance ground cover/understory habitat quality. Operating at the scale of 10,000 acres is recommended for supporting "source" populations for most pine associated priority species (including Northern Bobwhite).

Implementation recommendations and opportunities:

Prairie Warblers and most high priority temperate migrant and resident species of the southeastern coastal plain depend on management practices (e.g., burning) that open mature pine stands. However, restoring fire to reduce hardwoods and encourage grassy to shrub-scrub ground cover/understory in pine-dominated stands may reduce habitat for hardwood dependent nearctic-neotropical migrants. Unlike longleaf dominated stands, use of fire to control understory vegetation in loblolly stands may

require greater use of dormant season burning. Dormant season burning is less likely to kill loblolly and shortleaf pine seedlings. Although it does not support the more grassy-oriented species, dormant season burning should benefit the shrub-scrub oriented species.

Assuming that most longleaf management in the future will be concentrated on the use of growing season burning, the relatively few mature loblolly and shortleaf dominated stands mixed in the landscape may provide a valuable habitat component for shrub-scrub dependent species. The longer the interval between burning a stand, the more likely the stand will move into a pine-hardwood mix. However, few high priority species would clearly benefit from a proliferation of this forest type within the South Atlantic Coastal Plain. Occasional stands within a larger mature pine-dominated landscape where fire is infrequent may provide for locally interesting combinations of bird species. However, this type of management should not be widely encouraged as sound bird management for priority species.

Evaluation of assumptions:

Research, monitoring, and outreach needs are essentially the same as for longleaf pine (e.g., demographics and ideal patch size) and are addresses in the longleaf pine section. What role nest predators and cowbirds can play in smaller pine habitat fragments for pine priority species compared with hardwood species should be an interesting line of research.

Small populations of Red-cockaded Woodpeckers on public and private lands need to be maintained as the species is recovered (USDA Forest Service 1995). Details for supporting Red-cockaded Woodpecker populations are outlined in USDA Forest Service (1995), U.S. Fish and Wildlife Service (1985), and in the Longleaf Pine discussion.

Southern Pine: Short-Rotation "Plantation" Pine

Ecology and status:

On private industrial lands in the South Atlantic Coastal Plain, short-rotation pine can be important as an early-successional habitat. Short-rotation pine plantations are composed of either slash or loblolly pine. Depending on management emphasis, some "older" short-rotational pine stands may be managed to also support some otherwise hardwood dependent species.

Priority species, species suites, and habitat requirements:

Although not as important as regularly burned late successional pine, high densities of clearcuts on private industrial lands likely support many early-successional species (principally Northern Bobwhite, Bachman's and Field Sparrows, Prairie Warblers, and, in northeastern North Carolina and southeastern Virginia, breeding Henslow's Sparrows). In addition, edges and riparian streamside management zones may support transients. Pine canopies with a hardwood midstory and understory may provide marginal to suitable habitat for other priority species (e.g., Wood Thrush and Hooded Warbler).

Population and habitat objectives

Nongame bird management practices should be encouraged through incentives, cooperative agreements, etc. Practices should include (1) adequate streamside management zones (300 ft.) to support riparian-associated breeding birds, (2) proliferation of hardwoods (where feasible) in the understory of sapling/pole stands, and (3) consolidation of early-successional stands with less intense site preparation as economically feasible as much as possible.

Implementation recommendations and opportunities:

Pine management for pulp/paper production often may not provide optimal habitat for many high priority southern pine dependent landbirds. Opportunities under Farm Bill encouraging lower stocking rates and higher percentage of herbaceous and shrub-scrub habitat may reverse this trend on many thousands of acres under the Conservation Reserve Program. At the other end of the spectrum, management practices that retain dense hardwood understories and midstories could provide suitable habitat for some nearctic-neotropical migrants (Johnston and Odum 1956, Meyers and Johnson 1978). Wood Thrush, Hooded Warblers, and Whip-poor-wills appear to be stable in these commercial forests. Optimum management of high priority nongame landbirds within pine plantations would include retention of some "natural" pine or hardwood vegetation patches where applicable, or otherwise encouraging hardwood understory or midstory development. Conversion from hardwoods to pine or pine-hardwood mix, with appropriate management, is clearly better than no forested habitat at all. However, benefits to many high priority nearctic-neotropical migrants in these habitats would be less valuable than restoration and appropriate management of mature pine forests or forested wetlands (especially pocosins and other non-alluvial forested wetlands).

Evaluation of assumptions:

Monitoring efforts with cooperative landowners would help to clarify the importance of short-rotation pine habitats and verify the above recommendations as improving the status of certain species (especially early-successional and hardwood dependent species). Additional research is needed on the role of herbicides during site preparation to maximize bird use and the use of fire versus herbicides in reducing hardwood competitors of pine.

In addition to nongame species, concerns over numbers of Northern Bobwhite populations continue. The persistence of healthy game bird populations should be addressed when plans are formalized for distribution and persistence of early-

successional habitat for nongame species.

In addition to Northern Bobwhite, management recommendations for short-rotation “plantation” pine must be addressed also in the context of Wild Turkey management. Guidelines for Wild Turkey management are mostly favorable to many priority nongame species. For example, the National Wild Turkey Federation and many state small game biologists recommend maintaining wide riparian zones (300 ft.) that likely would benefit many nongame species (including some priority species). Increasingly within the coastal plain, growing season burns is becoming an acceptable management practice and is offered as a viable option to landowners working in cooperation with the National Wild Turkey Federation. However, not all recommendations are beneficial to priority nongame species, especially when maximizing Wild Turkey numbers and size is a primary land use objective. In hardwood stands where open understories for travel corridors are emphasized for Wild Turkey, maintaining patches of dense understories is also important for many nesting priority species (sometimes also including Wild Turkey). Whereas Northern Bobwhite and associated nongame species do better with relatively large forest openings, Wild Turkey respond better to narrow and long openings. These narrow and long openings within largely forested landscapes are overall likely neutral to priority nongame species, but where forest cover falls below 70 percent (or 90 percent in forest fragments less than 100,000 acres), such management is more likely detrimental for species most susceptible to cowbird parasitism or nest depredation. The above differences should be kept in mind when working with landowners, as they should choose which direction they prefer to follow, but as game and nongame biologists and interest groups work more closely together these options can be better explained for making informed decisions.

Among the most interesting opportunities for better bird management within this physiographic area is the development of novel approaches to deer management. “Bird-friendly” deer management guidelines must include means to maintain healthy understory vegetative structure and to minimize edges and openings where there are clear problems with cowbirds and nest predators. Although management approaches that focus on “quality” deer do work to keep overall numbers down, success of these

practices depends on availability of planted spring foods and edges. Generic deer management recommendations (e.g., edge creation, food plots) often provided to private landowners and implemented on public lands to increase deer populations would appear unnecessary and perhaps counterproductive within a mostly fragments landscape. When securing local vulnerable bird species is an important objective, care must be taken to review deer management with respect to forest distribution patterns as well as current and projected deer populations within a physiographic area.

"Bird-friendly" management will depend upon outreach involving private landowners and effective university and extension services, state forestry and wildlife agencies, and federal Forest Stewardship and Partners for Wildlife programs.

Oak-Hickory/Tulip Poplar/Pine Forests

Ecology and status:

Although some literature suggests that extensive upland hardwood-pine mixed forests existed at least north of the Savannah River within the South Atlantic Coastal Plain (see map in Skeen et al. 1993), it is generally recognized today that upland hardwoods prior to European colonization were restricted to sites where fires were infrequent. Two major types of forests are recognized: (1) turkey oak and other scrub oak dominated stands in protected sandhill sites and (2) southern mixed mesic forests generally along protected bluffs and ravines. Turkey/other scrub oak stands do not appear to support any high priority birds within the South Atlantic Coastal Plain that are not already dependent on longleaf sandhills and are not discussed further here. Southern mixed mesic forests, though very local, are important centers of regional biodiversity and provide high quality habitats for several priority hardwood species, at least locally. This latter forest type is discussed in more detail in the next section.

Riparian/Mixed Mesic Hardwoods (Southern Mixed, Hammocks)

Ecology and status:

The term riparian refers to streamside areas. In the present context, riparian habitats include bottomlands and all palustrine wetlands in coastal plains and prairies,

Mississippi Alluvial Plain, and Peninsular and Subtropical Florida (coastal physiographic areas). However, riparian forests may be dominated by tree and shrub species more typical of uplands throughout southeastern interior physiographic areas and locally in the coastal physiographic areas (forested wetlands in narrow floodplains, loess bluff oak/hickory and mixed mesic hardwoods). In many situations, upland riparian habitats are as important as wetland habitats to both aquatic and terrestrial fauna associated with streams and rivers, especially in those lands where there is high topographic relief or circumvented soils.

Hammocks are best defined as narrow bands of vegetation confined to slopes between upland sand/clayhill pinelands and bottomlands, with species composition determined by relative moisture retention and fire frequency. Hydric stands are distinguished from other forested wetlands by very intermittent flooding and some fire. High humidity and a consequent low frequency of fire distinguish hydric stands from mesic and xeric hammocks (Vince et al. 1989). Hydric hammocks provide important habitats for many species of wildlife, including Swallow-tailed Kite and black bear. Located near fire maintained longleaf pine and xeric scrub ecosystems, xeric hammocks are subject to the highest fire frequency, but retain enough moisture to support stands of sizable oaks and other hardwoods.

Mixed mesic hardwoods collectively are important within the coastal plain from North Carolina to Texas. These forests are referred to or included within southern mixed mesic hardwood forests, southern mixed hardwood forests, southern hardwood forests, temperate hardwood forests, temperate broad-leaved forests and mesic hammocks (Platt and Schwartz 1990, Hamel 1992a, Ware et al. 1993). Mixed mesic forests presently reach their greatest development within the Florida panhandle and adjacent to southwestern Georgia and Peninsular Florida.

In areas draining into the Apalachicola River, mesic hammocks are characterized by the codominance of southern magnolia and American beech. These mesic hammocks certainly constitute the most important of southeastern riparian woodlands by supporting a number of locally occurring endemic species (e.g., Florida yew and Florida torreya along Apalachicola Bluffs) as well as birds and other animals more

characteristic of forested wetlands.

Priority species, species suites, and habitat requirements:

Priority species within riparian/mixed mesic hardwood habitat include Swainson's Warbler, Kentucky Warbler, Acadian Flycatcher, Louisiana Waterthrush, and other transients. In most physiographic areas where the highly vulnerable Cerulean Warbler and the usually rare Swainson's Warbler are found, they are mostly restricted to (and are certainly most common in) riparian habitats within largely forested landscapes. Acadian Flycatchers and Louisiana Waterthrushes are always more common and widespread than the two warbler species above, but still consistently become rare away from riparian habitats in most physiographic areas.

Implementation recommendations and opportunities:

Maintenance of riparian vegetation along streamsides is almost universally considered essential by natural resource managers for minimizing erosion from upslope areas entering and seriously changing water quality (National Association of Conservation Districts 1994). In addition to improving stream quality, streamside buffers may benefit many rare and declining aquatic vertebrate and fish species throughout the Southeast. However, of greater interest to this report are benefits accrued by bird species. Streamside management zones, if widely implemented across a landscape, could be effective overall for supporting some vulnerable species. Because landbirds are not the sole concern when managing riparian habitat, the most effective conservation will balance economics with the needs of wildlife, including vulnerable neotropical migrants.

Melchiors (in press) and Wigley and Melchiors (1994) describe management opportunities as well as important caveats for interpreting existing data on wildlife use of retained riparian vegetation in actively managed landscapes. Existing data has been organized into three categories particularly useful for developing management recommendations: (1) streamside management zones in managed (usually short-

rotation pine) forest stands, (2) riparian forest habitat in otherwise agricultural or developed landscapes, and (3) moisture/elevation gradients in largely forested landscapes (Melchiors in press). Current understanding of bird-habitat relationships within largely forested landscapes, especially in mountainous areas ("3" above), indicate that forested riparian habitat is indeed important for supporting many species. The goal for managers concerned with the plight of species depending on healthy forested riparian habitat should be to avoid taking presently stable source populations below the threshold forming population sinks or outright local extirpations. Flexibility in managing riparian habitats is enhanced when large landscapes are under cooperative management. Relative width recommendations could depend on the nature of dominant landuse patterns. Adjacent lands dominated mostly by mature or maturing stands would suggest narrower streamside zones to be adequate. Forests dominated by short-rotation plantation forest management, with many early regeneration patches present during every decade, would more likely require moderate to wide zones. Finally, agricultural areas would require the widest zones if vulnerable landbirds were an important consideration for management. Within the South Atlantic Coastal Plain, many of the floodplain forested wetland objectives should suffice for riparian objectives.

