

# LOUISIANA COMPREHENSIVE WILDLIFE CONSERVATION STRATEGY



Louisiana Department of Wildlife & Fisheries  
September 2005



# **LOUISIANA COMPREHENSIVE WILDLIFE CONSERVATION STRATEGY**



**FINAL DRAFT  
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## EXECUTIVE SUMMARY

Louisiana serves as a permanent or temporary home to over 900 species of vertebrate animals and an unknown number of invertebrates. From its diverse coastal marshes to its interior pine-dominated landscapes, the state offers habitat to a variety of wildlife in numbers seldom exceeded elsewhere. These rich areas provide refuge to 24 million migrant songbirds on a typical spring day and 5 million waterfowl during an average winter. They're home to some 200 rookeries of wading birds and seabirds, some arguably the largest in North America.

Biologically diverse as it may be, many of the species and habitats critical to wildlife are declining. Through the development of the Comprehensive Wildlife Conservation Strategy (CWCS), we have reviewed the status of all wildlife species known in Louisiana, and have identified 240 species of concern that need specific conservation attention. This list of 173 vertebrates and 67 invertebrates is not limited to nongame species. Bobwhite Quail, Northern Pintail, and King Rail are examples of hunted species that are also in decline. Data indicate that the take from hunters is not the cause of this decline. Alternatively, habitat loss is the true source of the decline of these species and numerous nongame species. Factors that threaten habitat also influence populations of these declining species, and these threats must be addressed in order to stop the declines.

As an attempt to meet this challenge, the Louisiana Department of Wildlife and Fisheries (LDWF) broadened its constituency base in the development of the Louisiana CWCS. In addition to continuing its relationship with the sportsmen community, LDWF began dialog with new partners and constituents. LDWF's success in managing species of game animals (hunted, fished, and trapped species) has been due largely to our cooperation with hunters, anglers, trappers, and groups representing them. It has been necessary to develop new partnerships with organizations, individuals, and Federal and state agencies whose missions may impact wildlife and with whom we have had little or no interaction. It became evident early in the development of the CWCS that confirming and expanding these relationships would be key to creating a plan that would successfully halt the declines of species of conservation concern.

Through a process described in detail in Chapter 3, LDWF and its cooperators developed this CWCS. More than 7,500 person-hours have been spent within the last year alone identifying species in decline, assessing threats to these species and their habitats, and developing more than 325 actions (strategies) to help stop the declines of species in conservation need. Using a modified version of software developed by The Nature Conservancy (TNC), a habitat viability and threats analysis was completed for each of 38 terrestrial habitats in six ecoregions, 12 aquatic basins, and marine systems. A decision tree developed internally allowed LDWF to prioritize the habitats in each ecoregion for conservation actions. Of the 18 threats discussed, the following four threats were commonly identified as primary factors affecting these terrestrial habitats throughout the state:

- Habitat destruction or conversion
- Habitat fragmentation
- Habitat disturbance
- Altered composition and structure.

A similar list of threats appeared repeatedly across aquatic basins. These threats included:

- Modification of water levels/changes in natural flow patterns
- Sedimentation
- Habitat disturbance
- Nutrient loading
- Altered composition and structure

The threats arose from an array of sources discussed in Chapter 3.

The conservation actions or strategies were developed in seven focus group meetings across the state with invited conservation organizations, forestry and wildlife associations, Federal and state agencies, industry, universities, and private citizens. The strategies are presented by species, habitat, partner, threats and other groupings in Chapters 4 and 5, and Appendices N and O.

The development of new partnerships and the expansion of existing ones will be critical to implementing the Louisiana CWCS. The list of conservation strategies identifies 19 partners (six federal and five state agencies, as well as conservation organizations, non-government organizations (NGO), forestry, and industry). These are presented in Chapters 3 and 6. Some 105 strategies link us and our partners in conservation. The Louisiana CWCS emphasizes the importance of landowners in stopping the decline of species of conservation need. Some 42 strategies direct the agency to work with landowners. This represents nearly 13% of all strategies in the CWCS, and highlights the crucial role landowners will play in the implementation of the CWCS. Landowners, along with other partners, will be key to conservation in Louisiana in the years to come. The people of Louisiana will have greater opportunities to influence conservation of the state's wildlife than they have ever had before.

The Louisiana CWCS conservation priorities are presented in Chapter 7 and in Appendix M. Terrestrial habitats are addressed by ecoregion. During implementation, LDWF will assimilate the habitat priorities with conservation strategies developed for each habitat type. This will provide direction for conservation actions over the next ten years. As new data are developed and new issues arise, annual monitoring will allow for adapting the plan to changing conditions. Our pine forests, especially those associated with longleaf pine, are among those in need of critical attention, and are identified in Chapter 7 as high priorities in the ecoregions where they exist. The Louisiana CWCS provides conservation actions that we and our partners will take to insure survival of these and other habitats and the species they house. In aquatic systems, we lack data to thoroughly assess what is needed. Therefore, aquatic research is a conservation priority.

The State Wildlife Grants (SWG) Program will be used to support research and status surveys for species of concern and the habitats that support them. LDWF will create and maintain a database, to be updated yearly, containing information on all wildlife research and monitoring activities occurring in Louisiana, and is committed to hiring a full-time person at the project manager level to monitor the success of the strategies identified in this document.

Success of the Louisiana CWCS will rest on implementation of the various conservation actions or strategies developed in the writing of the plan. These strategies present explicit and concise approaches to addressing the identified threats to Louisiana's species of conservation concern and their associated habitats. The conservation actions or strategies fall into several categories including:

- Land protection efforts
- Information management
- Partnerships
- Education and outreach
- Technical interactions
- Restoration efforts
- Surveys and research
- Monitoring
- Conservation design

In order to accurately measure the success of these strategies, a series of performance indicators was devised (Tables 8.3 through 8.7). These performance indicators give concrete, quantitative measures on which LDWF can base its evaluation of the success of the CWCS. A specific schedule for reporting on the implementation of strategies and a database of the corresponding performance indicators is essential. Tables 8.8 and 8.9 present the schedules for accomplishing these tasks.

This document presents a plan that will guide the conservation efforts of the Louisiana Department of Wildlife and Fisheries over the next 10 years. It is ambitious, measurable, and necessary to focus the attention of our employees, our partners, and our public on the needs of those species in decline. Our challenge will be to continue the communications we currently have with our constituents and begin new dialog with the partners that can help us implement the ideas expressed in this plan. We must work together to assure a productive future for the wildlife we all value.

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## ROADMAP

This is a key of where to find within the CWCS the 8 elements as defined by Congress.

<b>Element #</b>	<b>Description</b>	<b>Location</b>
1	Information on the distribution and abundance of species of wildlife, including low and declining populations as the State fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the State's wildlife	Ch 3, pg 35-42 Chapter 4 Table 4.1, pg 286 Appendix F
2	Descriptions of locations and relative condition of key habitats and community types essential to conservation of species identified in (1)	Ch 2, pg 14-30 Figure 3.1, pg 44 Chapter 4 Appendix G
3	Descriptions of problems which may adversely affect species identified in (1) or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and habitats	Ch 3, pg 44-49 Chapter 4 Appendices J, K, & L
4	Descriptions of conservation actions determined to be necessary to conserve the identified species and habitats and priorities for implementing such actions	Ch 3, pg 49-51 Chapters 4, 5, 6, 7 & 8 Appendices M, N, & O
5	Proposed plans for monitoring species identified in (1) and their habitats, for monitoring the effectiveness of the conservation actions proposed in (4), and for adapting these conservation actions to respond appropriately to new information or changing conditions	Chapter 8 Tables 8.2-8.9
6	Descriptions of procedures to review the strategy at intervals not to exceed ten years	Chapter 1, pg 7 Tables 8.8 & 8.9
7	Plans for coordinating, to the extent feasible, the development, implementation, review, and revision of the strategy with Federal, State and local agencies and Indian tribes that manage significant land and water areas within the State or administer programs that significantly affect the conservation of identified species and habitats	Ch 3, pg 31-33 Ch 4, pg 290 Chapters 6 & 8 Tables 8.3 & 8.7
8	Documentation of broad-based public participation during the development and implementation of the strategy	Chapter 3, pg 31-33 Chapters 5 & 6

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## LIST OF ACRONYMS

AFB	Air Force Base
ATV	All Terrain Vehicle
BBCC	Black Bear Conservation Committee
BSG	Bird Study Group
BBS	Breeding Bird Survey
BCR	Bird Conservation Region
BLH	Bottomland Hardwood
BMP	Best Management Practice
BRAS	Baton Rouge Audubon Society
BTNEP	Barataria-Terrebonne National Estuary Program
CARA	Conservation and Reinvestment Act of 2000
CCA	Coastal Conservation Association
CLEAR	Coastal Louisiana Ecosystem Assessment and Restoration
COE	U.S. Army Corps of Engineers
CP33	NRCS program, habitat buffers for upland birds
CRD	Coastal Restoration Division (in LNDR/OCRM)
CRT	Louisiana Department of Culture, Recreation and Tourism
CRMS	Coastwide Reference Monitoring System
CRP	Conservation Reserve Program
CSA	Coastal Study Area
CUP	Coastal Use Permit
CWCS	Comprehensive Wildlife Conservation Strategy
CWPPRA	Coastal Wetlands Planning, Protection, and Restoration Act
CZMA	Coastal Zone Management Act
DMAP	Deer Management Assistance Program
DOD	Department of Defense
DOTD	Louisiana Department of Transportation and Development
DU	Ducks Unlimited
DW	Delta Waterfowl
EGCP	East Gulf Coastal Plain
EMRRP	Ecosystem Management and Restoration Research Program
EO	Element Occurrence
EPA	Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
ESA	Endangered Species Act
FFA	Future Farmers of America
FIA	Forest Inventory and Analysis
FLEP	Forest Land Enhancement Program
FPP	Forest Productivity Program
FSA	Farm Service Agency
GCJV	Gulf Coast Joint Venture
GCPM	Gulf Coast Prairies and Marshes
GIS	Geographic Information System

GIWW	Gulf Intracoastal Waterway
GMEI	Gulf of Mexico Estuarine Inventory
GSMFC	Gulf States Marine Fisheries Commission
IBA	Important Bird Area
KNF	Kisatchie National Forest
LAMP	Louisiana Amphibian Monitoring Program
LANSTF	Louisiana Aquatic Nuisance Species Task Force
LCA	Louisiana Coastal Area
LCES	Louisiana Cooperative Extension Service
LCRP	Louisiana Coastal Resources Program
LCWCRTF	Louisiana Coastal Wetlands Conservation and Restoration Task Force
LDAF	Louisiana Department of Agriculture and Forestry
LDED	Louisiana Department of Economic Development
LDEQ	Louisiana Department of Environmental quality
LDNR	Louisiana Department of Natural Resources
LDWF	Louisiana Department of Wildlife and Fisheries
LFA	Louisiana Forestry Association
LMRCC	Lower Mississippi River Conservation Committee
LMVJV	Lower Mississippi Valley Joint Venture
LNG	Liquefied Natural Gas
LNHP	Louisiana Natural Heritage Program
LNSRS	Louisiana Natural and Scenic River System
LOS	Louisiana Ornithological Society
LPB	Lake Pontchartrain Basin
LPBF	Lake Pontchartrain Basin Foundation
LSU	Louisiana State University
LWGCP	Lower West Gulf Coastal Plain
MAPS	Monitoring Avian Productivity and Survival
MARAD	U.S. Department of Transportation Maritime Administration
MDEQ	Mississippi Department of Environmental Quality
MDWFP	Mississippi Department of Wildlife, Fisheries, and Parks
MOU	Memorandum of Understanding
MRAP	Mississippi River Alluvial Plain
MRGO	Mississippi River Gulf Outlet
NAAMP	North American Amphibian Monitoring Program
NACD	National Association of Conservation Districts
NAWMP	North American Waterfowl Management Plan
NBCI	Northern Bobwhite Conservation Initiative
NBII	National Biological Information Infrastructure
NGO	Non Governmental Organization
NAS	National Audubon Society
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRDA	Natural Resource Damage Assessments

NRI	Natural Resources Inventory
NVC	National Vegetation Classification
NWR	National Wildlife Refuge
OAS	Orleans Audubon Society
OCRM	Office of Coastal Restoration and Management (in LDNR)
OSP	Louisiana Office of State Parks
PAH	polycyclic aromatic hydrocarbon
PARC	Partners for Amphibian and Reptile Conservation
PCB	polychlorinated biphenyl
PIF	Partners-in-Flight
PRISM	Program for Regional and International Shorebird Monitoring
RCW	Red-cockaded Woodpecker
RFRI	Recreational Fishing Research Institute
ROW	Right-of-Way
RRWP	Red River Waterway Project
SAV	Submersed Aquatic Vegetation
SFI	Sustainable Forestry Initiative
SEAFWA	Southeastern Association of Fish and Wildlife Agencies
SLPOH	Shortleaf Pine-Oak-Hickory
SMZ	Streamside Management Zone
SPC	Spill Prevention Control
SWG	State Wildlife Grants
TAC	Technical Advisory Committee (NRCS)
TNC	The Nature Conservancy
TPWD	Texas Parks and Wildlife Department
UEGCP	Upper East Gulf Coastal Plain
ULL	University of Louisiana at Lafayette
ULM	University of Louisiana at Monroe
USCB	U.S. Census Bureau
USCG	U.S. Coast Guard
USDC	U.S. Department of Commerce
USDI	U.S. Department of the Interior
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UWGCP	Upper West Gulf Coastal Plain
WCRP	Wildlife Conservation and Restoration Program
WMA	Wildlife Management Area
WRDA	Water Resources Development Act
WRP	Wetland Reserve Program

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## **CHAPTER 1. INTRODUCTION**

### **A. Conservation and Management of Wildlife and Fisheries Resources in Louisiana**

In Louisiana, the Department of Wildlife and Fisheries (LDWF) is the government agency vested with conservation and management of the wildlife in the state, including aquatic life, and is authorized to execute the laws enacted for the control and supervision of programs relating to the management, protection, conservation, and replenishment of wildlife, fish, and aquatic life, and the regulation of the shipping of wildlife, fish, furs, and skins. LDWF is organized into four appropriated budget offices: Secretary, Management and Finance, Wildlife, and Fisheries. Within the Office of Wildlife are the Wildlife Division and the Fur and Refuge Division. The Louisiana Natural Heritage Program (LNHP) is located within the Fur and Refuge Division. Within the Office of Fisheries are the Inland Fisheries Division and the Marine Fisheries Division.

#### **1. Mission Statement:**

LDWF's mission is to manage, conserve, and promote wise utilization of Louisiana's renewable fish and wildlife resources and their supporting habitats through replenishment, protection, enhancement, research, development, and education for the social and economic benefit of current and future generations; to provide opportunities for knowledge of and use and enjoyment of these resources; and to promote a safe and healthy environment for the users of the resources.

#### **2. Five-Year Plan 2006-2010:**

LDWF's latest five-year strategic plan (2006-2010) listed several goals relative to the threats posed to non-game fish and wildlife species. Some of the objectives in reaching these goals include:

- Developing plans for the recovery of five rare, threatened, or endangered species (RTE) and for the management of other non-game species. Strategies for accomplishing this objective include conducting biological surveys, concentrating on populations and ranges of RTEs and native plants, and determining management options for identified species.
- Development of recovery plans for all species of threatened and endangered fish. Strategies for accomplishing this objective include the development of a list of threatened and endangered fish species in Louisiana, gathering information on historical accounts of RTE species, and the development of recovery plans for RTE species.

The strategic plan is currently undergoing a revision and it is anticipated that many of the recommendations of the CWCS will be incorporated into the revision.

## **B. Problem and Need for a Comprehensive Wildlife Conservation Strategy**

### **1. Background:**

Early in the twentieth century, many of America's once numerous game fish and wildlife species were on the verge of becoming forever lost. In the 1930s, this situation began to change as harvests were better regulated, wildlife management areas and refuges were created, and game species populations were augmented or restored with translocated animals. Much of these efforts were funded by sportsmen through the sale of hunting and fishing licenses and by excise taxes placed on hunting and fishing equipment under the Pittman-Robertson Act (Wildlife Restoration Program) and later the Wallop-Breaux/Dingle-Johnson Acts (Sport Fish Restoration Program).

However, despite these successes, very little attention was given to species that were not hunted or fished. In time, these numerous non-game species were recognized as being in serious decline, some were on the verge of becoming extinct, and a few had been driven to extinction. In 1973 the Endangered Species Act (ESA) was enacted by bipartisan majorities in Congress and signed into law by President Richard Nixon. Upon signing the ESA, President Nixon stated that, "Nothing is more priceless and more worthy of preservation than the rich array of animal life with which our country has been blessed."

Today there are more than 1000 species federally-listed as endangered or threatened with 28 species occurring in Louisiana or its adjacent waters. While conservation efforts have had success in bringing some species back from the brink of extinction, most of these efforts have been very costly, opportunistic, and crisis-driven and have created an atmosphere of mistrust between private landowners and government. The lack of a strategic approach to species and habitat conservation has created the need for a complementary source of funding to support the conservation, protection, and restoration of all the wildlife species in our country.

### **2. Congressional Mandate and Guidance:**

Over the last four years, Congress has appropriated roughly \$325 million towards two federal programs that are specifically designed to take a proactive approach to fish and wildlife species management and address the continuing decline of wildlife species in all fifty States, the District of Columbia, and five U.S. Territories. These two programs, the Wildlife Conservation and Restoration Program (WCRP) and the State Wildlife Grants Program (SWG), were created as a compromise to the defeat of the Conservation and Reinvestment Act of 2000 (CARA) and are designed to provide annual allocations of funding for the development and implementation of on-the-ground efforts to benefit wildlife species and their habitats. This funding is intended to supplement, not duplicate, existing fish and wildlife programs by targeting species in greatest need of conservation, species indicative of the diversity and health of the states' wildlife resources, and species with low and declining populations, as deemed appropriate by the states' fish and wildlife agencies. In creating these new funding measures, Congress also required each state and



territory to develop a Comprehensive Wildlife Conservation Strategy (CWCS) by October 1, 2005.

The following 8 required elements are to be addressed in the CWCS:

1. Information on the distribution and abundance of species of wildlife, including low and declining populations as the State fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the State's wildlife.
2. Descriptions of locations and relative condition of key habitats and community types essential to conservation of species identified in (1).
3. Descriptions of problems which may adversely affect species identified in (1) or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and habitats.
4. Descriptions of conservation actions determined to be necessary to conserve the identified species and habitats and priorities for implementing such actions.
5. Proposed plans for monitoring species identified in (1) and their habitats, for monitoring the effectiveness of the conservation actions proposed in (4), and for adapting these conservation actions to respond appropriately to new information or changing conditions.
6. Descriptions of procedures to review the strategy at intervals not to exceed ten years.
7. Plans for coordinating, to the extent feasible, the development, implementation, review, and revision of the strategy with federal, State and local agencies and Indian tribes that manage significant land and water areas within the State or administer programs that significantly affect the conservation of identified species and habitats.
8. Documentation of broad-based public participation during the development and implementation of the strategy.

### **C. The CWCS in Louisiana**

#### **1. Purpose:**

The purpose of this CWCS is to develop a blueprint for guiding LDWF in the development of management actions for Louisiana's fish and wildlife species with emphasis on species of conservation concern and associated habitats they depend upon.

#### **2. Need:**

- Perform a comprehensive review of the status of all fish and wildlife species in Louisiana

- Provide a clear directive for the future management of these species in Louisiana
- Ensure that their management is consistent with federal, state, and parish plans as well as national and local environmental organization plans and recommendations
- Ensure that all species are protected from the threat of extinction and available for the enjoyment of the citizens of Louisiana

### **3. Goals and Objectives:**

The goals and objectives presented below are the initial ideas in response to the issues, concerns, and needs expressed by the core committee, species technical committees, stakeholders, and the public. These goals and objectives reflect LDWF's commitment to achieve the mandates of the SWG program and the mission of LDWF to serve as the steward of the wildlife resources of Louisiana.

#### **Goal 1: Species Conservation**

Provide the habitat and ecosystem functions that support healthy and viable populations of all species, avoiding the need to list additional species under the Endangered Species Act.

##### **Objective 1**

Conduct a comprehensive review of the current status of all wildlife in Louisiana with a focus on species of conservation concern.

##### **Objective 2**

Develop concrete management strategies which focus on species of conservation concern and their associated habitats identified in the CWCS.

##### **Objective 3**

Formulate partnerships with federal and state agencies, national and local non-governmental organizations, universities, businesses, and the public in the development and implementation of these strategies.

#### **Goal 2: Habitat Conservation**

Identify, conserve, manage, and restore terrestrial and aquatic habitats which are a priority for the continued survival of species of conservation concern.

##### **Objective 1**

Utilize the LNHP database to identify habitat types which are important to the conservation of species of concern, and continually evaluate and update the status of these habitats to direct conservation and restoration efforts.

##### **Objective 2**

Monitor threats to terrestrial and aquatic habitats of priority concern.

##### **Objective 3**

Promote and support terrestrial and aquatic habitat protection efforts.

**Objective 4**

Develop and implement terrestrial and aquatic habitat conservation and management recommendations.

**Objective 5**

Monitor the distribution and impacts of invasive/alien species, and develop and implement management strategies to abate this threat.

**Objective 6**

Promote the reintroduction and the continued use of prescribed fire in fire-dependent habitats.

**Goal 3: Public Outreach and Education**

Support educational efforts to improve the understanding by the general public and conservation stakeholders regarding species of conservation concern and related habitats.

**Objective 1**

Provide educational information using various media types.

**Objective 2**

Increase direct interactions between biologists and public and private stakeholders regarding species of concern and associated habitats.

**Objective 3**

Enhance the user's educational experience on WMAs and refuges.

**Goal 4: Partnerships**

Improve existing partnerships and develop new partnerships between LDWF and State and Federal natural resource agencies, non-governmental organizations and environmental groups, private industry, and academia.

**Objective 1**

Improve cooperative efforts to achieve common goals, improve efficiency, and prevent duplication of efforts.

**Objective 2**

Improve data collection, data management, and the dissemination of information between conservation partners.

**Objective 3**

Increase collaboration and communication with local, state, and regional conservation partners.

The approaches LDWF has considered for accomplishing these goals are:

- habitat conservation - conservation initiatives will be devised to preserve those habitats which are a priority to the continued viability of species of concern;
- species conservation - conservation initiatives will be concentrated on individual focal species or groups of species.

**Habitat Conservation** – Habitat conservation will focus on identifying all the current habitat types in a particular ecoregion, the present threats to these habitats, and ways of abating these threats. By following this approach, we will develop a hierarchical list that allows us to focus our efforts on the habitats of highest importance. The added benefit of this approach is the overall biodiversity conservation of a particular ecoregion.

**Species Conservation** – Species conservation will focus on identifying those species that are considered to have extremely low population estimates and those for which the status is unknown. These estimates will be derived from state rankings developed by LNHP. Specific threats to these species will be considered, and rankings will be developed to guide LDWF in making the decisions necessary to address population objectives.

Incorporating numerous existing plans already developed for the recovery and conservation of identified species will be a central aspect to this strategy. National plans exist for many species groups although the level of detail for quantitative objectives provided in these plans varies widely. Some national plans are supported by plans for smaller geographic areas, and these plans can serve as sources of population targets and habitat objectives.

To be successful in accomplishing this objective, LDWF will include a diverse array of stakeholders made up of federal, state, and local government agencies, non-governmental organizations (NGO's), businesses and industry, and private landowners in the development and implementation of the CWCS.

#### **4. Expected Results and Benefits:**

By addressing localized, regional, and statewide concerns across key terrestrial and aquatic habitats, it is expected that this strategy will:

- Provide updated public information on the current status of species of conservation concern in the state
- Provide updated public information on the current amount of available habitat for these species
- Serve as a means to readily identify the threats/stresses to the habitats these species depend upon and ways of abating them
- Initiate the development of new and improved partnerships to conserve biodiversity of the state

By establishing a framework to measure the effectiveness of the proposed conservation strategies and monitoring the results, this strategy not only fulfills the requirements set forth by Congress, it also serves as a blueprint in providing the critical directives and management objectives LDWF will use to conserve the rich biodiversity of Louisiana for future generations.

## **5. Looking to the Future:**

The Louisiana CWCS is written with a 10-year implementation cycle in mind. Although the document will be rewritten every 10 years, LDWF will report annually which conservation actions were attained, and make modifications as appropriate. The process of monitoring its effectiveness will include submission of monthly reports to the CWCS Coordinator by each division within the agency indicating which conservation actions were accomplished. This process will allow for continual assessment of the effectiveness of the CWCS, and allow for modifications that may be necessary in order to reach the goal of halting species declines in Louisiana. Tables 8.7 and 8.8 identify how we will evaluate and report the effectiveness of this iteration of the CWCS. Interim reporting, project evaluations, and reviews during the next 10 years will determine the nature and direction of the next iteration. There will be a need for fairly frequent review by the existing committees to determine how the CWCS is working as a planning resource and guidance document. Some of the questions that must be answered include:

- Are populations of the species of conservation concern declining?
- How helpful was the CWCS in annual project planning?
- How involved were we with out partners?
- What are the strengths and weaknesses of the CWCS?
- Were species and habitat data gaps filled?
- Were new MOAs completed with partners?
- Were new areas protected for species of conservation concern?
- Were priority habitats protected?
- Were threats identified in the CWCS eliminated or abated?
- Are other species or habitats in need of specific conservation measures?

By using both qualitative and quantitative success criteria, we will evaluate the success of the CWCS and respond to the diverse nature, scope, and scale of the strategies presented herein.

During the next 10 years we will meet at a minimum annually with all of our conservation partners. Within the first year, we will add partner representatives to the Core Committee, which will be responsible for tracking the success of the CWCS. When a CWCS revision occurs the Technical Committees will meet and the status of all wildlife will be reevaluated, and threats analyses will be completed again to determine those species of conservation concern. It will be critical to identify criteria to guide the 10-year review, review the major elements of the CWCS with those criteria, and identify areas needing revision and the nature of the revisions. Revisions will be reviewed by partners, technical teams, and the public in general and then major revisions will come to the Core

Committee, who will make recommendations to the LDWF Secretary for placing the revisions into the CWCS. External views are especially important during the revision to give the LDWF a “reality-check” and an outside perspective.

## CHAPTER 2. STATE OVERVIEW

### A. Geographic Context

#### 1. Geography:

Louisiana is located in the south-central United States at the terminus of the Mississippi River. Alexandria, Baton Rouge, Lafayette, Lake Charles, Monroe, New Orleans, and Shreveport are its major cities.

The physiographic features of the state include pine hills, alluvial plains, coastal marshes, prairies, and bluffs. Natural elevations range from below sea level along the coastal zone to 535 feet in the northern uplands. Land cover in the northwestern and western part of the state consists mostly of upland, mixed evergreen/deciduous forests. The northeast and south-central part of the state is mainly agriculture-cropland-grassland, with some remnant forests consisting of highly fragmented bottomland hardwoods. The upper portion of the southeastern part of the state, known as the Florida Parishes, consists primarily of upland forest dominated by evergreen/mixed hardwoods, agriculture-cropland-grassland areas with some upland scrub-shrub, and longleaf pine flatwoods. The lower southeastern portion is made up mainly of water, marsh areas ranging from fresh to saline, and bottomland hardwoods. The southwestern part of the state is dominated by agriculture-cropland-grassland and upland or wetland scrub-shrub vegetation. The coastal portion of the state is made up mostly of fresh, intermediate, brackish, and saline marshes and, increasingly, open water (Hartley et al. 2000).

Presently, nearly all of coastal Louisiana is retreating before the advance of the Gulf of Mexico due to the containment of the Mississippi River for navigation and flood control, and other factors. The Mississippi and Atchafalaya river deltas are the only coastal areas with significant sediment accretion and delta formation. The floodplain of the Atchafalaya River, the largest tributary of the Mississippi River, holds the best known example of forested wetlands in Louisiana and the largest remaining hardwood swamp in the country.

#### 2. Geology:

Geologically, most of Louisiana's surface area consist of Quaternary sediment. Holocene alluvial sediments deposited by the Mississippi, Red, Ouachita, and other rivers constitute 55% of the surface area, 25% of the state's surface is occupied by deposits associated with Pleistocene terraces, and the final 20% comprises strata of Tertiary age, principally on the Sabine uplift (which lies in the northwest portion of the state), and in the north Louisiana salt-dome basin. Within this area, Cretaceous rocks are present in a few small exposures on the tops of salt domes that have surface expression along with wind-blown loess deposits.

During glacial episodes in the Quaternary, sea levels dropped and shorelines moved seaward. As a result rivers flowing into the Gulf of Mexico would deposit their sediments farther out and outwash deposits of sand, gravel, and silt, known as valley trains, were deposited in the lower Mississippi valley. Remnants of valley trains deposited in the late Pleistocene can be found along the western edge of the Mississippi River flood plain in northeastern Louisiana. Areas adjacent to the Mississippi River valley were covered by loess, a wind-blown silt derived from glacial outwash deposits. Loess deposits up to several meters thick remain preserved in areas flanking the valley.

### **3. Coastal Zone:**

Louisiana has over 3 million acres of coastal wetlands which constitute about 30% of the remaining coastal marsh in the lower 48 states. Louisiana's coastal zone can be divided into two distinct regions: the Chenier Plain, extending west from Vermilion Bay, Louisiana, into Texas; and the Deltaic Plain, from Vermilion Bay east to the Pearl River Basin on the Mississippi state line. Both areas were formed by historic patterns of sedimentation and erosion from the Mississippi River and its distributaries along with influences from the Gulf of Mexico. Over the past several thousand years, these deltaic processes created more than four million acres of coastal wetlands and gave rise to one of the most productive ecosystems on Earth. The Chenier Plain contains highly productive inland lakes and wetlands behind oak-covered remnant beach ridges (cheniers) that parallel the coast. The Deltaic Plain is characterized by a vast system of low-lying wetlands and coastal barrier islands (Benoit 1997). These wetland ecosystems are of national significance in terms of their ability to support substantial commercial and recreational freshwater and marine fisheries. They also serve as a haven for fur-bearing animals, shorebirds, waterbirds, overwintering waterfowl, and migrating Neotropical songbirds.

Coastal Louisiana has one of the highest land loss rates in the United States. Thirty-five to 40 sq miles of coastal wetlands are estimated to have disappeared annually over the last 30 years, accounting for 90% of coastal marsh loss nationwide. Annual losses were estimated by the U.S. Army Corps of Engineers (COE) to be 40-50 sq miles during the late 1980's (Benoit 1997, Johnston et al. 1995). Since the 1930s, coastal Louisiana has lost over 1.2 million acres of land. It was estimated in 2000 that coastal Louisiana would experience an additional loss of 431,000 acres by 2050 (Fig. 2.1). Historic hydromodification of the Mississippi River, dredging canals for oil and gas exploration and pipeline installation, and dredging and filling for residential and commercial development combine with natural factors, such as hurricanes, to produce such losses (Benoit 1997). Additionally, sea level rise, land subsidence, and erosion of barrier islands, which leave the leeward areas less adequately buffered from wind and tidal influences, contribute to coastal wetland loss by converting coastal wetlands to open water areas. The extraction and transport of crude oil, natural gas, and other minerals from state lands and waters, and from the federally-controlled Outer Continental Shelf have required the development of an extensive network of access canals, pipelines, and drilling sites. These activities have contributed greatly to land loss and to ecosystem alterations from ensuing saltwater intrusion (Benoit 1997).



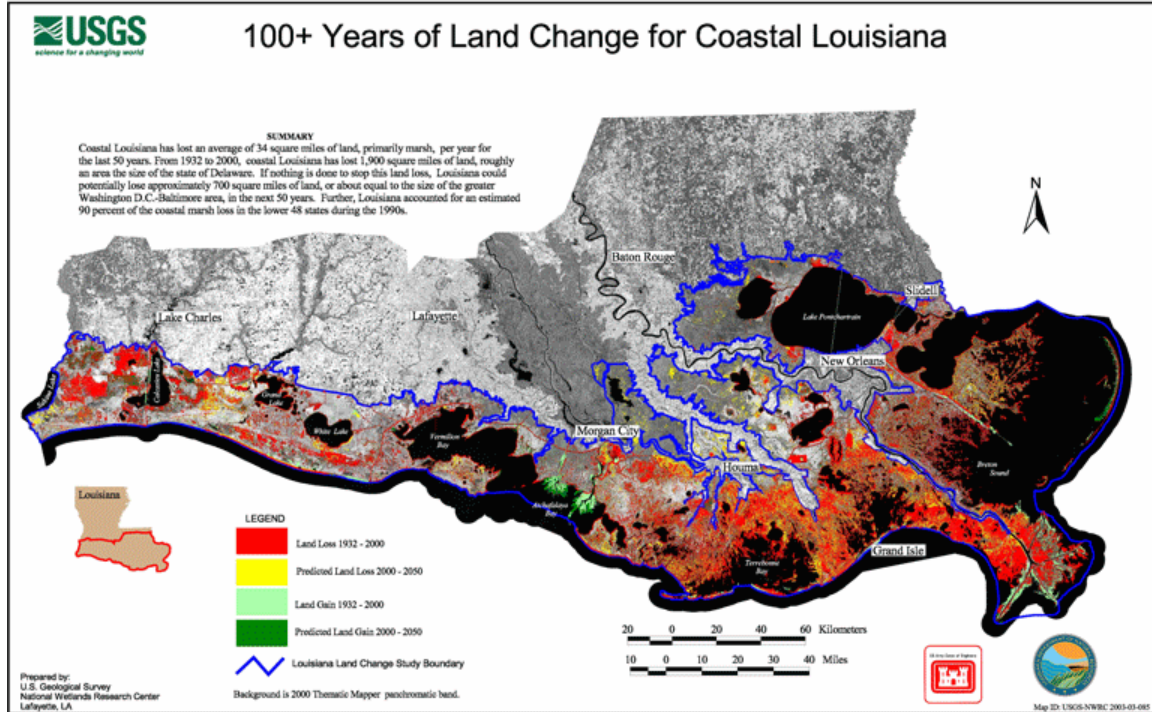


Figure 2.1. Historical and projected land loss for coastal Louisiana.

#### 4. Coastal Zone Facts:

**Historical Land Loss in Coastal Louisiana** - Louisiana has lost 1,900 square miles of land since the 1930's (Barras et al. 1994, Barras et al. 2003, Dunbar et al. 1992). Currently Louisiana has 30% of the total coastal marsh and accounts for 90% of the coastal marsh loss in the lower 48 states (Dahl 2000, Field et al. 1991, USGS 2005).

**Current Rate of Coastal Land Loss** - Between 1990 and 2000, wetland loss was approximately 24 square miles per year- that is the equivalent of approximately one football field lost every 38 minutes. The projected loss over the next 50 years, with current restoration efforts taken into account, is estimated to be approximately 500 square miles (Barras et al. 2003).

**Population Living in the Coastal Parishes** - In 2000, over 2 million residents- more than 50% of the state's population according to U.S. Census Bureau (USCB) estimates- lived in Louisiana's coastal parishes (USCB 2002).

**Louisiana Energy Facts** - Among the 50 states, the following are some statistics for Louisiana's Primary Energy Production for 2003 (LDNR 2004). Although production is statewide, much comes from the coastal parishes.

	Crude Oil	Natural Gas
Including Outer Continental Shelf Production	Ranks 1 <sup>st</sup>	Ranks 2 <sup>nd</sup>
Excluding Outer Continental Shelf Production	Ranks 4 <sup>th</sup>	Ranks 5 <sup>th</sup>

**Waterborne Commerce** - Louisiana coastal wetlands provide storm protection for ports that carry nearly 500 million tons of waterborne commerce annually, which accounts for 21% of all waterborne commerce in the United States each year. Four of the top ten largest ports in the United States are located in Louisiana (COE 2002).

**Commercial Fishing** - In 2002, Louisiana commercial landings exceeded 1 billion pounds with a dockside value of \$343 million, that accounts for approximately 30% of the total catch by weight in the lower 48 States (USDC 2002).

**Fur Harvest** - Trapping in Louisiana coastal wetlands generates approximately \$2 million annually (LDWF 2004a).

**Alligator Harvest** - The Louisiana alligator harvest is valued at approximately \$30 million annually (LDWF 2003).

**Waterfowl** - Louisiana's coastal wetlands provide habitat for over 5 million migratory waterfowl (LDWF 2000).

**Coastal Restoration Projects (1986-2004)** - 467 projects have been constructed

State-funded projects - 39 projects constructed

Breaux Act projects - 71 projects constructed

Parish Coastal Wetlands Restoration Program (Christmas Tree Program) - 35 projects constructed

Other federally-assisted projects - 31 projects constructed

Vegetation Planting Program - 291 project sites

#### **Other Coastal Restoration Efforts**

Breaux Act Projects - 61 additional projects have been approved and are currently in the design phase.

Louisiana Coastal Area Comprehensive Coastwide Ecosystem Restoration Study (LCA) - The goal of the LCA Study is to gain a federal and state commitment to a large-scale ecosystem restoration program in coastal Louisiana ([www.lca.gov](http://www.lca.gov)).

America's Wetland Campaign - The campaign was established in 2002 to increase national and world awareness of issues associated with Louisiana's coastal wetland loss ([www.americaswetland.com](http://www.americaswetland.com)).

Note: The above listed coastal zone facts change regularly and are only current as of 07/13/2005.

## **5. Climate:**

The climate in Louisiana is relatively mild due to the subtropical influence of the Gulf of Mexico and cooler, drier air from the central plains. Summers tend to be hot and humid and winters are mild. Monthly temperatures range from an average high of 93.3 F in the summer to an average low of 36.2 F in the winter. Average yearly precipitation ranges from 66 inches in the southeast to 48 inches in the northwest. The growing season is roughly 220 days in length. Louisiana is impacted by tropical weather disturbances with an average frequency of one tropical storm every 1.6 years, one hurricane every 3.3 years, and a major hurricane every 14 years (Roth 1998).

## **B. Land Ownership and Population Trends**

### **1. Land Ownership:**

The state of Louisiana covers 31.4 million acres, of which 3.8 million acres are

covered by water (NRCS 2000). Roughly 7% is in federal or state ownership and 93% is privately owned (Hartley et al. 2000). The high degree of private land ownership highlights the vital role private landowners can play in the conservation of the state's wildlife and fisheries resources.

Louisiana's forestlands cover 48% (13.2 million acres) of the state's land area (NRCS 2000). Private, non-industrial landowners own 62% of the state's forestland, forest-product industries own 29%, and the remaining 9% is in state or federal ownership (LDAF 2004). Agriculture lands cover 42% (11.5 million acres) of the state's land area with 73% (8.4 million acres) classified as actual crop, pasture or rangelands, 26% (3.0 million acres) classified as other rural lands and 1% (250,007 acres) classified as Conservation Reserve Program (CRP) land (NRCS 2000, 2005).

**2. Population Trends:**

According to the USCB (2000), Louisiana experienced a 5.9% increase in its population from 1990 to 2000. Much of this increase stems from urbanization of cities and is not reflective of an overall parish-wide population increase. Areas of the state which experienced some of the greatest increases due to residential development include Ascension, Livingston, St. Tammany, and Tangipahoa Parishes which together comprise a large portion of the East Gulf Coast Plain Ecoregion. In contrast, many parishes in the Upper West Gulf Coast Plain and the upper portion of the Mississippi River Alluvial Plain show decreasing population trends (Fig. 2.2). Habitat fragmentation, degradation,

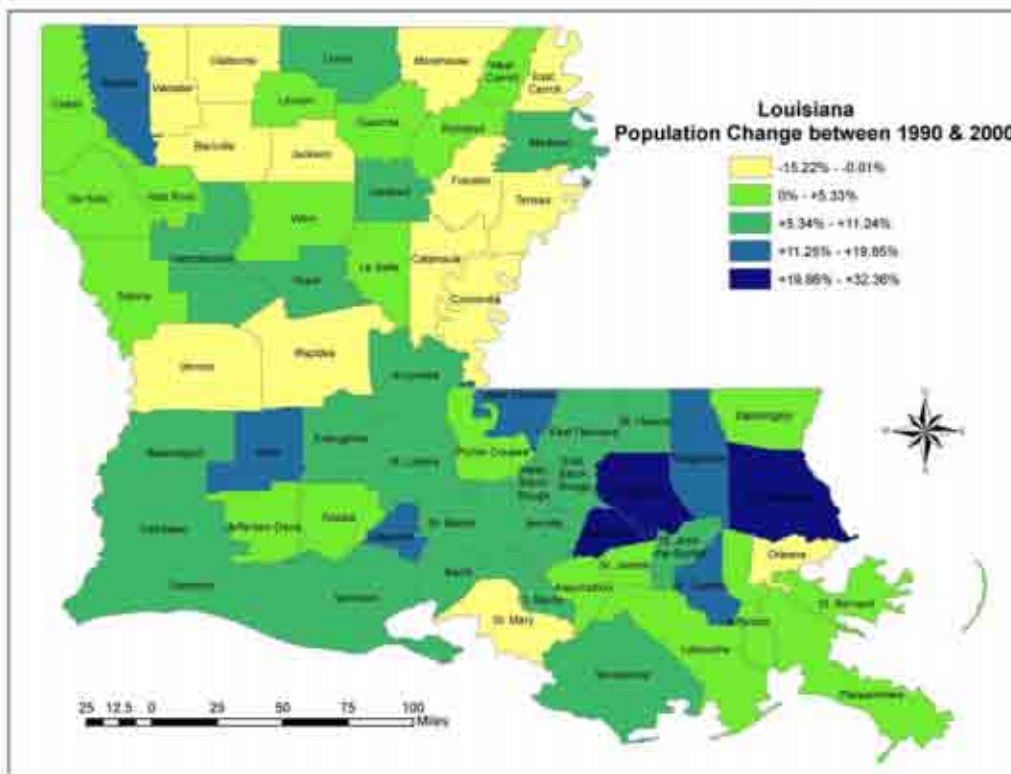


Figure 2.2. Louisiana's population trends by parish between 1990 and 2000.

and loss due to the continued increase in the population growth and associated development throughout Louisiana are some of the greatest threats to the state's wildlife and fisheries species. However, in areas which are experiencing population declines, the potential for habitat improvements for many of Louisiana's wildlife and fish species should be greater.

### **C. Recent Trends in Consumptive and Non-consumptive Recreational Use in Louisiana**

Sportspersons and wildlife watchers across the United States spend \$110 billion annually, 1.1 percent of the Nation's gross domestic product. In the southeastern region of the country, 19 percent of the population identify themselves as anglers, 9 percent are hunters, and 25 percent of the population participates in wildlife viewing activities (USDI et al. 2003).

Data provided by the latest National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (USDI et al. 2003) show that for the year 2001, 1.6 million people participated in fishing, hunting, and wildlife-watching activities in Louisiana. These activities resulted in roughly \$1.6 billion in expenditures with the majority spent on equipment (58%) and trip-related (36%) expenses. A total of 970,000 sportspersons participated in fishing and 12.1 million recreational fishing trips were made. Total expenditures were \$703 million with 57% trip-related, 39% for equipment, and 5% for other expenses. A total of 333,000 sportspersons participated in hunting and 6.3 million hunting trips were made. Total hunting expenditures were \$446 million with 61% spent on equipment, 27% trip-related, and 12% for other expenses. A total of 935,000 people participated in wildlife-watching activities and 2.4 million trips were made. Total expenditures were \$168 million with 58% spent on equipment, 33% trip-related and 9% for other expenses.

### **D. Ecological Regions and Aquatic Drainage Basins in the State**

#### **1. Terrestrial Systems:**

Louisiana contains a highly diverse ecological landscape and the physiographic distribution of species often corresponds to ecological boundaries. Areas which share similar ecological attributes such as vegetation, soils, geology, climate, hydrology, and wildlife can be classified as ecoregions. Using an ecoregion approach to conservation planning will allow LDWF to facilitate the implementation of the CWCS by identifying research and information needs, assessing environmental resources, determining regional conservation goals, and maximizing to the extent possible the limited agency resources currently available for species of conservation concern. For terrestrial species and habitats this strategy will follow the ecoregional habitat classification developed by The Nature Conservancy (TNC), which is adapted from Bailey (1995) and modified by the LNHP (Fig. 2.3).

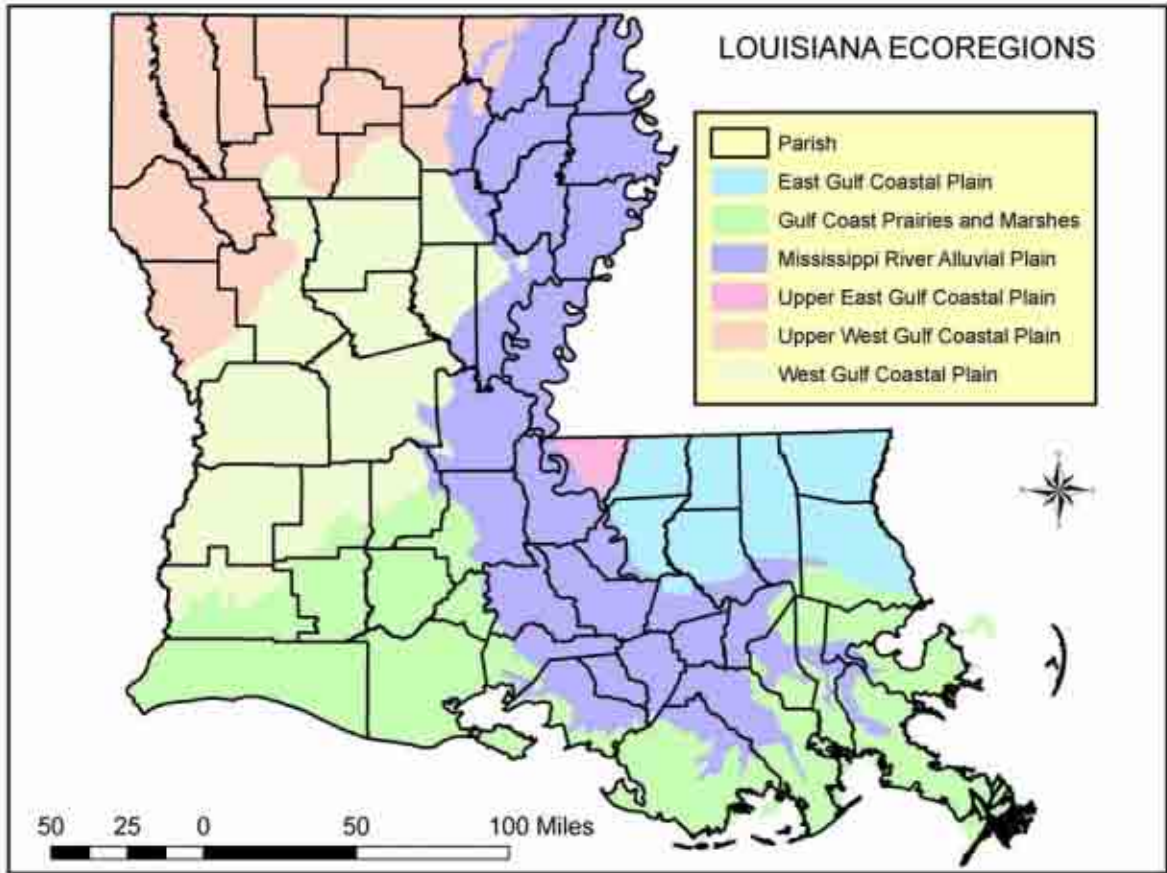


Figure 2.3. Ecoregions of Louisiana.

**a. East Gulf Coastal Plain**

The East Gulf Coastal Plain (EGCP) ecoregion extends from southwestern Georgia across western Florida, southern Alabama, and Mississippi, and into the Florida Parishes of Louisiana. It occurs in all or parts of East Feliciana, East Baton Rouge, Ascension, Livingston, St. Helena, Tangipahoa, St. Tammany, and Washington Parishes (Fig. 2.4). There is a transition of natural community types across this ecoregion. The western parishes of East Baton Rouge, Livingston, and Ascension contain influences from the Mississippi River Alluvial Plain with some Bottomland Hardwood Forests. Also in these three parishes are the Spruce Pine – Hardwood Flatwoods that appear to be a transition type between the bottomland forests and longleaf

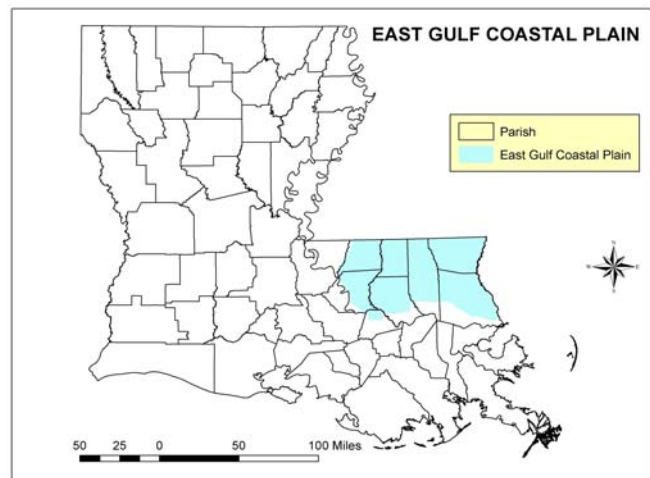


Figure 2.4. East Gulf Coastal Plain Ecoregion.

pine savannahs (Smith 1996). Eastern Longleaf Pine Savannahs, along with the Live Oak – Pine – Magnolia Forests, were once one of the predominant natural community types in the southeastern Florida Parishes. Also found in the EGCP are the Eastern Upland Longleaf Pine Forests, Eastern Hillside Seepage Bogs, and Slash Pine – Pondcypress – Hardwood Forests. Cypress Swamps, Small Stream Forests, and Bayhead Swamps occur throughout the ecoregion. Table 2.1 lists all of the habitats within the ecoregion and the number of species of conservation concern occurring within each habitat.

Table 2.1. Habitats and associated terrestrial species of conservation concern, by taxa, found in the East Gulf Coastal Plain ecoregion.

Habitat	Amphibian	Bird	Butterfly	Mammal	Reptile	Total
Eastern Longleaf Pine Savannah	8	14	2	5	8	37
Eastern Upland Longleaf Pine Forest	4	13	1	5	10	33
Mixed Hardwood-Loblolly Pine/Hardwood Slope Forest	4	14	2	6	7	33
Shortleaf Pine/Oak-Hickory Forest	0	18	4	5	2	29
Bottomland Hardwood Forest	2	16	2	5	3	28
Small Stream Forest	2	14	3	5	2	26
Agriculture/Cropland/Grassland	0	12	6	4	0	22
Slash Pine-Pond Cypress-Hardwood Forest	7	11	0	3	1	22
Live Oak-Pine-Magnolia Forest	1	11	0	3	4	19
Bayhead Swamp/Forested Seep	2	12	1	3	0	18
Cypress-Tupelo-Blackgum Swamp	1	10	1	4	1	17
Spruce Pine-Hardwood Flatwood	3	3	1	4	2	13
Eastern Hillside Seepage Bog	2	3	1	2	0	8

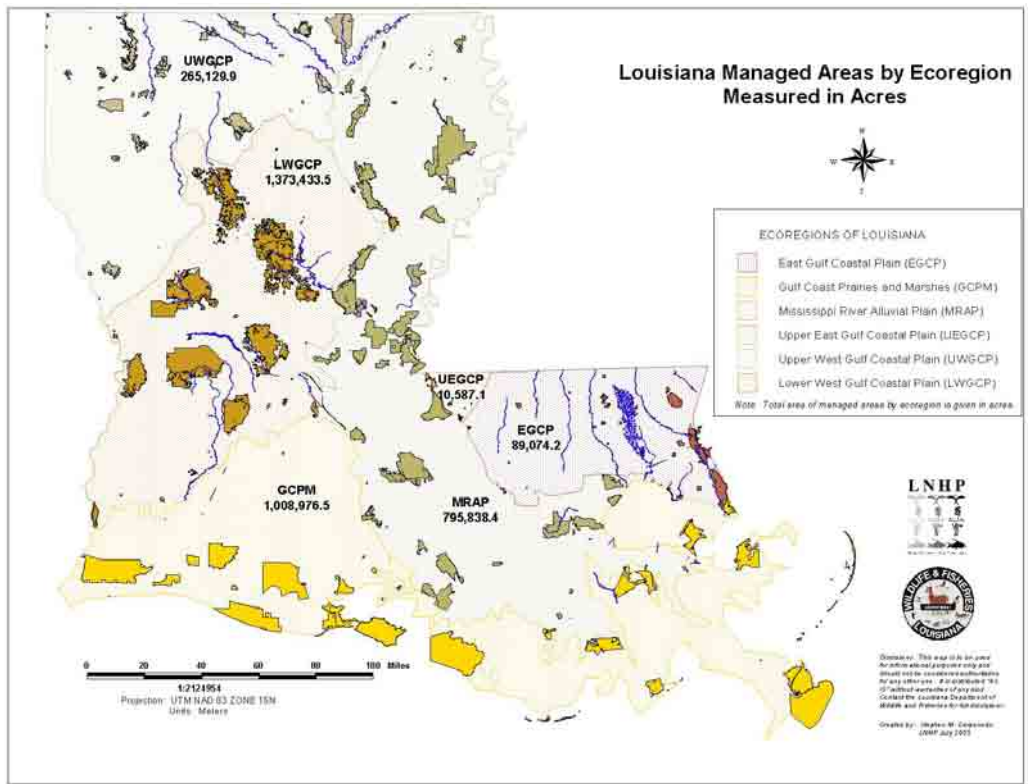


Figure 2.5. Managed areas and scenic streams in Louisiana.

Managed areas within Louisiana comprise 3.5 million acres and are found in all ecoregions of the state (Fig.2.5, Appendix A). In the EGCP, federal lands include Camp Villere National Guard Base, Bogue Chitto National Wildlife Refuge (NWR) and the northern parts of Big Branch Marsh NWR. Wildlife Management Areas include Hutchinson Creek, Sandy Hollow, Ben’s Creek, Waddill, Lake Ramsey Savannah, Tangipahoa Parish School Board, and Pearl River. State parks include Tickfaw, Fairview-Riverside, and Fontainebleau. State historic sites include Port Hudson and Centenary.

As one of Louisiana’s fastest growing areas, the EGCP will continue to experience the pressures of urban expansion and this poses the toughest challenge in balancing the needs of wildlife with that of humans. Population estimates from the 2000 census totaled 870,000 and is projected to increase by 8% to 945,000 in 2005 and by 15% to over 1 million by 2010 (LDED 2004).

**b. Upper East Gulf Coastal Plain**

The Upper East Gulf Coastal Plain (UEGCP) ecoregion includes portions of five states from western Kentucky and Tennessee down through Mississippi and Alabama and into Louisiana where a very small portion extends into West Feliciana Parish (Fig. 2.6). Within this small area of the state, Southern Mesophytic Hardwood Forest is the predominant natural community type that developed on loess hills with steep ravines and intermittent or spring-fed streams. Other associated community types include Hardwood Slope Forests and Mixed Hardwood –

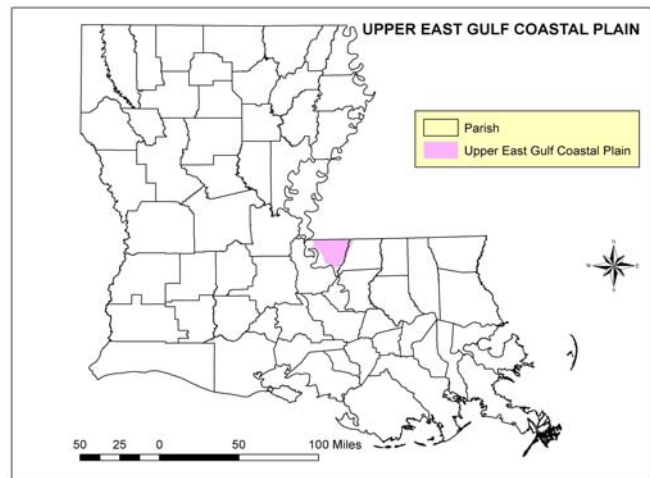


Figure 2.6. Upper East Gulf Coastal Plain Ecoregion.

Loblolly Forests. Bottomland Hardwood Forests, Small Stream Forests, and Cypress Swamps also are found in low-lying areas of this ecoregion with level to gentle topography. Table 2.2 lists all of the habitats within the ecoregion addressed within the strategy along with the number of species of conservation concern occurring within these habitats. The only state-managed area is Tunica Hills WMA. State historic sites include Locust Grove and Audubon (Fig. 2.5, Appendix A).

Table 2.2. Habitats and associated terrestrial species of conservation concern, by taxa, found in the Upper East Gulf Coastal Plain ecoregion.

Habitat	Amphibian	Bird	Butterfly	Mammal	Reptile	Total
Southern Mesophytic Hardwood Forest	3	11	2	6	2	24
Small Stream Forest	1	14	1	5	1	22
Agriculture/Cropland/Grassland	0	14	3	3	0	20

**c. Mississippi River Alluvial Plain**

The Mississippi River Alluvial Plain (MRAP) ecoregion extends from the very southern tip of Illinois down through southeastern Missouri, encompasses all of eastern Arkansas, the delta region of Mississippi and into northeast Louisiana then south following the Mississippi River to where its bottomland forests meet the coastal marshes. The ecoregion includes all or portions of East Carroll, West Carroll, Morehouse, Ouachita, Richland, Madison, Franklin, Caldwell, Tensas, Catahoula, LaSalle, Concordia, Avoyelles,

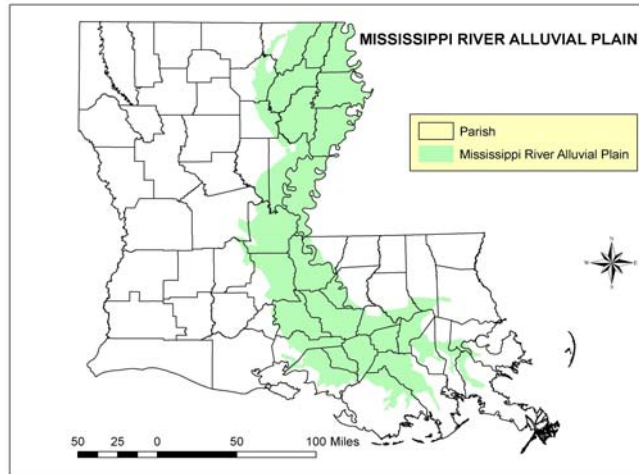


Figure 2.7. Mississippi River Alluvial Plain Ecoregion.

Rapides, Evangeline, St. Landry, Pointe Coupee, West Feliciana, West Baton Rouge, East Baton Rouge, Iberville, St. Martin, Lafayette, Iberia, St. Mary, Assumption, Terrebonne, Lafourche, St. James, Ascension, St. John the Baptist, Livingston, Tangipahoa, St. Charles, Jefferson, Orleans, Plaquemines, and St. Bernard Parishes (Fig. 2.7). The MRAP, rich in alluvial sediments, is known primarily for Bottomland Hardwood Forest natural community types as well as associated Cypress and Cypress-Tupelo Swamps. In addition, the northeastern portion of this ecoregion contains both Wet and Mesic Hardwood Flatwoods which are found on Macon Ridge. Table 2.3 lists all of the habitats within the ecoregion and the number of species of conservation concern occurring within each habitat.

Table 2.3. Habitats and associated terrestrial species of conservation concern, by taxa, found in the Mississippi River Alluvial Plain ecoregion.

