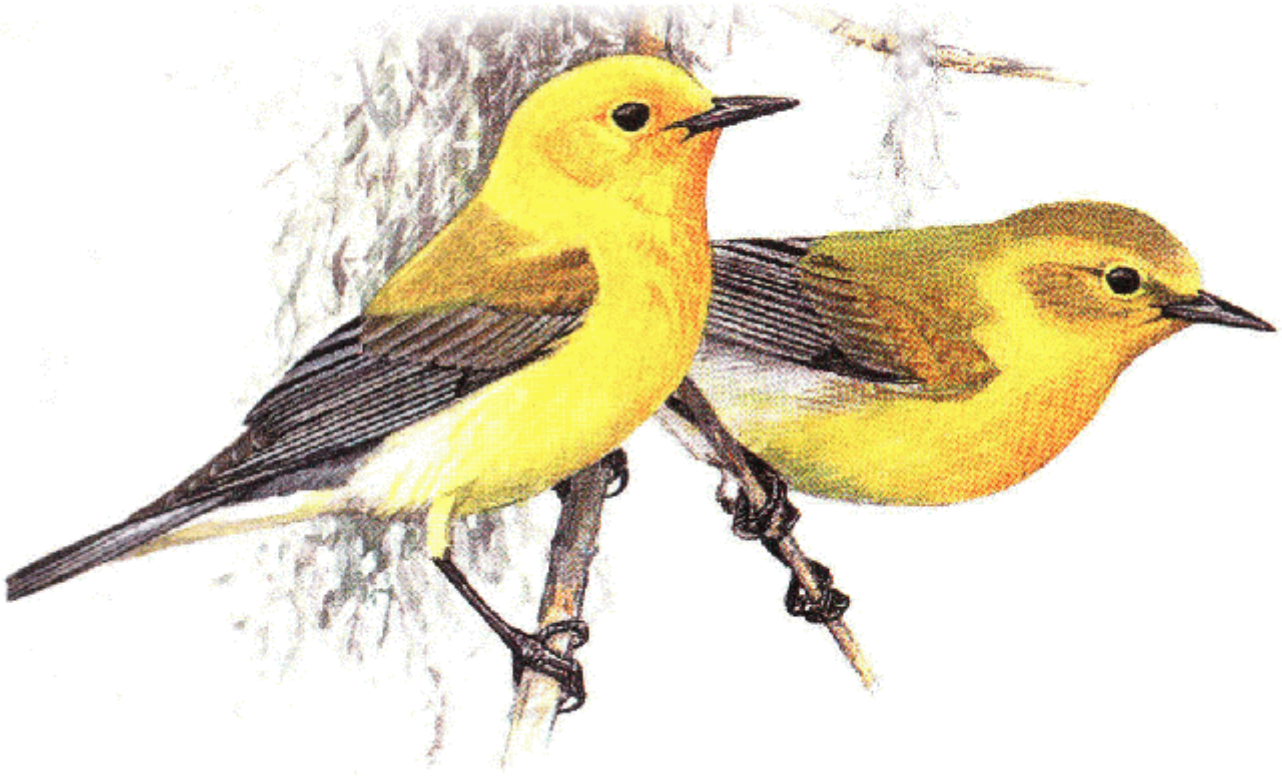
Partners in Flight
Bird Conservation Plan
for
The East Gulf Coastal Plain
(Physiographic Area 4)



American Bird Conservancy

Background:

The East Gulf Coastal Plain is characterized by a diversity of bird habitats, including coastal dunes and marshes, pine flatwoods and savannas, and expansive upland and bottomland hardwood forests. The typical vegetation types can be characterized broadly as southern mixed forest, oak-hickory-pine, and southern yellow pine, mixed with intervening floodplain forests (see Kuchler 1964, Martin et al. 1993). Live oak forests and coastal dune habitats occur along the coast. Ecological forces include disturbances such as fire, ice storms, wind storms, tornados, and flooding. Elevation ranges from 0 to 650 feet above sea level. Annual precipitation ranges from 40 to 60 inches generally, and 52 to 64 inches on the Florida coast (Keys et al. 1995).

The East Gulf Coastal Plain is approximately 245, 200 km^2 and occupies portions of Florida, Alabama, Mississippi, Louisiana, Tennessee, Kentucky, and Illinois (Figure 1). Nearly 30% of the land use in the area is classified as loblolly-shortleaf pine or longleaf pine forests, and another 30% is classified as corn or soybeans. Oak-hickory and oak-pine forests occupy about 25% of the remaining land (Table 1, Figure 2).

For ecological planning, the East Gulf Coastal Plain is divided into the lower, middle, and upper units; these units correspond roughly to the ecological units described by Key et al. (1995). The lower unit includes the barrier islands and coast to about 200 km inland and stretches from panhandle Florida to south Louisiana. The lower unit is characterized by predominantly flat, weakly dissected alluvial plains, and active coastlines. Quaternary geology and soils are typically Pliocene-Pleistocene sandy clay residuum (Keys et al. 1995). Predominant upland vegetation is slash and longleaf pine forest (including longleaf pine-turkey oak stands). Sand pine is the dominant canopy species in the xeric and deep sand areas of panhandle Florida and south Alabama (Enges et al. in press, Florida Natural Areas Inventory 1990).

Rivers and important estuaries include all the Florida panhandle rivers (the Escambia, Choctawatchee, Apalachicola, and Ochlockonee Rivers), the Tensaw River and Mobile Basin in Alabama, and the Pascagoula and Pearl Rivers in Mississippi. Floodplain wetlands are seasonally flooded habitats with alluvial sand or peat substrates. Typically, closed canopy forests include water oak, live oak, bald cypress, red maple, loblolly pine, overcup oak, water hickory, swamp chestnut oak,

and sweetgum (Florida Natural Areas Inventory 1990, Wharton et al. 1976, Martin et al. 1993, Enge et al. in press). Structurally, floodplain forest habitats range widely from open understory to dense thickets.

Coastal habitats in the East Gulf Coastal Plain include coastal upland habitats, such as beach/dune, coastal grassland, coastal strand, and maritime hammock, as well as coastal wetlands such as tidal marsh habitats (Enge et al. in press). Each habitat is shaped by strong and consistent winds, salt spray, and sun. Typical beach/dune vegetation includes sea oats, beach cordgrass, sand spur, dune panic grass, and beach morning glory. Coastal grasslands include muhly grass, bluestem grasses, and sea oats, as well as occasional shrubs such as wax myrtle and groundsel. Coastal strands and maritime hammocks include shrub and tree species that are tolerant of wind and salt spray, such as saw palmetto, sand live oak, cabbage palm, yaupon, sea grape, and prickly pear. Tidal marsh habitats include grasses, rushes, and sedges along low wave-energy wetlands and river mouths. Typical species include black needlerush, smooth cordgrass, and sawgrass (Enge et al. in press, Johnson and Barbour 1990).

The middle unit is delineated by a line which runs roughly east-west from approximately 20 km south of Jackson, Mississippi to near Birmingham, Alabama and extends north to the Mississippi-Tennessee state line. The middle unit is characterized by moderately dissected, irregular plains (see Martin et al. 1993). Quaternary geology and soils are typically Quaternary, Cenozoic sand, chert or clay deposits (Keys et al. 1995). Primary vegetation types include expanses of oak-hickory-pine in a variety of successional stages, the open grasslands of the Black Belt and Jackson Prairie, and floodplain forests. Major rivers include tributaries to the Mississippi River, such as the Pearl and Yazoo Rivers, and other rivers such as the Alabama and Tombigbee in Alabama.

Oak-hickory-pine forest is the most prevalent forest type through the middle unit of the East Gulf Coastal Plain; most pine forests consist of loblolly-shortleaf. Typically, potential natural vegetation could be “medium tall to tall forest of broadleaf deciduous and needleleaf evergreen trees” (Kuchler 1964). Forest structure and quality is influenced, however, by site conditions and fire, as well as past logging practices. Hardwoods are dominant over pine in many stands depending on soil moisture, past disturbance, and landowner objectives. Oaks include post, southern red, scarlet, chestnut, and blackjack. Hickories include pignut, mockernut, shagbark, and bitternut.

The Black Belt and the Jackson Prairie comprise the two largest areas that were open grasslands in the middle unit of the East Gulf Coastal Plain. The Black Belt is a gentle curve that stretches from northeast Mississippi into central Alabama. The Jackson Prairie is a large, rectangular shaped area in central Mississippi (see Martin et al. 1993). In these areas, 29 taxa are listed as characteristic (Mohr 1901), although 58 taxa have been reported on a small remnant (Schuster and McDaniel 1973). Dominant drier-site species include little bluestem and Indian grass, but rarely side-oats grama. Switch grass dominates mesic to wet-mesic sites; big bluestem occurs rarely. At the wet end of the spectrum, invasion from woody plants occur frequently (Martin et al. 1993).

Floodplain forests include oak-gum-cypress or elm-ash-cottonwood (Johnson and Shropshire 1983) throughout the area; Nutall's oak, laurel oak, water tupelo, and sweetbay become increasingly abundant in the southern portions of the area (see Cowardin et al. 1985, Martin et al. 1993). Forest structure ranges widely from open to dense. Structure is often determined by natural and/or altered flood regimes, stream migrations, soil erosion and deposition, and past management practices (see Martin et al. 1993 for a summary).

The upper unit roughly coincides with the Mississippi-Tennessee state and includes west Tennessee, west Kentucky, and parts of Illinois. The upper unit is characterized by flat to gently rolling uplands dissected by broad alluvial floodplains. Quaternary geology and soils are generally Wisconsin, Illinois loess and loessial alluvium (Keys et al. 1995). Primary vegetation was typically upland oak-hickory forests dissected by broad floodplain forests and patches of open grasslands. Major river systems are tributaries to the Mississippi River and include the Wolf, Hatchie, Forked Deer, and Obion Rivers.

Oak-hickory forests dominate the forest cover in the upland areas of the upper unit of the East Gulf Coastal Plain. Historically, in areas of Tertiary deposits on the Tennessee Plateau, the forest cover was dominated by red, black, southern red, and post oaks, as well as hickory (Loughridge 1888). On more mesic sites, white oak stands dominated (see Martin et al. 1993). Along the Mississippi River or loess bluffs, there was a variety of oaks, as well as walnut, hickory, yellow poplar, basswood, elm, beech, pawpaw, sweetgum, blackgum, and a dense understory of cane (Loughridge 1888). In the upper unit of the East Gulf Coastal Plain, most upland habitats have been converted to row crop

agriculture and urbanization. Although the Mississippi bluffs remain heavily forested, the forest structure is now dominated by smaller diameter trees and less undergrowth.

The Kentucky Barrens (Jackson Purchase) make up the largest grassland area in the upper unit of the East Gulf Coastal Plain. The term barrens may replace the word prairie and refers to an increase in brushy-grassy openings in these habitats (see DeSelm and Murdock 1993, DeSelm 1989). However, vegetation composition is more characteristic of the mid-west United States than the deep south in the Kentucky Barrens, which suggests that some migration of taxa from the west during some previous warm, dry period (Martin et al. 1993). Bluestem prairie, barrens, and other open, grassland habitats have been almost totally converted to pasture or row crop agriculture in the upper unit.

Floodplain forests are dominated by oak-gum-cypress or elm-ash-cottonwood (Johnson and Shopshire 1983). Dominant oaks include swamp chestnut, overcup, cherrybark, water and willow oaks. Typical vegetative communities range from bald cypress to sugarberry-mixed hardwoods to boxelder communities (Patterson and DeSelm 1989). Floodplain habitats have been impacted by altered stream channels, flood control, soil erosion, and past logging practices.

Conservation Issues:

In the East Gulf Coastal Plain, broad conservation issues that impact bird populations and/or habitats include:

(1) increasing global demand for pulpwood and economic incentives for shorter rotation and conversion to pine forest,

(2) suppression of fire, difficulty with public acceptance, permits to burn,

(3) coastal zone development caused by affluence in society, thus second home or increased money to provide retirement home in coastal areas,

(4) conversion of longleaf for shorter rotation, economically more important pines and lack of landowner education about the economic values of longleaf pine,

(5) flood control/stream alteration,

(6) forest exotics such as kudzu,

(7) pasture (economic) exotics such as fescue,

(8) soil erosion, and

(9) cumulative impacts of small urban developments as well as the above issues (including population growth in the physiographic area).

Conservation Opportunities:

Management of landscapes for bird conservation priorities may include three strategies: 1) manage and maintain existing habitats identified as being of value to bird populations 2) restore or consolidate important habitats and 3) provide a combination of these two strategies (Hunter, unpublished manuscript). For the East Gulf Coastal Plain, a combination of strategies will be required to increase and sustain breeding bird populations.

Public land management will play a vital role in developing quality bird habitats in the East Gulf Coastal Plain, especially for longleaf pine, bottomland hardwood forest restoration, and coastal habitats. Each habitat is undergoing an ecosystem approach to management. Steps to integrate bird conservation into ecosystem management projects include: 1) identify research needs and transfer research information on birds to managers early in the planning process, 2) include researchers knowledgeable about the requirements of birds on ecosystem management teams, 3) define priorities and monitoring goals for birds in ecosystem management plans, 4) subject ecosystem management plans to technical review by bird experts, 5) define collaboration goals with Partners in Flight in ecosystem management plans, and 6) include bird conservation strategies in ecosystem management demonstration projects (Finch et al. 1993).

Ecosystem management and bird conservation strategies require that public land management objectives not be independent of adjacent and nearby landowner objectives. As a result, East Gulf Coastal Plain opportunities include additional incentive programs for cooperative management of surrounding habitats, as well as public land. A program similar to Partnerships for Wildlife needs to continued and implemented through the U.S. Forest Service and U.S. Fish and Wildlife Service in the East Gulf Coastal Plain.

The Forest Products Industry is a major owner and land manager in the physiographic area. Although major industries are present, many timber companies are small family businesses. An

opportunity exists to work more closely with large and small companies to increase the acreage of forest lands, to increase tract size with cooperative reforestation efforts, and improve timber stand conditions that favor birds and economics.

Private, non-industrial landowners are the primary landownership class in the East Gulf Coastal Plain. Van Patter et al. (1990) suggested a range of techniques to enhance the effectiveness of private land stewardship: 1) educating the owner about the value of a tract, 2) verbal stewardship agreements, 3) written agreements which provide a more tangible incentive/reward, 4) cooperative management agreements, 5) lease, 6) conservation easement, and 7) purchase and sellback. Most landowners surveyed favored a combination of an award, tax incentives, and information about conservation management (Van Patter et al. 1990).

With regard to conservation on private lands, Sample (1995) advocates fostering conservation leadership among landowners through: 1) identifying and articulating landscape-scale conservation goals in the region, 2) identifying key landowners with regard both to the value of their land holdings and their ability to influence other property owners, 3) convening periodic meetings of landowners to promote the exchange of information among them and to build a sense of shared purpose, and 4) providing technical assistance to landowners, helping them to understand the connection of their lands to the wider landscape and assisting them with achieving conservation objectives and accruing tax advantages. Tax incentives are powerful measures to help private landowners justify protecting important bird areas in their control. As inheritance taxes are a major cause of the parcelization of contiguous tracts and of harvesting of timber, a case-by-case waiver of inheritance taxes on high-priority lands could help ensure their protection under single or long-term ownerships (Sample 1995).

With regard to stopover habitat management for the Neotropical migrants passing through the East Gulf Coastal Plain, the recommendations of McCann et al. (1993) are applicable. Effective provision of suitable habitats for transient migrants requires protecting a mosaic of different habitat types distributed throughout the region. Large forest blocks typically incorporate a wide diversity of microhabitats and could serve the dual purpose of enhancing breeding habitat for resident interior forest species, as well as providing suitable stopover habitat for transients. Coastal stopover habitats of the East Gulf Coastal Plain should receive special attention with regards to management, conservation, and restoration. These sites warrant special attention because many of the problems migrants face, such as

food acquisition, predator avoidance, and competition for limited resources, are magnified when migrants cross geographical barriers, such as the Gulf of Mexico (e.g., Moore and Woodrey 1993, Loria and Moore 1990; see Alerstam 1981).

Section 2: Avifaunal Analysis and Mapping Methods

Species prioritization:

Over 300 bird species occur annually in the East Gulf Coastal Plain as nesting species, post nesting dispersal species, transients, and/or wintering residents. Over 180 of these nest in the physiographic area. Representative nesting species include eastern meadowlark, field sparrow, 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 typical rural landscapes in the East Gulf Coastal Plain. In the upper unit of the East Gulf Coastal Plain, approximately 100 breeding bird species occur in a county (e.g. Coffey 1976, Ford and Hamel 1993, Ford and Waldron 1997). In the middle unit, approximately 100 breeding bird species occur in a county (Woodrey unpublished data). In the lower unit along the coast, approximately 120 breeding bird species occur in a county (Woodrey unpublished data, Toups and Jackson 1987).

The Partners in Flight prioritization scheme was developed to prioritize inventory, monitoring, management, and research actions among diverse birds and habitats (see Hunter et al. 1993, Carter et. al. in press). The system ranks each species based on 7 measures of conservation vulnerability: relative abundance, size of breeding range, size of non-breeding range, threats during breeding season, threats during non-breeding season, population trend, and relative density. In addition, Rosenberg and Wells (pers. comm.) have provided the percentage of a species global breeding population that occurs in a physiographic. 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 scheme in the East Gulf Coastal Plain (Table 2). Category I lists highest priority birds and includes 52 nesting, transient, and winter species which received a total Partners in Flight score of 22 or more. Habitat requirements for these species ranged widely from

grassland and early succession, to coastal beach and dunes, to forested wetlands and mature upland hardwood forest. Representative breeding species include Mississippi sandhill crane, red-cockaded woodpecker, Bachman's sparrow, swallow-tailed kite, Bewick's wren, Swainson's warbler, American kestrel, cerulean warbler, chuck-will's-widow, prairie warbler, worm-eating warbler, northern bobwhite, and yellow-billed cuckoo; winter residents include yellow rail, piping plover, sedge wren, Nelson's and saltmarsh sharp-tailed sparrows, and Henslow's sparrow; transients include buff-breasted sandpiper, black tern, Bicknell's thrush, black-throated blue warbler, and bobolink.