For most, if not all southeastern locations, few important wildlife species would be served by narrow (10-25 feet) grassy streamside buffers. Yet such narrow and grassy riparian conditions may be adequate for minimizing erosion, consistent with the dominant land use. Although there is little argument among natural resource managers on the importance of maintaining forested riparian areas for wildlife in general, there remains active debate on several points. These include (1) adequate to optimal streamside widths, (2) acceptable structure and plant composition, (3) species to be targeted, and depending on the wildlife targeted, (4) the desired intensity of active management consistent with balancing other priority land uses (Wigely and Melchiors 1994). General guidelines as given by Wigley and Melchiors (1994) include the correlation of streamside management zones (SMZs) with watershed size, the use of narrow SMZs on ephemeral or intermittent streams to promote diversity of bird communities in managed forests, and flexibility in SMZ width (fixed width SMZs may not

always encompass important habitat features where topography is variable).

Cost to landowners in maintaining wide SMZs can be considerable when timber production is the landowner's only or primary objective. Therefore, ongoing and future efforts to provide financial incentives, conservation easements, and partnerships through public-private programs (e.g., Farm Bill's Forest Stewardship, Partners for Wildlife) are critical for stabilizing or enhancing riparian and aquatic habitat throughout the Southeast. Fortunately, many wood producing industrial landowners and an increasing number of non-industrial landowners are responsible for helping to maintain high water quality and wildlife, especially landbirds. Nevertheless, "standard" recommendations for streamside management zone width and condition need to be presented to private landowners as optional if the recommendations are beyond those outline in State-sanctioned Best Management Practices (which are at a minimum usually considered adequate for imperiled aquatic fauna).

Cooperating partners should develop joint monitoring efforts in riparian habitats to better understand local responses by vulnerable species (whether birds, salamanders, or fishes) to on-going implementation of SMZs. Migration monitoring routes would seem most productive along riparian habitats and would add valuable information to timing and degree of transient passage through the South Atlantic Coastal Plain physiographic area. Ongoing efforts to improve watershed management (including riparian habitat condition) through data collection and outreach include tributaries and mainstems to the Flint, Chattahoochee, and Apalachicola. All these efforts involve both public and private interest groups.

Evaluation of assumptions:

Debates about the importance of streamside management zones at each local land management unit will likely continue without additional research. Nevertheless, existing data reveals these riparian habitats overall provide the best, if not the only, opportunities to support a large number of vulnerable neotropical migrants throughout much of the southeastern landscape away from major forested wetlands. Focusing on the needs of the most vulnerable birds likely occurring in any one area of interest can

assist land managers or interested landowners in making appropriate decisions on the width and condition of riparian habitats maintained in streamside management zones. Readers are encouraged to review several papers on this subject and include Keller et al. (1993), Kilgo et al. (1998), Hodges and Krementz (1996).

Urban/Suburban Backyards/Rural Woodlots

Ecology and status:

Along with maintaining riparian vegetation, mature woods maintained in otherwise "non-forested" areas may still provide important bird habitats at least for transient nearctic-neotropical migrants.

Priority species, species suites, and habitat requirements:

Woodlands within developed areas appear to serve as at least suitable habitat for transient nearctic-neotropical migrants as they move through the Southeast. Many transients may concentrate in isolated woodlots or in woodlands within more developed areas, especially where fleshy fruiting trees and shrubs are available during peak northbound and southbound movement periods. These woodlots may also provide some marginal to suitable habitat for other priority species.

Population and habitat objectives:

Private "backyard habitats" should be enhanced through outreach and incentives. Adequate cover, food (especially with native fleshy-fruit bearing trees and shrubs), and water should be encouraged in landscaping plans.

Implementation recommendations and opportunities:

Targeting "backyard habitat" programs and increasing incentives for more rural landowners to improve woodland habitat would be beneficial for transients as well as occasionally breeding species where mostly forested landscapes exist. The greatest potential for getting the local public involved and interested in bird conservation issues within the South Atlantic Coastal Plain will likely be tied to outreach involving backyard

and community efforts as described in the Partners in Flight “Flight Star” (Bird Education Center) Programs that have been initiated in several states (e.g., Georgia and Florida in this physiographic area).

Cooperating partners should develop joint monitoring efforts in developed habitats to better understand local responses by vulnerable species to on-going suburban expansion. Migration monitoring routes would seem most productive along extensively wooded habitats embedded within more developed environs and would add valuable information to timing and degree of transient passage through the South Atlantic Coastal Plain physiographic area.

Section IV: Implementation Recommendations and Summary

The following summary includes goal statements and objectives for major habitat types in the Southern Blue Ridge. Population and numerical habitat objectives are provided for specific bird species in need of priority conservation attention. The South Atlantic Coastal Plain includes the most expansive forested wetland systems, longleaf pine dominated ecosystems, the best remaining examples of maritime forests and estuarine systems, and very important beach and pelagic habitats for species otherwise rare or uncommon outside the region. Overall conservation priorities include stringent protection of existing functioning ecosystems, but many forested areas are altered requiring restoration through appropriate forestry practices and use of prescribed fire.

Grassland/Savanna/Pasture and Associated Wetlands

Goal - Retain native warm-season grasslands (including those associated with longleaf pine ecosystems) and restore enough areas to return habitat conditions to support priority grassland species at levels similar to those found in 1975.

Objectives - Both resident Loggerhead Shrike and Northern Bobwhite populations should be stabilized in 5 years and show increases within 20 years. Winter population objectives would be to support at least one third of all Henslow's Sparrows (shared with

pine flatwoods). Other species in need of monitoring are Bobolink (transient), Short-eared Owl (winter), Sedge Wren (winter), Barn Owl, Grasshopper Sparrow, and Northern Harrier. Locally, support a minimum 1,000 pairs of Henslow's Sparrows in eastern North Carolina and southeastern Virginia and support a minimum of 500 pairs of Florida Sandhill Cranes in south Georgia and north Florida. Habitat objectives for the South Atlantic Coastal Plain (again primarily driven through restoration of Northern Bobwhite habitat) include (1) retaining 300,000 acres of existing range (assuming this amount actually exists) and (2) restoring or converting 1,000,000 acres of native warm-season grasses. These objectives in part can be combined with objectives for longleaf restoration and maintenance and can be broken down on a state-by-state. For grasslands, restoration of appropriate disturbance (e.g., fire, grazing) regimes and cooperation with private landowners needed to restore warm-season grasses.

Managed and Palustrine Emergent Wetlands and Mudflats

Goal - Identify all potential management units; allocating timing and acreage to be flooded or drawn-down during migration events; provide protection for breeding Wood Storks and wintering rail populations; protect remnant "savanna-type" Carolina bays and managing beaver ponds and millponds to increase *Juncus* rushes potentially important for breeding rails.

Objectives - Specific population objectives will be developed by both U.S. shorebird and North American Colonial Waterbird planning efforts now underway. However, due to poor breeding success of both White Ibises and Wood Storks within Peninsular and Subtropical Florida, maintaining high breeding success among South Atlantic Coastal Plain populations is of great importance. For shorebirds, about 2.5 million out of over 5 million transient shorebirds appear to use inland and managed wetland habitat in the Southeastern U.S. (Hunter et al. 2000). Presently, at least 10,000 acres of managed wetlands for shorebirds ultimately are recommended for the South Atlantic Coastal Plain (Hunter et al. 2000). Flooding of allocated acreage should coincide with key shorebird

migration periods and should additionally benefit breeding Wood Storks and White Ibises as well as wintering and breeding rails.

Early-succession, Shrub-scrub, Old-Fields

Goal - Declines in Northern Bobwhite, Prairie Warbler, and Field Sparrow should be halted in 5 years and populations stabilized to increasing within 20 years to pre-1975 levels.

Objectives - Priorities include restoring grassy groundcover and shrub-scrub understory under mature pine through increased use of disturbance agents; seeking opportunities through Farm Bill and related programs to increase warm-season grasses and early successional habitats within agriculture-dominated landscapes; consolidating large patches of early successional oak/hickory and yellow pine on a sustainable basis to support Prairie Warblers and associated breeding birds. Habitat goals break down to (1) retaining 300,000 acres of 5-year idle lands, (2) 300,000 acres of annuals (forbs), and (3) 600,000 acres of 10-20 year herbaceous/shrub cover. These numbers serve as a starter for discussion, although existing range and acreage targeted for restoration within the South Atlantic Coastal Plain still needs to be determined.

Floodplain Forested Wetlands

Goal - Maintain or increase acreage of predominately mature forested wetlands and to focus management on increasing Swallow-tailed Kite nest sites and structural diversity of woodlands to support other priority species, particularly Cerulean and Swainson's Warblers.

Objectives - (1) Increasing kite nest site habitat to support at least 8 kite populations of at least 200 breeding-aged kites each and (2) increasing structural diversity to support a healthy Cerulean Warbler population of at least 100 pairs along the Roanoke River, and

at least 30 Swainson's and 60 Prothonotary Warbler populations among all systems. About 100,000 acres of mature forested wetland in the coastal plain appear to be necessary to support between 80-100 kite pairs. However, most known occupied areas in forested wetlands within the South Atlantic and East Gulf Coastal Plain physiographic areas are embedded within 400,000 acres or more of forest (much of which is pine). Forested floodplain wetlands in the South Atlantic Coastal Plain should be maintained or restored to reach goals of predominantly mature forests in at least (1) 10 patches >100,000 acres, (2) 15 patches >20,000 acres, (3) 7 patches >10,000 acres, and (4) 30 patches >6,000 acres.

Pocosins, Carolina Bays, Swamps, and other Non-alluvial Transitional Forested and Shrub-scrub Wetlands

Goal - Focus should be on restoring Atlantic white-cedar in eastern North Carolina and southeastern Virginia, minimizing pocosin land conversion, and effectively managing those areas that have been converted to plantation pine habitat. Priority species include Black-throated Green Warbler, Swainson's Warbler, Prothonotary Warbler, Worm-eating Warbler, and Prairie Warbler in hardwood, cypress, and Atlantic White-cedar communities. Red-cockaded Woodpecker, Brown-headed Nuthatch, Red-headed Woodpecker, and Chuck-will's-widow are among species associated with appropriately managed natural pond pine and loblolly pine plantation.

Objectives - Establish and maintain patches of mature forested wetlands of at least 20,000 acres for Black-throated Green Warblers source populations and 10,000 acres for Swainson's Warblers. For pine associated species, proposed population objectives (all for the southeastern Virginia, northeastern North Carolina area) are to have 250 groups of Red-cockaded woodpecker, which should also support healthy populations of Brown-headed Nuthatch and other pine-associated species. Sites in more grassy conditions should support at least an average of 7 coveys per 100 acres and more importantly support nesting Henslow's Sparrow populations. Species appearing to be

stable in commercial pine, former pocosin habitat, include Yellow-billed Cuckoos, Acadian Flycatchers, Worm-eating Warblers, Hooded Warblers, and Prairie Warblers. However, loblolly pine stands managed for sawtimber under these treatments are still less than 20 years old. The three highest priority species (Black-throated Green, Swainson's, and Prothonotary Warblers) dependent on large patches of tall pocosins and other forested wetlands have yet to show consistent use of commercial pine stands, but potential is there under certain conditions to support both hardwood understory species and pine overstory species (with the likely exception of Red-cockaded Woodpecker due to short harvest rotations on industry lands) as in pond pine pocosins.

Habitat objectives include (1) restoring and maintaining 47,000 acres of Atlantic white cedar in eastern North Carolina and Virginia, (2) minimizing further conversion of pocosins to other non-forest land uses, (3) maintain at least 5000 acres of pocosin grassland, (4) improve 40,000 acres of pond pine through more aggressive prescribed fire and (5) encouraging habitat management recommendations provided under the Short-rotation Pine discussion in areas where pocosins have been converted to plantation pine.