Habitat	Amphibian	Bird	Butterfly	Mammal	Reptile	Total
Agriculture/Cropland/Grassland	1	24	1	4	0	30
Bottomland Hardwood Forest	2	17	1	5	2	27
Batture	0	14	0	1	2	17
Cypress-Tupelo-Blackgum Swamp	1	10	1	4	1	17
Hardwood Flatwoods	1	10	0	5	1	17
Live Oak Natural Levee Forest	0	14	0	1	1	16
Sandbars	0	3	0	0	2	5

Federal lands include Indian Bayou WMA (COE), Black Bayou Lake, Handy Break, Tensas River, Bayou Cocodrie, Catahoula Lake, Lake Ophelia, Grand Cote, Cat Island, Atchafalaya, and Bayou Teche NWRs. Wildlife Management Areas include Bayou Macon, Big Colewa Bayou, Floy McElroy, Russell Sage, Ouachita, Big Lake, Buckhorn,



Boeuf, Dewey W. Wills, Red River, Three Rivers, Grassy Lake, Spring Bayou, Pomme De Terre, Thistlethwaite, Sherburne, Joyce, Manchac, Maurepas Swamp, Attakapas Island, and Elm Hall. State parks include Chemin A Haut, Lake Bruin, Lake Fausse Point, and Cypremort Point. State historic sites include Poverty Point, Winter Quarters, Marksville, and Longfellow-Evangeline (Fig. 2.5, Appendix A).

#### d. Upper West Gulf Coastal Plain

The Upper West Gulf Coastal Plain (UWGCP) ecoregion extends from south-central and southwestern Arkansas over to the extreme southeastern portion of Oklahoma and down into eastern Texas east to parts of northeastern Louisiana. It occurs in all or portions of Caddo, Bossier, Webster, Claiborne, Union, Morehouse, Ouachita, Lincoln, Jackson, Bienville, Natchitoches, Red River, Sabine, and DeSoto Parishes (Fig. 2.8).

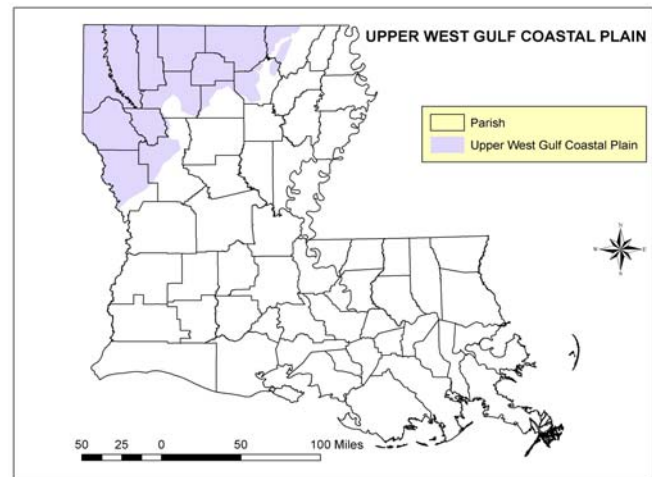


Figure 2.8. Upper West Gulf Coastal Plain Ecoregion.

The UWGCP was once recognized as the Shortleaf Pine – Oak – Hickory region of Louisiana, existing on sandy and clayey uplands above the range of longleaf pine in the West Gulf Coastal Plain (Newton, 1972). Upon settlement, the majority of the shortleaf pine was logged and has been replaced most recently by loblolly pine plantations. However, some natural stands of Shortleaf Pine - Oak - Hickory Forest still exist in this ecoregion. Western Xeric Sandhill Woodlands occur on xeric sands in the UWGCP. Hardwood Slope Forests and Mixed Hardwood - Loblolly Forests develop on more mesic conditions. Wet bottomlands include natural communities such as: Forested Seeps, Bayhead Swamps, Small Stream Forests, Bottomland Hardwood Forests, and Cypress Swamps. Table 2.4 lists all of the habitats within the ecoregion and the number of species of conservation concern occurring within each habitat.

Federal lands include the upper parts of Red River, Upper Ouachita, and D’Arbonne NWRs, the Caney Ranger District of Kisatchie National Forest (KNF), and the East Range of Barksdale Air Force Base (AFB). Wildlife Management Areas include Soda Lake, Bayou Pierre, Loggy Bayou, Jackson-Bienville, and Sabine. State Parks include Lake Claiborne, Lake D’Arbonne, Lake Bistineau, and North Toledo Bend. State historic sites include Mansfield, Los Adaes, and Fort Jessup (Fig. 2.5, Appendix A).

Table 2.4. Habitats and associated terrestrial species of conservation concern, by taxa, found in the Upper West Gulf Coastal Plain ecoregion.

Habitat	Amphibian	Bird	Butterfly	Mammal	Reptile	Total
Shortleaf Pine/Oak-Hickory Forest	2	20	6	5	4	37
Agriculture/Cropland/Grassland	2	20	6	3	1	32
Mixed Hardwood-Loblolly Pine/ Hardwood Slope Forest	2	17	5	5	3	32
Western Upland Longleaf Pine Forest	3	13	6	5	4	31
Small Stream Forest	3	15	3	6	1	28
Bottomland Hardwood Forest	4	15	1	3	3	26
Bayhead Swamp/ Forested Seep	1	12	3	3	0	19
Cypress-Tupelo-Blackgum Swamp	1	10	0	3	1	15
Western Xeric Sandhill Woodland	1	7	2	1	4	15
Hardwood Flatwoods	1	9	0	3	1	14
Calcareous Prairie	0	5	3	2	1	11
Calcareous Forest	0	4	0	1	1	6
Saline Prairie	0	3	0	2	1	6

### e. Lower West Gulf Coastal Plain

The Lower West Gulf Coastal Plain (LWGCP) ecoregion occurs from central Louisiana into eastern Texas. It includes all or portions of Ouachita, Jackson, Caldwell, Catahoula, LaSalle, Rapides, Avoyelles, Evangeline, Allen, Jefferson Davis, Calcasieu, Beauregard, Vernon, Sabine, Natchitoches, Grant, Winn, and Bienville Parishes (Fig. 2.9). This ecoregion is distinguished by a wide range of natural community types but is primarily known for its longleaf pine forests. In the central portion of this ecoregion, Western Upland

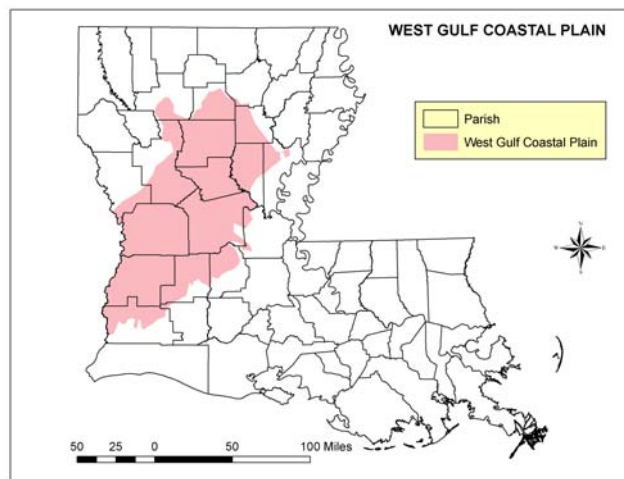


Figure 2.9. Lower West Gulf Coastal Plain Ecoregion.

Longleaf Pine Forests are found in association with Hardwood Slope Forests, and Mixed Hardwood - Loblolly Forests. Forested Seeps and Western Hillside Seepage Bogs occur along slopes and at lower elevations. The LWGCP contains unique geologic formations occurring in northeast to southwest bands across the ecoregion from Caldwell to Vernon Parish. These uplifted formations, the Jackson, Catahoula, Cook Mountain, and Fleming formations, present distinctive soil types and conditions which influenced the development of natural community types along these formation bands. Depending on the formation type and degree of uplift, calcareous clays, sandstones, saline deposits, siltstones and ironstones have shaped the development of natural communities such as the Calcareous Forests, Calcareous Prairies, Saline Prairies, and Sandstone Glades/Barrens of this ecoregion. The south and southwestern portions of the LWGCP ecoregion in Louisiana are known for Western Longleaf Pine Savannahs and associated Flatwoods Ponds and Seepage Bogs. This portion of the ecoregion is the transition zone between

Louisiana’s coastal prairies and upland longleaf pine forests. Table 2.5 lists all of the habitats within the ecoregion and the number of species of conservation concern occurring within each habitat.

Table 2.5. Habitats and associated terrestrial species of conservation concern, by taxa, found in the Lower West Gulf Coastal Plain ecoregion.

Habitat	Amphibian	Bird	Butterfly	Mammal	Reptile	Total
Agriculture/Cropland/Grassland	1	23	7	3	1	35
Shortleaf Pine/Oak-Hickory Forest	2	19	5	5	3	34
Mixed Hardwood-Loblolly Pine/ Hardwood Slope Forest	2	16	4	6	2	30
Western Upland Longleaf Pine Forest	3	13	5	4	3	28
Small Stream Forest	3	14	2	6	1	26
Bottomland Hardwood Forest	3	16	1	3	2	25
Western Longleaf Pine Savannah	2	16	2	2	2	24
Bayhead Swamp/ Forested Seep	1	12	2	2	0	17
Cypress-Tupelo-Blackgum Swamp	1	10	0	2	1	14
Calcareous Prairie	0	5	4	2	1	12
Western Xeric Sandhill Woodland	0	7	2	0	3	12
Calcareous Forest	0	4	0	2	1	7
Saline Prairie	0	3	0	2	1	6
Sandstone Glade/Barren	1	3	1	0	1	6
Western Hillside Seepage Bog	0	3	0	0	0	3

Federal lands include the lower portions Red River NWR and the Calcasieu, Catahoula, Kisatchie, and Winn Ranger Districts of KNF. Military lands include Fort Polk, Peason Ridge, and Camp Beauregard. Wildlife Management Areas include Boise-Vernon, Sabine Island, Walnut Hills, Marsh Bayou, Alexander State Forest, West Bay, Little River, Elbow Slough, and Sicily Island. State Parks include Caney Creek Lake, Chicot, South Toledo Bend, and Sam Houston Jones (Fig. 2.5, Appendix A).

**f. Gulf Coast Prairies and Marshes**

The Gulf Coast Prairies and Marshes (GCPM) ecoregion occupies the coastal zone of the Gulf of Mexico and stretches from Mexico up through Texas and into Louisiana. In Louisiana it occurs from the southwest portion of Louisiana’s coastal prairie region and southwest coast, extending east along the entire coastal area to southeast Louisiana. The GCPM occurs in all or portions of Lafayette, Acadia, St. Landry, Evangeline, Allen, Jefferson Davis, Calcasieu, Cameron, Vermilion, Iberia, St. Mary, Terrebonne, La Fourche, St. Charles, St. John the Baptist, Jefferson,

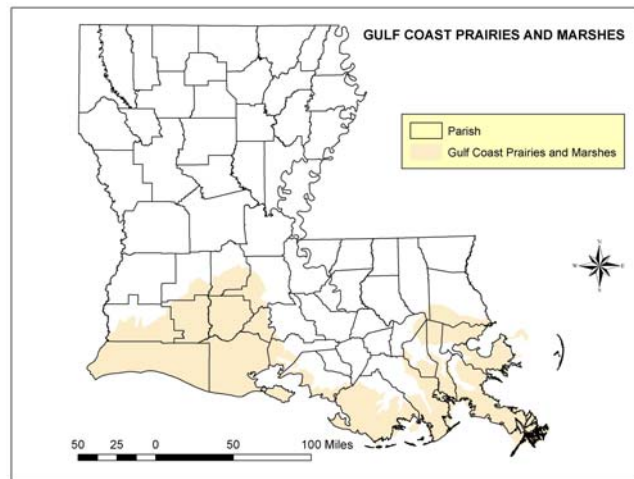


Figure 2.10. Gulf Coast Prairies and Marshes Ecoregion.

Plaquemines, St. Bernard, Orleans, St. Tammany, and Tangipahoa Parishes (Fig. 2.10).

As its name implies, this ecoregion's boundaries are defined by the coastal prairie and marsh natural community types. Louisiana's coastal prairies, once encompassing an estimated 2.5 million acres in the southwest portion of the state, now are considered critically imperiled with less than 600 acres remaining. The coastal marsh areas are comprised of salt, brackish, intermediate, and fresh marsh types across the coastal region. Associated natural communities include Cypress and Cypress-Tupelo Swamps, Coastal Live Oak-Hackberry Forests (cheniers) of the southwest coast, Live Oak Natural Levee Forests of the southeast coast, and some Bottomland Hardwood Forests. Also, the Salt Dome Hardwood Forests are unique to the south-central coast occurring on salt domes in this area. Table 2.6 lists all of the habitats within the ecoregion and the number of species of conservation concern occurring within each habitat.

Federal lands include Jean Lafitte National Historic Park and Sabine, Cameron Prairie, Lacassine, Shell Keys, Mandalay, Bayou Savage, Brenton, and Delta NWRs. Wildlife Management Areas include Rockefeller, Louisiana, Paul J. Rainey Wildlife Sanctuary, Marsh Island, Atchafalaya Delta, Terrebonne Barrier Islands, Pointe-Aux-Chenes, Salvador, Timken, Wisner, Pass-A-Loutre, and Biloxi. State Parks include Bayou Segnette, Cheniere au Tigre, Grande Isle, Palmetto Island, and St. Bernard (Fig. 2.5, Appendix A).

Table 2.6. Habitats and associated terrestrial species of conservation concern, by taxa, found in the Gulf Coast Prairies and Marshes ecoregion.

Habitat	Amphibian	Bird	Butterfly	Mammal	Reptile	Total
Brackish Marsh	0	30	5	0	1	36
Agriculture/Cropland/Grassland	1	27	5	1	1	35
Freshwater Marsh	0	27	3	0	1	31
Intermediate Marsh	0	26	5	0	0	31
Salt Marsh	0	20	5	0	1	26
Barrier Islands	0	17	2	0	6	25
Coastal Prairie	1	17	3	1	2	24
Vegetated Pioneer Emerging Delta	0	23	0	0	0	23
Bottomland Hardwood Forest	2	10	3	2	1	18
Coastal Live Oak-Hackberry Forest	0	7	2	1	2	12
Salt Dome Hardwood Forest	0	8	2	2	0	12
Coastal Dune Grassland/Shrub Thicket	0	6	2	1	2	11
Cypress-Tupelo-Blackgum Swamp	1	5	1	1	1	9
Coastal Mangrove-Marsh Shrubland	0	6	2	0	0	8
Live Oak Natural Levee Forest	0	7	0	0	0	7
Barrier Island Live Oak Forest	0	3	0	0	1	4

## **2. Aquatic Systems:**

### **a. Freshwater**

Louisiana's abundant bayous, rivers, lakes, reservoirs, and wetlands provide unlimited fishing, hunting, boating and recreational opportunities and are a major contributor to the state's wealth and economic growth. Today, aquatic habitats are in high demand as sources of domestic water supplies, irrigation for agriculture, and wastewater treatment. A growing proportion of Louisiana's population is beginning to appreciate the importance of our aquatic habitats as nursery areas for our commercial and sport fisheries. They are beginning to fully understand the problems of balancing biological and recreational uses with agriculture and urban needs, navigation, flood control, and waste water disposal.

Louisiana has more surface water available (84%) than any other state (XU 2004) and contains over 66,294 miles of rivers and streams, 1,078,031 acres (1,684 square miles) of lakes and reservoirs, 5,550,951 acres (9,191 square miles) of fresh and tidal wetlands and 4,899,840 acres (7,656 square miles) of estuaries (LDEQ 2004). The Mississippi River and its major tributary the Red River, along with other major river systems (Ouachita, Black, Calcasieu, Atchafalaya, Sabine, Pearl, and Mermentau), combine to incorporate more than 2,300 miles of navigable waterways.

The Mississippi drainage basin covers approximately 1.2 million square miles which represents 41% of the conterminous United States and 1/8 of North America. Combined with the Atchafalaya River basin, these two river systems are habitat for 195 species of native freshwater fish which represents almost 1/3 of the freshwater fish species in North America (Fremling et al. 1989). In addition, both river systems are habitat for over 40 species of marine fish. They also serve as conduits for the spread of invasive animal species such as the Rio Grande cichlid, Zebra mussel, and five species of Asian carp (LDWF 2004b).

A vast array of levees have been constructed for flood protection and to channelize the water flow in the rivers. Louisiana has more than 2,000 miles of levees as well as other flood control devices along these rivers. The present condition of Red and Pearl Rivers are heavily influenced by the locks and dams constructed for navigation and to control water levels. The Red River has a total of 5 lock and dam systems constructed between the Arkansas line and its outfall at the Mississippi River. The Sabine, Pearl, Atchafalaya, and Black Rivers have all undergone alterations to their natural flow regime.

There are roughly 488 lakes, ponds, and man-made reservoirs in Louisiana. These water bodies account for nearly 1.5 million surface acres of water. The largest of these is Lake Pontchartrain with a surface acreage that covers 621 square miles and totals 397,000 acres. Toledo Bend Reservoir located on the Louisiana/Texas border is the largest man-made body of water in the South and fifth largest in surface acres in the United States. The reservoir covers 186,000 acres and has a controlled storage capacity of 4,477,000 acre-feet (1.4 trillion gallons). The reservoir was formed when the Sabine

River was impounded for hydroelectric purposes, water supply, and recreation. Many of the states lakes are small natural oxbows, which are remnants of rivers after they have altered their course.

**b. Water Quality Assessments:**

The Louisiana Department of Environmental Quality (LDEQ) completed sampling of all twelve of Louisiana’s watershed management basins in 2002. A total of 479 water body management subsegments within the state were monitored once per month for a full year (LDEQ 2004). Designated use categories for the waters of Louisiana are: agriculture, drinking water supply, ecological significance, fish and wildlife propagation, outstanding natural resource, oyster production, and primary and secondary contact recreation. Water quality assessments for fish and wildlife propagation for the 4 major water body categories in Louisiana are listed in Table 2.7. Some of the major causes for water bodies not supporting their designated uses are: fecal coliform, dissolved oxygen, total suspended solids, turbidity, siltation, metals, pesticides, and total dissolved solids. For the water quality assessments given for each basin in Chapter 4, only the three primary designated uses recognized by LDEQ for most waters of the state are addressed. These 3 designated uses are primary contact recreation (swimming), secondary contact recreation (boating), and fish and wildlife propagation (fishing).

Table 2.7. Summary of Fish and Wildlife Propagation assessments for Louisiana's water bodies. (Reported in miles (water body count)).

	Fully Supporting	Not Supporting	Insufficient Data	Not Assessed	Total Size for Designated Use
Rivers and Streams	2,789 (95)	6,547 (248)	138 (5)	40 (6)	9,514 (354)
Lakes	78,890 (17)	586,298 (48)	0	2,284 (3)	667,472 (68)
Estuaries	3,049 (34)	1,905 (18)	0	0	4,954 (52)
Wetlands	543,360(4)	488,960 (4)	0	3,968 (2)	1,036,288 (10)

Source: Louisiana Department of Environmental Quality (2004)

**c. Louisiana’s Natural and Scenic Rivers:**

Louisiana’s Natural and Scenic River System (System) is one of the nation’s largest, oldest, most diverse, and most unique state river protection initiatives. It encompasses 51 streams or stream segments and is over 3,300 miles in length (Jenkins and Cascio 2000) (Fig. 2.5, Table 2.8). In the early 1970’s the Louisiana Natural and Scenic River Act (Act) was passed, creating the System which sets certain requirements for a river to meet for inclusion in the program. The Act also established a regulatory component, and designated the LDWF Secretary to administer the System.

The streams and rivers included in the System are protected through a permitting process and certain prohibitions mandated by the Act. Certain activities which would drastically alter the natural and scenic qualities of rivers in the System are prohibited.

These activities include:

- Channelization
- Channel realignment
- Clearing and snagging
- Impoundment construction
- Commercial clearcutting of timber within 100 feet of the low water mark

Other activities that may have a direct, significant ecological impact on the river must be permitted by LDWF, and the permit application must also be reviewed by LDEQ, Department of Agriculture and Forestry (LDAF), Department of Culture, Recreation and Tourism (CRT), and the Office of State Planning. Activities that must be permitted include, but are not limited to:

- Bridge, pipeline and power line crossings
- Bulkheads, piers, dock and ramp construction
- Waste water discharges
- Land development adjacent to the river

Table 2.8. Area, scenic streams, and percent land use of aquatic basins in Louisiana.

Basin	Area (miles) <sup>2</sup>	Scenic Streams		Major Land Uses (%)		
		Number of Streams	Designated Miles	Forested	Agriculture	Urban
Atchafalaya	2,374	0	0	19	15	1
Barataria	2,520	1	45	1	10	3
Calcasieu	4,270	4	566	51	26	3
Mermentau	4,786	0	0	8	57	2
Mississippi	1,886	0	0	20	18	3
Ouachita	7,644	10	751	59	29	2
Pearl	914	7	256	47	24	4
Pontchartrain	7,637	21	1,186	26	12	5
Red	7,500	5	427	54	30	3
Sabine	3,257	1	3	54	14	2
Terrebonne	3,979	0	0	11	14	2
Vermilion – Teche	4,047	1	82	16	47	4

Source: Louisiana Department of Environmental Quality (1993) and LNHP database.

#### d. Management Basins:

Louisiana has twelve water quality management basins delineated on the basis of the natural drainage patterns of the state's major river basins (Fig. 2.11). Each water quality management basin is subdivided into stream segments in which the hydraulic and water quality characteristics are fairly constant. Land use in the basins is dominated by forestry and agriculture although the percentage of urban use is considerable in the Pontchartrain

Basin (Table 2.8). The Pearl and Pontchartrain Basins have the highest aquatic species diversity, relative to their area, in the state and, along with the Ouachita Basin, contain the highest number of species of conservation concern (Table 2.9).

Table 2.9 Aquatic basins and associated aquatic species of conservation concern listed by taxa.

Basin	Crustacean	Freshwater Fish	Mussel	Reptile	Total
Atchafalaya	0	6	0	3	9
Barataria	0	2	0	2	4
Calcasieu	3	3	3	2	11
Mermentau	2	1	0	2	5
Mississippi	1	9	1	3	14
Ouachita	2	4	16	2	24
Pearl	3	13	5	5	26
Pontchartrain	3	6	8	2	19
Red	4	9	2	2	17
Sabine	3	4	4	3	14
Terrebonne	0	1	0	2	3
Vermilion – Teche	4	1	1	2	8

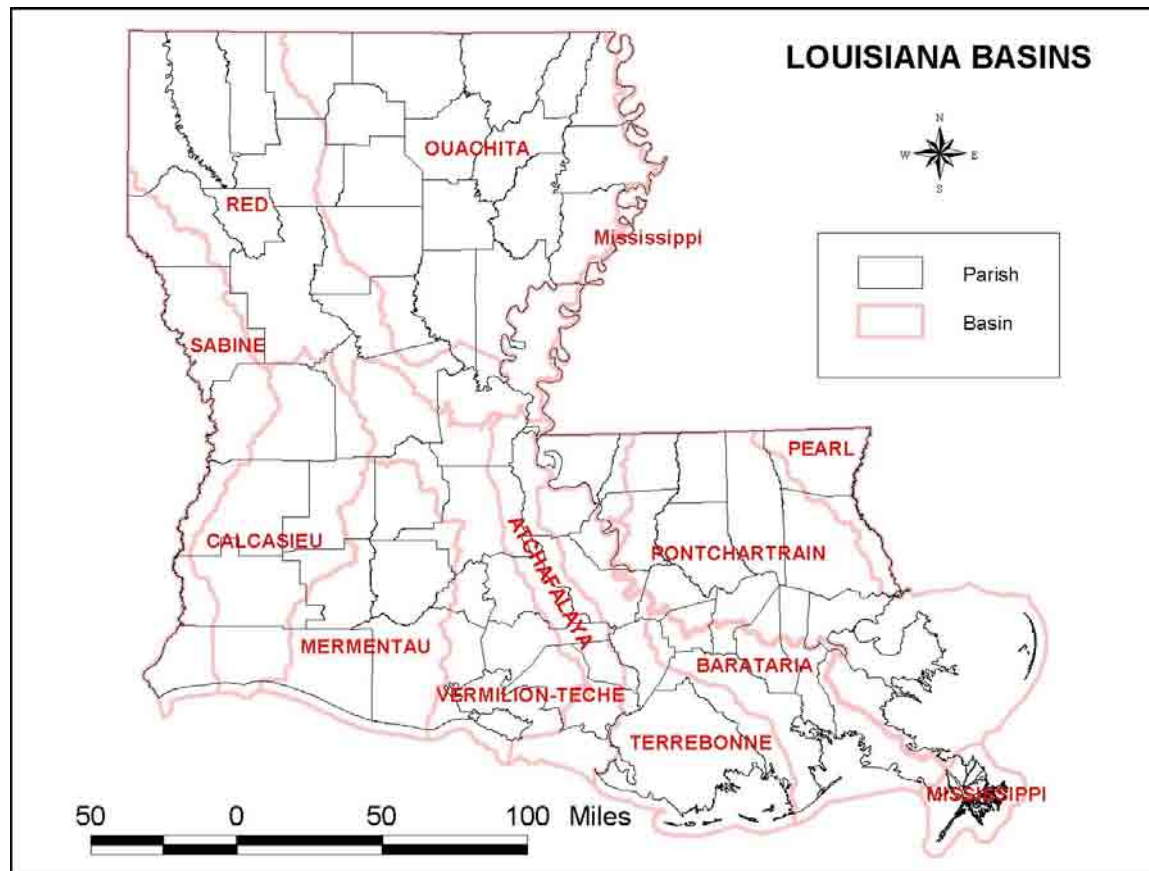


Figure 2.11. Aquatic basins in Louisiana.



## **1. Atchafalaya Basin**

The Atchafalaya River Basin is located in south-central Louisiana. The Atchafalaya River, a distributary of the Red, Black, and Mississippi Rivers, presently carries about 30 percent of the Mississippi's flow. The basin is well-defined by a system of levees which surround it on the north, east, and west. The entire basin serves as a major floodway for the Mississippi River floodwaters. The Atchafalaya Basin is predominantly bottomland hardwoods and cypress-tupelo swamp with some freshwater marshes in the lower distributary area. It constitutes the largest contiguous freshwater swamp in the United States.

## **2. Barataria Basin**

The Barataria Basin lies in the eastern coastal region of the state. This basin is bounded on the north and east by the lower Mississippi River, on the west by Bayou Lafourche, and on the south by the Gulf of Mexico. The major receiving waterbody in this basin is Barataria Bay. The Barataria Basin consists largely of bottomland hardwoods and fresh to brackish marshes, having some saline marsh on the fringes of Barataria Bay. Elevations in this basin range from minus two feet to four feet above sea level.

## **3. Calcasieu Basin**

The Calcasieu River Basin is located in southwestern Louisiana and is aligned in a north-south direction. Headwaters of the Calcasieu River are in the hills west of Alexandria. The river flows south for about 160 miles to the Gulf of Mexico. The mouth of the river is about 30 miles east of the Texas – Louisiana state line. The landscape in this basin varies from pine-forested hills in the upper end to brackish and salt marshes in the lower reaches around Calcasieu Lake.

## **4. Mermentau Basin**

The Mermentau River Basin is located in southwestern Louisiana and encompasses the prairie region of the state and a section of the coastal zone. The Mermentau River Basin is bounded on the north and east by the Vermilion – Teche River Basin, on the west by the Calcasieu River Basin, and on the south by the Gulf of Mexico. Little of the historic prairie habitat remains and the dominant habitat type is agricultural lands. Hardwood forests occur along the Mermentau and its larger tributaries. Fresh, intermediate, and brackish marshes constitute the majority of coastal wetlands with some salt marsh along the Gulf of Mexico.

## **5. Mississippi Basin**

The upper Mississippi River forms the boundary between Louisiana and Mississippi, flowing in a southerly direction. The lower Mississippi River flows southeasterly through the southeastern section of Louisiana. The upper stretch of the Mississippi does not get any tributary flow from the Louisiana side, which is leveed. Tributaries do enter from

Mississippi, including the Yazoo, Black, Homochitto, and Buffalo Rivers and Bayou Pierre. Tributary flow is received from Thompson's Creek, Bayou Sara, and Tunica and Monte Sano Bayous between the Old River Control Structure and Baton Rouge. The river is leveed on both the east and west banks from Baton Rouge below Monte Sano Bayou to Venice. This stretch of the river is also heavily industrialized, receiving numerous industrial discharges from Baton Rouge to New Orleans. The birdfoot delta of the Mississippi, where it flows into the Gulf, consists of fresh and intermediate marshes. The habitat of the upper portion of the basin, within the leveed batture lands, contains mostly bottomland hardwoods and a small amount of agriculture lands.

## **6. Ouachita Basin**

The Ouachita River's source is found in the Ouachita Mountains of west-central Arkansas near the Oklahoma border. The Ouachita River flows south through northeastern Louisiana and joins with the Tensas River to form the Black River, which empties into the Red River. Most of the basin consists of rich, alluvial plains cultivated in cotton and soybeans. The northwest corner of the basin is forested in pine, which is commercially harvested.

## **7. Pearl Basin**

The Pearl River Basin lies along the southeastern Louisiana – southwestern Mississippi border. This basin is bordered on the north by the Mississippi state line, by the Pearl River to the east, and on the west and south by the Lake Pontchartrain Basin. Elevations in the basin range from 350 feet above mean sea level in the northwest portion to sea level at the southern end. Correspondingly, the vegetation varies from pine forests and bottomland hardwoods to fresh and brackish marsh.

Seven Louisiana designated natural and scenic streams lie within the basin. The Pushepatapa Creek, Bogue Chitto River, Holmes Bayou, Bradley Slough, Wilson Slough, Morgan River, and West Pearl River are rich in species diversity. The basin is home to highest concentration of listed species of concern.

## **8. Pontchartrain Basin**

The Lake Pontchartrain Basin, located in southeastern Louisiana, consists of the tributaries and distributaries of Lake Pontchartrain, a large estuarine lake. The basin is bounded on the north by the Mississippi state line, on the west and south by the east bank Mississippi River levee, on the east by the Pearl River Basin, and on the southeast by Breton and Chandeleur Sounds. This basin includes Lake Borgne, Breton Sound, Chandeleur Sound, and the Chandeleur Island chain. The wooded uplands in the northern part of the basin consists of both pine and hardwood forests. The southern portions of the basin consist of cypress-tupelo swamps, bottomland hardwoods, and brackish and saline marshes. The marshes of the southeastern part of the basin constitute the most-rapidly eroding area along the Louisiana coast. Elevations in this basin range from minus five feet at New Orleans to over two hundred feet near the Mississippi border.

## **9. Red Basin**

The Red River has its origin in eastern New Mexico and flows across portions of Texas, Oklahoma, and Arkansas before entering northwestern Louisiana. The river flows southward to Shreveport, where it turns southeastward and flows for approximately 160 miles to its junction with the Atchafalaya River. From the Arkansas state line to Alexandria, the Red River is contained within high banks which range from 20 to 35 feet above low water level. Below Alexandria, the river flows through a flat alluvial plain which is subject to backwater flooding during periods of high water. The Sabine River Basin lies to the southwest of the Red River Basin, and the Ouachita River Basin lies to the east. The Calcasieu, Vermilion – Teche, and Atchafalaya River Basins lie south of the Red River Basin.

## **10. Sabine Basin**

The Sabine River Basin lies along the Texas-Louisiana border. The basin stretches from the Texas state line near Shreveport to the Gulf of Mexico. It is bounded on the east by the Red River Basin and Calcasieu River Basin. Characteristic vegetation ranges from mixed forests in the upper basin to hardwoods in the mid-section and brackish and saline marshes in the lower end.

## **11. Terrebonne Basin**

The Terrebonne Basin covers an area extending approximately 120 miles from the Mississippi River on the north to the Gulf of Mexico on the South. It varies in width from 18 miles to 70 miles. This basin is bounded on the west by the Atchafalaya River Basin and on the east by the Mississippi River and Bayou Lafourche. The topography of the entire basin is lowland, and all the land is subject to flooding except the natural levees along major waterways. The coastal portion of the basin is prone to tidal flooding and consists of marshes ranging from fresh to saline.

## **12. Vermilion – Teche Basin**

The Vermilion – Teche River Basin lies in south-central Louisiana. The upper end of the basin lies in the central part of the state near Alexandria, and the basin extends southward to the Gulf of Mexico. The basin is bordered on the north and northeast by a low escarpment and the lower end of the Red River Basin. The Atchafalaya River Basin is to the east, and the Mermentau River Basin is to the west. The wooded uplands of the northern part of the basin consists of both pine and hardwood forests. The central and southern portions of the basin consist of agricultural lands and the coastal zone is a mixture of fresh, intermediate, and brackish marsh.

## e. Marine

Louisiana's coastal habitats form an intergradation of habitats between upland habitats and open water marine habitats of the Gulf of Mexico. Within that gradation there are a wide variety of processes, both manmade and natural, creating an active landscape, where changes in dominant flora and fauna take place very quickly relative to many other systems. These habitats are utilized for their position on the landscape (e.g., first point of land for migrating neotropical birds), for the shelter they provide for the juvenile stages of many marine species, and as productive habitats for resident species.

Louisiana's estuarine and marine habitats are characterized by dynamic salinity regimes, riverine sedimentation patterns, and high productivity. The Mississippi River and its distributary, the Atchafalaya River are the ecological drivers of these systems, providing sediment and nutrients to coastal estuaries and fueling high productivity. Estuarine systems in southeastern Louisiana represent the remnants of five major cycles of delta building, resulting in large regressive delta formations dominated by organic sedimentation. The coastal marsh component of these estuaries is also experiencing the highest rate of wetland loss in the nation. Southwest Louisiana is dominated by fossil beach ridges with interspersed marshes. Coastal water bodies in this region are enclosed estuaries rather than the big open bays of the southeast. These estuaries are heavily impacted by human marsh management and navigational changes to the landscape. They are also extremely productive estuaries in terms of fisheries.

Marine habitats are generally seaward of the Gulf Intracoastal Waterway (GIWW) and extend out to the 3 mile limit. Louisiana's coastal zone is divided into 7 coastal study areas by LDWF's Marine Fisheries Division (Fig. 2.12).



Figure 2.12. Louisiana's coastal study areas.

## **CHAPTER 3. APPROACH**

The task of developing the comprehensive strategy has been coordinated among LDWF staff from the Fur & Refuge, Inland Fisheries, Marine Fisheries, and Wildlife Divisions. Additional coordination efforts were accomplished by soliciting input from representatives of other state and federal agencies, universities, non-governmental and environmental organizations, corporations and industry, and the citizens of Louisiana. Without their feedback and expertise completion of the CWCS would not have been possible.

### **A. Organizational Structure**

#### **1. Technical Committees**

A core committee of LDWF staff from the Fur & Refuge, Inland Fisheries, Marine Fisheries, and Wildlife Divisions and Public Information Section, was formed to develop the CWCS (Appendix B). The role of the core committee was to provide steering and technical guidance throughout the strategy development process.

Technical committees formed were comprised of persons with expertise on species of concern and their habitats (Appendix C). These committees helped to develop the species of concern list and provided biological guidance on habitat, threat, and monitoring issues.

As elements of the CWCS developed, the core committee presented them to a statewide focus group for review and comment. This group of federal and state agency personnel, members of non-governmental organizations, corporations and industry, and private citizens all share a common commitment to ensuring the health and diversity of Louisiana's fish and wildlife resources.

#### **2. Coordination with Other Agencies**

Several federal and state agencies were identified as having a potential role in the development of the CWCS, and each was asked to designate a representative to be the primary contact for that agency. The following is a list of those agencies and their representatives:

- Louisiana Cooperative Extension Service (Don Reed)
- Louisiana Department of Agriculture and Forestry (Michael Thomas)
- Louisiana Department of Culture, Recreation, and Tourism, Office of State Parks (David Latona)
- Louisiana Department of Environmental Quality (Chris Piehler)
- Louisiana Department of Natural Resources, Atchafalaya Basin Program (Sandra Thompson)
- Louisiana Department of Natural Resources, Coastal Restoration (Brad Miller)
- Louisiana Department of Transportation and Development (Jan Grenfell)

- Louisiana Division of Administration, Office of State Lands (Charles St. Romain)
- National Park Service (Martha Segura)
- National Oceanic and Atmospheric Administration (Richard Hartman)
- National Oceanic and Atmospheric Administration Fisheries (Jeff Rester)
- US Army Corps of Engineers, Atchafalaya Basin (Neil LaLonde)
- US Army Corps of Engineers, Bodcau (Susanne Odom)
- US Army Corps of Engineers, New Orleans (Chris Brantley)
- US Army Corps of Engineers, New Orleans (Nathan S. Dayan)
- US Army Corps of Engineers, New Orleans Planning (Barton Rogers)
- US Army Corps of Engineers, Vicksburg (Dan Twedt)
- US Department of Agriculture (John Pitre)
- US Department of Agriculture (Marty Floyd)
- US Department of Army, Fort Polk (Danny Hudson)
- US Fish and Wildlife Service (Bill Vermillion)
- US Fish and Wildlife Service (Debbie Fuller)
- US Forest Service, Kisatchie National Forest (Ken Dancak)
- US Geological Survey, National Wetlands Research Center (Carroll Cordes)

### **3. Public Involvement and Partnerships**

LDWF recognized early in the strategy development process that to achieve success in implementing this strategy (1) public participation must be a top priority and (2) this effort must be a multi-agency endeavor.

Public meetings were held across the state to inform the community of the CWCS goals and to gather input (Appendix D). In order to garner further public involvement and develop partnerships, LDWF posted information about the CWCS on its website ([www.wlf.louisiana.gov](http://www.wlf.louisiana.gov)), gave live television and radio interviews, and held statewide meetings to identify species of concern, complete habitat threat assessments and to develop strategies to abate habitat threats. Letters that explained what LDWF planned to accomplish through the SWG program and to encourage partnerships with other parties in the creation of the CWCS were mailed to more than 40 non-government organizations including:

- Acadiana Park Nature Station
- America's Wetland
- Audubon Council
- Barataria-Terrebonne National Estuary Program
- Baton Rouge Audubon Society
- Bayou Haystackers
- Bird Study Group
- Black Bear Conservation Committee
- Coalition to Restore Coastal Louisiana
- Coastal Conservation Association
- Farm Bureau Federation

- Gulf Restoration Network
- Louisiana Forestry Association
- Louisiana Coast
- Lake Pontchartrain Basin Foundation
- Lake Pontchartrain Fishermen's Association
- Louisiana Alligator Farmers & Ranchers Association
- Louisiana Aquaculture Association
- Louisiana Catfish Farmers Association
- Louisiana Cattleman's Association
- Louisiana Crab Task Force
- Louisiana Crawfish Farmers Association
- Louisiana Environmental Action Network
- Louisiana Hiking Club
- Louisiana Inshore Shrimper's Association
- Louisiana Landowners Association
- Louisiana Ornithological Society
- Louisiana Oyster Task Force
- Louisiana Oysters Dealers & Growers Association
- Louisiana Shrimp Association
- Louisiana Universities Marine Consortium
- Louisiana Urban Forestry Council
- Louisiana Wildlife Federation
- Mississippi River Basin Alliance
- Northlake Nature Center
- Orleans Audubon Society
- Sierra Club, Delta Chapter
- Terrebonne Fishermen's Organization
- The Nature Conservancy
- Tulane Green Club
- United Commercial Fishermen's Association
- American – Vietnamese Commercial Fishermen's Union

#### **4. Cooperation with Other States**

LDWF is a member of the Southeast Association of Fish and Wildlife Agencies (SEAFWA) Ad-hoc committee that is comprised of states in the USFWS Region 4. Meetings were held to coordinate development of the CWCS, and to facilitate networking among states to solve CWCS-related issues. LDWF also sponsored a meeting of adjacent states including Texas, Arkansas, and Mississippi to coordinate cross-border species and habitat issues.

#### **B. Species of Conservation Concern**

The primary focus of this CWCS is **species of conservation concern**, meaning those wildlife species, vertebrate and invertebrate, that show evidence of population declines

within Louisiana. In order to ensure the long-term survival of species of conservation concern and the habitats they depend upon, this plan will focus on: 1) habitats in need of protection and restoration; 2) species of conservation concern that depend upon these habitats; 3) habitats that are presently secure but may be subject to future degradation and loss; and 4) species considered to be stable at the present that show potential for future loss.

This strategy follows a two tiered approach: a coarse filter approach focused on landscape-level habitats, and a fine filter approach focused on individual species. The coarse filter approach allows for identification of those habitats subject to the greatest amount of stress/threats, and most in need of conservation. It is anticipated that roughly 85%-90% of the species in Louisiana can be identified and protected within these habitats using this method (Hartley et al. 2000). The fine filter approach allows for those individual species not covered by the coarse filter approach to be identified and individually managed. Species that are wide-ranging or have very local distributions may benefit from strategies developed for high-ranked or umbrella species.

The species of conservation concern list for the CWCS was developed based on the Natural Heritage methodology (Stein and Davis 2000). In order to categorize the current rarity status of Louisiana's species and habitats, the LNHP within the LDWF assigns ranks to the state's natural communities, vascular plants, vertebrate, and key invertebrate species. Each species or community is assigned a state rank (S1 to S5) (Appendix E) based on the following factors:

- estimated number of Element Occurrences (EOs)
- estimated state abundance
- state range
- adequately protected EOs
- threat of destruction
- ecological fragility

NatureServe, the parent organization for the Natural Heritage Network, assigns global ranks (G1 to G5) to species and natural communities based on the same factors, expanded to include consideration of the status over the entire natural range of each species or natural community (Appendix E).

The LNHP maintains EO data in the Geographical Information System (GIS)-based Biotics data system used by the Natural Heritage Network. Data are collected only for those species that are considered rare or threatened. EO data are collected for both rare and common natural communities (habitats) known to occur in the state. Species attaining a rank status of S1-S2-S3 form the base list for target species of conservation concern in this strategy.



## C. Species Prioritization Process

This strategy focuses on those species of concern that are experiencing population declines in Louisiana and in need of immediate conservation attention. In addition, the strategy will focus on those species that are migratory (primarily birds, butterflies, and to a lesser extent marine mammals) and use habitats within Louisiana during some part of their life cycle. With regard to terrestrial and aquatic invertebrates, the strategy will focus on butterflies, crawfish, and mussels in this first iteration. Future iterations of this strategy will attempt to construct conservation strategies for other groups of terrestrial and aquatic invertebrates in greater detail. However, it is expected that management strategies developed for the current taxonomic groups and their habitats will provide some benefit to terrestrial and aquatic invertebrates not mentioned in the first iteration of this plan.

The following criteria were used in the species prioritization process:

- Species classified as state species of conservation concern (S1-S2-S3)
- Species that are globally ranked as G1, G2, or G3
- Species that have been designated as needing immediate conservation attention through rangewide/nationwide status assessments. Examples include information contained in national bird conservation plans such as the Partners In Flight Conservation Plan, the U.S. Shorebird Conservation Plan, and the North American Waterfowl Plan
- Species which are locally endemic

The draft species list was developed and distributed to the technical expert committee (Appendix C) for review. The committee also provided input regarding species distributions by habitat type within Louisiana.

## D. Taxonomic Groups

The following discussion by taxonomic group supplies information on the current status for each group within the state. These discussions also provide a supportive line of reasoning regarding development of the **species of concern lists** for each group (Appendix F).

### 1. Amphibians and Reptiles

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There are 134 species of amphibians and reptiles occurring within Louisiana and its adjacent waters (Dundee and Rossman 1989). However, Louisiana is unique among high-diversity states in that it has no endemic species. Most of the species of concern are stable in adjacent states, which compromises Louisiana's herpetofaunal importance on a global scale. The greatest diversity is in the Florida Parishes, east of the Mississippi River. St. Tammany Parish alone is home to 104 species. Secondary areas of high diversity are in

the dissected uplands of central Louisiana. Areas with the lowest species diversities are in the coastal marshes and Mississippi floodplain.

Fourteen species of amphibians (8 salamanders, 4 frogs, 2 toads) and 30 species of reptiles (14 turtles, 3 lizards, 1 skink, 12 snakes) are considered species of concern by the LNHP (2002). The dusky gopher frog and ornate chorus frog are considered extirpated in Louisiana as recent surveys have been unable to document their continued existence (Siegel and Doody 1992, Thomas 1996). All of the marine turtles occurring in Louisiana are federally and state listed as threatened or endangered species. Four of the 5 are considered endangered and one, the loggerhead sea turtle, is considered threatened. U.S. Fish and Wildlife Service (USFWS) recovery plans have been developed for each (NMFS and USFWS 1991a, 1991b, 1992a, 1992b, 1993). Other federally-listed species include the gopher tortoise (USFWS 1990a) and the ringed map turtle (USFWS 1986). The Black pine snake and Louisiana pine snake are candidate species for federal-listing.

Each native amphibian and reptile species was evaluated on the basis of 10 parameters, with values of 1 to 4 (Boundy and Shively, 1997). Associated ranks are the sum for each of the 10 parameters. Seventy-five individuals with herpetological interests in Louisiana were afforded the opportunity to evaluate all of these species. The 23 individuals who comprised the technical committee are listed in Appendix C.

The present target list is based on the combined LNHP and Boundy and Shively lists, except as follows: Southern dusky salamander was added to the list because of documented drastic population declines (B. Means, personnel communication), supported by observations in Louisiana. John Carr (personnel communication) provided the following recommendations for map turtles: common map turtle (*Graptemys geographica*) was removed because the single Louisiana record is probably based on waif dispersal from Arkansas. Mississippi map turtle (*Graptemys pseudogeographica kohnii*) was removed because it is ubiquitous based on recent surveys. Sabine map turtle (*Graptemys ouachitensis sabinensis*) was added because it appears to have been extirpated from parts of its range, and status surveys are needed to determine its distribution. Gulf Coast box turtle (*Terrapene carolina major*) was removed because one of the key ranking factors, commercial harvest, is no longer in effect. Texas horned lizard (*Phrynosoma cornutum*) was removed because there is no evidence that the species was ever native to Louisiana. Southeastern crowned snake (*Tantilla coronata*) was added because it has only been found at one site in the past twenty years (J. Boundy, personnel observation). Timber rattlesnake (*Crotalus horridus*) was added due to a documented steady decline in eastern Texas (C. Rudolph, personnel communication), coupled with its sensitivity to human disturbance factors.

## 2. Birds

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Approximately 160 species of birds are year-round residents or probable confirmed breeders in Louisiana (Wiedenfeld and Swan 2000) and another 244 are known to regularly migrate through or winter in the state or its immediate adjacent waters (Lowery

1954). There are 69 species on the CWCS species of concern list of which 42 species are considered critically imperiled, imperiled, or rare and local by the LNHP (2002). Shorebirds and songbirds constitute the majority of species. Nine species are game birds. Recovery plans have been developed by the USFWS for federally-listed avian species found in Louisiana including the brown pelican (*Pelecanus occidentalis*), bald eagle (*Haliaeetus leucocephalus*), red-cockaded woodpecker (*Picoides borealis*), piping plover (*Charadrius melodus*), and interior least tern (*Sterna antillarum athalassos*) (USFWS 1986, 1990b, 2003; LDWF 2005). The brown pelican was delisted in the U.S. Atlantic coast, Florida, and Alabama in 1985. The USFWS was petitioned in 1998 to de-list the species in Louisiana. However, the brown pelican is currently listed as endangered in the state and is ranked imperiled (S2) by the LNHP. The bald eagle (USFWS 1989a), which has been recently proposed for delisting (USFWS 1999), is expanding its range in the state.

Five of the 8 federally-listed species are believed to be extirpated in Louisiana. There are occasional reports of sightings of the ivory-billed woodpecker (*Campephilus principalis*) in the state, with the latest report occurring in the spring of 1999. A subsequent attempt to document its presence in Louisiana was unsuccessful (Fitzpatrick 2002), and it is no longer considered to occur in Louisiana. However, with the recent discovery of this species in Arkansas in 2004 (Fitzpatrick 2005), LDWF made the decision to include the ivory-billed woodpecker on the CWCS species list in the event that it may be rediscovered in the state. Other species with historical range in Louisiana but now considered extirpated include Attwater's greater prairie chicken (*Tympanuchus cupido attwateri*), Bachman's warbler (*Vermivora bachmanii*), and Eskimo curlew (*Numenius borealis*). Efforts are currently being considered to reintroduce the whooping crane to Louisiana (S. King, personnel communication).

Biological objectives for avian species targeted in this strategy reflect the combined objectives of the Partners-in-Flight (PIF) North American Landbird Conservation Plan (Rich et al. 2004), North American Waterfowl Management Plan (NAWMP Committee 2004), North American Waterbird Conservation Plan (Kushlan et al. 2000), U.S. Shorebird Conservation Plan (Brown et al. 2001), American Woodcock Management Plan (USDI 1990), Northern Bobwhite Conservation Initiative (Dimmick et al. 2002), and USFWS species recovery plans.

The species of concern list for birds was developed using multiple data sources. The first step was to consult the LNHP (2002) species of concern list and to expand this list with data from the USFWS proposed list of priority bird species occurring in Louisiana (C. Hunter, personnel communication) and the PIF list. PIF scores for each of the 4 Bird Conservation Regions (BCR) occurring within Louisiana were averaged to provide an overall score for all species which breed, winter, or reside in the state. PIF scores were determined by methods described in Rich et al. (2004). Species above the numeric ranking value (n=19) for low importance set forth by the PIF national plan were considered of critical importance and added to the list. Birds of low importance and rare birds tracked by LNHP were placed on the state watch list which is comparable to the

stewardship list developed by PIF. The second step was to distribute this list to the 37 technical advisory experts for review and revision (Appendix C).

Species that do not occur on a regular basis within the boundaries of the state or that are no longer found within the state were excluded. These species include the Cerulean warbler (*Dendroica cerulea*) and Bewick's wren (*Thryomanes bewickii*). Some museum collection data from the Louisiana State University (LSU) Museum of Natural Science, detailing occurrences of certain species within the state, were used to further refine the list.

### 3. Mammals

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Seventy mammal species have been recorded from Louisiana or its immediate adjacent waters (Lowery 1974). Ten species are considered critically imperiled, imperiled, or rare and local by the LNHP (2002). Three bat species, the silver-haired bat (*Lasionycteris noctivagans*), big brown bat (*Eptesicus fuscus*), and northern myotis (*Myotis septentrionalis*), were recently discovered in Louisiana (Crnkovic 2003), and are considered state critically imperiled (S1). Louisiana is the most eastern and southern state in the distribution of the hispid pocket mouse (*Chaetodipus hispidus*) (NatureServe 2005) and it is currently ranked as an imperiled species. The eastern harvest mouse (*Reithrodontomys humulis*), southeastern shrew (*Sorex longirostris*), long-tailed weasel (*Mustela frenata*), and spotted skunk (*Spilogale putorius*) also are considered either imperiled or vulnerable in Louisiana. Of the eight federally-listed species, only the Louisiana black bear (*Ursus americanus luteolus*) and the West Indian manatee (*Trichechus manatus*) are currently receiving conservation attention in the state. The red wolf (*Canis rufus*) (USFWS 1990c) is considered to be extirpated from Louisiana, and the Florida panther (*Puma concolor coryi*) and ringtail (*Bassariscus astutus*) are of historical occurrence in Louisiana (Leberg et al. 2004, M. Hafner personnel communication, M. Carloss, personnel communication). Recovery plans for the Louisiana black bear (USFWS 1995b), West Indian manatee (USFWS 2001), finback whale (*Balaenoptera physalus*) and sei whale (*Balaenoptera borealis*) (USFWS 1998), and Florida panther (USFWS 1995a) have been developed by the U. S. Fish and Wildlife Service. There are no plans to reintroduce the Florida panther to Louisiana at this time.

Nutria (*Myocastor coypus*) and wild hogs (*Sus scrofa*) are two invasive mammal species that threaten several target habitats. Native to South America, nutria first became established in coastal Louisiana in the 1930's after escaping or being released from captivity. Soon after, feral populations were established near the Gulf Coast and in the early 1940's, expanded their range from into marshes from Port Arthur, Texas to the Mississippi River. Nutria damage became evident in Louisiana in the 1950's when their population was estimated to have reached 20 million. Nutria was the primary target for Louisiana trappers from the 1960's to the early 1980's, when prices for fur on the world market and in Louisiana fell drastically. Since then, the annual trapping harvest has declined significantly which has caused an increase in the destructive effects of nutria grazing on coastal wetlands. Nutria have been blamed for accelerating coastal erosion,

destroying marsh plants, and decreasing muskrat (*Ondatra zibethica*) populations. Wild hogs were introduced intentionally for domestic use in colonial times and in the mid-1900s for sport hunting. They inhabit forests and marshes throughout Louisiana and they can cause extensive damage to hurricane-protection levees and natural habitats throughout the state by rummaging, digging, and generally damaging soils and plants (LDWF 2004).

Mammal species included in this plan are generally those currently tracked by LNHP because they are considered to be critically imperiled or imperiled due to their rarity or vulnerability. Furthermore, the current list of mammal species tracked by LNHP was reviewed by experts (Appendix C), and their comments are incorporated into the list. As a result of their review, two bat species were added (southern myotis and northern myotis) and there was one recommendation to keep the ringtail in the target species list.

#### **4. Fishes**

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##### **a. Freshwater Fish**

Louisiana's high aquatic species diversity is due primarily to the complexity of aquatic habitats which range from small quiet streams and bayous, oxbows, and backwater areas, to large river systems such as the Mississippi, Atchafalaya, and Red, to estuarine areas of coastal Louisiana. One hundred forty-eight species of freshwater fishes are known to occur in Louisiana (Douglas 1974). Of these, roughly 21 species inhabit both fresh and salt-water environments. Twenty-seven species are considered critically imperiled, imperiled, or rare and local (LNHP 2002). A management plan for the paddlefish in Louisiana has been developed by LDWF (Reed 1991). Federally-listed species for which recovery plans have been developed include the Gulf sturgeon (*Acipenser oxyrinchus desotoi*) (USFWS et al. 1995c) and pallid sturgeon (*Scaphirhynchus albus*) (USFWS 1993). The pearl darter (*Percina aurora*) has a historical range within the state but is now considered extirpated (Suttkus et al. 1994).

The CWCS technical team identified 109 species of freshwater fish that are of concern within the state. Some of these species are widely distributed, whereas others have localized distributions. For example, many species only occur in small, clear-flowing sandy-bottom streams areas east of the Mississippi River (Douglas 1974). Little is known about the life history or distribution of many of these more restricted fish species. Potential threats experienced by fish species differ with river systems and drainage types.

Information for developing the freshwater fish species of concern list was obtained from state ranks provided by NatureServe (2005) and the LNHP database. University personnel from LSU and University of Louisiana at Monroe (ULM) were consulted for potential modifications to the NatureServe data (Appendix C). State ranks were modified for Gulf sturgeon, paddlefish, and blue sucker (*Cycleptus elongatus*) based on recent sampling by LDWF Inland Fisheries personnel.

## **b. Marine Fish**

Marine fishes occur in a wide range of habitats, from low-salinity marshes and estuaries to deep-water and open-ocean pelagic environments. Due to the productivity of Louisiana's coastal wetlands and bays, about 95% of its recreational and commercial fishery production comes from species that are estuarine-dependent for some portion of their life cycle.

Less well known are population levels of the non-commercial species of fish and invertebrates – the vast majority of the species present – that inhabit these estuarine environments. Their presence is believed to be critical to the functioning of the natural systems, and further surveys are needed to determine the status of these populations. Surveys might also be designed to provide information that furthers the understanding of ecological processes in these systems.

Louisiana wetlands are currently experiencing rapid changes associated with a wide range of natural and anthropogenic influences. These changes have the potential to reduce populations of a wide variety of organisms. There is no comprehensive list of marine fish species found along the Louisiana Gulf Coast, but ichthyologists estimate that approximately 400 species occur in the state's marine waters. Both wetland loss and stabilization of those losses are long-term issues, and the biological effects of these issues on the species that depend on these habitats are not well understood. This is especially true of species that are not commercially or recreationally harvested. While a fair amount of information exists on environmental and ecological requirements of commercially important species such as penaeid shrimp species, blue crab (*Callinectes sapidus*), and several of the estuarine and marine finfish species, comparable information is not available for most other species. While commercially valuable stocks may serve as umbrella species for a group of non-commercial species with similar life history parameters, many of these species life history parameters are not well understood.

Several anadromous species have been listed as species of special concern due to degradation of essential habitats, such as sea grass beds, estuarine marshes, and freshwater spawning and nursery areas (Musick et al. 2000). These include syngnathids (pipefishes and seahorses), an anadromous sturgeon, one topminnow, and an anadromous herring. Additional anadromous species may have been extirpated.

The focus of the state's management for this wide variety of species is to better understand how natural and anthropogenic events impact the abundance and diversity of species in these environments. The species selected for this process have close affinity to marsh or submerged vascular vegetation for most or all of their life cycle.

The list of marine fisheries species of special concern was compiled through input from LDWF personnel, university specialists and by analysis of seine data from the LDWF Finfish Monitoring Program (Appendix C). These species were chosen because they are not heavily fished, either recreationally or commercially, and are not generally caught as by-catch, but are ecologically important as an indicator species due to their

dependence on Louisiana's coastal marshes. They represent different salinity regimes from 0 to 30 ppt. for all marine habitats listed.

## 5. Mussels

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North American freshwater mussels (Family Unionidae and Margaritiferidae) are currently one of the world's most imperiled taxonomic groups (Master et al. 2000). There are 297 species and subspecies of mussels recognized in the United States (Turgeon et al. 1988). The southeastern United States contains the greatest species diversity with 269 species, of which 64 species (21.5% of the U.S. total) are currently known to occur in Louisiana (Neves et al. 1997). Of these, 30 species are ranked as critically imperiled or imperiled in the state by the LNHP (2002). Federally-listed species include pink mucket (*Lampsilis abrupta*) (USFWS 1976), fat pocketbook (*Potamilus capax*), inflated heelsplitter (*Potamilus inflatus*) (USFWS 1992), and Louisiana pearlshell (*Margaritifera hembeli*), the only mussel species endemic to Louisiana (USFWS 1989b). The brass mucket (*Actinonaias ligamentina*) is considered extirpated from the state. Twenty-nine rare mussel species for the state are known to occur in multiple states, and six of these species have ranges reaching into Canada. Two of the state's species are found in only one other state besides Louisiana, the Mississippi pigtoe (*Pleurobema beadleianum*) in Mississippi and the Louisiana pigtoe (*Pleurobema riddellii*) in Texas.

Invasive species that displace native bivalves and threaten Louisiana's mussels are the Asiatic clam (*Corbicula fluminea*) and the zebra mussel (*Dreissena polymorpha*). The Asiatic clam was first found in Louisiana in the early 1960's (Vidrine 1993), and they currently inhabit the Pearl, Red, Mississippi, Calcasieu, Sabine and Atchafalaya River basins and probably other basins. The zebra mussel, first found in Louisiana early in 1993 (Vidrine 1993), has settled in portions of the Mississippi and the Atchafalaya rivers using the Mississippi River as a travel corridor into Louisiana. Washboard (*Megaloniais nervosa*), three-ridge (*Amblema plicata*), ebonyshell (*Fusconaia ebena*), mapleleaf (*Quadrula quadrula*), and pimpleback (*Quadrula pustulosa*) are the harvestable mussels in Louisiana for the culture industry (Vidrine 1993).

Mussel species included in this plan are those currently tracked by the LNHP because they are considered to be critically imperiled or imperiled due to their rarity or vulnerability. Furthermore, the current list of mussel species tracked by the LNHP was reviewed by experts (Appendix C) and their comments were incorporated into the list.

## 6. Crustaceans

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There are 338 crawfish species in the United States, the southeast being the world's hotspot for crawfish diversity (Taylor et al. 1996). Thirty-four crawfish species are known to occur in Louisiana (Crandall and Fetzner 2001; J. Walls, personnel observation). Fourteen of these crawfish species are considered critically imperiled, imperiled, or rare and local by the LNHP (2002), including two endemic species, the

Calcasieu painted crawfish (*Orconectes blacki*) and Kisatchie painted crawfish (*Orconectes maletae*). Regardless of the preferred habitat, the viability of many of the rare crawfish is threatened because of their small ranges. Any habitat degradation severe enough to cause extirpation of these species at a single site or sites could also lead to their extinction (Taylor et al. 1996).

Crustacean species included in this plan are those currently tracked by the LNHP because they are considered to be critically imperiled or imperiled due to their rarity or vulnerability. Furthermore, the current list of crustacean species tracked by the LNHP was reviewed by experts (Appendix C) and their comments were incorporated into the list.