Category II provides a list of slightly lower priority species, and includes another 27 species with slightly lower total scores (19 to 21), but with a high score for area importance and population trend. These species are found largely in early succession habitats, open habitats, or water habitats. Two species are listed in Category III; these species received high global concern scores, or are a Watchlist Species (e.g. Carter et al. in press).

Category IV birds have high scores for area importance and population trend, regardless of total score. In the East Gulf Coastal Plain, 5 species are in this category. Many of these species should probably be monitored and others, such as blue jay and common grackle, possibly should be managed against.

Category V species have greater than 10% of their national breeding population within the East Gulf Coastal Plain; species from other categories may also have greater than 10% of their breeding population in the area. Bachman's sparrow and fish crow, for example, have over 20% of their national breeding population in this physiographic area, according to the Breeding Bird Survey results. Brown-headed nuthatch has over 15% of its breeding population in the area, and a host of species has between 10 and 15% of their breeding population in the area, including hooded warbler, Swainson's warbler, Eastern towhee, chuck-will's-widow, and summer tanager.

Categories VI and VII list federally threatened and endangered species, as well as species of state concern. These categories include 6 species, including bald eagle, painted bunting, and wood stork. Other species include those that should be monitored and/or managed against, such as shiny cowbird.

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 bird populations, Twedt et al. (1997) used Hamel's (1992) estimates of mean densities of breeding birds taken from Breeding Bird Survey data in their Mississippi Alluvial Valley Conservation Plan. From these density estimates they extrapolated to estimate the area required for 500 breeding pairs, then doubled that to approximate an area of suitable, interior habitat surrounded by a 1 km buffer zone of similar land use. 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 breeding pairs. We then doubled that to create a total area encompassing the core area and approximately a 1 km buffer zone (Table 3).

Habitat maps in this report:

Figures in this plan depicting the location of contiguous tracts of each habitat type were created from USFS FIA forest inventory data and shown at a 1 square km resolution. Though all states have been surveyed after 1990, data contained in the USFS FIA database cannot be expected to be fully current in 1998. Forest areas and locations presented in tables and figures may not reflect present stand conditions. Many areas shown as contiguous forest tracts may well be smaller and more fragmented than they appear in this report.

The database upon which figures and hectare estimates used in this plan were derived was produced by analysis of satellite imagery and assignment of a habitat type classification based on USFS forest inventory data at a 1 sq km scale. While that resolution is rather course, 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 at the 1 sq km scale and follow-up actions 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 owners. 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 may 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 concern species.

Section 3: Habitats and Objectives

Birds are grouped into 7 priority species-habitat suites for the East Gulf Coastal Plain (Table 4). The habitats covered in this plan and the number of high concern score birds in each habitat are:

Forested Wetland: 18 species

Longleaf Pine-Slash Pine: 15 species

Maritime communities:

Maritime Forest – 27 species

Beaches and Dunes – 21 species

Emergent wetlands – 14 species

Upland Hardwoods: Oak-hickory – 16 species

Loblolly Pine-Shortleaf Pine – 17 species

Early succession habitats:

Scrub-shrub/Old Field – 16 species

Short-rotation pine – 12 species

Grasslands and Pastures – 8 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 the assumptions of the plan.

Forested Wetlands

***Ecology and Status*:**

Bottomland hardwood forest, classified as oak-gum-cypress, occupies 1,809,000 ha (4,470,039 acres) in the East Gulf Coastal Plain. Significant acreage of bottomland hardwoods occur in the Hatchie, Pearl, Pascagoula, Tensaw, Mobile, and Apalachicola River watersheds (Figure 3). In the East Gulf Coastal Plain, important tree species and forest cover types within bottomland hardwoods include: cottonwood, black willow, overcup oak-water hickory, sweetgum-willow oak, sugarberry-American elm-green ash, eastern sycamore, sweetgum-American elm, willow oak-wateroak-laurel oak, swamp chestnut oak-cherrybark oak, baldcypress, baldcypress-water tupelo, water tupelo-swamp tupelo, sweetbay-swamp tupelo-red bay (Sharitz and Mitsch 1993).

Hydrology is the driving ecological force that defines vegetative species composition and structure in bottomland hardwood forests (see Cowardin et al. 1977, Sharitz and Mitsch 1993 for an overview). Bottomland hardwood forest habitats often maintain high canopy tree species diversity, as well as dense midstories and understories. Various hydrologic regimes contribute to supporting high densities of bird species and individuals (see Ford 1990). In the East Gulf Coastal Plain, human impacts to forested wetlands have included channelization, high grade logging, sedimentation, point and non-point source

pollution, agriculture, and urbanization. Because of these impacts, forests are continuous from the river to the bluffs in very few cases among East Gulf Coastal Plain watersheds.

Beaver populations have increased in the recent past as well, resulting in a change in both structure and composition of forested wetlands. Structural changes in beaver ponds include the addition of permanent water, an increase in the number of dead trees, and a resultant decrease in percent canopy closure. In west Tennessee, over 80% of the black willow and black willow-cypress communities sampled had been impacted by beaver (Patterson and DeSelm 1989).

Priority species, species suites, and habitat requriements:

Breeding bird species composition, relative abundance, and densities may vary widely among forested wetlands in watersheds of the East Gulf Coastal Plain. In the upper unit, 90 species were observed in forested habitats of west Tennessee watersheds; an average of 113 individuals and 28 species occurred at 59 sites sampled (Ford 1990). Highest breeding bird densities occurred in watersheds characterized by large forest tract size and relatively normal flood regimes; while highest species richness occurred near major continental rivers, such as the Mississippi and Tennessee Rivers.

In the East Gulf Coastal Plain, breeding bird communities are likely limited by cumulative impacts which reduce forest tract size, reduce habitat quality, and alter natural flood regimes. Cumulative impacts are watershed scale phenomena, and result from "the summation or interaction in space or time of individual minor projects" (Gosselink et al. 1989). In one Louisiana watershed, for example, densities of 11 of 37 birds declined and an estimated 3 to 4 species have been extirpated per decade because of the cumulative impacts and loss of bottomland hardwood forest (Gosselink et al. 1989).

Swainson's warbler, swallow-tailed kite, cerulean warbler, prothonotary warbler, Kentucky warbler, and yellow-billed cuckoo constitute the forested wetland bird species assemblage of highest concern in the East Gulf Coastal Plain. Of these species, prothonotary warbler, Kentucky warbler, and yellow-billed cuckoo are distributed throughout the East Gulf Coastal Plain in appropriate habitats. Sample densities from a variety of studies, which were used to set population and habitat objectives, were compiled Hamel (1992). All three species occurred on more than 45 of 59 sites in a west Tennessee study across all watersheds; on sites where they occurred, the average number of individuals

were 3 Kentucky warblers, 4 yellow-billed cuckoos, and 7 prothonotary warblers per 1 km transect (Ford 1990). Similar results occurred during Partners in Flight point counts (Roedel et al. 1997).

The North American breeding subspecies of the swallow-tailed kite 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 (Meyer 1995). The kite probably bred historically in 21 states, with concentrations in nine, but is now known to breed only in seven states, with the greatest nesting concentrations in peninsular and subtropical Florida (Meyer 1990, Meyer and Collopy 1990). In the East Gulf Coastal Plain, the swallow-tailed kite is found only in the lower unit. Apparently, stable populations occur on the lower Pearl River (J. Coulson unpublished data), Pascagoula River (M. Woodrey unpublished data), and the Florida panhandle rivers (K. Meyer, J. Cox, unpublished data). Swallow-tailed kites may require a minimum of 40,000 ha (100,000 acres) of bottomland hardwood forest for stable nesting populations of 80 to 85 pairs (Cely and Sorrow 1990). Within these large tracts, kites prefer nest trees greater than 40 m tall (Cely and Sorrow 1990).

Cerulean warbler persists in the highlands and plateaus from the Southern Appalachians westward, but has been reduced from its historical distribution as a breeding species in the southeastern coastal plain. Cerulean warblers were present on 15 of 59 study sites spread among west Tennessee watersheds, and averaged nearly 3 singing males per 1 km transect on sites where they occurred. This species occurred only on public lands or lands managed for sawtimber and hunt clubs (Ford 1990). Currently, the only known persistent population in the East Gulf Coastal Plain is located in forested wetlands along the Hatchie River in west Tennessee.

Hamel (1992b; also see Robbins et al. 1992) recommended 4,000 ha (10,000 acre) tracts of mature forested wetlands to maintain a source population of cerulean warblers based on his work in the coastal plain of Tennessee. Within these tracts, trees greater than 50 cm dbh and taller than average canopy height are preferred. In areas where the landscape is dominated by agriculture, such as within the Mississippi Alluvial Plain, a more conservative estimate of 8,000 ha (20,000 acres) may be necessary to support a source population.

Swainson's warbler and prothonotary warbler, which occur throughout the East Gulf Coastal Plain, are high priority species which require conservation attention. Although widespread throughout the area, Swainson’s Warblers have been extirpated from panhandle Florida since the 1970’s. In west

Tennessee, this species occurred on 26 of 59 study sites, and averaged almost 2 singing males per site where it occurred (Ford 1990). Nesting Swainson's warbler prefers cane thickets or other dense shrub layer under a fairly closed canopy. A source population of Swainson's warblers probably requires at least 2,400 ha (6,000 acres) [4,000 ha (10,000 acres) in agriculturally-dominated landscapes] of mature forested wetlands.

Prothonotary Warblers are cavity nesting birds, probably requiring at least 1,600 ha (4,000 acres) [2,800 ha (7,000 acres) in agriculturally-dominated landscapes] of mature forested wetlands. This species will also actively adopt artificial nesting boxes, given the proper placement of the nesting boxes over standing water (Petit 1989, Ford 1990).

Generally, habitat requirements for viable breeding populations for this species assemblage include large tract sizes, areas of mature forest (large diameter trees) interspersed with other land use and forest successional stages, and near natural hydrologic regimes. 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 other bird species.

Population and habitat objectives:

Population objectives

The goal for forested floodplain wetlands within the East Gulf Coastal Plain is to maintain or increase (through restoration and improved management) acreage of predominately mature forested wetlands. Management focus should be to: 1) support at least 5 swallow-tailed kite populations of 80-100 pairs each, 2) to develop structural diversity to support 3 healthy cerulean warbler populations, and 3) to sustain at least 11 Swainson's and 12 prothonotary warbler populations among all systems.

For swallow-tailed kites to become secure throughout the Southeast, maintenance of at least 80 breeding pairs in at least 13 major southeastern coastal plain flood plains is necessary. The largest number (5) of these populations are expected to come from the East Gulf Coastal Plain. Estimates of about 40,000 ha (100,000 acres) of mature forested wetland in the coastal plain appear to be necessary to support between 80-100 Swallow-tailed Kite pairs (Cely and Sorrow 1990). The goal of

establishing 5 populations is made in recognition that populations already exist in the Mobile Delta, Pascagoula, Pearl, and Apalachicola River systems, but are of unknown size and population health. In addition to existing populations, we recommend adding one more small population in west Tennessee, along the Hatchie River, as a goal (as adjacent to habitat restoration for Mississippi Alluvial Valley; see Twedt et al. 1997).

The Hatchie River may support the largest East Gulf Coastal Plain population of cerulean warbler. The population size is unknown, but could be 50 pairs today, with potential for 80 to 100 pairs in the future (Bob Ford, personal communication). Whether or not there were ever other large East Gulf populations is unknown. Also unclear is why the Hatchie River supports the largest population within the East Gulf Coastal Plain, but the extensive and varied canopy structure of the Hatchie River floodplain forest should be investigated to see if other systems have the same qualities.

Management and restoration of both alluvial and non-alluvial forested wetlands within all East Gulf floodplains will be necessary to sustain 11 Swainson's and 12 twelve prothonotary warbler populations. Swainson's warblers appears to have been extirpated from Florida except along the panhandle since the mid-1970's, but their status here is unclear (Stevenson and Anderson, 1994).

Habitat objectives

Determining habitat objectives for the area sensitive species - Swallow-tailed Kite, Cerulean Warbler, Swainson's Warbler, and Prothonotary Warbler - is straight forward. For example, five populations of kites in the East Gulf Coastal Plain on 40,000 ha (100,000 acres) each in southeast Louisiana, south Mississippi, south Alabama, the panhandle Florida, and west Tennessee would require a habitat objective of 200,000 ha (500,000 acres). A minimum estimate of 24,000 ha (60,000 acres) is required to maintain and restore three populations of Cerulean Warblers, two populations located in the Hatchie River basin and one in the Wolf River basin. A minimum habitat objective for Swainson's Warbler, Prothonotary Warbler, and other less area-sensitive species in the East Gulf Coastal Plain is 68,000 ha. Thus, a minimum total habitat objective for bottomland hardwood forests in the East Gulf Coastal Plain is 292,000 ha.

Implementation recommendations and opportunities:

Implementation opportunities for bottomland hardwood forests in the East Gulf Coastal Plain include increasing effective partnerships with the U.S. Fish and Wildlife Service, U.S. Forest Service, Lower Mississippi Valley Joint Venture, state and local government agencies, forest products industry, and non-government organizations, such as Ducks Unlimited, The Nature Conservancy, National Audubon Society, and National Wildlife Federation affiliates.

The U.S. Fish and Wildlife Service and U.S. Forest Service manages public land within the East Gulf Coastal Plain, and can implement direct management practices for bottomland hardwood forest birds on those lands. Furthermore, federal dollars may be leveraged to support cooperative ecosystem management approaches that include bird conservation initiatives adjacent and surrounding landowners and habitats. In addition to possible refuge and National Forest money for increased private lands management, private, private non-industrial landowners may take advantage of the Wetlands Reserve Program (WRP) to reforest floodplain farmlands. States could consider increasing project points for landowners applying for WRP in Partners in Flight targeted watersheds such as the Mobile Delta, Pascagoula, Pearl, Apalachicola River, and Hatchie Rivers.

The Lower Mississippi Valley Joint Venture offers opportunities for increased forest wetland management, especially in regard to reforestation and water management. The Joint Venture can provide leadership and technical assistance for select projects to better manage water and natural hydrology that could benefit waterfowl, shorebirds, and priority songbirds in the East Gulf Coastal Plain.

State and local government agencies play an important role in bottomland hardwood forest management. The role of state and local government can range from reforestation and wildlife management to water management and flood control. Although these roles can often seem contradictory among agencies, an opportunity exists to coordinate state and local interests for better floodplain management. In Tennessee, for example, recent legislation has enacted growth management legislation that requires counties to devise a growth plan that incorporates active conservation of greenways, parks, and wildlife management areas. Through that planning process, rivers and bottomland hardwood forest corridors are examples of habitats that can be identified through a county-wide plan without a significant impact on economic return.

The forest products industry is active in bottomland hardwood forests of the East Gulf Coastal Plain, and range in size from large companies to small family businesses. These companies offer opportunities for reforestation and improved forest management throughout the area. In many cases, private, non-industrial landowners may be convinced to actively manage for long rotation timber on lands with a site index of 50 or 60. Furthermore, marginal farmlands can be reforested with cottonwood and sycamore to provide for a short term economic gain, while an understory of oak develops.

Many non-government organizations are interested in bottomland hardwood forests as well. Ducks Unlimited and other organizations can assist landowners in managing for waterfowl, and these lands can then be leased for waterfowl hunting. The Nature Conservancy has begun a national campaign initiative for the Hatchie River, and has completed ecoregional planning for the lower unit of the East Gulf Coastal Plain. Each program can assit with Partners in Flight objecitves while reaching their organizational objectives.

Evaluation of assumptions:

Assumptions are inherent in the above discussion and must be addressed systematically. Population and habitat goals for migratory landbirds assume the need for spatial requirements of territorial individuals. To ensure source populations within forested habitat, several assumptions have been made. These assumptions can be placed into five broad categories: habitat availability, species distribution, breeding bird densities, source populations, and genetic viability.

<u>Swallow-tailed Kites</u>

Swallow-tailed kite research and monitoring needs require special attention independent of other forested wetland species (*e.g.*, requiring use of cranes or aircraft to detect nest/roosting sites and count individuals). Status survey and inventory efforts to provide better population estimates along all East Gulf Coastal Plain flood plains is essential for planning specific population and therefore habitat objectives.

1. Surveys are currently underway for the Pearl River and hopefully in the near future for the Apalachicola River basin, Mobile Delta, and the Pascagoula River Basin.

2. Additional research and monitoring priorities are being prepared by Ken Meyers (USDI Biological Resources Division, Gainesville, Florida).
3. Feasibility for reintroduction or population enhancement also should be pursued.