Maritime Forest/Shrub-scrub

Goal - Priority management includes maintaining and protecting existing high quality habitat; enhancing quality of private lands through outreach and incentives focused on encouraging adequate cover, food, and water in landscaping plans. Of greatest concern are breeding Eastern Painted Bunting and Common Ground-Dove populations. These habitats are likely essential for especially autumn (southbound) landbird transients.

Objectives - Stabilize or reverse population declines for Eastern Painted Buntings and Common Ground-Doves during the next 20 years. Of particular importance is

demonstrating stability for Painted Bunting populations on sea islands, especially in Georgia and South Carolina. Measure of reproductive success should be used to gauge population health. In addition, autumn migration monitoring should be increased to reveal population trends of transients along the Atlantic coastline. Habitat objectives include protecting and maintaining existing high quality maritime woodland and shrub-scrub habitats. High quality habitat is defined as largely forested areas with some edge and forest openings for buntings, and stands exhibiting structural diversity and large amounts of fleshy fruit for transients. Further determination of specific objectives requires a better understanding of present status information for both breeding and transient species. In the meantime, programs targeting both public land mangers and private landowners to provide adequate cover, food (especially native fleshy-fruit bearing plants), and water in landscaping should be encouraged.

Estuarine Emergent Wetlands

Goal - Protect wetland habitat either by resource management agencies or through private-public partnerships. In addition, effects of management (e.g., burning, ditching, etc.) need to be determined (especially for sparrows and rails).

Objectives - Population status and health for Sharp-tailed and Seaside Sparrows and all rail species is virtually unknown. Monitoring protocols need to be developed and widely implemented to determine baseline population status. Studies of contaminant effects on bird species dependent upon estuarine emergent wetlands should be conducted. All potential habitat should be protected either by resource management agencies or through private-public partnerships. In addition, effects of management (e.g., burning, ditching) need to be assessed for sparrows and rails. Although no net loss of estuarine emergent wetlands has occurred since the mid-1970's, water quality and contaminant issues may still influence the quality of habitat.

Beaches, Estuarine Mudflats

Goal - All potential habitat should be protected through resource management agencies or private-public partnerships particularly for migratory shorebirds (especially Red Knot), nesting Least Terns, Wilson's Plovers, Snowy Plovers, and Piping Plovers.

Objectives - Controlling recreational pressure on nesting beach birds or resting migratory shorebirds is essential from April-October. Other specific objectives are under development through parallel bird conservation planning efforts for shorebirds and colonial waterbirds.

Open Ocean (Gulf Stream)

Goal - Protect foraging gadfly petrels and other seabirds from contaminants and collisions with night lights. Species of importance include Black-capped Petrel and Bermuda Petrel.

Objectives - Foraging gadfly (Pterodroma) petrels and other seabirds should be protected from mercury and oil spills from ships, potential from future off-shore exploration drilling, longline fisheries (where known concentrations overlap heavily fished areas), and from collisions with night lights. In addition, work should begin on a range-wide conservation strategy for both gadfly petrels, Caribbean breeding White-tailed Tropicbirds and Audubon's Shearwaters, and other South Atlantic Seabirds. Conservation plans would require international partnerships with Caribbean nations and Bermuda.

Longleaf Flatwoods

Goal - Continue or increase emphasis on late successional stands, especially on public lands, and increasing disturbance regimes to increase ground cover/understory habitat

quality for the conservation of Red-cockaded Woodpecker, Southeastern American Kestrel Bachman's Sparrow, Henslow's Sparrow, and Brown-headed Nuthatch. Disturbance regimes (e.g., growing season fire) should be increased to establish ground cover/understory habitat quality. In addition, policies and incentives should be used to (1) double the number of longleaf pine acres on private land by the year 2025 (returning to 1975 levels), and (2) encourage appropriate management on both public and private land.

Objectives - Recovery goals for Red-cockaded Woodpecker populations have been established for 8 areas within the South Atlantic Coastal Plain Physiographic Area. Agency personnel and (in most areas) private landowners are working to establish specific population and habitat goals to achieve long-term viable Red-cockaded Woodpecker populations. In addition, most cooperators are dedicated to restoring longleaf pine ecosystem functions and values in order to stabilize associated longleaf pine communities. All of these efforts, plus efforts in pocosin and early-successional habitats should be considered successful when population sizes (as measured by BBS) reach pre-1975 levels for Northern Bobwhite, Brown-headed Nuthatch, Prairie Warbler, Bachman's and Field Sparrows. Population objectives that can be measured locally would be to support on average 5 pairs per 100 acres of at least suitable habitat for Brown-headed Nuthatch, 7 coveys of Northern Bobwhite, and 6 pairs of Bachman’s Sparrow.

Habitat objectives should have emphasized on late successional stands, especially on public lands. to include not only Red-cockaded Woodpeckers (where appropriate), but also Bachman’s and Henslow’s Sparrows, Southeastern American Kestrels, Brown-headed Nuthatches, and other priority species. By the year 2025, over 700,000 acres of at least 5-year old stands of longleaf pine should be established on private land through Conservation Reserve Program. It is assumed here that most or all acreages on private land would be managed primarily for timber production, at rotations not likely to support red-cockaded woodpeckers unless by prior agreement. Hopefully, however,

most of this acreage will attain conditions or management status that would support the many other longleaf pine associated species that do not impinge upon normal sawtimber harvesting practices. All 485,000 acres of longleaf on public lands should be in functional condition by year 2025, with an additional 165,000 acres improved to good condition on private lands (both corporate/industrial and non-industrial) for a total of 650,000 acres by year 2025.

Longleaf Sandhills

Goal - As with longleaf flatwoods, habitat goals are to continue or increase emphasis on late successional stands and increase disturbance regimes.

Longleaf/Slash Savannas

Goal - Again, habitat conservation should center around increased emphasis on late successional stands and increased disturbance regimes.

Loblolly/Shortleaf Pine

Goal - Brown-headed Nuthatch, Red-cockaded Woodpecker, and to a lesser extent Prairie Warbler and Field Sparrow are important loblolly/shortleaf species. In addition to conservation goals for the above pine habitats, emphasis should focus on lower stocking rates on private stands managed for sawtimber.

Population objectives

As with longleaf pine, increasing quality of these southern pine habitats should contribute to achieving pre-1975 population levels for the same priority species described under longleaf and slash dominated pine stands. Similarly, densities for Brown-headed Nuthatch should be similar to that described in the previous section. However, average densities are likely to be lower in loblolly stands where burning

regimes may not allow for long-term maintenance of grassy conditions, whereas shortleaf forests are likely more similar to longleaf communities in supporting grassy-herbaceous dependent species. Prairie warblers and Field Sarrows may be more prevalent in mature loblolly and possibly shortleaf as well when compared to very frequently burned longleaf communities.

Habitat objectives

Emphasis on late successional stands, especially on public lands, should continue, if not increase. In addition, initial stocking rates on private lands managed for sawtimber should be lowered. Disturbance regimes (e.g., judicious use of fire, herbicides) should be increased to enhance ground cover/understory habitat quality. Operating at the scale of 10,000 acres is recommended for supporting “source” populations for most pine associated priority species (including Northern Bobwhite).

Short-rotation "Plantation" Pine

Goal - Habitat is important for transients and marginal to suitable for other priority species. Conservation goals are to encourage through incentives and cooperative agreements better bird management practices involving streamside management zones, hardwood proliferation in understories of sapling/pole stands, and consolidation of early-successional stands.

Objectives - Nongame bird management practices should be encouraged through incentives, cooperative agreements, etc. Practices should include (1) adequate streamside management zones (300 ft.) to support riparian-associated breeding birds, (2) proliferation of hardwoods (where feasible) in the understory of sapling/pole stands, and (3) consolidation of early-successional stands with less intense site preparation as economically feasible as much as possible.

Oak/Hickory/Yellow Poplar/Pine

Goal - Species of concern include Wood Thrush, Hooded Warbler, and Chuck-will's-widow. Forest patches should be consolidated and increased in size through restoration (especially in North Carolina). Research should focus on determining need for a greater proportion of older age classes and improved stand quality for understory breeding birds.

Riparian/Mixed Mesic Hardwoods (Southern Mixed, Hammocks)

Goal - Swainson's Warbler, Kentucky Warbler, and transients are important species. Habitat goals include ensuring protection and enhancing quality of existing streamside woodlands and "virgin" hammocks and restoration of additional streamside woodlands.

Urban/Suburban "Backyards"

Goal - Habitat is important for transients and marginal to suitable for other priority species. Conservation goals are to enhance through outreach, incentives, etc., quality of existing private "backyard habitats" by encouraging adequate cover, food, and water in landscaping plans.

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Appendix II

Scientific and Common Names of Plants and Animals Listed in the South Atlantic Coastal Management Plan

Plants

American Elm	*Ulmus americana*
Bald Cypress	*Taxodium distichum*
Black Needlerush	*Juncus roemerianus*
Black Willow	*Salix nigra*
Bluestems	*Andropogon* sp.
Canebrake	*Arundinaria gigantea*
Cherrybark Oak	*Quercus pagoda*
Cutthroat Grass	*Panicum abscissum*
Eastern Cottonwood	*Populus deltoids*
Eastern Sycamore	*Platanus occidentalis*
Elms	*Ulmus* spp. and *Planera Aquatica*
Ferns	*Woodwardia virginica, Osmunda cinnamomea*
Flordia Torreya	*Torreya taxifolia*
Florida Yew	*Taxus floridana*
Gallberry	*Ilex Glabra*
Green Ash	*Fraxinus pennsylvanica*
Hemlock	*Tsuga caroliniana*
Laurel Oak	*Quercus laurifolia*
Live Oak	*Quercus virginiana*
Loblolly Pine	*Pinus taeda*
Longleaf Pines	*Pinus palustris*
Overcup Oak	*Quercus lyrata*
Palmetto gallberry	*Ilex glabra*
Pitcher plant	*Sarracenia* sp.
Pond Pine	*Pinus serotina*
Red Bay	*Persea borbonia*
River Birch	*Betula nigra*
Saltmarsh cordgrass	*Spartina alterniflora*
Saw Palmetto	*Serenoa repens*
Seabeach amaranth	*Amaranthus pumious*
Shortleaf Pine	*Pinus echinata*
Shrubs	*Baccharis* sp.
Shumard Oak	*Quercus shumardii*
Slash	*Pinus elliotti*
Southern Scrub Oak	*Quercus* sp.
Spanish moss	*Tillandsia usneoides*

Spruce	*Picea*
Sugarberry	*Celtis laevigata*
Swamp Chestnut Oak	*Quercus michauxii*
Swamp Cottonwood	*Populus heterophylla*
Swamp Tupelo	*Nyssa biflora*
Swamp Willow	*Salix Caroliniana*
Sweetbay	*Magnolia virginiana*
Sweetgum	*Liquidambar styraciflua*
Water Hickory	*Carya aquatica*
Water Tupelo	*Nyssa aquatica*
Water Oak	*Quercus nigra*
Wax Myrtle (Southern Bayberry)	*Myrica cerifera*
White Cedar (Atlantic White Cedar)	*Chamaecyparis thyoides*
Willow Oak	*Quercus phellos*
White Pine	*Pinus strobus*
Wiregrasses	*Aristida stricta, Aristida beyrichiana*
Yaupon holly	*Ilex ambigua*

Animals

Bison	*Bison bison*
Elk	*Cervus candensis*
Flatwoods salamander	*Ambystoma cingulatum*
Gopher frog	*Rana areolata*
Gopher tortoise	*Gopherus polyphemus*
Indigo snake	*Drymarchon corais*
Oldfield (beach) mice	*Peromyscus polionotus* (subspp.)
Plain fox squirrel	*Sciurus niger*

Appendix II. Scientific and common names of avian species included in the South Atlantic Coastal Management Plan.