## **7. Butterflies**

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The LNHP does not currently track butterflies species, nor does it have current data on the status of this taxonomic group in Louisiana. However, LDWF's strategy committee has agreed that efforts should be made to include butterfly species as targets within the CWCS. University experts were consulted and asked to provide information on Louisiana's current butterfly diversity and their biological status, along with recommendations on which species are of conservation concern (Appendix C).

### **E. Habitats**

Developing a species conservation strategy must begin with identifying habitats or natural communities present within the state and assessing:

- their importance to species of conservation concern
- threats facing each habitat
- the habitat's viability

Once this is accomplished the habitats are then ranked.

The habitat types within the state have been separated into terrestrial and aquatic. Separate categories allow for a thorough review of habitats within the two systems, and facilitate implementation of conservation actions based on similarity of management techniques and strategies. Terrestrial systems include all habitat types (wetlands and uplands) that are important to birds, mammals, amphibians, reptiles, and butterflies. Aquatic systems include the bayous, streams, rivers, marshes, and lakes and bays that are important to fish, mussels, crustaceans, and many reptile species (turtles).

#### **1. Terrestrial Habitats**

Natural communities are composed of groups of plant and animal species that regularly or often occur in association with each other in certain landscapes or physical environments. Habitat types are the specific natural communities where a plant or animal



resides or is ordinarily found. Nature is seldom divided into discrete units and is characteristically composed of a continuous mosaic of natural communities. The factors that help to define a particular community (i.e., associated vegetation, soil, substrate, hydrology, topography, climate, fire history) usually exist along gradients, and therefore every occurrence of a natural community will be unique in some way. The habitat classification developed for the strategy has levels of distinctiveness that are defined according to the physical and biotic factors that occur repetitively at various locations, and are recognized as habitat or potential habitat for native wildlife species occurring within Louisiana.

A system for classifying natural communities and an inventory of a region's natural resources are essential for a complete understanding of the natural resources of that region, and also provide the framework for determining the area's protection priorities and research needs. Protecting natural communities preserves the ecological functions of the area while also providing the added benefit of safeguarding both the rare and common species occurring within that community type.

The terrestrial habitat types described in this document are based on the natural community classification outlined by LNHP (1986-2004) which was developed using the National Vegetation Classification (NVC). The NVC system was created by TNC to address the needs of their conservation planning and programs, and is now accepted as a classification standard used by all federal agencies (Grossman et al. 1998, Anderson et al. 1998). Some of the natural community types in the LNHP document were combined based on similarities in floristics and management strategies. It should be noted that the term terrestrial is used loosely here to refer to all non-aquatic habitats associated with a soil substrate and having emergent to upland vegetation types.

Appendix G lists the terrestrial habitat types of Louisiana by ecoregion within the state and provides state and global rankings assigned to each habitat type by LNHP. Accurate mapping of habitat distributions is not currently possible for many terrestrial types due to data gaps, but general vegetation distributions are available. Figure 3.1 contains a broad view of presettlement natural vegetation types within the state (Newton 1972). Louisiana contains six ecoregions (Fig. 2.3) or areas of general similarity in ecological systems and natural resources present to those areas. Terrestrial habitat types were assigned by ecoregion to facilitate viability and stress assessments of those habitat types and the development of conservation strategies. Strategies were structured based on threats ongoing in each particular ecoregion of the state that potentially affect wildlife habitats. State ranks are developed by LNHP and global ranks by NatureServe based on research, scientific literature, statewide inventories, and consultation with scientific experts.

## **2. Aquatic Habitats**

Aquatic habitats were separated into two categories: freshwater and marine systems. Freshwater systems were assessed by management basin as defined by the LDEQ (Fig. 2.10). Habitats within basins were assessed by the following stream type designations:

backwater, head water, main channel, side channel, and tributary. Marine systems assessments were based on geomorphic features of the water bottoms located in Louisiana’s coastal waters. Marine habitats included: soft mud bottom, shell/shellhash bottom, hard mud/clay bottom, sandy bottom and open water.

As with terrestrial habitats, strategies for aquatic habitats were structured based on threats ongoing in each particular basin, or the coastal waters that potentially affect wildlife habitats. Unlike terrestrial habitats, there are no state or global rankings developed for these habitats.

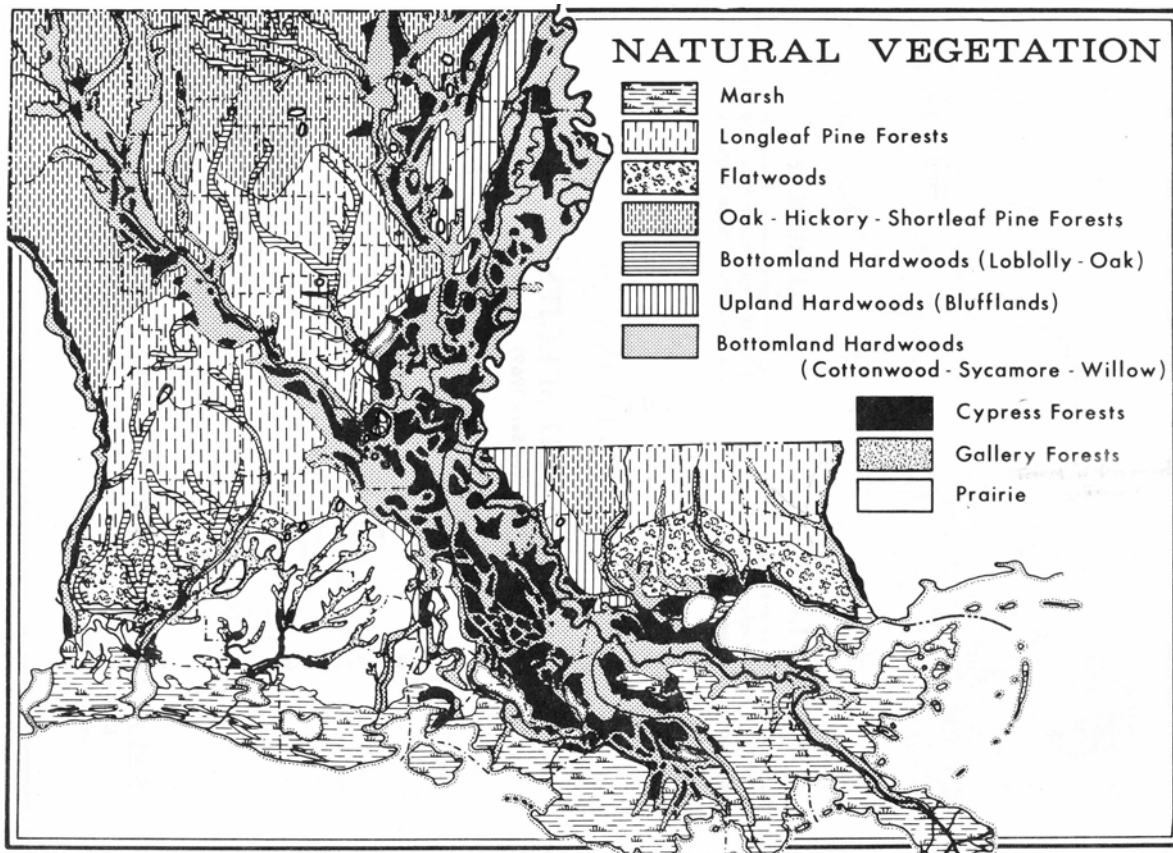


Figure 3.1. Primary natural vegetation types and presettlement distribution in Louisiana (Newton 1972).

## F. Threats to Species of Concern and Related Habitats

The majority of the threats affecting Louisiana wildlife and their respective habitats are the direct or indirect result of encroachment by human development and related development pressures. Rapid population growth and subsequent demands on the state’s natural resources have resulted in substantial habitat losses. Early impacts from human activities, such as the establishment of the state’s agriculture base, resulted in the clearing and cultivation of prime alluvial areas, and have all but extirpated the coastal prairies of the southwestern parishes. Live oak cheniers and natural levee forests, found at higher elevations in the Gulf Coast Prairies and Marshes ecoregion, were the first to be

developed for construction of roadways and home sites. Over the last century the leveeing of the Mississippi River, construction of canal networks, and other development activities in marsh habitats have seriously degraded the state's coastal ecosystems. Expected population increases over the next century will create greater demands for residential sites, increase water usage and wastewater issues, increase the number of vehicles on the roads, and increase commercial and industrial development. All of these issues will have some impact Louisiana's wildlife and habitats.

In order to effectively identify and address the widespread threats to wildlife habitats, an assessment of habitat viabilities and threats to each habitat type was needed. A listing of habitat threats and sources of those threats was compiled using TNC's Site Conservation/Measures of Success Workbook software (2000) and from input provided by the LDWF Core Committee and the CWCS Habitat Assessment Committee (Appendix H). Habitat types were evaluated by ecoregion, basin or coastal waters. Viability was assessed as a measure of the following three conditions:

- Size - a measure of the area of the habitat's occurrence
- Condition - an integrated measure of the composition, structure, and biotic interactions that characterize the occurrence
- Landscape Context - an integrated measure of two factors: the dominant environmental regimes and processes that establish and maintain the habitat occurrence and connectivity

Threats were then identified for each habitat type within ecoregion, basin, or coastal waters and these threats were rated by severity (level of damage expected over the next 10 years) and scope (geographic scope of impact expected over the next 10 years). A stress rating for each threat was calculated using the combination of severity and scope ratings. Next, the sources of the threats were rated as to their contribution to the overall threat and its irreversibility potential. For example, habitat destruction/conversion was identified as a major threat to Eastern Longleaf Pine Savannahs in the East Gulf Coastal Plain. Tremendous population growth has occurred in this ecoregion (20-30% increase between 1990-2000) and is expected to continue at a high level over the next decade (Figure 2.1). This threat was given a "Very High" rating in both severity and scope due to the sources of the habitat conversion threat, namely residential development. The combined ratings for severity and scope resulted in a stress rating of "Very High". The contribution of residential development to Eastern Longleaf Pine Savannah habitat destruction/conversion was considered "Very High" and it was rated "Very High" in irreversibility potential. A source rating for the threat (residential development) was calculated from the combined scores for contribution and irreversibility. The final threat rating resulted from the combined source/stress rating from the viability table. The rankings of threats and sources of threats resulting from these assessments were used to prioritize threats to habitats within ecoregion, basin or coastal waters and this information was then used to develop conservation strategies addressing major threats for each habitat type. In order to develop conservation strategies to address the threats to species and their associated habitats, statewide meetings were held in order to gather technical and public input (Appendix I). As an example of the assessment procedure, the spreadsheets from

the East Gulf Coastal Plain habitat/threats assessment may be viewed in Appendix J. A listing of all Threats and Sources of Threat identified during this assessment process and their definitions are found in Appendix K and Appendix L, respectively.

## G. Threats to Terrestrial Habitats

Threats that appeared repeatedly across terrestrial habitats and ecoregions included:

- Habitat destruction or conversion
- Habitat fragmentation
- Habitat disturbance
- Altered habitat composition and structure

**Habitat destruction or conversion** involves actions which permanently alter a habitat so that natural functions and values of the ecosystem are disrupted and are not considered restorable. Historically, this threat was widespread across all habitats throughout the state, and it remains a current threat facing wildlife habitats throughout Louisiana. When habitat destruction or conversion occurs, **habitat fragmentation** follows. The remaining habitat becomes isolated on the landscape as it is divided into smaller and smaller blocks. Wildlife populations in these fragmented habitats are isolated from other breeding populations, face increased competition for limited resources, and come into conflict with other land uses.

The sources of threat for both **habitat destruction** and **habitat fragmentation** include:

- **Residential development** – This source of threat is greatest in the EGCP, UEGCP, and areas surrounding major urban centers of the state
- **Commercial/industrial development** – This source of threat follows occurrence patterns similar to residential development
- **Conversion to agriculture or other forest types** – These actions completely remove the natural plant associations of a habitat, can damage soils, and displace native wildlife species
- **Development of pipelines, roads or utilities** – Construction activities destroy habitats, result in fragmentation of surrounding habitats, and can serve as vectors for invasive and alien species introductions
- **Channelization of rivers or streams** – This source of threat directly destroys aquatic species habitat
- **Gravel mining** – These activities also destroy aquatic habitats, often impact adjacent small stream forests
- **Construction of ditches, drainage or diversion systems** – This source of threat alters natural hydrology of a site and can result in destruction of wetland habitats

**Habitat disturbance** involves actions that may alter some aspects of a habitat, but these changes, while serious, are generally not permanent, or can be ameliorated through restoration efforts or management actions.

The sources of threat for **habitat disturbance** include:

- **Invasive/alien species** - Invasive plant and animal species pose a serious source of threat for most habitat types across the state, and can profoundly alter natural systems. These species can out-compete native species for limited resources, and many become pervasive, dominating entire habitats. Early detection and control are essential to halt the expansion of invasives.
- **Incompatible forestry practices** - This source of threat includes forest management activities that may alter in some way the natural processes or characteristics of a habitat type. These practices include but are not exclusive to activities such as broad application of herbicides that decrease diversity and alter composition of herbaceous plant layers, fire suppression causing denser tree and understory cover and decreased diversity in the understory, logging on sites when soils are saturated causing rutting and compaction, even-aged forest management and monoculture stands which decrease habitat diversity, and bedding of an area to enhance timber production of off-site commercial species.
- **Residential development** – This source of threat includes indirect affects from residential communities to surrounding natural habitats such as non-point source pollution causing degradation of wetlands, recreational use that damages soils, and introduction of invasive species that out-compete native flora and fauna.
- **Development of pipelines, roads or utilities** – This source of threat includes construction and maintenance activities that alter surrounding natural habitats such as stream siltation, storage of construction equipment, application of herbicides, and clearing of rights-of-way.
- **Construction of ditches, drainage or diversion systems** – This source of threat includes activities that alter the hydrology of natural systems such as construction of drainage ditches to either remove water from or divert water to a site.
- **Channelization of rivers or streams** – As with development of pipelines, roads and utilities, this source of threat includes construction and maintenance activities that alter surrounding natural habitat.

**Altered composition and structure** refers to changes in plant community species composition and community structure that result from human activity. Plant species usually associated with, or naturally occurring in, a certain habitat may or may not be present, they may not occur in expected numbers, or other species generally not occurring in the habitat might become established. In addition, the natural habitat structure may be altered such that wildlife food and foraging areas, or nesting sites are no longer available. As with habitat disturbance, these changes can seriously alter a habitat type, but they can often be reversed through appropriate management or restoration efforts.

The sources of threats identified for **altered composition and structure** include:

- **Fire suppression** - Refers to the changes occurring in the historic frequency or patterns of fire in a natural habitat due to competing or surrounding land use practices, and public perceptions. Many of Louisiana's natural communities are fire adapted or dependent including all longleaf pine associations, bogs, and

prairies. These plant and animal species associations developed in the presence of regular fire cycles, and fire is critical to maintaining these natural habitats. Fire has numerous benefits to natural systems (Moore 2001), including:

- Seedbed preparation
- Reducing woody plant competition
- Preventing establishment and spread of invasive species
- Recycling nutrients
- Reducing hazardous fuel build-up
- Maintaining herbaceous layer species diversity
- Maintaining quality and abundance of food and nesting sites for many species

When natural fire regimes are altered or removed, all of the above benefits are lost, and the natural system composition and structure is altered through species succession and/or the establishment of invasive species.

- **Invasive/alien species** – Invasive or exotic plant species alter natural systems by out-competing native plants for habitat resources and replacing them within the plant community composition. Invasive or alien animal species can also alter composition and structure through severe disturbance of a habitat causing loss of certain native plant species in an area or allowing the introduction of invasive plants.
- **Incompatible forestry practices** – Some forestry or forest management practices such as establishment of monoculture stands, planting of off-site tree species or fire suppression alter the plant associations normally found in a habitat and change the natural community structure.
- **Construction of ditches, drainage or diversion systems** - These activities alter the hydrology of natural systems that can lead to a change in plant and animal species composition.
- **Livestock production practices** – These practices can damage aquatic habitats by decreasing water quality and related factors that, in turn, cause changes in aquatic species associations of a habitat.
- **Operation of dams and reservoirs** – As with construction of ditches, drainage or diversion systems, these activities alter the hydrology of natural systems, disrupting the transport of important nutrients and sediments and block the movement of aquatic species that can lead to a change in native species associations.

## H. Threats to Aquatic Habitats

The decline of many native fish and mussel species is a result of the reduced quantity and quality of available habitat. Other specific causes of decline include levee construction, damming and channelization of the state's major rivers, including the Atchafalaya, Mississippi, Pearl, Red, and Sabine Rivers, for flood control and navigation along with agricultural uses, deforestation, erosion, pollution, and introduced species.

Threats that appeared repeatedly across basins included:

- Modification of water levels/changes in natural flow patterns
- Sedimentation
- Habitat disturbance
- Nutrient loading
- Altered composition and structure

Top sources of threats across all basins include:

- Channelization of rivers or streams
- Construction of navigable waterways
- Dam construction
- Invasive/alien species
- Levee or dike construction
- Oil and gas drilling
- Operation of dams and reservoirs
- Commercial/industrial development
- Conversion to agriculture or other forest types

## **I. Prioritization of Terrestrial Habitats by Ecoregions**

Conservation actions or strategies were developed for each terrestrial habitat and key wildlife species of conservation concern within each of the habitats to address threats identified by the habitat assessments. In order to maximize conservation benefits using available resources, ranking or prioritization lists of habitats were developed. These lists of priority habitats will allow LDWF to direct conservation efforts to those wildlife habitats and associated species of concern that need the most attention, and will bring the greatest benefit to the maximum number of species.

A process was formed to create the habitat priority list, and, as with the threats assessments, this process was completed by ecoregion (Chart 3.1). Within each ecoregion, the habitats were divided into two groups or tiers based on whether or not they occurred only in that ecoregion (Tier 1) or in multiple ecoregions (Tier 2). This first step in the process gave priority to those habitats with limited ranges, ensuring that threats to these habitats and conservation needs would not be overlooked.

In the second step, completed within each tier, the habitats were divided into two groups, matrix habitats or secondary habitats. A matrix habitat is a natural community that represents the primary or predominant habitat type found within a particular region (ecoregion, parish, river basin, etc.) or is considered to have dominated a region prior to settlement. Determination of presettlement matrix habitats for a region is based on factors such as local vegetation, soils, topography, hydrology, climate, fire history, and historic accounts and records. Secondary habitats were considered all other habitats naturally occurring in a particular ecoregion.

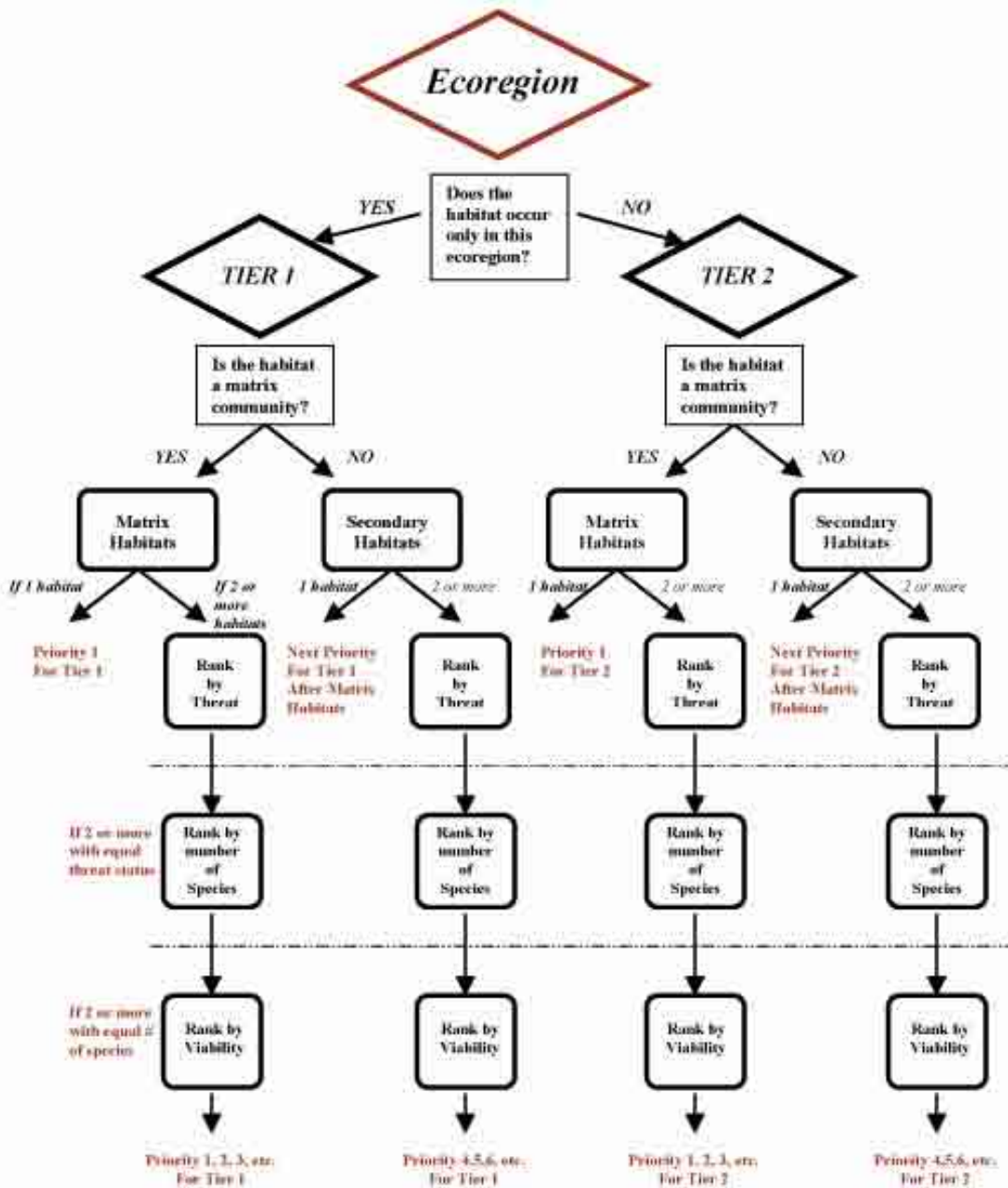


Chart 3.1. Terrestrial habitat prioritization process flowchart.

The third part of the process is completed within both the matrix and secondary habitat groups of each tier. If there is only one habitat, then it becomes priority one. If there are two or more habitats in a group, then they are ranked using three variables. The first variable is threat status. Habitats with a very high threat status are given first priority, followed by high threat status habitats, and then medium and low threat status habitats. If there is more than one habitat within a threat status category, then these habitats are ranked by number of target species, and those habitats with the highest number of species are given preference. If the number of species between habitats is the



same, then their final ranking is determined by viability rank. In this case, those habitats with good viability have first preference, followed by rankings of fair and poor viability. The resulting terrestrial habitat priority lists are found in Appendix M. It should be noted that Agriculture-Crop-Grassland was not included in the prioritization process because it is an artificial habitat type, not a natural community. However, since many species of conservation concern utilize this habitat type, strategies were developed to address threats to the habitat, and conservation actions were planned to implement the strategies.

## **J. Prioritization of Aquatic Habitats**

Establishing priorities within aquatic habitats is difficult due to the overall lack of ecological and biological information for the majority of aquatic habitats and associated species of conservation concern. With this first iteration, development of a priority process was not possible due to these data gaps. Therefore, the highest priority for freshwater and marine systems is to initiate and support research on species assemblages to determine their ecological and biological needs.

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## CHAPTER 4. CONSERVATION HABITATS & SPECIES ASSESSMENTS

### A. Terrestrial Habitats (List by ecoregion found in Appendix G)

#### 1. Agriculture - Crop – Grassland

*Rarity Rank:* N/A

*Synonyms:* None

*Ecological Systems:* None

##### *General Description:*

This is a general category made up of diverse land cover and land use features of altered habitats resulting from human activity. These areas occur in every ecoregion throughout the state. The land cover types may include all or some of the following:

- Scattered woody and herbaceous vegetation representing orchards (pecan, citrus, etc.), vineyards, experimental plots, plant nurseries, roadway rights-of-way
- Row and cover crops consisting of various grain crops, cotton, sweet potatoes, soybeans, rice and sugarcane
- Fields that have been tilled or untilled containing exposed or partially exposed soil
- Fallow fields or areas which have been left idle during the growing season
- Utility rights-of-way
- Grasslands dominated by perennial graminoid plants (primarily pastures and/or rangelands)

Some species of wildlife benefit from agricultural production. Historically, agricultural practices and the type of crops produced were highly varied, and this provided a habitat diversity that favored numerous species. As this habitat became less diverse as a result of changing agricultural practices and larger tracts in production, the habitat quality declined for many species of wildlife. This was particularly true for resident and breeding edge/grassland species such as northern bobwhite, eastern bluebirds, dickcissels, rusty blackbirds, and many species of sparrows. In addition, the value of this habitat for birds migrating across these habitats has diminished.

Within this habitat type, there may be patches of “natural” habitat such as vegetated streamsides, embedded wetlands, and small blocks of forest which can serve as important breeding, dispersal, and travel corridors for various wildlife species when sufficiently large. While no species of conservation concern are dependent upon these habitats for survival per se, they often support some of the highest concentrations of these resident and migratory species. For example, flooded rice fields and crawfish ponds are extremely important to shorebirds, wading birds, and waterfowl. These fields are integral components of the Lower Mississippi Valley Joint Venture (LMVJV) and Gulf Coast

Joint Venture (GCJV) plans for meeting the needs of shorebirds, wading birds, and waterfowl. Similarly, grain crops can support the highest populations of northern bobwhite and wintering sparrows when good field borders are incorporated into the farming operation. In fragmented habitats, conservation features on agricultural lands may serve to connect patches of natural habitat. Irrigation ditches are heavily used by wading birds and crustaceans, fencerows serve as breeding sites for some songbirds, and wooded drainages can serve as travel corridors for mammals, especially the Louisiana black bear.

**Current Extent and Status:**

There are approximately 7.8 million acres of farm land in Louisiana (Farmland Information Center 2004). Working agricultural landscapes can be greatly enhanced with proper planning. The Federal Farm Bill offers some of the greatest opportunities for these enhancements to occur because of the sheer magnitude of the dollars associated with farm programs. Typically cost-share, incentive payments, or both are provided to qualified participants. Invasive species such as *Triadica sebifera* (Chinese tallow tree) can be a problem on areas where no management is conducted.



AG – CROP - GRASSLAND SPECIES OF CONSERVATION CONCERN (49)		
<b>AMPHIBIANS</b>	American Woodcock	Falcate Orangetip
Strecker's Chorus Frog	Short-eared Owl	Reakirt's Blue
Southern Crawfish Frog	Scissor-tailed Flycatcher	Little Metalmark
	Sedge Wren	Creole Pearly Eye
<b>BIRDS</b>	Spragues Pipit	Southern Dogface
American Bittern	Loggerhead Shrike	
Wood Stork	Painted Bunting	<b>CRUSTACEANS</b>
Mottled Duck	Dickcissel	Sabine Fencing Crawfish
Northern Pintail	Field Sparrow	Ouachita Fencing Crawfish
Northern Harrier	Grasshopper Sparrow	
Northern Bobwhite	Henslow's Sparrow	<b>MAMMALS</b>
Yellow Rail	Le Conte's Sparrow	Southeastern Shrew
Black Rail	Smith's Longspur	Eastern Harvest Mouse
Clapper Rail	Rusty Blackbird	Louisiana Black Bear
King Rail		Long-tailed Weasel
Sandhill Crane	<b>BUTTERFLIES</b>	Eastern Spotted Skunk
Whooping Crane	Wild Indigo Duskywing	
Marbled Godwit	Cobweb Skipper	<b>REPTILES</b>
Dunlin	Dusted Skipper	Western Slender Glass Lizard
Short-billed Dowitcher	Yucca Giant Skipper	Gopher Tortoise

***Priority Species Research and Survey Needs:***

Southern Crawfish Frog: Present occurrence poorly known in Louisiana; known to exist on agricultural lands in adjacent states. Determine current use of agricultural lands by crawfish frogs in Louisiana, and determine which land practices enable persistent use by frogs.

Mottled Ducks: Research is needed on nesting success, brood rearing and brood success rates, molting habitat needs, and annual recruitment and survival rates along with other basic research to determine breeding and recruitment constraints.

Loggerhead Shrike: Monitoring of distribution, reproductive success, and evaluation of nesting habitat in Louisiana.

Rusty Blackbird: Initiate surveys to determine wintering population abundances and habitat use to augment Christmas Bird Counts.

Rails: Initiate intensive surveys to determine population densities and distributions in rice and crawfish farm habitats.

***Species Conservation Strategies:***

1. Shorebirds:
  - Work with landowners (especially rice and crawfish farmers) to implement management and conservation recommendations for waterbirds (especially rails) of SWG project T18 upon completion and USFWS waterbird management plan.
  - Partner with LMVJV, GCJV, USFWS and other interested groups to encourage farmers to manage water levels to provide habitat for shorebirds during migration, with an emphasis on early fall migration.
2. Early Successional Bird Species: Continue to encourage landowners to maintain areas in early successional stage to benefit these species.
3. Northern Bobwhite and Grassland Birds: Support implementation of recommended habitat restoration actions specified in Northern Bobwhite Conservation Initiative (NBCI) and by LDWF quail and grassland bird task force.
4. Partner with LSU and University of Louisiana, Lafayette (ULL) to develop/update management guidelines/Best Management Practices (BMPs) for species of conservation concern that occur in lands cultivated for rice and sugarcane.
5. Promote safe and cost effective fire ant control and reduction of other plant and animal exotics on agricultural lands.

***Threats Affecting Habitat:***

1. Incompatible management practices and invasive species are the main threats to this habitat.
2. Expansion of sugarcane into the rice/prairie region of southwest Louisiana.
3. Clean farming practices which include the removal of hedgerows and fencelines.

***Habitat Conservation Strategies:***

1. Encourage planting of native species along field borders and filter strips to create micro-habitat for wildlife species (CP33 – NRCS program, habitat buffers for upland birds).
2. Encourage the development of “soft or feathered” edges on the agricultural landscape through natural succession, planting of native grasses, legumes and forbs, and small shrubs (plum thickets, blackberry, etc.) when appropriate, and management to maintain these habitats.
3. Encourage management of fallow fields to maintain early succession and to prevent invasion of woody shrubs and trees.
4. Encourage planting of native grasses and proper timing of mowing and haying to prevent destruction of borrows and nests in grasslands and rights-of-way.
5. Work with farmers, state (LDEQ, LDNR) and federal (NRCS, USGS) agencies, university extension services, local and parish governments, and the legislature to develop a comprehensive statewide water rights/use plan.
6. Provide farmers with information on federal/state incentive programs.
7. Secure funding for a position whose sole purpose is Farm Bill Programs/Agricultural Liaison.
8. Secure funding for LDWF positions to be located at NRCS regional offices to provide wildlife recommendations to NRCS District Conservationists as they develop farm conservation plans.
9. Actively participate in NRCS state technical advisory committee (TAC).
10. Develop and distribute promotional materials on federal/state incentive programs beneficial to wildlife geared towards farmers and NRCS/Farm Service Agency (FSA) personnel.
11. Partner with LSU Agriculture Extension to develop and implement strategies in this habitat.
12. Provide information on CWCS target species and habitats for teacher and other workshops (Future Farmers of America (FFA), Envirothon, etc.) to ensure their use in Louisiana schools.

***References:***

FARMLAND INFORMATION CENTER. 2004. Website. <http://www.farmlandinfo.org>

## 2. Barrier Island Live Oak Forest

**Rarity Rank:** S1/G1

**Synonyms:** Maritime Forest

**Ecological Systems:** CES203.513 Mississippi Delta Maritime Forest

### **General Description:**

This barrier island community is currently restricted to Grand Isle, Jefferson Parish, Louisiana, where it occupies a small area (less than 1,000 acres). All known occurrences are impacted by development, exotic species, clearing of understory vegetation, and habitat fragmentation. This community appears to be distinct from other *Quercus virginiana* (live oak) communities occurring to the east and west, but little is known about this habitat type. It is



dominated by *Quercus virginiana*, with a minor component of *Celtis laevigata* (hackberry). *Zanthoxylum clava-herculis* (toothache tree), *Diospyros virginiana* (persimmon), *Gleditsia triacanthos* (honeylocust), and *Morella cerifera* (waxmyrtle) are typical associates (LNHP 1986-2004, West 1938, Brown 1930). Trees in this habitat type can exhibit the effects of saltwater spray and wind, having a stunted appearance and leaning away from the prevailing wind (West 1938, Brown 1930).

### **Current Extent and Status:**

There is no complete information regarding the presettlement extent of this natural community type on Louisiana's barrier islands. The last remaining barrier island live oak forest in Louisiana occurs on Grand Isle. TNC's Lafitte Woods Preserve protects 13 acres of this forest and TNC helped restore 30 acres by planting live oak and hackberry trees on property owned by ExxonMobil. The Orleans Chapter of the Audubon Society (OAS) has proposed a bird sanctuary on an additional 17 acres (the Sureway Woods) and is currently raising funds to purchase this property.



BARRIER ISLAND LIVE OAK FOREST SPECIES OF CONSERVATION CONCERN (4)	
<b>BIRDS</b> Yellow-billed Cuckoo Painted Bunting Orchard Oriole	<b>REPTILES</b> Eastern Glass Lizard

***Priority Species Research and Survey Needs:***

Eastern Glass Lizard: Not observed at outlying Grand Isle population in nearly 30 years, despite adequate habitat. Conduct surveys to determine if Grand Isle population is extant.

***Species Conservation Strategies:***

1. Migratory Birds: Continue efforts to support conservation of remaining habitat.

***Threats Affecting Habitat:***

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat			
	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation
Commercial/ industrial development		XXX		XXX
Development/maintenance of pipelines, roads or utilities		XXX	XXX	
Invasive/alien species	XXX			
Recreational use/vehicles		XXX	XXX	
Residential development		XXX	XXX	
Shoreline erosion				XXX

***Habitat Conservation Strategies:***

1. Partner with NGOs (TNC, Louisiana Ornithological Society (LOS), National Audubon Society (NAS)), state and federal agencies, industry, and private landowners to promote conservation of remaining barrier island live oak forests.
2. Work with the legislature to develop tax incentives and conservation servitudes or leases for landowners to encourage conservation of this habitat type.
3. Promote planting of live oak and other native tree species.



4. Provide educational information on this habitat type and its importance to species of conservation concern to landowners/land managers through technical pamphlets and the LDWF website.
5. Support NRCS and Louisiana Department of Natural Resources (LDNR) efforts for shoreline stabilization and habitat restoration.
6. Work with LCA, Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA) to broaden the extent of coastal restoration projects.
7. Work with local governing boards to recommend limits on All Terrain Vehicles (ATVs) in this habitat.
8. Work with appropriate planning commissions to provide LNHP data that illustrates locations of this habitat type.
9. Work with NRCS Plant Materials Center, Barataria-Terrebonne National Estuary Program (BTNEP), and Office of State Parks (OSP) to develop restoration program for this habitat.

***References:***

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### 3. Barrier Island

**Rarity Rank:** N/A

**Synonyms:** None

**Ecological Systems:**

CES203.469 Louisiana Beach

CES203.471 Southeastern Coastal Plain Interdunal Wetland

**General Description:**

Louisiana's coastal Barrier Islands are important breeding and nesting habitat for migratory shorebirds and colonial nesting waterbirds. The islands are not classified as a single natural community due to the fact that they are comprised of several habitat types including: Coastal Dune Grasslands, Coastal Dune Shrub Thickets, and Coastal Mangrove-Marsh Shrubland. Marine Submergent Aquatic Vegetation also occurs in bays behind these islands. Predominant plant species include:

*Spartina patens* (marshhay cordgrass), *Spartina alterniflora* (smooth cordgrass), *Sporobolus virginicus* (coast dropseed), and *Avicennia germinans* (black mangrove). Species distribution is determined by elevation gradients and exposure to saltwater spray or tidal overwash. Generally, succulent species and vines are found on the beach fronts, wiregrass on highest dunes, and black mangrove and smooth cordgrass on the sheltered bayside areas.



**Current Extent and Status:**

Barrier islands in Louisiana are old shorelines of abandoned, eroding deltas of the Mississippi River. Since deltaic processes have been altered due to the leveeing of the Mississippi River, we can expect no new barrier islands to form. The current major barrier islands include the Chandeleur Island chain, Grand Isle and Grand Terre, Timbalier Islands, and Isle Dernieres. Louisiana's barrier islands are much younger and geologically less resistant than non-deltaic barrier islands of adjacent states. Major efforts are being



made to preserve and protect these islands from tropical storm impacts. These include the use of breakwaters to buffer wave action, pumping of material from back bay areas

and sand fencing and planting of vegetation along beaches to anchor sand and stabilize the substrate.

Several barrier islands or portions of islands fall within conservation areas. Much of the Chandeleur chain is captured by Breton NWR, which was established in 1904 and is the second oldest refuge in the national refuge system. Isle Dernieres Barrier Islands Refuge, managed by LDWF, includes Wine, Whiskey, East, Trinity, and Raccoon Islands. Grand Isle is the only inhabited barrier island and as a result, much of the natural habitat is altered. However, examples of native habitats are preserved on sites such as the Lafitte Woods Preserve, managed by TNC, which protects a live oak forest, and Grand Isle State Park which captures beach, coastal dune shrub thicket, and salt marsh habitats.

<b>BARRIER ISLANDS SPECIES OF CONSERVATION CONCERN (23)</b>		
<b>BIRDS</b>	Dunlin	<b>BUTTERFLIES</b>
Brown Pelican	Short-billed Dowitcher	Obscure Skipper
Reddish Egret	Gull-billed Tern	Eastern Pygmy Blue
Yellow-crowned Night-Heron	Caspian Tern	
Snowy Plover	Royal Tern	<b>REPTILES</b>
Wilson's Plover	Sandwich Tern	Loggerhead Seaturtle
Piping Plover	Common Tern	Kemp's Ridley Seaturtle
American Oystercatcher	Forster's Tern	Leatherback Seaturtle
Marbled Godwit	Black Skimmer	Mississippi Diamondback Terrapin

***Priority Species Research and Survey Needs:***

Snowy Plover, Wilson's Plover, Piping Plover: Continue to monitor breeding and wintering populations along the coast and on barrier islands.

Reddish Egret and American Oystercatcher: Conduct research to assess the limiting factors on reproduction and the effects of human coastal recreational activities on bird populations. Intensive surveys are needed to accurately determine population levels.

Terns: Conduct research to determine the factors effecting overall population densities and continue with surveys of breeding sites.

Waterbirds: Continue to conduct rookery surveys to update database information.

Obscure Skipper and Eastern Pygmy Blue: Conduct surveys to determine current distribution and abundance for inclusion in LNHP database.

Mississippi Diamondback Terrapin: Population status in Louisiana is unknown. Drastic declines have been documented in other states, but the source of their decline has not been identified. Conduct trawl/nest surveys.

***Species Conservation Strategies:***

1. Terns:
  - Disturbance and loss of nesting habitat are major threats; develop partnerships to strengthen the protection and restoration of barrier islands.
  - Develop a comprehensive survey methodology to determine long term trends in population abundances.
2. Shorebirds, Wading Birds:
  - Provide public education regarding the importance of waterbird nesting colonies and shorebird feeding areas. Reduce the negative effects on these areas from recreational and other uses.
  - Coordinate with GCJV to implement recommendations of shorebird and wading bird conservation plans.
3. Brown Pelican: Continue with long-term monitoring of nesting colonies.

***Threats Affecting Habitat:***

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat		
	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Fragmentation
Commercial/industrial development		XXX	
Development/maintenance of pipelines, roads or utilities			XXX
Invasive/alien species	XXX		
Recreational use/vehicles	XXX		
Residential development		XXX	
Shoreline erosion			XXX

***Habitat Conservation Strategies:***

1. Partner with state and federal agencies, NGOs, private landowners, etc. to promote the protection and restoration of barrier islands.
2. Promote education regarding invasive plant species within this habitat and methods to eradicate and/or control invasives.
3. Support NRCS and LDNR efforts for shoreline stabilization and habitat restoration.
4. Work with LCA, CWPPRA to support coastal restoration projects, specifically targeting important nesting areas and species of conservation concern.
5. Work with local governments to recommend limits on recreational vehicle use of this habitat.

6. Work with appropriate planning commissions to provide LNHP data that illustrates locations of this habitat type.
7. Work with NRCS Plant Materials Center, BTNEP, and OSP to develop restoration program for this habitat.

## 4. Batture

**Rarity Rank:** S4S5/G4G5

**Synonyms:** Riverfront Pioneer, Cottonwood-Willow, Black Willow, Cottonwood.

**Ecological Systems:**

CES203.190 Mississippi River Riparian Forest

CES203.512 Lower Mississippi River Bottomland and Floodplain Forest

CES203.489 East Gulf Coastal Plain Large River Floodplain Forest

CES203.065 Red River Large Floodplain Forest

CES203.488 West Gulf Coastal Plain Large River Floodplain Forest

**General Description:**

The batture community develops on the slope between the natural levee crest and major streams/ivers. It is a pioneer community which is first to appear on newly formed sand bars and river margins. The area receives sands and silts with each flood. The soils are semi-permanently inundated or saturated. Soil inundation or saturation by surface water or groundwater occurs periodically for a major portion of the growing season. Such conditions typically prevail during spring and summer months with a frequency ranging from 51 to 100 years per 100 years. The total duration of time for the seasonal event(s) normally exceeds 25 percent of the growing season.



*Salix nigra* (black willow) comprises a majority of the stocking, and *Populus deltoides* (cottonwood) is the primary associate. Secondary species may be, depending chiefly on successional stage, *Betula nigra* (riverbirch), *Fraxinus pennsylvanica* (green ash), *Platanus occidentalis* (American sycamore), *Carya illinoensis* (pecan), *Celtis laevigata* (hackberry), *Acer rubrum* (red maple), *Forestiera acuminata* (swamp privet), *Planera aquatica* (water elm), *Ulmus americana* (American elm), *Taxodium distichum* (baldcypress), *Acer negundo* (box elder) and *Morus rubra* (red mulberry). *Salix exigua* (sandbar willow) may be common in certain sites. Batture is a community undergoing relatively rapid succession. Black willow is a temporary, short-lived pioneer species of very rapid growth. Cottonwood will outgrow willow and become dominant except where frequent and extended growing-season flooding covers the trees and limits its growth. As sediments build up in the community and succession progresses, willow and cottonwood become less dominant and secondary associates gain increasing importance in the community. The community often succeeds into Hackberry-American Elm-Green Ash or Sycamore-Sweetgum-American Elm Bottomland Forest.

The successional sequence is a function of river meander movement rates and point bar formation. Rivers with swift meander movements over unconsolidated sands produce tapered slopes on point bars which are first colonized by the Batture community.

***Current Extent and Status:***

Batture occurs primarily along the Mississippi River but also along the Atchafalaya, Red, and perhaps other smaller rivers. It is apparently a secure and viable habitat in Louisiana. The acreage and number of intact sites is unknown.



<b>BATTURE SPECIES OF CONSERVATION CONCERN (20)</b>		
<b>BIRDS</b>	Northern Parula	<b>REPTILES</b>
Yellow-crowned Night-Heron	Prothonotary Warbler	Ringed Map Turtle
Wood Stork	Swainson's Warbler	Ouachita Map Turtle
Swallow-tailed Kite	Kentucky Warbler	Sabine Map Turtle
Bald Eagle	Hooded Warbler	Pascagoula Map Turtle
American Woodcock	Orchard Oriole	Timber Rattlesnake
Yellow-billed Cuckoo		
Wood Thrush	<b>MAMMALS</b>	
Yellow-throated Vireo	Long-tailed Weasel	

***Priority Species Research and Survey Needs:***

Swallow-tailed Kite: Continue with nesting surveys and monitoring of kites on public and private lands to fill data gaps in distribution and abundance for inclusion in LNHP database and Audubon nationwide database.

Songbirds: Continue to support research on silviculture/land management practices and their effects on all songbird species.

Long-tailed Weasel: Considered vulnerable in Louisiana. Intensive surveys needed to update occurrence records and abundance for inclusion in LNHP database. Document the habitat relationships of the long-tailed weasel and how dependent this species is upon batture habitats, relative to other habitat types.

***Species Conservation Strategies:***

1. Identify Important Bird Areas (IBAs) or potential IBAs and partner with Baton Rouge Audubon Society (BRAS), OAS, and the NAS to implement conservation recommendations from SWG project T27 upon completion.

2. Swallow-tailed Kite: Implement conservation and management recommendations of SWG project T9 (Coulson 2004).
3. Bald Eagle: Continue with long-term monitoring of active bald eagle nests, successful breeding pairs, and fledged eagles.
4. Work with landowners to initiate or continue the implementation of PIF bird conservation plans, conservation plans developed for amphibians and reptiles, and USFWS endangered and threatened species recovery plans over the next 10 years.

***Threats Affecting Habitat:***

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat					
	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Fragmentation	Herbivory	Modification of Water Levels; Changes in Natural Flow Patterns	Toxins/ Contaminants
Borrow pits		XXX	XXX			
Commercial/industrial development		XXX	XXX			
Construction of ditches, drainage or diversion systems		XXX	XXX			
Industrial discharge						XXX
Invasive/alien species	XXX					
Management of/for certain species	XXX			XXX		
Mining practices		XXX	XXX			
Operation of drainage or diversion systems	XXX				XXX	XXX

***Habitat Conservation Strategies:***

1. Work with city planning commissions and local conservation groups to promote development of batture reserves to retain natural habitats.
2. Work with LDEQ, the Environmental Protection Agency (EPA), and other federal and state agencies to fill data gaps concerning ecological system processes and water quality/discharge impacts on this habitat.
3. Work with COE and local levee boards to maintain the natural ecology of batture areas and to educate these organizations on the productivity of this habitat in meeting the needs of resident and migratory wildlife species.



***References:***

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## 5. Bayhead Swamp/Forested Seep

**Rarity Rank:** S3/G3?

**Synonyms:** Baygall, Reed Brake, Acid Seep Forest, Spring-Head, Green-Head

**Ecological Systems:** CES203.505 Southern Coastal Plain Seepage Swamp and Baygall  
CES203.372 West Gulf Coastal Plain Seepage Swamp and Baygall

### **General Description:**

(Note: Bayhead Swamp and Forested Seep are described as distinct communities in the LNHP Natural Communities of Louisiana. They are considered together here due to their floristic similarity and similarity in management needs.)



**Bayhead Swamps** are typically densely stocked, often-flooded forested wetlands that develop in broad, shallow, braided drains, or along margins of creeks with little or no creek banks (LNHP 1986-2004, Brooks et al 1993, Guillory et al 1990, Smith 1996). They are also found in relatively deep depressional areas in flatwoods, or in the headwaters of creeks in sandy, acidic uplands across much of the state. They occur on the sandy uplands of western Louisiana in both the Upper and Lower West Gulf Coastal Plains (UWGCP and LWGCP), but are probably most common in the pine flatwoods of the East Gulf Coastal Plain (EGCP) lying on the Pleistocene Terraces that flank the Bogue Chitto River in Washington Parish (Smith 1999). They are seasonally to semi-permanently saturated or flooded.

**Forested Seeps** occur in northwest, central, and western Louisiana (UWGCP and LWGCP), typically in association with mixed pine-hardwood forests, on hillsides, to the base of slopes. The plant species composition is very similar to that of bayhead swamps. Forested seeps are continually moist due to constant seepage forced to the surface by an underlying impervious layer (LNHP 1986-2004).

Soils of bayhead swamps/forested seeps are deep, very poorly drained, very strongly acid loamy fine sand, fine sandy loam or silt loam, with relatively high organic matter content. Available water capacity is high, surface runoff is very slow to ponded. Inherent fertility is low. Some typical soils are Myatt fine sandy loam, Guyton silt loam and Osier loamy fine sand (Smith 1996).

The overstory of both bayheads and forested seeps is typically characterized by a closed to nearly closed canopy. The midstory is often densely stocked with various shrubs, many of which are evergreen, and there is often an abundance of ferns, except in the lowest, often-flooded depressions where little herb cover is present, other than

*Sphagnum* spp., which can form thick mats. These forests naturally vary from a few acres up to more than 100 acres in size (Brooks et al 1993, Smith 1996).

Bayhead swamps generally occupy the lowest positions on the landscape, with the exception of the principal permanent streams that drain the area. They are found just down the topographic gradient from pine and hardwood flatwoods. The highly acidic nature of the soils combined with the abundance of organic muck that accumulates on the swamp floor often produces a "blackwater" (actually tea-colored water) condition in streams associated with bayhead swamps.

Fire probably played a minor role in bayhead swamps because of its topographic position, usually wet nature, and general lack of appropriate fuels to carry a fire. However, fires may have occurred during exceedingly dry periods in broader bayheads, or may have been fairly frequent in narrow bayhead drains. Switch cane (*Arundinaria gigantea*), a highly combustible woody grass, can form dense thickets in bayheads (particularly at their edges, hence the old name "reed brake"), and may have played a key role in the fire dynamics of this community, especially in narrower bayhead drains (Smith 1996).

*Magnolia virginiana* (sweet bay, often dominant) and *Nyssa sylvatica* (black gum) are the common overstory trees. *Quercus laurifolia* (laurel oak), *Acer rubrum* (red maple), *Liquidambar styraciflua* (sweet gum), *Q. nigra* (water oak), *Taxodium distichum* (baldcypress), *T. ascendens* (pondecypress, in EGCP), *Pinus elliotii* (slash pine, in EGCP), and *P. palustris* (longleaf pine) may be present. A diversity of shrubs or small trees, primarily evergreen, are prevalent in the community. Species that may be present include *Persea borbonia* (red bay), *Cyrilla racemiflora* (swamp cyrilla, in EGCP and southwest Louisiana), *Morella heterophylla* (bigleaf wax myrtle), *M. cerifera* (wax myrtle), *Ilex glabra* (little-leaf gallberry, in EGCP), *I. coriacea* (sweet gallberry, in EGCP and southwest Louisiana), *I. opaca* (American holly), *Lindera subcoriacea* (S1/G2) (bog spicebush, in EGCP), *Lyonia lucida* (fetterbush, in EGCP), *L. ligustrina* (fetterbush), *Leucothoe axillaris* (leucothoe, in EGCP), *L. racemosa* (leucothoe), *Itea virginica* (Virginia willow), *Aronia arbutifolia* (red chokeberry), *Viburnum nudum* (possum-haw viburnum), *Rhus vernix* (poison sumac), *Clethra alnifolia* (summer sweet, primarily in EGCP), *Alnus serrulata* (hazel alder), *Styrax americana* (American snowbell), *Rhododendron serrulatum* (summer azalea), *R. canescens* (wild azalea), *Rhododendron oblongifolium* (wild azalea, central, western, and north Louisiana), and other species. *Smilax laurifolia* (bamboo greenbrier) and *Decumaria barbara* (climbing hydrangea) are often conspicuous community members. Herbaceous flora is usually sparse but may include ferns, such as *Lorinseria areolata* (net-veined chain fern), *Onoclea sensibilis* (sensitive fern), *Osmunda cinnamomea* (cinnamon fern), and *O. regalis* (royal fern), and a few orchid species (LNHP 1986-2004, NatureServe 2005).

### ***Current Extent and Status:***

Presettlement extent of bayheads and seeps statewide in Louisiana is estimated to have been 100,000 to 200,000 acres, with only 25 to 50% currently remaining (Smith

1993). Some of these habitats occur on public lands in the UWGCP and LWGCP where they are protected and in most cases, appropriate management is applied. These public lands include KNF, Fort Polk, Barksdale Air Force Base and Bodcau WMA. Bodcau and KNF have a total of 145 acres of a forested seep habitat registered with the Natural Areas Registry Program (one site on each area). Clear Creek and West Bay WMAs, which are in the southwest part of the state, certainly support this habitat but the status of it on these areas is not known. Both of these areas are owned by forest products companies and are leased by LDWF. Also in central and northwest Louisiana there are three privately owned forested seeps totaling 71 acres which are entered in the Natural Areas Registry Program. There is only minimal protection for remaining bayhead swamps in the EGCP. TNC's Abita Creek, Talisheek and Charter Oak Preserves in St. Tammany Parish contain the largest protected areas of bayhead swamps in the Florida Parishes. The combined preserves total 3,928 acres with an unknown number of acres in bayhead swamp and including longleaf pine savannahs and flatwoods, hillside seepage bogs, slash pine-pondcypress/hardwood and riparian forests. In addition, 20 acres are protected within the Bogue Chitto State Park in Washington Parish. There are currently no bayhead properties in the EGCP registered with the Louisiana Natural Areas Registry Program. Today these wetlands are most often found surrounded by commercial timberlands and are affected by management on these adjacent lands. One such bayhead, of 20 acres or less, has been given a "special site" designation by the forest industry owner.



<b>BAYHEAD SWAMP – FORESTED SEEP SPECIES OF CONSERVATION CONCERN (20)</b>		
<b>AMPHIBIANS</b>	Northern Parula	<b>BUTTERFLIES</b>
Southern Dusky Salamander	Prothonotary Warbler	Pepper and Salt Skipper
Gulf Coast Mud Salamander	Swainson's Warbler	Falcate Orangetip
	Kentucky Warbler	Harvester
<b>BIRDS</b>	Hooded Warbler	
American Woodcock	Painted Bunting	<b>MAMMALS</b>
Yellow-billed Cuckoo	Rusty Blackbird	Southeastern Shrew
Wood Thrush	Orchard Oriole	Southeastern Myotis
Yellow-throated Vireo		Long-tailed Weasel

***Priority Species Research and Survey Needs:***

Southern Dusky Salamander: This species is exhibiting drastic declines in relatively pristine areas throughout its range; its status is not currently being addressed by the Federal government. Initiate status surveys at reference sites to determine the extent of population declines in protected sites.

Pepper and Salt Skipper: Conduct surveys to determine current distribution and abundance for inclusion in LNHP database.

Southeastern Shrew: Considered imperiled in Louisiana, Louisiana represents the western edge of its range together with Arkansas and Missouri. Intensive surveys needed to update occurrence records and abundance for inclusion in LNHP database.

Long-tailed Weasel: Considered vulnerable in Louisiana. Intensive surveys needed to update occurrence records and abundance for inclusion in LNHP database.

Songbirds: Continue to fund monitoring of songbird populations within this habitat type and the effects of forest management on these species.

***Species Conservation Strategies:***

1. When appropriate, support recommendations by the Ecosystem Management and Restoration Research Program (EMRRP) (Martin 2002).

***Threats Affecting Habitat:***

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat							
	Altered Composition/Structure	Altered Water Quality	Groundwater Depletion	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation	Modification of Water Levels; Changes in Natural Flow Patterns	Sedimentation
Channelization of rivers or streams	XXX			XXX	XXX		XXX	XXX
Construction of ditches, drainage or diversion systems	XXX			XXX	XXX		XXX	XXX
Conversion to agriculture or other forest types				XXX		XXX		XXX
Development/maintenance of pipelines, roads or utilities	XXX			XXX	XXX	XXX	XXX	XXX
Excessive groundwater withdrawal			XXX					
Fire suppression	XXX							
Incompatible forestry practices	XXX	XXX			XXX		XXX	XXX
Invasive/alien species	XXX				XXX			
Recreational use/vehicles	XXX				XXX			
Residential development				XXX	XXX	XXX		XXX

***Habitat Conservation Strategies:***

1. Work with Louisiana Forestry Association (LFA) to produce a publication for landowners which discusses BMPs for Streamside Management Zones (SMZs) and methods for effective landowner/logger communication.
2. Conduct surveys to determine the current extent and condition of this habitat type.
3. Develop management plans/recommendations for this habitat type.
4. Support research investigating the effects of altered hydrology regimes within this and adjacent habitats.
5. Work with appropriate planning commissions to provide LNHP data that illustrates locations of this habitat type.

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## 6. Bottomland Hardwood Forest

**Rarity Rank:** S4/G4G5

**Synonyms:** Mixed Bottomland Hardwoods, Broad Stream Margins, Hardwood Bottoms

**Ecological Systems:**

CES203.512 Lower Mississippi River Bottomland and Floodplain Forest

CES203.489 East Gulf Coastal Plain Large River Floodplain Forest

CES203.065 Red River Large Floodplain Forest

CES203.488 West Gulf Coastal Plain Large River Floodplain Forest

**General Description:**

Bottomland hardwood forests are forested, alluvial wetlands occupying broad floodplain areas that flank large river systems. These forests are found throughout Louisiana in all parishes, but are the predominant natural community type of the Mississippi River Alluvial Plain. They also play a major role in the EGCP where they are predominantly associated with the Pearl, and Bogue Chitto River floodplains, with some additional areas along the Tangipahoa, Natalbany, Tickfaw and Amite Rivers (Smith 1999b). Bottomland hardwood forests are characterized and maintained by a natural hydrologic regime of alternating wet and dry periods generally following seasonal flooding events. These forests support distinct assemblages of plants and animals associated with particular landforms, hydric soils, and hydrologic regimes. They are important natural communities for maintenance of water quality, providing a very productive habitat for a variety of fish and wildlife species, and are important in regulating flooding and stream recharge. Bottomland hardwoods are extremely productive areas due in part to periodic flood-transported and deposited particulate and dissolved organic matter and nutrients (LNHP 1986-2004). In general, forested floodplain habitats are mixtures of broadleaf deciduous, needleleaf deciduous, and evergreen trees and shrubs. Bottomland hardwood forests contain a number of species which can be aggregated into specific associations or communities based on environmental factors such as physiography, topography, soils, and moisture regime (Allen 1997, The Nature Conservancy 2004). In the far eastern portion of the EGCP, along the lower Pearl River, several species associations are recognized with *Quercus laurifolia* (laurel oak) being the community dominant and *Persea borbonia* (red bay) being common in the understory (White 1983).



The following are three associations recognized by the LNHP in bottomland hardwood forests of Louisiana (LNHP1986-2004):

1). **Overcup Oak - Water Hickory Bottomland Forest**

*Quercus lyrata* (overcup oak) and *Carya aquatica* (water hickory) are codominants of this floodplain forest which occurs on low-lying poorly drained flats, sloughs in the lowest backwater basins, and on low ridges with clay soils that are subject to inundation. Semi-permanently inundated or saturated soils are generally present for major portion of the growing season. Associate species include *Fraxinus pennsylvanica* (green ash), *Celtis laevigata* (hackberry), *Cornus foemina* (swamp dogwood), *Forestiera acuminata* (swamp privet), *Planera aquatica* (planertree), *Cephalanthus occidentalis* (buttonbush) and vines. This community type has a long successional stage.

2). **Hackberry-American Elm-Green Ash Bottomland Forest**

*Celtis laevigata* (hackberry), *Ulmus americana* (American elm), and *Fraxinus pennsylvanica* (green ash) are codominants. This community occurs in floodplains of major rivers on low ridges, flats and sloughs in first bottoms. Soils are seasonally inundated or saturated periodically for 1 to 2 months during the growing season. Common associates are *Carya aquatica* (water hickory), *Quercus texana* (nuttall oak), *Q. phellos* (willow oak), *Q. nigra* (water oak), *Q. lyrata* (overcup oak), *Liquidambar styraciflua* (sweetgum), *Acer negundo* (box elder), *Ulmus alata* (winged elm), *Acer rubrum* (red maple), *Gleditsia aquatica* (water locust) and *Plantanus occidentalis* (American sycamore). Understory species include *Cornus foemina* (swamp dogwood), *Crataegus* spp. (hawthorn), and *Morus rubra* (red mulberry). Many vines and herbaceous plants are present.

3). **Sweetgum-Water Oak Bottomland Forest**

The community dominants are *Liquidambar styraciflua* (sweetgum) and *Quercus nigra* (water oak). Major associates are *Celtis laevigata* (hackberry), *Fraxinus pennsylvanica* (green ash), *Ulmus americana* (American elm), and *Q. texana* (Nuttall oak). It occurs in alluvial floodplains, extensively in the Mississippi alluvial valley on well drained first bottom ridges. Associated species are *Acer rubrum* (red maple), *Morus rubra* (red mulberry), *Smilax* spp. (greenbrier), *Sabal minor* (dwarf palmetto), *Ilex decidua* (deciduous holly), *Crataegus viridis* (green hawthorn), *Ampelopsis arborea* (peppervine), *Campsis radicans* (trumpet creeper), and *Toxicodendron radicans* (poison ivy). Soils are seasonally saturated or inundated for up to 2 months during the growing season.