Priority Passerine Species

1. For priority landbird species, we assume that habitat availability is the primary limiting factor for populations of birds breeding in bottomland hardwood forests and that maintaining or restoring "suitable" forest patches (i.e. patches of adequate size, shape, and management) will provide adequate habitat for these species.
2. We also assume that the breeding bird densities recorded in Hamel (1992) based on data from the southeastern U.S. reflect the average densities of birds in the East Gulf Coastal Plain.
3. Territory distribution within forest patches is assumed to be such that the target number of 500 breeding pairs of the appropriate species (with some exceptions; *e.g.*, Swallow-tailed Kite) will occur within suitable forest patches. Each suitable forest patch is assumed to support a source population of each of its representative breeding species; that is, populations that on average produce more offspring than the number required to replace mortality of adults within the forest patch.
4. Finally, we assume that gene flow within and among populations in forest patches is sufficient to maintain and/or increase the current genetic diversity of the species within the East Gulf Coastal Plain.

Further research and monitoring priorities are discussed in Appendix I.

Longleaf Pine-Slash Pine: includes Flatwoods, Sandhills, Slash Pine Savanna

Ecology and status:

Longleaf-Slash Pine forests constitute approximately 5% of the land use/land cover in the East Gulf Coastal Plain. This forest type occurs on approximately 2,034,000ha (5,026,014 acres). The largest concentrations are in the lower unit, primarily southern Mississippi. Over 2,500 fairly discrete patches are less than 4000 ha (10,000 acres), 14 concentrations are between 4000 and 8000 ha (10,000 and 20,000 acres), 11 concentrations are between 8000 and 40000 ha (10,000 and 100,000 acres) and 3 concentrations are greater than 40,000 ha (100,000 acres) , and a large portion of these habitats occur on federally managed public lands (University of Arkansas, personal communications; Figure 5).

Historically, longleaf pine occurred as at least a co-dominant in southern pine forests at the time of European colonization. Over 36,800,000 ha (92 million acres) are estimated to have been where longleaf was the dominant canopy tree, stretching from southeast Virginia to east Texas and interrupted only by major floodplain forested wetlands and occasional prairies (Frost 1993). Pre-European 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 36,800,000 ha (92,000,000 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). Currently, less than 3% of longleaf acreage occurs (Frost 1993).

The conversion of many natural pine and hardwood stands to short-rotation pine plantation during this century has resulted in an almost complete elimination of functioning longleaf pine ecosystems (Croker 1987, Ware et al. 1993). Unlike other temperate forest ecosystems, the high level of biodiversity found in natural longleaf pine forests is restricted to the condition of the ground layer. Frequent growing-season fires are essential for maintaining the density of bunch grasses, principally wiregrasses (*Aristida stricta* and *A. beyrichiana)* in the east and bluestems (*Andropogon* spp.) towards the west, forbs and vines, and keeps the shrub layer to a minimum (Frost 1993). Unfortunately, fire suppression has been emphasized in forest management during most of this century and when fire is used as a management tool it has been mostly applied during the dormant season (Croker 1987, Frost 1993). Even judicial use of predominately dormant season fires in sandhills and flatwoods usually leads to reduction in grasses and forbs, and therefore habitat quality for most high priority species with an increase in saw palmetto, gallberry, and braken fern carpeting the understory.

Savannas, sandhills, and flatwoods communities are all adapted to frequent fire for long term maintenance of habitat quality. Classic savannas are best maintained by growing-season burns, and are

subject to frequent fires, but frequent burning is not necessarily required; as sites go from wet mineral soils to more wet loamy or sandy soils, frequent growing-season fires become essential (Frost 1995). Natural fire frequency is about the same for an average longleaf stand in flatwoods or in sandhills, but for different reasons. Sandhills are drier communities and support sparser ground cover, while flatwoods are wetter with denser ground cover. Wetter than average flatwoods and savannas, with less frequent fires, favors slash pine.

Especially essential for bird conservation within the East Gulf Coastal Plain are the longleaf and slash pine savannas formerly found throughout the lower coastal plain and the dry and wet prairies from southeastern Louisiana to the Florida panhandle. Currently, less than three percent of the original savanna can be found in the Southeast (Noss et al. 1995). The largest remaining fragments of pine savanna (outside of the Apalachicola National Forest, Florida) within the East Gulf Coastal Plain are Garcon Point, Florida, Grand Bay, Alabama, and Mississippi Sandhill Crane National Wildlife Refuge, Mississippi.

Priority species, species suites, and habitat requirements:

Based primarily on community-wide surveys, Engstrom (1993) found that 86 species of birds are characteristically found in longleaf pine forest. Of these 86 species, 35 are permanent residents, 29 species are breeders and 22 species are winter visitors. The red-cockaded woodpecker, brown headed nuthatch, and Bachman's sparrow are largely sympatric with longleaf pine and commonly use longleaf pine habitats.

Although a large number of species are dependent on mature longleaf pine forest communities, most management attention has been focused on red-cockaded woodpecker. However, the longleaf pine savanna forest type provides the primary habitat for several species of high concern, including Mississippi sandhill crane, Bachman's sparrow, brown-headed nuthatch, prairie warbler, Henslow's sparrow (winter only), sedge wren (winter only), and northern bobwhite. Of these species, Northern bobwhites, Bachman's sparrows, Henslow's sparrows (winter only) and sedge wrens (winter only) optimally use sparsely-stocked pine savanna. Southeastern American kestrels, red-cockaded woodpeckers, and brown-headed nuthatches may occur if 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).

Recovery of red-cockaded woodpecker populations will be accomplished only where large patches include mature and over 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 through 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 (e.g., Costa 1996, Beyer et al. 1996, Conner et al. 1996, Jones and Hunt 1996).

A habitat patch size of 50,000 ha (125,000 acres) or more assure that enough appropriately-managed pine habitat will be available at all times to support a recovered (viable) population. This figure was established assuming pine regeneration sites within a given patch will be temporarily unavailable to woodpeckers. 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 recovers (Reed et al. 1988, U.S.D.A. Forest Service 1995).

Regardless of patch size, pine-dominated ecosystems provide habitat for many vulnerable species. Forests managed for red-cockaded woodpecker recovery equal or 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-dependant 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.

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's distribution probably coincided closely with the distribution of red-cockaded woodpeckers within predominately longleaf pine and, secondarily, with shortleaf pine at the time of first European colonization. The specific habitat characteristics most optimal for Bachman's sparrows, however, can be duplicated in other anthropogenic associated habitats (*e.g.*, clearcuts, powerline right-of-ways) on a temporary basis.

Among the variety of habitats used by Bachman's sparrows, 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.

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 some mature and overmature pine stands, and less drastic site preparation should support the largest and healthiest sparrow populations.

Bachman's sparrows is a poor disperser and unable to quickly colonize from one suitable site to another without early-successional linkages (*e.g.*, powerline right-of-ways, tornado alleys), nearby mature and overmature 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 appearing clearcuts that were widely scattered and isolated within a landscape 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 and overmature pine stands are available, but use of clearcuts declines in landscapes where mature and overmature pine stands dominate the landscape. Mature and overmature longleaf stands appear to be the most preferred habitat type and this type certainly provides for decades of relative stability in habitat quality under long rotations and frequent growing-season fire management (Dunning and Watts 1991).

Wintering Henslow's sparrows are apparently most common in moist to wet grassy dominated savannas and flatwoods (Chandler and Woodrey 1995, McNair 1998). However, the specific habitat

requirements of this species wintering within the coastal plain are poorly known. Nevertheless, two studies on this species during winter are in progress within Mississippi Sandhill Crane National Wildlife Refuge, Mississippi, and International Paper lands in south Alabama. Preliminary 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 (Engstrom and McNair personal communication, Woodrey and Chandler unpublished data, Plentovich personal communication). During winter, this species' apparent dependence primarily on pine flatwoods and savannas, including pitcher plant bogs, complicate management priorities outside the breeding season. Consistent use by of moist sites dominated by broomsedge grasses during winter support the need to provide grassy habitats for this species independent of sites with a pine overstory. Disturbance, through burning (savannas) or mowing (powerline right-of-ways) of wintering sites is also critical for maintaining suitable to optimal habitat.

No data exist on the specific numbers of Henslow's sparrows wintering within the East Gulf Coastal Plain, but it can be assumed that up to a third of the global population may be involved. Similarly, trend data are unavailable and developing simple protocols that could provide for widespread monitoring during winter are currently underway (Riley, Carrie, and Shackleford personal communication).

The highest priority neotropical migrant species associated with slightly longer burning cycles is the northern prairie warbler. This subspecies 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. The northern prairie warbler is arguably more widespread and perhaps more common than it was at the time of European colonization. However, 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). Early-successional habitats may be used by prairie warblers but may not represent optimal and relatively long-term optimal habitat.

Among other 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, and this 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 neotropical migrants are best taken care of in mature forested wetlands, while other species are peripheral in occurrence or otherwise of low priority status within the East Gulf Coastal Plain (Hunter et al. 1994).

Besides Red-cockaded woodpecker, three other cavity-dependent species also require some degree of attention within pine and pine-hardwood habitats. Of these three, the species requiring the most attention is the Southeastern American kestrel, which formerly ranged from southwestern South Carolina apparently west across the coastal plain to Louisiana 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 Fall line), with a small population also persisting along the Mississippi Gulf Coast (Collopy 1996). Declines in Southeastern American kestrels are attributed to both reduced number of longleaf pine snags left standing in agricultural areas and open pine woods and increasingly intense nature of agriculture and urban development, reducing most suitable foraging habitat (Hoffman and Collopy 1988).

The other priority cavity nesting species, great crested flycatchers and brown-headed nuthatches, are more secure because they use a broader range of habitats and are generally more common throughout their distributions. Great crested flycatchers remain common and populations appear stable within the East Gulf Coastal Plain. This flycatcher also makes use of appropriately sized nest boxes, even where natural cavities are present. In contrast, the brown-headed nuthatch, though still locally common, is less restricted in overall distribution than the red-cockaded woodpecker, but it has declining populations within the East Gulf Coastal Plain. The trend towards shorter harvest rotations with the East Gulf Coastal Plain commercial pine forests may be impacting brown-headed nuthatch populations; this species excavates its own cavities in both older live pines (often with dead limbs) and pine snags. On most public lands, increasing harvest rotation of pines may compensate for declines, if indeed changing practices on private lands are associated with the overall population trend. At the very

least, greater attention to monitoring brown-headed nuthatch populations on both public and private pinelands appears warranted.

Population and habitat objectives:

Population objectives

Recovery goals for red-cockaded woodpecker populations have been established for 6 areas within the East Gulf Coastal Plain Physiographic Area (USFWS 1995). Agency personnel and private landowners within each of these areas are working to establish specific population and habitat goals to achieve long-term viable red-cockaded woodpecker populations. Personnel and private landowners in most if not all of these areas are also dedicated to restoring longleaf pine ecosystem functions and values that should stabilize entire longleaf pine dependent plant and animal species. The red-cockaded woodpecker recovery areas are (1) Apalachicola National Forest, (2) Conecuh National Forest, (3) DeSoto National Forest, (4) Bienville National Forest, (5) Noxubee National Wildlife Refuge, and (6) Homochitto National Forest.

Other properties or cooperatives within the East Gulf Coastal Plain with substantial existing or proposed longleaf pine acreage include (1) University of Mississippi Lands in Stone Co., Mississippi. Managers of this property should be encouraged, through policy and/or incentives, to restore longleaf pine communities to the maximum extent possible, if they have not already.

Habitat objectives

Current management efforts of longleaf pine habitats in the East Gulf Coastal Plain should continue or increase emphasis on late successional stands, especially on public lands, and increase disturbance (*e.g.*, growing season fire) regimes to increase ground cover/understory habitat quality. On both public and private lands, use policy and incentives to double the number of longleaf pine acres by the year 2025 in longleaf, while encouraging appropriate management as much as possible to include not only red-cockaded woodpeckers, where appropriate, but also for Bachman's and Henslow's sparrows, southeastern American kestrel, brown-headed nuthatches and the other species and species groups described above.

The total number of longleaf pine acres is approximately 1.1 million ha (2,750,000 acres) within the East Gulf Coastal Plain. A goal of 2.5 million ha (6,250,000 acres) of at least 5-year old stands by

year 2025, therefore serves as an initial target to divide among states in the East Gulf Coastal Plain. Assuming a simple doubling of existing acreage may suffice as an initial set of state restoration objectives. The feasibility of converting or restoring longleaf pine during the next 25 or more years in the panhandle of Florida, in Alabama, and in Mississippi should be determined and adjusted as appropriate. It is assumed here that most or all acreage 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 269,600 ha (674,000 acres) of longleaf forest is in good condition rangewide. Currently, about 1.1 million ha (2,750,000 acres of functioning longleaf pine ecosystems are spread across this physiographic area. The goal should be to have all the area of longleaf pine habitat on public lands meeting Frosts's definition of good condition by year 2025, with some as yet undetermined additional hectares improved to good condition on private lands (both corporate/industrial and non-industrial) by year 2025.

Conservation opportunities

Cooperating private landowners and the quail plantations of the panhandle of Florida, 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 what in most instances are perceived and not 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 which 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).

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.

Dunning and Watts (1990) observed that drumchopping as part of site-preparation after clear cutting greatly reduced site quality for Bachman's sparrows as little deadwood projecting above the surface was available for song perches. They recommend burning as a better method for site preparation prior to planting as most consistent with the habitat requirements of Bachman's sparrows. They also observed that 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 "old-growth" 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 and overmature pine stands, and less drastic site preparation should support the largest and healthiest sparrow populations.

Caution is warranted 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 than red-cockaded woodpeckers to the majority of species strongly associated with longleaf pine ecosystems by being associated 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, the method by which 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.

In those areas where long-term goals are for ecosystem restoration, the above practices do not lead efficiently to a grassy dominated ground cover required by Bachman's sparrwo and other species (Plentovich, Holler, Hill, and Tucker, Jr. personal communication). In other areas where few mature and overmature 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 preferable from an ecosystem perspective for managing longleaf pine communities, ground and shrub-scrub nesting birds may suffer direct 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. 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 the quail plantations of the Redhills of southwestern Georgia and adjacent Florida involves management specifically for northern bobwhite with 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 personal communication), 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). 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.

Although considered a short-term fix to a long-term problem, the use of kestrel nest boxes has lead to increased nesting of the Southeastern subspecies in Florida (Loftin, R. W. unpublished data, reported in Collopy 1996), South Carolina (along the Fall-line in sandhills; Cely and Sorrow 1988), and Georgia (most use along the Fall-line, Fort Gordon; Breen 1995).

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. Reasons for growing longleaf include it being widely:

> "recognized as a high-quality timber tree providing a wide range of products: logs, poles, pilings, posts, peelers for plywood, and pulpwood . . . produces more dry weight per unit volume [of any southern pine] . . . 30 to 80% of the trees in a longleaf stand will make poles, which are more

valuable than sawlogs . . . once established, [it] is a low-risk species to manage. It is resistant to fire and the more serious diseases and insect pests that afflict other southern pines . . . more resistant than slash pine to breakage from ice storms . . . develops a massive taproot . . . helping reduce the risk of windthrow . . . suited to wide range of management goals and silvicultural methods . . . include even-aged, two-aged, and, on many sites, a range of all-aged management methods . . . uneven-aged stands can be regularly burned at 2- to 4-year intervals to control hardwoods and brush or prepare a seedbed without the need for any special measures to protect regeneration . . . the species grows as well as, or better than, the other southern pines once it has emerged from the grass stage . . . produce poles and logs in 40 to 50-year rotations".

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 thinnings 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 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 (see below), 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".

Evaluation of assumptions

Assumptions

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 for seeably 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,

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

(4) Pine-fire research is underway through most southern universities, several non-governmental organizations, governmental agencies, military installations, and national wildlife refuges. Very important in these efforts, especially for the East Gulf Coastal Plain, is understanding the conditions and requirements under which wiregrass and other herbaceous plants best reproduce and spread within longleaf ecosystems.

(5) Additional 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.

Maritime Communities: Maritime Forest, Beaches and Dunes, Emergent Wetlands (includes scrub-shrub, tidal wetlands, open gulf waters)

Maritime Forest

Ecology and status:

Southeastern maritime communities can be divided into discrete conservation planning units (modified from Slater and Odum 1993, Gosselink et al., 1979, Sandifer et al., 1980) including the Central Gulf Barrier Islands and Coastline (Horseshoe Point, Florida to Cat Island, Mississippi. Historical maritime communities, comprising about 640,000 ha (1,600,00 acres) in the Southeast, have undergone dramatic changes since European/African colonization. Maritime communities are driven by natural disturbances including periodic catastrophic storms (*e.g.*, hurricanes) and dominant plants are variously tolerant of salt-spray, drought conditions, and warm-season fire. Today, natural succession and recovery processes are forever interrupted by widespread human alterations occurring in all maritime communities within all conservation planning units identified in this report. The extent and the rate of recovery for maritime communities from natural disturbances is of course dependent upon the human history (both Native and European/African) in the area, the effects of often distant dredge and fill operations on beach and dune erosion and accretion rates, and continuing direct pressures to develop upon or manipulate these communities.

Maritime communities are interconnected complexes of dunes and beaches, scrub-shrub, woodlands, estuaries, and open ocean. Along the coastal areas of the East Gulf Coastal Plain, as of the late 1970's, less than 10% of maritime land cover was in forest, about 15% in beaches in dunes, about 54% in wetlands, 1% was in rangeland, less than 1% in agriculture, and about 10% in urban or beach

resort (Slater and Odum 1993). Each maritime community provides habitats for different subsets of vulnerable species.

Maritime forests usually form on the leeward side of shrub-scrub thickets or on the bay side of islands. These habitats are relatively tolerant of salt spray, bright sunshine, wind shear, droughty conditions, periodic catastrophic storms (e.g. hurricanes) and nutrient poor soils. Dominant species include oaks, pines, red bay, and numerous understory species and can be referred to as coastal hammocks or part of southern mixed hardwood forest types (Platt and Schwartz 1990, Ware et al. 1993). The presence or dominance of laurel oak, as well as loblolly or slash pine is indicative of younger succession stands. Successional scrub-shrub habitats are usually dominated by saw palmetto, yaupon holly, and wax myrtle.