Common Name	Scientific Name
Red-throated Loon	*Gavia stellata*
Black-capped Petrels	*Pterodroma hasitata*
Bermuda Petrels	*Pterodroma cahow*
White-tailed Tropicbirds	*Phaethon lepturus*
Audubon's Shearwater	*Puffinus lherminieri*
Wood Stork	*Mycteria americana*
Florida Sandhill Crane	*Grus canadensis*
White Ibis	*Eudocimus albus*
American Bittern	*Botaurus lentiginosus*
Least Bittern	*Ixobrychus exilis*
Reddish Egret	*Egretta rufescens*
Brant	*Branta bernicla*
American Black Duck	*Anas rubripes*
Lesser Scaup	*Aythya affinis*
Greater Scaup	*Aythya marila*
Tundra Swan	*Cygnus columbianus*
Wood Duck	*Aix sponsa*
Northern Pintail	*Anas acuta*
Blue-winged Teal	*Anas discors*
Swallow-tailed Kite	*Elanoides forficatus*
Southeastern American Kestrel	*Falco sparverius*
Florida Short-tailed Hawk	*Buteo brachyurus fuliginosus*
Peregrine Falcon	*Falco peregrinus*
Bald Eagle	*Haliaeetus leucocephalus*
Mississippi Kite	*Ictinia mississippiensis*
Northern Harrier	*Circus cyaneus*
Wild Turkey	*Meleagris gallopavo*
Northern Bobwhite	*Colinus virginianus*
Black Rail	*Laterallus jamaicensis*
Yellow Rail	*Coturnicops noveboracensis*
King Rail	*Rallus elegans*
Limpkin	*Aramus guarauna*
Red Knot	*Calidris canutus*
Piping Plover	*Charadrius melodus*
Snowy Plover	*Charadrius alexandrinus*
American Oystercatcher	*Haematopus palliatus*
Wilson's Plover	*Charadrius wilsonia*
Stilt Sandpiper	*Calidris himantopus*

Buff-breasted Sandpiper	*Tryngites subruficollis*
American Golden Plover	*Pluvialis dominica*
American Woodcock	*Scolopax mino*
Black Skimmer	*Rynchops niger*
Least Tern	*Sterna antillarum*
Roseate Tern	*Sterna dougallii*
Gull-billed Tern	*Sterna nilotica*
Common Tern	*Sterna hirundo*
Laughing Gull	*Larus atricilla*

Common Ground-Dove	*Columbina passerina*
Yellow-billed Cuckoo	*Coccyzus americanus*
Short-eared Owl	*Asio flammeus*
Barn Owl	*Tyto alba*
Chuck-will's-widow	*Caprimulgus carolinensis*
Whip-poor-will	*Caprimulgus vociferus*
Red-cockaded Woodpecker	*Picoides borealis*
Red-bellied Woodpecker	*Melanerpes carolinus*
Red-headed Woodpecker	*Melanerpes erythrocephalus*
Ivory-billed Woodpecker	*Campephilus principalis*
Great-crested Flycatcher	*Myiarchus crinitus*
Acadian Flycatcher	*Empidonax virescens*
Eastern Kingbird	*Tyrannus tyrannus*
Bicknell's Thrush	*Catharus bicknelli*
White-eyed Vireo	*Vireo griseus*
Yellow-throated Vireo	*Vireo flavifrons*
Rusty Blackbird	*Euphagus carolinus*
Red-winged Blackbird	*Agelaius phoeniceus*
Orchard Oriole	*Icterus spurius*
Eastern Meadowlark	*Sturnella magna*
Brown-headed Cowbird	*Molothrus ater*
Loggerhead Shrike	*Lanius ludovicianus*

Summer Tanager	*Piranga rubra*
Yellow-throated Warbler	*Dendroica dominica*
Swainson's Warbler	*Limnothlypis swainsonii*
Cerulean Warbler	*Dendroica cerulea*
Prothonotary Warbler	*Protonotaria citrea*
Wayne’s Black-throated Green Warbler	*Dendroica virens*
Black-throated Blue Warbler	*Dendroica caerulescens*
Brown-headed Nuthatch	*Sitta pusilla*
Worm-eating Warbler	*Helmitheros vermivorus*
Hooded Warbler	*Wilsonia citrina*
Kentucky Warbler	*Oporornis formosus*

American Redstart	*Setophaga ruticilla*
Black-and-white Warbler	*Mniotilta varia*
Yellow-breasted Chat	*Icteria virens*
Prairie Warbler	*Dendroica discolor*
Carolina Chickadee	*Poecile carolinensis*
Sedge Wren	*Cistothorus platensis*
Louisiana Waterthrush	*Seiurus motacilla*
Henslow's Sparrow	*Ammodramus henslowii*
Bachman's Sparrow	*Aimophila aestivalis*
Saltmarsh Sharp-tailed Sparrow	*Ammodramus caudacutus*
Nelson's Sharp-tailed Sparrow	*Ammodramus nelsoni*
Seaside Sparrow	*Ammodramus maritimus*
Savannah Sparrow	*Passerculus sandwichensis*
Cape Sable Sparrow	*Ammodramus maritimus mirabilis*
Eastern Towhee	*Pipilo erythrophthalmus*
Grasshopper Sparrow	*Ammodramus savannarum*
Field Sparrow	*Spizella pusilla*
Eastern Painted Bunting	*Passerina ciris*
Indigo Bunting	*Passerina cyanea*
Blue-grosbeak	*Guiraca caerulea*

Table 1. Priority bird species for South Atlantic Coastal Plain: Entry criteria and selection rationale.

Priority Entry Criteria[1]	Species	Total PIF Priority Species Score	Score		Percent of BBS Population	Local Migratory Status[2]	Geographical or Historical Notes
			Area Importance	Population Trend			
Ia.	Bewick's Wren Appalachian	35	5	5		C	Nearly extinct
	Kirtland's Warbler[5]	35	5	5		A	Mostly SC, GA
	Black-capped Petrel	32	5	5		P	Concentrations off NC
	Bermuda Petrel[5]	32	2	5		P	Increasingly regular off NC
	Red Knot South Atlantic	32	5	5		C	Mostly GA, FL
	Red-cockaded Woodpecker[5]	32	5	4	80.4*	R	
	Snowy Plover Southeast	31	3	5		D	St. Joseph Peninsula to Dog Island, FL Gulf
	Painted Bunting Eastern	31	5	5		B	GA, SC, n. FL, se NC
	Roseate Tern[5] North American	30	3	4		A	Highly Pelagic
	Black-throated Green Warbler Wayne's (Coastal)	30	5	4	100.0*	B	VA, NC, SC
	Bachman's Sparrow	30	5	5	36.6*	R	Primarily breeding
	Saltmarsh Sharp-tailed Sparrow	30	5	3		C	
	Wood Stork[5] Southeast	29	4	4	44.3?	D	FL, GA, se SC
	Henslow's Sparrow	29	5	4		D	Winters FL, GA, SC(?), breeding ne NC, se VA
	Swallow-tailed Kite North American	28	4	3	10.8	B	SC, GA, FL
	American Kestrel Southeastern	28	5	4		D	
	Piping Plover[5]	28	4	4		D	Mostly winter, breeding NC, possibly SC
	American Oystercatcher North American	28	5	3		D	

Table 1 (cont.).

Priority Entry Criteria[1]	Species	Total PIF Priority Species Score	Score: Area Importance	Score: Population Trend	Percent of BBS Population	Local Migratory Status[2]	Geographical or Historical Notes
Ib.	Short-tailed Hawk Florida	27	2	3		B	St. Marks to Lower Suwannee, FL
	Black Rail	27	4	4		D	
	Sandhill Crane Florida	27	3	3		R	FL, GA
	Brown-headed Nuthatch	27	5	5	38.7*	R	
	Nelson's Sharp-tailed Sparrow	27	3	3		C	
	Audubon's Shearwater Caribbean	26	5	3		P	
	Yellow Rail	26	4	3		C	
	Wilson's Plover	26	4	3		D	Mostly breeds, irregular in winter in GA, FL
	Bicknell's Thrush	26	5	3		A	
	Swainson's Warbler	26	4	1	15.9	B	
	Seaside Sparrow	26	5	3		D	Atl. and Gulf pops. may represent full species
	Whimbrel	25	5	5		A	
	Buff-breasted Sandpiper	25	3	4		A	
	Black-throated Blue Warbler	25	5	3		A	
	Cerulean Warbler	25	2	3		B	Roanoke River, NC; elsewhere?
	Brown Pelican Southeast	24	5	1		R	
	Marbled Godwit	24	3	4		C	
	Bobolink	24	5	5		A	
	Buff-breasted Sandpiper	24	3	3		A	
	Brant	23	3	5		C	Mostly NC
	King Rail	23	5	4		D	
	Sandhill Crane Greater	23	5	3		C	FL, GA

Table 1 (cont.).

Priority Entry Criteria[1]	Species	Total PIF Priority Species Score	Score: Area Importance	Score: Population Trend	Percent of BBS Population	Local Migratory Status[2]	Geographical or Historical Notes
Ib (cont.).	White Ibis	23	5	4[4]		D	
	Stilt Sandpiper	23	4	5		A	
	Solitary Sandpiper	23	5	3		A	
	American Woodcock	23	5	4		D	Mostly winter, some breeding
	Wood Thrush	23	3	5	8.5*	B	
	Northern Parula	23	5	5	23.7*	B	
	Cape May Warbler	23	5	3		A	
	Worm-eating Warbler	23	3	2	14.7	B	
	Connecticut Warbler	23	5	3		A	
	Hooded Warbler	23	4	4	15.0*	B	
	Cory's Shearwater	22	5	3		P	
	White Ibis	22	4	4	15.7?	D	
	American Black Duck	22	3	5		D	Breeds VA, NC; formerly wintered to GA
	Clapper Rail	22	5	3		D	
	Semipalmated Sandpiper	22	5	5		A	
	Purple Sandpiper	22	4	2		C	
	Short-billed Dowitcher	22	5	5		A	Many winter
	Short-eared Owl	22	3	5		C	
	Black Tern	22	5	5		A	
	Sedge Wren	22	4	2		C	
	Veery	22	5	5		A	
	Yellow-throated Warbler	22	4	3	25.5*	D	Mostly breeding, some winter coastal GA, ne FL
	Prairie Warbler	22	3	4	17.9*	B	
	Bay-breasted Warbler	22	3	3		A	
	Louisiana Waterthrush	22	4	2	8.1	B	
	Field Sparrow	22	5	5		D	Primarily winter
	Le Conte's Sparrow	22	3	2		C	Mostly GA, SC

Table 1 (cont.).

Priority Entry Criteria[1]	Species	Total PIF Priority Species Score	Score		Percent of BBS Population	Local Migratory Status[2]	Geographical or Historical Notes
			Area Importance	Population Trend			
IIa.	American Bittern	21	4	5		D	Most wintering, local breeding
	Canvasback	21	4	4		C	
	Northern Bobwhite	21	4	5		R	
	Black-bellied Plover	21	4	5		A	Many winter
	Willet	21	5	3		D	
	Ruddy Turnstone	21	5	5		A	Many winter
	Sanderling	21	5	5		A	Many winter
	Western Sandpiper	21	5	3		A	Many winter
	Gull-billed Tern	21	5	4	11.5?	D	
	Least Tern	21	5	5		B	
	Black Skimmer	21	4	5		D	
	Yellow-billed Cuckoo	21	4	5		B	
	Black-throated Green Warbler (all, including Wayne's)	21	5	3		A	
	Grasshopper Sparrow	21	5	5		D	Primarily migration, some breeding and wintering
	Least Bittern	20	5	3		B	
	Lesser Scaup	20	5	5		C	
	Black Scoter	20	4	5		C	
	Northern Harrier	20	4	4		C	
	American Avocet	20	3	3		C	
	Least Sandpiper	20	5	5		A	
	Dunlin	20	4	5		C	
	Sandwich Tern	20	5	3		B	
	Common Ground-Dove	20	3	5	17.6?	R	FL to se SC
	Palm Warbler	20	3	5		C	
	Eastern Towhee	20	5	5	24.5*	D	

Table 1 (cont.).