***Current Extent and Status:***

Bottomland hardwood forest loss is estimated to be 50 to 75 % of the original presettlement acreage, statewide (Smith 1993). Old-growth examples of this habitat type are very rare. In the MRAP, clearing for agricultural production was the primary factor that led to fragmentation and decline of this habitat type. Large tracts of bottomland



hardwood forest remain but most are either second or third growth stands. This habitat can be found within many of the WMAs managed by LDWF and on NWRs managed by the USFWS. WMAs support 304,982 acres of bottomland hardwoods, while NWRs contain another 150,000 acres. The U.S. Army Corps of Engineers (COE) oversees the Atchafalaya Basin Floodway which is the largest remaining block of bottomland hardwood forests and swamp in the U.S. (595,000 acres) yet most of the basin remains in private ownership. Louisiana's ECGP still contains extensive areas of bottomland hardwood forest primarily along the Pearl and Bogue Chitto Rivers in St. Tammany and Washington Parishes, respectively. Much of this acreage is contained within the Bogue Chitto NWR, managed by the USFWS, and Pearl River WMA, operated by LDWF. The lower Tangipahoa and Natalbany Rivers in Tangipahoa Parish, as well as the Tickfaw and Amite Rivers in Livingston Parish, support tracts of bottomland forest (Smith 1999a, Smith 1999b). Louisiana State Parks including Chicot, Lake Fausse Point, Tickfaw, Fontainebleau, and Bogue Chitto support bottomland hardwood forests. Other small privately owned bottomland hardwood sites are located within all parishes in the state, and a total of 4,400 acres of combined bottomland hardwood forests and swamps are registered with the Louisiana Natural Areas Registry Program. Restoration efforts have been in progress since the 1980's, and with the aid of the Conservation Reserve Program (CRP) and Wetland Reserve Program (WRP) over 365,000 acres have been reforested in Louisiana (R. Marcantel, personal communication). Reconnecting fragmented forest blocks and restoration of wetland forest functions are the major challenges to reforestation efforts and are essential to providing adequate wildlife habitat in bottomland hardwood forest systems.



<b>BOTTOMLAND HARDWOOD FOREST SPECIES OF CONSERVATION CONCERN (34)</b>		
<b>AMPHIBIANS</b>	Yellow-throated Vireo	<b>MAMMALS</b>
Southern Dusky Salamander	Northern Parula	Southeastern Shrew
Louisiana Slimy Salamander	Prothonotary Warbler	Southeastern Myotis
Strecker's Chorus Frog	Swainson's Warbler	Louisiana Black Bear
Eastern Spadefoot	Louisiana Waterthrush	Long-tailed Weasel
Southern Crawfish Frog	Kentucky Warbler	Eastern Spotted Skunk
	Hooded Warbler	
<b>BIRDS</b>	Field Sparrow	<b>REPTILES</b>
Yellow-crowned Night-Heron	Rusty Blackbird	Alligator Snapping Turtle
Wood Stork	Orchard Oriole	Western Worm Snake
Swallow-tailed Kite		Common Rainbow Snake
Bald Eagle	<b>BUTTERFLIES</b>	Timber Rattlesnake
American Woodcock	Celia's Roadside Skipper	
Yellow-billed Cuckoo	Falcate Orangetip	
Wood Thrush	'Seminole' Texan Crescent	

***Priority Species Research and Survey Needs:***

Strecker's Chorus Frog: The current status of this species in Louisiana is uncertain, and it may be extirpated. Intensive surveys are needed to update occurrence records and abundance for inclusion in LNHP database.

Swallow-tailed Kite: Continue to inventory and monitor Swallow-tailed Kites on public and private lands to fill data gaps in distribution and abundance for inclusion in the LNHP database and Audubon nationwide database. Begin research to determine the effects of silviculture/land management practices on this species.

Rusty Blackbird: Initiate surveys to determine wintering population abundances and habitat use to augment Christmas Bird Counts.

Songbirds: Continue to support research on silviculture/land management practices and their effects on all songbird species in this habitat.

Waterbirds: Continue to conduct rookery surveys to update the LNHP database information.

'Seminole' Texan Crescent: Conduct surveys to determine current distribution and abundance for inclusion in the LNHP database.

Louisiana Black Bear: Continue research on ecology and support repatriation efforts.

Eastern Spotted Skunk: Considered critically imperiled in Louisiana, intensive surveys are needed to update occurrence records and abundance for inclusion in LNHP database.

Southeastern Shrew: Considered imperiled in Louisiana. Together with Arkansas and Missouri, Louisiana represents the western edge of its range. Intensive surveys needed to update occurrence records and abundance for inclusion in LNHP database.

**Species Conservation Strategies:**

1. Swallow-tailed Kite: Implement conservation and management recommendations of SWG project T9 (Coulson 2004).
2. Bald Eagle: Continue long-term monitoring of active bald eagle nests, successful breeding pairs, and fledged eagles.
3. Louisiana Black Bear: Partner with the Black Bear Conservation Committee (BBCC), USFWS and continue to support the implementation of recovery efforts for this species.
4. American Woodcock: Develop partnerships with state and federal agencies, NGOs, and the private sector to implement the American Woodcock Management Plan.

5. Promote the use of appropriate silvicultural techniques to restore/manage Bottomland Hardwood (BLH) forests for wildlife (include importance of tree species diversity, den trees for birds and mammals, leaf litter, etc). Snags should be retained during logging operations for cavity-nesting wildlife species. Efforts need to be made to maintain sufficient levels of woody debris in stands for reptiles, amphibians and small mammals.
6. Work with landowners to initiate or continue the implementation of PIF bird conservation plans, conservation plans developed for amphibians and reptiles, and USFWS threatened and endangered species recovery plans over the next 10 years.
7. Determine the microhabitat preferences and requirements of species utilizing bottomland hardwood forest to understand how these species are utilizing the habitat to determine management needs.

***Threats Affecting Habitat:***

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat								
	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation	Herbivory	Modification of Water Levels; Changes in Natural Flow Patterns	Predation/ Parasitism/ Disease	Sedimentation	Toxins/ Contaminants
Channelization of rivers or streams	XXX	XXX				XXX			
Commercial/ industrial development		XXX		XXX					
Construction of ditches, drainage or diversion systems	XXX					XXX			
Conversion to agriculture or other forest types		XXX		XXX		XXX			
Crop production practices		XXX				XXX		XXX	XXX
Dam construction		XXX		XXX		XXX			
Development/maintenance of pipelines, roads or utilities		XXX	XXX	XXX		XXX			
Incompatible forestry practices	XXX		XXX	XXX		XXX			
Invasive/alien species	XXX	XXX			XXX				
Oil or gas drilling		XXX	XXX	XXX					
Operation of dams or reservoirs	XXX					XXX			
Operation of drainage or diversion systems	XXX	XXX	XXX			XXX			
Parasites/pathogens	XXX						XXX		
Recreational use/vehicles			XXX						
Residential development		XXX	XXX	XXX		XXX			

***Habitat Conservation Strategies:***

1. Continue to monitor nuisance species (nutria, beaver, etc.) and control them as needed.
2. Promote use of appropriate silvicultural techniques to restore/manage BLH forests for wildlife (include importance of tree species diversity), den trees for birds and mammals, etc.
3. Encourage the use of BMP's in the conservation of this habitat type.
4. Work with NRCS and LFA to promote economic value of hardwood lumber to encourage the management/restoration of this habitat.
5. Support research regarding palmetto abundance in bottomlands and effects on wildlife species and habitat structure.
6. Work with adjoining states to address water management issues that affect bottomland hardwood habitat in Louisiana.
7. Work with BBCC, Louisiana Department of Transportation and Development (DOTD), NRCS, USFWS, U.S. Forest Service (USFS), private landowners, etc. to promote corridors of bottomland hardwood forests for wildlife species.
8. Work with oil and gas corporations to encourage the use of directional drilling to minimize the environmental impacts to this habitat.

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## 7. Brackish Marsh

**Rarity Rank:** S3S4/G4?

**Synonyms:** Needle Rush Marsh, Edge-Zone Marsh, Middle Estuary

**Ecological Systems:**

CES203.471 Mississippi Delta Salt and Brackish Tidal Marsh

CES203.468 Gulf Coast Chenier Plain Salt and Brackish Tidal Marsh

**General Description:**

Brackish marsh is usually found between salt marsh and intermediate marsh, although it may occasionally lie adjacent to the Gulf of Mexico. This community is irregularly tidally flooded and is dominated by salt-tolerant graminoids. Small pools or ponds may be scattered throughout.

Plant diversity and soil organic matter content are higher in brackish marsh than in salt marsh. Brackish marsh is typically dominated by *Spartina patens* (marshhay cordgrass). Other significant associated species include *Distichlis spicata* (salt grass), *Schoenoplectus olneyi* (three-cornered grass), *S. robustus* (salt marsh bulrush), *Eleocharis parvula* (dwarf spikeweed), *Ruppia maritima* (widgeon grass), *Paspalum vaginatum* (seashore paspalum), *Juncus roemianus* (black rush), *Bacopa monnieri* (coastal water hyssop), *Spartina alteriflora* (smooth cordgrass), and *S. cynosuroides* (big cordgrass). Two other major autotrophic groups in brackish marsh are epiphytic algae and benthic algae. Generally speaking, vertebrate species population levels are higher in brackish marsh compared to Salt Marsh. Brackish marsh is of very high value to estuarine larval forms of marine organisms such as shrimp, crabs, menhaden, etc. (See Salt Marsh for other functions). Brackish marsh salinity averages about 8 ppt. This community may be changed to another marsh type by shifts in salinity. Intrusion of salt water from the Gulf of Mexico up numerous waterways exerts a major influence in the configuration of the various marsh types.

**Current Extent and Status:**

Presettlement extent of brackish marsh was estimated to have been between 500,000 and 1,000,000 acres with 50 to 75 percent remaining today (Smith 1993). At present the total acreage of brackish marsh appears to be increasing due to shifts in marsh salinity levels (LNHP 1986-2004). However, stable, viable examples of brackish marsh are rare in Louisiana.



There are a number of conservation areas in the Louisiana marsh managed by state and federal agencies and private organizations. The management of these sites is largely aimed at preserving and improving wintering waterfowl habitat. This involves the use of water control structures to regulate water

levels and salinity input, water/sediment diversions to abate marsh deterioration, and prescribed burning to improve habitat and food quality for wildlife. These management activities are necessary since levee construction and chanelization of waterways altered their hydrology and have cut many canals in the marsh for navigation and oil and gas exploration which serve as avenues for salt water intrusion. The Chenier plain will continue to deteriorate due to lack of sediment deposition by long shore currents which occurred historically when the Mississippi River shifted further west.

NWRs that support brackish marsh include Bayou Sauvage (approximately 9,000 acres are brackish), Delta (brackish acreage not known, about 60% of the 49,000 acre refuge is fresh marsh), and Sabine (total acreage ca 124,000, brackish marsh acreage unknown, approx. 33,000 acres are impounded fresh marsh). Of the areas managed by LDWF, Marsh Island and State Wildlife Refuges contain large areas of brackish marsh (70,000 acres and 13,000 acres, respectively). Biloxi WMA (40,000 total acres) supports mostly brackish marsh. Other refuges and WMAs containing brackish marsh, among other marsh types, include Pointe-aux-Chenes (total acres just over 31,000) and Rockefeller (total acres 76,000, intensely managed). Paul J. Rainey Sanctuary, owned by The Audubon Society, is 26,000 acres and consists largely of brackish marsh with a small area of intermediate marsh. Rainey Sanctuary is contiguous with LDWF's State Wildlife Refuge.

<b>BRACKISH MARSH SPECIES OF CONSERVATION CONCERN (36)</b>		
<b>BIRDS</b>	Clapper Rail	Loggerhead Shrike
Brown Pelican	King Rail	Seaside Sparrow
American Bittern	Whooping Crane	Nelson's Sharp-tailed Sparrow
Reddish Egret	Marbled Godwit	
Yellow-crowned Night-Heron	Dunlin	<b>BUTTERFLIES</b>
Mottled Duck	Short-billed Dowitcher	Neamathla Skipper
Northern Pintail	Gull-billed Tern	Palatka Skipper
Canvasback	Caspian Tern	Dion Skipper
Redhead	Royal Tern	Great Southern White
Lesser Scaup	Sandwich Tern	Western Pygmy-Blue
Bald Eagle	Common Tern	
Northern Harrier	Forster's Tern	<b>REPTILES</b>
Yellow Rail	Black Skimmer	Mississippi Diamondback Terrapin
Black Rail	Short-eared Owl	

***Priority Species Research and Survey Needs:***

Northern Harrier: Conduct surveys to determine its current distribution and winter abundance in coastal areas.

Yellow Rail and Black Rail: Determine current distribution and winter abundance in coastal areas.

Reddish Egret: Surveys needed to assess limiting factors on their reproductive success and the effects of human coastal recreational activities on bird populations.

Seaside Sparrow and Nelson's Sharp-tailed Sparrow: Conduct surveys to determine their current abundance and distribution in relation to changes in marsh composition. Large populations should be monitored on a yearly basis to detect long-term trends and to guide management decisions.

Waterbirds: Continue to conduct rookery surveys to update the LNHP database information.

Palatka Skipper, Great Southern White, Western Pygmy-Blue: Conduct surveys to determine current distribution and abundance for inclusion in the LNHP database.

Mississippi Diamondback Terrapin: Population status in Louisiana unknown; drastic declines apparent in other states, but perceived threats have not been proven. Review Marine Fisheries seine records and conduct replicate surveys to evaluate population trends.

### ***Species Conservation Strategies:***

1. Terns:
  - Disturbance and loss of nesting habitat are major threats; develop partnerships to strengthen the protection and restoration of barrier islands.
  - Develop a comprehensive survey methodology to determine long term trends in population abundances.
2. Shorebirds, Wading Birds:
  - Provide public education regarding the importance of waterbird nesting colonies and shorebird feeding areas. Reduce the negative effects on these areas from recreational and other uses.
  - Work with landowners to implement management and conservation recommendations for waterbirds (especially rails) of SWG project T18 upon completion.
  - Coordinate with GCJV to implement recommendations of shorebird and wading bird conservation plans.
  - Disturbance and loss of nesting habitat are major threats. The continued protection and restoration of coastal marshes are top priorities. Develop new and/or improve existing partnerships to achieve this goal.
3. Waterfowl:
  - Continue to encourage the creation/enhancement/maintenance of high-quality habitat across Louisiana.
  - Work with Ducks Unlimited (DU), Delta Waterfowl (DW), and USFWS to assuring that quality habitat, including refuge from hunting and other disturbance, is distributed across the landscape.
  - Encourage the maintenance of rice farming north of marshes and discourage conversion to crops with lower value to waterfowl.
  - Continue LDWF partnerships with DU, DW, USWFS, and state wildlife management agencies to conserve habitat on the northern breeding grounds.



4. Brown Pelican: Continue with long-term monitoring of nesting colonies.
5. Bald Eagle: Continue with long-term monitoring of active bald eagle nests, successful breeding pairs, and fledged eagles.

***Threats Affecting Habitat:***

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat								
	Altered Composition/Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation	Herbivory	Modification of Water Levels; Changes in Natural Flow Patterns	Salinity Alteration	Shoreline Erosion	
Commercial/industrial development				XXX			XXX		
Construction of navigable waterways	XXX	XXX	XXX			XXX	XXX	XXX	
Development/maintenance of pipelines, roads or utilities		XXX	XXX			XXX			
Fire suppression	XXX	XXX	XXX						
Grazing practices	XXX	XXX	XXX						
Invasive/alien species	XXX	XXX			XXX				
Levee or dike construction	XXX	XXX	XXX			XXX		XXX	
Residential development		XXX	XXX						
Recreational use/vehicles									
Saltwater intrusion	XXX	XXX	XXX				XXX	XXX	

***Habitat Conservation Strategies:***

1. Develop methods to encourage landowners to remove cattle from brackish marshes and manage the land for wildlife conservation.
2. Promote waterfowl management as an alternative to livestock production by providing incentives to landowners.
3. Support and encourage expansion of the mini-refuge system administered by USFWS refuges.
4. Work with LCA, CWPPRA to support coastal restoration projects, specifically targeting important waterbird nesting areas and species of conservation concern.
5. Work with COE and state agencies to insure water control structures provide the maximum benefit to brackish marsh.

6. Work with NRCS Plant Materials Center and BTNEP to develop viable cultivars for marsh restoration efforts.

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## 8. Calcareous Forest

**Rarity Rank:** S2/G2?Q

**Synonyms:** Calcareous Hardwood Forest, Dry Calcareous Woodland, Blackland Hardwood Forest, Upland Hardwood Forest, Circum-Neutral Forest

**Ecological Systems:**

CES203.379 West Gulf Coastal Plain Southern Calcareous Prairie

CES203.378 West Gulf Coastal Plain Pine-Hardwood Forest

**General Description:**

This community occurs on calcareous substrata in the uplands of central, western and northwest Louisiana. It characteristically occurs on hills and slopes on either side of small creeks, at times in a mosaic with calcareous prairies. Associated geological formations so far identified are the same as for calcareous prairie. Soils are stiff calcareous clays, not quite as alkaline as in the prairies (surface pH ~ 6.5-7.5), with very high shrink-swell characteristics. Individual occurrences are usually of limited areal extent.

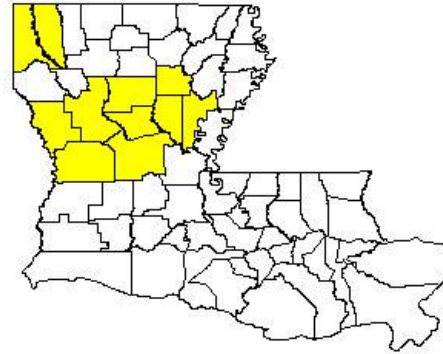


Common overstory species include *Quercus stellata* (post oak, often dominant), *Q. shumardii* (shumard oak), *Q. alba* (white oak), *Q. muhlenbergii* (chinkapin oak), *Carya myristiciformis* (nutmeg hickory), *C. ovata* (shagbark hickory), *C. tomentosa* (mockernut hickory), *Pinus echinata* (shortleaf pine), *P. taeda* (loblolly pine), *Fraxinus americana* (white ash), *Diospyros virginiana* (persimmon), *Liquidambar styraciflua* (sweetgum), *Celtis* spp. (hackberries), *Gleditsia triacanthos* (honey locust), *Morus rubra* (red mulberry), *Fagus grandifolia* (beech), *Ulmus rubra* (slippery elm), *U. americana* (American elm), *U. alata* (winged elm), *U. crassifolia* (rock elm), and *Acer rubrum* (red maple). *Quercus sinuata* var. *sinuata* (Durand oak) and *Q. oglethorpensis* (Oglethorp oak) may rarely be present. Trees, especially pines, are often stunted and/or crooked due to extreme physical soil properties. Midstory and understory shrubs typically include *Viburnum rufidulum* (rusty blackhaw), *Crataegus* spp. (hawthorns), *Prunus mexicana* (Mexican plum), *Cercis canadensis* (red bud), *Chionanthus virginicus* (fringe-tree), *Asimina triloba* (paw-paw), *Ilex decidua* (deciduous holly), *Vaccinium arboreum* (winter huckleberry), *Rhamnus caroliniana* (Indian cherry), *Rhus copallina* (flame-leaf sumac), *Ostrya virginica* (hop-hornbeam), and *Aesculus pavia* (red buckeye). *Maclura pomifera* (osage-orange) may occur sporadically, especially in northwest Louisiana. The herbaceous layer may contain *Symphotrichum drummondii* (Drummond's aster), *Solidago auriculata* (auricled goldenrod), *Cynoglossum virginianum* (hound's-tounge), *Antennaria plantaginifolia*

(plantain-leaf pussy-toes), *Lithospermum tuberosum* (tuberous puccoon), *Pedicularis canadensis* (Canadian lousewort), *Podophyllum peltatum* (may-apple), *Phlox divaricata* (phlox), *Elephantopus* spp. (elephant-foot), *Viola* spp. (violets), *Chasmanthium* spp. (spangle-grasses), *Bromus* spp. (brome grasses), *Onosmodium hispidissimum* (false-gromwell), *Sanicula canadensis* (snakeroot), *Zizia aurea* (golden alexanders), *Tipularia discolor* (crane-fly orchid), *Agrimonia* spp. (agrimony), *Galium* spp. (bedstraws), and others. Fire is thought to have played a minor role in the dynamics of this community.

**Current Extent and Status:**

Additional field survey work is needed to more accurately determine the status and extent of calcareous forests. It is estimated that 50,000 to 100,000 acres of this habitat occurred in presettlement times and that 25 to 50 percent remain today (Smith 1993). Confirmed occurrences in the LNHP database are from Bossier, Caldwell, Grant, and Winn Parishes. Calcareous forests certainly occur (or did occur) in the remaining parishes in the distribution map. There are several high quality occurrences on conservation areas such as KNF (particularly the Winn Ranger District), Barksdale Air Force Base, Bodcau WMA, and TNC's Copenhagen Hills Preserve.



CALCAREOUS FOREST SPECIES OF CONSERVATION CONCERN (7)	
<b>BIRDS</b>	<b>MAMMALS</b>
American Woodcock	Long-tailed Weasel
Yellow-billed Cuckoo	Eastern Spotted Skunk
Wood Thrush	
Orchard Oriole	<b>REPTILES</b>
	Southeastern Scarlet Snake

**Priority Species Research and Survey Needs:**

Birds: Work with state Breeding Bird Survey (BBS) coordinator to ensure that survey routes are conducted in this habitat where feasible.

**Species Conservation Strategies:**

- Wood Thrush: Develop a monitoring program (i.e., Monitoring Avian Productivity and Survival (MAPS)) to assess relative abundance in this habitat.

***Threats Affecting Habitat:***

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat		
	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance
Conversion to agriculture or other forest types		XXX	
Fire suppression	XXX		
Incompatible forestry practices	XXX		XXX
Invasive/alien species	XXX		
Recreational use/vehicles			XXX

***Habitat Conservation Strategies:***

1. Conduct surveys to determine the current extent and condition of this habitat type.
2. Develop management plans/recommendations for this habitat type.
3. Promote fire as essential management tool; promote alternatives where prescribed burning is not an option.
4. Provide educational information on this habitat type and its importance to species of conservation concern to landowners/land managers through technical pamphlets and the LDWF website.
5. Work with the legislature to provide incentives (tax breaks, etc.) to landowners to retain the natural state of areas where this habitat occurs.
6. Support research to understand the basic ecosystem characteristics and processes of this habitat type.

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## 9. Calcareous Prairie

**Rarity Rank:** S1/G1

**Synonyms:** Barrens, Calcareous Barrens, Calcareous Clay Prairie, Keiffer Prairie, Jackson Prairie, Blackland Prairie, Calcareous Glade

**Ecological Systems:** CES203.379 West Gulf Coastal Plain Southern Calcareous Prairie

### **General Description:**

Calcareous prairies are typically small, naturally treeless areas occurring on calcareous substrata in the uplands of central, western, and northwest Louisiana. They range in size from less than one acre, up to 80 or more acres, and occur in a mosaic with calcareous forests. Calcareous prairies have been identified in association with four geological formations: Intermediate Terraces (Pleistocene) associated with old Red River deposits in northwest Louisiana (**Morse Clay Prairies**), the **Fleming**



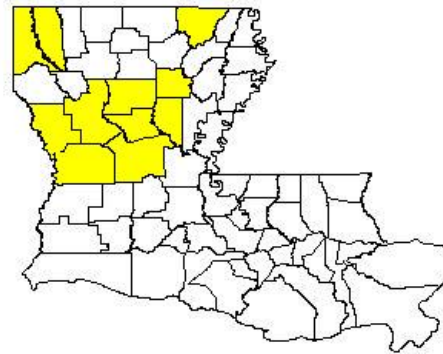
**Formation** (Tertiary-Miocene) in central-western Louisiana, the **Jackson Group** (Tertiary-Eocene) in central Louisiana, and the **Cook Mountain Formation** (Tertiary-Eocene) in central and western Louisiana. Soils are stiff calcareous clays (surface pH ~ 7.5-8.0), with very high shrink-swell characteristics, and range in color from red to olive-tan to gray-black. Various soil inclusions occur (depending on geology) and may include calcareous concretions (limestone nodules), marine mollusc shells, shark teeth, and gypsum crystals.

The herbaceous flora is very diverse and dominated by grasses, composites, and legumes. Common grass species are *Schizachyrium scoparium* (little bluestem), *Sporobolus* spp. (dropseeds), *Andropogon glomeratus* (bushy broomsedge), *Andropogon gerardii* (big bluestem), *Sorghastrum nutans* (Indian grass), *Aristida* spp. (three-awn grasses), *Paspalum* spp. (pasp grasses), *Panicum* spp. (panic grasses), *Eragrostis* spp. (love grasses), and *Setaria* spp. (bristle grasses). A number of exotic grass species may occur. Common composites include *Eurybia* spp. and *Symphotrichum* spp. (asters), *Liatris* spp. (blazing-stars), *Coreopsis* spp. (tick-seeds), *Solidago* spp. (goldenrods), *Ambrosia psilostachya* (western ragweed), *Vernonia* spp. (ironweeds), *Rudbeckia* spp. (brown-eyed susans), *Eupatorium* spp. (thoroughworts), *Echinacea pallida* (pale coneflower), *E. purpurea* (purple coneflower), *Silphium* spp. (rosin-weeds), *Cacalia plantaginea* (Indian plantain), *Gaillardia aestivalis* (blanket flower), and *Helenium* spp. (sneeze-weeds). Frequently encountered legumes include *Acacia angustissima* (prairie acacia), *Baptisia* spp. (indigos), *Desmanthus illinoensis* (wad o'pods), *Galactia volubilis* (milk pea), *Mimosa strigillosa* (sensitive-plant), *Neptunia lutea* (yellow puff), *Petalostemum candidum* (white prairie-clover), and *P. purpureum* (purple prairie-clover).

Additional forbs of prominence are *Anemone berlandieri* (wind flower), *Ranunculus* spp. (crow-foot), *Asclepias* spp. (milk-weeds), *Callirhoe papaver* (poppy-mallow), *Delphinium carolinianum* (larkspur), *Hedyotis nigricans* (bluets), *Hedyotis purpurea* var. *calycosa* (prairie bluets), *Linum* spp. (flax), *Oenothera speciosa* (Mexican evening-primrose), *Ruellia humilis* (wild petunia), and *Salvia azurea* (blue sage). Calciphilic woody species that are often present (and that may come to dominate unburned prairies) include *Crataegus* spp. (hawthorns, often most prominent), *Bumelia lanuginosa* (chittum-wood), *Berchemia scandens* (rattan-vine), *Diospyros virginiana* (persimmon), *Cornus drummondii* (rough-leaf dogwood), *Juniperus virginiana* (eastern red cedar), *Ilex decidua* (deciduous holly), *Smilax bona-nox* (greenbrier), *Fraxinus americana* (white ash), and *Gleditsia triacanthos* (honeylocust). *Maclura pomifera* (osage-orange) may sporadically occur on edges, especially in northwestern Louisiana. Regularly-occurring fire, high soil pH, and extreme physical soil properties are postulated to have acted in concert to generate and perpetuate these upland clay prairies.

**Current Extent and Status:**

Historically there was an estimated 2,000 to 10,000 acres of calcareous prairie statewide and five to 10 percent of the original extent is thought to remain today (Smith 1993). Currently there are a handful of protected calcareous prairies on each formation.



Calcareous prairies found on the Jackson formation are concentrated near Copenhagen in Caldwell Parish. Many of these are captured by TNC’s Copenhagen Hills Preserve. There is one known occurrence of this type on the Catahoula Ranger District of KNF in Grant Parish. There is a high concentration of Cook Mountain calcareous prairies on the Winn Ranger District of KNF near Calvin in Winn Parish. Recently, the USFS has been working to remove invading woody vegetation and expand these prairies openings to their former extent. There are a few prairies just off of KNF on private land that have an opportunity to be protected and managed for the benefit of this habitat type. A narrow finger of the Cook Mountain Formation extends southwest into Sabine Parish and supports one known calcareous prairie near Florien that is degraded but recoverable. There are surely more prairies along this portion of the Cook Mountain Formation. Fleming Calcareous Prairies are scattered in Vernon, Rapides, and Natchitoches Parishes. Several occurrences are on Ft. Polk and KNF. Most are on private land and are likely degraded. Given the inclusional nature of this habitat, they are frequently site prepared and planted in loblolly pine plantations despite their poor capacity to grow timber. Survey work is needed to determine the condition of calcareous prairies on private land.

There are about 15 known Morse Clay prairies in Bossier and Caddo parishes, several of which are found on public land. Several are captured by Bodcau WMA, which is owned by COE and leased by LDWF. Some of the prairie acreage on Bodcau WMA is



protected in registered natural areas but much (probably >50%) of the acreage that was historically Morse Clay prairie on Bodcau WMA is now managed for food plots. There is an excellent opportunity to attempt to restore this habitat on Bodcau WMA.

There are several Morse Clay calcareous prairies known to occur on Barksdale Air Force Base. Most of these prairies, particularly the ones within Escarpment Natural Area, are of high quality (McInnis 1997). The Barksdale prairies are important intrinsically, but they also present a standard by which the quality of other prairies may be evaluated. This is especially important in monitoring the results of restoration projects. The status of the Morse Clay prairies on private land is unknown. Only one such prairie has been visited in the last 10 to 12 years. The prairie was still viable but contained large-diameter *Juniperus virginiana* (eastern redcedar).

CALCAREOUS PRAIRIES SPECIES OF CONSERVATION CONCERN (12)		
<b>BIRDS</b>	<b>BUTTERFLIES</b>	<b>MAMMALS</b>
Northern Bobwhite	Dusted Skipper	Hispid Pocket Mouse
American Woodcock	Reakirt's Blue	Eastern Harvest Mouse
Loggerhead Shrike	Little Metalmark	
Field Sparrow	Southern Dogface	<b>REPTILES</b>
Grasshopper Sparrow		Western Slender Glass Lizard

***Priority Species Research and Survey Needs:***

Loggerhead Shrike: BBS data for the period 1966-2000 indicate a 71% population decline rangewide. Monitoring of reproductive success and the effects of pesticides on food availability are needed along with statewide evaluation of changes in available habitat.

Birds: Work with state BBS coordinator to ensure that BBS routes are conducted in this habitat where feasible.

Hispid Pocket Mouse: Considered imperiled in Louisiana, intensive surveys needed to update occurrence records and abundance for inclusion in the LNHP database.

Eastern Harvest Mouse: Considered vulnerable in Louisiana, intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

Western Slender Glass Lizard: Exhibiting rangewide population declines; their status in Louisiana is not well known. Work cooperatively with forestry agencies, forestry companies and field biologists to collect observation data.

***Species Conservation Strategies:***

1. Northern Bobwhite and Grassland Birds: Support the implementation of recommended habitat restoration actions specified in NBCI and by LDWF Quail and Grassland Bird Task Force.

***Threats Affecting Habitat:***

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat			
	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Soil Erosion
Conversion to agriculture or other forest types	XXX	XXX		
Incompatible forestry practices	XXX		XXX	XXX
Invasive/alien species	XXX		XXX	XXX
Log deck debris			XXX	
Management of/for certain species	XXX		XXX	
Oil or gas drilling		XXX	XXX	
Recreational use/vehicles			XXX	XXX
Residential development		XXX	XXX	

***Habitat Conservation Strategies:***

1. Conduct status surveys to determine the extent and condition of this habitat type (Morse clay prairie, all types).
2. Work with land managers/hunting clubs/extension agents, etc. to discourage the placement of food plots within this habitat type.
3. Encourage the reporting of occurrences of this habitat type (target foresters).
4. Investigate funding opportunities for prairie restoration and the development of plant materials for prairie restoration.
5. Provide educational information on this habitat type and its importance to species of conservation concern to landowners/land managers through technical pamphlets and the LDWF website.
6. Work with the legislature to provide incentives (tax breaks, etc.) to landowners to retain the natural state of areas where this habitat occurs.
7. Support research to determine the effectiveness of restoration efforts of this habitat.

***References:***

LNHP. 1986-2004. The natural communities of Louisiana. Louisiana Natural Heritage Program, Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.

- MARTIN, D. L., AND L. M. SMITH. 1991. A survey and description of the natural plant communities of the Kisatchie National Forest, Winn and Kisatchie Districts. Louisiana Natural Heritage Program, Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.
- MCINNIS, N. C. 1997. Barksdale Air Force Base - threatened and endangered species - natural areas survey. The Nature Conservancy, Louisiana Field Office, Baton Rouge, LA.
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## 10. Coastal Dune Grassland/Shrub Thicket

**Rarity Rank:** S1S2/G2G3

**Synonyms:** Maritime Grassland, Dune Meadow, Dune Grass

**Ecological Systems:**

CES203.469 Louisiana Beach

CES203.471 Southeastern Coastal Plain Interdunal Wetland

CES203.544 Upper Texas Coast Beach

### **General Description:**

(Note: Coastal Dune Grasslands and Coastal Dune Shrub Thickets are described as distinct communities in the LNHP Natural Communities of Louisiana. They are considered together here due to their floristic similarity and similarity in management needs.)



**Coastal Dune Grassland** occurs on beach dunes and relatively elevated backshore areas (ridges) above intertidal beaches on barrier islands and on the mainland. The dunes of Louisiana's barrier islands and mainland beaches are poorly developed because of the high frequency of overwash associated with hurricanes and storms, and a limited amount of eolian-transported sand. The sites are normally xeric (excessively drained) owing to the fact that they are elevated above the highest flood mark (except during hurricanes). These sites are exposed to moderate to high amounts of salt spray. In addition, limited nutrient availability and substrate instability also affect coastal dune vegetation.

The vegetative cover ranges from sparse to fairly dense and is dominated by salt spray tolerant grasses, which may include *Spartina patens* (wiregrass, usually present and often dominant), *Uniola paniculata* (sea oats), *Panicum amarum* (beach panic), *Triplasis purpurea* (purple sandgrass), *Paspalum vaginatum* (jointgrass), *Schizachyrium maritimum* (seacoast bluestem), *Distichlis spicata* (saltgrass), *Cenchrus* spp (sandburs), *Chloris petraea* (finger grass), *Sporobolus virginicus* (coast dropseed), *Eragrostis oxylepis* (red lovegrass), and *Andropogon* spp. (broomsedges). Forbs are common in this community and may form forb-dominated zones, particularly on the gulfward side of the dune. Forbs include *Batis maritima* (salt wort), *Ipomea stolonifera* (beach morning-glory), *I. pes-caprae* (goat-foot morning-glory), *Heliotropium currasivicum* (seaside heliotrope), *Strophostyles helvola* (sand wild bean), *Agalinis maritima* (seaside false foxglove), *Iva imbricata* (sumpweed), *Solidago sempervirens* (seaside goldenrod), *Cakile* spp. (sea rockets), *Croton punctatus* (punctate goatweed), *Hydrocotyle bonariensis* (large leaf pennywort), *Heterotheca subaxillaris* (camphor weed), *Sesuvium portulacastrum* (sea purselane), *Pluchea camphorata* (camphor-weed), *Sabatia stellaris* (seastar rose-gentian), *Atriplex arenaria* (quelite), *Aphanostephus skirrobasis* (lazy daisy), *Salicornia*

spp. (glassworts), *Sueda linearis* (annual seepweed), *Centrosema virginianum* (butterfly pea) and *Lippia nodiflora* (common frog-fruit). Shrubs from adjacent Coastal Dune Shrub Thickets may occur as scattered individuals in this community. These sites are subject to frequent storm overwash with salt water flooding and sand deposition. These events frequently give rise to what are called "barrier flats". Dune swales may be extensive and are considered as inclusions in this natural community. Dunes and ridges may be shifted or eroded by storm floods, destroying vegetation.

If dunes remain stable, allowing natural succession to progress, then **Coastal Dune Shrub Thickets** are formed. These occur on established sand dunes and beach ridges on barrier islands and the mainland coast. Coastal dune shrub thickets are of very limited extent in Louisiana due to relatively poorly developed coastal dunes. The sites are typically xeric to xeric/mesic and moderately exposed to salt spray. This community normally appears as a relatively dense stand of shrubs. A variety of salt-tolerant shrubs may occur including *Morella cerifera* (wax myrtle), *Ilex vomitoria* (yaupon), *Iva* spp. (marsh elder), *Baccharis halimifolia* (saltbush), *Acacia smallii* (acacia), and *Zanthoxylum clava-herculis* (toothache tree). The shrubs are often covered with a dense growth of lichens. Vines, such as *Smilax* spp. (greenbriers) and *Vitis mustangensis* (wild grape), are often present. This community may be destroyed by sand dune migration or erosion and may be replaced by Coastal Dune Grassland.

**Current Extent and Status:**

Coastal dune grassland and shrub thickets are estimated to have occupied less than 2,000 acres each in presettlement times and for both communities, 50 to 75% is thought to remain today (Smith 1993). The most extensive examples of coastal dune grasslands are on the Chandeleur Islands, Timablier Islands, Isle Dernieres, and on the Chenier Plain from about Rutherford Beach (east of Cameron) westward to near the Texas state line. This habitat also occurs along other barrier islands and shorelines subject to high wave energy. The Chandeleur Islands are part of Breton NWR. Five islands in the Isle Dernieres chain (Wine, Whiskey, East, Trinity, and Raccoon) comprise LDWF's Isle Dernieres Barrier Islands Refuge.



Grand Isle supports some extensive coastal dune shrub thickets specifically on the east and west ends of the island. A considerable portion of this habitat is captured by Grand Isle State Park. None of the Cameron Parish coastal dune grassland/shrub thicket habitat falls within a conservation area.

COASTAL DUNE – GRASSLAND SHRUB THICKET SPECIES OF CONSERVATION CONCERN (11)		
<b>BIRDS</b> Brown Pelican Northern Harrier Wilson’s Plover Short-eared Owl Loggerhead Shrike	Grasshopper Sparrow  <b>BUTTERFLIES</b> Wild Indigo Duskywing Great Southern White	<b>MAMMALS</b> Eastern Spotted Skunk  <b>REPTILES</b> Western Slender Glass Lizard Eastern Glass Lizard

**Priority Species Research and Survey Needs:**

Northern Harrier: Conduct surveys to determine their current distribution and winter abundance in coastal areas.

Wild Indigo Duskywing and Great Southern White: Conduct surveys to determine their current distribution and abundance for inclusion in LNHP database.

Eastern Glass Lizard: This species has not been observed outside of the Grand Isle population in nearly thirty years, despite adequate habitat. Conduct surveys to determine if Grand Isle population is extant.

**Species Conservation Strategies:**

1. Brown Pelican: Continue with long-term monitoring of nesting colonies.
2. Waterbirds and Shorebirds: Work with LCA, CWPPRA to incorporate strategies specifically targeting important waterbird and shorebird nesting areas in all future coastal restoration efforts.

**Threats Affecting Habitat:**

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat			
	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation
Development/maintenance of pipelines, roads or utilities		XXX	XXX	XXX
Fire suppression	XXX			
Grazing practices	XXX		XXX	
Invasive/alien species	XXX			
Recreational use/vehicles	XXX		XXX	
Residential development		XXX	XXX	XXX
Shoreline erosion		XXX		XXX

***Habitat Conservation Strategies:***

1. Partner with NGOs, private landowners, etc. to promote protection of coastal dune grasslands and shrub thickets and continue to encourage landowners to enroll this habitat type in the Natural Areas Registry Program.
2. Promote education about invasive plant species within this habitat and methods to eradicate or control invasives.
3. Support NRCS and LDNR efforts for shoreline stabilization and habitat restoration.
4. Work with local governments to recommend limits on recreational vehicle use of this habitat.
5. Work with appropriate planning commissions to provide LNHP data that illustrates locations of this habitat type.
6. Work with NRCS Plant Materials Center and BTNEP to develop viable cultivars for coastal dune restoration efforts.
7. Work with the legislature to develop tax incentives and conservation easements or leases for landowners to encourage conservation of this habitat type.

***References:***

LNHP. 1986-2004. The natural communities of Louisiana. Louisiana Natural Heritage Program, Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.

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## 11. Coastal Live Oak-Hackberry Forest

**Rarity Rank:** S1S2/G2

**Synonyms:** Cheniere, Maritime Forest, Chenier Maritime Forest

**Ecological Systems:** CES203.466 West Gulf Coastal Plain Chenier and Upper Texas Coastal Fringe Forest and Woodland

### **General Description:**

Coastal Live Oak-Hackberry Forest or Cheniere (French for "place of oaks") is the natural community which formed on abandoned beach ridges primarily in southwest Louisiana. These ancient beaches were stranded via deltaic sedimentation by the constantly shifting Mississippi River. Composed primarily of fine sandy loams with sand and shell layers or deposits, these ridges are mostly 4 to 5 feet above sea level. *Quercus virginiana* (live oak) and *Celtis laevigata*



(hackberry) are the dominant canopy species. Other characteristic species are *Gleditsia triacanthos* (honeylocust), *Acer rubrum* var. *drummondii* (swamp red maple), *Zanthoxylum clava-herculis* (toothache tree), *Quercus nigra* (water oak), *Fraxinus pennsylvanica* (green ash), and *Ulmus americana* (American elm). Subcanopy species include *Crataegus viridis* (green hawthorn), *Dispyros virginiana* (persimmon), and *Ilex decidua* (deciduous holly). *Sabal minor* (palmetto) and *Opuntia* spp. (prickly pear cactus) are also common in the understory (LNHP 1986-2004, NatureServe 2005, Neyland and Meyer 1997). *Triadica sebifera* (= *Sapium sebiferum*; Chinese tallowtree) has become a serious invader of chenier forests, and can have major impacts on community structure and composition (Neyland and Meyer 1997). The chenieres are important storm barriers limiting saltwater intrusion into marshes. Typically, marshes north of chenieres are fresher than those gulfward. This community also functions as important wildlife habitat and serves as vital resting habitat for trans-gulf-migrating birds (Mueller 1990). Hundreds of thousands of birds (hundreds of different species) use chenieres as a stop-over point during migration.

### **Current Extent and Status:**

Louisiana's coastal chenier forests occur in the Chenier Plain from Iberia Parish westward across Vermilion and Cameron parishes. Since this forest type is found only on remnant beach ridges which are higher and drier than the surrounding marshes, they were the first areas to be cleared and developed. Of the original 100,000 to 500,000 acres in Louisiana, only 2,000 to 10,000 acres remain, 2-10 % of presettlement extent. The majority of these remnant forests are altered and fragmented, and threats continue from residential development, roads and utility construction, and overgrazing. Currently there



are few cheniers supporting high-quality examples of this natural community, and very few are afforded any degree of protection. The Audubon Society maintains the 40 acre Peveto Woods Bird and Butterfly Sanctuary in Cameron Parish, and one 146 acre tract owned by the Vermilion Parish School Board is registered with the Louisiana Natural Areas Registry Program.



***Importance to Neotropical Migrant Songbirds:***

It must be noted that the chenier plain-coastal live oak-hackberry forest habitat is extremely important as stopover sites for neotropical songbirds during spring and fall migration. The majority of migrants fly nonstop for more than 1,000 kilometers to cross the Gulf of Mexico each spring. At least 82 species of migratory birds regularly use these wooded habitats to replenish energy reserves necessary to successfully complete their migration immediately after crossing the Gulf of Mexico. During fall migration these chenier plain habitats provide important habitat corridors and staging areas as birds move along the coast through Texas and around the Gulf of Mexico on their journey to Central and South America.

COASTAL LIVE OAK - HACKBERRY FOREST SPECIES OF CONSERVATION CONCERN (13)		
<b>BIRDS</b>	<b>BUTTERFLIES</b>	<b>REPTILES</b>
American Woodcock	Celia's Roadside Skipper	Ornate Box Turtle
Yellow-billed Cuckoo	Falcate Orangetip	Western Slender Glass Lizard
Northern Parula		Timber Rattlesnake
Prothonotary Warbler	<b>MAMMALS</b>	
Painted Bunting	Southeastern Myotis	
Field Sparrow		
Orchard Oriole		

***Priority Species Research and Survey Needs:***

Celia's Roadside Skipper, Falcate Orangetip: Conduct surveys to determine their current distribution and abundance for inclusion in the LNHP database.

Ornate Box Turtle: Initiate surveys in areas identified by SWG project T20 (Lorenz and Hemmerling 2004) to update occurrence and abundance data for inclusion in the LNHP database.

Neotropical Migrant Birds: Continue to monitor neotropical bird use of chenier habitats.

***Species Conservation Strategies:***

1. Promote the benefits of bat colonies and roost sites and develop partnerships with landowners to encourage protection of valuable sites.

2. Work with landowners to initiate or continue the implementation of PIF bird conservation plans, conservation plans developed for amphibians and reptiles, and USFWS endangered and threatened species recovery plans over the next 10 years.
3. Determine the microhabitat preferences and requirements of species utilizing Coastal Live Oak-Hackberry Forest to understand how these species are utilizing the habitat and to determine management needs.

***Threats Affecting Habitat:***

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat			
	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation
Development/maintenance of pipelines, roads or utilities				XXX
Grazing practices	XXX		XXX	
Invasive/alien species	XXX			
Mining practices		XXX		
Residential development		XXX	XXX	XXX
Shoreline erosion		XXX		

***Habitat Conservation Strategies:***

1. Work with the legislature to provide incentives (tax breaks, etc.) to landowners to retain the natural state of areas where this habitat occurs.
2. Partner with state and federal agencies, NGOs, private landowners, etc. to increase conservation efforts of cheniers.
3. Work with COE and NRCS to develop better strategies for the placement of dredge materials as a restoration method for this habitat type.
4. Provide educational information on this habitat type and its importance to species of conservation concern to landowners/land managers through technical pamphlets and the LDWF website.
5. Review Texas tax exemption policies regarding livestock. Determine which of these policies may apply to conservation of cheniers in Louisiana, and work with the legislature to incorporate these policies into the tax code.
6. Support NRCS and LDNR efforts for shoreline stabilization and habitat restoration.
7. Support public acquisition/protection of high quality cheniers that have the potential for longterm sustainability.

8. Develop methods to encourage landowners to remove cattle from cheniers and manage the land for wildlife conservation.
9. Work with LCA, CWPPRA to broaden the coastal restoration projects to include cheniers.
10. Work with appropriate planning commissions to provide LNHP data that illustrates locations of this habitat type.
11. Provide information to landowners about incentive programs/cost share opportunities to control invasives.

**References:**

LNHP. 1986-2004. The natural communities of Louisiana. Louisiana Natural Heritage Program, Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.

LORENZ, N. F., AND S. A. HEMMERLING. 2004. Identification of potential habitat sites for the ornate box turtle (*Terrapene ornate*), the crested caracara (*Caracara cheriway*), and the burrowing owl (*Athene cunicularia*) using GIS capabilities. Final report. Report to the Louisiana Natural Heritage Program, Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.

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## 12. Coastal Mangrove-Marsh Shrubland

**Rarity Rank:** S3/G2?

**Synonyms:** Intertidal Saltwater Swamp, Saltwater Swamp, Mangrove Swamp

**Ecological Systems:** CES203.471 Mississippi Delta Salt and Brackish Tidal Marsh

### **General Description:**

Coastal Mangrove/Marsh Shrubland are estuarine communities dominated by *Avicennia germinans* (black mangrove). Although sometimes termed a swamp, the physiognomy of the community in Louisiana more closely resembles a shrub thicket. The coastal region of Louisiana delimits the northern range of this community due to mangrove's inability to tolerate temperatures below freezing. The top-kill caused by winter freezes also limits mangroves to a shrub-like form (10 feet or less in height), unlike Florida where they attain forest stature. Other characteristic vegetation associates include: *Spartina alterniflora* (smooth cordgrass), *Batis maritima* (saltwort), *Salicornia virginica* (creeping glasswort), *Iva frutescens* (marshelder), *Borrchia frutescens* (sea ox-eye), and *Distichlis spicata* (salt grass). Mixed stands of both species are comparatively frequent in Louisiana. Salt marshes and mangrove habitats are integral parts of the Louisiana barrier island system. The mangrove shrubland has several important ecological functions: the extensive root systems stabilize the shoreline and reduce erosion; the cover and food they provide create an excellent nursery area for fish and shellfish; the community improves surrounding water quality by filtering nutrients and suspended sediments; and many colonial waterbirds use the mangrove swamp for nesting.



### **Current Extent and Status:**

Mangroves in Louisiana are found along the fringes of the Deltaic Plain coastal marshes most commonly flanking large bays and on the leeward side of barrier islands. Montz (1980) estimated that in the late 1970's a total of 3,900 to 5,900 acres of mangroves occurred in Louisiana. Hard freezes in the winters of 1983 and 1984 seriously reduced the extent of this community in coastal Louisiana. The mangrove swamps importance in erosion control was clearly



documented by the extreme erosion of Queen Bess Island following the 1983-84 dieback, and today mangrove is often used for marsh stabilization in coastal restoration projects. Mild winters of the past decade have allowed expansion of this natural community in southeastern Louisiana's coastal marshes. Large expanses can be viewed near the southern terminus of LA Hwy 1 on the eastside of Timbalier Bay near Port Fourchon, with patchy occurrences continuing along the highway to Grand Isle.

COASTAL MANGROVE – MARSH SHRUBLAND SPECIES OF CONSERVATION CONCERN (8)	
<b>BIRDS</b>	<b>BUTTERFLIES</b>
Brown Pelican	Great Southern White
Reddish Egret	Western Pygmy-Blue
Yellow-crowned Night-Heron	
Clapper Rail	
Seaside Sparrow	
Nelson's Sharp-tailed Sparrow	

***Priority Species Research and Survey Needs:***

Seaside Sparrow and Nelson's Sharp-tailed Sparrow: Surveys are needed to determine the current abundance and distribution in relation to marsh changes. Large populations should be monitored on a scheduled basis to detect long-term population trends and to guide management decisions.

Brown Pelicans: Large populations should be monitored on a scheduled basis to detect long-term population trends and to guide management decisions.

Waterbirds: Continue to conduct rookery surveys to update the LNHP database.

Great Southern White and Western Pygmy-Blue: Conduct surveys to determine their current distribution and abundance for inclusion in the LNHP database.

***Species Conservation Strategies:***

1. Shorebirds, Wading Birds:

- Provide public education regarding the importance of waterbird nesting colonies and shorebird feeding areas. Reduce the negative effects of recreational and other uses on these areas.
- Implement management and conservation recommendations for waterbirds (especially rails) of SWG project T18 upon completion.

***Threats Affecting Habitat:***

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat		
	Altered Composition/ Structure	Habitat Disturbance	Habitat Fragmentation
Invasive/alien species	XXX		
Recreational use/vehicles		XXX	
Shoreline erosion	XXX		XXX

***Habitat Conservation Strategies:***

1. Work with the legislature to develop tax incentives and conservation easements or leases for landowners to encourage conservation of this habitat type.
2. Promote the planting of mangrove as a soil stabilizer in habitat restoration projects.
3. Provide educational information on this habitat type and its importance to species of conservation concern to landowners/land managers through technical pamphlets and the LDWF website.
4. Support NRCS and LDNR efforts for shoreline stabilization and habitat restoration.
5. Work with LCA, CWPPRA to support coastal restoration projects, specifically targeting important nesting habitat for species of conservation concern.
6. Work with local governments to recommend limits on recreational vehicle use of this habitat, particularly where it occurs on barrier islands.
7. Work with appropriate planning commissions to provide LNHP data that illustrates locations of this habitat type.
8. Work with NRCS Plant Materials Center, BTNEP, and OSP to develop restoration program for this habitat.

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### 13. Coastal Prairie

**Rarity Rank:** S1/G2Q

**Synonyms:** Great Southwest Prairie, Eastern Coastal Prairie, Gulf Cordgrass Prairie, Cajun Prairie

**Ecological Systems:**

CES203.550 Texas-Louisiana Coastal Prairie

CES203.541 Texas-Louisiana Coastal Prairie Pondshore

CES203.543 Texas-Louisiana Saline Coastal Prairie

CES203.542 West Gulf Coastal Plain Texas-Louisiana Coastal Prairie Slough

**General Description:**

The prairie region of southwestern Louisiana was once very extensive (approximately 2.5 million acres), but today is limited to small, remnant parcels. On the south edge of its range, the community may occur on "islands" or "ridges" surrounded by marsh. The region is underlain by an impervious clay pan 6 to 18 inches below the surface that prevents downward percolation of water and inhibits upward movement of capillary water. Soils are typically circum-neutral to alkaline, saturated in winter, and often very dry in late spring and fall.

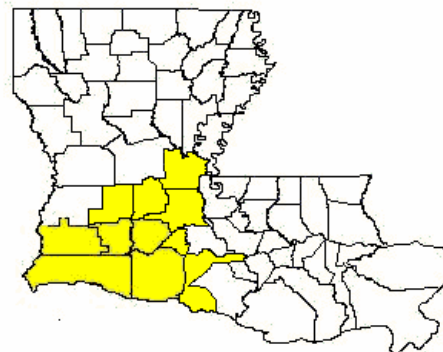


Historically, trees were confined to the more elevated and better drained stream sides or ridges, forming "gallery forests", and acted to divide the Coastal Prairie into many subunits or "coves". The intrinsic soil conditions and frequent burning from lightning strikes prevented invasion by woody trees and shrubs and maintained the prairie vegetation. The natural demarcation line between the forest and grassland was (and is) very sharp. Coastal Prairie vegetation is extremely diverse and dominated by grasses, including *Paspalum plicatulum* (brownseed paspalum), *Paspalum* spp. (pasp grasses), *Schizachyrium scoparium* and *S. tenerum* (little and slender bluestem), *Andropogon gerardii* (big bluestem), *Andropogon* spp. (broomsedges), *Aristida* spp. (three-awn grasses), *Eragrostis* spp. (love grasses), *Spartina patens* (wire grass, near marshes), *Panicum virgatum* (switch grass), *Panicum* spp. (panic grasses), *Sorghastrum nutans* (Indian grass), *Sporobolus* spp. (dropseeds), and *Tridens* spp. (purple-top). Important sedges in the community include *Carex* spp. (caric sedges), *Cyperus* spp. (umbrella sedges), *Rhynchospora* spp. (beaked sedges), and *Scleria* spp. (nut-rushes). An abundance of forbs is present including *Cacalia ovata* (Indian platan), *Helianthus mollis* (sunflower), *Liatris* spp. (blazing-stars), *Asclepias* spp. (milkweeds), *Silphium* spp. (rosin-weeds), *Petalostemum* spp. (prairie clovers), *Baptisia* spp. (indigos), *Amsonia tabernaemontana* (blue star), *Rudbeckia* spp. (brown-eyed susans), *Euphorbia* spp. (spurges), *Euthamia* spp. (flat-topped goldenrods), *Hedyotis nigricans* (bluets), *Ruellia humilis* (wild petunia), *Ludwigia* spp. (water primroses), *Coreopsis* spp.

(tickseeds), *Solidago* spp. (goldenrods), *Agalinis* spp. (false foxgloves), and *Eupatorium* spp. (thoroughworts) (Allen et al. 2001, Grace et al. 2000, LNHP 1986-2004). Many plants in Coastal Prairie also occur in the pine savannahs and flatwoods that occur immediately north of the coastal prairie region. These include many of the above, plus *Drosera brevifolia* (sundew), *Polygala* spp. (milkworts), *Aletris* spp. (colic-roots), *Rhexia* spp. (meadow beauties), and *Sabatia* spp. (rose-gentians). As mentioned previously, fire plays a critical role in this natural community. Certain woody species may invade this habitat without periodic fire. The introduced species *Triadica sebifera* (= *Sapium sebiferum*; Chinese tallow tree) has become especially problematic, forming dense thickets or forests. The transition zone from coastal prairie to pine savannah is extremely diverse with the two habitat types sharing most herbaceous species in the transitional area. Baygalls or bayhead swamps may be included within coastal prairie.

***Current Extent and Status:***

Remnant Louisiana coastal prairies, once covering an estimated 2.5 million acres, have been reduced to less than 1 % of the original extent (Smith 1993). The disappearance of the coastal prairie can be attributed to rice and sugar cane production, oil exploration, and residential and commercial development. The current estimated upland prairie remnant extent is 93 acres and approximately 500 acres remain of the wet or marsh fringing prairie (L. Allain, personal communication). The majority of the upland remnants exist along railroad right-of-ways between railroad tracks and highways. Many of these are threatened by highway widening projects, and fire suppression. Sabine NWR, managed by the USFWS, supports at least two known intact marsh fringing prairies with a total estimated area of 100 acres. White Lake Wetland Conservation Area, managed by the LDWF, has a wet prairie site of unknown condition and size. There are other wet prairies located on private lands, currently with no protection. Prairie restoration efforts began in the late 1980's, and there are 3 primary sites that have had some degree of success. The Eunice Prairie, owned by the Cajun Prairie Habitat Preservation Society, is a 15-acre restoration site that is registered with the Natural Areas Registry Program. The Duralde Prairie, owned by the USFWS, is a 345 acre restoration project, and another privately owned tract near Gueydan, Louisiana is being restored with the help of the NRCS and USGS.





COASTAL PRAIRIES SPECIES OF CONSERVATION CONCERN (24)		
<b>AMPHIBIANS</b>	American Woodcock	<b>BUTTERFLIES</b>
Southern Crawfish Frog	Short-eared Owl	Reakirt's Blue
	Scissor-tailed Flycatcher	Little Metalmark
<b>BIRDS</b>	Spragues Pipit	Southern Dogface
Mottled Duck	Loggerhead Shrike	
Northern Harrier	Dickcissel	<b>MAMMALS</b>
Northern Bobwhite	Field Sparrow	Eastern Spotted Skunk
Yellow Rail	Grasshopper Sparrow	
Black Rail	Henslow's Sparrow	<b>REPTILES</b>
Sandhill Crane	Le Conte's Sparrow	Ornate Box Turtle
Whooping Crane		Western Slender Glass Lizard

***Priority Species Research and Survey Needs:***

Ornate Box Turtle: Initiate surveys in areas identified by SWG project T20 (Lorenze et al. 2004) to update occurrence and abundance data for inclusion in the LNHP database.

Waterbirds: Continue to conduct rookery surveys to update the LNHP database information.

Mottled Ducks: Research is needed on nesting success, brood rearing and brood success rates, molting habitat needs, and annual recruitment and survival rates along with other basic research to determine breeding and recruitment constraints.

Sandhill Cranes: Develop a monitoring program to determine their use of this habitat.

Short-eared Owl: Christmas Bird Count data indicate a significant decline in North America between 1960 and 1989. Expand efforts to locate and study wintering populations to determine limiting factors, management needs, and provide data necessary for habitat protection efforts.

Reakirt's Blue, Little Metalmark, Southern Dogface: Conduct surveys to determine current distribution and abundance for inclusion in the LNHP database.

***Species Conservation Strategies:***

1. Northern Bobwhite and Grassland Birds: Support implementation of recommended habitat restoration actions specified in NBCI and by LDWF Quail and Grassland Bird Task Force.
2. Shorebirds, Wading Birds:
  - Provide public education regarding the importance of waterbird nesting colonies and shorebird feeding areas. Reduce the negative effects of recreational and other uses on these areas.
  - Work with landowners to implement management and conservation recommendations for waterbirds (especially rails) of SWG project T18 upon completion.

3. Waterfowl:
  - Continue to encourage the creation/enhancement/maintenance of high-quality habitat across Louisiana.
  - Work with DU, DW, and USFWS to assuring that quality habitat, including refuge from hunting and other disturbance, is distributed across the landscape.
  - Encourage maintenance of rice agriculture and discourage conversion to crops with lower value to waterfowl.
  - Continue LDWF partnerships with DU, DW, USWFS, and state wildlife management agencies to conserve habitat on the northern breeding grounds.
4. Partner with LSU and ULL to develop/update management guidelines/BMPs for species of conservation concern that occur in lands cultivated for rice and sugarcane.