Development along coastal areas is accelerating, often at the expense of upland maritime woodlands, dunes, and beaches (Culliton et al. 1990, Moore et al. 1993). Estimates are for a population increase of 60% in coastal zones of the United States by the year 2010 and in the southeast, the northern Gulf coast is expected to follow this trend (Cullitan et al. 1990). The rate of development is so great that the development of coastal zones has been identified as a conservation problem for migratory birds using the northern coast of the Gulf of Mexico (Moore et al. 1990). Thus, possibly the most important migratory stopover areas of the Nearctic-Neotropical migration system in the southeastern United States appear in critical need of protection (Ford et al. 1997).

Maritime forest and associated scrub-shrub habitats provide resting and refueling sites for neotropical migratory landbirds moving to and from their Caribbean and Latin American wintering grounds (e.g., Moore et al 1990, Moore and Woodrey 1993, Woodrey and Moore 1997). However, predicting which specific areas are important at any one time has proven difficult, due to many factors (such as weather) which are also unpredictable (Moore et al 1995). Thus, conservation of these communities and the migrants dependent upon them must be measured in terms of at least decades and with all forest patches as potentially important until techniques (such as radar) provide better resolution of consistent concentration sites.

Among transient neotropical migrants, spring migration extends from late March to late May with each species having its own seasonal pattern. Neotropical migrants breeding in coastal plain habitats (mostly forested wetland species) arrive first, followed by species breeding farther north. Autumn

migration occurs from August through October, again with each species having distinctive seasonal patterns. The inherent importance of maritime woodlands to neotropical migrants *en route* along the Gulf coast is in some ways very obvious and in other ways not so obvious. Autumn migrants, as they funnel southward, often find their way to coastal woodlands immediately along the northern coast of the Gulf of Mexico. Unlike areas along the Atlantic Coast, where maritime forests are oriented north-to-south, most maritime woodlands in the East Gulf Coastal Plain are mostly oriented east-to-west from Florida to Texas. Although some species stopover in maritime woodlands during autumn along the Gulf coastline in preparation for a trans-Gulf flight (e.g., Woodrey and Moore 1997), other species such as gray catbird (Eddins and Rogers 1992) clearly orient either towards the Peninsular Florida Gulf coast (and the West Indies) or towards the Texas coast (and Mexico).

It is during spring that the Gulf coast is clearly of great importance to neotropical migrants, but migrating flocks by-pass maritime woodlands on many fair-weather days (especially with southerly winds) for the more extensive forests (preference for bottomlands) 35-50 miles inland (Moore unpublished data). However, during stormy spring weather (accompanying a weather front pushed along by strong northerly winds), Gulf coast maritime woodlands become critically important as the first suitable habitat available for recuperating (through resting and foraging) exhausted trans-Gulf migrants (Moore and Kerlinger 1987).

Priority species, species suites, and habitat requirements:

Few studies of migrant-habitat relationships have been conducted in the East Gulf Coastal Plain. However, data are available for spring migration on barrier islands off the coast of Mississippi (Moore et al. 1990) and for Ft. Morgan Peninsula (Moore and Woodrey 1993). Through these studies, coastal habitats have been catagorize into four major habitat types: marsh-meadow, scrub-shrub, pine forest, and deciduous forest. Results of several studies indicate that all these habitat types are important for at some species of migratory birds. Thus, the development of species suites or the use of the umbrella species concept provides little utility here.

In addition to census work, Dr. Moore and his graduate students have mist-netted migrants at a variety of sites along the northern Gulf Coast. Some of the more common species captured during the spring include Swainson's thrush, red-eyed vireo, ovenbird, Kentucky warbler, hooded warbler,

summer tanager, and indigo bunting (Moore and Kerlinger 1987, Kuenzi et al. 1991). Species commonly captured in the autumn include blue-gray gnatcatcher, gray catbird, Swainson's Thrush, red-eyed vireo, magnolia warbler, prairie warbler, palm warbler, American redstart, and indigo bunting (Woodrey and Moore 1997). Several species, including chuck-will's-widow, prairie warbler and palm warbler are considered high priority in maritime forest habitats (Table 2). The obvious focus of much of this research has been the use of coastal stopover sites during migration because this is where one might expect natural selection to be operating most strongly. However, as noted previously, birds will over-fly coastal habitats, making landfall in inland habitats. Little data concerning habitat associations at inland sites are available from any location throughout the Southeast U.S., let alone the East Gulf Coastal Plain.

In spite of the difficulties with determining habitat requirements for migratory birds, at least one species, the painted bunting, may be a fairly common breeding bird in maritime forests. Along the central Gulf coast, maritime forest and shrub-scrub may be important for supporting population centers for breeding painted buntings, similar to populations along the south Atlantic coast (Toups and Jackson 1987, Thompson 1991, Woodrey unpublished data). In addition, the taller trees, or groups of trees, may serve as important roost sites for long-legged colonial wading birds (including Federally endangered wood stork) and for Federally threatened bald eagles. Maritime shrub-scrub on protected small islands also may serve as nest sites for brown pelicans and some long-legged colonial wading birds.

Population and habitat objectives

Population objectives

Any attempt to set population objectives for transients along coastal regions of the East Gulf Coastal Plain at this time would be purely speculative. The difficulty in setting objectives arises from the inherent variation in numbers of individuals and species using particular sites from year to year (Moore et al. 1995). Thus, suitable migratory stopover sites must be protected across the breadth of known migratory pathways. Further, maintaining or creating a matrix of smaller and more widely distributed habitats may be a more effective management strategy for migratory landbirds than were areas of larger habitat patches(Moore et al. 1995). Until broad-scale monitoring programs such as the Migration

Monitoring Program (managed by the Gulf Coast Bird Observatory) have been implemented and conducted for several years, no attempt should be made to determine population objectives. Other methods which may contribute useful information to setting habitat objectives include weather surveillance radar and long-term banding studies at sites scattered throughout the East Gulf Coastal Plain.

Habitat objectives

The current goal for this habitat should be to maintain and protect existing high quality habitat (largely forested context, 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 encourage adequate cover and food (especially with native fleshy-fruit bearing plants), and water in landscaping plans should be featured. Further, increased integration of bird habitats into new coastal development plans and use of opportunities to integrate habitat patches of maritime forest into parks and into existing developments should be pursued.

Implementation recommendations and opportunities:

When both Gulf and South Atlantic coasts are considered together, almost all eastern neotropical migrants (and many species breeding north and west to Alaska) must pass through the Southeast at least once annually, their survival most often depending upon a healthy distribution of maritime or other near-coastal woodlands (Moore et al. 1993). A management and habitat restoration strategy for neotropical migrants using coastal areas must also consider the extent and condition of both maritime woodlands and inland forests (again, 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.). Highlights for action involving transient issues are provided here along with general strategies for addressing island-by-island issues for the maritime ecosystem as a whole.

Some management decisions favor active burning programs while others favor fire suppression, again based on the prevailing values expressed by the landowners or the public. Accretion and erosion of some beaches are allowed to "naturally" occur, while other beaches are actively "nourished." Some beaches are managed to minimize disturbance from humans, so that nesting birds and sea turtles can be more successful, while other communities maximize opportunities for beach access and use by people. Some maritime woodlands and dune areas are actively grazed by domestic stock with the intent of mimicking disturbance regimes, while other sites are managed by fire to accomplish the same goal. Some Sea Islands maintain active timber production (mostly pine), while other islands have very limited or no timber cutting activity. Each of these options have different effects upon different fauna and flora, with the ultimate and large-scale effects depending on which fauna and flora and other ecosystem values are most important for influencing the desires of the public or the actions of managers and private landowners at each location. Inadvertent results of independent management decisions may be avoided by a broader view of major management issues.

A more regional view of what is needed to maintain vulnerable species would be likely to help guide local public management decisions and provide specific goals upon which private-public sector partnerships may be formed to manage maritime communities. The Sea Islands of Georgia and South Carolina provide an excellent example of a collaborative conservation effort between a number of private and public lands operating under differing management philosophies. A cohesive and cooperative assessment of management techniques and monitoring the responses of dependent fauna and flora may provide important insight into the best approaches for each desired maritime natural resource element and may help identify the best means of mixing these approaches within the Sea Island conservation planning unit.

Perhaps a healthy balance among the Sea Islands presently exists and there is little need for adjustment, or perhaps certain natural resource elements are in steep decline and none of the management strategies adequately address the problem(s). In the latter case, the Sea Island managers who can be the most flexible may be able to make adjustments to better secure the natural resource(s) in question while all islands continue monitoring to make sure other important natural resources are not irreversibly harmed as a result. This process in essence (1) brings a group of experienced managers and landowners together, (2) assesses the health of the natural resources of common interest regionally

(not one island at a time as is done now), (3) identifies the natural resources most at risk, and (4) leads to a definition of roles and responsibilities based on opportunities consistent with the differing management philosophies of each manager and landowner. The strengths of these considerations can lead to many conservation opportunities working with private landowners and local communities.

As a final example, strategies for restoring maritime woodlands to benefit neotropical migrants should include not only rural, but also residential areas. For effective restoration, whether it be a live oak woodland or a backyard habitat for migrants, the list of plants should include native fruit-bearing shrubs, vines, and trees. Many fruiting plants are becoming increasingly known as important food sources for nongame birds, especially neotropical migrants as they make their incredible hemispheric trek. Currently, a handbook and database titled "Southeastern Fleshy Fruits Eaten by Neotropical Landbird Migrants" is being compiled by Lorie Yates and Frank Moore with the Migratory Bird Group at the University of Southern Mississippi.

Evaluation of assumptions:

Microhabitat needs for each species as they migrate through the East Gulf Coastal Plain are not well understood, but research is underway to provide better management guidance in the future (*e.g.*, Moore et al. 1990, Moore and Woodrey 1993, Woodrey and Moore in preparation). Mixing the results of this research on migrating landbirds, along with the needs of nesting bird species (*e.g.*, eastern painted bunting) and other high priority species (*e.g.*, Federally endangered wood stork and Federally threatened bald eagle) should provide many opportunities for partnerships all along the northern Gulf coast. Differing management philosophies found among landowners and public land managers in this extensive area provide opportunities to test and define best management strategies for supporting such a large number of species.

Research on habitat selection, reproductive success, and taxonomy of eastern painted bunting is critical for better understanding how to maintain presently healthy populations or improve the status of less secure populations of this species. The painted bunting also makes for an excellent species to tailor public outreach and citizen science efforts around. Jim Cox and colleagues at the Florida Game and Freshwater Fish Commission launched Project Bunting Watch (tailored after Cornell's Project Feeder Watch) in 1996, soliciting observations of buntings and cowbirds from feeder watchers. Similar efforts

in Georgia and South Carolina have been initiated as well. Although interest and research has recently increased, more effort should be focused on the following migration research needs: (1) navigation strategies (diurnal versus nocturnal migration, circum versus trans-Gulf migration, (2) physiological requirements (*e.g.*, nutritional/foraging strategies [building adequate fat levels, avoiding dehydration]), defining important stopover areas (both ecologically [*e.g.*, preferred/optimal versus suitable and marginal habitat] and geographically [*e.g.*, concentration sites]) based on absolute numbers and the condition of birds, (3) defining contaminant issues and how contaminants may result in vagrancy, physiological stresses, etc., (4) defining local foraging requirements (such as the extent of frugivory in both fall and spring) that could lead to better local management, (5) does species abundance, species composition, and number of individuals vary with forest patch size?, (6) does species abundance, species composition, and/or number of individuals vary with distance from a major corridor (*e.g.*, Mississippi River)?, (6) what landscape features (*e.g.*, habitat matrix, interior/edge relations, % cover of different land cover types, number of patches) within a specific diameter (*e.g.*, 10-12 km) affect species abundance, species composition, and/or number of individuals?, and (7) define "Coastal Hiatus" along Gulf Coast both geographically and in terms of management implications.

Beaches and Dunes

Beaches and dune habitats are important elements in maritime communities. Beaches, dunes, and overwash areas provide important foraging habitat for migratory and wintering shorebirds, resident colonial nesting water birds, and migratory raptors. Beaches above high tide line and dunes provide nesting habitat specifically for several high priority shorebirds. Beaches, overwash, and dunes are also important throughout the region for recovering a number of Federally listed plants and animals, including seabeach amaranth (*Amaranthus pumilus*), nesting sea turtles, and oldfield (beach) mice (*Peromyscus polionotus* subspp.). The popularity of beaches, particularly during the summer, has resulted in numerous conflicts between beach nesting species and humans. Human communities interested in natural resources and dependent economically on tourism are in the middle of these conflicts, involving both public and private beaches.

Development along coastal areas is accelerating, often at the expense of upland maritime woodlands, dunes, and beaches. As of the mid-1970's, less than 15% of the original dune and beach

habitat is still in existence (Salter and Odum 1993). Although loss of coastal wetlands has slowed under regulatory protection since the 1970's, development in coastal uplands ultimately results in continuing reduction of at least coastal wetland environmental quality. Development is most obvious along the Florida Atlantic Barrier Islands (over 50% of present land use) and the Eastern Gulf Coast barrier islands (Slater and Odum 1993).

Priority species, species suites, and habitat requirements:

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. Two species of high priority plovers are found along the beaches of this physiographic area. Federally threatened piping plovers (*Charadrius melodus*) are winter residents along coastal areas of the East Gulf Coastal Plain. About 100-150 birds winter within this physiographic area, 2-3 percent of all birds counted during international winter surveys (Nicholls and Baldassarre 1990, Haig and Plissner 1993). Numbers of piping plovers counted during the 1991 International Piping Plover Census indicates that groups ranging in size from 1 to 50 individuals are typically found in appropriate habitat along the Gulf coast (Haig and Plissner 1993). The majority of wintering plovers observed along the Gulf coast during the census were found on ocean beaches, with fewer individuals using sand flats in protected bays. The origins of piping plovers found along the northern Gulf coast includes individuals from Northern Great Plains and Great Lakes populations (Haig and Oring 1988).

Cuban (southeastern) snowy plovers occur only along the Gulf Coast and Playa Lakes region (southern Great Plains) and on a few Caribbean islands (Puerto Rico, Hispaniola, Cuba). Of an estimated 300 breeding snowy plover pairs along the Gulf Coast (about 170 pairs along the Florida panhandle), about 100 snowy plover pairs regularly occur within this physiographic area (Simons and Woodrey unpublished data). Within this physiographic area snowy plovers are restricted as a resident species along the coastline beaches and barrier islands of the Gulf coast.

Although all colonially nesting larids are of conservation interest, along the Northern Gulf Coast (with the exception of laughing gulls other than it can be a serious egg predator of the other species), least terns and black skimmers are now receiving the most attention. Least terns and black skimmers are now being found nesting on graveled rooftops (as does roseate tern in South Florida) *in lieu* of

beaches. This shift appears to reflect loss of suitable natural habitat rather than expansion of opportunities *per se* by these species. Other nesting terns are mostly restricted to nesting on small isolated islands where mammalian predators are absent.

Habitat and population objectives:

The goal for this habitat is to ensure all potential habitat is protected either by resource management agencies or through private-public partnerships. In addition, controlling recreational pressure, and in some cases predator pressure from April-October for the benefit of nesting beach birds or resting migratory shorebirds is essential. No population nor habitat objectives for piping plovers wintering along the Gulf coast (U.S. Fish and Wildlife Service 1994). However, the U. S. Fish and Wildlife Service (1994) recognizes that winter habitats are threatened by industrial and urban expansion which could result in the absolute loss of wintering habitat. The quality of wintering sites is an issue - use is threatened by increased human use of beaches along the northern Gulf coast.

Implementation recommendations and opportunities:

Recreation is a serious problem on public lands where beach nesting birds are repeatedly disturbed. However, other serious problems exist such as high levels of predation (both natural and human induced) and inclement weather which can severely set back very small breeding populations. With most nesting pairs of piping plovers occurring on National Park Service and U.S. Fish and Wildlife Service lands and with most Snowy Plovers nesting also on Florida State Park and Federal lands, it is incumbent upon these natural resource agencies to do the best they can to minimize conflicts between nesting birds and recreationists. In some areas, where recreation is already minimal, predators are the most serious problem leading perhaps to managers implementing some sort of localized predator control.

When beach nourishment is called for by local communities, consideration of beach nesting animals can be accommodated by conducting the work during the winter (specific guidelines exist for sea turtles and piping plover and these along with considerations for other listed species, are usually available from local Fish and Wildlife Service and State wildlife agency offices). In addition, some beach-nesting birds

are now found using artificial structures (gravel roofs) allowing for private-public partnerships in such situations.

Evaluation of assumptions:

Although systematic surveys are being conducted regularly (e.g., International Piping Plover Census), a better understanding of the annual fluctuations of populations and habitat requirements of high priority species such as piping plover and snowy plover is essential to the conservation of these species. Thus, research efforts in this habitat should focus on (1) determination of the importance of beach habitats to transient red knots in the East Gulf Coastal Plain, (2) conducting annual surveys for nesting snowy plovers, determine the habitat requirements of wintering piping and snowy plovers, (3) conduct more detailed studies of the breeding ecology of snowy plovers, and (4) determine the extent to which piping and snowy plovers use private lands versus state or federally protected lands.

Emergent wetlands

Ecology and status:

As with the previous section concerning specific habitats within maritime communities, emergent estuarine wetlands are an essential element of the ecosystem. Bordering maritime woodlands in many areas, estuaries, including tidal flats and emergent wetlands, function to separate islands from each other and in many cases islands from mainland. The importance of these communities to aquatic animals (including the production of commercially important fisheries) and as environmental filters is widely documented. These 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 including rails, bitterns, wrens and sparrows.