Priority Entry Criteria[1]	Species	Total PIF Priority Species Score	Score: Area Importance	Score: Population Trend	Percent of BBS Population	Local Migratory Status[2]	Geographical or Historical Notes
IIb (cont.).	Red-throated Loon	19	5	4		C	Major concentrations from Back Bay, VA, to Cape Fear, NC, uncommon to rare elsewhere
	Common Loon	19	5	3		C	
	Greater Scaup	19	3	5		C	
	Greater Yellowlegs	19	5	3		A	Some winter
	Pectoral Sandpiper	19	5	3		A	
	Royal Tern	19	5	3	30.6?	D	
	Barn Owl	19	5	3		D	
	Least Flycatcher	19	3	5		A	
	Carolina Chickadee	19	4	4	11.4	R	
	Rusty Blackbird	19	3	5		C	
IIb.	Chuck-will's-widow	21	5	2	21.7*	B	
	Prothonotary Warbler	21	4	1	34.4*	B	
	Acadian Flycatcher	20	4	1	13.7	B	
	White-eyed Vireo	20	5	2	17.8	D	Primarily breeding
	Yellow-throated Vireo	19	4	1	10.8*	B	
	Pine Warbler	19	5	2	22.2*	D	
	Summer Tanager	19	5	2	18.6*	B	
	Orchard Oriole	19	5	2	12.9*	B	
IIIa.	Kentucky Warbler	19	2	1	2.5	B	
IIIb.	Bald Eagle[5]	17	3	2		D	

Table 1 (cont.).

Priority Entry Criteria[1]	Species	Total PIF Priority Species Score	Score: Area Importance	Score: Population Trend	Percent of BBS Population	Local Migratory Status[2]	Geographical or Historical Notes
Regional Interest	Great Blue Heron	13	4	1		D	
	Great Egret	14	4	2		D	
	Snowy Egret	14	4	2		D	
	Little Blue Heron	15	4	2		D	
	Tricolored Heron	18	4	3		D	
	Black-crowned Night-Heron	17	4	5		D	
	Yellow-crowned Night-Heron	18	5	2		D	
	Glossy Ibis	17	4	3		D	
	Canada Goose Atlantic pops.	No Score				C	Mostly NC, SC
	Tundra Swan	20	4	1		C	Mostly ne NC
	Wood Duck	17	3	2		D	
	Mallard	15	5	3		D	Mostly winter
	Blue-winged Teal	17	5	3		A	Some winter
	Northern Pintail	16	3	5		C	
	Redhead	21	3	4		C	
	Ring-necked Duck	19	4	2		C	
	Surf Scoter	20	3	4		C	Mostly NC
	White-winged Scoter	17	3	4		C	Mostly NC
	Mississippi Kite	19	3	1		B	Most common FL to SC; Rare and local NC
	Limpkin	16	2	2		R	Iso. pop. Apalachicola, FL
	Semipalmated Plover	17	5	3		A	Many winter
	Spotted Sandpiper	18	5	3		A	Many winter
	Lesser Yellowlegs	18	5	3		A	Many winter
	Common Tern	16	3	4		D	Of special concern VA, NC
	Forster's Tern	19	2	3		D	
	Whip-poor-will	18	3	1		B	
	Red-headed Woodpecker	19	4	2	4.8	D	Primarily breeding

Table 1 (cont.).

Priority Entry Criteria[1]	Species	Total PIF Priority Species Score	Score: Area Importance	Score: Population Trend	Percent of BBS Population	Local Migratory Status[2]	Geographical or Historical Notes
Regional Interest (cont.).	Eastern Wood-Pewee	18	4	2		B	
	Eastern Kingbird	18	4	4		B	
	Loggerhead Shrike	19	3	4		D	Rare now in NC, VA
	Black-and-white Warbler	14	2	1		D	Primarily breeding, rare winter coastal GA, FL
	Yellow-breasted Chat	16	4	1		B	
	Eastern Meadowlark	16	2	5		D	

[1]Entry criteria:

Ia. Overall Highest Priority Species. Species with total score 28-35. Ordered by total score. Consider deleting species with AI ≤ 2 confirmed to be of peripheral occurrence and not of local conservation interest, but retain species potentially undersampled by BBS or known to have greatly declined during this century.

Ib. Overall High Priority Species. Species with total score 22-27. Ordered by total score. Consider deleting species with AI ≤ 2 confirmed to be of peripheral occurrence and not of local conservation interest, but retain species potentially undersampled by BBS or known to have greatly declined during this century.

IIa. Area Priority Species. Species with slightly lower score total 19-21 with PT+AI=8+. Ordered by total score. These are overall moderate priority species.

IIb. Species with High Percent of BBS Population. Species with score total 19-21 with percent of BBS population above a threshold established (based on relative size of physiographic area), not already listed above, ordered by total score (*signifies highest percentage among physiographic area). These are overall moderate priority species.

IIIa. Additional Species of Global Priority. Add WatchList species (Partners in Flight-National Audubon Society priority species at national level), not already listed in either I or II, with AI=2+. Order by total score. Consider deleting species with AI=2 if confirmed to be of peripheral occurrence and not of local conservation interest, but retain if a local population is viable and/or manageable. These are also overall moderate priority species.

IIIb. Additional Federally Listed Species. Federal listed species if not already included above. Overall low priority, but appropriate legal obligations (**"**legal priority species**"**) to protect through appropriate management and monitoring still apply. Only Bald Eagle meets this criterion in some Southeast physiographic areas.

Other Local or Regional Interest Species. Includes game or nongame species identified by State Working Groups. Also, may include

species often meeting criteria for I or II within other physiographic areas and therefore of regional interest for monitoring throughout the Southeast. These are overall low priority species within physiographic area, but may be more important within one or more States (especially where multiple states have designated some special protective status on the species).

[2] Local Migratory Status, codes adapted from Texas Partners in Flight as follows:

A = Breeds in temperate or tropical areas outside of region, and winters in temperate or tropics outside of region (*i.e.*, passage migrant).

B = Breeds in temperate or tropical areas including the region, and winters exclusively in temperate or tropics outside the region (*i.e.*, includes both breeding and transient populations).

C = Breeds in temperate or tropical areas outside of region, and winters in both the region and in temperate or tropical areas beyond area (*i.e.*, includes both transient and wintering populations).

D = Breeds and winters in the region, with perhaps different populations involved, including populations moving through to winter beyond the region in temperate or tropical areas (*i.e.*, populations may be present throughout year, but may include a large number of passage migrants).

E = Species reaching distributional limits within the region, either as short-distance or long-distance breeding migrants, but at population levels above peripheral status.

F = Same as E except for wintering (non-breeding) migrants.

R = Resident, generally non-migratory species (though there may be local movements).

RP= Resident, non-migratory species, reaching distributional limits within the region, but at population levels above peripheral status.

P = Pelagic, breeding grounds outside of region, but can occur during breeding season.

PB = Post-breeding dispersal or non-breeding resident; species present during breeding season, but not known to be breeding in the region proper.

[3]Highest percent of breeding population recorded in temperate North America indicated by **"*"**; ? indicates species widespread outside of temperate North America and/or waterbirds poorly sampled by Breeding Bird Survey within physio. area.

[4]AI or PT score revised from what was derived by BBS data, or lack thereof, based on better local information.

[5]Species listed as either Federal Endangered or Threatened.

Table 2. Hypothesized forest area (ha) required to support about 500 pairs, based mostly on Hamel's (1992) estimated mean densities for breeding pairs from Breeding Bird Census data (exceptions are for supporting 100 pairs of Swallow-tailed Kite and 500 family groups for Red-cockaded Woodpecker based on empirical data). Number of hectares (acres) per breeing pair has been multiplied by 1000 in order to double area estimate for 500 pairs and thus provide an aproximate 1 km buffer zone aound the area required for 500 pairs (which may include unsuitable or marginal forested habitat conditions, but is still a buffer against potential elevated depredation and nest parasitism problems associated with landscape fragmentation).

Species	Total Priority Score	Patch Size Recommendation	Habitat Area Objective
Red-cockaded Woodpecker	32	50,000 (125,000)	50,000 (125,000)
Painted Bunting	31	12,000 (30,000)	40,000 (100,000)
Black-throated Green Warbler	30	1,500 (3,750)	8,000 (20,000)
Bachman's Sparrow	30	7,700 (19,250)	8,000 (20,000)
American Kestrel	28	32,000 (80,000)	40,000 (100,000)
Swallow-tailed Kite	28	40,000 (100,000)	160,000 (400,000)
Brown-headed Nuthatch	27	8,900 (22,250)	8,000 (20,000)
Swainson's Warbler	26	4,700 (11,750)	4,000 (10,000)
Cerulean Warbler	25	4,000 (10,000)	8,000 (20,000)
American Woodcock	23	4,500 (11,250)	4,000 (10,000)
Wood Thrush	23	2,800 (7,000)	4,000 (10,000)
Northern Parula	23	2,900 (7,250)	4,000 (10,000)
Worm-eating Warbler	23	2,900 (7,250)	4,000 (10,000)
Hooded Warbler	23	2,500 (6,250)	4,000 (10,000)
Yellow-throated Warbler	22	7,800 (19,500)	8,000 (20,000)
Prairie Warbler	22	2,700 (6,750)	4,000 (10,000)
Louisiana Waterthrush	22	7,100 (17,750)	8,000 (20,000)
Field Sparrow	22	2,300 (5,750)	4,000 (10,000)
Northern Bobwhite	21	6,000 (15,000)	8,000 (20,000)
Yellow-billed Cuckoo	21	6,600 (16,500)	8,000 (20,000)
Prothonotary Warbler	21	2,700 (6,750)	4,000 (10,000)
Common Ground-Dove	20	14,800 (37,000)	40,000 (100,000)
Acadian Flycatcher	20	2,800 (7,000)	4,000 (10,000)
White-eyed Vireo	20	3,700 (9,250)	4,000 (10,000)
Eastern Towhee	20	2,500 (6,250)	4,000 (10,000)
Red-headed Woodpecker	19	17,400 (43,500)	40,000 (100,000)
Yellow-throated Vireo	19	7,800 (19,500)	8,000 (20,000)
Carolina Chickadee	19	4,300 (10,750)	4,000 (10,000)
Pine Warbler	19	4,500 (11,250)	4,000 (10,000)
Kentucky Warbler	19	8,000 (20,000)	8,000 (20,000)
Summer Tanager	19	4,500 (11,250)	4,000 (10,000)
Orchard Oriole	19	6,500 (16,250)	8,000 (20,000)
Eastern Wood-Pewee	18	5,400 (13,500)	8,000 (20,000)
Yellow-breasted Chat	16	2,400 (6,000)	4,000 (10,000)
Black-and-white Warbler	14	3,900 (9,750)	4,000 (10,000)

Table 3. Areas of vegetative cover types in South Atlantic Coastal Plain, physiographic area 3. Forest coverages are taken from USFS FIA data, nonforest cover types are modified from USGS data. Water coverage is combined from both databases by adding USGS water in the "nonforest" section of the USFS database.

Cover types	Area (ha)	Area (ac)	Percent of Total
Longleaf-slash pine forest	4,644,100	11,475,571	18.83
Loblolly-shortleaf pine forest	2,704,600	6,683,067	10.97
Oak-pine forest	2,193,600	5,420,386	8.89
Oak-hickory forest	385,700	953,065	1.56
Oak-gum-cypress forest	5,097,500	12,595,922	20.67
Wheat, irrigated agriculture	504,700	1,247,114	2.05
Corn, soybeans	7,628,800	18,850,765	30.93
Bluestem grassland	61,500	151,966	0.25
Grama, wheatgrass grassland	41,000	101,311	0.17
Pasture, hay, mixed crops	88,400	218,436	0.36
Sagebrush, greasewood, creosote brushland	12,600	31,135	0.05
Fresh, saltwater marsh	79,300	195,950	0.32
Water	338,000	835,198	1.37
Urban	638,000	1,576,498	2.59
No data	243,000	600,453	0.99
Totals	24,660,800	60,936,837	100.00

Table 4. South Atlantic Coastal Plain Bird-Habitat Associations. TB=threats breeding score, TN=threats non-breeding score.