***Threats Affecting Habitat:***

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat			
	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation
Conversion to agriculture or other forest types		XXX		XXX
Development/maintenance of pipelines, roads or utilities		XXX		XXX
Fire suppression	XXX			
Grazing practices	XXX		XXX	
Invasive/alien species	XXX			

***Habitat Conservation Strategies:***

1. Partner with NGOs, state and federal agencies, private landowners, etc. to promote protection, restoration, and expansion of coastal prairie habitat.
2. Promote fire as essential management tool. Burn these areas as needed and promote alternatives to fire where prescribed burning is not an option.
3. Provide educational information on this habitat type and its importance to species of conservation concern to landowners/land managers through technical pamphlets and the LDWF website.
4. Review existing grassland management plans and incorporate NBCI strategies to encourage restoration of this habitat type.

5. Support Louisiana Native Plant Initiative located at McNeese State University for the development of plant materials to facilitate restoration of coastal prairies, and help develop partnerships to secure long-term funding for the plant materials center.
6. Support research to determine grazing schedules, etc. regarding possible livestock production on restored coastal prairie sites as a management technique.
7. Work with land managers/hunting clubs/extension agents, etc. to discourage the placement of food plots in this habitat type.
8. Investigate restoration of coastal prairie on White Lake Wetlands Conservation Area.
9. Partner with NRCS to encourage farmers to plant native prairie plant species on agricultural buffer areas (CP33).
10. Partner with DOTD and federal agencies to promote the planting of native prairie species in rights-of-way areas where historic native prairies occurred.
11. Work with the legislature to provide incentives (tax breaks, etc.) to landowners to retain the natural state of areas where this habitat occurs.

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## 14. Cypress-Tupelo-Blackgum Swamps

**Rarity Rank:** S4/G3G5

**Synonyms:** Freshwater Swamp, Brake, Swamp Forest

**Ecological Systems:**

CES203.490 Lower Mississippi River Bottomland Depression

CES203.065 Red River Large Floodplain Forest

CES203.384 Southern Coastal Plain Nonriverine Basin Swamp

CES203.459 West Gulf Coastal Plain Near Coast Large River Swamp

### **General Description:**

(Note: Baldcypress Swamp (S4), Baldcypress-Tupelo Swamp (S4), Tupelo-Blackgum Swamp (S4), Pondcypress/Blackgum Swamp (S1), Scrub/Shrub Swamp (S4S5), and Shrub Swamp (S4S5) are described as distinct communities in the LNHP Natural Communities of Louisiana. They are considered together here due to their floristic similarity and/or similarity in management needs.)



Cypress-Tupelo-Blackgum Swamps throughout the natural range, are forested, alluvial swamps growing on intermittently exposed soils most commonly along rivers and streams but also occurring in backswamp depressions and swales. The soils are inundated or saturated by surface water or ground water on a nearly permanent basis throughout the growing season except during periods of extreme drought. However, even deepwater swamps, with almost continuous flooding, experience seasonal fluctuations in water levels (LNHP 1986-2004). Baldcypress swamps generally occur on mucks and clays, and also silts and sands with underlying clay layers (Alfisols, Entisols, Histosols, and Inceptisols) (Conner and Buford 1998).

Cypress-Tupelo-Blackgum swamps have relatively low floristic diversity. *Taxodium distichum* (baldcypress) and *Nyssa aquatica* (tupelo gum) are co-dominants. Common associates are *Nyssa sylvatica* var. *biflora* (swamp blackgum), *Acer rubrum* var. *drummondii* (swamp red maple), *Salix nigra* (black willow), *Fraxinus profunda* (pumpkin ash), *F. pennsylvanica* (green ash), *Planera aquatica* (water elm), *Gleditsia aquatica* (water locust), *Itea virginica* (Virginia willow), and *Cephalanthus occidentalis* (buttonbush). Composition of associate species may vary widely from site to site. Undergrowth is often sparse because of low light intensity and long hydroperiod. Neither

bald cypress nor tupelo gum seeds germinate underwater, nor can young seedlings of these trees survive long submergence. Establishment of young trees can only occur during periods of exceptionally long drought. This probably explains why these species tend to occur in even-aged stands since the environmental conditions favorable for germination and establishment of saplings occur very infrequently.

Those areas dominated by tupelo and blackgum are also alluvial but occur on higher topographic positions than baldcypress dominated swamps. Baldcypress is a common associate, along with *Quercus laurifolia* (laurel oak), *Leucothoe racemosa* (leucothoe), *Cyrilla racemiflora* (swamp cyrilla), and *Cornus foemina* (swamp dogwood). *Taxodium ascendens* (pondcypress), along with swamp blackgum dominate a limited number of swamps making this natural community rare in Louisiana. This type seems to be confined to areas along the lower Pearl River, and adjoining the north shore of Lake Pontchartrain and Lake Maurepas (Smith 1999). Pondcypress/Blackgum swamps appear to occupy the backwater portions of larger swamplands, in places much removed from active stream channels. They are related to and often grade into baldcypress swamps more influenced by river flooding (Smith 1999).

***Current Extent and Status:***

Cypress-tupelo-blackgum swamps may be found throughout Louisiana, and sizeable areas of swamp still remain, even though the historic extent is considerably reduced. Statewide estimates of swamp loss range from 25 to 50 % of the original presettlement acreage and old-growth examples are very rare (Smith 1993, The Nature Conservancy 2004). The Atchafalaya Basin Floodway contains the greatest remaining contiguous acreage in the United States with an estimated 595,000 acres of collective swamp and bottomland hardwoods, the majority of which is privately owned. Large tracts also occur on some state LDWF WMAs with an estimated total of 97,107 acres, USFWS NWRs such as Cat Island, and properties under the administration of the COE. Some of these large swamp tracts occur in Louisiana's ECGP and are contained within the Bogue Chitto NWR and Pearl River WMA. The lower Tangipahoa River in Tangipahoa Parish, as well as, the Tickfaw and Amite Rivers in Livingston Parish and lands surrounding Lakes Pontchartrain and Maurepas also support large remaining tracts of cypress-tupelo-blackgum swamps (approximately 213,000 acres) (Governor's Science Working Group on Coastal Wetland Forest Conservation and Use 2005). Approximately 50 percent of these swamps fall on state WMAs (Joyce, Maurepas, and Manchac), and the other half are primarily privately owned. The Barataria Basin with 242,000 acres and Lake Verret area with 101,000 acres



contain extensive freshwater swamps, again in private ownership. Louisiana State Parks including Chicot, Lake Fausse Pointe, Tickfaw, and Bogue Chitto provide some small refuge for Louisiana’s swamps. A total of 4,400 acres of combined swamps and bottomland hardwood forests are registered with the Louisiana Natural Areas Registry Program. And finally, there are a few scattered local community parks containing swamps throughout the state such as Baton Rouge’s small 65 acre Bluebonnet swamp operated by Recreation and Park Commision for the Parish of East Baton Rouge.

All of Louisiana’s swamps are threatened by land loss and encroaching interests, however, the swamps of the lower Mississippi River Alluvial Plain in south central and southeastern Louisiana face additional peril from subsidence, altered hydrology, coastal erosion, and saltwater intrusion. All of these factors combine to promote rapid loss and prevent adequate regeneration of these swamps.

<b>CYPRESS – TUPELO - BLACKGUM SWAMP SPECIES OF CONSERVATION CONCERN (18)</b>		
<b>AMPHIBIANS</b>	Yellow-throated Vireo	<b>MAMMALS</b>
Southern Dusky Salamander	Northern Parula	Southeastern Shrew
	Prothonotary Warbler	Southeastern Myotis
<b>BIRDS</b>	Swainson's Warbler	Louisiana Black Bear
Yellow-crowned Night-Heron	Kentucky Warbler	Long-tailed Weasel
Wood Stork	Hooded Warbler	
Swallow-tailed Kite		<b>REPTILES</b>
Bald Eagle	<b>BUTTERFLIES</b>	Alligator Snapping Turtle
Yellow-billed Cuckoo	'Seminole' Texan Crescent	

***Priority Species Research and Survey Needs:***

Southern Dusky Salamander: Apparently extirpated from numerous swamp sites throughout the State. Causes for its disappearance are unknown. Solicit assistance from interested parties to search for dusky salamanders.

Swallow-tailed Kite: Continue inventory and monitor Swallow-tailed Kites on public and private lands to fill data gaps in the distribution and abundance for inclusion in the LNHP database and Audubon nationwide database.

'Seminole' Texan Crescent: Conduct surveys to determine current distribution and abundance for inclusion in the LNHP database.

Songbirds: Continue to conduct research needed to assess silviculture/land management practices and the effects on all songbird species.

Waterbirds: Continue to conduct rookery surveys to update the LNHP database.

***Species Conservation Strategies:***

1. Swallow-tailed Kite: Implement conservation and management recommendations of SWG project T9 (Coulson 2004).

2. Bald Eagle: Continue with long-term monitoring of active bald eagle nests, successful breeding pairs, and fledged eagles.
3. Louisiana Black Bear: Partner with the BBCC, USFWS and continue to support the implementation of recovery efforts for this species.
4. Work with landowners to initiate or continue the implementation of PIF bird conservation plans, conservation plans developed for amphibians and reptiles, and USFWS threatened and endangered species recovery plans over the next 10 years.

***Threats Affecting Habitat:***

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat					
	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation	Modification of Water Levels; Changes in Natural Flow Patterns	Sedimentation
Channelization of rivers or streams					XXX	XXX
Construction of ditches, drainage or diversion systems	XXX				XXX	XXX
Development/ maintenance of pipelines, roads or utilities		XXX	XXX	XXX	XXX	XXX
Incompatible forestry practices	XXX					XXX
Invasive/alien species	XXX					
Operation of dams or reservoirs	XXX				XXX	XXX

***Habitat Conservation Strategies:***

1. Work with landowners/land managers to promote conservation of habitat sites that may not regenerate naturally after logging due to changes in hydrology, herbivory, and other factors. Promote use of “condition classes” as defined by the Governor’s Science Working Group on Coastal Wetland Forest Conservation and Use to identify these target swamp habitat areas in need of conservation attention.
2. Work with and support efforts of LCA, CWPPRA, and Governor’s Commission on Coastal Wetland Forest Conservation and Use regarding coastal restoration (specifically swamp habitat restoration, regeneration, and sustainability) and to establish and maintain long-term monitoring sites within coastal wetland forests.
3. Promote use of appropriate silvicultural techniques to restore/manage swamps for wildlife (include importance of tree species diversity, den trees for birds and mammals, etc.).

4. Work with Cypress Legacy Program and other environmental groups to identify old-growth areas where conservation actions can be implemented.
5. Support research to determine the importance of Spanish moss to species of conservation concern and determine if moss is declining in Louisiana.
6. Work with adjoining states to address water management issues that affect cypress-tupelo-blackgum swamps in Louisiana.
7. Work with COE, DU and other groups to enhance swamp hydrologic conditions to control invasives on Caddo Lake and Catahoula Lake.
8. Work with COE to influence water levels in the Atchafalaya Basin to benefit this habitat type.
9. Continue to monitor nuisance species (nutria, beaver, etc.) and control them as needed.
10. Partner with state and federal agencies and other interested groups to conduct surveys and develop GIS data on the extent and condition of swamps throughout Louisiana.

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## 15. Eastern Hillside Seepage Bog

**Rarity Rank:** S2/G2

**Synonyms:** Pitcher Plant Bog, Herbaceous Bog, Bog, Hillside Seep, Hillside Bog

**Ecological Systems:** CES203.078 Southern Coastal Plain Herbaceous Seepage Bog

### **General Description:**

Hillside seepage bogs are open, mostly treeless, herb-dominated natural wetlands of hilly, sandy uplands historically dominated by longleaf pine of the East and West Gulf Coastal Plains in Louisiana. In the East Gulf Coastal Plain, these bogs occur on the Pleistocene high terraces in Washington and St. Tammany Parishes, arising commonly on mid- to low slopes, on saturated, strongly acidic (pH ca. 4.5 - 5.5) and nutrient-poor substrates of fine sandy loams or loamy fine sands with relatively high organic matter content (Smith 1996, Plummer 1963). Soil series names have generally not been assigned to bogs due to the naturally very limited acreage in the state (Smith 1996).



These bogs are generally persistently wet from seepage, and are variable in size being most often less than 1 acre but rarely exceeding 10 acres. EGCP bogs are underlain by an impervious clay layer that, when conditions are right, causes ground water to constantly seep to the soil surface. The herbaceous groundcover is dense, continuous and floristically rich. It is dominated by sedges, grasses and grass-like plants, and many kinds of unusual forbs, including pitcher-plants (*Sarracenia* spp.) and a variety of orchid species. Patches of shrubs are often present within bogs, and can become more prevalent, possibly degrading the habitat, if fire is excluded from the system. Since hillside bogs are embedded in what are now or historically were longleaf pine forests, they are fire-driven systems. They evolved with frequent growing-season fire events. Among other things, frequent fire deters invasion by shrubs and trees and stimulates growth, flowering and seed production by indigenous bog herbs (Barker 1980).



The degree to which a bog remains wet throughout the year depends on the size of the watershed, the soil infiltration rate upslope, the rate of saturated flow in the soil, the topographic position of the bog, the bog's water storage capacity, and the rate of water leaving the bog from evapo-transpiration and through surface and sub-surface flow. In general, the greater the infiltration rate of the watershed soils and the water holding

capacity of bog soils, the smaller recharge area needed to maintain seepage throughout dry periods of the year. Therefore, bogs are extremely sensitive to surrounding land management activities, and are easily degraded or destroyed by activities that alter natural hydrologic regimes.

Hillside seepage bogs are rich in herbaceous plant species, primarily grasses and grass-like plants (graminoids), although a large variety of forbs are present. There appears to be a distinct relationship between the number of species present and bog size (MacRoberts and MacRoberts 1992, 1993); more than 100 plant species may be found in a relatively large bog (MacRoberts and MacRoberts 1988). Many species are restricted to this habitat and closely allied longleaf pine flatwood savannahs.

Vegetation dominants include: *Andropogon* spp. (bluestems), *Aristida* spp. (threeawn grasses), *Panicum* spp. (panic grasses), *Ctenium aromaticum* (tooth-ache grass), *Muhlenbergia capillaris* (hairawn muhly), *Rhynchospora* spp. (beak-rushes), *Rhynchospora stenophylla* (narrow-leaved beakrush, S1G4), *Xyris* spp. (yellow-eyed grasses), *Eriocaulon* spp. (pipeworts), *Lachnocaulon* spp. (bog buttons), *Dichromena latifolia* (giant white top sedge), *Scleria* spp. (nut-rushes), *Fuirena* spp. (umbrella grasses), and *Fimbristylis* spp. (fimbry-sedge). Primary forbs include *Sarracenia alata* (green pitcher plant), *Rhexia* spp. (meadow beauties), *Polygala* spp. (milkworts), *Liatris* spp. (blazing stars), *Aletris lutea* (colic-root), *Eupatorium* spp. (thorough-worts), *Coreopsis linifolia* (narrow-leaved tickseed), *Drosera* spp. (sundews). Many rare forbs are found in EGCP bogs including *Sarracenia psittacina* (parrot pitcherplant, S3G4), *Pinguicula lutea* (yellow butterwort, S2G4G5), *Lilium catesbaei* (southern red lily, S1G4), *Tofieldia racemosa* (coastal false-asphodel, S2S3G5), *Lophiola aurea* (golden crest, S2S3G4), and *Macranthera flammea* (flame flower, S2G3). Various orchids, especially *Platanthera* spp. (fringed orchids), are often conspicuous members of the flora. Ferns (principally *Osmunda* spp.) and club-mosses (*Lycopodium* spp.) are usually present and sphagnum moss is often abundant (LNHP 1986-2004, MacRoberts and MacRoberts 1988, 1993a, 1993b, 1991).

**Current Extent and Status:**

Hillside seepage bogs in the EGCP of Louisiana are naturally small in size, and historically were embedded within longleaf pine forests. Presettlement extent of seepage bogs in the EGCP of Louisiana is estimated at less than 2,000 acres, with only 10 to 25% currently remaining in St. Tammany and Washington Parishes (Smith 1993). These present day bogs are most often found surrounded by commercial timberlands, being too wet and other soil conditions unfavorable for commercial tree production, or along powerline and pipeline right-of-ways where management practices such as mowing to keep shrubs and other woody vegetation under control have allowed the bog plants to persist (Sheridan et al.



1997). There is currently only minimal protection for remaining bogs. TNC's Abita Creek Preserve in St. Tammany Parish contains a seepage bog of approximately 8 acres. There is one very small, privately owned bog of less than 1 acre registered with the Louisiana Natural Areas Registry Program, and a 1-acre bog, owned by a commercial timber company, has been given a "special site" designation by that company. No bogs are known from federal or state public lands in the EGCP. A larger, 20-acre bog, containing at least 5 species of state rare and one globally rare plant species, is privately owned and current status of this bog is unknown.

EASTERN HILLSIDE SEEPAGE BOG SPECIES OF CONSERVATION CONCERN (8)			
AMPHIBIANS	BIRDS	BUTTERFLIES	MAMMALS
Gulf Coast Mud Salamander	Sedge Wren	Arogos Skipper	Southeastern Shrew
Southern Red Salamander	Henslow's Sparrow		Long-tailed Weasel
	Le Conte's Sparrow		

***Priority Species Research and Survey Needs:***

Sedge Wren, Henslow's Sparrow, Le Conte's Sparrow: Continue to inventory and monitor this species and its habitat on public and private lands to fill data gaps in species distribution and abundance for inclusion in the LNHP database and the Audubon nationwide database.

Gulf Coast Mud Salamander, Southern Red Salamander: Gulf Coast Mud Salamander; recently (post 1960s) recorded from only one site in Louisiana. Conduct surveys to determine current distribution and abundance of both species for inclusion in LNHP database.

Arogos Skipper: Conduct surveys to determine its current distribution and abundance for inclusion in the LNHP database.

Southeastern Shrew: Considered imperiled in Louisiana. Together with Arkansas and Missouri, Louisiana represents the western edge of its range. Intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

***Species Conservation Strategies:***

1. Henslow's Sparrow: Implement conservation and management recommendations of SWG projects T22 and T32 upon completion.
2. Work with landowners to initiate or continue the implementation of PIF bird conservation plans, conservation plans developed for amphibians and reptiles, and USFWS endangered and threatened species recovery plans over the next 10 years.
3. Document habitat relationships of priority species to determine how dependent they are upon this habitat type, relative to other habitat types.

***Threats Affecting Habitat:***

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat			
	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Modification of Water Levels; Changes in Natural Flow Patterns
Construction of ditches, drainage or diversion systems	XXX		XXX	XXX
Conversion to agriculture or other forest types		XXX		
Development/maintenance of pipelines, roads or utilities			XXX	
Fire suppression	XXX			
Incompatible forestry practices	XXX		XXX	XXX
Invasive/alien species	XXX			
Residential development		XXX	XXX	

***Habitat Conservation Strategies:***

1. Conduct surveys to determine extent and condition of this habitat type with a focus on identifying the surrounding landscape context (i.e., residential developments, etc.) that might be affected by prescribed burning.
2. Once bogs are identified, conduct landowner surveys to aid in the development of management strategies for these sites.
3. Continue to encourage landowners to implement BMPs and adopt Sustainable Forestry Initiative (SFI) standards in the management of this habitat type.
4. Work with land managers/hunting clubs/extension agents, etc. to discourage the placement of food plots in this habitat type.
5. Promote utilization of federal cost share programs (NRCS) to address invasive species problems.
6. Provide additional cost share funds for landowners to drastically reduce or eliminate costs associated with conducting prescribed burns on their property.
7. Provide education/outreach to promote conservation and preservation of this habitat type.
8. Work with the legislature to provide incentives (tax breaks, etc.) to landowners to retain the natural state of areas where this habitat occurs.
9. Work with appropriate planning commissions to provide LNHP data that illustrates locations of this habitat type.

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## 16. Eastern Longleaf Pine Savannah

**Rarity Rank:** S1/G1

**Synonyms:** Pine Savannah, Pine Flatwood, Grass-Sedge Bog, Pitcher-Plant Prairie, Pitcher-Plant Meadow, Pitcher-Plant Bog, Herbaceous Bog, Flatwood Bog

**Ecological Systems:** CES203.375 East Gulf Coastal Plain Near-Coast Pine Flatwoods

### **General Description:**

Longleaf pine flatwood savannahs (pine savannahs) are floristically rich, herb-dominated wetlands, that are naturally sparsely stocked with longleaf pine (*Pinus palustris*). They historically dominated the Gulf coastal plain flatwood regions of southeast and southwest Louisiana EGCP and LWGCP. The term "savannah" is classically used to describe expansive herb-dominated areas with scattered trees (Smith 1996).



Pine savannahs are found naturally on broad "flats" occupying the poorly drained and seasonally saturated/flooded depressional areas and low flats. These communities are subject to a highly fluctuating water table, from surface saturation and shallow flooding in late fall/winter/early spring to growing-season droughtiness. In the EGCP, pine savannahs are commonly associated with mesic pine flatwoods intermingled on slight rises and low ridges, and typically grade down slope to slash pine-pondcypress/hardwood forest, bayhead swamp and/or small stream forest (LNHP 1986-2004). Soils in eastern longleaf savannahs are hydric, very strongly acidic, nutrient-poor fine sandy loams and silt loams, low in organic matter. The soils may be underlain by an impeding layer, are slowly permeable and water runs off the surface slowly. Some common soils are Myatt fine sandy loam, Guyton silt loam, and Stough fine sandy loam.

For the most part, savannah remnants seen today are relatively limited in size compared to the broad expanses that once existed. Presettlement habitat was a very open "forest" (canopy cover averaged much less than 50%), with the scattered trees almost exclusively longleaf pine. Few shrubs and hardwoods were encountered, except in wetter depressional acid swamps (e.g., slash pine-pond cypress/hardwood forest and bayhead swamp) and along creek bottoms that bisected the flatwoods region (Smith 1996). Fire, soil conditions and a seasonally high water table work in concert to control community structure in longleaf pine flatwood savannahs, but fire is considered the critical element in their maintenance. All of the species indigenous to pine savannahs have evolved over millennia within a regime of frequent (once every 1 to 4 years) lightning-season surface fires and most depend on fire for perpetuation in their natural habitat. Among other things, fire stimulates flowering and fruit/seed production of savannah herbs and



pyrophytic shrubs, deters invasion by fire-intolerant woody vegetation, and exposes mineral soil for seedlings of indigenous herbs and longleaf pine to become established. In the absence of frequent burning, pine savannahs quickly succeed into shrub/tree thickets, and sun-loving herbs are reduced and most are eventually eliminated without fire (Smith 1996).

Pine savannahs support a rich variety of plant species. The community is most often dominated by numerous types of grasses and sedges, but is noted by many for its interesting collection of insectivorous plants and showy orchids, lilies and others, and for its very high floristic diversity. Many of the plants known from pine savannahs are restricted to this habitat or closely-allied hillside bogs. Common woody species include *P. palustris* (longleaf pine, usually predominant tree species), *Pinus elliotii* (slash pine, in EGCP), *Magnolia virginiana* (sweet bay), *Nyssa sylvatica* (blackgum), *Quercus virginiana* (live oak), *Q. marilandica* (blackjack oak), *Q. laurifolia* (laurel oak), *Cyrilla racemiflora* (swamp cyrilla), *Morella* spp. (waxmyrtles), *Hypericum* spp. (St. John's worts), and *Styrax americana* (littleleaf snowbell). *Taxodium ascendens* (poncypress, in EGCP) may occur but is usually restricted to slightly lower areas within the site. Herbaceous vegetation of pine savannahs is very diverse, dominated by graminoids, and similar to that occurring in hillside bogs. Graminoids present include *Andropogon* spp. (broomsedges), *Schizachyrium scoparium* and *S. tenerum* (little and slender bluestem), *Panicum* spp. (panic grasses), *Aristida* spp. (three-awn grasses), *Ctenium aromaticum* (toothache grass), *Muhlenbergia capillaris* (hairawn muhly), *Erianthus* spp. (plume-grasses), *Coelorachis* spp. (jointgrasses), *Rhynchospora* spp. (beak-rushes) including *Rhynchospora chapmanii* (S2) and *Rhynchospora compressa* (S1S2), *Xyris* spp. (yellow-eyed grasses), *Fuirena* spp. (umbrella grasses), *Scleria* spp. (nut-rushes), *Dichromena latifolia* (giant white top sedge), *Eriocaulon* spp. (pipeworts), *Lachnocaulon* spp. (bog buttons), and *Fimbristylis* spp. (fimbry-sedge). Some forbs common in the community include *Sarracenia* spp. (pitcherplants) including *Sarracenia psittacina* (parrot pitcherplant, S3), *Agalinis* spp. (gerardias), *Lobelia* spp. (lobelias), *Rhexia* spp. (meadow beauties), *Eryngium integrifolium* (bog thistle), *Oxypolis filiformis* (narrow-leaved hog-fennel), *Polygala* spp. (milkworts), *Liatris* spp. (blazing-stars), *Sabatia* spp. (rose-gentians), *Drosera* spp. (sundews), *Pinguicula* spp. (butterworts) including *Pinguicula lutea* (S2), *Utricularia* spp. (bladderworts), and *Platanthera* spp. (fringed-orchids). Various additional species belonging to the lily family (Liliaceae) including *Aletris lutea* (yellow colic-root) and *Tofieldia racemosa* (coastal false-asphodel, S2S3), species from the sunflower family (Asteraceae) including *Carphephorus pseudoliatris* (chaffhead), and members of the orchid family (Orchidaceae) including *Cleistis bifaria* (spreading pogonia, S1) are prominent. *Lycopodium* spp. (club-mosses) and sphagnum moss are often abundant (Smith 1996, LNHP 1986-2004).

### **Current Extent and Status:**

Historically the eastern Florida Parishes of Louisiana were dominated by extensive stands of longleaf pine. Now barely 1 % of the original estimated 100,000 to 500,000 acres of longleaf pine savannahs remains. Land conversion, development, and timber production were initial factors in this habitat loss. Today there are a few thousand acres

in small blocks scattered across this area. TNC protects and manages about 4,272 acres of longleaf savannah on portions of their Abita Creek, Lake Ramsey and Talisheek Preserves. LDWF also owns and manages the larger portion of Lake Ramsey WMA, with 796 acres of savannah. The Big Branch, Pearl River, and Bogue Chitto NWF collectively contain about 7,000 acres of “pine flatwoods” with remnants of savannah herbaceous layers, and some of these sites are in the process of being restored to longleaf systems. A very few private tracts are recorded with the Louisiana Natural Areas Registry Program for a total of 13 acres. In light of the significant losses of this habitat and it’s importance to numerous wildlife target species, it is critical that an inventory is conducted for all remaining savannah sites, followed by identification and prioritization of areas for conservation and restoration of this habitat type.



EASTERN LONGLEAF PINE SAVANNAH SPECIES OF CONSERVATION CONCERN (37)		
<p><b>AMPHIBIANS</b></p> <p>Eastern Tiger Salamander Southern Dusky Salamander Four-toed Salamander Oak Toad Barking Treefrog Ornate Chorus Frog Eastern Spadefoot Dusky Gopher Frog</p> <p><b>BIRDS</b></p> <p>Northern Harrier Northern Bobwhite Yellow Rail American Woodcock</p>	<p>Chuck-Will's-Widow Red-cockaded Woodpecker Brown-headed Nuthatch Sedge Wren Loggerhead Shrike Prairie Warbler Bachman's Sparrow Field Sparrow Henslow's Sparrow Le Conte's Sparrow</p> <p><b>BUTTERFLIES</b></p> <p>Yucca Giant Skipper Little Metalmark</p>	<p><b>MAMMALS</b></p> <p>Southeastern Myotis Southeastern Shrew Eastern Harvest Mouse Long-tailed Weasel Eastern Spotted Skunk</p> <p><b>REPTILES</b></p> <p>Eastern Slender Glass Lizard Eastern Glass Lizard Northern Scarlet Snake Mole Kingsnake Scarlet Kingsnake Pine Woods Littersnake Southeastern Crowned Snake Harlequin Coralsnake</p>

***Priority Species Research and Survey Needs:***

Northern Bobwhite: Populations have declined precipitously from 1980-1999, averaging 8.2% per year in BCR 25; 6.0% per year in BCR 26; 5.8% per year in BCR 27; 4.5% per year in BCR 37. Continue to monitor populations thru breeding bird and hunting surveys.

Bachman's Sparrow: Intensive surveys are needed to produce estimates of current population size statewide. Develop projects which determine relationship between population size and vegetation succession on quality sites. Determine whether management activities can create a mosaic of adjacent sites that together provide continuously occupied habitat. Determine dispersal behavior to maximize the benefits/effects of future habitat management.

Henslow's Sparrow: Obtain more information on winter habitat abundance, distribution, and habitat needs throughout Louisiana.

Bats: Conduct habitat use and life history studies for species that may potentially use this habitat (e.g., big brown bat, southeastern myotis).

Eastern Harvest Mouse: Considered vulnerable in Louisiana, intensive surveys needed to update occurrence records and abundance for inclusion in the LNHP database.

Songbirds:

- Continue to support research on silviculture/land management practices and their effects on all songbird species.
- Continue to monitor songbird abundance and reproductive success (with emphasis on species of conservation concern) in natural habitats as compared to commercial stands through the establishment of MAPS stations and BBS routes to determine species utilization patterns between these habitats.

Establish monitoring systems and protocols for medium and small mammals to determine current population abundances and trends in this habitat.

Determine the microhabitat preferences and requirements of species utilizing eastern longleaf pine savannah to understand how these species are utilizing this habitat and to determine management needs.

***Species Conservation Strategies:***

1. Henslow's Sparrow, Bachman's Sparrow:
  - Implement conservation and management recommendations of SWG projects T22 and T32 upon completion.
  - Monitor reproductive success of Bachman's sparrows to determine limiting factors.
  - Work with landowners to encourage use of BMPs for prescribed fire management and timber harvesting techniques to improve habitat quality.
2. Red-cockaded Woodpecker:
  - Continue to support implementation of the Louisiana Statewide Red-cockaded Woodpecker (RCW) Safe Harbor Program.
  - Support USFWS recovery efforts outlined in the RCW recovery plan, 2<sup>nd</sup> Revision.
  - Encourage the establishment of new RCW populations.
  - Investigate potential land acquisition of this habitat type to increase and support new populations.
3. Northern Bobwhite and Grassland Birds: Support implementation of recommended habitat restoration actions specified in NBCI and by LDWF quail and grassland bird task force.
4. Eastern Slender Glass Lizard, Northern Scarlet Snake, Mole Kingsnake, Scarlet Kingsnake, Southeastern Crowned Snake, Harlequin Coralsnake: Observations on this guild of longleaf specialists have declined significantly in recent years. Promote increased acreage and natural management of longleaf pine as a timber resource and substitute for loblolly monoculture.

5. Amphibians:

- Develop educational information and management techniques to address ephemeral ponds and their importance to all amphibians, with emphasis on species of conservation concern, and make this information available to landowners/land managers through technical pamphlets and the LDWF website.
  - Promote management recommendations developed by Partners for Amphibian and Reptile Conservation (PARC).
6. Encourage the retention of snags during logging operations to increase the number available for cavity-nesting wildlife species. Efforts need to be made to maintain sufficient levels of woody debris in stands for reptiles, amphibians and small mammals.
7. Document the habitat relationships of species of conservation concern and how dependent they are upon eastern longleaf pine savannah, relative to other habitat types.

***Threats Affecting Habitat:***

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat				
	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation	Modification of Water Levels; Changes in Natural Flow Patterns
Commercial/industrial development		XXX		XXX	
Construction of ditches, drainage or diversion systems	XXX	XXX	XXX		XXX
Conversion to agriculture or other forest types		XXX		XXX	
Development/maintenance of pipelines, roads or utilities		XXX	XXX	XXX	
Fire suppression	XXX				
Incompatible forestry practices	XXX		XXX		XXX
Invasive/alien species	XXX				
Residential development		XXX	XXX	XXX	

***Habitat Conservation Strategies:***

1. Conduct surveys to determine extent and condition of this habitat type with a focus on identifying the surrounding landscape context (i.e., residential developments, etc.) that might be affected by prescribed burning management.
2. Educate landowners, adjacent residents, developers, and the general public about the crucial role of prescribed burning in the management of longleaf pine systems (multi-agency, multi-group effort).
3. Encourage longer rotation ages when compatible with the landowner's management objectives.
4. Once savannahs are identified conduct landowner surveys to aid in the development of management strategies for these sites.
5. Promote the advantages of growing longleaf pine and associated herbaceous ground cover.
6. Work with land managers/hunting clubs/extension agents, etc. to discourage the placement of food plots in this habitat type.
7. Promote utilization of state and federal cost share programs (Forest Land Enhancement Program (FLEP) and NRCS programs) to address invasive species problems.
8. Provide additional cost share funds through programs such as FLEP in order to drastically reduce or eliminate landowners' costs associated with conducting prescribed burns their property.
9. Work with appropriate planning commissions to provide LNHP data that illustrates locations of this habitat type.
10. Investigate the availability of additional cost-share funding opportunities, through FLEP, FPP or other programs, for landowners to reduce the cost of longleaf pine management.
11. Encourage a university curriculum that incorporates the identification of sensitive natural areas into student studies (especially landscape architecture and courses for planners).
12. Work with the Longleaf Alliance to incorporate their strategies for longleaf pine management and restoration into current restoration efforts.

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- . 1999. Historic vegetation of the Florida Parishes. Louisiana Natural Heritage Program, Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.

## 17. Eastern Upland Longleaf Pine Forest

**Rarity Rank:** S1S2/G1G2

**Synonyms:** Sandhill Pine Forest

**Ecological Systems:**

CES203.496 East Gulf Coastal Plain Interior Upland Longleaf Pine Woodland

### **General Description:**

This community type occurs in the hilly uplands of the central and eastern Florida Parishes of Louisiana. It occurs on acidic loamy sands to acid clays associated with Pleistocene terraces. The gopher tortoise (*Gopherus polyphemus*), federally-listed as a threatened species and requiring sandy soils and an open herbaceous understory, is found in this habitat. The community is



characteristically dissected by small to large branch or creek bottoms. *Pinus palustris* (longleaf pine) is the dominant overstory species, and in locations where fire has frequently occurred, it is often the only canopy species. Where fire is less frequent or suppressed, a number of overstory associates may occur, including *Pinus echinata* (shortleaf pine), *Pinus taeda* (loblolly pine), *Nyssa sylvatica* (black gum), *Liquidambar styraciflua* (sweetgum), *Q. stellata* (post oak), *Q. marilandica* (blackjack oak), *Q. shumardii*



(shumard oak), *Q. alba* (white oak), *Q. nigra* (water oak), *Prunus serotina* (black cherry), *Acer rubrum* (red maple), *Diospyros virginiana* (persimmon), and *Sassafras albidum* (sassafras). Significant shrub species include *Cornus florida* (flowering dogwood), *Vaccinium arboreum* (winter honeysuckle), *V. elliotii* (elliott's blueberry), *V. stamineum* (deer berry), *V. darrowii* (dwarf blueberry), *Gaylussacia dumosa* (dwarf huckleberry), *Callicarpa americana* (French mulberry), *Morella cerifera* (wax myrtle), *Bumelia lanuginosa* (chittum-wood), *Ilex vomitoria* (yaupon), *I. opaca* (American holly), *Rubus* spp. (blackberries), and *Rhus copallina* (winged sumac). Common vines include *Vitis* spp. (grapes), *Smilax* spp. (greenbriers), *Parthenocissus quinquefolia* (Virginia creeper), and *Gelsemium sempervirens* (yellow jessamine). The herbaceous flora may be exceedingly diverse if fire has frequently occurred. Grasses, composites, and legumes are predominant in the ground layer. *Andropogon* spp. (broomsedges) and *Schizachyrium* spp. (bluestems) are usually the dominant grasses, but several other genera are usually present, including *Aristida* (three-awn grasses), *Sporobolus* (dropseeds), *Panicum* (panic grasses), *Anthaenantia* (silky scales), *Ctenium aromaticum* (toothache grass), *Digitaria* (crab grasses), *Eragrostis* (love grasses), *Erianthus* (plume grasses), *Gymnopogon* (skeleton grasses), *Muhlenbergia* (muhly grasses), *Paspalum* (paspary grasses), and *Setaria*

spp. (bristle grasses). Composites include *Eurybia* spp. and *Symphyotrichum* spp. (asters), *Carphephorus odoratissimus* (vanilla plant), *Chrysopsis* spp. (golden asters), *Heterotheca* spp. (golden asters), *Elephantopus* spp. (elephant-foot), *Eupatorium* spp. (thoroughworts), *Euthamia* spp. (flat-topped goldenrods), *Gnaphalium* spp. (rabbit tobaccos), *Helenium* spp. (sneeze-weeds), *Helianthus* spp. (sunflowers), *Liatris* spp. (blazing-stars), *Rudbeckia* spp. (brown-eyed susans), *Solidago* spp. (goldenrods), and *Vernonia* spp. (ironweeds). Prominent legumes are *Baptisia* spp. (indigos), *Cassia* spp. (partridge-peas), *Centrosema virginianum* (butterfly pea), *Clitoria mariana* (pigeon wings), *Crotolaria* spp. (rattle pods), *Desmodium* spp. (beggar's ticks), *Lespedeza* spp. (bush clovers), *Stylsanthes biflora* (pencil-flower), *Rhynchosia* spp. (snout beans), and *Tephrosia* spp. (hoary peas). Additional frequent forbs include *Oenothera* spp. (evening primroses), *Polygala* spp. (milkworts), *Lobelia* spp. (lobelias), *Callirhoe papaver* (poppy-mallow), *Ruellia* spp. (wild petunias), *Hypoxis* spp. (yellow-eyed grasses), *Asclepias* spp. (mildweeds), *Lechea* spp. (pinweeds), *Euphorbia* spp. (spurges), *Sabatia* spp. (rose-gentians), *Agalinis* spp. (false foxgloves), and *Rhexia* spp. (meadow beauties). The fern *Pteridium aquilinum* (bracken fern) is often conspicuous in large colonies (LNHP 1986-2004).

**Current Extent and Status:**

Historically the eastern Florida Parishes of Louisiana were dominated by extensive stands of longleaf pine. Now only 1 to 5 % of the original estimated 1 to 2 million acres of upland longleaf pine forests remain (Smith 1993, 1999). Land conversion, development, and timber production were initial factors in this habitat loss. Today there are a few thousand acres in small blocks scattered across this area. The LDWF owns and manages Sandy Hollow WMA with 2,500 acres of upland longleaf forest. LDWF also manages a Tangipahoa Parish School Board longleaf tract of 1,000 acres, and Ben’s Creek WMA, owned by Weyerhaeuser, with about 100 acres of longleaf pine. The school board tract is in poor condition with a thick woody understory due to fire suppression. The Office of State Lands manages a 200-acre longleaf site, but it also has been fire suppressed. Both of these sites are restorable if proper management is applied in the very near future. Camp Whispering Pines, a 300-acre tract owned and managed by the Girl Scout Council of Southeast Louisiana, is an excellent example of longleaf habitat restoration. This site was also overgrown with woody shrubs and hardwood trees because fire had been excluded from the habitat. By returning controlled burning and incorporating other longleaf management techniques, the site has been once again restored to a healthy upland longleaf system. Louisiana State University’s, Lee Memorial Forest has a small longleaf tract of approximately 50 acres, and there are about 1,100 acres of eastern upland longleaf registered with the Natural Areas Registry Program (this amount includes the Camp Whispering Pines tract).





<b>EASTERN UPLAND LONGLEAF PINE FOREST SPECIES OF CONSERVATION CONCERN (33)</b>		
<b>AMPHIBIANS</b>	Prairie Warbler	Long-tailed Weasel
Oak Toad	Bachman's Sparrow	Eastern Spotted Skunk
Barking Treefrog	Field Sparrow	
Ornate Chorus Frog	Henslow's Sparrow	<b>REPTILES</b>
Eastern Spadefoot	Le Conte's Sparrow	Gopher Tortoise
	Orchard Oriole	Eastern Slender Glass Lizard
<b>BIRDS</b>	<b>BUTTERFLIES</b>	Eastern Glass Lizard
Northern Bobwhite	Yucca Giant Skipper	Northern Scarlet Snake
American Woodcock		Mole Kingsnake
Chuck-Will's-Widow	<b>MAMMALS</b>	Scarlet Kingsnake
Red-cockaded Woodpecker	Southeastern Shrew	Black Pine Snake
Brown-headed Nuthatch	Southeastern Myotis	Southeastern Crowned Snake
Sedge Wren	Big Brown Bat	Harlequin Coral Snake
Loggerhead Shrike		Eastern Diamond-backed Rattlesnake

***Priority Species Research and Survey Needs:***

Brown-headed Nuthatch: Investigate the impacts of silviculture/land management on this species and causes of this species' decline.

Songbirds:

- Continue to support research on silviculture/land management practices and their effects on all songbird species.
- Develop long-term monitoring projects that focus on abundances and reproductive success (with emphasis on species of conservation concern) in this habitat type through the establishment of MAPS stations and BBS routes.

Yucca Giant Skipper: Conduct surveys to determine current distribution and abundance for inclusion in the LNHP database.

***Species Conservation Strategies:***

1. Northern Bobwhite and Grassland Birds: Support implementation of recommended habitat restoration actions specified in NBCI and by LDWF quail and grassland bird task force.
2. Red-cockaded Woodpecker:
  - Continue to support implementation of the Louisiana Statewide RCW Safe Harbor Program.
  - Support USFWS recovery efforts outlined in the RCW recovery plan, 2<sup>nd</sup> Revision.
  - Encourage the establishment of new RCW populations.
  - Investigate potential land acquisition of this habitat type to increase and support new populations.
3. Brown-headed Nuthatch: Encourage landowners to use group-selection and single-tree selection harvesting methods and maintain or increase the number of standing snags.

4. Henslow's Sparrow, Bachman's Sparrow:
  - Monitor reproductive success of Bachman's sparrows to determine habitat limiting factors.
  - Work with landowners to encourage use of BMPs for prescribed fire management and timber harvesting techniques to improve habitat quality.
  - Implement conservation and management recommendations of SWG projects T22 and T32 upon completion.
5. Eastern Slender Glass Lizard, Northern Scarlet Snake, Mole Kingsnake, Scarlet Kingsnake, Southeastern Crowned Snake, Harlequin Coralsnake: Observations on this guild of longleaf specialists have declined significantly in recent years. Promote increased acreage and natural management of longleaf pine as a timber resource and substitute for loblolly monoculture.
6. Work with landowners to initiate or continue the implementation of PIF bird conservation plans, conservation plans developed for amphibians and reptiles, and USFWS threatened and endangered species recovery plans over the next 10 years.

***Threats Affecting Habitat:***

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat			
	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation
Commercial/industrial development		XXX		
Conversion to agriculture or other forest types		XXX		XXX
Development/maintenance of pipelines, roads or utilities		XXX	XXX	XXX
Fire suppression	XXX			
Incompatible forestry practices	XXX		XXX	
Invasive/alien species	XXX			
Residential development		XXX	XXX	XXX

***Habitat Conservation Strategies:***

1. Conduct surveys to determine extent and condition of this habitat type with a focus on identifying the surrounding landscape context (i.e., residential developments, etc.) that might be affected by prescribed burning.

2. Encourage longer rotation ages when compatible with the landowner's management objectives.
3. Work with land managers/hunting clubs/extension agents, etc. to discourage the placement of food plots in this habitat type.
4. Educate landowners, adjacent residents, developers, and the general public about the crucial role of prescribed burning in the management of longleaf pine systems (multi-agency, multi-group effort).
5. Promote advantages of growing longleaf pine and associated herbaceous ground cover.
6. Promote utilization of state and federal cost share programs (FLEP and NRCS programs) to address invasive species problems.
7. Promote value-added products produced from longleaf pine to encourage landowners to replant longleaf pine instead of loblolly pine.
8. Provide additional cost share funds through programs such as FLEP in order to drastically reduce or eliminate landowners' costs associated with conducting prescribed burns on their property.
9. Investigate the availability of additional cost-share funding opportunities, through FLEP, FPP or other programs, for landowners to reduce the cost of longleaf pine management.
10. Work with the Longleaf Alliance to incorporate their strategies for longleaf pine management and restoration into current restoration efforts.
11. Work with appropriate planning commissions to provide LNHP data that illustrates locations of this habitat type.

***References:***

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## 18. Freshwater Marsh

**Rarity Rank:** S1S2/G3G4

**Synonyms:** Fresh Marsh, Paille Fine (pronounced "pie feen") Marsh

**Ecological Systems:**

CES203.467 Gulf Coast Chenier Plain Fresh and Oligohaline Tidal Marsh

CES203.470 Mississippi Delta Fresh and Oligohaline Tidal Marsh

### **General Description:**

Freshwater marsh is normally located adjacent to intermediate marsh along the northern most extent of the coastal marshes, although it may occur beside coastal Bays where freshwater is entering the bay (e.g., Atchafalaya Bay). Small pools or ponds may be scattered.



The floristic composition of these sites is quite heterogeneous and is variable from site to site. Frequency and duration of flooding which are intimately related to microtopography seem to be the primary factors governing species distributions. Substrate, current flow, salinity, competition, and allelopathy are also important in determining species distribution patterns. Freshwater Marsh has the greatest plant diversity and highest soil organic matter content of any marsh type. Chabreck (1972) reported 92 plant species in fresh marsh versus only 17 different species in salt marsh. It is frequently dominated by *Panicum hemitomon* (maidencane). Other characteristic species include *Eleocharis* spp. (spikesedge), *Sagittaria lancifolia* (= *S. falcata*), *Alternanthera philoxeroides* (alligator weed), *Spartina patens* (wire grass), *Phragmites communis* (roseau cane), *Bacopa monnieri* (coastal water hyssop), *Ceratophyllum demersum* (coontail), *Cyperus odoratus* (fragrant flatsedge), *Eichhornia crassipes* (water hyacinth), *Pontederia cordata* (pickerelweed), *Peltandra virginica* (arrow arum), *Hydrocotyle* spp. (pennyworts), *Lemna minor* (common duckweed), *Myriophyllum* spp. (water milfoils), *Nymphaea odorata* (white waterlily), *Typha* spp. (cattail), *Utricularia* spp. (bladderworts), *Vigna luteola* (deer pea), and *Zizaniopsis miliacea* (southern wildrice) (LNHP 1986-2004). Epiphytic and benthic algae are two other major autotroph groups in freshwater marsh. A significant portion of freshwater marsh is floating marsh (flotant) which occurs in the Deltaic Plain of Louisiana. Salinities are usually less than 2 ppt and normally average about 0.5-1 ppt.

### **Current Extent and Status:**

Freshwater marsh has undergone the largest reduction in acreage of any of the marsh types over the past 20 years due mainly to salt water intrusion, canal dredging, and commercial, industrial and residential development. Presettlement acreage was estimated

at 1 to 2 million acres, but has been reduced by 25 to 50 % of this original extent (Smith 1993). The largest contiguous tracts of fresh marsh occur in Terrebonne, St. Mary, Vermillion, Cameron, LaFourche and St. Charles Parishes (Hartley et al. 2000). In the Chenier Plain of southwestern Louisiana, Sabine, Cameron Prairie, and Lacassine NWFs have a combined 75,121 acres of fresh marsh. State lands in the Chenier Plain include the White Lake Wetlands Conservation



Area with approximately 52,000 acres of freshwater marsh, and Rockefeller Wildlife Refuge with a total area of 76,042 acres, approximately one-third of which is fresh marsh. Both of these conservation areas are managed by the LDWF. In the Deltaic Plain of southeastern Louisiana, LDWF lands with freshwater marsh habitat include the Atchafalaya Delta WMA (total land area of 19,000 acres and unknown acres of fresh marsh), Salvador WMA (30,000 acres), Timken WMA (3,000 acres), Pass-a-Loutre WMA at the terminous of the Mississippi River (115,000 total acres, the majority are canals and waterways with some freshwater and intermediate marsh), Pearl River WMA (total 36,000 acres with approximately one-fourth in freshwater and intermediate marsh), and very small amounts of freshwater marsh on Joyce and Maurepas Swamp WMAs. NWRs with freshwater marsh in the Deltaic Plain include the Delta NWR (48,800 acres of fresh and brackish marsh), Bayou Sauvage NWR (23,000 acres of fresh and intermediate marsh), Big Branch NWR (total land area of 15,000 acres and unknown acres of fresh and intermediate marsh), and Mandalay NWR (total land area of 4,212 acres of cypress swamp and some fresh marsh). One Natural Areas Registry site with fresh marsh in St. Charles Parish totals 82.5 acres, and TNC protects a total of 586 acres on their White Kitchen Preserve (unknown number of fresh marsh acres).

Wildlife populations are generally highest in this marsh type and it supports high numbers of wintering waterfowl. As with the other marsh types, freshwater marsh acts as important nursery areas for the young of many marine species, such as croaker, seatrout, blackdrum, and flounder. The community may change to a more saline marsh type because of salt water intrusion or may become open water. The drought periods of 1999 and 2000 have contributed to cattail invasions of freshwater ponds and led to substantial loss of open water ponds in freshwater marshes east of LA Hwy 27, and in other areas. “Flotant” creation has occurred in many areas and this is having an impact on waterfowl and other wetland species. Places which were open “black water” areas with good amounts of *Lemna* sp. have become non-waterfowl areas with choked up flotant and *Salvinina* sp. and other mat-forming plants taking over and has resulted in a great loss of waterfowl habitat.

FRESHWATER MARSH SPECIES OF CONSERVATION CONCERN (31)		
<b>BIRDS</b>	Black Rail	Short-eared Owl
American Bittern	Clapper Rail	Sedge Wren
Yellow-crowned Night-Heron	King Rail	Loggerhead Shrike
Wood Stork	Sandhill Crane	Nelson's Sharp-tailed Sparrow
Mottled Duck	Whooping Crane	
Northern Pintail	Marbled Godwit	<b>BUTTERFLIES</b>
Canvasback	Dunlin	Neamathla Skipper
Redhead	Short-billed Dowitcher	Dion Skipper
Lesser Scaup	Gull-billed Tern	Great Southern White
Bald Eagle	Caspian Tern	
Northern Harrier	Common Tern	<b>REPTILES</b>
Yellow Rail	Forster's Tern	Alligator Snapping Turtle

***Priority Species Research and Survey Needs:***

Dion Skipper, Neamathla Skipper and Great Southern White: Conduct surveys to determine current distribution and abundance for inclusion in the LNHP database.

Rails: Initiate intensive surveys to better understand population densities and distributions in coastal marsh habitats.

Terns: Continue with nesting surveys and initiate research that focuses on factors (predation, human disturbance, etc.) effecting overall population densities.

Whooping Crane: Continue to coordinate with USFWS and LSU to develop plans for reintroduction of species on the White Lake Wetlands Conservation Area.

Waterbirds: Continue to conduct rookery surveys to update the LNHP database.

***Species Conservation Strategies:***

1. Shorebirds, Wading Birds:

- Provide public education regarding the importance of waterbird nesting colonies and shorebird feeding areas. Reduce the negative effects on these areas from recreational and other uses.
- Work with landowners to implement management and conservation recommendations for waterbirds (especially rails) of SWG project T18 upon completion.
- Coordinate with GCJV to implement recommendations of shorebird and wading bird conservation plans.
- Disturbance and loss of nesting habitat are major threats to these species. Continue with protection and restoration efforts of coastal. Develop new and/or improve existing partnerships to achieve this goal.

2. Waterfowl:
  - Continue to encourage the creation/enhancement/maintenance of high-quality habitat across Louisiana.
  - Work with DU, DW, and USFWS to assuring that quality habitat, including refuge from hunting and other disturbance, is distributed across the landscape.
  - Encourage maintenance of rice agriculture and discourage conversion to crops with lower value to waterfowl.
  - Continue LDWF partnerships with DU, DW, USWFS, and state wildlife management agencies to conserve habitat on the northern breeding grounds.
3. Bald Eagle: Continue with long-term monitoring of active bald eagle nests, successful breeding pairs, and fledged eagles.

***Threats Affecting Habitat:***

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat						
	Altered Composition/ Structure	Altered Water Quality	Habitat Destruction or Conversion	Habitat Disturbance	Herbivory	Modification of Water Levels; Changes in Natural Flow Patterns	Salinity Alteration
Channelization of rivers or streams	XXX	XXX	XXX			XXX	XXX
Construction of ditches, drainage or diversion systems		XXX	XXX			XXX	XXX
Development/maintenance of pipelines, roads or utilities		XXX	XXX	XXX		XXX	XXX
Grazing practices	XXX	XXX	XXX	XXX			
Invasive/alien species	XXX	XXX	XXX		XXX		
Levee or dike construction	XXX	XXX	XXX	XXX		XXX	
Residential development			XXX	XXX			
Saltwater intrusion	XXX	XXX	XXX	XXX			XXX

***Habitat Conservation Strategies:***

1. Encourage the NRCS Plant Materials Center and other growers to produce a greater variety of plant species for the restoration of coastal habitats.

2. Work with COE and NRCS to develop better strategies for the placement of dredge materials as a restoration method for this habitat type.
3. Work with COE to influence water levels in the Atchafalaya Basin to benefit this habitat type.
4. Work with LCA, CWPPRA to broaden coastal restoration projects to include freshwater marsh.
5. Work with appropriate planning commissions to provide LNHP data that illustrates locations of this habitat type.

***References:***

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## 19. Hardwood Flatwoods

**Rarity Rank:** S2S3/G2G3

**Synonyms:** Willow Oak Flats, Pin Oak Flats

**Ecological Systems:**

CES203.548 West Gulf Coastal Plain Nonriverine Wet Hardwood Flatwoods

CES203.193 Lower Mississippi River Flatwoods

CES203.557 East Gulf Coastal Plain Southern Loblolly-Hardwood Flatwood

CES203.278 West Gulf Coastal Plain Pine-Hardwood Flatwoods

**General Description:**

(Note: Wet hardwood flatwoods and mesic hardwood flatwoods are described as two distinct communities in the LNHP community classification system but are being treated together here due to similarities in the two habitat types.)

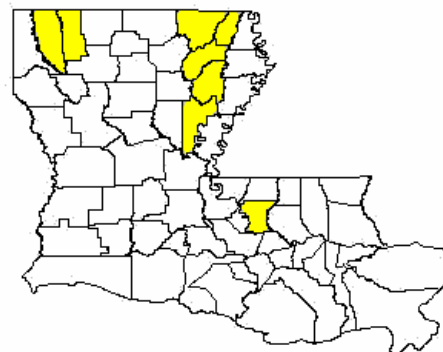
Wet hardwood flatwoods occur on hydric soils and are isolated and not usually affected by overbank flooding of a drainage. They occur on poorly drained flats and depressions. Mesic hardwood flatwoods occur on non-hydric, better drained soils on higher topographic positions than wet hardwood flatwoods, such as on low ridges and knolls. Wet hardwood flatwoods occur on Pleistocene Red River Channels in northwest Louisiana and on Pleistocene Valley Train Sediments on Macon Ridge in the northeast part of the state. Wet hardwood flatwoods historically occurred as primary habitat in East Baton Rouge Parish (Smith 1999). Soils are poorly drained silt loams to clays. On Macon Ridge the principal soil series that support this community are Calhoun and Gilbert silt loams. Occurrences in the Red River Valley are found on the Acadia series. Currently all known occurrences of mesic hardwood flatwoods are on Macon Ridge in West Carroll, Richland, Franklin and Morehouse Parishes in northeast Louisiana.

Dominant overstory trees of wet hardwood flatwoods include *Quercus phellos* (willow oak), *Fraxinus pennsylvanica* (green ash), *Carya ovata* (shagbark hickory), *Ulmus americana* (American elm), *Ulmus crassifolia* (cedar elm) and *Celtis laevigata* (hackberry). Other trees that are fairly frequent but not as common locally include *Quercus stellata* (post oak), *Q. pagoda* (cherrybark oak), *Liquidambar styraciflua* (sweetgum), *Carya myristiciformis* (nutmeg hickory) and *Gleditsia aquatica* (honeylocust). *Quercus lyrata* (overcup oak), *Quercus texana* (Nuttall oak), *Planera aquatica* (planertree), and *Forestiera acuminata* (swamp privet) dominate in wetter examples of this habitat. *Ulmus alata* (winged elm) and *U. crassifolia* are often abundant in the midstory. *Sabal minor* (palmetto) can be thick in the understory. Other important shrubs are *Ilex decidua* (deciduous holly) and *Styrax americana* (snowbell). Important herbaceous plants include *Cardamine bulbosa* (bulbous bitter cress), *Cynoscidium digitatum* (finger dog shade), *Tradescantia occidentalis* (small-flowered spiderwort), *Amsonia tabernaemontana* (bluestar), *Clematis crispa* (curl-flower), *Hymenocallis liriosome* (spider lily), *Carex intumescens* (common bladder caric sedge), *Trepocarpus aethusae* (muskweed), *Ranunculus pusillus* (low spearwort), and *Galium tinctorium* (dye bedstraw). *Climacium* sp. (tree moss) is usually abundant on the forest floor.

Mesic hardwood flatwoods support greater floristic diversity than wet hardwood flatwoods. Overstory dominants include *Carya alba* (mockernut hickory), *Nyssa sylvatica* (blackgum), *Quercus alba* (white oak), *Q. pagoda* (cherrybark oak), *Q. nigra* (water oak), *Q. michauxii* (cow oak), and *Liquidambar styraciflua* (sweetgum). *Quercus shumardii* (Shumard oak) and *Q. falcata* (southern red oak) are fairly frequent but not usually abundant. Common midstory trees include *Cornus florida* (flowering dogwood), *Ostrya virginiana* (eastern hophornbeam), *Aralia spinosa* (Devil's walking stick), *Ulmus alata* (winged elm), *Sassafras albidum* (sassafras), and *Acer rubrum* (red maple). Important shrubs/small trees are *Vaccinium arboreum* (tree huckleberry), *V. virgatum* (large cluster blueberry), *Viburnum rufidulum* (rusty blackhaw), *Crataegus marshallii* (parsley hawthorn), *Aesculus pavia* (red buckeye), *Frangula caroliniana* (Carolina buckthorn), *Asimina triloba* (pawpaw), *Hypericum hypericoides* (St. Andrew's Cross), and *Euonymus americana* (strawberry bush). Although infrequent, *Hamamelis virginiana* (witch hazel) can be locally abundant. Important woody vines include *Toxicodendron radicans* (poison ivy), *Parthenocissus quinquefolia* (Virginia creeper), *Vitis rotundifolia* (muscadine), *V. aestivalis* (summer grape), and *Smilax smallii* (lance-leaf greenbrier). Poison ivy and Virginia creeper are usually thick on the ground and are well-represented by high climbing individuals. Common and characteristic herbaceous plants include *Chasmanthium laxum* var. *sessiliflorum* (woods oats), *Dichanthelium boscii* (panic grass), *Podophyllum peltatum* (mayapple), *Carex cherokeensis* (Cherokee caric sedge), *Elephantopus carolinianus* and *E. tomentosus* (elephant's foot), *Scleria oligantha* (littlehead nutsedge), *Aristolochia serpentaria* (Virginia Dutchman's pipe), *Botrychium virginianum* (rattlesnake fern), *Passiflora lutea* (yellow passionflower), *Dioscorea villosa* (wild yam), *Clitoria mariana* (Atlantic pigeonwings), *Sanicula canadensis* (sanicle), *Geum canadense* (white avens), *Galium circaezans* (wild licorice), *Agrimonia rostellata* (woodland agrimony), *Spigelia marilandica* (Indian pink), *Clematis virginiana* (virgin's bower), *Phryma leptostachya* (lopseed), *Ruellia caroliniensis* (wild petunia), and *Smallanthus uvedalia* (bear's foot).

**Current Extent and Status:**

Most known occurrences of hardwood flatwoods are on the Macon Ridge in northeast Louisiana. The habitat is rare and threatened where it occurs in Bossier and Webster Parishes. A small amount of acreage of this habitat is captured by Bodcau WMA in Bossier Parish. The Louisiana Army Ammunition Plant in southern Bossier and Webster Parishes supports a high quality 69 acre hardwood flatwoods (McInnis and Martin 1995). In addition to East Baton Rouge, hardwood flatwoods may have been present in adjacent parishes of East Feliciana and Livingston.