As mentioned previously, development along coastal areas has recently accelerated (Culliton et al. 1990). However, as of the mid-1970's, about 54% of maritime communities in the East Gulf Coastal Plain remains in wetlands (Slater and Odum 1993). Although loss of coastal wetlands has slowed under regulatory protection since the 1970's, development in coastal uplands ultimately results in continuing reduction of at least coastal wetland environmental quality.

Priority species, species suites, and habitat requirements:

The Nelson's sharp-tailed sparrow and the salt marsh sharp-tailed sparrow, created by the recent taxonomic decision to split the sharp-tailed sparrow complex into two species (Greenlaw 1993, AOU 1995), are the two highest priority species found in estuarine emergent wetlands in the East Gulf Coastal Plain. Both species are winter residents in this physiographic area with Nelson's sharp-tailed sparrows apparently being much more common than salt marsh sharp-tailed sparrows (Imhof 1976, Greenlaw and Rising 1994, Woodrey unpublished data). However, it should be pointed out here that little work has been done to determine the occurrence and abundance of these species along the northern Gulf coast.

The seaside sparrow is a permanent resident of the East Gulf Coastal Plain (Imhof 1976, Toups and Jackson 1987). 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).

A better understanding of the distribution and abundance of black and yellow rails (as well as king, clapper, and other rails) is clearly needed. Black rails have a complicated distribution, in part due to its cryptic nature, but the East Gulf Coastal Plain is probably an important physiographic area overall for this species. Resident populations are suspected from Alabama (Imhof 1976) but unknown from other sites within this physiographic area. This species may also be resident in appropriate habitat along the panhandle region of Florida as well, but wintering populations from either the midwest or from the Atlantic seaboard are thought to move into these areas as well as where resident populations already exist. Yellow rails presumably winter throughout the physiographic area, which probably supports a large proportion of wintering individuals within the Southeast. However, yellow rails are even more secretive than black rails and the true occurrence and distribution are unknown.

Although at least yellow rails also occur in freshwater marshes, rails are perhaps most numerous within brackish and tidal wetlands. Black rail surveys in South Carolina and Florida indicate an affinity for thick patches of black needlerush *(Juncus roemerianus*) stands in unmanaged tidal marsh, while in managed tidal marsh this species was associated with infrequently flooded "high" marsh with predominately clumps of shorter cordgrass (*Spartina patens*, *S. spatinea*, and *S. bakeri*), saltmarsh bulrush (*Scirpus robustus*), glassworts (*Salicornia virginica, S. bigelowii*), and salt grass (*Distichlis*

spicata), with water levels rarely exceeding a few inches (Cely et al. 1990, W.R. Eddleman unpubl. data reported in D. E. Runde and N. Wamer, 1996, pp. 323-328 in Rodgers, Kale and Smith).

The description of black rail habitat is similar to that for seaside sparrows, at least with the now extinct dusky seaside sparrow in central Florida and within the Big Bend region of Florida within this physiographic area. Seaside sparrows along the northern Gulf coast are most closely associated with the extensive tidal marshes occurring behind barrier and sea islands (Imhof 1976, Woodrey unpublished data). Both black rails and seaside sparrows are apparently tolerant of early invasion of shrubs (including *Baccharis sp*., as well as mangroves further south in Peninsular Florida), but abandon marshes as these shrubs become dominant (Kale 1996). Prudent use of fire (e.g., 2-3 year burn cycles) should retard shrub invasion, but care needs to be employed to not disrupt nesting birds.

Population trends for black rails are unknown, as they are for most rail species, other than the suspected decline of king rails mentioned earlier. Population trends for both sharp-tailed sparrows are unknown and even though there has been little net change in the amount of estuarine emergent wetlands since the mid-1970's, the restricted distributions of these species, as well as seaside sparrows, along with their micro-habitat requirements suggest that monitoring these species at least every 10 years would be most prudent.

Eddleman et al. (1988) outline conservation strategies for rails in North America and in the case of the East Gulf Coastal Plain the higher priority black and yellow rails may require a management and maintenance (with monitoring) strategy at this time. Meanwhile, the more widespread but apparently declining king rail may require a higher level attention to determine reasons for decline and corrective management measures as necessary.

Habitat and population objectives:

Few recommendations can be made regarding population and habitat objectives for estuarine emergent wetlands, given the lack of information regarding the distribution and abundance of many of the high priority species which use this habitat in the East Gulf Coastal Plain. However, the goal for this habitat should be to ensure all potential habitat is protected either by resource management agencies or through private-public partnerships; effects of management (e.g., burning, ditching, etc.) need to be determined especially for sparrows and rails.

Implementation recommendations and opportunities:

Although not among the top physiographic areas in terms of total acreage of estuarine emergent wetlands, states in the East Gulf Coastal Plain do contain a fair amount of acreage in this habitat type. Most importantly, however, there was no net loss of estuarine emergent wetlands within this physiographic area between the mid-1970's and mid-1980's (Hefner et al. 1994).

Water quality and contaminant issues may still influence the quality of habitat for high priority bird species. Point source pollution such as oil spills and other spills (like near Brunswick, Georgia, and hog farm excrement overflow in North Carolina) are testaments to declining quality. Increasing development along coastlines leads to increased non-point source pollution as well. Frequent burning (e.g., on a yearly basis) would undoubtedly reduce habitat quality for a number of priority species. Similarly ditching (for mosquito control) must take into account potentially negative effects on high priority rails and sparrows, but limited ditching within extensive marsh systems may have little ultimate impact. Management strategies on Federal and State public lands must keep the needs of the above species in mind as decisions are made on burning regimes and open marsh water management practices.

Management tools for enhancing open water foraging habitat for many species may include open marsh water management and pothole blasting (Hardin 1987, Martin and Marcy 1989, Meredith and Saveikis 1987, Wilson et al. 1987). Open water is encouraged when deemed appropriate to not only provide foraging habitat but to also retard eventual encroachment of some emergent wetlands by more terrestrial vegetation. There are limits, however, on how much open water can occur before adversely affecting some marsh species, especially rails, not dependent on open water. Determining when these limits are exceeded is still a debated subject.

Fire management in marshes is often important for retarding shrub-scrub encroachment, reducing overall vegetation cover, and increasing diversity of emergent vegetation. Opening marshes in this way is 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 if possible 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. Actions involving estuarine wetlands do come under Federal and State regulation, but proactive restoration of estuarine habitats using incentives would be useful for encouraging additional habitat on private lands outright or for adding to adjacent mitigation lands.

Evaluation of assumptions:

Given the lack of knowledge regarding the distribution and abundance of many of the high priority species, systematic surveys and special monitoring techniques need to be employed to better determine the status and population trends of king, yellow, and black rails, and seaside, salt marsh sharp-tailed, and Nelson's sharp-tailed sparrows using estuarine emergent wetlands throughout this physiographic area.

The effects of management, particularly fire, need to be determined. Specifically, when and under what conditions prescribed fire can provide the maximum benefit and least harm to all bird communities dependent upon estuarine habitats. Frost (1995) provides information helpful for understanding plant species composition in marshes in association with salinity and fire frequency.

Further studies addressing contaminant effects on bird species dependent upon estuarine emergent wetlands continue to be needed and corrective measures employed where deemed necessary. In addition, taxonomic clarification of the seaside sparrow complex needs to be pursued to best determine conservation priorities of each of the extant populations. Similar taxonomic investigations of black rail populations also may be instructive.

Upland Hardwoods: Oak-hickory: includes Loess Bluffs, Tennessee Plateau, Mixed Pine-Hardwood

Ecology and status:

including oak-pine forests, constitute nearly 20% of total land use/land cover in the East Gulf Coastal Plain. Approximately 1,410,045 ha (3,525,112 acres) were classified as oak-hickory forest, and an additional 2,861,002 ha (7,152,505 acres) were classified as oak-pine

The largest concentrations of oak-hickory forest are in the upper unit (the Tennessee Plateau near the Tennessee River), the middle unit east of the Black Belt, and portions of the Mississippi River bluffs in the lower unit. Using the GIS clumping procedure, over 6,000 sites are fairly discrete clumps under 4000 ha, 14 concentrations are between 4000 and 8000 ha, 9 concentrations are between 8000 and 40000 ha (20,000 and 100,000 acres) and only 1 concentration is greater than 40,000 ha (100,000 acres; Figure _____). Relatively, a very small amount occurs on federally managed public lands.

Oak-pine forests are most common slightly further south and occur commonly throughout the middle unit, except in the Black Belt. This is the third most common land use/land cover type in the area at %11.67.

Using the GIS clumping procedure, over 8,000 sites are fairly discrete clumps under 4000 ha (10,000 acres), 35 concentrations are between 4000 and 8000 ha (10,000 and 20,000 acres), 32 concentrations are between 8000 and 40000 ha (20,000 and 100,000 acres), and 4 concentrations greater than 40000 ha (100,000 acres; Figure _____). Relatively, only a small amount occurs on federally managed public lands.

Historically, Tennessee Plateau : an 1820 survey indicated that 72% of trees mentioned were oak-hickory, leading oaks were post, blackjack, white and red; the overall mosaic was barrens, post oak-blackjack oak savannas, white oak uplands, elm-ash-maple, cypress swamps (in Bryant and Martin 1988, Martin et al, biodiversity)

Loess bluff is continuous forest for the most part, although areas where kudzu has taken over and killed trees, etc., also very narrow. Loess bluffs: southern end, magnolia-holly-beech association, other areas, characteristic were white oak, sugar maple, beech, black cherry, tulip tree; at the northern end the west Kentucky bluffs were called the "cane hills", one of the heaviest and most varied of original forest growth????great variety of oak, as well as hickory, walnut, tulip, basswood, elm, beech, pawpaw, always a dense undergrowth of cane, is cane almost all gone? Why? Loess forests were a mixture of mixed mesophytic from the north, bottomland hardwoods to west and southern mixed forest to south and east (Caplenor).

No outstanding examples are known for upland oak-hickory forest. The best examples are actually in urban areas and protected as small parks, e.g. Overton Park Memphis. However, these areas are so small that edge is throughout and vegetative community is threatened by exotics.

What is known about how the system works?

very little, since so little has remained intact – assume that fire played a role here as well for oak regeneration, combined with ice storms, other weather and other factors, which limited pine into Tennessee/Kentucky.

Determination of succession patterns are difficult – too valuable for agriculture to remain fallow for long in Martin

Is habitat fragmentation an issue?

major issue for isolated woodlots and loess bluffs, both generally surrounded by hard edge of agriculture or urban/rural home development

maybe less of an issue further south as pine dominance buffers some hardwood areas

Quality of habitat – status and why?

typically poor quality habitat, searches in west Tennessee/Kentucky for outstanding examples have failed

much grazed or cut over hard (high grading)

remaining previously in row crop agriculture, tremendous soil erosion (Natchez Trace) and only now beginning to recover (thus mixed pine . . . .)

see Tennessee/Mississippi/Alabama forest cover inventory results?

Priority species, species suites, and habitat requirements:

Habitat and population objectives:

Population objectives

Habitat and population objectives

how many areas like Natchez Trace and Chickasaw to expand or create?

In upper coastal plain, can we go with 5 areas about 4,000 ha (10,000 acres) each (4 TN, 1 KY) ? In TN, 2 existing? Check Nathan Bedford Forrest SP, Big Sandy, also, part of MAV plan around Reelfoot calls for ------- acres into bluffs, etc.

What currently exists in Mississippi and Alabama? Can we say 10 total, if so, how many are existing, such as national park battlefield at Vicksburg? Is this applicable in Florida, or is it mostly pine?

- Loess bluff – remain continuous, but see below, need better content management, and buffers? In TN we have used stream side management as minimum, at least 300 feet on either side of bluff? Optimum are corridors that connect these bluffs to nearest river and into coastal plain by 1,000 linear acres?

Implementation recommendations and opportunities:

Quantity and location of habitats

Petit et al. (1995) have proposed a sample management plan for forest-interior migratory birds in fragmented landscapes which emphasizes the maintenance of 100s - 1,000s of ha (250-2500 acres) of late-rotation forest habitat. They suggest creating a core area within a national forest where cutting is restricted (also suggested by Robinson 1993). Restrictions could take the form of designated wilderness areas or a tract in which low-disturbance-intensity harvests, such as single-tree or small group selection, were implemented. Outside the core area, cutting practices would not be so restricted, but might be managed so that the more severe prescriptions were allocated to the periphery of the national forest boundary with the less-intensive harvests occurring nearest the core area. Even-aged silviculture might be practiced only in forests adjoining agricultural or pasture lands. Mature stands should be interconnected with wide forest corridors (at least 100 - 300 m, also suggested by Robinson 1993). Such forest corridors would serve both as travel routes and as habitat for species of concern. Petit et al. (1995) further suggest that partnerships among national forest, timber industry, and other owners of forested lands could ensure that rotation schedules were adjusted to sustain large blocks of interconnected mature forest patches in the matrix of habitats and ownerships within a regional planning unit. Incentive plans might encourage private owners to restore mature forest tracts and to enhance connectivity among other forests in the region.

consolidate as possible, places like Natchez Trace as demonstration,
how many of each of these types of areas?
Tie to increased hunting opportunity purchases
Highly erodible lands, consolidate many landowners with incentive programs, need to say where would have best results for proactive approach to landowners

b. Quality of the habitat - management

hardwood regeneration, review work at Natchez Trace and Chickasaw

what about pine buffers, anything known?

Evaluation of assumptions:

Loblolly Pine-Shortleaf Pine

Ecology and status:

Loblolly-shortleaf pine forests constitute approximately 16% of the land use/land cover in the East Gulf Coastal Plain, and occupies approximately 3,824,989 ha (9,562,472 acres; Table 3, CAST data, University of Arkansas). The vast majority is located in the middle and lower units; the largest concentration is the southwest corner of the area, other concentrations are centered along the south and southwest edge of the Black Belt Prairie region.

Using the GIS clumping procedure, over 9,000 sites are fairly discrete units less than 4000 ha (10,000 acres), 48 concentrations are between 4000 and 8000 ha (10,000 and 20,000 acres), 27 concentrations are between 8000 and 40000 ha (20,000 and 100,000 acres), and 5 are greater than 40,000 ha (100,000 acres; Table 4). The majority of large concentrations occur on federally managed public lands (particularly U.S. Forest Service land). Unfortunately, using GIS, it is impossible to determine which patches are industrial plantation, the age class of each patch, and which patches are forest under more natural conditions.

Much of the coastal plain region once characterized by longleaf pine still has a substantial pine component - much of it now loblolly-shortleaf pine forests. Unfortunately, much of these forests are now actually plantations. In the East Gulf Coastal Plain, at least 5 counties in central Alabama, south Alabama and panhandle Florida have 26 to 50% of the land area in pine plantations whereas about 25 counties are 16 to 25 % pine plantation, mostly in central east Mississippi, south Mississippi, central and south Alabama, and the panhandle region of Florida Boyce and Martin 1993). At the Tennessee-Mississippi border, land once dominated by pine has now been converted mostly to row crop agriculture and pasture (Bob Ford personal communication).

Timber rotations for loblolly-shortleaf pine forests appear to be managed at about 60 to 80 years in the East Gulf Coastal Plain except where non-industrial landowner has let it go unintentionally (Bob Ford personal communication). For more mature stands, an 80 to 120 year rotation seems reasonable; rotation length where red-cockaded woodpeckers are under active management is assumed to be between 80-120 years (depending on site index) for loblolly stands and between 100-200 years (depending on site index) for shortleaf pine (U.S.D.A. Forest Service 1995). Where red-cockaded woodpecker recovery is not an issue, loblolly and shortleaf are assumed to be on at least a 50-year rotation.

Although longleaf pine is ecologically the most important of the southern pines within the coastal plain, today other species have replaced the longleaf as more economically important. The most economically important pines within the East Gulf Coastal Plain today are the faster growing slash and loblolly pines. At the time of European colonization, approximately 14,400,000 ha (36,000,000 acres) of southeastern forests estimated to support longleaf were mixed with other pine and hardwood trees (Frost 1993). Presettlement mixed pine-hardwood forests where longleaf was a relatively minor component (estimated to be on about 7,200,000 ha (18,000,000 acres throughout the Southeast) occurred within the East Gulf Coastal Plain mostly in transitional areas with shortleaf and loblolly pines becoming more dominant in the northern portions of the physiographic area. In the more southern regions of the East Gulf Coastal Plain, slash pine becomes the co-dominant to dominant pine.

Slash pine "naturally" is an important species within flatwoods and savannas of the East Gulf Coastal Plain, usually dominating over longleaf on the moistest of sites, as already discussed above. Of focus in this section, loblolly pine is an excellent natural invader of disturbed sites and today is the most frequent pine found in old fields as succession moves from early-succession to forest. Even in areas where longleaf is still a numerically important species, disturbance during the last two centuries has led to an increase of loblolly pines (*e.g.*, most population and area goals above given for longleaf take into account the prevalence and use in many areas of loblolly, even for red-cockaded woodpecker). Nevertheless, small patches of overmature loblolly pines prior to European settlement may have played important roles for some species (*e.g.*, see treatment of swallow-tailed kite nest site requirements under the Forested Wetlands section above). Unlike loblolly, shortleaf pine is more like longleaf in being very long-lived and better adapted to growing season fires. Shortleaf pine becomes more important in hilly

upland areas, most prevalent within coastal plain sites west of the Mississippi River and into the Ozark-Ouachita Highlands.