	Total Score	TB	TN	Notes
PRAIRIES, SAVANNAS, AND GRASSLANDS, OPEN COUNTRY				
Extremely High Priority				
Bachman's Sparrow	30	4	4	Primarily breeding
Henslow's Sparrow	29		4	FL, GA, SC(?)
High Priority				
Sandhill Crane (Florida)	27	4	3	FL, GA
Henslow's Sparrow	26	4		NC, VA
Yellow Rail	26		4	
Bobolink	24		4	
Buff-breasted Sandpiper	24		3	Turf farms, airports, pastures
Sandhill Crane (Greater)	23		3	FL, GA
American Woodcock	23	3	3	Primarily winter
Northern Bobwhite	22	3	3	
Short-eared Owl	22		4	
Sedge Wren	22		3	
LeConte's Sparrow	22		4	Most in GA and SC
Moderate Priority				
Grasshopper Sparrow	21	3	3	Primarily migration
Loggerhead Shrike	20	4	3	Rare now in NC, VA
Palm Warbler	20		2	
Northern Harrier	20		3	
Barn Owl	19	3	3	
Local or Regional Interest				
Eastern Kingbird	18	3	2	
Eastern Meadowlark	17	3	3	
Bald Eagle	17	3	3	
EARLY SUCCESSIONAL SHRUB-SCRUB				
Extremely High Priority				
Bewick's Wren (Appalachian)	35		5	Nearing extinction
Painted Bunting (Eastern)	31	4		GA, SC, n. FL, se NC
Bachman's Sparrow	30	4	4	Primarily breeding
Henslow's Sparrow	29		4	FL, GA, SC (?)

Table 4 (cont.).

	Total Score	TB	TN	Notes
EARLY SUCCESSIONAL (CONT.)				
<u>High Priority</u>				
Henslow's Sparrow	26	4		NC, VA
American Woodcock	23	3	3	Primarily winter
Prairie Warbler	23	3		
Northern Bobwhite	22	3	3	
Field Sparrow	22	3	3	Primarily winter
<u>Moderate Priority</u>				
Common Ground-Dove	20	4	3	FL to se SC
Eastern Towhee	20	3	2	
Palm Warbler	20		2	
White-eyed Vireo	19	3	2	Primarily breeding
Orchard Oriole	19	3		
<u>Local or Regional Interest</u>				
Whip-poor-will	18	3		Ground nesting
Yellow-breasted Chat	16	3	2	
SOUTHERN PINE (SAVANNAS, FLATWOODS, SANDHILLS)				
<u>Extremely High Priority</u>				
Red-cockaded Woodpecker	32	5	5	Cavity nesting
Bachman's Sparrow	30	4	4	Primarily breeding, ground nesting
Henslow's Sparrow	29		4	Flatwoods, savannas, ground
American Kestrel (Southeast)	28	4	3	Primarily sandhills, cavity nesting
<u>High Priority</u>				
Brown-headed Nuthatch	27	3	3	Cavity nesting
Prairie Warbler	23	3		Understory
Northern Bobwhite	22	3	3	Ground
<u>Moderate Priority</u>				
Red-headed Woodpecker	21	3	3	Primarily breeding, cavity nesting
Chuck-will's-widow	21	3		Ground, open understory
Pine Warbler	19	2	2	

Table 4 (cont.).

	Total Score	TB	TN	Notes
CONIFER-HARDWOOD "GENERALISTS" (INCLUDING SPECIES USING BOTH PINE DOMINATED AND HARDWOOD DOMINATED STANDS)				
Extremely High Priority				
Black-throated Green Warbler	30	4		VA, NC, ne SC; canopy, often non-alluvial wetlands
High Priority				
Wood Thrush	24	3		Midstory nesting, ground foraging
Northern Parula	23	3		Canopy
Hooded Warbler	23	3		Understory
Worm-eating Warbler	23	3		Ground nesting
Yellow-throated Warbler	22	3		Mostly breeding, canopy
Moderate Priority				
Yellow-billed Cuckoo	21	3		Upper midstory
Carolina Chickadee	20	2	1	Cavity nesting
"Watchlist" Species				
Kentucky Warbler	20	3		Ground nesting
Local or Regional Interest				
Acadian Flycatcher	20	3		Midstory
Summer Tanager	19	3		Canopy
Yellow-throated Vireo	19	3		Canopy
Eastern Wood-Pewee	18	3		Midstory
Black-and-white Warbler	14	2	2	Primarily breeding, ground nesting
FORESTED WETLANDS (ALLUVIAL AND NON-ALLUVIAL, EXCEPT POND PINE [TALL] POCOSIN)				
Extremely High Priority				
Swallow-tailed Kite (Southeast)	28	4		Nests in "super-emergent" trees
Swainson's Warbler	28	4		Understory, forages ground
High Priority				
Short-tailed Hawk (Florida)	27	4		St. Marks to Lower Suwannee, FL
Cerulean Warbler	25	4		Roanoke River, NC
American Woodcock	23	3	3	Understory, forages ground
American Black Duck	22	4	3	Breeds VA, NC; formerly wintered to GA

Table 4 (cont.).

	Total Score	TB	TN	Notes
FORESTED WETLANDS (CONT.)				
Moderate Priority				
Prothonotary Warbler	21	3		Cavity nesting
Louisiana Waterthrush	21	3		Streamside
Rusty Blackbird	19		3	Roosts in trees, forages ground
Local or Regional Interest				
Wood Duck	19	3	3	Cavity nesting
Mississippi Kite	19	3		Edge nesting
Bald Eagle[1]	17	3	3	
Limpkin (Florida)	17	3	3	Apalachicola, Suwannee
POND PINE (TALL) POCOSIN				
Extremely High Priority				
Red-cockaded Woodpecker	32	5	5	Cavity nesting
Swainson's Warbler	28	4		Understory, forages ground
High Priority				
Brown-headed Nuthatch	27	3	3	Cavity nesting
American Woodcock	23	3	3	Understory, forages ground
Prairie Warbler	23	3		Understory
Northern Bobwhite	22	3	3	Ground
Prothonotary Warbler	22	3		Cavity nesting
Moderate Priority				
Red-headed Woodpecker	21	3	3	Primarily breeding, cavity nesting
Rusty Blackbird	19		3	Roosts in trees, forages ground
Chuck-will's-widow	21	3		Ground, open understory
Louisiana Waterthrush	21	3		Streamside
Pine Warbler	19	2	2	
Local or Regional Interest				
Wood Duck	19	3	3	Cavity nesting
MARITIME WOODLANDS (many of the same species under pine-hardwood, but also transient landbirds and 2 breeding species)				
Extremely High Priority				
Kirtland's Warbler	35		5	
Painted Bunting (Eastern)	31	4		GA, SC, ne FL, se NC; edges

Table 4 (cont.).

	Total Score	TB	TN	Notes
MARITIME WOODLANDS (CONT.)				
<u>High Priority</u>				
Bicknell's Thrush	26		4	
Black-throated Blue Warbler	25		4	
Cape May Warbler	23		3	
Connecticut Warbler	23		2	
Veery	22		3	
Bay-breasted Warbler	22		3	
<u>Moderate Priority</u>				
Black-throated Green Warbler (All, including Wayne's)	21		3	
Common Ground-Dove	20	4	3	Ground nesting
Least Flycatcher	19		2	
COLONIAL TREE AND/OR BRUSH NESTING WATERBIRDS (most species feed in emergent wetlands, open water, or mudflats)				
<u>Extremely High Priority</u>				
Wood Stork (Southeast)	29	4	3	FL, GA, se SC
<u>High Priority</u>				
Brown Pelican (Southeast)	24	4	3	Coastal
White Ibis	22	4	2	
<u>Local or Regional Interest</u>				
Tricolored Heron	18	2	2	
Yellow-crowned Night-Heron	18	3	2	
Black-crowned Night-Heron	17	2	2	
Little Blue Heron	15	3	2	
Great Egret	14	2	2	
Snowy Egret	14	2	2	
Great Blue Heron	13	2	2	
COLONIAL GROUND NESTING WATERBIRDS (most species feeding in open water or emergent wetlands)				
<u>Moderate Priority</u>				
Black Skimmer	21	3	2	Beaches, dunes, rooftops
Gull-billed Tern	21	3		Marshes, protected islets
Least Tern	21	4		Beaches, dunes, rooftops
Sandwich Tern	20	3		Protected islets
Royal Tern	19	3	2	Protected islets

Table 4 (cont.).

	Total Score	TB	TN	Notes
COLONIAL GROUND NESTING WATERBIRDS (CONT.)				
Local or Regional Interest				
Forster's Tern	19	3	2	Marshes, NC
Glossy Ibis	17	3	2	Marshes
Common Tern	16	3	2	Protected islets, NC
EMERGENT WETLANDS				
Extremely High Priority				
Saltmarsh Sharp-tailed Sparrow	30		4	Coastal
High Priority				
Black Rail	27	4	4	
Nelson's Sharp-tailed Sparrow	27		4	Coastal
Yellow Rail	26		4	
Seaside Sparrow	26	3	3	Coastal
King Rail	23	3	3	
American Black Duck	22	4	3	Mostly NC, formerly to GA
Clapper Rail	22	3	3	Coastal
Moderate Priority				
American Bittern	21	3	3	Most wintering, local breeding
Least Bittern	20	3		
Northern Harrier	20		3	
Local or Regional Interest				
Peregrine Falcon	19		3	
Bald Eagle	17	3	3	
BEACHFRONT				
Extremely High Priroity				
Red Knot (South Atlantic)	32		4	Mostly GA, FL
Snowy Plover (Southeast Gulf)	31	5	4	St. Joseph Peninsula to Dog Island
Piping Plover	28	4	4	Mostly winter, local breeding NC (SC?)
American Oystercatcher (Eastern North America)	28	4	4	
High Priority				
Wilson's Plover	26	4	4	
Purple Sandpiper	22		3	Rocky coastal areas

Table 4 (cont.).

	Total Score	TB	TN	Notes
BEACHFRONT (CONT.)				
Moderate Priority				
Willet	21	3	2	
Black-bellied Plover	21		3	Many overwinter
Sanderling	21		4	Many overwinter
Ruddy Turnstone	21		4	Many overwinter
Local or Regional Interest				
Peregrine Falcon	19		3	Some overwinter
ESTUARIES, MUDFLATS, AND IMPOUNDMENTS				
High Priority				
Whimbrel	25		4	Some overwinter
Marbled Godwit	24		4	
Stilt Sandpiper	23		3	Mostly inland
Solitary Sandpiper	23		2	Mostly inland
Semipalmated Sandpiper	22		3	
Short-billed Dowitcher	22		3	Many winter
Buff-breasted Sandpiper	25		4	Mostly inland
Black Tern	22		3	
Moderate Priority				
Western Sandpiper	21		4	Many winter
American Avocet	20		4	
Dunlin	20		3	
Least Sandpiper	20		2	Many winter
Greater Yellowlegs	19		2	Some winter
Pectoral Sandpiper	19		2	Mostly inland
High Percent of Continental Population				
Semipalmated Plover	17		2	Many winter
Spotted Sandpiper	18		2	Many winter
Lesser Yellowlegs	18		2	Many winter
OPEN WATER				
Extremely High Priority				
Black-capped Petrel	32		3	Pelagic
Bermuda Petrel	32		5	Pelagic
Roseate Tern (North American)	30		3	Pelagic

Table 4 (cont.).

	Total Score	TB	TN	Notes
OPEN WATER (CONT.)				
<u>High Priority</u>				
Brant	23		3	Mostly NC
Audubon's Shearwater (Caribbean)	26		4	Pelagic
Cory's Shearwater	22		3	Pelagic
American Black Duck	22	4	3	Breeds VA, NC; formerly wintered to GA
<u>Moderate Priority</u>				
Canvasback	21		2	
Lesser Scaup	20		3	
Black Scoter	20		3	
Greater Scaup	19		3	
Common Loon	19		3	
Red-throated Loon	19		3	Major concentrations from Back Bay, VA, to Cape Fear, NC, uncommon to rare elsewhere
<u>Local or Regional Interest</u>				
Tundra Swan	20		3	NC (especially, Mattamuskeet NWR)
Wood Duck	19	3	3	
Mallard	15	2	2	Mostly winter
Blue-winged Teal	17		2	Some overwinter
Northern Pintail	16		2	
Redhead	21		3	
Rin-necked Duck	19		3	
Surf Scoter	20		3	
White-winged Scoter	17		3	
Canada Goose (Atlantic pop.)	???			