Hardwood flatwoods represent a gap in our knowledge. Research is needed to determine more accurately its former extent in Louisiana and to identify and characterize remnants of this habitat type.

<b>HARDWOOD FLATWOODS SPECIES OF CONSERVATION CONCERN (17)</b>		
<b>AMPHIBIANS</b> Southern Dusky Salamander	Yellow-throated Vireo Northern Parula Swainson's Warbler	Southeastern Myotis Louisiana Black Bear Long-tailed Weasel
<b>BIRDS</b> American Woodcock Yellow-billed Cuckoo Chuck-Will's-Widow Wood Thrush	Kentucky Warbler Painted Bunting Orchard Oriole	<b>REPTILES</b> Timber Rattlesnake
	<b>MAMMALS</b> Southeastern Shrew	

***Priority Species Research and Survey Needs:***

Songbirds:

- Continue to support research on silviculture/land management practices and their effects on all songbird species.
- Develop long-term monitoring projects that focus on abundances and reproductive success (with emphasis on species of conservation concern) in this habitat type through the establishment of MAPS stations and BBS routes.

Chuck-Will's-Widow: Research is needed to better understand the population dynamics of this species. Studies should focus on distribution patterns, habitat availability and use, nesting success, and territory size requirements. Implementation of night-time surveys along with sighting reports by foresters, birders, etc. are needed to augment sparse BBS records.

Louisiana Black Bear: Continue research on its ecology and support repatriation efforts.

Eastern Spotted Skunk: Considered critically imperiled in Louisiana, intensive surveys needed to update occurrence records and abundance for inclusion in the LNHP database.

Southeastern Shrew: Considered imperiled in Louisiana. Together with Arkansas and Missouri, Louisiana represents the western edge of its range. Intensive surveys needed to update occurrence records and abundance for inclusion in LNHP database.

Document the habitat relationships of species of conservation concern and how dependent they are upon hardwood flatwoods, relative to other habitat types.

Determine the microhabitat preferences and requirements of species occupying hardwood flatwoods to understand how these species are utilizing the habitat and to determine management needs.

***Species Conservation Strategies:***

1. Identify IBA's or potential IBA's and partner with BRAS, OAS, and the NAS to implement conservation recommendations from SWG project T27 upon completion.

2. Chuck-Will's-Widow: Work with federal agencies and bird conservation organizations to produce technical pamphlets highlighting the habitat and management requirements of this species and make them available to landowners.
3. Louisiana Black Bear: Partner with the BBCC, USFWS and continue to support the implementation of recovery efforts for this species.
4. Timber Rattlesnake: Naturally low-occurring population levels and persecution make persistence in isolated forest blocks untenable. Prohibit killing of timber rattlesnakes and retain connectivity of flatwoods.
5. Promote use of appropriate silvicultural techniques to restore/manage hardwoods flatwoods for wildlife (include importance of tree species diversity, den trees for birds and mammals, leaf litter, etc).
6. Promote snag retention during logging operations to increase the numbers available for cavity-nesting wildlife species. Efforts need to be made to maintain sufficient levels of woody debris in stands for reptiles, amphibians and small mammals.

***Threats Affecting Habitat:***

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat			
	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation
Conversion to agriculture or other forest types		XXX		XXX
Incompatible forestry practices	XXX		XXX	
Invasive/alien species	XXX			
Residential development		XXX	XXX	XXX

***Habitat Conservation Strategies:***

1. Support additional research on the extent of this habitat type, its ecological characteristics, and its classification.
2. Map remnants of this habitat type to aid in establishing priority sites for acquisition and conservation.
3. Work with appropriate planning commissions to provide LNHP data that illustrates locations of this habitat type.
4. Provide educational information on this habitat type and its importance to species of conservation concern to landowners/land managers through technical pamphlets and the LDWF website.

5. Work with the legislature to provide incentives (tax breaks, etc.) to landowners to retain the natural state of areas where this habitat occurs.

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## 20. Intermediate Marsh

**Rarity Rank:** S3S4/G4

**Synonyms:** Oligohaline Marsh

**Ecological Systems:**

CES203.467 Gulf Coast Chenier Plain Fresh and Oligohaline Tidal Marsh

CES203.470 Mississippi Delta Fresh and Oligohaline Tidal Marsh

### **General Description:**

This natural community lies between brackish marsh and freshwater marsh, although it infrequently may be adjacent to the Gulf. Intermediate marsh has an irregular tidal regime, is oligohaline (salinity of 3 to 10 ppt), and is dominated by narrow-leaved, persistent species. Small pools or ponds may be scattered. Plant diversity and soil organic matter content is higher than in brackish marsh. This marsh is characterized by a diversity of species, many of which are found in freshwater marsh and some of which are found in brackish marsh. Chabreck (1972) reported 55 plant species in intermediate marsh versus only 17 different species in salt marsh. It is often dominated by *Spartina patens* (wire grass). Other characteristic species include *Phragmites communis* (roseau cane), *Sagittaria lancifolia* (= *S. falcata*; bulltongue), *Bacopa monnieri* (coastal water hyssop), *Eleocharis* spp. (spikesedge), *Scirpus olneyi* (three-cornered grass), *S. californicus* (giant bulrush), *S. americanus* (common threesquare), *Vigna luteola* (deer pea), *Paspalum vaginatum* (seashore paspalum), *Panicum virgatum* (switch grass), *Leptochloa fascicularis* (bearded sprangletop), *Pluchea camphorata* (camphor-weed), *Echinonchloa walteri* (walter millet), *Cyperus odoratus* (fragrant flatsedge), *Alternanthera philoxeroides* (alligator weed), *Najas guadalupensis* (southern naiad), *Spartina cynosuroides* (big cordgrass), and *S. spartineae* (gulf cordgrass) (LNHP 1986-2004). Two other major autotrophic groups in intermediate marsh are epiphytic and benthic algae. Intermediate marsh occupies the least acreage of any of the four marsh types. This marsh type is very important to many species of avian wildlife and supports large numbers of wintering waterfowl. It is also critical nursery habitat to larval marine organisms. Gradual changes in salinity conditions can cause this habitat to shift towards brackish marsh.

### **Current Extent and Status:**

The acreage of intermediate marsh appears to be decreasing due to salt water intrusion, canal dredging, and commercial, industrial, and residential development. Presettlement acreage was estimated at 100,000 to 500,000 acres, but has been reduced by 50 to 75 % of this original extent (Smith 1993). The largest contiguous tracts of intermediate marsh occur in Cameron, Vermilion, Terrebonne, and Lafourche Parishes



(Hartley et al. 2000). In the Chenier Plain of southwestern Louisiana, Sabine NWRs, managed by the USFWS contains approximately 91,000 acres of intermediate to brackish marsh. Rockefeller Wildlife Refuge, managed by LDWF has a total of 76,000 acres with approximately one-fifth of its acreage in intermediate marsh. In the Deltaic Plain of southeastern Louisiana, LDWF lands with freshwater marsh habitat include Pointe-aux-Chenes WMA (35,000 total acres, the majority are in brackish marsh with some intermediate marsh), Pass-a-Loutre WMA at the terminus of the Mississippi River (115,000 total acres, the majority are canals and waterways with some fresh and intermediate marsh), Pearl River WMA (total 36,000 acres with approximately one-fourth in freshwater and intermediate marsh), Biloxi WMA (39,583 acres of intermediate and salt marsh), and Manchac WMA (total 8,300 acres, once cypress swamp but now converted to intermediate marsh). NWRs with intermediate marsh in the Deltaic Plain include Bayou Sauvage NWR (23,000 acres of fresh and intermediate marsh), and Big Branch NWR (total land area of 15,000 acres, intermediate marsh acreage unknown).

<b>INTERMEDIATE MARSH SPECIES OF CONSERVATION CONCERN (31)</b>		
<b>BIRDS</b>	Black Rail	Forster's Tern
Brown Pelican	Clapper Rail	Short-eared Owl
American Bittern	King Rail	Sedge Wren
Reddish Egret	Sandhill Crane	Loggerhead Shrike
Yellow-crowned Night-Heron	Whooping Crane	
Mottled Duck	Marbled Godwit	<b>BUTTERFLIES</b>
Northern Pintail	Dunlin	Neamathla Skipper
Canvasback	Short-billed Dowitcher	Dion Skipper
Redhead	Gull-billed Tern	Obscure Skipper
Lesser Scaup	Caspian Tern	Great Southern White
Bald Eagle	Common Tern	Western Pygmy-Blue
Northern Harrier		

***Priority Species Research and Survey Needs:***

Rails: Initiate intensive surveys to better understand population densities and distributions in coastal marsh habitats.

Terns: Continue with nesting surveys and initiate research that focuses on factors (predation, human disturbance, etc.) effecting overall population densities.

Brown Pelican: Continue long-term monitoring of nesting colonies.

Waterbirds: Continue to conduct rookery surveys to update the LNHP database.

Butterflies: Conduct surveys to determine current distribution and abundance of all butterfly species, especially species of conservation concern, for inclusion in the LNHP database.

*Species Conservation Strategies:*

1. Terns:
  - Disturbance and loss of nesting habitat are major threats to terns. Develop partnerships to strengthen the protection and restoration of barrier islands.
  - Develop a comprehensive survey methodology to determine long term trends in population abundances.
2. Shorebirds, Wading Birds:
  - Provide public education regarding the importance of waterbird nesting colonies and shorebird feeding areas. Reduce the negative effects on these areas from recreational and other uses.
  - Work with landowners to implement management and conservation recommendations for waterbirds (especially rails) of SWG project T18 upon completion.
  - Coordinate with GCJV to implement recommendations of shorebird and wading bird conservation plans.
  - Disturbance and loss of nesting habitat are major threats to these species. Continue to protect and restore coastal marshes. Develop new and/or improve existing partnerships to achieve this goal.
3. Waterfowl:
  - Continue to encourage the creation/enhancement/maintenance of high-quality habitat across Louisiana.
  - Work with DU, DW, and USFWS to assuring that quality habitat, including refuge from hunting and other disturbance, is distributed across the landscape.
  - Encourage maintenance of rice agriculture and discourage conversion to crops with lower value to waterfowl.
  - Continue LDWF partnerships with DU, DW, USWFS, and state wildlife management agencies to conserve habitat on the northern breeding grounds.
4. Continue to work with USFWS/LSU in efforts to reintroduce whooping crane to Louisiana.



**Threats Affecting Habitat:**

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat						
	Altered Composition/ Structure	Altered Water Quality	Habitat Destruction or Conversion	Habitat Disturbance	Herbivory	Modification of Water Levels; Changes in Natural Flow Patterns	Salinity Alteration
Channelization of rivers or streams	XXX	XXX	XXX			XXX	XXX
Construction of ditches, drainage or diversion systems		XXX	XXX			XXX	XXX
Development/maintenance of pipelines, roads or utilities		XXX	XXX	XXX		XXX	XXX
Grazing practices	XXX	XXX	XXX	XXX			
Invasive/alien species	XXX	XXX	XXX		XXX		
Levee or dike construction	XXX	XXX	XXX	XXX		XXX	
Residential development			XXX	XXX			
Saltwater intrusion	XXX	XXX	XXX	XXX			XXX

**Habitat Conservation Strategies:**

1. Encourage the NRCS Plant Materials Center and other growers to produce a greater variety of plant species for the restoration of coastal habitats.
2. Work with COE and state agencies to insure water control structures provide the maximum benefit to intermediate marsh.
3. Work with landowners to develop alternatives to livestock production in this habitat.
4. Work with LCA, CWPPRA for protection and restoration of intermediate marsh.
5. Support NRCS and DNR efforts to stabilize shorelines and restore habitat.

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## 21. Live Oak-Pine-Magnolia Forest

**Rarity Rank:** S2/G2G3

**Synonyms:** Maritime Forest, Maritime Mesophytic Forest

**Ecological Systems:** CES203.503 East Gulf Coastal Plain Maritime Forest

### **General Description:**

This community is known in Louisiana from southern St. Tammany Parish, and occurs in a zone within 2 miles of Lake Pontchartrain where the Pleistocene prairie terrace meets the lake. Soils typically are sandy in nature. The community may exhibit site to site variation in species composition and physiognomy depending on soil moisture regime, age, fire history, relative exposure to salt spray, local relief, proximity to drains, and salt-water inundation during very high tides (such as those associated with hurricanes). A number of these factors are related to distance from the lake. The canopy structure of natural stands is believed to be more open than present-day stands. Overstory species include *Quercus virginiana* (live oak), *Pinus palustris* (longleaf pine), *Pinus elliottii* (slash pine), *Pinus taeda* (loblolly pine), and *Magnolia grandiflora* (southern magnolia). Significant canopy associates may include *Quercus nigra* (water oak), *Q. alba* (white oak), *Q. michauxii* (swamp white oak), *Q. laurifolia* (laurel oak), *Q. pagoda* (cherybark oak), *Liquidambar styraciflua* (sweetgum), *Fraxinus* spp. (ashes), *Acer rubrum* (red maple), *Magnolia virginiana* (sweet bay), *Liquidambar styraciflua* (sweetgum), *Celtis laevigata* (hackberry), and *Nyssa sylvatica* (black gum). Principal midstory and understory plants include *Sabal minor* (dwarf palmetto), *Ilex opaca* (American holly), *Ilex vomitoria* (yaupon), *Vaccinium* spp. (blueberries), *Osmanthus americanus* (devil-wood), *Carpinus caroliniana* (iron wood), *Ostrya virginiana* (hophornbeam), *Symplocos tinctoria* (sweetleaf), *Asimina parviflora* (dwarf pawpaw), *Oxydendrum arboreum* (sourwood), *Aralia spinosa* (devil's walking stick), *Persea borbonia* (red bay), *Rhus copallina* (winged sumac), *Morella cerifera* (wax myrtle), *Callicarpa americana* (french mulberry), *Sassafras albidum* (sassafras), *Thelypteris palustris* (southern marsh-fern), *Osmunda cinnamomea* (cinnamon fern), and *Lorinseria areolata* (net-veined chain-fern). Many vine species are present.

This natural community may in reality be a transitional type between mesic Mixed Hardwood-Loblolly Forest and/or Beech-Magnolia Forest and more typical maritime forests that occur in coastal states east of Louisiana. Or it may be an artificial aggregation, with the original species complement disproportionately represented in today's forests. Further field inventories are needed to more fully understand and define this community. Fire, although uncommon, may play an important role in Live Oak-Pine-Magnolia Forest.

**Current Extent and Status:**

This community is extremely restricted in its occurrence in Louisiana, and is known only from St. Tammany Parish along the northshore of Lake Pontchartrain. Presettlement estimates of this habitat type are from 10,000 to 50,000 acres, but only 10 to 25 % of the original extent remains today. A small portion of this habitat is protected at Fontainebleau State Park. All other occurrences are under private ownership.



LIVE OAK – PINE – MAGNOLIA FOREST SPECIES OF CONSERVATION CONCERN (19)		
<b>AMPHIBIANS</b>	Swainson's Warbler	Southeastern Myotis
Oak Toad	Kentucky Warbler	Long-tailed Weasel
	Hooded Warbler	
<b>BIRDS</b>	Field Sparrow	<b>REPTILES</b>
Yellow-billed Cuckoo	Rusty Blackbird	Eastern Glass Lizard
Chuck-Will's-Widow	Orchard Oriole	Pine Woods Littersnake
Wood Thrush		Southeastern Crowned Snake
Yellow-throated Vireo	<b>MAMMALS</b>	Harlequin Coralsnake
Northern Parula	Southeastern Shrew	

**Priority Species Research and Survey Needs:**

Chuck-Will's-Widow: Research is needed to better understand the population dynamics of this species. Studies should focus on distribution patterns, habitat availability and use, nesting success, and territory size requirements. Implementation of night-time surveys along with sighting reports by foresters, birders, etc. are needed to augment sparse BBS records.

Southeastern Shrew: Considered imperiled in Louisiana. Together with Arkansas and Missouri, Louisiana represents the western edge of its range. Intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

Long-tailed Weasel: Considered vulnerable in LA. Intensive surveys needed to update occurrence records and abundance for inclusion in LNHP database.

Southeastern Crowned Snake: Recent records are from ridges along the north shore of Lake Pontchartrain, but recent surveys have failed to detect crowned snakes. Initiate pitfall trap surveys at Fontainebleau State Park and Big Branch NWR are needed to assess potential occurrence in developing areas.

Document the habitat relationships of species of conservation concern and how dependent they are upon live oak- pine-magnolia forest habitats, relative to other habitat types.

Determine the microhabitat preferences and requirements of species occupying live oak – pine-magnolia forest to understand how these species are utilizing the habitat to determine management needs.

***Species Conservation Strategies:***

1. Chuck-Will's-Widow: Work with federal agencies and bird conservation organizations to produce technical pamphlets highlighting the habitat and management requirements of this species and make them available to landowners.
2. Songbirds: Continue to monitor songbird abundance and reproductive success (with emphasis on species of conservation concern) in this habitat through the establishment of MAPS stations.
3. Promote snag retention during logging operations to increase their numbers for cavity-nesting species. Efforts need to be made to maintain sufficient levels of woody debris in stands for reptiles, amphibians and small mammals.

***Threats Affecting Habitat:***

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat			
	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation
Conversion to agriculture or other forest types		XXX		XXX
Development/maintenance of pipelines, roads or utilities		XXX	XXX	XXX
Incompatible forestry practices	XXX		XXX	
Invasive/alien species	XXX		XXX	
Residential development		XXX	XXX	XXX

***Habitat Conservation Strategies:***

1. Conduct inventories to determine the amount and extent of all remaining undeveloped acres of this habitat type.
2. Support research to identify historic fire regimes and general natural community characteristics of this habitat.
3. Partner with NGOs, OSP, private landowners, etc. to initiate restoration and preservation efforts of live oak – pine – magnolia forests and continue to encourage landowners to enroll this habitat type in the Natural Areas Registry Program.

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## 22. Live Oak Natural Levee Forest

**Rarity Rank:** S1S2/G2

**Synonyms:** Natural Levee Forest, Frontland Forest

**Ecological Systems:**

CES203.512 Lower Mississippi River Bottomland and Floodplain Forest

### **General Description:**

This community occurs principally in southeastern Louisiana on natural levees or frontlands and on islands within marshes and swamps. It is similar in some respects to coastal live oak-hackberry forest in that both develop on natural ridges in the coastal zone and overstory dominants are comparable. *Quercus virginiana* (live oak) typically dominates the stand, but *Q. nigra* (water oak), *Ulmus americana* (American elm), *Celtis laevigata* (hackberry), *Acer rubrum* var. *drummondii* (Drummond red maple), and *Fraxinus pennsylvanica* (green ash) are usually prominent community members, and may be predominant in areas. Overstory associates may include *Q. pagoda* (cherrybark oak), *Q. texana* (Nuttall oak), *Gleditsia triacanthos* (honey locust), *Liquidambar styraciflua* (sweetgum), and *Acer negundo* (box-elder). *Nyssa aquatica*



(tupelo gum) and *Taxodium distichum* (baldcypress) are often present in wet depressions or on edges. *Sabal minor* (dwarf palmetto) is usually the most conspicuous midstory and understory shrub, often attaining heights of up to 4 m, but a number of other shrubs may be present, including *Ilex decidua* (deciduous holly), *Crataegus viridis* (green hawthorn), *Cornus foemina* (swamp dogwood), *Planera aquatica* (water elm), *Morella cerifera* (wax myrtle), *Sambucus canadensis* (elderberry), and *Persea borbonia* (red bay). The herbaceous layer is often poorly developed, but may contain such species as *Tradescantia* spp. (spiderworts), *Solidago sempervirens* (seaside goldenrod), *Samolus verlandieri* (water-pimpernel), *Sanicula canadensis* (snakeroot), *Arisaema dracontium* (green dragon), *Nemophylla aphylla* (baby blue eyes), *Geum canadensis* (geum), *Hydrocotyle* spp. (penny-worts), *Eupatorium* spp. (thoroughworts), *Polygonum* spp. (smartweeds), *Polygonum virginica* (jumpseed), *Packera glabella* (= *Senecio glabellus*) (yellow-top), *Panicum* spp. (panic grasses), *Oplismenus hirtellus* (basket grass), and *Thelypteris* spp. (marsh ferns). Vines are usually prominent and include *Mikania scandens* (climbing hempvine), *Cocculus carolinianum* (Carolina moonseed), *Campsis radicans* (trumpet creeper), *Toxicodendron radicans* (poison ivy), *Berchemia scandens* (rattan vine), and *Smilax rotundifolia* (common greenbrier). Epiphytes are significant community members and include the highly conspicuous *Tillandsia usneoides* (Spanish moss), plus *Polypodium polypodioides* (resurrection fern), and *Phoradendron tomentosum* (mistle-

toe). Several introduced species have become serious invaders of this habitat, including *Lygodium japonicum* (Japanese climbing fern), *Triadica sebifera* (= *Sapium sebiferum*) (Chinese tallow tree), and *Lonicera japonica* (Japanese honeysuckle).

**Current Extent and Status:**

Louisiana’s live oak natural levee forests occur in the Deltaic Plain of extreme southeastern parishes from Orleans and St. Bernard Parishes westward to St. Mary Parish. Since this forest type is found only on natural levees which are higher and drier than the surrounding bottomlands and marshes, they were the first areas to be cleared for agriculture and residential development. Of the original 500,000 to 1,000,000 acres in Louisiana, currently only 10,000 to 50,000 acres remain, 1-5 % of presettlement extent. The majority of these remnant forests are altered and fragmented, and threats continue from residential development, roads and utility installation, overgrazing, coastal erosion and saltwater intrusion. The majority of natural levee forests are in private ownership. A portion is protected within Jean Lafitte National Historical Park and Bayou Sauvage NWR. There are also a few remnant strips on the Wisner, Pointe-aux-Chenes, and Salvador WMAs. One tract of 71 acres, owned by Plaquemines Parish, is part of the Louisiana Natural Areas Registry Program.



LIVE OAK NATURAL LEVEE FOREST SPECIES OF CONSERVATION CONCERN (16)		
<b>BIRDS</b>	Yellow-throated Vireo	Orchard Oriole
Yellow-crowned Night-Heron	Northern Parula	
Wood Stork	Prothonotary Warbler	<b>MAMMALS</b>
Bald Eagle	Swainson's Warbler	Long-tailed Weasel
American Woodcock	Kentucky Warbler	
Yellow-billed Cuckoo	Hooded Warbler	<b>REPTILES</b>
Wood Thrush	Painted Bunting	Timber Rattlesnake

**Priority Species Research and Survey Needs:**

Songbirds: Continued research is needed on silviculture/land management practices and their effects on all songbird species.

Long-tailed Weasel: Considered vulnerable in Louisiana. Intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

Document the habitat relationships of species of conservation concern and how dependent they are upon live oak natural levee forest habitats, relative to other habitat types.



Determine the microhabitat preferences and requirements of species occupying live oak natural levee forests to understand how these species are utilizing the habitat to determine management needs.

***Species Conservation Strategies:***

1. Timber Rattlesnake: Naturally low-occurring population levels and persecution make their persistence in isolated forest blocks untenable. Prohibit killing timber rattlesnakes. Reduce vehicular travel where possible to avoid snake kills.
2. Swallow-tailed Kite: Implement conservation and management recommendations of SWG project T9 (Coulson 2004).
3. Bald Eagle: Continue with long-term monitoring of active bald eagle nests, successful breeding pairs, and fledged eagles.
4. Identify IBA's or potential IBA's and partner with BRAS, OAS, and the NAS to implement conservation recommendations from SWG project T27 upon completion.
5. Work with landowners to initiate or continue the implementation of PIF bird conservation plans, conservation plans developed for amphibians and reptiles, and USFWS endangered and threatened species recovery plans over the next 10 years.

***Threats Affecting Habitat:***

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat				
	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation	Herbivory
Development/maintenance of pipelines, roads or utilities		XXX	XXX	XXX	
Invasive/alien species	XXX				
Management of/for certain species					XXX
Recreational use/vehicles			XXX		
Residential development		XXX	XXX	XXX	
Saltwater intrusion	XXX	XXX			

***Habitat Conservation Strategies:***

1. Work with the legislature to develop tax incentives and conservation servitudes or leases for landowners to encourage conservation of this habitat type.

2. Partner with NGOs, private landowners, etc. to promote protection of live oak forests and continue to encourage landowners to enroll this habitat type in the Natural Areas Registry Program.
3. Work with COE and NRCS to develop strategies for the placement of dredge materials as a restoration method for this habitat type.
4. Provide educational information on this habitat type and its importance to species of conservation concern to landowners/land managers through technical pamphlets and the LDWF website.
5. Support NRCS and DNR efforts for shoreline stabilization and habitat restoration.
6. Work with LCA, CWPPRA to broaden the coastal restoration projects to include live oak forests.
7. Work with local parish planning commissions and DNR to change zoning classifications to reduce development within this habitat type.

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### 23. Mixed Hardwood-Loblolly Pine/Hardwood Slope Forest

**Rarity Rank:** Mixed Hardwood-Loblolly Pine Forest- S4/G4  
Hardwood Slope Forest - S3S4/G4

**Synonyms:** Mixed Pine Hardwood, Loblolly Pine-Hardwood, Beech-Magnolia Forest,  
Mixed Hardwood Forest, Hammock, Mixed Mesic Hardwood Forest

**Ecological Systems:**

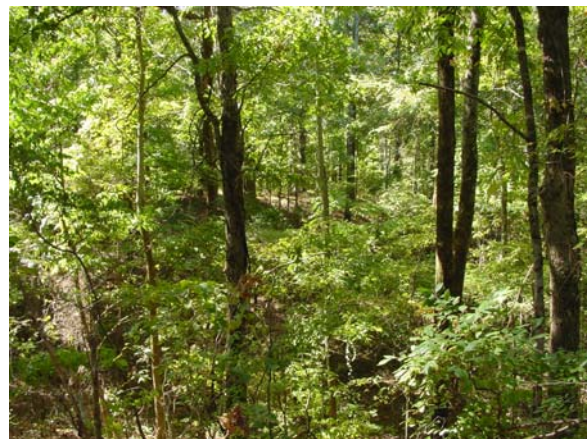
CES203.476 East Gulf Coastal Plain Southern Mesic Slope Forest

CES203.280 West Gulf Coastal Plain Mesic Hardwood Forest

CES203.378 West Gulf Coastal Plain Pine-Hardwood Forest

**General Description:**

(Note: Hardwood slope forests and mixed hardwood - loblolly pine forests are described as distinct communities in the LNHP Natural Communities of Louisiana. They are considered together here due to their floristic similarity and similarity in management needs.)



These two communities can be similar in species composition but they differ in topographic position and soil moisture, with hardwood slope forests being more mesic. Both communities are more or less evenly distributed in the uplands statewide.

Hardwood slope forests occur on slopes (often steep) rising out of small (or larger) stream floodplains. Mixed hardwood - loblolly pine forests are found upslope and, depending on moisture regime, on low ridge tops. *Pinus taeda* (loblolly pine) may be present but infrequent in a hardwood slope forest, but comprises 20 percent or more of the overstory, associated with various hardwood species, in a mixed hardwood - loblolly pine forest.

Without fire, mixed hardwood-loblolly pine forest succession is toward hardwood dominance. Given the available pine needle fuel, regular fire was a process maintaining a significant pine component. Other types of disturbances may also allow loblolly pine to remain a component of the forest. Fire may have occurred very rarely in hardwood slope forests, but is not a process required to maintain this community. In hardwood slope forests, *Fagus grandifolia* (beech) and *Magnolia grandiflora* (southern magnolia) are typically canopy dominants. However, in north Louisiana, southern magnolia is often infrequent or absent. Other primary overstory species include *Quercus alba* (white oak), *Q. shumardii* (shumard oak), *Q. michauxii* (swamp white oak), *Q. nigra* (water oak), *Q. laurifolia* (laurel oak), *Q. velutina* (black oak), *Magnolia acuminata* (cucumber tree), *M. macrophylla* (big-leaf magnolia), *M. pyramidata* (pyramid magnolia, rarely),

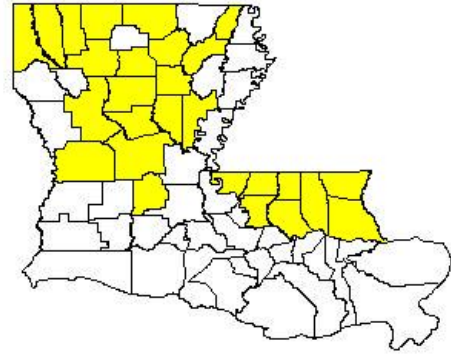
*Liriodendron tulipifera* (tulip tree), *Liquidambar styraciflua* (sweetgum), *Carya tomentosa* (mockernut hickory), *C. cordiformis* (bitternut hickory), and *C. glabra* (pignut hickory). *Pinus taeda* may be present sporadically in the overstory, and *Pinus glabra* (spruce pine) is an occasional associate in the Florida Parishes. Significant midstory and understory associates are *Oxydendrum arboreum* (sourwood), *Halesia diptera* (silverbell), *Styrax grandifolia* (bigleaf snowbell), *Cornus florida* (flowering dogwood), *Symplocos tinctoria* (sweetleaf), *Prunus caroliniana* (cherry-laurel), *Stewartia malacodendron* (silky camelia), *Amelanchier arborea* (downy service-berry), *Ilex ambigua* (holly), *Illicium floridanum* (starbush, southeastern Louisiana), *Carpinus caroliniana* (ironwood), *Ostrya virginiana* (eastern hophornbeam), *Vaccinium arboreum* (winter huckleberry), *V. elliotii* (Elliott's blueberry), and *Erythrina herbacea* (red coral bean). Herbaceous species include *Hexastylis arifolia* (wild ginger, southeast Louisiana), *Trillium* spp. (wake-robbers), *Polygonatum biflorum* (smooth solomon's seal), *Uvularia perfoliatum* (bellwort), *Tipularia discolor* (crane-fly orchid), *Viola* spp. (violets), *Spigelia marilandica* (Indian pink), *Podophyllum peltatum* (may-apple), *Sanicula* spp. (snakeroots), *Polymnia uvedalia* (bear-paw), *Chamaelirium luteum* (devil's-bit), *Lilium michauxii* (Carolina lily), *Arisaema* spp. (jack-in-the-pulpits), *Prenanthes altissima* (tall rattlesnake root), *Polystichum acrostichoides* (Christmas fern), and *Phegopteris hexagonoptera* (broad beech-fern). On salt domes in the coastal zone, this natural community lacks beech, but includes *Q. virginiana* (live oak), various elms (*Ulmus* spp.), and other species not typical of hardwood slope forests above the coastal zone.

In mixed hardwood - loblolly pine forests *Pinus taeda* comprises at least 20 percent of the overstory. On moist sites *Liquidambar styraciflua* (sweetgum), *Fagus grandifolia*, *Quercus nigra*, *Q. pagoda* (cherrybark oak), *Q. michauxii*, *Q. alba*, *Liriodendron tulipifera* (yellow poplar), *Ulmus americana* (American elm), *Magnolia grandiflora*, *Acer rubrum*, and *Carya glabra* are important hardwood components. On dryer upland sites protected from fire, overstory dominants in addition to loblolly are *Quercus falcata* (southern red oak), *Q. stellata* (post oak), *Q. nigra*, *Q. marilandica* (blackjack oak), *Nyssa sylvatica* (black gum) and *Carya tomentosa*. This community occurs infrequently on sandy, xeric sites and here, *Q. incana* (bluejack oak) and *Q. hemispherica* (upland laurel oak) are frequent associates. Shrubs and understory species may include, depending on moisture regime, *Ilex glabra* (gallberry), *Callicarpa americana* (french mulberry), *Cornus florida*, *Crataegus* spp. (hawthorns), *Oxydendrum arboreum* (sourwood), *Vaccinium elliotii*, *V. arboreum*, *Rhus copallina* (winged sumac), *Toxicodendron radicans* (poison ivy), *Morella cerifera* (wax myrtle), *Ilex vomitoria* (yaupon), *Rubus* spp. (blackberries), *I. decidua* (deciduous holly), *Malus angustifolia* (crab apple), and *Gelsemium sempervirens* (yellow jessamine), *Mitchella repens* (partridge-berry), and *Viola* spp. (violets).

#### **Current Extent and Status:**

As indicated by rarity ranks for these two communities this habitat is not as imperilled as many others. A mixed loblolly pine-hardwood type is expanding in some cases into uplands due to fire suppression. However, older, more natural examples of this habitat are threatened by conversion to pine plantations (Martin and Smith 1993, Grace

and Smith 1995, Williams and Smith 1995). Natural occurrences are scattered mainly in the WGCP of central Louisiana and EGCP in the eastern Florida Parishes. There are a few occurrences known on Macon Ridge in the MRAP and it was probably much more common there historically. A number of occurrences are on conservation lands such as Kisatchie National Forest. The hardwood slope forest community is estimated to have occupied 100,000 to 500,000 acres historically and of that an estimated 25 to 50 % still remains (Smith 1993). Mixed hardwood-loblolly pine forest is estimated to have been more extensive, occupying 500,000 to 1,000,000 acres historically with the same percentage thought to remain today (Smith 1993).



<b>MIXED HARDWOOD - LOBLOLLY PINE/HARDWOOD SLOPE FOREST SPECIES OF CONSERVATION CONCERN (45)</b>		
<b>AMPHIBIANS</b>	Northern Parula	<b>MAMMALS</b>
Louisiana Slimy Salamander	Prairie Warbler	Southeastern Shrew
Southern Red-backed Salamander	Worm-eating Warbler	Southeastern Myotis
Southern Red Salamander	Swainson's Warbler	Northern Myotis
Oak Toad	Louisiana Waterthrush	Silver-haired Bat
Barking Treefrog	Kentucky Warbler	Big Brown Bat
Eastern Spadefoot	Hooded Warbler	Louisiana Black Bear
	Field Sparrow	Long-tailed Weasel
	Orchard Oriole	Eastern Spotted Skunk
<b>BIRDS</b>	<b>BUTTERFLIES</b>	<b>REPTILES</b>
Bald Eagle	Wild Indigo Duskywing	Eastern Glass Lizard
American Woodcock	Pepper and Salt Skipper	Western Worm Snake
Yellow-billed Cuckoo	Yucca Giant Skipper	Northern Scarlet Snake
Chuck-Will's-Widow	Falcate Orangetip	Mole Kingsnake
Brown-headed Nuthatch	Harvester	Scarlet Kingsnake
Wood Thrush	Little Metalmark	Pine Woods Littersnake
Bell's Vireo		Harlequin Coral Snake
Yellow-throated Vireo		Timber Rattlesnake

***Priority Species Research and Survey Needs:***

Songbirds:

- Continue to support research on silviculture/land management practices and their effects on all songbird species.
- Develop long-term monitoring projects that focus on abundances and reproductive success (with emphasis on species of conservation concern) in this habitat type through the establishment of MAPS stations and BBS routes.

Butterflies: Conduct surveys to determine current distribution and abundance of all butterfly species, especially species of conservation concern, for inclusion in the LNHP database.

Chuck-Will's-Widow: Research is needed to better understand population dynamics of this species. Studies should focus on distribution patterns, habitat availability and use, nesting success, and territory size requirements. Implementation of night-time surveys along with sighting reports by foresters, birders, etc. are needed to augment spars BBS records.

Bats:

- Northern Myotis: This species was first documented in Louisiana in 2003 (Crnkovic 2003). Conduct intensive surveys to determine its current status in Louisiana and to evaluate the importance of bridges as roost sites (Leberg 2004).
- Develop projects that target species of conservation concern and focus on their distribution, abundance, and ecological needs in this habitat type (Lacki et al. 2001).
- Research the genetic identities of different Myotis species in the state (Leberg 2004).

Eastern Spotted Skunk: Considered critically imperiled in Louisiana. Intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

Long-tailed Weasel: Considered vulnerable in Louisiana. Intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

Ringtail: Louisiana represents the eastern edge of its range. Intensive surveys are needed to determine its current status in Louisiana.

Determine the microhabitat preferences and requirements of species utilizing mixed hardwood-loblolly pine/hardwood slope forest to understand how these species are utilizing the habitat to develop management guidelines for these species.

***Species Conservation Strategies:***

1. Louisiana Slimy Salamander, Southern Red-backed Salamander, Western Worm Snake: This guild of species occurs in isolated slope sites, and appears to be intolerant of habitat alteration. Encourage timber companies to designate no-cut zones (especially on slopes, slope crests, and riparian borders).
2. Songbirds:
  - Continue to encourage landowners to maintain areas in early successional stage to benefit bird species which depend on this habitat.
  - Work with NRCS, USFWS, USFS to develop and distribute technical pamphlets which contain information about the importance of early successional habitat for species of conservation concern.
  - Continue to monitor songbird abundance and reproductive success (with emphasis on species of conservation concern) in this habitat through the establishment of MAPS stations.

3. Chuck-Will's-Widow: Work with federal agencies and bird conservation organizations to produce technical pamphlets highlighting the habitat and management requirements of this species and make available to landowners.
4. Bald Eagle: Continue with long-term monitoring of active bald eagle nests, successful breeding pairs, and fledged eagles.
5. Louisiana Black Bear: Partner with the BBCC, USFWS and continue to support the implementation of recovery efforts for this species.
6. Establish monitoring systems and protocols for target bats species and other mammal species associated with mixed hardwood-loblolly pine/hardwood slope forest.
7. Work with landowners to initiate or continue the implementation of PIF bird conservation plans, conservation plans developed for amphibians and reptiles, and USFWS threatened and endangered species recovery plans over the next 10 years.

***Threats Affecting Habitat:***

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat			
	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation
Conversion to agriculture or other forest types		XXX		XXX
Development/maintenance of pipelines, roads or utilities			XXX	XXX
Fire suppression	XXX			
Incompatible forestry practices	XXX		XXX	XXX
Invasive/alien species	XXX			
Recreational use/vehicles			XXX	
Residential development		XXX	XXX	XXX

***Habitat Conservation Strategies:***

1. Develop best management practices for restoration of this habitat type including appropriate fire regimes and herbicide uses.
2. Continue to encourage landowners to implement BMPs and adopt SFI standards in the management of this habitat type.
3. Encourage use of existing NRCS, USFWS programs in providing cost share incentives to landowners for invasive species control.
4. Develop partnerships with federal and state agencies, NGO's and others to identify potential parcels of this habitat type for acquisition and conservation.

5. Work with the legislature to provide incentives (tax breaks, etc.) to landowners to retain the natural state of areas where this habitat occurs.
6. Work with appropriate planning commissions to provide LNHP data that illustrates locations of this habitat type.

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## 24. Saline Prairie

**Rarity Rank:** S1/G1G2

**Synonyms:** Barrens, Salt Barrens, Slicks

**Ecological Systems:** CES203.291 West Gulf Coastal Plain Saline Glade

### **General Description:**

Saline prairie is a natural, mostly treeless natural community currently known from a few scattered sites in central and northwestern Louisiana. Typically only a few acres in size, they may be wet, mesic or dry prairies. The wet variants arise on low flat terraces subject to regular flooding adjacent to or near small to intermediate streams. Wet saline prairies usually grade upslope into mesic or dry saline prairies. In aspect, these prairies are usually a mosaic of variably dense herbaceous vegetation (thick to thin), with interspersed bare soil areas (“slicks”). Shrubs are intermixed to a greater or lesser degree, and may in places form saline shrub thickets.



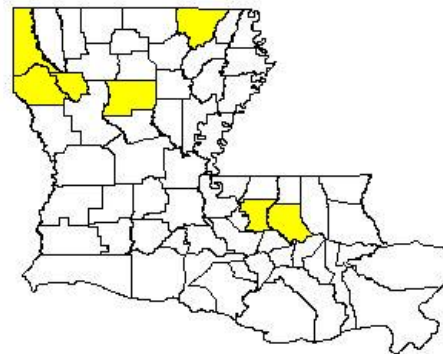
The soils for all saline prairies have high levels of exchangeable sodium and (at times) magnesium in the subsoil and near the surface horizons that have created extreme conditions for plant growth. Such conditions include relatively high alkalinity, very poor movement of water and air in the soil, resistance to wetting that can induce droughty conditions, resistance to drying once saturated, and sodic horizon in the subsoil that acts much like a dense claypan and is very resistant to root penetration. The soil, naturally low in fertility, contains relatively high levels of certain water-soluble salts that are injurious to plants and may produce alkali chlorosis and mortality. The principal soils supporting the community in the UWGCP and EGCP are the Bonn and Lafe series. Occurrences on the LWGCP are on Brimstone soils. The plant community therefore includes many halophytic (salt tolerant) forbs, grasses and grass-like plants.

Characteristic plants include *Aristida* spp. (three-awn grasses), *Aster subulatus*, *Atriplex pentandra* (orach), *Bacopa monnieri* (water hyssop), *B. rotundifolia*, *Carex glaucescens* (sedge), *Chasmanthium latifolium* (spikegrass), *Diodia teres* (poorjoe), *Distichlis spicata* (alkali grass), *Eleocharis* spp. (spikerush), *Fimbristylis castanea*, *Geocarpon minimum* (earthfruit, federally-listed as threatened, image above), *Heliotropium curassivicum* (heliotropes), *Hibiscus moscheutos* ssp. *lasiocarpus* (hibiscus), *Iris brevicaulis* (lance iris), *Iva angustifolia* (marsh elder), *Juncus* spp. (rushes), *Ludwigia* spp. (primrose), *Lythrum lineare* (loosestrife), *Panicum virgatum* (switchgrass), *Phyla nodiflora* (frog-fruit), *Pluchea camphorata* (stinkweed), *Polygonum*

*aviculare* (knotweed), *Proserpinaca pectinata* (mermaid-weed), *Rhynchospora corniculata* (beakrush), *Schizachyrium scoparium* (little bluestem), *Solidago sempervirens* (seaside goldenrod), *Spartina pectinata* (prairie cordgrass), *Tradescantia occidentalis* (spiderwort), and *Tridens strictus* (sandgrass). Characteristic tree, shrub and vine species (nearby or very scattered in prairie) include: *Ampelopsis arborea* (peppervine), *Baccharis hamilifolia* (saltbush), *Berchemia scandens* (rattan vine), *Cephalanthus occidentalis* (buttonbush), *Crataegus berberifolia* (barberry hawthorn), *C. brachyacantha* (blueberry hawthorn), *C. virdis* (green hawthorn), *Fraxinus caroliniana* (Carolina ash), *Morella cerifera* (wax myrtle), *Pinus taeda* (loblolly pine), *Quercus lyrata* (overcup oak), *Q. nigra* (water oak), *Q. similis* (delta post oak), *Q. phellos* (willow oak), and *Ulmus crassifolia* (cedar elm).

**Current Extent and Status:**

Saline prairies are widely scattered in Louisiana. There are only three known intact saline prairies in the UWGCP. Two of them are in Red River Parish and one is in southern Caddo Parish. The Red River saline prairies are on industrial forest land and are being protected. The Caddo prairie is on non-industrial private land and LNHP is just beginning to work with the landowner toward conservation of the site. There are several other saline prairies in Caddo and Desoto parishes that require a field survey to determine their status. There is one named saline prairie in Morehouse Parish called Prairie de Butte that is now completely extirpated. There are patches of Lafe series soil near this site with some characteristic flora but no known intact prairies. In the Lower West Gulf Coastal Plain there are several high quality saline prairies in southeast Winn Parish. Two of these prairies support the federally-listed *Geocarpon minimum* (earth fruit). Saline prairies are suspected to occur in adjacent Caldwell Parish. Saline prairies were historically known from East Baton Rouge Parish and Livingston Parishes and these prairies have now been extirpated (Smith 1999). Saline Prairies were not extensive in presettlement times. The estimated presettlement acreage for Saline Prairie is less than 2,000 with an estimated 10 to 25 % remaining (Smith 1993).



SALINE PRAIRIE SPECIES OF CONSERVATION CONCERN (6)		
BIRDS	MAMMALS	REPTILES
American Woodcock Field Sparrow Grasshopper Sparrow	Hispid Pocket Mouse Eastern Harvest Mouse	Western Slender Glass Lizard

***Priority Species Research and Survey Needs:***

Field Sparrow and Grasshopper Sparrow: Survey's are needed to determine breeding (Field Sparrow) and wintering population abundances and to assess the amount and quality of available habitat statewide.

Eastern Harvest Mouse: Considered vulnerable in Louisiana. Intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

Hispid Pocket Mouse: Louisiana represents the eastern edge of its range. Intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

Western Slender Glass Lizard: Occurrence in saline prairies is likely but imperfectly known. Glass lizards are declining over much of their range, regardless of habitat alteration. Determine the extent of any correlations between glass lizard occurrence and Saline Prairies.

Determine the microhabitat preferences and requirements of species occurring in saline prairies to understand how these species are utilizing the habitat to develop management recommendations.

***Species Conservation Strategies:***

1. Songbirds:

- Continue to encourage landowners to maintain areas in an early successional stage to benefit bird species which depend on this habitat.
- Work with NRCS, USFWS, USFS to develop and distribute technical pamphlets which contain information about the importance of early successional habitat for species of conservation concern.
- Continue to monitor songbird abundance and reproductive success (with emphasis on species of conservation concern) in this habitat through the establishment of MAPS stations.

***Threats Affecting Habitat:***

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat			
	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Soil Erosion
Development/maintenance of pipelines, roads or utilities		XXX	XXX	
Grazing practices	XXX	XXX		
Incompatible forestry practices	XXX	XXX	XXX	XXX
Invasive/alien species	XXX		XXX	XXX
Oil or gas drilling		XXX		
Recreational use/vehicles	XXX	XXX	XXX	XXX

***Habitat Conservation Strategies:***

1. Provide educational information on this habitat type and its importance to species of conservation concern to landowners/land managers through technical pamphlets and the LDWF website.
2. Conduct surveys to determine the current extent and condition of this habitat type.
3. Develop management plans/recommendations for this habitat type.
4. Prepare GIS layer of soil type locations where prairies might occur and provide this information to the timber industry.
5. Work with the legislature to provide incentives (tax breaks, etc.) to landowners to retain the natural state of areas where this habitat occurs.
6. Provide management guidelines for control of invasive species within this habitat type.
7. Support research to understand basic ecosystem characteristics and processes and to develop methods to reduce soil erosion.
8. Develop strategies to address damage from feral hogs within this habitat type.
9. Work with hunting clubs and other landowners to restrict ATV use to existing trails to prevent degradation of this habitat type.

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## 25. Salt Dome Hardwood Forest

**Rarity Rank:** S1/G1

**Synonyms:** None

**Ecological Systems:** CES203.466 West Gulf Coastal Plain Chenier and Upper Texas Coastal Fringe Forest and Woodland

### **General Description:**

This is an upland forest type on loess-derived silt loams of salt domes in coastal Louisiana. Area of occurrence is very restricted. The canopy is dominated by *Quercus virginiana* (live oak), *Magnolia grandiflora* (Southern magnolia), *Q. pagoda* (cherrybark oak), *Ulmus americana* (American elm), *Celtis laevigata* (hackberry), *Liquidambar styraciflua* (sweetgum), *Tilia americana* var. *caroliniana* (basswood), *Q. nigra* (water oak), and *Carya glabra* (pignut hickory).



The epiphyte *Pleopeltis polypodioides* (resurrection fern) is quite common in canopy trees. The patchy to dense understory consists of *Prunus caroliniana* (cherry laurel), *Ilex vomitoria* (yaupon), *Sabal minor* (dwarf palmetto), *Callicarpa americana* (french mulberry), *Aesculus pavia* (red buckeye), and *Smilax rotundifolia* (common greenbriar). The herb layer is typically sparse and includes *Oplismenus hirtellus* ssp. *setarius* (bristle basketgrass), *Sanicula canadensis* (black snakeroot), *Malvaviscus arboreus* var. *drummondii* (wax mallow), and *Elephantopus carolinianus* (Carolina elephant's foot). Common woody vines include *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (poison ivy), *Vitis rotundifolia* (muscadine grape), *Rubus* spp. (blackberry), *Ampelopsis arborea* (peppervine), and *Smilax bona-nox* (saw greenbriar).

### **Current Extent and Status:**

The five salt domes, or “islands” of Louisiana are Avery, Belle Isle, Cote Blanche, Jefferson, and Weeks. Currently, Cote Blanche and Weeks support high quality forest. The condition of Belle Isle is unknown but it is suspected that there is some good habitat there. There is a 350 acre tract on Jefferson Island that is part of LDWF’s Louisiana Natural Areas Registry Program (Live Oak Garden Natural Area). However the current condition of the forest on this site is unknown. Avery Island, while quite large, supports very



little natural forest as much has been cleared and the remainder is disturbed, overrun with exotics, and affected by severe erosion. An assessment of size and quality of remaining salt dome hardwood forest is warranted.

<b>SALT DOME HARDWOOD FOREST SPECIES OF CONSERVATION CONCERN (13)</b>		
<b>BIRDS</b> Bald Eagle American Woodcock Yellow-billed Cuckoo Northern Parula Prothonotary Warbler	Painted Bunting Orchard Oriole  <b>BUTTERFLIES</b> Celia's Roadside Skipper Wild Indigo Duskywing	<b>MAMMALS</b> Southeastern Myotis Louisiana Black Bear Eastern Spotted Skunk  <b>REPTILES</b> Timber Rattlesnake

***Priority Species Research and Survey Needs:***

Neotropical Migrant Birds: Institute long-term surveys to monitor neotropical bird use of this habitat during migration.

Butterflies: Conduct surveys to determine the current distribution and abundance of all butterfly species, especially species of conservation concern, for inclusion in the LNHP database.

Determine the microhabitat preferences and requirements of species occurring in salt dome hardwood forests to understand how these species are utilizing the habitat to develop management recommendations.

***Species Conservation Strategies:***

1. Louisiana Black Bear: Partner with the BBCC, USFWS and continue to support the implementation of recovery efforts for this species.
2. Timber Rattlesnake: Naturally low-occurring population levels and persecution makes their persistence on isolated domes untenable. Prohibit killing or removal of timber rattlesnakes from salt domes.
3. Songbirds: Develop a monitoring program (i.e., MAPS) to assess relative abundances of songbird species in this habitat.
4. Promote the benefits of bat colonies and roost sites and develop partnerships with landowners to encourage protection of valuable sites.

***Threats Affecting Habitat:***

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat				
	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation	Toxins/ Contaminants
Commercial/industrial development		XXX			
Development/maintenance of pipelines, roads or utilities		XXX	XXX	XXX	
Invasive/alien species	XXX				
Mining practices		XXX			XXX

***Habitat Conservation Strategies:***

1. Partner with state and federal agencies, NGOs, private landowners, etc. to promote conservation and restoration of salt dome hardwood forests.
2. Provide educational information on this habitat type and its importance to species of conservation concern to landowners/land managers through technical pamphlets and the LDWF website.
3. Support NRCS and DNR efforts to stabilize shorelines and restore this habitat type.
4. Support surveys to estimate the presence of invasives plant and animal species in remaining habitat.
5. Develop strategies to address damage from feral hogs within this habitat type.

***References:***

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## 26. Salt Marsh

**Rarity Rank:** S1/G1

**Synonyms:** Smooth Cordgrass Marsh, Saltgrass Marsh, Saline Marsh

**Ecological Systems:**

CES203.468 Gulf Coast Chenier Plain Salt and Brackish Tidal Marsh

CES203.471 Mississippi Delta Salt and Brackish Tidal Marsh

**General Description:**

Typically, salt marsh is the marsh area closest to the beach rim of the Gulf of Mexico, and, in general, varies from 1-15 miles in width. These marshes are regularly tidally flooded, flat, polyhaline areas dominated by salt-tolerant grasses and very few other species. Small pools or ponds may be scattered. Salt marsh has the least plant diversity and the lowest soil organic matter content of any marsh type. The community is often totally dominated by *Spartina alterniflora* (smooth cordgrass).



Significant associate species includes *S. patens* (wiregrass), *Distichlis spicata* (salt grass), *Juncus roemarianus* (black rush), and *Batis maritima* (salt wort). Two other major groups of autotrophs found in Salt Marsh are microscopic algae on the surface of the vascular plants, and benthic algae (usually diatoms) living on or in the marsh sediment. Soil and water conditions regulate plant growth and salinity appears to be the primary factor determining species composition. The mean salinity of salt marsh is about 16 ppt. The area of salt marsh is increasing apparently due to salt-water intrusion resulting in shifts in marsh salinity levels. Salt marsh acts as nursery areas for myriads of larval forms of shrimp, crabs, redfish, seatrout, menhaden, etc., and greatly enhances the production of marine organisms directly related to the enormous primary productivity of the marsh vegetation. Factors which promote the growth of salt marsh plants include: 1) a long growing season, 2) abundant rainfall, 3) presence of soil nutrients, 4) low tide differential and tidally transported nutrients. Natural factors negatively impacting salt marsh include prolonged periods of inundation caused by winds, tides, or rain, especially those periods associated with hurricanes, subsidence, and erosion. Salt marsh also functions as a nitrogen and phosphorus sink (at least seasonally), thereby improving the quality of water that passes through it. In addition, it can alleviate the effects of storms and flooding by acting as a buffer and providing storage for large amounts of water.

**Current Extent and Status:**

Salt marsh is estimated to have occupied 500,000 to 1,000,000 acres in presettlement times, with an estimated 50 to 75 % remaining (Smith 1993). Salt marsh is most extensive on the deltaic plain of southeast Louisiana. The area of Salt Marsh is currently

increasing apparently due to salt-water intrusion resulting in shifts in marsh salinity levels (LNHP 1986-2004). However, coastal erosion is a threat as it results in conversion of marsh to open shallow water.



There are a number of conservation areas in the Louisiana marsh managed by state and federal agencies. The management of these sites is aimed at preserving and improving wintering waterfowl habitat. This involves the use of water control structures to regulate water and salinity input, water/sediment diversions to abate marsh deterioration, and prescribed burning to improve habitat and food quality for wildlife. These management activities are necessary since the leveeing and chanelization of waterways altered their hydrology and many canals have been cut in the marsh for navigation and oil and gas exploration which serve as avenues for salt water intrusion. The Chenier plain will continue to deteriorate due to lack of sediment deposition by long shore currents which occurred historically when the Mississippi River shifted further west.

Few conservation areas support extensive salt marsh. Wisner WMA consists of 21,000 acres and supports almost entirely salt marsh. Biloxi WMA (nearly 40,000 acres) features mostly brackish marsh but supports a sizeable area of salt marsh along Lake Borgne. Marsh Island Wildlife Refuge (70,000 acres), Rockefeller Wildlife Refuge (76,000 acres), and State Wildlife Refuge (13,000 acres) support salt marsh along the Gulf of Mexico. The acreages of salt marsh for these refuges is unknown but appears to account for a small portion of these sites.

<b>SALT MARSH SPECIES OF CONSERVATION CONCERN (26)</b>		
<b>BIRDS</b>	Gull-billed Tern	<b>BUTTERFLIES</b>
Reddish Egret	Caspian Tern	Neamathla Skipper
Yellow-crowned Night-Heron	Royal Tern	Dion Skipper
Northern Harrier	Sandwich Tern	Obscure Skipper
Black Rail	Common Tern	Great Southern White
Clapper Rail	Forster's Tern	Western Pygmy-Blue
Whooping Crane	Black Skimmer	
American Oystercatcher	Short-eared Owl	<b>REPTILES</b>
Marbled Godwit	Seaside Sparrow	Mississippi Diamondback Terrapin
Dunlin	Nelson's Sharp-tailed Sparrow	
Short-billed Dowitcher		

***Priority Species Research and Survey Needs:***

Seaside Sparrow and Nelson's Sharp-tailed Sparrow: Surveys are needed to determine their current abundance and distribution in relation to marsh changes. Large populations should be monitored on a scheduled basis to detect long-term population trends and to guide management decisions.

Black Rail: Determine current distribution and winter abundance in coastal areas.

Reddish Egret: Surveys are needed to assess limiting factors on reproductive success and the effects of human coastal recreational activities on bird populations.

Waterbirds: Continue to conduct rookery surveys to update database information.

Butterflies: Conduct surveys to determine current distribution and abundance of all butterfly species, especially species of conservation concern, for inclusion in the LNHP database.

Mississippi Diamondback Terrapin: Current population status in Louisiana is unknown. Drastic declines are apparent in other states, but the cause of these declines is unknown. Review Marine Fisheries seine records and conduct replicate surveys to evaluate population trends.

### ***Species Conservation Strategies:***

#### 1. Terns:

- Disturbance and loss of nesting habitat are major threats to terns. Develop partnerships to strengthen the protection and restoration of barrier islands.
- Develop a comprehensive survey methodology to determine long-term trends in population abundances.

#### 2. Shorebirds, Wading Birds:

- Provide public education regarding the importance of waterbird nesting colonies and shorebird feeding areas. Reduce the negative effects on these areas from recreation and other uses.
- Work with landowners to implement management and conservation recommendations for waterbirds (especially rails) of SWG project T18 upon completion.
- Coordinate with GCJV to implement recommendations of shorebird and wading bird conservation plans.
- Disturbance and loss of nesting habitat are major threats to these species. Continue to protect and restore coastal marshes. Develop new and/or improve existing partnerships to achieve this goal.

### ***Threats Affecting Habitat:***

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat			
	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation	Shoreline Erosion
Commercial/industrial development	XXX	XXX	XXX	
Construction of navigable waterways	XXX	XXX		XXX
Development/maintenance of pipelines, roads or utilities	XXX	XXX		
Invasive/alien species	XXX			
Levee or dike construction	XXX	XXX		XXX
Residential development	XXX	XXX		

***Habitat Conservation Strategies:***

1. Provide public education and support existing efforts/programs regarding invasive species; coordinate these efforts with LSU Ag Extension agents, NRCS, Sea Grant (rapid assessment projects – Calcasieu), etc.
2. Review oversight capabilities of DOTD, LDEQ, LDNR and other agencies to enforce construction specifications and recommendations of permits issued by these agencies.
3. Support NRCS and LDNR efforts for shoreline stabilization and habitat restoration.
4. Work with LCA, CWPPRA to support coastal restoration projects, specifically targeting important nesting areas and species of conservation concern.
5. Work with COE and state agencies to insure water control structures provide the maximum benefit to salt marsh.
6. Work with NRCS Plant Materials Center and BTNEP to develop viable cultivars for marsh restoration efforts.

***References:***

CHABRECK, R. H., AND G. LINScombe. 1988. Louisiana coastal marsh vegetative type maps. Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.

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## 27. Sandbars

**Rarity Rank:** S4S5/G4

**Synonyms:** River Sandbar

**Ecological Systems:** None

### **General Description:**

A sand/gravel deposit in or adjacent to permanently flowing freshwater contained within a natural channel. They are formed from coarse to fine-drained alluvial deposits. The community structure is dependent on the mix and stability of substrate, severity and depth of flooding, and permanent nature of the particular site. The hydrologic regime ranges from intermittently exposed to intermittently flooded. If present, vegetation is dominated by sparse to dense growth of shrubby or herbaceous plants. *Cephalanthus occidentalis* (buttonbush), and *Sambucus canadensis* (elderberry) are common shrubs, and *Salix nigra* (willow) and *Populus deltoides* (cottonwood) are common tree species (Jones 2004). Herbs include *Scirpus* spp. (bulrush), *Carex* spp. (sedges), and *Juncus* spp. (rushes) (LNHP 1986-2004). The community is successional in nature but generally remains unforested because of repeated flood disturbance. Also due to the early successional nature of sandbars they can be invaded by exotic plant species (NatureServe 2005). These areas are critical nesting areas for the federally-endangered interior least tern (*Sterna antillarum athalassos*).



These areas are critical nesting areas for the federally-endangered interior least tern (*Sterna antillarum athalassos*).



### **Current Extent and Status:**

Sandbar habitat within the Mississippi River has shown a general decline over the past 50 years. The U.S. Army Corps of Engineers reported a 33 % decrease in sandbar habitat in the lower Mississippi River between Memphis, Tennessee and Baton Rouge, Louisiana from 1948 to 1994 (U.S. Fish and Wildlife Service 2005). Major threats exist from channelization, water diversions, frequent and prolonged fluctuations in river water levels, changes in



vegetation, and disturbance from recreational use. More research on these areas, particularly in relation to nesting tern colonies, is warranted.