Habitat fragmentation may be an issue in southern pine forests but is likely not a serious problem in industrial forest settings. More importantly, consideration must be given to the fact that throughout the East Gulf Coastal Plain, loblolly-shortleaf pine forests provide a forested buffer zone adjacent to forested wetlands. As bird habitats, these forests are probably good for early succession birds up until about 12 years old, then become inhospitable fairly quickly until it reaches a more mature stand (after "short rotation" of 25 years).

Priority species, species suites, and habitat requirements:

Other than pure stands of longleaf pine, mature loblolly and shortleaf pines (often along with longleaf mixed in) provide perhaps the most stable habitat within the East Gulf Coastal Plain for brown-headed nuthatch, Bachman's sparrow, red-cockaded woodpecker, American Kestrel, Chuck-will's-widow, Yellow-billed Cuckoo, Eastern Wood-Pewee, and Summer tanager. The abundance of these species, other than the nuthatch, is dictated by the season and frequency of burning. Red-cockaded woodpeckers also make frequent use of the older loblolly and shortleaf pines, as defined above, for creating cavities.

Regularly burned stands provide the most optimal habitat for all bird species associated with mature pine. Late successional stands are necessary for supporting healthy red-cockaded woodpecker populations. Other details for supporting red-cockaded woodpeckers are outlined in USDA Forest Service (1995), U.S. Fish and Wildlife Service (1985) and the longleaf pine section above. A patch size figure of 50,000 ha (125,000 acres) or more for a viable red-cockaded woodpecker population was established assuming pine regeneration sites within a given patch will be temporarily unavailable to woodpeckers. 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).

Regardless of patch size, but probably not smaller than 2,000 ha (5,000 acres), appropriately-managed pine-dominated ecosystems provide habitat for many vulnerable species. Species that may be found in shrub-scrub, but optimally use grassy dominated ground layer, include northern bobwhites,

Bachman's sparrows, and field sparrows (at least during winter). 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.

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). Prairie warblers throughout most of their breeding distribution today are 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. However, 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).

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 neotropical migrants. 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 depend on this management. Unlike longleaf dominated stands, use of fire to control understory vegetation may require greater use of dormant season burning, which is less likely to kill loblolly and shortleaf pine seedlings. Predominate use of dormant season burning within the coastal plain is less likely to support the more grassy-oriented species, but 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 and overmature 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, but few high priority species would clearly benefit from a proliferation of this forest type within the East Gulf Coastal Plain. Occasional stands within a larger mature pine dominated landscape where fire is infrequent may provide for locally interesting combinations of bird species, but this type of

management within pine forest ecosystems (regardless of species) should not be widely encouraged as sound bird management for priority species.

Habitat and population objectives:

Population objectives

Loblolly-shortleaf pine forest habitats can temporarily replace loss of other early succession habitats, and can be managed as such. However, population and habitat objectives for these early successional habitats are addressed later in this plan (see Early succession: Scrub-shrub/Old field, Early succession: Short-rotation Pine sections). For further discussion of population objectives, particularly for red-cockaded woodpecker, please see the Longleaf Pine-Slash Pine section.

Habitat objectives

The habitat management goal for loblolly-shortleaf pine habitat is to continue or increase emphasis on late successional stands, especially on public lands, lower initial stocking rates on private lands managed for sawtimber, and increase disturbance (*e.g.*, judicious use of fire, herbicides) regimes to increase ground cover/understory habitat quality. Also, as mentioned previously, habitat patch sizes of 50,000 ha (125,000 acres) or more need to be maintained for viable populations of red-cockaded woodpecker. Smaller pine-dominated forests under public or cooperating private land management also support important woodpecker populations and should be maintained as the species is recovered. A minimum patch size of 2,000 ha (5,000 acres) of appropriately-managed pine-dominated should be conserved as these areas provide habitat for many vulnerable species.

Implementation recommendations and opportunities

The conservation opportunities for the maintenance and restoration of loblolly-shortleaf pine habitat are assumed to be the same as described for longleaf pine-slash pine habitats, recognizing the differences in the fire management and timber harvest rotations.

Evaluation of assumptions

In addition to the research actions outlined for longleaf pine-slash pine habitats (especially the demographic and ideal patch size thresholds), the following research questions should be addressed: (1) How much of a pine plantation (in terms of %) constitutes a fragmentation problem for upland hardwood nesting birds?; (2) what are the levels of productivity for birds in a hardwood understory of pines?; and (3) Are birds as productive in temporary early succession habitats as they are in longer term early succession habitats.

Early succession: Scrub-shrub/Old field

Ecology and status:

Historically, the most stable shrub-scrub habitats were those subjected to reasonably predictable large-scale disturbance regimes such as fire-prone vegetation under mature southern pine forests (including longleaf pine-southern scrub oak [*Quercus* sp.], wiregrass [*Aristida stricta*], bluestem [*Andropogon* sp.], saw palmetto [*Serenoa repens*], cutthroat grass [*Panicum abscissum*], ferns (*Woodwardia virginica*, *Osmunda cinnamomea*], and gallberry [*Ilex glabra*]), pitcher plant (*Sarracenia* sp.] bogs, remnant cedar glades and the highly endangered xeric scrublands of coastal Florida, harboring many threatened and endangered plant and animal species.

Early-successional shrub-scrub habitats originate and are maintained by natural disturbance phenomena including grazing hoofed animals, tornados, hurricanes, ice storms, and most notably fire. These disturbances are also important for maintaining native grasslands, with shrub-scrub developing and influencing the next disturbance cycle. However, elimination of migrating bison and elk (*Cervus canadensis*) herds soon after European colonization in eastern North America and an emphasis on fire suppression after the 1930s has led to the loss of most native grassland, shrub-scrub habitats, as well as the longleaf pine forests from the Southeast.

During the earlier decades of this century small farms and inefficient farming practices were more common in the Southeast, allowing for a replacement of the more natural shrub-scrub habitats largely lost during this same time period. However, these "old-fields" and shrub-scrub "hedgerow" habitats

are today being quickly lost. Causes of these losses range from land conversion to more efficient "clean" farming with few maintained hedgerows, land conversion to housing subdivisions, or land allowed to succeed towards more mature forest stages. Other structurally similar habitats can be produced through even-aged regeneration of forests. However, clearcuts are by design transitory habitats and do not provide long-term stability for shrub-scrub species in any one tract. 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 those birds dependent on shrub-scrub habitats.

Although poorly known, habitat fragmentation is possibly an issue regarding species found in early successional habitats. For example, prairie warblers are frequently absent from clearcuts <8 ha (20 acres) and appear to increase incrementally with size of cut up to about 40 ha (100 acres). Bachman's sparrows move more frequently between early successional patches when some type of early successional corridor connects the two sites (Dunning et al. 1995).

Priority species, species suites, and habitat requirements:

Bachman's sparrow, Bewick's wren, American kestrel, and prairie warbler are the three high priority species which occur in scrub-shrub and old field habitats in this physiographic area. 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, but, as with grassland birds, most shrub-scrub species are undergoing declines (again, some very steep). Many early successional species rank relatively high among species of conservation concern in the Southeast because of these population declines, but fewer shrub-scrub species are considered highly vulnerable compared with the long-list of highly vulnerable grassland species. Several shrub-scrub species do warrant close management attention, some during both breeding and non-breeding portions of their annual cycle.

Bachman's sparrow appears to successfully use (*i.e.*, with high fecundity) early-successional habitats high in grassy cover produced through clear cutting of both hardwoods and pine, but unless there is a steady supply of these habitats over time local populations will likely disappear within a few

years. Otherwise, Bachman's sparrows are best treated as a Southern Pine species, the section where more detail will be provided for this species, except for specific management recommendations that can be provided for this species within steadily available early-successional habitat, below.

Some high priority shrub-scrub species such as northern prairie warblers (*Dendroica discolor discolor*), are clearly more common today than they were at the turn of the century. However, these species still have relatively small geographic distributions and they should receive attention due to the rapid rate at which losses are occurring to relatively stable shrub-scrub habitats. In particular, the northern prairie warbler appears to have been largely a species associated with shrub-scrub understories of regularly disturbed longleaf pine (*Pinus palustris*), especially in sandhills situations and loblolly (*Pinus taeda*)-shortleaf (*Pinus echinata*) pine (Nolan 1978). The loss of these habitats through fire suppression during this century appeared to be compensated by the concurrent increase in old-fields and regeneration of forests through clear cutting. The overall loss of shrub-scrub in managed landscapes, including the suppression of natural fire regimes is undoubtedly contributing to decline of not only the northern prairie warbler, but also northern bobwhite and possibly American woodcock.

A very important restoration management concern for many shrub-scrub species may be minimum habitat patch size to support healthy populations. Although the term "area-sensitive" is applied most frequently to mature forest species. Early-successional species, also may require minimum areas of relatively stable shrub-scrub habitat (*i.e.*, succession set-back at regular intervals), but evidence is only now accumulating on this point. Prairie warblers are frequently absent from clearcuts less than 8 ha (20 acres) in size and appear to incrementally increase in densities, as do other shrub-scrub species, as clearcut size increases [to at least 40 ha (100 acres) in size; Doug James personal communication].

Another management issue which needs to be is the use of corridors for dispersal and movement between habitat patches. For example, work on a Savannah River Site suggests at least Bachman's sparrow move more frequently from one early-successional patch to another, both surrounded by unsuitable pine habitat, when an early successional corridor connects the two sites, such as along tornado alleys and a series of linear clearcuts (Dunning et al. 1995). The same effect probably would occur with appropriately managed powerline right-of-ways *(i.e.*, infrequent mowing or use of herbicides).

Habitat and population objectives:

The goal for early-successional habitats in the East Gulf Coastal Plain is to restore grassy ground cover and shrub-scrub understory under mature pine through increased use of appropriate disturbance (*e.g.*, fire) regimes; seek opportunities through Farm Bill and related programs to increase warm-season grasses and early successional habitats within agriculture-dominated landscapes, while also consolidating large patches of early successional hardwood and pine on a sustainable basis to support healthy populations of prairie warblers and other associated breeding birds.

Capel et al. (1994) recommended reestablishing a combination of early-successional habitats to cover the variety of foraging, nesting, cover needs in order to restore early-successional wildlife populations to pre-1980 levels. Capel et al. (1994) specifically set goals of (1) establishing 1,050,000 ha (2,625,000 acres) of 5-year idled lands in native vegetation or grass-legume mixes, (2) establishing 1,050,000 ha (2,625,000 acres) of annual vegetation (forbs or annually established cover) and (3) 1,820,000 ha (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.

Determination of present acreage of existing range and acreage targeted for restoration for the East Gulf Coastal Plain needs to be determined within each State (Kentucky, Tennessee, Mississippi, Alabama, Louisiana, Florida). State and local technical committees led by the U.S. Natural Resources Conservation Service to implement the 1996 Farm Bill have formed to identify priority conservation areas and target funding and implementation criteria within these States. From the wildlife viewpoint, the small game/private lands biologists of State wildlife agencies are providing leadership, but specific objectives (acreage, locations, etc.) still need to be specified. Step-down objectives for the East Gulf Coastal Plain of retaining 120,000 ha (300,000 acres) of 5-year idle lands, 120,000 ha (300,000 acres) of annuals (forbs), and 240,000 ha (600,000 acres) of 10-20 year idle serves as a starter for discussion. These objectives can further be divided among the States (see Table presented under grassland objectives).

Implementation recommendations and opportunities:

A frequent management recommendation is to provide narrow shelterbelts (hedgerows) strips on farmland, with the intended result being reduction of soil erosion from wind and to provide wildlife habitat for species like rabbits and northern bobwhite. However, only the blue grosbeak, among nongame breeding species, appears to successfully use shelterbelts and this species is also the only shrub-scrub species now increasing in the Southeast. Most other species show high susceptibility to breeding failure in shelterbelt-like habitat, even when present in high numbers (*i.e.*, illustrating an "ecological trap"), undoubtedly due to the high abundance of nest predators and brown-headed cowbirds associated with agricultural or highly fragmented landscapes. However, if strips are developed to diversify pine monocultures, target game species should benefit and these habitats should be expected to support healthier nongame bird populations as well.

The merits of shelterbelts within croplands for soil erosion control and game management are unquestioned. In addition, many wintering nongame bird species appear to do well in shelterbelts (*e.g.*, many sparrows). However, if many of the breeding shrub-scrub species are to benefit from Farm Bill and related programs, opportunities to work with private landowners to restore blocks of at least 20 - 40 ha (50-100 acres) in old-field or shrub-scrub condition would be most important. Of course rabbits and northern bobwhite would also benefit from this recommendation.

Increasing concern for American woodcock also warrants close attention to providing early-successional habitats within the East Gulf Coastal Plain as this physiographic area serves as a fairly major wintering area for this species. Present information demonstrates heavy use of forested wetlands during the day, while many birds use (display, feed, roost) early-successional pine stands in the coastal plain of Georgia (Krametz et al. 1995), suggesting attention be given to in these habitats in the East Gulf Coastal Plain.

Evaluation of assumptions:

Future studies are required to answer critical questions regarding the restoration and maintenance of scrub-shrub and old field habitats in the East Gulf Coast Plain. Research efforts should address the following issues:

(1) physiographic area wide surveys to determine the current status and distribution of Bewick's Wren;
(2) studies of the use of corridors in the movement and dispersal of high priority species;
(3) determination of the present acreage of existing habitat and acreage targets for restoration in the East Gulf Coastal Plain;
(4) determination of the optimal spatial arrangements and total coverage of 5-year idled lands and acres supporting annuals;
(5) documentation and monitoring the response to habitat restoration through the Farm Bill for early-successional birds;
(6) determine the effects of using even-aged management as a source habitat for early-successional species; and
(7) determine the relative impacts to early-successional species of "permanent" scrub-shrub and "temporary" scrub-shrub habitats.

Early succession: Short-rotation Pine

Ecology and status:

Short rotation pine acreage (rotation age of 20 to 25 years) has increased dramatically in the northern and eastern portions of the East Gulf Coastal Plain in response to growing demands for pulpwood products. In the southern portion of the physiographic area, pine plantations are fairly common but are based on longer rotations (rotation age of 60 years). Short rotation pine management occupies about 10% to 15% of the landscape in the northeastern part of the East Gulf Coastal Plain. This acreage is based on site conditions and landowner patterns. The increasing demand for short rotation pine to provide pulp materials for building and other uses is providing incentives to non-industrial landowners to increase the land base of short rotation pine.

The forest products industry, however, is the primary manager of these habitats, although ownership may be increasingly private, non-industrial. Other than industry, short rotation pine is

managed by private non-industrial landowners, state forests, state Wildlife Management Areas, local parks, and others.

In short rotation pine habitats, bird species richness and abundance is greatest in years 1 through 11, and may decline rapidly in years 12 through 25 (Dickson et al. 1993), especially for high concern score birds. Prior to European settlement, these bird species were most common in barrens, glades, and large forest openings. Many bird populations may have reached unprecedented highs prior to the 1960's because of the widespread abandonment of farms and the resultant increase of old fields. However, old field habitats have succeeded to mature forests, or have changed to agriculture or urbanization (see, for example, Nicholson 1997).

Management issues for these birds are complex (Thompson and Dessecker 1997). Nest productivity rates remain unclear for many species nesting in short rotation pine, especially in comparison to natural forest disturbances or old fields. Area sensitivity may be an management issue for these birds in that a larger patch of short rotation pine may provide better habitats than small patches.

Priority species, species suites, and habitat requirements:

Partners in Flight high concern score (greater than or equal to 22) bird species for this habitat include Bachman's sparrow, Bewick's wren, prairie warbler, and northern bobwhite (Carter et al. in press). Other birds of this habitat with moderate (that is, species that should be closely monitored and perhaps managed) to low concern scores include field sparrow, white-eyed vireo, yellow-breasted chat, and eastern towhee.

Habitat and Population objectives:

In the East Gulf Coastal Plain, short rotation pine habitats occur primarily in west Tennessee, north central Mississippi, and central Alabama. Although habitat availability shifts across the landscape, a consistent source of opportunity in short rotation pine may help stabilize some bird populations, especially as other temporary habitats (such as abandoned farms) continue to decline. The habitat goal for short rotation pine is to stabilize the current acreage at about 10% of the landscape. Over time, this habitat goal would stabilize potential source populations of birds such as prairie warbler and field

sparrow. The vast majority of short rotation pine would best be supplied by the forest products industry. Source populations must be assured in more permanent scrub-shrub habitats, in addition to pine management.

Implementation recommendations and opportunities:

The forest products industry manages the vast majority of short rotation pine habitats; public lands and private non-industrial lands add minimal amounts to that acreage. As such, short rotation pine habitats are largely dependent on industry ownerships and the location of mills, as well as site conditions.

Broadly, stand management for short rotation pine include the following guidelines:

1. a rotation length of 22 to 25 years,
2. no further entry unless management requires hardwood controls,
3. maintaining pine management on the same acres over time,
4. an average size cut of less than 16 ha to 32 ha (40 acres to about 80 acres),
5. a configuration of cuts that is usually dependent on topography and soils, as well as economic needs,
6. Sustainable Forestry Initiative (SFI) guidelines recommend that adjacent clearcuts should not be executed in less than 3 years or when growth is less than 2 meters,
7. SFI guidelines recommends cuts to average no more than 48 ha (120 acres),
8. site preparation may be by either chemical or mechanical treatments and depend on site conditions,
9. soil productivity issues need additional research, indications are that soils can continue to produce short rotation pine indefintely, but fertilization may increase over time, and
10. short rotation pine is managed predominantly in plantations of loblolly pine.