Table 5. Thirty years (1966-1996) of Breeding Bird Survey population trends in continental and physiographic area for some South Atlantic Coastal Plain grassland-associated species. Population trend is expressed as perecent chnage per year, "P" represents statistical significance of the change or trend (*=0.05<P<0.10; **=0.01<P<0.05; ***=P<0.01), "N" represents sample size in terms of number of routes, and "R.A." represents relative abundance in terms of mean numbers of individuals per route.

	Temperate North America				South Atlantic Coastal Plain			
Species	Population Trend	P	N	R.A.	Population Trend	P	N	R.A.
Northern Bobwhite	-2.4	***	1392	21.48	-3.8	***	122	32.06
Killdeer	-0.5	***	2921	5.38	7.2	***	84	0.94
Eastern Kingbird	-0.6	***	2365	4.34	-1.6		116	5.87
Horned Lark	-1.1	***	1742	27.45	7.5		11	0.22
Loggerhead Shrike	-3.6	***	1292	1.86	-2.2		81	2.13
Bachman's Sparrow	-2.4		166	0.72	-3.6	***	59	1.34
Chipping Sparrow	-0.2		2490	7.40	-1.3		66	4.83
Field Sparrow	-3.3	***	1584	5.30	-1.4		70	4.08
Grasshopper Sparrow	-3.7	***	1370	4.01	-8.6	***	9	0.24
Eastern Meadowlark	-0.6	**	1423	44.86	-4.9	***	107	8.23
Brown-headed Cowbird	-1.0	***	3169	13.03	1.5	***	115	6.72

Table 6. South Atlantic Coastal Plain Farm Bill objectives in hectares (acres) stepped down from Southeast Regional Objectives.

	Warm Season Grasses*		Early Successional Shrub-Scrub		
State	Retain	Covert/Restore	5-Year Idle	Annual Veg./Forbs	10-20 Year Idle
Virginia	2,000 (5,000)	4,000 (10,000)	10,000 (25,000)	10,000 (25,000)	20,000 (50,000)
North Carolina	26,000 (65,000)	100,000 (250,000)	30,000 (75,000)	30,000 (75,000)	60,000 (150,000)
South Carolina	26,000 (65,000)	100,000 (250,000)	30,000 (75,000)	30,000 (75,000)	60,000 (150,000)
Georgia	26,000 (65,000)	100,000 (250,000)	30,000 (75,000)	30,000 (75,000)	60,000 (150,000)
Florida	40,000 (100,000)	96,000 (240,000)	20,000 (50,000)	20,000 (50,000)	40,000 (100,000)
Total	120,000 (300,000)	400,000 (1,000,000)	120,000 (300,000)	120,000 (300,000)	240,000 (600,000)

*Mostly achievable in association with longleaf pine restoration goals (see Table 12).

Table 7. Thirty years (1966-1996) of Breeding Bird Survey population trends in continental and physiographic area for some South Atlantic Coastal Plain among shrub-scrub (early successional) associated species. Population trend is expressed as perecent chnage per year, "P" represents statistical significance of the change or trend (*=0.05<P<0.10; **=0.01<P<0.05; ***=P<0.01), "N" represents sample size in terms of number of routes, and "R.A." represents relative abundance in terms of mean numbers of individuals per route.

	Temperate North America				South Atlantic Coastal Plain			
Species	Population Trend	P	N	R.A.	Population Trend	P	N	R.A.
Common Ground-Dove	-2.7	***	185	1.88	-1.4		63	1.51
White-eyed Vireo	0.0		957	4.77	-0.4		122	9.68
Gray Catbird	-0.3	*	1947	2.64	-0.6		92	3.21
Brown Thrasher	-1.2	***	2002	3.16	-0.2		120	6.80
Prairie Warbler	-2.6	***	723	1.92	-1.9		79	2.87
Common Yellowthroat	-0.4	***	2558	7.67	-1.5	***	121	14.68
Yellow-breasted Chat	-0.4		1189	3.35	3.6	***	104	4.92
Blue Grosbeak	1.3	***	1023	2.53	2.2	***	116	8.80
Indigo Bunting	-0.7	***	1813	11.57	-1.3	***	118	17.06
Painted Bunting	-3.2	***	277	5.61	-3.5	***	22	0.98
Eastern Towhee	-2.3	***	1522	7.83	-1.7	***	123	29.52
Orchard Oriole	-1.9	***	1243	2.76	0.3		114	6.79

Table 8. Preliminary descriptions of future desired conditions for forested wetlands within the South Atlantic Coastal Plain. The details are based on information available for supporting populations of high priority species (e.g., Hamel 1992), but local data should be used to drive management directions.

1. Promote a variety of tree species appropriate for site conditions such as substrates and flooding regimes, minimize large single-species plantations.

2. Large blocks of contiguous, managed habitat (85-95% forested in more fragmented landscapes; >70% forested in largely forested landscapes)), with at least ½ of total area (including buffer, which may be more forested wetland or other forest types) consisting of suitable mature forested wetland habitat unless otherwise indicated:

    a. Prothonotary Warbler: 2,700 ha (6,750 a) for 500 pairs (mean 15 pairs/40 ha [100 a]), with preferred habitat area objective of 4,000 ha (10,000 a).

    b. Swainson's Warbler: 4,700 ha (11,750 a) for 500 pairs (mean 9 pairs/40 ha [100 a]), with preferred habitat area objective of 4,000 ha (10,000 a).

    c. Yellow-throated Warbler: 7,800 ha (19,500 a) for 500 pairs (mean 5 pairs/40 ha [100 a]), with preferred habitat area objective of 8,000 ha (20,000 a).

    d. Cerulean Warbler: preferred habitat area objective is 8,000 ha (20,000 a) for an unknown number of pairs.

    e. Black-throated Green Warbler: preferred habitat area objective is 8,000 ha (20,000 a) for an unknown number of pairs.

    f. Swallow-tailed Kite: preferred habitat area objective is 160,000 ha (400,000 a) with at least 1/4 consisting of mature forested wetlands for at least 200 breeding-aged birds.

3. Retain within stands snags 15 cm (6 in) dbh or greater for Prothonotary Warblers and, at least 5 snags/ha (2 snags/a) of 35 cm (14 in) dbh or greater for many other larger cavity nesters.

4. Stands with moderately open canopy (e.g., 50-75% canopy closure), drier sites (saturated soil but little standing water during breeding season), well-developed and dense but patchy midstory and understory layer with no or little ground cover for ground foraging Swainson's Warbler, Wood Thrush, American Woodcock, and many other species.

5. Stands with high numbers of very large and tall trees (over 50 cm (20 in) dbh, over 25 m [80 feet] in height), complex canopy structure (obvious patchy canopy and subcanopy layers) for Cerulean Warbler (especially bottomland hardwoods), Black-throated Green Warbler (especially Atlantic white-cedar, cypress), and Yellow-throated Warbler (especially cypress and loblolly pine).

6. Stands with patches of "super-emergent" trees (over 27 m [90 feet], frequently loblolly pine, but also sweetgum, cottonwood, sometimes cypress) within major forested floodplains often in proximity to marshes and other open habitats for Swallow-tailed Kite.

Table 9. Forested wetlands (not including non-wetland forested buffers) within the South Atlantic Coastal Plain, present status and potential future goals in hectares (acres).

Forested Wetland System	Patches and Area (x 1000) Present	Future?
Virginia/North Carolina		
Dismal Swamp to Albemarle Sound	1 of 8-40 (20-100) (Dismal Swamp)	2 of >40 (100)
	2 of 2.4-4 (6-10) (Chowan Swamp and North River)	2 of 4-8 (10-20)
North Carolina		
Roanoke	1 of 8-40 (20-100) (Roanoke River)	1 of >40 (100)
Albemarle-Pamlico	1 of >40 (100) (Alligator River)	1 of >40 (100) 1 of 8-40 (20-100)
	2 of 8-40 (20-100) (Pocosin Lakes and Gull Rock/Swan Quarter)	1 of >40 (100)
Pamlico-Neuse (Tar-Neuse)	1 of <2.4 (6) (Goose Creek)	1 of 2.4-4 (6-10)
Croatan to Wilmington	1 of 8-40 (20-100) (Croatan and surrounding lands)	1 of >40 (100)
	2 of 8-40 (20-100) (Holly Shelter, Angola Bay, [Hoffman Forest])	3 of 8-40 (20-100)
	1 of 2.4-4 (6-10) (Sandy Run/Camp Lejeune)	1 of 4-8 (10-20)
Cape Fear	1 of 4-8 (10-20) (Bladen Lakes/Jones Lake)	1 of 8-40 (20-100)
Wilmington to Winyah Bay	1 of 8-40 (20-100) (Green Swamp)	1 of >40 (100)
North Carolina/South Carolina		
Winyah Bay (Pee Dee-Waccamaw-Black, Lumber)	1 of >40 (100)	1 of >40 (100)

Table 9 (cont.).

<u>South Carolina</u>		
Santee-Cooper Francis Marion)	1 of >40 (100)	1 of >40 (100)
ACE Basin (Ashepoo- Combahee-Edisto)	1 of 8-40 (20-100)	1 of >40 (100)
Broad	?????	2 of 2.4-4 (6-10)
<u>South Carolina/Georgia</u>		
Savannah	?????	1 of >40 (100)
<u>Georgia</u>		
Ogeechee-Canoochee	?????	3 of 2.4-4 (6-10)
Altamaha-Satilla-Little Satilla, etc.	?????	1 of >40 (100) 2 of 8-40 (20-100) 5 of 4-8 (10-20) 6 of 2.4-4 (6-10)
Flint	?????	2 of 2.4-4 (6-10)
<u>Georgia/Florida</u>		
St. Mary's	?????	1 of 2.4-4 (6-10)
Okefenokee to Osceola	1 of >40 (100)	1 of >40 (100)
Upper Suwannee-Grand Bay	?????	1 of 2.4-4 (6-10)
Lower Suwannee to Aucilla	1 of >40 (100)	1 of >40 (100)
St. Mark's to Apalachicola (including Chipola)	?????	1 of >40 (100)
<u>Georgia/Alabama</u>		
Chattahoochee	?????	4 of 2.4-4 (6-10)

Table 10. Notes on season(s) of occurrence, micro-habitats, and notes on conservation needs for priority and other bird species of interest dependent upon (at least in part) and occurring in southeastern maritime communities.

Community/ Species	Season	Habitat Use	Conservation Notes
<u>Maritime forest and shrub-scrub</u>			
Brown Pelican	Breeding	Nest sites	Protect nesting colonies
White Ibis	Breeding	Nest sites	Protect nesting colonies
Wood Stork	Breeding	Nest sites	Protect nesting colonies, Federally listed
Osprey	Breeding	Nest sites	
Bald Eagle	Breeding	Nest sites	Federally listed
Yellow-billed Cuckoo	Breeding	Nest and forage	
Chuck-will's-widow	Breeding	Nest and forage	Associated with open woodlands
Gray Kingbird	Breeding	Nest sites	Forages in open areas, coastal FL, GA
Bicknell's Thrush	Migration	Forage and rest	Understory, ground
Northern Parula	Breeding	Nest and forage	Mature trees, Spanish moss used for nests
Cape May Warbler	Migration	Forage and rest	Canopy
Black-throated Blue Warbler	Migration	Forage and rest	Midstory
Black-throated Green Warbler	Migration	Forage and rest	Canopy
Yellow-throated Warbler	Breeding	Nest and forage	Mature trees, Spanish moss used for nests
Kirtland's Warbler	Migration	Forage and rest	Understory, presumably GA, SC
Prairie Warbler	Breeding	Nest and forage	Mature forest
Blackpoll Warbler	Migration	Forage and rest	Canopy
Connecticut Warbler	Migration	Forage and rest	Ground
Painted Bunting	Breeding	Nest and forage	Understory, edges important, rapidly declining
<u>Estuarine emergent wetlands</u>			
Common Loon	Wintering	Forage	Open water, problems with contaminants and fish tackle
American White Pelican	Wintering	Forage	Open water, problems with contaminants and fish tackle
Brown Pelican	Resident	Forage and rest	Former=open water, latter=exposed flats; problems with contaminants, fish tackle
American Bittern	Wintering	Forage and cover	Marshes
Least Bittern	Breeding	Forage and cover	Marshes
White Ibis	Resident	Forage	Marshes and exposed flats
Wood Stork	Resident	Forage	Marshes and exposed flats
American Black Duck	Breeding	Nest and forage	Marshes with small open water patches
	Wintering	Forage and rest	Marshes and open water
Osprey	Resident	Forage	Open water
Bald Eagle	Resident	Forage	Open water
Northern Harrier	Wintering	Forage and rest	Marshes

Table 10 (cont.).