<b>SANDBARS SPECIES OF CONSERVATION CONCERN (14)</b>		
<b>BIRDS</b>	Common Tern	Ringed Map Turtle
Piping Plover	Forster's Tern	Ouachita Map Turtle
American Oystercatcher	Interior Least Tern	Sabine Map Turtle
Dunlin		Pascagoula Map Turtle
Gull-billed Tern	<b>REPTILES</b>	Stripe-necked Musk Turtle
Caspian Tern	Alligator Snapping Turtle	

***Priority Species Research and Survey Needs:***

Terns: Continue to support nesting surveys and initiate research that focuses on factors (such as predation, human disturbance, etc.) effecting overall population densities.

***Species Conservation Strategies:***

- Interior Least Tern:
  - Implement conservation recommendations of USFWS recovery plan (USFWS 1990b).
  - Work with COE to regulate water levels during breeding season.
  - Determine feasibility of using abandoned barges as artificial nesting habitat (Hervey 2001).
  - Provide funding to support long term efforts to locate and monitor nest colonies.
- Map Turtles: Sandbars and beaches provide primary nesting sites, and submerged portions are used for foraging. Eliminate off-road vehicles from sandbars and beaches during nesting periods.

***Threats Affecting Habitat:***

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

<b>Source of Threat</b>	<b>Threat</b>	
	Habitat Disturbance	Modification of Water Levels; Changes in Natural Flow Patterns
Channelization of rivers or streams		XXX
Levee or dike construction		XXX
Operation of drainage or diversion systems		XXX
Recreational use/vehicles	XXX	
Shoreline stabilization		XXX

***Habitat Conservation Strategies:***

1. Determine ownership/management authority for sandbars in the Red and Mississippi rivers.
2. Support vegetation control for sandbars and research on this habitat.
3. Work with COE to develop Memorandum Of Understanding (MOU) regarding sandbar management.
4. Work with the appropriate agencies to develop limits on recreational vehicle use of this habitat.

***References:***

HERVEY, H. 2001. Nesting success of least terns on the Red River of Louisiana. *The Journal of Louisiana Ornithology* 5(1):1-21.

JONES, K. H. 2004. Population survey of the interior least tern on the Mississippi River from Cape Girardeau, Missouri to Baton Rouge, Louisiana. Report to U.S. Army Corps of Engineers, Memphis District.

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## 28. Sandstone Glade/Barren

**Rarity Rank:** S1S2/G1G2

**Synonyms:** Catahoula Barren, Sandstone Outcrop

**Ecological Systems:** CES203.364 West Gulf Coastal Plain Catahoula Barrens

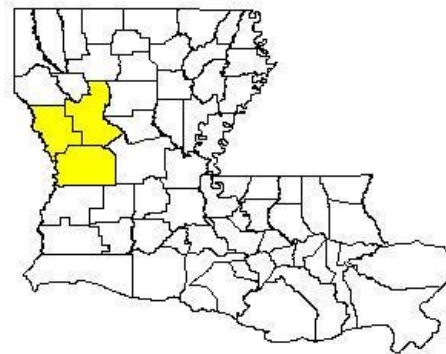
### **General Description:**

This natural community develops on outcropping sandstone in pine forests, chiefly in a belt running from northeast to southwest across central Louisiana, and is primarily associated with the Catahoula formation. The community appears as a complex of sandstone boulders, intermixed with shrubs and trees occurring as individuals or in patches. Associated soils are characteristically acidic and are highly erodible, often eroding to form an irregular, sandstone-studded landscape of gullies, bluffs, and miniature gorges and buttes. Much of the soil and rock is unvegetated. Tree species present may include *Pinus palustris* (longleaf pine), *P. echinata* (shortleaf pine), *P. taeda* (loblolly pine), *Quercus stellata* (post oak), *Q. incana* (bluejack oak), *Q. marilandica* (blackjack oak), and *Liquidambar styraciflua* (sweetgum). Shrubs may include *Ilex vomitoria* (yaupon), *Vaccinium arboreum* (winter huckleberry), *V. elliotii* (Elliott's blueberry), *Bumelia lanuginosa* (chittum-wood), and *Crataegus* spp. (hawthorns). Common herbaceous species are *Bigelovia virgata* (rayless goldenrod, often the dominant herb), *Andropogon* spp. (broomsedges), *Eragrostis* spp. (love grasses), *Liatris* spp. (blazing-stars), and *Aster* spp. (asters). *Talinum parviflorum* (small-flowered flame-flower) may rarely be present. Saxicolous mosses and lichens abound.



### **Current Extent and Status:**

Sandstone glades are thought to have occupied less than 2,000 acres in presettlement times with an estimated 50 to 75% remaining today (Smith 1993). Most known occurrences are on the Kisatchie District of KNF in southern Natchitoches Parish. There are a handful of known glades on private land in varying condition. There are probably more examples of this habitat both on KNF and on private lands.





SANDSTONE GLADE BARREN SPECIES OF CONSERVATION CONCERN (6)		
<b>AMPHIBIANS</b> Southern Red-backed Salamander	<b>BIRDS</b> Chuck-Will's-Widow Loggerhead Shrike Field Sparrow	<b>BUTTERFLIES</b> Cobweb Skipper  <b>REPTILES</b> Western Slender Glass Lizard

***Priority Species Research and Survey Needs:***

Chuck-Will's-Widow: Research is needed to better understand this species' population dynamics. Studies should focus on distribution patterns, habitat availability and use, nesting success, and territory size requirements. Implementation of night-time surveys along with sighting reports by foresters, birders, etc. are needed to augment sparse BBS records.

Loggerhead Shrike: BBS data for the period 1966-2000 indicate a 71% population decline rangewide. Monitoring of reproductive success and the effects of pesticides on food availability are needed along with a statewide evaluation of changes in available habitat.

Cobweb Skipper: Conduct surveys to determine current distribution and abundance for inclusion in the LNHP database.

Western Slender Glass Lizard: Occurrence in Sandstone Glades likely but imperfectly known. Glass lizards are declining over much of their range, regardless of habitat alteration. Determine the extent of any correlations between glass lizard occurrence and Sandstone Glades.

***Species Conservation Strategies:***

1. Chuck-Will's-Widow: Work with federal agencies and bird conservation organizations to produce technical pamphlets highlighting the habitat and management requirements of this species and make available to landowners.

***Threats Affecting Habitat:***

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat	
	Altered Composition/ Structure	Habitat Disturbance
Fire suppression	XXX	
Incompatible forestry practices	XXX	XXX
Recreational use/vehicles	XXX	XXX

***Habitat Conservation Strategies:***

1. Conduct surveys to determine the current extent and condition of this habitat type.
2. Develop educational materials about the importance and rarity of this habitat for the general public.
3. Encourage the use of prescribed fire as a management tool.
4. Provide educational information on this habitat type and its importance to species of conservation concern to landowners/land managers through technical pamphlets and the LDWF website.
5. Support research on the community classification of sandstone glades.

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## 29. Shortleaf Pine/Oak-Hickory Forest

**Rarity Rank:** S2S3/G2G3

**Synonyms:** Shortleaf Pine-Oak, Oak-Hickory Forest

**Ecological Systems:**

CES203.378 West Gulf Coastal Plain Pine-Hardwood Forest

CES203.506 East Gulf Coastal Plain Interior Shortleaf Pine-Oak Forest

**General Description:**

The Shortleaf Pine/Oak-Hickory Forest community (SLPOH) occurs on dry hills, principally in central and northern Louisiana, although it may occur sporadically in the Florida Parishes. In the Upper West Gulf Coastal Plain, this was the most prevalent community on the landscape (i.e., it was the matrix community).



Principle overstory species include *Pinus echinata* (shortleaf pine), *Pinus taeda* (loblolly pine), *Quercus falcata* (southern red oak), *Q. stellata* (post oak), *Q. marilandica* (blackjack oak), *Q. velutina* (black oak), *Q. alba* (white oak), *Q. pagoda* (cherrybark oak), *Q. shumardii* (shumard oak), *Carya tomentosa* (mockernut hickory), *C. texana* (black hickory), *C. cordiformis* (bitternut hickory), *Ulmus alata* (winged elm), *Fraxinus americana* (white ash), *Nyssa sylvatica* (black gum), *Liquidambar styraciflua* (sweetgum), and *Acer rubrum* (red maple). Midstory and understory shrubs may include *Vaccinium arboreum* (winter huckleberry), *Vaccinium virgatum* (bunch blueberry), *Bumelia lanuginosa* (chittum-wood), *Callicarpa americana* (french mulberry), *Viburnum rufidulum* (rusty blackhaw), *Ilex decidua* (deciduous holly), *Crataegus* spp. (hawthorns), and *Prunus mexicana* (Mexican plum). Herbaceous flora is usually sparse but may consist of *Eurybia* spp. and *Symphyotrichum* spp. (asters), *Solidago* spp. (goldenrods), *Silphium* spp. (rosin-weeds), *Antennaria plantaginifolia* (plantain-leaf pussy-toes), *Desmodium* spp. (beggar-ticks), *Trillium* spp. (wake-robbers), *Chasmanthium* spp. (spangle-grasses), *Viola* spp. (violets), *Mitchella repens* (partridge-berry), *Helianthus* spp. (sunflowers), *Liatris* spp. (blazing-stars), and *Panicum* spp. (panic grasses).

Fire is an important process in this community. Historical fire frequency is thought to have been 5 to 15 years (Martin and Smith 1993). Oak-hickory forest is the theoretical climax forest stage beyond shortleaf pine/oak-hickory forest in central and north Louisiana. However, no occurrences of oak-hickory forest lacking shortleaf pine have been observed, probably because disturbance has been frequent enough to allow perpetuation of shortleaf pine in the community. It is thought species composition would be essentially similar to that of shortleaf pine/oak-hickory forests. At times, this community may take on the aspect of what has been termed loblolly-shortleaf pine forest.

**Current Extent and Status:**

There was an estimated 4,000,000 to 6,000,000 acres of SLPOH in Louisiana and of this original extent 5 to 10 percent is thought to remain today (Smith 1993). Most of this acreage by far was in northwestern Louisiana in the UWGCP.



Currently there are 4 known high-quality occurrences of SLPOH in the UWGCP in the LNHP database. These sites total approximately 160 acres. There are 2 known additional sites, one in Caddo Parish on Eddie Jones Parish Park that have not been surveyed thoroughly and another in Claiborne Parish on Summerfield Springs Preserve owned by TNC. Eddie Jones Park occurrence is at least 100 acres (L. Raymond, personal communication) and the TNC preserve is a little less than 100 acres. Much of this community has been lost or degraded due to conversion of forest types and fire suppression (NatureServe 2005).

There are about 15 known occurrences in the WGCP and a handful in the Florida Parishes on the EGCP. Several of these are on conservation areas such as KNF.

SHORTLEAF PINE – OAK – HICKORY FOREST SPECIES OF CONSERVATION CONCERN (41)		
<b>AMPHIBIANS</b>	Swainson's Warbler	<b>MAMMALS</b>
Louisiana Slimy Salamander	Kentucky Warbler	Southeastern Shrew
Southern Crawfish Frog	Hooded Warbler	Southeastern Myotis
<b>BIRDS</b>	Painted Bunting	Silver-haired Bat
Bald Eagle	Bachman's Sparrow	Big Brown Bat
American Woodcock	Field Sparrow	Louisiana Black Bear
Yellow-billed Cuckoo	Rusty Blackbird	Ringtail
Chuck-Will's-Widow	Orchard Oriole	Long-tailed Weasel
Red-cockaded Woodpecker	<b>BUTTERFLIES</b>	Eastern Spotted Skunk
Brown-headed Nuthatch	Wild Indigo Duskywing	<b>REPTILES</b>
Wood Thrush	Dusted Skipper	Western Slender Glass Lizard
Bell's Vireo	Pepper and Salt Skipper	Southern Prairie Skink
Yellow-throated Vireo	Yucca Giant Skipper	Southeastern Scarlet Snake
Northern Parula	Falcate Orangetip	Timber Rattlesnake
Prairie Warbler	Harvester	
Worm-eating Warbler	Little Metalmark	

**Priority Species Research and Survey Needs:**

Bachman's Sparrow: Intensive surveys are needed to produce estimates of current population size statewide. Develop projects which determine the relationship between population size and vegetation succession on quality sites. Determine whether management activities can create a mosaic of adjacent sites that together provide continuously occupied habitat. Determine dispersal behavior to maximize the benefits/effects of future habitat management.

Chuck-Will's-Widow: Research is needed to better understand the population dynamics of this species. Studies should focus on distribution patterns, habitat availability and use, nesting success, and territory size requirements. Implementation of night-time surveys along with sighting reports by foresters, birders, etc. are needed to augment spars BBS records.

Brown-headed Nuthatch: Investigate the impacts of silviculture/land management practices and their effects on species declines.

Rusty Blackbird: Initiate surveys to determine wintering population abundances and habitat use to augment Christmas Bird Counts.

Songbirds: Continued research on silviculture/land management practices and their effects on all songbird species.

Butterflies: Conduct surveys to determine current distribution and abundance of all butterfly species, especially species of conservation concern, for inclusion in the LNHP database.

Ringtail: Louisiana represents the eastern edge of its range, intensive surveys are needed to determine its current status in Louisiana.

Eastern Spotted Skunk: Considered critically imperiled in Louisiana, intensive surveys are needed to update occurrence records and abundance for inclusion in LNHP database.

Southeastern Shrew: Considered imperiled in Louisiana. Together with Arkansas and Missouri, Louisiana represents the western edge of its range. Intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

Bats: Develop projects that target species of conservation concern. Conduct research which focuses on their distribution, abundance, and ecological needs in this habitat type (Lacki and Schwierjohann 2001).

Establish monitoring systems and protocols for all bat and mammal species of conservation concern associated with shortleaf pine-oak-hickory forest.

Determine the microhabitat preferences and requirements of species occurring in shortleaf pine-oak-hickory forest to understand how these species are utilizing this habitat in order to develop management guidelines for these species.

### ***Species Conservation Strategies:***

1. Louisiana Slimy Salamander: Requires intact, relatively old-growth forest. Encourage timber companies to designate no-cut zones, especially on slopes and riparian borders.

2. Bachman's Sparrow:
  - Implement recommendations of SWG project T22 upon completion.
  - Monitor reproductive success of Bachman's sparrows to determine limiting factors.
  - Work with landowners to encourage the use of BMPs for prescribed fire management and timber harvesting techniques to improve habitat quality.
3. Chuck-Will's-Widow: Work with federal agencies and bird conservation organizations to produce technical pamphlets highlighting the habitat and management requirements of this species and make them available to landowners.
4. Brown-headed Nuthatch: Encourage landowners to use group-selection and single-tree selection harvesting methods and maintain or increase the number of standing snags.
5. Louisiana Black Bear: Partner with the BBCC, USFWS and continue to support the implementation of recovery efforts for this species.
6. Work with landowners to initiate or continue the implementation of PIF bird conservation plans, conservation plans developed for amphibians and reptiles, and USFWS threatened and endangered species recovery plans over the next 10 years.
7. Encourage snag retention during logging operations to increase the numbers available for cavity-nesting species. Efforts need to be made to maintain sufficient levels of woody debris in stands for reptiles, amphibians and small mammals.

***Threats Affecting Habitat:***

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat			
	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation
Conversion to agriculture or other forest types		XXX		XXX
Development/maintenance of pipelines, roads or utilities		XXX	XXX	XXX
Fire suppression	XXX			
Incompatible forestry practices	XXX		XXX	
Invasive/alien species	XXX		XXX	
Mining practices		XXX		XXX
Recreational use/vehicles			XXX	
Residential development		XXX	XXX	XXX

***Habitat Conservation Strategies:***

1. Conduct surveys to determine the current extent and condition of this habitat type.
2. Develop best management practices for restoration of this habitat type including appropriate fire regimes and herbicide uses.
3. Work with USFS, Department of Defense (DOD), and Office of State Lands to encourage the conservation and restoration of this habitat where it exists on public lands.
4. Encourage LDAF and other growers to produce shortleaf pine seedlings for distribution to landowners interested in restoring this habitat type.
5. Develop partnerships with federal and state agencies, NGO's and others to identify potential parcels of this habitat type for acquisition and conservation.
6. Work with the legislature to provide incentives (tax breaks, etc.) to landowners to retain the natural state of areas where this habitat occurs.
7. Provide education/outreach to illustrate the value of this habitat to wildlife and to promote conservation and preservation of this habitat type.

***References:***

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- LACKI, M. J., AND J. H. SCHWIERJOHANN. 2001. Day-roost characteristics of northern bats in mixed mesophytic forest. *Journal of Wildlife Management* 65(3):482-488.
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### 30. Slash Pine-Pondcypress/Hardwood Forest

**Rarity Rank:** S2S3/G3?

**Synonyms:** Slash Pine-Hardwood

**Ecological Systems:** CES203.375 East Gulf Coastal Plain Near-Coast Pine Flatwoods

**General Description:**

This natural wetland forest type is restricted to the wet acidic flatwoods on the far eastern Pleistocene prairie terraces of Louisiana's EGCP. It is found in a mosaic with longleaf pine flatwoods and savannahs, and bayhead swamps, existing in a hydrologic/topographic transitional zone between the higher, "drier" longleaf pine flatwood savannahs to the lower, wetter bayhead swamps. It may also be present on broad flats that were historically partially protected from frequent surface fires by surrounding bayheads or seeps. Soils of the slash pine/pondcypress forests are hydric, strongly acidic and nutrient poor silt loams and fine sandy loams. Two principal soils are Myatt fine sandy loam and Guyton silt loam. Surface soils are typically saturated for much of the year and shallow water may be present in the late fall/winter/early spring and after rains during the growing season.



The community seems to vary considerably in structure and somewhat in composition from one place to another, apparently as a consequence of minor variations in topography, soil conditions, and hydrologic and fire regimes (LNHP 1986-2004, Teague et al. 1995). The typically closed canopy is dominated by *Pinus elliottii* (slash pine) and *Taxodium ascendens* (pondcypress), with *Nyssa biflora* (swamp black gum) and *Magnolia virginiana* (sweetbay) as primary associates. The understory is often dense, with *Cyrilla racemiflora* (swamp cyrilla), *Ilex coriacea* (sweet gallberry), *Lyonia lucida* (fetterbush), *I. glabra* (littleleaf gallberry), *Itea virginica* (Virginia willow), *Morella heterophylla* (bigleaf waxmyrtle), and *M. cerifera* (waxmyrtle) characteristic species. *Sphagnum* spp. (sphagnum moss), *Pteridophytes* (ferns), and *Smilax* spp. (greenbriers) are common. There is minimal herbaceous undergrowth, but *Arundinaria gigantea* (switch cane) can form dense thickets, and usually there are many acid loving wetland shrubs. Scattered, depauperate specimens of herbs, more typical of sunny wet pine savannahs (e.g., *Sarracenia alata*, yellow pitcher-plant), may be observed. Pondcypress may dominate minor depressions (LNHP 1986-2004, Penfound and Watkins 1937).

Slash pine-pondcypress/hardwood forest evolved with recurrent lightning-season ground fires and regular light surface fire appears critical in maintaining this community. Both slash pine and pondcypress are fire-adapted species and can survive fires once they attain a certain size; however, neither is as fire resistant as longleaf pine. The natural fire

return interval of this community is difficult to estimate but is tentatively believed to have varied on the average between 5 and 20 years, a frequency that would periodically allow for the regeneration of slash pine and pondcypress, and associated hardwoods during the longer fire return intervals. Such a frequency would as well preclude complete dominance of the site by hardwoods (Smith 1996).

***Current Extent and Status:***

In the EGCP of Louisiana, the slash pine-pondcypress/hardwood community is primarily associated with pine flatwoods including eastern longleaf pine savannah and occasional bogs. Presettlement extent of this habitat is estimated at 50,000 to 100,000 acres, with only 10 to 25% currently remaining (Smith 1993, Smith 1999). The Nature Conservancy’s Abita Creek and Talisheek Preserves in St. Tammany Parish contain the only protected examples of this community type. These preserves encompass approximately 3,768 total acres which also include longleaf pine savannahs and flatwoods, seepage bogs, bayhead swamps and riparian forests. There are some examples of the slash pine-pondcypress/hardwood community on commercial timberlands and sites owned by commercial developers, however the extent of these acres is unknown.



SLASH PINE – PONDCYPRESS – HARDWOOD FOREST SPECIES OF CONSERVATION CONCERN (22)		
<b>AMPHIBIANS</b>	<b>BIRDS</b>	
Southern Dusky Salamander	Yellow-crowned Night-Heron	Hooded Warbler
Gulf Coast Mud Salamander	Swallow-tailed Kite	Orchard Oriole
Oak Toad	American Woodcock	<b>MAMMALS</b>
Barking Treefrog	Yellow-billed Cuckoo	Southeastern Shrew
Ornate Chorus Frog	Wood Thrush	Southeastern Myotis
Eastern Spadefoot	Yellow-throated Vireo	Long-tailed Weasel
Dusky Gopher Frog	Northern Parula	<b>REPTILES</b>
	Prothonotary Warbler	Pine Woods Littersnake
	Kentucky Warbler	

***Priority Species Research and Survey Needs:***

Southern Dusky Salamander, Gulf Coast Mud Salamander: Both species are exhibiting drastic declines in relatively pristine areas throughout their range. However, the status of neither species is being addressed by the Federal government. Initiate status surveys at reference sites to determine the extent of declines in protected sites (e.g., Talisheek Bay).

Swallow-tailed Kite: Continued to inventory and monitor Swallow-tailed Kites on public and private lands to fill data gaps in their distribution and abundance for inclusion in the LNHP database and Audubon nationwide database.

Yellow-billed Cuckoo: Continue to monitor populations throughout the state to establish abundance patterns.

Songbirds:

- Continue to support research on silviculture/land management practices and their effects on all songbird species.
- Develop longterm monitoring projects that focus on abundances and reproductive success (with emphasis on species of conservation concern) in this habitat type through the establishment of MAPS stations and BBS routes.

Southeastern Shrew: Considered imperiled in Louisiana. Together with Arkansas and Missouri, Louisiana represents the western edge of its range. Intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

*Species Conservation Strategies:*

1. Swallow-tailed Kite: Implement conservation and management recommendations of SWG project T9 (Coulson 2004).
2. Work with landowners to initiate or continue the implementation of PIF bird conservation plans, conservation plans developed for amphibians and reptiles, and USFWS threatened and endangered species recovery plans over the next 10 years.
3. Establish monitoring systems and protocols which focus on small mammal population abundances and trends.

**Threats Affecting Habitat:**

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat				
	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation	Modification of Water Levels; Changes in Natural Flow Patterns
Channelization of rivers or streams					XXX
Commercial/industrial development		XXX			
Construction of ditches, drainage or diversion systems	XXX		XXX		XXX
Conversion to agriculture or other forest types		XXX		XXX	
Development/maintenance of pipelines, roads or utilities		XXX	XXX	XXX	
Fire suppression	XXX				
Incompatible forestry practices	XXX		XXX		XXX
Invasive/alien species	XXX				
Residential development		XXX	XXX	XXX	

**Habitat Conservation Strategies:**

1. Conduct surveys to determine the extent and condition of this habitat type with a focus on identifying the surrounding landscape context (i.e., residential developments, etc.) that might be affected by prescribed burning.
2. Work with appropriate planning commissions to provide them with LNHP data that illustrates locations of this habitat type.
3. Develop BMPs for ephemeral ponds.
4. Develop educational information regarding the importance of ephemeral ponds for species of concern and make this information available to landowners/land managers through technical pamphlets and the LDWF website.
5. Educate landowners, adjacent residents, developers, and the general public about the crucial role of prescribed burning in the management of slash pine/hardwood systems (multi-agency, multi-group effort).
6. Continue to encourage landowners to implement BMPs and adopt SFI standards in the management of this habitat type.
7. Provide additional cost share funds for landowners to drastically reduce or eliminate costs associated with conducting prescribed burns their property.
8. Promote utilization of federal cost share programs (NRCS) to address invasive species problems.

9. Work with the legislature to provide incentives (tax breaks, etc.) to landowners to retain the natural state of areas where this habitat occurs.

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## 31. Small Stream Forest

**Rarity Rank:** S3/G3

**Synonyms:** Riparian Forest, Small Stream Floodplain Forest, Creek Bottom Forest, Sandy Branch Bottom, Upland Stream Forest, Hammock

**Ecological Systems:**

CES203.559 East Gulf Coastal Plain Small Stream and River Forest

CES203.487 West Gulf Coastal Plain Small Stream and River Forest

**General Description:**

Small stream forests are relatively narrow wetland forests occurring along small rivers and large creeks in central, western, southeastern, and northern Louisiana. They are seasonally flooded for brief periods. The percentage of sand, silt, calcareous clay, acidic clay, and organic material in the soil is highly variable (depending on local geology) and has a significant effect on species composition. Soils are typically classified as silt-loams. At times, the community is



quite similar in species composition to hardwood slope forests (beech-magnolia forests). These forested wetlands are critical components of the landscape filtering surface and subsurface flows, improving water quality, and storing sediment and nutrients (Rummer 2004). Common trees include *Magnolia grandiflora* (southern magnolia), *Fagus grandifolia* (beech), *Nyssa sylvatica* (blackgum), *Quercus michauxii* (swamp white oak), *Q. alba* (white oak), *Q. nigra* (water oak), *Q. laurifolia* (laurel oak), *Q. pagoda* (cherrybark oak), *Liquidambar styraciflua* (sweetgum), *Platanus occidentalis* (sycamore), *Acer rubrum* (red maple), *Betula nigra* (river birch), *Carya ovata* (shagbark hickory), *Carya cordiformis* (bitternut hickory), *Fraxinus americana* (white ash), *F. caroliniana* (water ash), *Prunus caroliniana* (cherry laurel), *Ulmus alata* (winged elm), and *Liriodendron tulipifera* (yellow poplar, southeastern and central Louisiana). *Pinus glabra* (spruce pine) is a common associate in the Florida Parishes, and *Taxodium distichum* (baldcypress) and *Pinus taeda* (loblolly pine) are occasional associates statewide. *Magnolia virginiana* (sweet bay) and *M. macrophylla* (bigleaf magnolia) may be present. Primary midstory and understory associates include *Halesia diptera* (silverbell), *Carpinus caroliniana* (ironwood), *Viburnum dentatum* (arrow-wood), *Itea virginica* (Virginia willow), *Symplocos tinctoria* (sweetleaf), *Alnus serrulata* (hazel alder), *Rhododendron canescens* (wild azalea) and *Styrax grandifolia* (bigleaf snowbell). *Illicium floridanum* (starbush) and *Sebastiania fruticosa* (sebastian bush) are common in the Florida Parishes, the former at times being the dominant understory shrub. *Cyrilla racemiflora* (swamp cyrilla), *Lyonia lucida* (fetterbush), *Leucothoe axillaris* (leucothoe), *L. racemosa* (leucothoe), and *Ilex verticillata* (winterberry) are common understory affiliates in the



eastern Florida Parishes. *Isoetes louisianensis* (Louisiana quillwort), an aquatic fern that is federally-listed as endangered, occurs in and along streams clothed by small stream forests in the eastern Florida Parishes. Communities possessing physical characteristics and species complement of both riparian forest and bayhead swamp occur in central and northern Louisiana.

**Current Extent and Status:**

Riparian forests are extremely susceptible to damage, and only an estimated 25 to 50% of Louisiana’s original small stream forests remain intact (Smith 1993). Initial habitat loss, degradation and fragmentation of these forested wetlands was due primarily to agricultural conversion and timber harvesting. With the implementation of BMPs for forestry and agricultural uses, current source for stream habitat destruction has shifted primarily to urbanization, although silvicultural and agricultural activities are still contributing some threat (Rummer 2004). The Louisiana Natural and Scenic River System (LNSRS) program currently monitors and protects 70 streams or stream segments in the state with over 3,300 miles of streams in the system. The LNSRS has been effective in protecting some of the state’s riparian forests, however this is only a very small portion of the total stream miles in the state (about 19%). Streams or portions of streams on both federal and state public lands such as KNF and various state parks and WMAs are also afforded some protection. The Natural Areas Registry Program has 12 properties containing small stream forests with a total of 792 acres.



SMALL STREAM FOREST SPECIES OF CONSERVATION CONCERN (36)		
<p><b>AMPHIBIANS</b></p> <ul style="list-style-type: none"> <li>Southern Dusky Salamander</li> <li>Four-toed Salamander</li> <li>Webster’s Salamander</li> <li>Louisiana Slimy Salamander</li> <li>Southern Red-backed Salamander</li> </ul> <p><b>BIRDS</b></p> <ul style="list-style-type: none"> <li>American Woodcock</li> <li>Yellow-billed Cuckoo</li> <li>Chuck-Will’s-Widow</li> <li>Wood Thrush</li> <li>Bell’s Vireo</li> <li>Yellow-throated Vireo</li> <li>Northern Parula</li> </ul>	<ul style="list-style-type: none"> <li>Prothonotary Warbler</li> <li>Worm-eating Warbler</li> <li>Swainson’s Warbler</li> <li>Louisiana Waterthrush</li> <li>Kentucky Warbler</li> <li>Hooded Warbler</li> <li>Rusty Blackbird</li> <li>Orchard Oriole</li> </ul> <p><b>BUTTERFLIES</b></p> <ul style="list-style-type: none"> <li>Pepper and Salt Skipper</li> <li>Falcate Orangetip</li> <li>Harvester</li> <li>‘Seminole’ Texan Crescent</li> <li>Creole Pearly Eye</li> <li>Appalachian Brown</li> </ul>	<p><b>MAMMALS</b></p> <ul style="list-style-type: none"> <li>Southeastern Shrew</li> <li>Southeastern Myotis</li> <li>Northern Myotis</li> <li>Silver-haired Bat</li> <li>Big Brown Bat</li> <li>Ringtail</li> <li>Long-tailed Weasel</li> <li>Eastern Spotted Skunk</li> </ul> <p><b>REPTILES</b></p> <ul style="list-style-type: none"> <li>Common Rainbow Snake</li> <li>Timber Rattlesnake</li> </ul>

**Priority Species Research and Survey Needs:**

Bell’s Vireo: Initiate surveys to determine their population abundance and distribution in the northern portion of state and develop species management recommendations.

Songbirds: Continue research on the effects of silviculture/land management practices on all songbird species.

Butterflies: Conduct surveys to determine current distribution and abundance of all butterfly species, especially species of conservation concern, for inclusion in the LNHP database.

Bats:

- Northern Myotis: This species was first documented in Louisiana in 2003 (Crnkovic 2003). Conduct intensive surveys to determine its current status in Louisiana and to evaluate the importance of bridges as roost sites (Leberg 2004).
- Develop projects that target species of conservation concern and focus on their distribution, abundance, and ecological needs in this habitat type (Lacki and Schwierjohann 2001).
- Research the genetic identities of different Myotis species in the state (Leberg 2004).

Ringtail: Louisiana represents the eastern edge of its range. Intensive surveys are needed to determine its current status in Louisiana.

Eastern Spotted Skunk: Considered critically imperiled in Louisiana. Intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

Long-tailed Weasel: Considered vulnerable in Louisiana. Intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

Conduct habitat use and life history studies for mammal species of conservation concern that may potentially use this habitat.

Document the habitat relationships of species of conservation concern to understand how dependent they are upon small stream forest habitats, relative to other habitat types.

***Species Conservation Strategies:***

1. Louisiana Slimy Salamander: Requires intact, relatively old-growth forest. Encourage timber companies to designate no-cut zones in riparian bottoms.
2. Timber Rattlesnake: Naturally low-occurring population levels and persecution make persistence in isolated forest blocks untenable. Prohibit killing of timber rattlesnakes and retain the connectivity of required habitats.
3. Work with landowners to initiate or continue the implementation of PIF bird conservation plans, conservation plans developed for amphibians and reptiles, and USFWS threatened and endangered species recovery plans over the next 10 years.
4. When appropriate, support recommendations by the EMRRP (Martin 2002).



**Threats Affecting Habitat:**

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat							
	Altered Composition/ Structure	Altered Water Quality	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation	Modification of Water Levels; Changes in Natural Flow Patterns	Sedimentation	Toxins/ Contaminants
Channelization of rivers or streams	XXX		XXX	XXX		XXX	XXX	
Commercial/industrial development			XXX	XXX	XXX		XXX	
Construction of ditches, drainage or diversion systems						XXX	XXX	
Conversion to agriculture or other forest types			XXX		XXX	XXX		
Dam construction	XXX		XXX		XXX	XXX	XXX	
Development/maintenance of pipelines, roads or utilities			XXX	XXX	XXX		XXX	XXX
Gravel mining		XXX	XXX				XXX	XXX
Incompatible forestry practices	XXX	XXX		XXX	XXX	XXX	XXX	XXX
Invasive/alien species	XXX			XXX			XXX	
Livestock production practices	XXX	XXX						
Mining practices			XXX				XXX	
Oil or gas drilling			XXX		XXX			
Parasites/pathogens	XXX							
Recreational use/vehicles				XXX				
Residential development			XXX	XXX	XXX		XXX	

**Habitat Conservation Strategies:**

1. Conduct a comprehensive state inventory on the status and condition of Louisiana’s streams, including ownership patterns, landscape context and uses.
2. Work with TNC and other partners to develop guidelines and funding mechanisms for restoration of abandoned gravel mines.
3. Form a committee composed of gravel mining interests, LDEQ, LDNR, TNC, and other interested groups to develop BMPs for current and proposed gravel mines to prevent or reduce the impacts to streams and the surrounding forest habitat.
4. Develop educational information that focuses on the importance of streamside zones as wildlife corridors and distribute them to landowners/land managers through technical pamphlets and the LDWF website.

5. Work with LFA to produce a publication for landowners which discusses BMPs for SMZs and methods for effective landowner/logger communication.
6. Where livestock production is an issue, encourage the use of Environmental Quality Incentives Program (EQIP) and other incentive programs to aid farmers in fencing off riparian zones and providing alternative water sources for livestock.

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## 32. Southern Mesophytic Forest

**Rarity Rank:** S2S3/G1G2

**Synonyms:** Relict Northern Hardwood Forest, Bluffland Forest, Beech-Magnolia Forest, Upland Hardwood Forest, Mixed Mesophytic Forest

**Ecological Systems:**

CES203.556 East Gulf Coastal Plain Southern Loess Bluff Forest

CES203.476 East Gulf Coastal Plain Southern Mesic Slope Forest

**General Description:**

This community is currently recognized in Louisiana only in the northwestern Florida Parishes, primarily in the region known as the Tunica Hills. It develops on deep, fertile, circum-neutral to slightly alkaline loessial deposits that have eroded over thousands of years to form a characteristic highly-dissected landscape of high, narrow ridges, steep slopes, and deep ravines (usually with intermittent to permanent streams). These topographic characteristics create a relatively cool, moist micro-climate on the slopes and in the ravines. Thus, these dissected hills have sustained localized populations of some characteristic Appalachian species, principally herbaceous, thought to have originally migrated south ahead of advancing glaciers in the past ice-age.



Overstory species include *Fagus grandifolia* (beech), *Quercus shumardii* (shumard oak), *Q. alba* (white oak), *Q. muhlenbergii* (chinkapin oak), *Q. michauxii* (cow oak), *Q. nigra* (water oak), *Liriodendron tulipifera* (yellow poplar), *Magnolia grandiflora* (southern magnolia), *M. acuminata* (cucumber magnolia), *M. pyramidata* (pyramid magnolia), *Ulmus americana* (American elm), *U. rubra* (slippery elm), *Tillia caroliniana* (Carolina basswood), *Morus rubra* (red mulberry), *Acer floridanum* (Florida sugar maple), *Carya glabra* (pignut hickory), *C. cordiformis* (bitternut hickory), *Fraxinus americana* (white ash), *Celtis laevigata* (hackberry), and *Platanus occidentalis* (sycamore). *Ilex opaca* (American holly) is rarely encountered as a tree, almost always as a shrub. No pine species are thought to be native to this habitat. Shrub species include *Lindera benzoin* (spice bush), *Hydrangea quercifolia* (oak-leaf hydrangea), *H. arborescens* (mountain hydrangea), *Asimina triloba* (paw-paw), *Euonymus americanum* (stawberry bush), *Halesia diptera* (silverbell), *Cercis canadensis* (red bud), *Sambucus canadensis* (elderberry), and *Ostrya virginiana* (hop-hornbeam). Thick stands of *Arundinaria gigantea* (giant cane) may be present, especially in ravine bottoms. Vines may include *Schisandra glabra* (smooth woodbine), *Vitis* spp. (grapes), *Bignonia capreolata* (cross-vine), *Trachelospermum difforme* (climbing dogbane), *Parthenocissus*

*quinquefolia* (Virginia creeper), and rarely *Celastrus scandens* (climbing bittersweet). The exotic vine *Lonicera japonica* (Japanese honeysuckle) has become a serious pest in many places.

The herbaceous flora is particularly rich in ferns, including *Adiantum pedatum* (northern maidenhair-fern), *Thelypteris* spp. (marsh ferns), *Athyrium thelypteroides* (silver glade-fern), *A. pycnocarpon* (glade-fern), *A. felix-femina* (southern lady fern), *Cystopteris protrusa* (lowland brittle-fern), *Polystichum acrostichoides* (christmas fern), *Botrychium virginianum* (rattlesnake fern), *B. biternatum* (southern grape-fern), *Asplenium platyneuron* (ebony spleenwort), and *Phegopteris hexagonoptera* (broad beech-fern). A number of exotic ferns are apparently thriving in the Tunica Hills. Additional herbs of prominence include *Sanicula* spp. (snakeroots), *Actaea pachypoda* (bane-berry), *Laportea canadensis* (nettle), *Podophyllum peltatum* (may-apple), *Trillium foetidissimum* (foetid wake-robin), *Cynoglossum virginianum* (hound's-tounge), *Aristolochia serpentaria* (dutchman's-pipe), *Cryptotaenia canadensis* (hone-wort), *Lithospermum tuberosum* (tuberous puccoon), *Lobelia* spp. (lobelias), and *Pachysandra procumbens* (Allegheny-spurge). *Panax quinquefolius* (ginseng) and *Asarum canadensis* (Canadian ginger) rarely occur. Mosses and liverworts are common (Delcourt and Delcourt 1974,1975, LNHP 1986-2004, Martin 1992).

#### ***Current Extent and Status:***

Currently only about 25 % (50,000 to 100,000 acres) of Louisiana's southern mesophytic forests remain intact (Smith 1993). Clearing for agriculture, timber harvesting and development in West Feliciana Parish brought about loss, degradation, and fragmentation of these forests. The southern mesophytic forest type is extremely susceptible to soil damage, particularly erosion stemming from any form of disturbance, such as logging or road building, that exposes bare soil.



In such cases, the very steep slopes and loess soil result in frequent landslides (Quigley and Platt 1996). The largest protected tract of this habitat in Louisiana is found on the Tunica Hills WMA with 5,231 acres. Nearby the OSP manages a site that will open in the near future as a state preservation area, and TNC manages 110 acres on the Mary Ann Brown Preserve southeast of St. Francisville. The Natural Areas Registry Program has several properties registered for a total of 618 acres with another 815 acres proposed for membership in the program.

SOUTHERN MESOPHYTIC FOREST SPECIES OF CONSERVATION CONCERN (24)		
<b>AMPHIBIANS</b>	Worm-eating Warbler	<b>MAMMALS</b>
Webster's Salamander	Swainson's Warbler	Southeastern Shrew
Barking Treefrog	Louisiana Waterthrush	Southeastern Myotis
Eastern Spadefoot	Kentucky Warbler	Big Brown Bat
	Hooded Warbler	Louisiana Black Bear
	Orchard Oriole	Long-tailed Weasel
<b>BIRDS</b>	<b>BUTTERFLIES</b>	Eastern Spotted Skunk
American Woodcock	Falcate Orangetip	
Yellow-billed Cuckoo	Creole Pearly Eye	<b>REPTILES</b>
Wood Thrush		Scarlet Kingsnake
Yellow-throated Vireo		Timber Rattlesnake
Northern Parula		

***Priority Species Research and Survey Needs:***

Eastern Spotted Skunk: Considered critically imperiled in Louisiana, intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

Long-tailed Weasel: Considered vulnerable in Louisiana. Intensive surveys needed to update occurrence records and abundance for inclusion in the LNHP database.

Songbirds:

- Continue to support research on the effects of silviculture/land management practices on all songbird species.
- Develop longterm monitoring projects that focus on abundances and reproductive success (with emphasis on species of conservation concern) in this habitat type through the establishment of MAPS stations and BBS routes.

Butterflies: Conduct surveys to determine current distribution and abundance of all butterfly species, especially species of conservation concern, for inclusion in the LNHP database.

Conduct habitat use and life history studies for mammal species of conservation concern that may potentially use this habitat.

Document the habitat relationships of priority species to know how dependent they are upon Southern Mesophytic Forest habitats, relative to other habitat types.

Determine the microhabitat preferences and requirements of species occurring in southern mesophytic forests to understand how these species are utilizing the habitat to determine management needs.

***Species Conservation Strategies:***

1. Timber Rattlesnake: Naturally low-occurring population levels and persecution make persistence tenuous. Prohibit the killing and removal of timber rattlesnakes. Reduce vehicular traffic in sensitive areas.
2. Work with landowners to initiate or continue the implementation of PIF bird conservation plans, conservation plans developed for amphibians and reptiles, and USFWS threatened and endangered species recovery plans over the next 10 years.

***Threats Affecting Habitat:***

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat				
	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation	Soil Erosion
Conversion to agriculture or other forest types		XXX		XXX	
Development/maintenance of pipelines, roads or utilities		XXX	XXX	XXX	
Incompatible forestry practices	XXX		XXX		XXX
Invasive/alien species	XXX				
Recreational use/vehicles			XXX		XXX
Residential development		XXX	XXX	XXX	XXX

***Habitat Conservation Strategies:***

1. Develop partnerships with federal and state agencies, NGO's and others to identify potential parcels of this habitat type for acquisition and conservation.
2. Provide education/outreach to promote conservation and preservation of this habitat type.
3. Work with the legislature to provide incentives (tax breaks, etc.) to landowners to retain the natural state of areas where this habitat occurs.
4. Provide loggers and landowners with updated BMPs for harvesting timber in this habitat type.
5. Partner with OSP to design nature/recreational trails for state parks lands and develop similar trails on Tunica Hills WMA.

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### 33. Spruce Pine-Hardwood Flatwood

**Rarity Rank:** S1/G1G2

**Synonyms:** Pine-Hardwood Flatwoods

**Ecological Systems:** CES203.557 East Gulf Coastal Plain Southern Loblolly-Hardwood Flatwoods

**General Description:**

This flatwoods type is a natural mixed forest community indigenous to the western Florida Parishes in southeast Louisiana. A wetland variant of this community occupies poorly drained flats, depressional areas and small drainages (sometimes called “slashes”) that lie in a mosaic with higher, non-wetland areas. Such higher areas support a mesic spruce pine-hardwood flatwoods forest. Both variants are distinguished by the



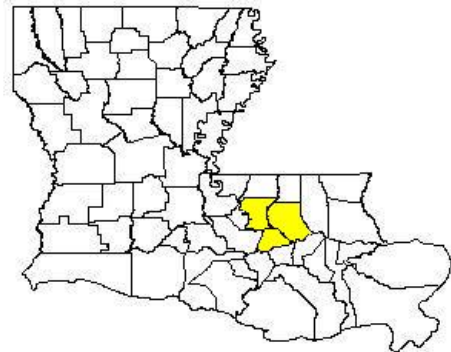
prevalence of *Pinus glabra* (spruce pine) over *P. taeda* (loblolly pine), although loblolly is usually present at some level. Hardwoods usually dominate the forest, but spruce pine can dominate areas within the stand. Soils are hydric, acidic silt loams including the Encrow, Gilbert and Springfield series. These soils are significantly higher in nutrient levels than those historically supporting the *P. palustris* (longleaf pine) communities occupying similar hydrologic settings immediately to the east (Smith 1996). This edaphic factor may have precluded longleaf from this community type. Historically fire was probably very rare as the component plant species are not fire adapted and fuel conditions are not conducive to fire. Additional characteristic native tree, shrub and vine species include: *Acer rubrum* (red maple), *Ampelopsis arborea* (peppervine), *Berchemia scandens* (rattan vine), *Brunnichia cirrhosa* (ladies’ eardrops), *Campsis radicans* (trumpet creeper), *Carya glabra* (pignut hickory), *Cephalanthus occidentalis* (buttonbush), *Cornus foemina* (swamp dogwood), *Crataegus opaca* (mayhaw), *C. viridis* (greenhaw), *Diospyros virginiana* (persimmon), *Fraxinus caroliniana* (Carolina ash), *F. pennsylvanica* (green ash), *Ilex decidua* (deciduous holly), *I. opaca* (American holly), *Itea virginica* (Virginia willow), *Liquidambar styraciflua* (sweetgum), *Magnolia grandiflora* (Southern magnolia), *Morella cerifera* (wax myrtle), *Nyssa biflora* (swamp blackgum), *N. sylvatica* (blackgum), *Quercus laurifolia* (laurel oak), *Q. michauxii* (swamp chestnut oak), *Q. nigra* (water oak), *Q. pagoda* (cherrybark oak), *Q. phellos* (willow oak), *Toxicodendron radicans* (poison ivy), *Salix nigra* (black willow), *Sambucus canadensis* (elderberry), *Smilax glauca*, *S. rotundifolia*, *Styrax americanus* (snowbell), *Viburnum dentatum* (arrowwood), and *Vitis rotundifolia* (muscadine). Spruce pine-hardwood flatwoods typically have a dense canopy resulting in heavy shading and usually a sparse understory. *Sabal minor* (dwarf palmetto) is often an understory dominant. Other understory natives include: *Arundinaria gigantea* (switchcane), *Boehmeria cylindrica* (hempweed), *Carex* spp. (sedges), *Chasmanthium* spp.



(spikegrasses), *Cyperus* spp. (flatsedges), *Gratiola virginiana* (roundfruit hedgehyssop), *Hygrophila lacustris* (Gulf swampweed), *Hypericum* spp. (St. Andrew’s cross), *Juncus* spp. (rushes), *Justicia ovata* (waterwillow), *Ludwigia* spp. (primrose willow) , *Lycopus rubellus* (taperleaf horehound), *L. virginicus* (water horehound), *Lysimachia radicans* (trailing yellow loosestrife), *Onoclea sensibilis* (sensitive fern), *Osmunda regalis* (royal fern), *Panicum gymnocarpon* (savannah panicgrass), *Polygonum* spp. (smartweed), *Rhynchospora* spp. (beaksedge), *Sabatia calycina* (coastal rose gentian), *Saururus cernuus* (lizard’s tail), *Schoenoplectus* spp. (bullrushes), *Solidago gigantea* (goldenrod), *Thelypteris palustris* (Southern shield fern), *Triadenum walteri* (greater marsh St. John’s wort), *Vernonia gigantea* ssp. *gigantea* (giant ironweed), and *Woodwardia areolata* (netted chain fern).

**Current Extent and Status:**

Spruce pine-hardwood flatwoods are restricted to Louisiana, occurring in a very narrow range in Livingston, East Baton Rouge and perhaps Ascension Parishes. Presettlement acreage is estimated at 50,000 to 100,000 acres with only 10 % currently remaining (Smith 1993). The predominant threat to this habitat type is conversion to commercial and residential developments due to the rapid expansion of urbanization along the Interstate-12 corridor in the Florida Parishes of Louisiana. Other major factors threatening this association include logging and conversion to commercial pine plantations, and hydrological alterations. Today the remaining spruce pine flatwoods are primarily in private ownership. Only one private tract of 152 acres is registered with the Louisiana Natural Areas Registry Program, and an additional site of unknown acreage is protected within Tickfaw State Park.



SPRUCE PINE – HARDWOOD FLATWOOD SPECIES OF CONSERVATION CONCERN (19)		
<b>AMPHIBIANS</b>	Northern Parula	<b>MAMMALS</b>
Southern Dusky Salamander	Prothonotary Warbler	Southeastern Shrew
Four-toed Salamander	Swainson’s Warbler	Southeastern Myotis
Gulf Coast Mud Salamander	Hooded Warbler	Long-tailed Weasel
<b>BIRDS</b>	Rusty Blackbird	<b>REPTILES</b>
American Woodcock	Orchard Oriole	Scarlet Kingsnake
Yellow-billed Cuckoo	<b>BUTTERFLIES</b>	Timber Rattlesnake
Wood Thrush	Appalachian Brown	
Yellow-throated Vireo		

**Priority Species Research and Survey Needs:**

Songbirds: Continued research on the effects of silviculture/land management practices on all songbird species.

Appalachian Brown: Conduct surveys to determine its current distribution and abundance for inclusion in the LNHP database.

Southeastern Shrew: Together with Arkansas and Missouri, Louisiana represents the western edge of its range. Intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

Long-tailed Weasel: Considered vulnerable in Louisiana. Intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

Determine the microhabitat preferences and requirements of target species occurring in spruce pine- hardwood flatwood forests to understand how these species are utilizing the habitat to determine management needs.

***Species Conservation Strategies:***

1. Four-toed Salamander: Recent Louisiana records are all from Spruce Pine – Hardwood Flatwood forest. Reproduction requires fishless gum ponds. Locate gum ponds and buffer from anthropogenic modification to perpetuate reproduction.
2. Work with landowners to initiate or continue the implementation of PIF bird conservation plans, conservation plans developed for amphibians and reptiles, and USFWS threatened and endangered species recovery plans over the next 10 years.

***Threats Affecting Habitat:***

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat				
	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation	Modification of Water Levels; Changes in Natural Flow Patterns
Commercial/industrial development		XXX			
Construction of ditches, drainage or diversion systems	XXX		XXX		XXX
Conversion to agriculture or other forest types		XXX		XXX	
Development/maintenance of pipelines, roads or utilities		XXX	XXX	XXX	
Incompatible forestry practices	XXX		XXX		XXX
Invasive/alien species	XXX				
Residential development		XXX	XXX	XXX	

***Habitat Conservation Strategies:***

1. Conduct surveys to determine the current extent and condition of this habitat type.
2. Work with appropriate planning commissions to provide them with LNHP data that illustrates locations of this habitat type.
3. Partner with NGOs, OSP, private landowners, etc. to initiate restoration and preservation efforts of spruce pine – hardwood flatwood forests and continue to encourage landowners to enroll this habitat type in the Natural Areas Registry Program.
4. Work with interested groups to promote SFI guidelines and develop new BMPs specific to this habitat. Distribute these guidelines to landowners/land managers through technical pamphlets and the LDWF website.
5. Promote the use of federal cost share programs (NRCS) to control invasive species.
6. Provide education/outreach to promote conservation and preservation of this habitat type with an emphasis on the effects of invasive/exotic plant species (tallow, privet, etc.).
7. Work with the legislature to provide incentives (tax breaks, etc.) to landowners to retain the natural state of areas where this habitat occurs.
8. Encourage LDAF and other growers to produce spruce pine seedlings for distribution to landowners interested in restoring this habitat type.
9. Promote controlled access for recreational use/vehicles in this habitat type.

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### 34. Vegetated Pioneer Emerging Delta

**Rarity Rank:** S2S3/G3G4

**Synonyms:** Delta Flats, Emergent Islands

**Ecological Systems:** CES203.470 Mississippi Delta Fresh and Oligohaline Tidal Marsh

**General Description:**

Vegetated Pioneer Emerging Delta is a dynamic community forming primarily within the actively building delta region at the mouth of the Atchafalaya River. Zonation of species occurs on the newly accreted land. *Echinochloa walteri* (coast cockspur grass) dominates the higher areas; *Sagittaria latifolia* (broadleaf bulltongue), *S. platyphylla* (delta arrowhead), *Cyperus difformis* (variable flatsedge), *Leptochloa uninervia* (Mexican sprangletop), and *Eleocharis parvula* (dwarf spikerush) dominate the lower zones inundated by daily tides; *Sagittaria platyphylla* (delta arrowhead), *Cyperus difformis* (variable flatsedge), *Leptochloa uninervia* (Mexican sprangletop), *Eleocharis parvula* (dwarf spikerush) and *Bacopa monnieri* (coastal water hyssop) dominate the intermediate zone. Other characteristic vegetation includes *Salix* spp. (willow), *Typha latifolia* (common cattail), *Scirpus validus* (softstem bulrush), *Scirpus americanus* (threesquare bulrush), and *Juncus effusus* (soft rush).



The island soils contain a greater percentage of sand and less moisture than marsh soils. The pioneer ridge vegetation is similar to the sand bars and delta of the Mississippi River while the pioneer marsh vegetation is similar to that of fresh marsh areas. The community is very diverse with as many as 241 species. The pioneer community is successional in nature and changes rapidly with time. The new delta community's ecological functions are similar in nature to marsh and mudflat systems.

**Current Extent and Status:**

According to Smith (1993) there was an estimated 2,000 to 10,000 acres of vegetated pioneer emerging delta in presettlement times. An estimated 75 to 100 percent is present today.

There are two areas of the Louisiana coast supporting this habitat: the actively forming Atchafalaya Delta and the current mouth of the Mississippi River. In the case of the former area,



newly created delta land is incorporated into Atchafalaya Delta WMA. The WMA is 141,000 acres, and consists of newly formed land and open shallow bay. About 27,000 acres are vegetated land. Land is created by natural deltaic processes and by dredge spoil strategically deposited by the COE. Most newly formed land at the mouth of the Mississippi River in Plaquemines Parish is captured in Pass-a-Loutre WMA, which totals 115,000 acres. In addition to delta splays, this total acreage also includes fresh and intermediate marsh. The Mississippi River has been held in its current course for an over-extended period of time and would likely have switched deltas recently. Management activities at Pass-a-Loutre include diverting sediment-laden waters into shallow open water habitat to create new delta land.

VEGETATED PIONEER EMERGING DELTA SPECIES OF CONSERVATION CONCERN (23)		
<b>BIRDS</b>	Lesser Scaup	Short-billed Dowitcher
Brown Pelican	Bald Eagle	Gull-billed Tern
Reddish Egret	Whooping Crane	Caspian Tern
Yellow-crowned Night-Heron	Snowy Plover	Royal Tern
Mottled Duck	Wilson's Plover	Sandwich Tern
Northern Pintail	Piping Plover	Common Tern
Canvasback	Marbled Godwit	Forster's Tern
Redhead	Dunlin	Black Skimmer

***Priority Species Research and Survey Needs:***

Brown Pelicans: Large populations should be monitored on a scheduled basis to detect long-term trends and to guide management decisions.

Reddish Egret: Surveys are needed to assess the limiting factors of reproductive success and the effects of human coastal recreational activities on egret populations.

Piping Plovers: Conduct long term winter surveys to monitor yearly abundance patterns.

Shorebirds and Terns: Initiate surveys to determine species use of this habitat and develop management recommendations for inclusion in future coastal restoration plans.

***Species Conservation Strategies:***

1. Shorebirds, Wading Birds:
  - Provide public education regarding the importance of waterbird nesting colonies and shorebird feeding areas. Reduce the negative effects on these areas from recreational and other uses.
  - Coordinate with GCJV to implement recommendations of shorebird and wading bird conservation plans.
2. Brown Pelican: Continue with long-term monitoring of nesting colonies.
3. Bald Eagle: Continue with long-term monitoring of active bald eagle nests, successful breeding pairs, and fledged eagles.

**Threats Affecting Habitat:**

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat				
	Altered Composition/ Structure	Habitat Disturbance	Herbivory	Modification of Water Levels; Changes in Natural Flow Patterns	Salinity Alteration
Channelization of rivers or streams	XXX			XXX	
Invasive/alien species	XXX		XXX		
Operation of drainage or diversion systems				XXX	
Recreational use/vehicles		XXX			
Saltwater intrusion					XXX

**Habitat Conservation Strategies:**

1. Identify and protect sensitive areas from disturbances such as boats or other motorized vehicles and recreational use. Limit human access to this habitat type.
2. Work with COE to develop better strategies for the placement of dredge materials as a restoration method for this habitat type. Promote appropriate use of dredge spoil to develop new areas for nesting sites, general stopover sites, and to enhance aquatic species habitat.
3. Work with COE, LDNR, and other interested groups to develop improved management techniques for this habitat type.
4. Work with COE and others to manage water control to create more high quality habitat and benefit existing delta habitat.
5. Work with LCA, CWPPRA, NRCS to incorporate management objectives for the protection and restoration of emerging delta habitat.

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### 35. Western Hillside Seepage Bog

**Rarity Rank:** S2/G2G3

**Synonyms:** Pitcher Plant Bog, Herbaceous Bog, Bog, Hillside Seep, Hillside Bog

**Ecological Systems:** CES203.194 West Gulf Coastal Plain Herbaceous Seepage Bog

#### **General Description:**

Hillside seepage bogs are open, mostly treeless, herb-dominated natural wetlands of hilly, sandy uplands historically dominated by *Pinus palustris* (longleaf pine) of the East and West Gulf Coastal Plains in Louisiana. In the WGCP, these bogs occur on the Pleistocene high and intermediate terraces and on Tertiary uplands (Catahoula, Fleming, and Sparta formations). They occur commonly on mid- to low slopes, on saturated, strongly acidic (pH ca. 4.5 - 5.5) and nutrient-poor substrates of fine sandy loams or loamy fine sands with relatively high organic matter content (Smith 1996). Soil series names have generally not been assigned to bogs due to the naturally very limited acreage in the state (Smith 1996).



These bogs are generally persistently wet from seepage, and are variable in size being most often less than 1 acre but rarely exceeding 10 acres. WGCP bogs are underlain by an impervious clay or sandstone layer that, when conditions are right, causes ground water to constantly seep to the soil surface. The herbaceous groundcover is dense, continuous and floristically rich. It is dominated by sedges, grasses and grass-like plants, and many kinds of unusual forbs, including pitcher-plants (*Sarracenia alata*) and a variety of orchid species. Patches of shrubs are often present within bogs, and can become more prevelant, possibly degrading the habitat, if fire is excluded from the system. Since hillside bogs are embedded in what are now or historically were longleaf pine forests, they are fire-driven systems. They evolved with frequent growing-season fire events. Among other things, frequent fire deters invasion by shrubs and trees and stimulates growth, flowering and seed production by indigenous bog herbs (Barker 1980).

The degree to which a bog remains wet throughout the year depends on the size of the watershed, the soil infiltration rate upslope, the rate of saturated flow in the soil, the topographic position of the bog, the bog's water storage capacity, and the rate of water leaving the bog from evapo-transpiration and through surface and sub-surface flow. In general, the greater the infiltration rate of the watershed soils and the water holding capacity of bog soils, the smaller the recharge area needed to maintain seepage throughout dry periods of the year. Therefore, bogs are extremely sensitive to



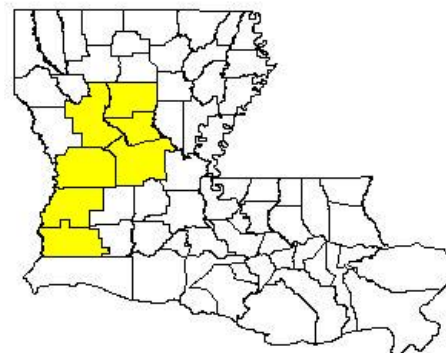
surrounding land management activities, and are easily degraded or destroyed by activities that alter natural hydrologic regimes.

Hillside seepage bogs are rich in herbaceous plant species, primarily grasses and grass-like plants (graminoids), although a large variety of forbs is present. There appears to be a distinct relationship between the number of species present and bog (MacRoberts and MacRoberts 1992, 1993). More than 100 plant species may be found in a relatively large bog (MacRoberts and MacRoberts 1988). Many species are restricted to this habitat and closely allied longleaf pine flatwood savannahs.