Private, non-industrial or public lands pine management may differ somewhat by longer rotations, increased entries, and cuts of less than 20 acres, depending on the objectives and knowledge of the land manager.

Opportunities to integrate bird management into short rotation pine guidelines exist for the average size of cuts, configuration of cuts, site preparation, slash piles, number of entries to the stand, soil productivity, genetically improved trees, logging decks, and snag retention and location. Some guidelines will not be discussed further here because of economic factors and/or minimal difference as bird habitats; these are rotation length of 22 to 25 years, replanting those acres back to pine management, and the use of loblolly pine in plantations.

The average size of most pine plantations range from less than 16 ha (40 acres) to about to about 32 ha (80 acres), depending on land owner objectives. The Sustainable Forestry Initiative demands that member industries do not average even age cuts over 48 ha (120 acres). Thompson et al. (1996) suggest that in heavily forested landscapes, bird habitat management may best be accomplished by enlarging plantations and, thus, providing increased patch size of adjacent hardwood stands.

Pine plantation configuration is often based on topographic considerations, or encourages irregular shaped to increase edge habitats for wildlife. A square cut is better than other configurations in order to reduce edge and increase interior habitats for high concern score birds. The location of cuts is critical as well. While there is always competition for the best soils, the bird habitat management recommendation for short rotation pine is to keep pine on the minimal soils and site conditions and manage mature hardwoods on the best sites, such as coves or northern aspects.

Site preparation can be by chemical or mechanical treatments. Site preparation may make a difference for bird habitats, although the impacts of site preparation on birds is poorly understood. The retention of slash piles is perhaps the biggest issue. Bewick's wren occur in slash piles, which is quickly becoming the last dependable habitat condition for this species. Poorest conditions occur when the remaining brush and slash is bulldozed into windrows and burned. Such habitat can remain viable 3 to 5 years unless burned and thinned regularly.

Most stands do not receive a second entry unless an increasing hardwood understory requires management. No second entry probably provides the best habitat conditions for birds; the more hardwood understory that can be economically tolerated the better.

Soil productivity and genetically improved trees are issues for long term management of bird habitat conditions. The impacts of soil productivity and the resultant use of fertilizers, as well as insect

productivity (food base for birds) is very poorly known. However, at a landscape level, soil productivity and genetically improved trees may result in more efficient use of the land for pine production and result in increased acreage in other, more productive bird habitats.

The distribution of snags and other trees left may affect bird nest productivity in short rotation pine habitats. Robbins (1993) speculated that snags and whips clumped at edges may provide the best amount of habitat for cavity nesters, while reducing effective perch sites for nest parasites or predators. This management recommendation remains poorly understood.

Evaluation of assumptions:

Landscape and stand specific habitat recommendations for short rotation pine are based on several assumptions. These assumptions include the following items.

1. Estimates regarding the percentage of forested land and the percentage of short rotation pine are accurate. Detailed studies of economic conditions and urban sprawl projections are needed.

2. Recommendations regarding size of pine plantations need further clarification. This recommendation assumes that the same amount of timber volume is needed from the landscape and that areas not n pine will remain longer in mature hardwood management. Additional research and/or adaptive management strategies are needed to clarify bird productivity in those habitats.

3. Recommendations for this plan assume that birds that require early successional habitats are area sensitive; that is, larger early succession tracts may result in higher nest productivity for high concern score species.

4. The effects of snags and other trees at edges of plantations, particularly predictions of increased bird nest productivity, are poorly understood. More research is needed to justify this management recommendation.

5. The difference between chemical and mechanical treatments on bird habitats is poorly known.

6. Industry research concerning soil productivity and genetically improved trees could benefit bird habitat planning and implementation. Research concerning these issues need to be combined with adequate bird inventory, monitoring and research.

Grasslands and Pastures

Ecology and status:

Approximately 498 ha (1,245 acres) of classified grasslands exist in the East Gulf Coastal Plain according to satellite imagery interpretation. Another 21,502 ha (53755 acres) were classified as grassland-crops and 3,484 ha (8,710 acres) in shrubland-grassland (Table 3; University of Arkansas, CAST). It remains unclear how much overlap occurs with pasture, although the potential exists for extremely high overlap. The majority of these habitats were located in west Kentucky and west Tennessee and in the Black Belt of Mississippi and central Alabama.

Historical grass-dominated ecosystems of the Southeast, 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 within a forest-dominated landscape (including pitcher plant [*Sarracenia* sp.] bogs, prairies, sedgelands, barrens and glades, savannas, and the Everglades). Nevertheless, remnant southeastern grasslands remain biodiversity centers of global importance, with many southeastern endemic species totally dependent upon these ecosystems (DeSelm and Murdock 1993). Thus, loss and conversion of southeastern grasslands to other land uses has resulted in many species of plants and animals requiring protection under the Endangered Species Act of 1973, as amended. Many species of southeastern grassland birds are Federally listed and others are candidates for future listing. As a result, restoration and appropriate management of grasslands and prairies would rate high on the regional list of needed conservation actions for these species.

Historically, East Gulf Coastal Plain grasslands were scattered among a mosaic of various habitat types across the region. Savannas and barrens, areas with a mix of grasses, shrubs, and scattered trees, were present in the upper and middle Coastal Plain of Kentucky, Tennessee, Mississippi and Alabama (Deselm and Murdock 1993). Eastern tallgrass prairie existed in small patches as well, most of which were more similar to mid-west habitats than typical southern open lands. The primary areas for grasslands throughout the area were the Kentucky Barrens in the Jackson Purchase of Kentucky, the Black Belt in Mississippi and Alabama, and the Jackson Prairie in Mississippi.

Perhaps the largest remnant patch of grasslands in the East Gulf Coastal Plain is the Black Belt and the Jackson Prairie region. This region stretches from central Alabama swinging northwestward through northeast Mississippi. Botanical surveys of this area indicate that little bluestem and Indian grass are the dominant grass with eastern red cedar being a constant invader (Deselm and Murdock 1993). Big bluestem is also often present, particularly in depressions, along ditches, and at clearing edges.

East Gulf Coastal Plain grasslands have been maintained by a variety of natural and human factors. Grazing is the major use of grasslands in the Southeast. Grazing typically results in dominance by species characteristic of drier sites. However, the effects of grazing are not uniform nor are they easily defined (Deselm and Murdock 1993). Fire, both natural and human caused, is an important ecological factor affecting grasslands in the Southeast. The intensity, duration, and time of year in which burning takes place are important in determining the effects. The response of grasslands to both grazing and fire is strikingly similar and suggests a close coupling of the ecological forces. (Estes et al. 1979). In spite of the appearance that grasslands are fire dependent, recent work suggests that droughts may be more important than fire in retarding tree invasion in some areas.

Elsewhere within this physiographic area, the proliferation of pastureland, airfields (both commercial and military), and other "artificially" created grasslands have historically provided for much grassland bird habitat. Undoubtedly, there is much more crop and pastureland than native grasslands today than prior to European colonization. Nevertheless, remnant native grasslands still support the core habitats for most highly vulnerable species, but many of these species do benefit in part from cropland management. In addition, many of the more widespread open country birds do extensively use crop and pasture lands. However, even these more common and widespread grassland species are showing strong declining trends due to changes in landowner preference from warm-season to cool-season grasses in pastures and efficient and frequent mowing (haying) practices.

In the lower Coastal Plain, longleaf and slash pine savannas may be considered high priority grasslands. However, pine savannas are inextricably linked to quality, adjacent pine habitats. As a result, pine savannas are treated under longleaf pine habitats in this plan.

Priority species, species suites, and habitat requirements:

Within grasslands of the East Gulf Coastal Plain, Bewicks's wren, Henslow's sparrow, Northern bobwhite, and loggerhead shrike are the species of high conservation concern (Table 2). Henslow's sparrow is perhaps the most vulnerable of grassland birds not now federally listed that is dependent upon southeastern grasslands within the East Gulf Coastal Plain. This physiographic area now serves as an important wintering area for this species, with scattered breeding (pairs or populations?) in Kentucky and Tennessee (formerly Kentucky Barrens. In addition, the easternmost population centers of wintering LeConte's sparrows also are found in the East Gulf Coastal Plain.

Henslow's sparrow is generally considered a grassland specialist while breeding, but it 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 (frequently 3-5 years after disturbance from fire or mowing). During winter, this species' apparent dependence primarily on pine flatwoods and savannas, including pitcher plant bogs, complicate where this species would be best provided for outside the breeding season (discussed previously in the longleaf pine-slash pine section). Nevertheless, consistent use by at least some birds of moist sites dominated by broomsedge grasses during winter, such as along some powerline right-of-ways, marsh edges, and fallow fields, support the need to provide grassy habitats for this species independent of sites with a pine overstory. Disturbance through burning (savannas) or mowing (powerline right-of-ways) of wintering sites is also critical for maintaining suitable to optimal habitat. The Loggerhead shrike remains a fairly common species at least within the Lower Coastal Plain from Alabama to Mississippi. Loggerhead shrike populations have suffered significant and steep populations declines within this physiographic area. Despite the persistence of this species within at least part of the east Gulf Coastal Plain, rapid declines now found throughout the range of this species, including populations breeding north of the physiographic area into Canada that are migratory, are considered the most highly vulnerable of loggerhead shrike populations. Since these northern populations overlap resident populations within the East Gulf Coastal Plain and there is a lack of evidence to support specific causes of decline tied to the breeding season it is often suggested that the reasons for decline are probably tied to the wintering grounds (*i.e.*, the Southeast). These suggestions continue to be made despite the obvious and continuing loss of habitat (grasslands with hedgerows and/or perch sites) throughout the eastern range of this species.

Information and background for Bachman's sparrows and Southeastern American kestrels are treated under longleaf pine-slash pine section.

***Habitat and Population Objectives*:**

Pasture and range wildlife populations should be restored pre-1980 levels (see Capel et al. 1994). To achieve that goal nationwide, Capel et al. (1994) specifically set objectives of (1) retaining 1,600,000 ha (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 4,092,400 ha (10,231,000 acres). Warm-season grasses are more drought-hardy and provide livestock with reliable summer forage. As a result, the southeastern livestock industry would be much less vulnerable to periodic economic stress. In addition, native warm-season grasses contribute significantly to future soil quality, as the only rapid developer of topsoil in the A soil horizon, a major consideration for many southeastern soils which have been farmed for more than 200 years.

A long term habitat restoration goal for the East Gulf Coastal Plain is to provide 40,000 ha (100,000 acres) of restored native, warm-season grass habitats. At least 20,000 ha (50,000 acres) would occur ideally in 5 areas; each area would consist of 4,000 ha (10,000 acres) or more. In these landscapes, primary habitat and land use would be provided by mix of native, warm season grasses in a variety of successional stages. These 5 areas should be scattered from Illinois, west Kentucky and west Tennessee, Mississippi and central Alabama. Primary targets areas include the Kentucky Barrens, Jackson Prairie, and Black Belt. The remaining 20,000 ha (50,000 acres) should occur in 500 patches of at least 40 ha (100 acres) each, and be distributed throughout the East Gulf Coastal Plain based on opportunity and landowner objectives.

Implementation recommendations and opportunities:

The foraging and nesting requirements of some breeding species (if enough native grassland is available nearby) and many migratory or wintering species can be met by farmers and ranchers. Thus, the restoration of native grass-dominated habitats, along with cooperative agreements with private landowners to support compatible practices on lands under active production, can have the greatest conservation benefit for the grassland species of highest concern. Furthermore, efforts to promote large

landscapes of mostly native, warm season grasses may be achieved through landowner contact programs and targeted priority zones.

The Kentucky Division of Fish and Wildlife Resources, for example, has recently begun experimental grassland restoration work in Hancock County. This project promotes native warm season grass management through the state upland game program to provide evidence regarding nest productivity and habitat utilization. Through the Natural Resource Conservation Service and other agriculture related programs, the project is expected to reach at least 200 ha (500 acres) on traditional Farm Bill customer lands. Successful implementation could increase participation and provide incentive towards larger blocks of native grassland habitats. Monitoring, seed purchase, labor, and other costs is provided by the program.

The Tennessee Wildlife Resources Agency provides a similar cost share with Quail Unlimited for public lands management. For private lands, the Tennessee Wildlife Resources Agency may provide extra financial incentive to WHIP participants for projects such as fescue eradication, first prescribed burn, and field borders. Although no specific counties are targeted, some will have significant acreage enrolled.

Partners in Flight biologists have worked closely with game bird biologists in both states to maximize the amount of information gained regarding management of nesting birds. Further investigations should lead to minimum acreage requirements from participating landowners, as well as the best locations and opportunities for implementation. Tentatively, grassland restoration goals are thought to be best in blocks greater than 40 ha (100 acres).

Milan Army Arsenal, in west Tennessee, provides an excellent opportunity to research priority management questions regarding minimum size and management requirements. Milan Arsenal may offer the best opportunity to provide habitat potential for Henslow's Sparrow and Bell's Vireo, as well as an entire species suite of grassland species.

Small scale restoration and management of grass-dominated communities is necessary for recovering many Federally and State protected plant species in the Southeast and can provide benefits to vulnerable grassland birds on a limited scale. In many cases, these conservation efforts must involve cooperative agreements with private or corporate landowners. Utility right-of-ways in many areas allow excellent opportunities for maintaining grassland habitats when appropriate management protocols

are followed (Deselm and Murdock 1993). Prairie restoration on family farms also need to be encouraged, such efforts are now underway in several southeastern States, including Kentucky.

Evaluation of assumptions:

Landscape and stand specific grassland and savanna management recommendations were based on several assumptions. These assumptions include the following items.

Estimates regarding the minimum acreage requirements for birds in the East Gulf Coastal Plain were based on studies in the Great Plains, which may not be viable here because of the difference in the context of the landscape. Detailed studies regarding bird species assemblage distribution based on minimum size class are needed.

Nest productivity is unknown during various management regimes or for various size classes; most information is based on the presence, absence, or relative abundance of species. Studies of nest productivity are needed.

The seed stock for grassland species restored is often unknown or not locally provided, which generates questions of plant genetic viability and, thus, community viability. Studies regarding the viability of restored communities, and the long term impact to sustaining bird populations, are needed.

Although much has been learned recently, more research is needed to clarify burn and disturbance regimes and the impact to bird populations, especially in small isolated habitats.

Increased inventories are needed for breeding populations and management for Henslow's Sparrow and Bell's Vireo in Kentucky and Tennessee.

Management protocols need to be developed for fallow fields.

Monitoring bird population response to Farm Bill progress is needed.

Field and remote reconnaissance is necessary to find outstanding examples of grasslands, with time sequence monitoring to determine successional changes.

Riparian woodlands

Ecology and status:

The term riparian refers to streamside areas. Riparian woodlands may also be called greenbelts, stream corridors, streamside management zones, or streamside buffers. In the East Gulf Coastal Plain, riparian habitat may be dominated by tree and shrub species more typical of uplands, such as oak-hickory, or beech-maple, or may occur as narrow strips of forested wetlands. Upland riparian habitats are often important habitats to both aquatic and terrestrial fauna, especially in those lands where there is high topographic relief.

Riparian vegetation is considered essential for minimizing erosion from upslope areas entering and seriously changing water quality (National Association of Conservation Districts 1994). The importance of minimizing erosion through maintenance of riparian habitats is perhaps most important in areas being developed for residential or industrial use. However, maintenance of riparian vegetation adjacent to areas mined, farmed, or timbered remains necessary to reduce runoff and erosion, and minimize environmental contamination from applied chemicals.

Priority species, species suites, and habitat recommendations:

Acadian flycatcher, Cerulean Warbler, Swainson's Warbler, and Louisiana Waterthrush are most common in riparian habitats within largely forested landscapes. Maximum numbers for Acadian Flycatchers and Louisiana Waterthrushes appear consistently when streamside management zones are at least 42 m to 84 m (150-300 feet) wide, with somewhat open understory, adjacent to recently regenerated loblolly pine plantations in coastal plain, Piedmont, and Ouachita studies (Dickson unpublished data, Tassone 1981, Melchoirs and Cicero 1987, Tappe et al. 1994). In agricultural landscapes, or along major floodplains maximum numbers of the most area-sensitive species peaked in streamside management zones of at least 84 m (300 feet) in width (Keller et al. 1993, Hodges et al. 1995).

Landbirds, many considered area-sensitive, are among the wildlife species now frequently targeted by natural resource managers when developing guidelines for implementing streamside management zones within riparian habitats. Maintaining the width of riparian habitats as "bigger is better" would

provide for an optimum strategy for vulnerable landbirds, if this group of species constituted the only consideration for making management decisions (Dickson and Warren 1994). Effective conservation in most managed landscapes, however, requires that the best information be made available to balance economics with the needs of wildlife. For this reason, both managers and biologists should carefully review Wigely and Melchoirs (1994) and Melchoirs (in press) who describe both management opportunities as well as important caveats for interpreting existing data on wildlife use of retained riparian vegetation in actively managed landscapes.

***Habitat and population objectives*:**

It remains unclear whether local implementation of wider streamside management zones in heavily managed landscapes would provide for suitable or optimal habitat for many vulnerable species. Reproductive success may be low in areas otherwise considered fragmented landscapes or where habitats are vulnerable to a high degree of nest parasitism and depredation.

Simple indices for species richness and diversity do not always show riparian habitats supporting more species or numbers of birds than adjacent non-riparian forests (e.g. Smith 1977, Gates and Giffen 1991, Murray and Best 1995). Nevertheless, many of the most vulnerable species occurring in the Southeast are found in forested riparian habitats, but are not present in upslope forests, within both forested and fragmented landscapes. The goal for managers should be to avoid taking presently stable source populations below the threshold and, as a result, forming population sinks or outright local extirpations.