Community/ Species	Season	Habitat Use	Conservation Notes
Estuaries (cont.)			
Yellow Rail	Wintering	Forag and cover	Marshes
Black Rail	Resident	Forage and cover	Marshes
Clapper Rail	Resident	Forage and cover	Marshes
King Rail	Wintering	Forage and cover	Marshes
Black-bellied Plover	Non-breeding	Forage and rest	Exposed flats
Semipalmated Plover	Non-breeding	Forage and rest	Exposed flats
American Oystercatcher	Non-breeding	Forage and rest	Exposed flats
Greater Yellowlegs	Non-breeding	Forage and rest	Exposed flats
Lesser Yellowlegs	Non-breeding	Forage and rest	Exposed flats
Willet	Non-breeding	Forage and rest	Exposed flats
Whimbrel	Non-breeding	Forage and rest	Exposed flats
Marbled Godwit	Non-breeding	Forage and rest	Exposed flats
Semipalmated Sandpiper	Non-breeding	Forage and rest	Exposed flats
Western Sandpiper	Non-breeding	Forage and rest	Exposed flats
Least Sandpiper	Non-breeding	Forage and rest	Exposed flats
Dunlin	Non-breeding	Forage and rest	Exposed flats
Short-billed Dowitcher	Non-breeding	Forage and rest	Exposed flats
Gull-billed Tern	Breeding	Forage	Over marshes
Royal Tern	Resident	Forage	Open water
Sandwich Tern	Breeding	Forage	Open water
Common Tern	Migration	Forage	Open water
Forster's Tern	Breeding	Nest and forage	Former=marshes; latter=open water
Least Tern	Breeding	Forage	Open water
Black Skimmer	Resident	Forage	Open water
Saltmarsh Sharp-tailed Sparrow	Wintering	Forage and cover	Marshes
Nelson's Sharp-tailed Sparrow	Wintering	Forage and cover	Marshes
Seaside Sparrow	Resident	Nest and forage	Marshes
Beaches and dunes and adjacent ocean			
Brown Pelican	Resident	Forage and rest	Former=ocean; latter=beaches
Osprey	Resident	Forage	Ocean
Merlin	Non-breeding	Forage	Beaches
Peregrine Falcon	Non-breeding	Forage	Beaches
Black-bellied Plover	Non-breeding	Forage and rest	Beaches
Snowy Plover	Resident	Nest and forage	Beaches; vulnerable to disturbances
Wilson's Plover	Breeding	Nest and forage	Beaches; vulnerable to disturbances
Piping Plover	Breeding (NC)	Nest and forage	Beaches; vulnerable to disturbances
	Non-breeding	Forage and rest	Beaches; vulnerable to disturbances
American Oystercatcher	Resident	Nest and forage	Beaches; vulnerable to disturbances
Willet	Resident	Nest and forage	Former=behind dunes; latter=beaches
Ruddy Turnstone	Non-breeding	Forage and rest	Beaches
Red Knot	Non-breeding	Forage and rest	Beaches
Sanderling	Non-breeding	Forage and rest	Beaches

Table 10 (cont.).

Community/ Species	Season	Habitat Use	Conservation Notes
Beaches and dunes (cont.)			
Purple Sandpiper	Wintering	Forage and rest	Rock jetties and beaches
Dunlin	Wintering	Forage and rest	Beaches
Gull-billed Tern	Breeding	Nest	Protected beaches on islands
Royal Tern	Breeding	Nest and forage	Former=protected islands; latter=ocean
Sandwich Tern	Breeding	Nest and forage	Former=protected islands; latter=ocean
Common Tern	Breeding	Nest and forage	Former=protected islands; latter=ocean
Forster's Tern	Resident	Forage	Ocean
Least Tern	Breeding	Nest and forage	Former=beaches; latter=ocean
Black Skimmer	Resident	Nest and forage	Former=beaches; latter=ocean
Open ocean			
Red-throated Loon	Wintering	Forage	Susceptible to contaminants and fishing gear (particularly gillnets)
Common Loon	Wintering	Forage	Susceptible to contaminants and fishing gear (particularly gillnets)
Bermuda Petrel	Non-breeding	Forage	Off of NC, susceptible to off-shore mineral exploration; Federally listed
Black-capped Petrel	Non-breeding	Forage	Most off of NC, susceptible to off-shore mineral exploration
Cory's Shearwater	Non-breeding	Forage	Major concentrations off of NC
Greater Shearwater	Non-breeding	Forage	Major concentrations off of NC
Sooty Shearwater	Non-breeding	Forage	Major concentrations off of NC
Audubon's Shearwater	Non-breeding	Forage	Major concentrations off of NC
Wilson's Storm-Petrel	Non-breeding	Forage	Major concentrations off of NC
Northern Gannet	Wintering	Forage	Susceptible to fishing gear (gillnets)
Red-necked Phalarope	Wintering	Forage	
Red Phalarope	Wintering	Forage	
Pomarine Jaeger	Non-breeding	Forage	
Parasitic Jaeger	Non-breeding	Forage	
Black-legged Kittiwake	Wintering	Forage	
Bridled Tern	Non-breeding	Forage	
Sooty Tern	Non-breeding	Forage	

Table 11. Preliminary descriptions of future desired conditions for mature southern pine forest types within the South Atlantic Coastal Plain. The details are based on information available for supporting populations of high priority species (e.g., Hamel 1992), but local data should be used to drive management directions.

Mature pine-dominated forests

1. Average stocking:

    a. *Pine savanna*: very sparse canopy and low basal area (2.5-5.0 m^2/ha [10-20 ft^2/a]).

    b. *Sandhills, flatwoods, loblolly/shortleaf, pond pine pcosin*: open canopy and moderate basal area (10-25 m^2/ha [40-100 ft^2/a]).

2. Large blocks of contiguous, managed habitat (85-95% forested in more fragmented landscapes; >70% forested in largely forested landscapes)), with at least **2** of total area (including buffer, which may be more forested wetland or other forest types) consisting of suitable mature pine forest habitat for the species unless otherwise indicated:

    a. Northern Bobwhite: 6,000 ha (15,000 a) for 500 coveys (mean 7 coveys/40 ha [100 a]), with preferred habitat area objective of 8,000 ha (20,000 a).

    b. Bachman's Sparrow: 7,700 ha (19,250 a) for 500 pairs (mean 5 pairs/40 ha [100 a]), with preferred habitat area objective of 8,000 ha (20,000 a).

    c. Brown-headed Nuthatch: 8,900 ha (22,250 a) for 500 pairs (mean 4.5 pairs/40 ha [100 a]).

    d. Red-headed Woodpecker: 17,400 ha (43,500 a) for 500 pairs (mean 2 pairs/40 ha [100 a]), with preferred habitat area objective of 40,000 ha (100,000 a).

    e. Red-cockaded Woodpecker: preferred habitat area objective is 50,000 ha (125,000 a) for 400-500 family groups.

3. Predominance of mature age classes (over 60 years) should be emphasized.

4. Special management attention on the maintenance and development of patches composed of older trees, depending on pine species from 80 (loblolly) to over 200 years (longleaf), especially for the more vulnerable cavity nesting species (Red-cockaded Woodpecker, Brown-headed Nuthatch, American Kestrel, Red-headed Woodpecker).

5. Control midstory and understory vegetation density and place management emphasis on grassy/herbaceous ground cover with patches of shrub-scrub which should improve habitat conditions in all forest types for Red-cockaded Woodpecker, Red-headed Woodpecker, Chuck-will's-widow, Brown-headed Nuthatch. Minimize or avoid practices resulting in increasing ferns, gallberry, palmetto at the expence of warm-season native grasses and herbaceous plants.

    a. *Savanna*: regular growing-season prescribed burns favoring habitat conditions for American Kestrel, Northern Bobwhite, Henslow's and Bachman's Sparrows, and Loggerhead Shrike.

Table 11 (cont.).

Mature pine-dominated forests (cont.).

b. *Sandhills*: regular growing-season prescribed burns favoring habitat conditions for American Kestrel, Northern Bobwhite, Henslow's and Bachman's Sparrows. Drains and other areas with less frequent fire return should support shrub-scrub (presumably oaks patches) supporting Prairie Warbler and Field Sparrow, also important for prviding winter cover for Northern Bobwhite.

c. *Flatwoods*: regular growing-season prescribed burns favoring habitat conditions for Northern Bobwhite, Henslow's and Bachman's Sparrows.

d. *Pond pine pocosin*: regular growing-season prescribed burns to reduce height of bays and other pocosin vegetation; stand replacement burns result in savanna-like conditions potentially used by breeding Henslow's Sparrow, and definitely by wintering Henslow's Sparrow, breeding Bachman's Sparrow and Northern Bobwhite.

e. *Loblolly/shortleaf* : use both dormant and growing-season burns as site conditions and the level of hardwood control dictate; resulting heterogeneity should support Bachman's and Field Sparrows, Prairie Warbler, and Northern Bobwhite.

6. In all mature pine types, regeneration should emphasize predominance of older age classes and maintaining capability to effectively control midstory and understory vegetation. Silvicultural techniques may range from even-aged regeneration, especially for loblolly and slash pine to natural regeneration within existing stands for longleaf pine. If not in conflict with Red-cockaded Woodpecker or other Federally listed species, regeneration patches >10 ha (25 a) with emphasis on low intensity site preparation (maintenance of brushpiles and use of fire, as opposed to herbicides and roller-chopping) should support suitable to optimal habitat conditions for Northern Bobwhite and Bachman's Sparrow in the grass/forb stage and Prarie Warbler and Field Sparrow in shrub-seedling stage.

Mixed pine-hardwood, short-rotation pine sawtimber, pine poletimber

1. Moderate basal area for sawtimber (16-20 m^2/ha [65-80 ft^2/a]) and pine poletimber (14-16 m^2/ha [55-65 ft^2/a]), with moderate canopy cover (50-75% cover).

2. Encouraging dense midstory and understory development under moderately open canopy should support many other species typically associated with hardwood forests (Acadian Flycatcher, Wood Thrush, Black-and-white Warbler, Worm-eating Warbler, Kentucky Warbler).

3. Encouraging open midstory and understory under moderately open pine canopy through mechanical thinning, herbicides, or prescribed burning may support suitable habitat (at least temporarily) for species more typical of open pine forests (Chuck-will's-widow, Red-headed Woodpecker, and Brown-headed Nuthatch).

4. Retain snags over 35 cm (15 inches) for cavity nesting species, also use nest boxes.

5. Assuming various forms of even-aged regeneration, patches (with appropriate erosion controls, etc.) of 20-40 ha (50-100 a), with new patches adjacent to previous patches preferred for Northern Bobwhite, Prairie Warbler, Bachman's and Field Sparrows.

Table 12. Acreage and distribution of longleaf pine among ownerships (adapted after Landers et al. 1995) with proposed restoration goals in hectares (acres)*.

State	Total Acreage	Percentage of Total Area				
		Federal	State and Local Gov't	Industry	Non-indus. and Farms	Restoration Objectives
Florida	150,560 (376,400)	43	10	23	24	36,000 (90,000)
Georgia	208,000 (520,000)	11	1	24	64	132,000 (330,000)
South Carolina	147,600 (369,000)	25	6	24	45	66,000 (165,000)
North Carolina	102,200 (255,500)	28	15	16	41	42,000 (105,000)
Virginia	???					12,000 (30,000)
Total	608,440 (1,521,100)	25	7	22	46	288,000 (720,000)

*Throughout the histoical range of longleaf pine, 1.9 million ha (4.7 million acres) remained in 1975. To return to 1975 levels, 600,000 ha (1.5 million acres) need to be restored. Goals for restoration through Farm Bill (e.g., Regional Longleaf Pine Conservation Priority Area) could include simply doubling the area of longleaf presently found on Farm and Non-industrial Private lands, about 480,000 ha (1.2 million acres), with the remaining 120,000 ha (300,000 a) coming from restoration on public and cooperating industrial private lands.