Flexibility in managing riparian habitats is also enhanced when large landscapes are under cooperative management. Relative width recommendations, for example, could depend on the nature of dominant landuse patterns. Adjacent lands dominated mostly by mature or maturing stands suggest narrower streamside zones would 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 likely require the widest zones if vulnerable landbirds were an important consideration for management.

***Implementation recommendations and opportunities*:**

Melchoirs (in press) organized existing data into three categories particularly useful for developing management recommendations: (1) streamside management zones in managed (usually short-rotation pine) forest stands, (2) riparian forest habitats in otherwise agricultural or developed landscapes, and (3) moisture/elevation gradients in largely forested landscapes. Landowner objectives may largely define the role of streamside management zones for any larger landscape.

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 viable opportunities to support a large number of vulnerable landbirds throughout the landscape away from major forested wetlands.

The following quote and other recommendations from Melchoirs (in press) are particularly relevant for partners to keep in mind as conservation strategies are mapped out for their landscape:

> . . . one should not expect the same roles on lands owned by individuals, corporations, and the public. Regardless of ownership and from a landscape perspective, variable-width SMZs [streamside management zones] seem intuitively appropriate given the wide variation in stream, floodplain, and SMZ dimensions should roughly correlate, increasing from the upper end towards the lower end of a watershed. Even narrow SMZs on ephemeral or intermittent streams are important and can contribute to the diversity of the bird community in a managed forest. Fixed-width SMZs may not always encompass important habitat features in areas where topography and habitats are variable (Melchoirs and Cicero 1987); and flexibility in management seems important from an operational perspective (Wigley and Melchoirs 1994).

Such flexibility is important as the economic costs and benefits of timber, birds, and streamside management zones remain largely conjectural and in need of further validation. Standard recommendations for streamside management zone width and condition need to be presented to private landowners as optional if the recommendations are beyond those outlined in state-sanctioned Best Management Practices.

Ongoing and future efforts to provide financial incentives, conservation easements, and partnerships formed through public-private programs like the Farm Bill's Forest Stewardship provisions (U.S.D.A.

Forest Service) and Partners for Wildlife (U.S. Fish and Wildlife Service) are critical for stabilizing or enhancing the riparian habitat throughout the Southeast.

***Evaluation of assumption*s:**

Implementation of this plan is based on several assumptions which require further research or adaptive management within the context different landscapes as described by Melchoirs (in press). These landscapes include riparian zones in managed forests, in agriculture or urban areas, or along moisture/elevation gradients in largely forested areas. Research projects could clarify the following four items regarding streamside management zones:

optimum vegetative structure,

desired plant species composition,

maximum active management advisable within riparian habitats, and

a standard minimum width of riparian habitats necessary to minimize erosion within a variety of landscapes.

Section IV – Implementation recommendations and summary

30 May 2001 - -

This section is not currently available. The author(s) are working on revising this and other aspects of the plan, and will replace this version with the new one as soon as it is complete. If you have questions, please contact Dean Demarest, Southeast Regional Coordinator, Partners in Flight at dean_demarest@mail.dnr.state.ga.us.

Physiographic area: East Gulf Coastal Plain (BBS 04, SEPIF C1)

Table 1. Priority bird species listed by total Parteners in Flight concern score, and segregated by entry criteria. Other measures include area of importance and population trends scores, percent of BBS population, and local migratory status.

Priority Entry Critera & species	Total PIF score	Concern scores AI	PT	Percent BBS	Local migratory status
Ia. Highest overall priority					
Mississippi Sandhill Crane	35	5	5	-	RP
Red-cockaded Woodpecker	31	4	4	11.0	RP
Bachman's Sparrow	30	5	5	28.1	D
Nelson's Sharp-tailed Sparrow	29	5	3	-	C
Golden-winged Warbler	29	4	5	-	A
Henslow's Sparrow	29	4	5	-	F
Black Rail	28	4	4	-	D
Swallow-tailed Kite	28	4	3	-	E
Bewick's Wren	28	3	5	8.0	E
Piping Plover	28	4	4	-	C
Salt Marsh Sharp-tailed Sparrow	28	3	3	-	C
Swainson's Warbler	29	5	3	13.3	B
Ib. High overall priority					
American Kestrel	27	4	4	-	E
Snowy Plover	27	4	5	-	E
Brown-headed Nuthatch	26	5	4	16.6	R
Cerulean Warbler	26	3	3	11.7	E
Seaside Sparrow	26	5	3	-	E
Yellow Rail	26	4	3	-	C
Bicknell's Thrush	25	4	3	-	A
Prothonotary Warbler	25	4	5	9.5	B
Chuck-will's-widow	24	5	5	11.8	B
Prairie Warbler	24	4	5	7.4	B
Reddish Egret	24	2	3	-	E
Wilson's Plover	24	5	4	-	E
Worm-eating Warbler	24	3	3	1.6	E
Blue-winged Warbler	24	5	3	-	A
Bay-breasted Warbler	24	5	3	-	A
Bobolink	24	5	5	-	A
Red Knot	24	3	4	-	A
Stilt Sandpiper	24	3	3	-	A
Buff-breasted Sandpiper	24	3	3	-	A
Black-throated Blue Warbler	23	3	3	-	A
Bell's Vireo	23	2	3	-	B
American Black Duck	23	4	5	-	D
Redhead	23	5	4	-	C
Marbled Godwit	23	3	4	-	C
Short-billed Dowitcher	22	3	4	-	C
Black Tern	22	5	5	-	A

Kentucky Warbler	22	4	2	9.8	B
Orchard Oriole	22	5	5	9.3	B
Brown Pelican	22	4	1	80.2	RP
Clapper Rail	22	5	3	27.7	RP
American Oystercatcher	22	5	3	-	RP
Willet	22	4	5	-	RP
Northern Bobwhite	22	5	5	-	R
Yellow-billed Cuckoo	22	5	5	7.1	B
Red-headed Woodpecker	22	4	5	3.3	D
American Woodcock	22	4	4	-	D
Sedge Wren	22	5	5	-	C
Veery	22	5	5	-	A
Palm Warbler	22	5	5	-	A
Canada Warbler	22	4	3	-	A

II. Physiographic area priority species

Chimney Swift	21	4	5	-	B
Eastern Wood-Pewee	21	4	5	-	B
Loggerhead Shrike	21	4	5	-	D
American Bittern	21	4	5	-	D
King Rail	21	5	3	-	D
Black Skimmer	21	4	5	71.7	E
Canvasback	21	4	4	-	C
Semipalmated Sandpiper	21	4	5	-	A
Black-billed Cuckoo	21	5	3	-	A
Least Flycatcher	21	5	5	-	A
Chestnut-sided Warbler	21	5	3	-	A
Black-throated Green Warbler	21	5	3	-	A
Blackpoll Warbler	21	5	3	-	A
Rusty Blackbird	21	5	5	-	C
Northern Harrier	20	4	4	-	C
Sanderling	20	3	5	-	A
Common Ground-Dove	20	4	4	9.1	R
Purple Martin	20	5	5	11.2	B
Carolina Chicakdee	20	4	5	6.7	R
Field Sparrow	20	3	5	-	R
Gull-billed Tern	20	5	3	23.6	E
Sandwich Tern	20	5	3	-	E
Dunlin	20	4	5	-	E
Royal Tern	19	5	3	32.1	E
Least Tern	19	4	4	63.8	E
Eastern Kingbird	19	4	5	-	B
Common Loon	19	5	3	-	C

III. Additional species: global priority

Wood Thrush	21	4	2	5.7	B
Louisiana Waterthrush	21	3	2	3.7	B

IV. Additional species: abundant and declining in the physiographic area

Downy Woodpecker	18	5	5	-	R
Eastern Meadowlark	18	4	5	-	D
Blue Jay	17	5	5	-	D
Common Grackle	15	4	5	-	D
Mourning Dove	14	4	5	-	D

V. Additonal species: responsibility for monitoring (>10% BBS)

White-eyed Vireo	20	5	2	13.3	B
Hooded Warbler	20	4	1	13.9	B
Summer Tanager	19	5	2	10.9	B
Fish Crow	18	4	3	21.2	D
Red-bellied Woodpecker	18	5	2	10.0	R
Pine Warbler	18	5	1	11.8	D
Yellow-breasted Chat	17	5	1	13.5	B
Eastern Towhee	17	5	2	12.3	D

VI. Federal listed species

Bald Eagle	18	3	3	-	D

VII. Local, state, or regional interest species

Painted Bunting	21	3	4	-	D
Ovenbird	17	2	3	-	B
Shiny Cowbird	10	1	3	-	D
Brown Creeper		????			D
Wood Stork		????			?

Migration status key:

A = transient species, breeds and winters outside of physiographic area.

B = breeds in temperate or tropical areas including the physiographic area, but winters exclusively outside the regtion.

C = Breeds outside of the physiographic area, but winters in physiographic area.

D = Breeds and winters in the physiographic area, but two different populations may be involved.

E = Species reaching distributional limits in the physiographic area as breeding populations, but above peripheral status.

F = As E above, but for wintering species.

R = Resident, generally non-migratory species.

RP = Resident, generally non-migratory species reachong distributional limits in the physiographic area, but above peripheral status.

Physiographic area: East Gulf Coastal Plain (BBS 04, SEPIF C1)

Table 2. Bird species assemblages designated for broad habitat type within the physiographic area, and listed by total Partners in Flight score. The sum of Area Importance, Population Trend, and Threats to Breeding are included as the Habitat Score, and provides as an indication of the importance of the habitat in the area. The overall score indicates management criteria, see below. Habitat suitability is derived from Hamel (1995).

Habitat	Species	Total PIF score	Habitat score	Overall score [1]	Habitat suitability
Grasslands	Mississippi Sandhill Cran	35	15	I, V	
	Bachman's Sparrow	30	14	II, V	
	Henslow's Sparrow	25	9	II, V	
	Bobolink	24	-	III	
	Northern Bobwhite	22	13	III	
	Sedge Wren	22	-	VI	
	Loggerhead Shrike	21	13	II, V	
	Field Sparrow	20	11	IV	
	Northern Harrier	20	-	IV	
	Eastern Kingbird	19	12	IV	
	Eastern Meadowlark	18	12	VI	
Early succesion, Scrub-shrub Old field	Bewick's Wren	28	12	II, V	
	American Kestrel	27	12	II, V	
	Prairie Warbler	25	13	III	
	Bell's Vireo	23	9	III	
	LeConte's Sparrow	23	-	III	
	American Woodcock	22	11	III	
	Loggerhead Shrike	21	13	II, V	
	Rusty Blackbird	21	-	VI	
	Painted Bunting	21	9	VI	
	White-eyed Vireo	20	10	VI	
	Field Sparrow	20	11	VI	
	Northern Harrier	20	-	IV	
	Yellow-breasted Chat	17	9	VI	
	Eastern Towhee	17	10	IV	
	Mourning Dove	14	10	IV	
	Shiny Cowbird	10	5	VI	
Forested wetlands	Swainson's Warbler	29	12	III, V	
	Swallow-tailed Kite	27	12	II,V	
	Cerulean Warbler	26	10	I, V	
	Prothonotary Warbler	25	12	III	
	Kentucky Warbler	23	10	III	
	Yellow-billed Cuckoo	22	13	III	
	Eastern Wood-Pewee	21	12	VI	
	Carolina Chickadee	20	11	VI	
	Summer Tanager	19	10	VI	
	Red-bellied Woodpecker	18	9	VI	
	Bald Eagle	18	9	III	
	Fish Crow	18	9	VI	
	Downy Woodpecker	18	12	VI	

	Mourning Dove	14	10	IV
	Blue Jay	17	11	VI
	Common Grackle	15	10	VI
	Brown Creeper		??	VI
	Wood Stork		??	VI
Oak-hickory	Swallow-tailed Kite	27	12	II, V
Loess Bluffs	Cerulean Warbler	26	10	I, V
TN Plateau	Chuck-will's widow	24	13	II, V
Mixed Pine	Worm-eating Warbler	24	9	III
	Kentucky Warbler	23	10	III
	Orchard Oriole	23	14	IV
	Yellow-billed Cuckoo	22	13	III
	Eastern Wood-Pewee	21	12	VI
	Carolina Chickadee	20	11	VI
	Hooded Warbler	20	10	III
	Summer Tanager	19	10	IV
	Downy Woodpecker	18	12	VI
	Red-bellied Woodpecker	18	9	VI
	Blue Jay	17	11	VI
	Ovenbird	17	7	VI
	Common Grackle	15	10	VI
Loblolly-	Red-cockaded Woodpecker	31	13	I, V
Shortleaf	Bachman's Sparrow	30	14	II, V
	American Kestrel	27	12	II, V
	Brown-headed Nuthatch	27	13	III
	Chuck-will's widow	24	13	II, V
	Orchard Oriole	23	14	IV
	Yellow-billed Cuckoo	22	13	III
	Northern Bobwhite	22	13	III
	Eastern Wood-Pewee	21	12	VI
	Carolina Chickadee	20	11	VI
	Eastern Kingbird	19	12	VI
	Summer Tanager	19	10	VI
	Downy Woodpecker	18	12	VI
	Red-bellied Woodpecker	18	9	VI
	Blue Jay	17	11	VI
	Eastern Towhee	17	10	IV
	Mourning Dove	14	10	III
Longleaf -	Mississippi Sandhill Crane	35	15	I, V
Flatwoods	Red-cockaded Woodpecker	31	13	I, V
Sandhills	Bachman's Sparrow	30	14	II, V
Slash Savanna	Brown-headed Nuthatch	27	13	III
	Prairie Warbler	25	13	III
	Henslow's Sparrow	25	9	II, V
	Orchard Oriole	23	14	IV
	Northern Bobwhite	22	13	III
	Eastern Wood-Pewee	21	12	VI
	Carolina Chickadee	20	11	VI
	Eastern Kingbird	19	12	IV

	Summer Tanager	19	10	VI
	Downy Woodpecker	18	11	VI
	Red-bellied Woodpecker	18	9	VI
	Blue Jay	17	11	VI
Short-rotation Pine	Bachman's Sparrow	30	14	III, V
	Bewick's Wren	28	12	II, V
	Prairie Warbler	25	13	III
	Northern Bobwhite	22	13	III
	Field Sparrow	20	11	IV
	White-eyed Vireo	20	10	IV
	Downy Woodpecker	18	12	VI
	Red-bellied Woodpecker	18	9	VI
	Blue Jay	17	11	VI
	Yellow-breasted Chat	17	10	VI
	Eastern Towhee	17	10	IV
	Mourning Dove	14	10	III
Maritime forest	Prairie Warbler	25	13	III
	Bicknell's Thrush	25	-	III
	Chuck-will's-widow	24	13	II
	Blue-winged Warbler	24	-	III
	Bay-breasted Warbler	24	-	III
	Orchard Oriole	23	14	III
	Black-throated Blue Warbler	23	-	III
	Northern Bobwhite	22	12	III
	Yellow-billed Cuckoo	22	13	III
	Veery	22	-	III
	Palm Warbler	22	-	VI
	Canada Warbler	22	-	VI
	Eastern Wood-Pewee	21	12	VI
	Black-billed Cuckoo	21	-	III
	Least Flycatcher	21	-	III
	Chestnut-sided Warbler	21	-	III
	Black-throated Green Warbler	21	-	III
	Blackpoll Warbler	21	-	III
	Common Ground-Dove	20	12	IV
	Carolina Chickadee	20	11	VI
	Summer Tanager	19	10	VI
	Downy Woodpecker	18	12	VI
	Red-bellied Woodpecker	18	9	VI
	Fish Crow	18	9	VI
	Blue Jay	17	11	VI
	Yellow-breasted Chat	17	10	VI
	Eastern Towhee	17	10	IV
Emergent Wetlands	Nelson's Sharp-tailed Sparrow	29	-	II, V
	Salt Marsh Sharp-tailed Sparrow	28	-	II, V
	Swallow-tailed Kite	27	12	II, V
	Yellow Rail	26	-	III, V
	Seaside Sparrow	26	11	III, V

	Reddish Egret	25	10	III
	LeConte's Sparrow	23	-	III
	American Black Duck	23	-	III
	Redhead	23	-	III
	Sedge Wren	22	-	VI
	Clapper Rail	21	10	IV
	American Bittern	21	12	IV
	King Rail	21	10	IV
	Canvasback	21	-	III
Beaches and Dunes	Piping Plover	28	-	II
	Snowy Plover	27	13	II
	Red Knot	24	-	III
	Stilt Sandpiper	24	-	VI
	Buff-breasted Sandpiper	24	-	III
	Wilson's Plover	24	13	II
	Marbler Godwit	23	-	III
	American Oystercatcher	22	11	IV
	Willet	22	13	IV
	Brown Pelican	22	9	VI
	Short-billed Dowitcher	22	-	III
	Black Tern	22	-	VI
	Semipalmated Sandpiper	21	-	IV
	Least Tern	20	13	II
	Sandwhich Tern	20	11	IV
	Black Skimmer	20	11	IV
	Brown Pelican	20	10	IV
	Royal Tern	20	10	IV
	Sanderling	20	-	VI
	Dunlin	20	-	VI
	Gull-billed Tern	18	9	IV

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1 = Overall scores refer to the following:

I = Crisis recovery necessary

II = Immediate management and/or policy action necessary range-wide

III = Active, integrated management is needed to reverse, stabilize, or increase populations

IV = Long-term planning and habitat responsibility are needed, in association with monitoring

V = Research is necessary to further clarify population status or level of threat to species or habitat

VI = Monitor population trends and develop habitat management only as population levels dictate.

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