Vegetation dominants include: *Andropogon* spp. (bluestems), *Aristida* spp. (threeawn grasses), *Panicum* spp. (panic grasses), *Ctenium aromaticum* (tooth-ache grass), *Muhlenbergia capillaris* (hairawn muhly), *Rhynchospora* spp. (beak-rushes), *Rhynchospora stenophylla* (narrow-leaved beakrush, S1G4), *Xyris* spp. (yellow-eyed grasses), *Eriocaulon* spp. (pipeworts), *Lachnocaulon* spp. (bog buttons), *Dichromena latifolia* (giant white top sedge), *Scleria* spp. (nut-rushes), *Fuirena* spp. (umbrella grasses), and *Fimbristylis* spp. (fimbry-sedge). Primary forbs include *Sarracenia alata* (green pitcher plant), *Rhexia* spp. (meadow beauties), *Polygala* spp. (milkworts), *Liatris* spp. (blazing stars), *Aletris lutea* (colic-root), *Eupatorium* spp. (thorough-worts), *Coreopsis linifolia* (narrow-leaved tickseed), *Drosera* spp. (sundews). Many rare forbs are found in EGCP bogs including *Sarracenia psittacina* (parrot pitcherplant, S3G4), *Pinguicula lutea* (yellow butterwort, S2G4G5), *Lilium catesbaei* (southern red lily, S1G4), *Tofieldia racemosa* (coastal false-asphodel, S2S3G5), *Lophiola aurea* (golden crest, S2S3G4), and *Macranthera flammea* (flame flower, S2G3). Various orchids, especially *Platanthera* spp. (fringed orchids), are often conspicuous members of the flora. Ferns (principally *Osmunda* spp.) and club-mosses (*Lycopodium* spp.) are usually present and sphagnum moss is often abundant (LNHP 1986-2004, MacRoberts and MacRoberts 1988, 1993a, 1993b, 1991).

***Current Extent and Status:***

In the WGCP hillside seepage bogs are found from Calcasieu north to Natchitoches and Winn Parishes. There are many known for Vernon and Natchitoches probably due to KNF and Ft. Polk and the superior habitat conditions on those areas plus the ease of access to conduct surveys. There are probably many in Beauregard Parish. The habitat is rare in Calcasieu Parish and restricted to the extreme northern part of the parish. There is one known non-*Sarracenia* bog in each of Grant and Rapides Parishes and they are both poorly developed. There are a handful of bogs known in northern Winn Parish and these currently represent the northern most bogs in Louisiana.



This habitat overall has good viability in the WGCP, owing to the many protected occurrences on KNF and Ft. Polk. There are likely many examples on private land that are degraded (mainly by fire suppression) but recoverable, especially in Beauregard Parish.

WESTERN HILLSIDE SEEPAGE BOG SPECIES OF CONSERVATION CONCERN (5)		
<b>BIRDS</b> Sedge Wren Henslow's Sparrow Le Conte's Sparrow	<b>BUTTERFLIES</b> Arogos Skipper	<b>CRUSTACEANS</b> Pine Hills Crawfish

***Priority Species Research and Survey Needs:***

Sedge Wren, Henslow's Sparrow, Le Conte's Sparrow: Continue to inventory and monitor the status of these species and their habitat on public and private lands to fill data gaps in species distribution and abundance for inclusion in the LNHP database and Audubon nationwide database.

Arogos Skipper: Conduct surveys to determine its current distribution and abundance for inclusion in the LNHP database.

Examine the demographics, habitat-use patterns, and impacts of feral hogs on ground nesting birds, salamanders, and small mammals (Warren and Ford 1997).

***Species Conservation Strategies:***

1. Work with landowners to initiate or continue the implementation of PIF bird conservation plans, conservation plans developed for amphibians and reptiles, and USFWS threatened and endangered species recovery plans over the next 10 years.
2. Examine the demographics, habitat-use patterns, and impacts of feral hogs on ground nesting birds, salamanders and small mammals (Warren and Ford 1997).
3. Implement conservation and management recommendations of SWG projects T22 and T32 upon completion.

***Threats Affecting Habitat:***

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat		
	Altered Composition/ Structure	Habitat Disturbance	Modification of Water Levels; Changes in Natural Flow Patterns
Fire suppression	XXX		
Incompatible forestry practices	XXX	XXX	XXX
Invasive/alien species	XXX	XXX	
Recreational use/vehicles	XXX	XXX	

***Habitat Conservation Strategies:***

1. Conduct surveys to determine the extent and condition of this habitat type with a focus on identifying the surrounding landscape context (i.e., residential developments, etc.) that might be affected by prescribed burning.
2. Once bogs are identified, conduct landowner surveys to aid in the development of management strategies for these sites.
3. Continue to encourage landowners to implement BMPs and adopt SFI standards in the management of this habitat type.
4. Work with land managers/hunting clubs/extension agents, etc. to discourage the placement of food plots in this habitat type.
5. Promote the utilization of federal cost share programs (NRCS) to address invasive species problems.
6. Provide additional cost share funds for landowners to drastically reduce or eliminate the costs associated with conducting prescribed burns on their property.
7. Provide education/outreach to promote conservation and preservation of this habitat type.
8. Work with the legislature to provide incentives (tax breaks, etc.) to landowners to retain the natural state of areas where this habitat occurs.
9. Work with appropriate planning commissions to provide them with LNHP data that illustrates locations of this habitat type.
10. Develop strategies to address damage from feral hogs within this habitat type.

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### 36. Western Longleaf Pine Savannah

**Rarity Rank:** Acidic - S1S2/G2G3; Saline - S1/G1; Flatwoods Pond - S1/G2Q

**Synonyms:** Open Savannah, Pine Flatwoods, Coastal Meadow, Pine Meadow, Pine Barren

**Ecological Systems:** CES203.547 West Gulf Coastal Plain Flatwoods Pond  
CES203.191 West Gulf Coastal Plain Wet Longleaf Pine Savannah  
and Flatwoods

#### **General Description:**

(Note: Western Longleaf Pine Savannah includes both the Acidic savannah type (S1S2), and Saline savannah type (S1), and are combined due to similarities in management strategies. The Flatwoods Pond (S1) natural community type occurs as small inclusions within the Western Longleaf Pine Savannahs, and therefore is combined with the savannahs.)



Pine savannahs are floristically rich, herb-dominated wetlands, that are naturally sparsely stocked with *Pinus palustris* (longleaf pine). They historically dominated the Gulf Coastal Plain flatwood regions of southeast and southwest Louisiana. The term “savannah” is classically used to describe expansive herb-dominated areas with scattered trees. Wet savannahs occupy the poorly drained and seasonally saturated/flooded depressional areas and low flats, while the non-wetland flatwoods occupy the better drained slight rises, low ridges and “pimple mounds” (only WGCP). Pine savannahs are subject to a highly fluctuating water table, from surface saturation/shallow flooding in late fall/winter/early spring to growing-season droughtiness. Soils are hydric, very strongly acidic, nutrient poor, fine sandy loams and silt loams, low in organic matter. There is a western Louisiana variant on saline soil (Brimstone silt loam). The soils for both eastern and western types may be underlain by an impeding layer so that they are only slowly permeable and water runs off the surface gradually.

Common woody species include *Pinus palustris* (usually predominant tree species), *Magnolia virginiana* (sweet bay), *Nyssa sylvatica* (black gum), *Quercus virginiana* (live oak), *Q. marilandica* (blackjack oak), *Q. laurifolia* (laurel oak), *Cyrilla racemiflora* (swamp cyrilla), *Morella* spp. (wax myrtles), *Hypericum* spp. (St. John's worts), and *Styrax americana* (littleleaf snowbell). Although past logging has altered the arboreal characteristics of most occurrences of the community (primarily by reducing coverage of longleaf pine), the herbaceous complement is thought to differ little from that present

prior to timbering and stumping activities. Herbaceous vegetation of pine savannahs is very diverse, dominated by graminoids, and similar to that occurring in hillside bogs. Graminoids present include *Andropogon* spp. (broomsedges), *Schizachyrium scoparium* and *S. tenerum* (little and slender bluestem), *Panicum* spp. (panic grasses), *Aristida* spp. (three-awn grasses), *Ctenium aromaticum* (toothache grass), *Muhlenbergia expansa* (hairawn muhly), *Erianthus* spp. (plume-grasses), *Coelorachis* spp. (jointgrasses), *Rhynchospora* spp. (beak-rushes), *Xyris* spp. (yellow-eyed grasses), *Fuirena* spp. (umbrella grasses), *Scleria* spp. (nut-rushes), *Dichromena latifolia* (giant white top sedge), *Eriocaulon* spp. (pipeworts), *Lachnocaulon* spp. (bog buttons), and *Fimbristylis* spp. (fimbry-sedge). Some forbs common in the community include *Agalinis* spp. (gerardias), *Lobelia* spp. (lobelias), *Rhexia* spp. (meadow beauties), *Eryngium integrifolium* (bog thistle), *Oxypolis filiformis* (narrow-leaved hog-fennel), *Polygala* spp. (milkworts), *Liatris* spp. (blazing-stars), *Sabatia* spp. (rose-gentians), *Drosera* spp. (sundews), *Pinguicula* spp. (butterworts), *Marshallia tenuifolia* (thin-leaved barbara's-buttons, southwestern Louisiana), *Utricularia* spp. (bladderworts), and *Platanthera* spp. (fringed-orchids). The only known extant occurrence of *Schwalbea americana* (American chaffseed), which is federally-listed as endangered, is found on pimple mounds in a longleaf pine savannah in Allen Parish. This species is known historically from Calcasieu and Rapides Parishes. Various additional species belonging to the lily family (Liliaceae), sunflower family (Asteraceae), and orchid family (Orchidaceae) are prominent. *Lycopodium* spp. (club-mosses) and sphagnum moss are often abundant. Fire frequency is a major factor controlling species occurrence and community structure. Without frequent fire (preferably growing season burns which mimic historic fire regimes), shrubs, and eventually trees, especially hardwoods, would gain dominance and eliminate most of the herbaceous flora.



*Schwalbea americana*



Flatwoods Ponds are relatively small, natural depressional wetlands embedded within current or historic longleaf pine flatwoods/savannahs of western Louisiana. They are believed to occupy swales and depressions remaining from ancient Pleistocene stream channels, and are often linear in shape, although circular and elliptical ponds are common. Their size ranges from less than 1 acre up to about 30 or 40 acres, but average 1 to 5 acres. In general, small ponds are relatively shallow, while larger ponds are deeper. They may range from just a few inches deep relative to surrounding pine flats, to approximately 5 feet deep in deeper, larger ponds. Generally treeless, these ponds are vegetated by a variety of obligate and facultative wetland

herbaceous species, mainly tall sedges and grasses. Native herbaceous species that usually characterize shallow ponds or edges of deeper ponds include: *Andropogon glomeratus* var. *glaucopsis* (bushy beardgrass), *Aristida palustris* (= *A. affinis*) (longleaf three-awn grass), *Coreopsis linifolia* (tickseed), *Eleocharis tuberculosa* (spikerush), *Eriocaulon decangulare* (pipewort), the beakrushes - *Rhynchospora filifolia*, *R. gracilentia*, *R. rariflora*, and *Dichromena latifolia*, *Gratiola brevifolia* (hyssop), *Hypericum galioides* (St. John's wort), *Hyptis alata* (bitter mint), *Panicum virgatum* (switchgrass), *Pluchea rosea* (stinkweed), *Polygala ramosa* (candyroot), *Proserpinaca pectinata* (mermaid-weed), *Hibiscus aculeatus* (comfort-root), and *Rhexia lutea* (meadow beauty). Deep ponds are characterized by a variable mix of herbs, including: *Amsonia glaberrima* (bluestar), *Bacopa caroliniana* (blue-hyssop), *Carex verrucosa*, *Dichanthelium* spp., *Hibiscus moscheutos* ssp. *lasiocarpus*, *Juncus effuses* (soft rush), *Ludwigia pilosa* (evening primrose), *Lycopus rubellus* (bugleweed), *Oxypolis filiformis* (hog-fennel), *Panicum hemitomom* (maidencane), *Panicum virgatum* (switchgrass), beakrushes - *Rhynchospora cephalantha* and *R. corniculata*, and *Sagittaria graminea* (arrowhead). Trees, often appearing stunted, may be present in deeper, more frequently flooded, and therefore less fire-exposed parts of ponds. Tree and woody species may include: *Nyssa biflora* (swamp blackgum), *Acer rubrum* (red maple), *Cephalanthus occidentalis* (buttonbush), *Styrax americanus* (small snowbell), *Crataegus opaca* (mayhaw), and *Morella cerifera* (waxmyrtle). The hydrologic regime of these ponds is characterized by a seasonally fluctuating water level - dry in summer and flooded the other 3 seasons. This water level fluctuation causes distinct vegetation zones with species sorting out according to their relative tolerance or competitive adaptations to flooding and saturated soil conditions. Flatwood ponds were historically maintained by frequent lightning generated fires that, every few years, swept the longleaf pine flats in which flatwoods ponds are embedded. Such fires burned the ponds during the late spring/summer dry season, killing back encroaching shrubs and trees and rejuvenating the herbaceous ground cover.

**Current Extent and Status:**

Western longleaf flatwoods savannahs and imbedded communities are highly threatened and much reduced from their original extent. This habitat is estimated to have occupied 1,000,000 to 2,000,000 acres in presettlement times with and estimated 1 to 5 percent remaining (Smith 1993). Threats include conversion to slash or loblolly pine plantations, residential/commercial development, fire exclusion/inappropriate fire regime, hydrological alterations (to include adjacent areas), contamination by chemicals (herbicides, fertilizers), and physical damage from timber harvesting/planting activities (Smith 1996).





There are very few high quality examples of longleaf pine savannahs and they tend to be isolated on the landscape. Protected examples occur on KNF and there are several on private land. A high quality acidic savannah is being protected by TNC on their CC Road Savannah Preserve in Allen Parish, which totals 468 acres. TNC is also protecting a saline variant on their Persimmon Gully Preserve in Calcasieu Parish. Persimmon Gully is a 255-acre preserve. An additional 40 acres of saline longleaf pine savannah in Calcasieu Parish are being protected by a forest products company. Several longleaf savannahs on private tracts are registered as Natural Areas. Barnes Creek Savannah Natural Area, in Allen Parish, totals 680 acres and supports a good quality acidic savannah with several flatwoods ponds. In the same part of Allen Parish, Parkers Longleaf Natural Area supports a savannah and totals 160 acres. There are several more sites in southwest Louisiana, some of which being as large as several hundred acres, that support high quality longleaf pine savannah habitat. These sites should be considered a conservation priority.

WESTERN LONGLEAF PINE SAVANNAH SPECIES OF CONSERVATION CONCERN (23)		
<b>AMPHIBIANS</b>	Red-cockaded Woodpecker	<b>BUTTERFLIES</b>
Eastern Tiger Salamander	Scissor-tailed Flycatcher	Reakirt's Blue
Southern Crawfish Frog	Brown-headed Nuthatch	Little Metalmark
	Sedge Wren	
<b>BIRDS</b>	Loggerhead Shrike	<b>MAMMALS</b>
Northern Harrier	Bachman's Sparrow	Hispid Pocket Mouse
Northern Bobwhite	Field Sparrow	Eastern Harvest Mouse
Yellow Rail	Henslow's Sparrow	
American Woodcock	Le Conte's Sparrow	<b>REPTILES</b>
Yellow-billed Cuckoo		Western Slender Glass Lizard
Chuck-Will's-Widow		Southeastern Scarlet Snake

***Priority Species Research and Survey Needs:***

Northern Bobwhite: Populations have declined precipitously from 1980-1999, averaging 8.2% per year in BCR 25; 6.0% per year in BCR 26; 5.8% per year in BCR 27; 4.5% per year in BCR 37. Continue to monitor populations thru breeding bird and hunting surveys.

Bachman's Sparrow: Intensive surveys are needed to produce estimates of current population size statewide. Develop projects which determine the relationship between population size and vegetation succession on quality sites. Determine whether management activities can create a mosaic of adjacent sites that together provide continuously occupied habitat. Determine dispersal behavior to maximize the benefits/effects of future habitat management.

Henslow's Sparrow: Obtain more information on winter habitat abundance, distribution, and habitat needs throughout Louisiana.

Eastern Harvest Mouse: Considered vulnerable in Louisiana. Intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

Hispid Pocket Mouse: Louisiana represents the eastern edge of its range. Intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

Determine the microhabitat preferences and requirements of species occurring in western longleaf pine savannahs to understand how these species are utilizing the habitat to develop management recommendations for these species.

***Species Conservation Strategies:***

1. Southern Crawfish Frog: Difficult to detect, with very few recent records. Breeds in fishless, vernal ponds/gum ponds. Locate and buffer potential breeding sites.
2. Red-cockaded Woodpecker:
  - Continue to support the implementation of the Louisiana Statewide RCW Safe Harbor Program.
  - Support USFWS recovery efforts outlined in the RCW recovery plan, 2<sup>nd</sup> Revision.
  - Encourage the establishment of new RCW populations.
  - Investigate potential land acquisition of this habitat type to increase and support new RCW populations
3. Henslow's Sparrow, Bachman's Sparrow:
  - Implement conservation and management recommendations of SWG projects T22 and T32 upon completion.
  - Monitor reproductive success of Bachman's sparrows to determine limiting factors.
  - Work with landowners to encourage the use of BMPs for prescribed fire management and timber harvesting techniques to improve habitat quality.
4. Northern Bobwhite and Grassland Birds: Support implementation of recommended habitat restoration actions specified in NBCI and by LDWF Quail and Grassland Bird Task Force.

**Threats Affecting Habitat:**

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat				
	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation	Modification of Water Levels; Changes in Natural Flow Patterns
Commercial/industrial development		XXX		XXX	
Conversion to agriculture or other forest types		XXX		XXX	
Development/maintenance of pipelines, roads or utilities		XXX	XXX	XXX	XXX
Fire suppression	XXX			XXX	
Incompatible forestry practices	XXX		XXX		XXX
Invasive/alien species	XXX				
Residential development		XXX	XXX	XXX	

**Habitat Conservation Strategies:**

1. Conduct surveys to determine the extent and condition of this habitat type with a focus on identifying the surrounding landscape context (i.e., residential developments, etc.) that might be affected by prescribed burning.
2. Educate landowners, adjacent residents, developers, and the general public about the crucial role of prescribed burning in the management of longleaf pine ecosystems (multi-agency, multi-group effort).
3. Provide additional cost share funds through programs such as FLEP in order to drastically reduce or eliminate landowners' costs associated with conducting prescribed burns their property.
4. Develop educational information regarding the importance of ephemeral ponds for species of concern, and make this info available to landowners/land managers through technical pamphlets and the LDWF website.
5. Once savannahs are identified conduct landowner surveys to aid in the development of management strategies for these sites.
6. Encourage longer longleaf pine rotation ages when compatible with the landowner's management objectives.
7. Investigate the availability of additional cost-share funding opportunities, through FLEP, Forest Productivity Program (FPP) or other programs, for landowners to reduce the cost of longleaf pine management.
8. Promote advantages of growing longleaf pine and associated herbaceous ground cover.

9. Work with land managers/hunting clubs/extension agents, etc. to discourage the placement of food plots in this habitat type.
10. Promote utilization of state and federal cost share programs (FLEP and NRCS programs) to address invasive species problems.
11. Work with the Longleaf Alliance to incorporate their strategies for longleaf pine management and restoration into current restoration efforts.
12. Work with appropriate planning commissions to provide them with LNHP data that illustrates locations of this habitat type.
13. Encourage a university curriculum that incorporates the identification of sensitive natural areas into student studies (especially landscape architecture and courses for planners).

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### 37. Western Upland Longleaf Pine Forest

**Rarity Rank:** S2S3/G2G3

**Synonyms:** Sandhill Pine Forest, Clayhill Pine Forest

**Ecological Systems:**

CES203.293 West Gulf Coastal Plain Upland Longleaf Pine Forest and Woodland

**General Description:**

This habitat occurs in the hilly uplands in western and central Louisiana. It occurs on acidic loamy sands to acid clays associated with Pleistocene or Tertiary formations. The community is characteristically dissected by small to large branch or creek bottoms. *Pinus palustris* (longleaf pine) is the dominant overstory species, and in locations where fire has frequently occurred, it is often the only canopy species. Where fire is less frequent or suppressed, a number of overstory associates may occur, including

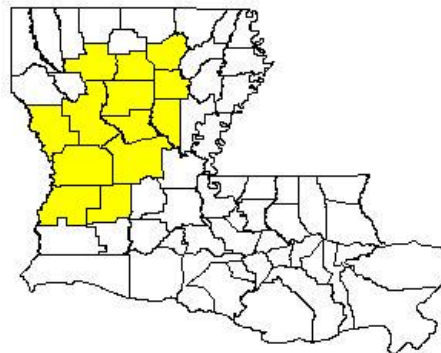


*Pinus echinata* (shortleaf pine), *Pinus taeda* (loblolly pine), *Nyssa sylvatica* (black gum), *Liquidambar styraciflua* (sweetgum), *Quercus falcata*, *Q. stellata* (post oak), *Q. marilandica* (blackjack oak), *Q. shumardii* (shumard oak), *Q. alba* (white oak), *Q. nigra* (water oak), *Prunus serotina* (black cherry), *Carya tomentosa* (mockernut hickory), *C. texana* (black hickory, central Louisiana), *Acer rubrum* (red maple), *Diospyros virginiana* (persimmon), and *Sassafras albidum* (sassafras). In sandy soils, *Q. incana* (bluejack oak) and *Q. hemisperica* (upland laurel oak) are frequent associates. Significant shrub species include *Cornus florida* (flowering dogwood), *Vaccinium arboreum* (winter honeysuckle), *V. elliotii* (elliott's blueberry), *V. stamineum* (deer berry), *V. darrowii* (dwarf blueberry, southeast Louisiana), *Gaylussacia dumosa* (dwarf huckleberry, southeast Louisiana), *Callicarpa americana* (French mulberry), *Morella cerifera* (wax myrtle), *Bumelia lanuginosa* (chittum-wood), *Ilex vomitoria* (yaupon), *I. opaca* (American holly), *Rubus* spp. (blackberries), and *Rhus copallina* (winged sumac). Common vines include *Vitis* spp. (grapes), *Smilax* spp. (greenbriers), *Parthenocissus quinquefolia* (Virginia creeper), and *Gelsemium sempervirens* (yellow jessamine). The herbaceous flora may be exceedingly diverse if fire has frequently occurred. Grasses, composites, and legumes are predominant in the ground layer. *Andropogon* spp. (broomsedges) and *Schizachyrium* spp. (bluestems) are usually the dominant grasses, but several other genera are usually present, including *Aristida* (three-awn grasses), *Sporobolus* (dropseeds), *Panicum* (panic grasses), *Anthaenantia* (silky scales), *Ctenium aromaticum* (toothache grass), *Digitaria* (crab grasses), *Eragrostis* (love grasses), *Erianthus* (plume grasses), *Gymnopogon* (skeleton grasses), *Muhlenbergia* (muhly grasses), *Paspalum* (pasp grasses), and *Setaria* spp. (bristle grasses). Composites include *Eurybia* spp. and *Symphotrichum* spp. (asters), *Carphephorus odoratissimus*

(vanilla plant), *Chrysopsis* spp. (golden asters), *Heterotheca* spp. (golden asters), *Elaphantopus* spp. (elephant-foot), *Eupatorium* spp. (thoroughworts), *Euthamia* spp. (flat-topped goldenrods), *Gnaphalium* spp. (rabbit tobaccos), *Helenium* spp. (sneeze-weeds), *Helianthus* spp. (sunflowers), *Liatris* spp. (blazing-stars), *Rudbeckia* spp. (brown-eyed susans), *Solidago* spp. (goldenrods), and *Vernonia* spp. (ironweeds). Prominent legumes are *Baptisia* spp. (indigos), *Cassia* spp. (partridge-peas), *Centrosema virginianum* (butterfly pea), *Clitoria mariana* (pigeon wings), *Crotolaria* spp. (rattle pods), *Desmodium* spp. (beggar's ticks), *Lespedeza* spp. (bush clovers), *Stylsanthes biflora* (pencil-flower), *Rhynchosia* spp. (snout beans), and *Tephrosia* spp. (hoary peas). Additional frequent forbs include *Oenothera* spp. (evening primroses), *Polygala* spp. (milkworts), *Lobelia* spp. (lobelias), *Callirhoe papaver* (poppy-mallow), *Ruellia* spp. (wild petunias), *Hypoxis* spp. (yellow-eyed grasses), *Asclepias* spp. (mildweeds), *Lechea* spp. (pinweeds), *Euphorbia* spp. (spurges), *Sabatia* spp. (rose-gentians), *Agalinis* spp. (false foxgloves), and *Rhexia* spp. (meadow beauties). The fern *Pteridium aquilinum* (bracken fern) is often conspicuous in large colonies.

**Current Extent and Status:**

Western upland longleaf pine forests historically dominated large areas in the LWGCP. However much of this area has been converted to other forest types or developed. The estimated presettlement acreage of this habitat is 2,000,000 to 4,000,000 with an estimated 10 to 25 % remaining (Smith 1993). While much of this habitat has been lost or altered, there are a number of high quality occurrences, particularly on KNF, Ft. Polk, and Peason Ridge Military Reservation (Grace and Smith 1995, Hart and Lester 1993, Martin and Smith 1991, 1993).



WESTERN UPLAND LONGLEAF PINE FOREST SPECIES OF CONSERVATION CONCERN (32)		
<b>AMPHIBIANS</b>	Loggerhead Shrike	<b>MAMMALS</b>
Eastern Tiger Salamander	Prairie Warbler	Southeastern Myotis
Louisiana Slimy Salamander	Bachman's Sparrow	Silver-haired Bat
Southern Red-backed Salamander	Field Sparrow	Big Brown Bat
Southern Crawfish Frog	Henslow's Sparrow	Ringtail
	Le Conte's Sparrow	Long-tailed Weasel
<b>BIRDS</b>	<b>BUTTERFLIES</b>	<b>REPTILES</b>
Northern Bobwhite	Wild Indigo Duskywing	Western Slender Glass Lizard
American Woodcock	Dusted Skipper	Southern Prairie Skink
Yellow-billed Cuckoo	Pepper and Salt Skipper	Southeastern Scarlet Snake
Red-cockaded Woodpecker	Falcate Orangetip	Louisiana Pine Snake
Brown-headed Nuthatch	Harvester	
Sedge Wren	Little Metalmark	
Wood Thrush		

***Priority Species Research and Survey Needs:***

Brown-headed Nuthatch: Investigate the impacts of silviculture/land management practices on this species and the causes of this species' decline.

Loggerhead Shrike: BBS data for the period 1966-2000 indicate a 71% population decline rangewide. Monitoring of this species reproductive success and the effects of pesticides in reducing food availability are needed along with a statewide evaluation of changes in available habitat.

Songbirds:

- Continue to support research on the effects of silviculture/land management practices on all songbird species.
- Develop longterm monitoring projects that focus on species abundances and reproductive success (with emphasis on species of conservation concern) in this habitat type through the establishment of MAPS stations and BBS routes.

Butterflies: Conduct surveys to determine the current distribution and abundance of all butterfly species, especially species of conservation concern, for inclusion in the LNHP database.

Bats:

- Develop projects that target species of conservation concern and focus on their distribution, abundance, and ecological needs in this habitat type (Lacki and Schwierjohann 2001).
- Research the genetic identities of different *Myotis* species in the state (Leberg 2004).

Ringtail: Louisiana represents the eastern edge of its range. Intensive surveys are needed to determine its current status in Louisiana.

Long-tailed Weasel: Considered vulnerable in Louisiana. Intensive surveys are needed to update occurrence records and abundance for inclusion in the LNHP database.

Louisiana Pine Snake: The quality of remaining habitat has been degraded due to logging, fire suppression, short-rotation silviculture, and conversion to pasture lands. Some of the best remaining populations occur on industrial forest lands. Continue to support research into this species life history, limiting factors that reduce reproductive success, and the use of herbicides instead of prescribed burning on composition and/or density of ground cover vegetation and its effects on pocket gophers.

***Species Conservation Strategies:***

1. Northern Bobwhite and Grassland Birds: Support the implementation of recommended habitat restoration actions specified in NBCI and by LDWF Quail and Grassland Bird Task Force.

2. Red-cockaded Woodpecker:
  - Continue to support implementation of the Louisiana Statewide RCW Safe Harbor Program.
  - Support USFWS recovery efforts outlined in the RCW recovery plan, 2<sup>nd</sup> Revision.
  - Encourage the establishment of new RCW populations.
  - Investigate potential land acquisition of this habitat type to increase and support new populations.
3. Brown-headed Nuthatch: Encourage landowners to use group-selection and single-tree selection harvesting methods and maintain or increase the number of standing snags.
4. Henslow's Sparrow, Bachman's Sparrow:
  - Implement conservation and management recommendations of SWG projects T22 and T32 upon completion.
  - Monitor reproductive success of Bachman's sparrows to determine limiting factors.
  - Work with landowners to encourage the use of BMPs for prescribed fire management and timber harvesting techniques to improve habitat quality.
5. Western Slender Glass Lizard, Louisiana Pine Snake:
  - Continue to work with timber industry, USFS, and USFWS to promote habitat and species conservation strategies to increase populations on quality sites.
  - Implement conservation and management recommendations of SWG project T10 upon completion.
6. Promote the use of appropriate silvicultural techniques to restore/manage western upland longleaf pine forests for wildlife (include importance of tree species diversity, den trees for birds and mammals, leaf litter, etc).
7. Promote snag retention during logging operations to increase the numbers available for cavity-nesting species.
8. Develop management recommendations to maintain sufficient levels of woody debris in stands for reptiles, amphibians, and small mammals.

***Threats Affecting Habitat:***

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.



Source of Threat	Threat			
	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation
Conversion to agriculture or other forest types		XXX		XXX
Development/maintenance of pipelines, roads or utilities		XXX	XXX	XXX
Fire suppression	XXX			XXX
Incompatible forestry practices	XXX		XXX	
Invasive/alien species	XXX			
Oil or gas drilling		XXX	XXX	
Recreational use/vehicles			XXX	

***Habitat Conservation Strategies:***

1. Conduct surveys to determine the extent and condition of this habitat type with a focus on identifying the surrounding landscape context (i.e., residential developments, etc.) that might be affected by prescribed burning.
2. Encourage longer rotation ages when compatible with the landowner’s management objectives.
3. Work with land managers/hunting clubs/extension agents, etc. to discourage the placement of food plots in this habitat type.
4. Educate landowners, adjacent residents, developers, and the general public about the crucial role of prescribed burning in the management of longleaf pine ecosystems (multi-agency, multi-group effort).
5. Promote advantages of growing longleaf pine and associated herbaceous ground cover.
6. Promote utilization of state and federal cost share programs (FLEP and NRCS programs) to address invasive species problems.
7. Promote value-added products produced from longleaf pine to encourage landowners to replant longleaf pine instead of off-site pine species.
8. Provide additional cost share funds through programs such as FLEP in order to drastically reduce or eliminate landowners’ costs associated with conducting prescribed burns their property.
9. Investigate the availability of additional cost-share funding opportunities, through FLEP, FPP or other programs, for landowners to reduce the cost of longleaf pine management.
10. Work with the Longleaf Alliance to incorporate their strategies for longleaf pine management and restoration into current restoration efforts.
11. Work with appropriate planning commissions to provide them with LNHP data that illustrates locations of this habitat type.

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### 38. Western Xeric Sandhill Woodland

**Rarity Rank:** S2S3 (S1 - Florida Parishes)/G2G3

**Synonyms:** Oak-Farkleberry Sandy Lands

**Ecological Systems:** CES203.056 West Gulf Coastal Plain Sandhill Oak and Shortleaf Pine Forest and Woodland

#### **General Description:**

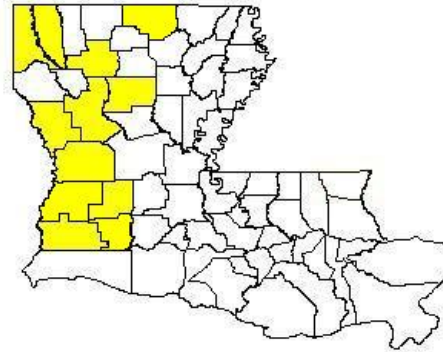
Western Xeric Sandhill Woodlands develop on deep Tertiary marine sands (particularly of the Sparta formation in northwest Louisiana) and also on Pleistocene stream terraces. The soil is nutrient-poor and dries quickly. Trees are often stunted because of extreme site conditions. Fire is thought to be an important process in maintaining this community. However some xeric sandhill woodlands may be isolated by landscape features which make them less subject to fire (e.g., nearly surrounded by a floodplain). This community may have the appearance of a scrubby shrub-woodland. Small, natural openings may be scattered.



Overstory species may include *Pinus echinata* (shortleaf pine), *Pinus taeda* (loblolly pine), *Quercus stellata* (post oak), *Q. marilandica* (blackjack oak), *Q. incana* (bluejack oak), *Q. stellata* var. *margaretta* (sand post oak), and *Q. hemispherica* (upland laurel oak). Shrub species may include *Asimina parviflora* (dwarf paw-paw), *Vaccinium arboreum* (winter huckleberry, may be dominant), *Bumelia lanuginosa* (chittum-wood), *Ilex vomitoria* (yaupon), *Chionanthus virginicus* (fringe-tree), *Rhamnus caroliniana* (Indian cherry), *Polygonella americana*. (jointweed), *Stillingia sylvatica* (stillingia), and *Hamamelis virginiana* (witch-hazel). The herbaceous layer is sparsely developed, but may include *Opuntia humifusa* (prickly-pear cactus), *Andropogon* spp. (broomsedges), *Asclepias* spp. (milkweeds), *Aristida lanosa* and *A. desmantha* (three-awn grasses), *Smilax pumila* (sarsaparilla vine), *Cnidoscolous texana* (bull-nettles), *Tephrosia virginiana* (goat's-rue), and *Tradescantia reverchonii* (downy spider wort). Foliose lichens (especially those in the genera *Cladina* and *Cladonia*) may occur in profusion. Many state-rare species are indigenous to this habitat, including *Astragalus soxmaniorum* (soxman's milk-vetch), *Zornia bracteata* (viperina), *Streptanthus hyacinthoides* (smooth twistflower), *Polanisia erosa* (large clammy-weed), *Penstemon murrayanus* (cupleaf beardtounge), *Eriogonum longifolium* and *E. multiflora* (wild buckwheats), *Silene subciliata* (scarlet catchfly), *Tetragonotheca ludoviciana* (Louisiana square-head), *Prunus gracilis* (sandhill plum), and others.

**Current Extent and Status:**

Presettlement extent of Western Xeric Sandhill Woodland habitat is estimated to have been 50,000 to 100,000 acres, with 10 to 25 % remaining today (Smith 1993). Northern Caddo Parish is a “hotspot” for this habitat with a relatively high concentration of sandhill woodlands. However, most of the sandhill woodlands there are highly degraded (MacRoberts and MacRoberts 1995). There are opportunities for restortation of this habitat in Caddo Parish.



There are several protected examples of sandhill woodlands on KNF in Natchitoches Parish, including one that is registered with the Louisiana Natural Areas Registry Program (Saline Bayou Sandylands Natural Areas, 64 acres). There is a well-known stream terrace sandhill woodland site near Goldonna in Winn Parish on an in-holding within KNF. The site has been known as a unique botanical area since the 1930s. The condition of the interior of the woodland needs to be determined.

There is a high concentration of stream terrace sandy woodlands mainly along the Calcasieu River and its tributaries in southwest Louisiana, as well as along the Sabine River. The principle soil series supporting these woodlands is Bienville loamy fine sand. Recent inspection of aerial photographs revealed that many of these stream terrace sandy woodlands, particularly the largest and highest in elevation, have been converted to densely-stocked pine plantations. At present there are only fragments of this habitat known in southwest Louisiana. Locating and protecting remaining examples of this habitat should be a conservation priority.

<b>WESTERN XERIC SANDHILL WOODLANDS SPECIES OF CONSERVATION CONCERN (15)</b>		
<b>AMPHIBIANS</b> Strecker's Chorus Frog	Loggerhead Shrike Prairie Warbler Field Sparrow	<b>MAMMALS</b> Ringtail
<b>BIRDS</b> Northern Bobwhite American Woodcock Yellow-billed Cuckoo Chuck-Will's-Widow	<b>BUTTERFLIES</b> Wild Indigo Duskywing Cobweb Skipper	<b>REPTILES</b> Western Slender Glass Lizard Southern Prairie Skink Northern Scarlet Snake Louisiana Pine Snake

**Priority Species Research and Survey Needs:**

Chuck-Will's-Widow: Research is needed to better understand the population dynamics of this species. Studies should focus on distribution patterns, habitat availability and use, nesting success, and territory size requirements. Implementation of night-time surveys along with sighting reports by foresters, birders, etc. are needed to augment sparse BBS records.

Loggerhead Shrike: BBS data for the period 1966-2000 indicate a 71% population decline range-wide. Monitoring of reproductive success and the effects of pesticides in reducing food availability are needed along with statewide evaluation of changes in available habitat.

Butterflies: Conduct surveys to determine the current distribution and abundance of all butterfly species, especially species of conservation concern, for inclusion in the LNHP database.

Ringtail: Louisiana represents the eastern edge of its range. Intensive surveys are needed to determine its current status in Louisiana.

Western Slender Glass Lizard: Occurrence in Western Xeric Sandhill Woodlands likely but imperfectly known. Glass lizards are declining over much of their range, regardless of habitat alteration. Determine the extent of any correlations between glass lizard occurrence and Western Xeric Sandhill Woodlands.

Louisiana Pine Snake: A sandhill specialist with a severely reduced range. Sandhills are also necessary for its principle prey – Baird's Pocket Gopher (*Geomys breviceps*). The quality of remaining habitat has been degraded due to logging, fire suppression, short-rotation silviculture, and conversion to pasture lands. Some of the best remaining populations occur on industrial forest lands. Continue to support research into this species life history, limiting factors that reduce reproductive success, and the use of herbicides instead of prescribed burning on composition and/or density of ground cover vegetation and its effects on pocket gophers.

***Species Conservation Strategies:***

1. Chuck-Will's-Widow: Work with federal agencies and bird conservation organizations to produce technical pamphlets highlighting the habitat and management requirements of this species and make them available to landowners.
2. Louisiana Pine Snake:
  - Maintain open canopy pine woodland in xeric sandhill community.
  - Eliminate root chopping at sites under timber management.
  - Continue to work with timber industry, USFS, and USFWS to promote habitat and species conservation strategies to increase populations on quality sites.
  - Implement conservation and management recommendations of SWG project T10 upon completion.

***Threats Affecting Habitat:***

The following table illustrates the threats identified for this habitat type and the sources of these threats. This represents all threats and sources of threats identified across all ecoregions of the state where this habitat occurs.

Source of Threat	Threat			
	Altered Composition/ Structure	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation
Commercial/industrial development		XXX		XXX
Conversion to agriculture or other forest types		XXX		XXX
Development/maintenance of pipelines, roads or utilities		XXX		XXX
Fire suppression	XXX			
Incompatible forestry practices	XXX		XXX	
Oil or gas drilling		XXX		XXX
Parasites/pathogens	XXX			
Recreational use/vehicles			XXX	
Residential development		XXX	XXX	XXX

***Habitat Conservation Strategies:***

1. Conduct surveys to determine the current extent and condition of this habitat type.
2. Develop management plans/recommendations for this habitat type.
3. Develop relationships with mineral rights owners and work to minimize impacts from mineral extraction activities.
4. Provide education/outreach to promote conservation and preservation of this habitat type.
5. Identify priority areas for land acquisition or preservation/conservation.
6. Work with land managers/hunting clubs/extension agents, etc. to discourage the placement of food plots in this habitat type.
7. Work with the legislature to provide incentives (tax breaks, etc.) to landowners to retain the natural state of areas where this habitat occurs.
8. Support research to understand the basic ecosystem characteristics and processes of this habitat type.
9. Provide educational information on this habitat type and its importance to species of conservation concern to landowners/land managers through technical pamphlets and the LDWF website.

***References:***

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## B. Aquatic Habitats

### 1. Freshwater Habitats

#### a. Atchafalaya Basin

##### *General Description:*

The Atchafalaya Basin, at nearly 1 million acres, is the nation's largest river-swamp system (Demas et al. 2001). Located in south-central Louisiana, the system stretches from the river's origin near Simmesport to its termination into the Atchafalaya Bay. It is contained on its east and west borders by flood protection levees. Water flow into the Atchafalaya Basin is controlled at the Old River control structure. The structure diverts 30% of Mississippi River water down through the Atchafalaya Basin (LDEQ 1993). A unique feature of the Atchafalaya Basin system is that it has one of the last active river deltas in the state (LCWCRTF 1993).



The Atchafalaya Basin has many commercial uses including commercial fishing, trapping, logging, oil and gas production, nature tours, and limited commerce. Recreational activities include fishing, hunting, camping, bird watching, swimming, and boating. Species diversity of the Atchafalaya Basin ecosystem ranges from wild turkeys in the bottomland hardwood forests of Pointe Coupee parish to blue crabs and shrimp in the coastal marshes.



There are roughly 100 species of freshwater fishes (W. Kelso, personal communication), 22 species of mussels (Vidrine 1993), and 10 species of crawfish (J. Walls, personal communication) found within the Atchafalaya Basin.

##### *Water Quality:*

The 2004 Water Quality Inventory Report (LDEQ 2004) indicated that 50% of the 12 water body subsegments within the basin were fully supporting their three primary designated uses. However, 50% of the subsegments were not supporting their designated use for fish and wildlife propagation. The suspected causes for these water quality



problems include: fecal coliform, suspended solids, sedimentation/siltation, mercury, turbidity, and low concentration of dissolved oxygen. The suspected sources of the water quality problems include: crop production, petroleum activities, channelization, dredging, industrial point sources, waste storage/tank leaks, and spills.

ATCHAFALAYA BASIN SPECIES OF CONSERVATION CONCERN (9)	
<b>FRESHWATER FISH</b>	<b>REPTILES</b>
Pallid Sturgeon	Alligator Snapping Turtle
Paddlefish	Ouachita Map Turtle
Bluehead Shiner	Mississippi Diamond-backed Terrapin
Blue Sucker	
Gulf Pipefish	
Western Sand Darter	

***Priority Species Research and Survey Needs:***

Blue Sucker: Additional surveys are needed, specifically targeting its preferred habitat, as recommended in WCRP project R1 (Bart and Rios 2003).

Fish: Taxonomic inventory of all fish species throughout the entire river basin are needed to determine their current population distributions and abundance.

Alligator Snapping Turtle: Baseline mark-release data were obtained during the late 1990s. New surveys are needed to obtain population trend data for this species.

***Species Conservation Strategies:***

1. Develop "white paper" on issues associated with Old River control structure as it affects on pallid sturgeon and address these issues with the COE.

***Threats Affecting Basin:***

The following table illustrates the threats identified for the Atchafalaya Basin and the sources of these threats. This represents all threats and sources of threats identified for this basin.

Source of Threat	Threat								
	Altered Composition/ Structure	Altered Water Quality	Competition for Resources	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation	Modification of water levels; changes in natural flow patterns	Nutrient Loading	Sedimentation
Channelization of rivers or streams	XXX	XXX		XXX	XXX	XXX	XXX	XXX	XXX
Construction of navigable waterways	XXX	XXX		XXX	XXX	XXX	XXX	XXX	XXX
Dam construction	XXX			XXX			XXX		
Invasive/alien species	XXX		XXX	XXX			XXX		
Levee or dike construction	XXX	XXX		XXX		XXX	XXX	XXX	XXX
Oil or gas drilling					XXX		XXX		
Operation of dams or reservoirs	XXX			XXX			XXX	XXX	XXX
Shoreline stabilization	XXX			XXX			XXX	XXX	XXX

***Basin Conservation Strategies:***

1. Promote oil spill prevention (Spill Prevention Control, SPC) regulations and natural resource response mechanisms (Natural Resource Damage Assessments, NRDA).
2. Promote the use of BMP’s for water runoff. Promote enforcement of sanitary regulations.
3. Promote methods to restore historical flow regimes within the Atchafalaya Basin.
4. Monitor nutrient inputs/water quality (utilize existing data, USGS stations).
5. Support research efforts.
6. Prepare educational material on potential impacts of invasive species in the Atchafalaya Basin.
7. Coordinate with Atchafalaya Basin Program (LDNR) and BTNEP to abate a multitude of threats to this basin.

***References:***

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DEMAS, C. R., S. R. BRAZELTON, AND N. J. POWELL. 2001. The Atchafalaya Basin—River of Trees. USGS fact sheet 021-02. Website. <http://la.water.usgs.gov/pdfs/rivertree-web.pdf>.

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VIDRINE, M. F. 1993. The historical distribution of freshwater mussels in Louisiana. Gail Q. Vidrine Collectables. Eunice, LA. 225 pp.

## b. Barataria Basin

### *General Description:*

The upper Barataria Basin was formed approximately 3,500-4,000 years ago as part of the Lafourche Delta complex. Encompassing approximately 300,000 acres, it is bordered on the north and east by the levees of the Mississippi River, which were constructed after the flood of 1927, on the west by Bayou Lafourche and on the south by the Gulf of Mexico. The basin is mainly comprised of the following 4 terrestrial habitat types: ag-crop-grasslands (primarily sugarcane), bottomland hardwood forests, cypress-tupelo swamps, and coastal marshes which range from fresh to salt water. Almost all freshwater input is from local precipitation with minor inflow from the Greater Intracoastal Waterway (LaCoast 2005). Wetland loss due to coastal erosion is a major environmental issue affecting the basin.



There are roughly 55 species of freshwater fishes (W. Kelso, personal communication) and 9 species of crawfish (J. Walls, personal communication) found within the Barataria Basin. The basin supports many commercial activities ranging from sugarcane production and aquaculture to commercial fishing, trapping, logging, and oil and gas production. Recreational activities include fishing, hunting, bird watching, swimming, and boating.

### *Water Quality:*

The 2004 Water Quality Inventory Report (LDEQ 2004) indicated that 35% of the 26 water body subsegments within the basin were fully supporting their three primary designated uses. However, 65% of the subsegments were not supporting their designated use for fish and wildlife propagation. The suspected causes for these water quality problems include: metals, nutrients, oil and grease, fecal coliform, low concentration of dissolved oxygen, dissolved and suspended solids, and turbidity. The suspected sources of the water quality problems include: crop production, pastureland, urban runoff, septic tanks, spills, minor industrial point sources, petroleum activities, highway and maintenance runoff, hydromodification, and dredging.

<b>BARATARIA BASIN SPECIES OF CONSERVATION CONCERN (4)</b>	
<b>FRESHWATER FISH</b>	<b>REPTILES</b>
Paddlefish	Alligator Snapping Turtle
Gulf Pipefish	Mississippi Diamond-backed Terrapin

**Priority Species Research and Survey Needs:**

Fish: Taxonomic inventory of all fish species throughout the entire river basin are needed to determine their current population distributions and abundance.

Mississippi Diamondback Terrapin: The status of this species is unknown. Endangered Species Act candidate status is pending. Evaluate trawl data from LDWF Marine Fisheries trawl surveys for distribution estimates. Initiate surveys in vicinity of recent trawl captures to assess current population abundance.

**Species Conservation Strategies:**

1. Mississippi Diamondback Terrapin: Conservation of coastal dune habitat is paramount to terrapin reproduction. Continued removal of abandoned crab traps will drastically reduce incidental mortality.
2. Initiate long-term sampling to identify trends in the distribution and abundance of native and invasive species within the Barataria Basin.
3. Work with LCA, CWPPRA to incorporate strategies developed for aquatic species of conservation concern into future coastal restoration efforts.

**Threats Affecting Basin:**

The following table illustrates the threats identified for the Barataria Basin and the sources of these threats. This represents all threats and sources of threats identified for this basin.

Source of Threat	Threat						
	Altered Composition/Structure	Altered Water Quality	Habitat Disturbance	Modification of Water Levels; Changes in Natural Flow Patterns	Nutrient Loading	Salinity Alteration	Sedimentation
Channelization of rivers or streams	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Commercial/industrial development	XXX	XXX	XXX			XXX	XXX
Construction of ditches, drainage or diversion systems	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Construction of navigable waterways	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Incompatible forestry practices	XXX	XXX	XXX		XXX		XXX
Invasive/alien species	XXX	XXX	XXX				
Levee or dike construction	XXX	XXX	XXX	XXX			
Mining practices	XXX	XXX	XXX	XXX	XXX		XXX
Oil or gas drilling	XXX	XXX	XXX	XXX	XXX	XXX	XXX

***Basin Conservation Strategies:***

1. Support efforts to construct fresh water diversion canals from the Mississippi River into the Barataria Basin.
2. Work with BTNEP to coordinate efforts to abate threats to this basin.

***References:***

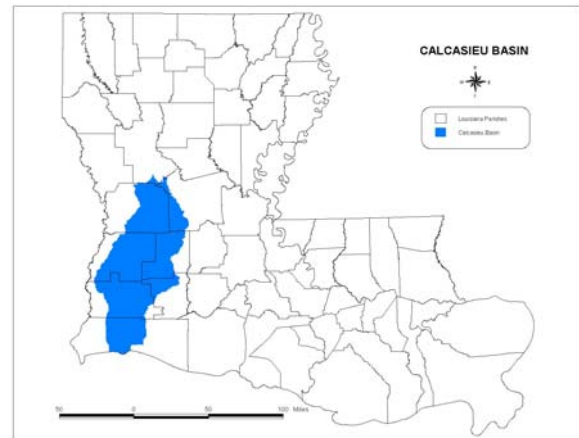
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LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY. 2004. Louisiana Water Quality Inventory: Integrated Report. Water Quality Assessment Division, Standards Assessment and Nonpoint Source Section. Baton Rouge, LA. 110 pp.

## c. Calcasieu Basin

### *General Description:*

The Calcasieu River Basin, located in southwest Louisiana, comprises approximately 4,105 square miles of drainage area and represents 8 percent of the area of the state. Headwaters of the river are found in the hills west of the city of Alexandria. Flow is in a southerly direction for about 215 miles to the Gulf of Mexico where it empties at a point 30 miles east of the Louisiana-Texas state line. From the upland hills with elevations generally being around 260 feet above mean sea level (a maximum of 400 feet



above mean sea level) the river flows through the coastal prairie and coastal marshes, which have an elevation ranging from 1-2 feet above mean sea level. The flood plains are extremely flat with little relief and average 2-3 feet above mean sea level. The river flows through the following lakes: Lake Charles, Prien Lake, Moss Lake and Calcasieu Lake. Dominant features include oxbow lakes, natural levees and the surrounding Pleistocene Uplands (Weston 1974). The city of Lake Charles lies in the southern portion of the basin and this area has been heavily industrialized by petro-chemical plants.

The Calcasieu river varies from a small fast flowing stream in the headwaters to a broad, sluggish estuary from the latitude of Lake Charles to its entrance into the gulf. Flows in the upper basin may range from a high of 180,000 cubic feet per second in the winter and spring to zero during the summer and fall. The lower portion of the river from the city of Lake Charles to the gulf is subject to tidal variation. A semidiurnal tide extends 65 miles upstream and has mean tidal ranges of 1.7 feet at the river mouth and 0.7 foot at Lake Charles. An existing saltwater barrier across the Calcasieu River at Lake Charles divides the upper and lower basins and prevents saltwater intrusion from degrading this major source of irrigation water supply for rice production. Navigation improvements have modified the Calcasieu from its mouth approximately 52.6 river miles inland (Weston 1974).

There are roughly 75 species of freshwater fishes (W. Kelso, personal communication), 30 species of mussels (Vidrine 1993), and 16 species of crawfish (J. Walls, personal communication) found within the Calcasieu Basin.

### *Water Quality:*

The 2004 Water Quality Inventory Report (LDEQ 2004) indicated that 23% of the 39 water body subsegments within the basin were fully supporting their three primary designated uses. However, 71% of the subsegments were not supporting their designated

use for fish and wildlife propagation. The suspected causes for these water quality problems include: metals, nutrients, fecal coliform, organic enrichment and low concentration of dissolved oxygen, dissolved and suspended solids, and turbidity. The suspected sources of the water quality problems include: home sewage systems, agriculture, silviculture, urban storm water runoff, and dredging.

CALCASIEU BASIN SPECIES OF CONSERVATION CONCERN (11)		
<b>CRUSTACEANS</b>	Western Sand Darter	<b>REPTILES</b>
Calcasieu Painted Crawfish	Bigscale Logperch	Alligator Snapping Turtle
Teche Painted Crawfish		Mississippi Diamond-backed Terrapin
Old Prairie Crawfish	<b>MUSSELS</b>	
	Sandbank Pocketbook	
<b>FRESHWATER FISH</b>	Louisiana Pigtoe	
Paddlefish	Southern Creekmussel	

***Priority Species Research and Survey Needs:***

Fish: Taxonomic inventory of all fish species throughout the entire river basin are needed to determine their current population distributions and abundance.

Mussels: Surveys are needed to update historic occurrence records and develop new baseline data on current species population distributions and abundance.



Calcasieu painted crawfish

Crustaceans: Continued surveys of historic locality records are needed to update species abundance and distribution data for inclusion in the LNHP database.

Mississippi Diamondback Terrapin: The status of this species is unknown. Endangered Species Act candidate status is pending. Evaluate trawl data from LDWF Marine Fisheries trawl surveys for distribution estimates. Initiate surveys in vicinity of recent trawl captures to assess current population abundance.

***Species Conservation Strategies:***

1. Identify sites where low head dams are present and evaluate their effects on fish distribution/dispersal patterns. Develop recommendations to improve fish passage through low head dams.
2. Sampling is needed to identify trends in the range and abundance of invasive fish species (especially carp). Incorporate recommendations of State Management Plan for Aquatic Invasive Species (LDWF 2005) to control invasive fish species.



**Threats Affecting Basin:**

The following table illustrates the threats identified for the Calcasieu Basin and the sources of these threats. This represents all threats and sources of threats identified for this basin.

Source of Threat	Threat							
	Altered Composition/Structure	Altered Water Quality	Habitat Destruction or Conversion	Habitat Fragmentation	Modification of Water Levels; Changes in Natural Flow Patterns	Salinity Alteration	Sedimentation	Toxins/Contaminants
Channelization of rivers or streams	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Commercial/industrial development	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Construction of ditches, drainage or diversion systems	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Construction of navigable waterways	XXX	XXX		XXX	XXX	XXX	XXX	XXX
Conversion to agriculture or other forest types							XXX	
Development/maintenance of pipelines, roads or utilities	XXX	XXX		XXX	XXX	XXX	XXX	XXX
Industrial discharge	XXX	XXX		XXX	XXX	XXX	XXX	XXX
Operation of drainage or diversion systems	XXX	XXX		XXX	XXX	XXX	XXX	XXX
Residential development	XXX	XXX		XXX	XXX	XXX	XXX	XXX

**Basin Conservation Strategies:**

1. Support current initiatives and develop new programs where necessary that help reduce siltation and sedimentation throughout the Calcasieu Basin.
2. Work with the Louisiana Aquatic Nuisance Species Task Force (LANSTF) to identify and address threats related to invasive species.
3. Develop partnerships with regulatory agencies to share data on habitat threats and to ensure compliance of existing regulations.
4. Develop an internal procedure to distribute information on proposed reservoirs to LDWF fisheries biologists to solicit their input into LDWF comments on these proposed documents.

**References:**

LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY. 2004. Louisiana Water Quality Inventory: Integrated Report. Water Quality Assessment Division, Standards Assessment and Nonpoint Source Section. Baton Rouge, LA. 110 pp.

LOUISIANA DEPARTMENT OF WILDLIFE AND FISHERIES. 2004b. State Management Plan for Aquatic Invasive Species in Louisiana. Draft. Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.

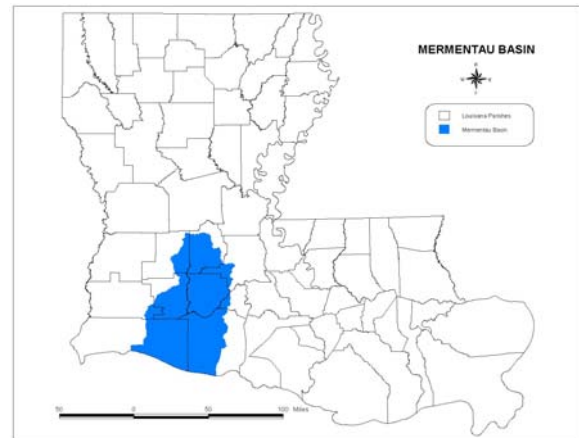
VIDRINE, M. F. 1993. The historical distribution of freshwater mussels in Louisiana. Gail Q. Vidrine Collectables. Eunice, LA. 225 pp.

WESTON, R. F. INC. 1974. Water Quality Management Plan for the Calcasieu River Basin. Prepared for Louisiana Health and Social and Rehabilitation Services Administration.

## d. Mermentau Basin

### *General Description:*

The Mermentau River Basin is located in the southwestern part of Louisiana and comprises a drainage area of approximately 6,730 square miles. This basin, located between the Teche-Vermilion and Calcasieu river basins, comprises a controlled system for the drainage of Mermentau River and its tributaries. Catfish Point and Schooner Bayou Control Structures and Calcasieu and Leland Bowman Locks control the impoundment of winter runoff for irrigation use in the summertime (COE 1998).



The basin is composed of 3 different and distinctive land forms which are arranged in broad bands from north to south. The northern part of the basin is a flatwoods area which gives way to an undulating landscape extending northward into the drainage basins of the Calcasieu and Red Rivers. To the south of the flatwoods area lies a broad prairie which extends from Bayou Teche on the east to a point near Vinton, Louisiana (located in the Calcasieu Basin) to the west. The prairie is characterized by large expanses of flat grassland dissected by the numerous tributaries of the basin and dotted with “islands” of oak trees and other mixed hardwoods. The prairie, which is extensively cultivated, gives way to a band of marshland which extends from east to west along Louisiana’s entire coastline. The marsh is further subdivided into a fresh water marsh, which borders the prairie to the north, then merges into intermediate and brackish marshes and finally terminating with salt water marsh which forms the coastline adjacent to the Gulf of Mexico and its bays (Domingue, Szabo & Assoc. Inc. 1975).

The lower portion of the basin is bounded on the east by Freshwater Bayou Channel, on the south by the Gulf of Mexico, on the west by Louisiana Highway 27, and on the north by the Gulf Intercoastal Waterway (GIWW). This portion of the basin contains about 450,000 acres of wetlands, consisting of 190,000 acres of fresh marsh, 135,000 acres of intermediate marsh, and 101,000 acres of brackish marsh. A total of 104,380 acres of marsh has converted to open water since 1932, a loss of 19% of the historical wetlands in the basin and represents 9% of wetland loss in Louisiana (LaCoast 2005).

There are roughly 64 species of freshwater fishes (W. Kelso, personal communication), 22 species of mussels (Vidrine 1993), and 13 species of crawfish (J. Walls, personal communication) found within the Mermentau Basin.

**Water Quality:**

The 2004 Water Quality Inventory Report (LDEQ 2004) indicated that 5% of the 20 water body subsegments within the basin were fully supporting their three primary designated uses. However, of the 20 subsegments, only the Mermentau River from the Catfish Point control structure to the Gulf of Mexico (Estuarine) was fully supporting its designated use for fish and wildlife propagation. The suspected causes for these water quality problems include: metals, nutrients, fecal coliform, organic enrichment and low concentration of dissolved oxygen, pesticides, dissolved and suspended solids, and turbidity. The suspected sources of the water quality problems include: home sewage systems, agriculture, silviculture, urban storm water runoff, and dredging.

MERMENTAU BASIN SPECIES OF CONSERVATION CONCERN (5)		
<b>CRUSTACEANS</b>	<b>FRESHWATER FISH</b>	<b>REPTILES</b>
Teche Painted Crawfish Old Prairie Crawfish	Paddlefish	Alligator Snapping Turtle Mississippi Diamond-backed Terrapin

**Priority Species Research and Survey Needs:**

Paddlefish: Continue with stock assessment surveys.

Crustaceans: Continue surveys to update historic locality records in order to update abundance and distribution data for inclusion in the LNHP database.



Mississippi Diamondback Terrapin: The status of this species is unknown. Endangered Species Act candidate status is pending. Evaluate trawl data from LDWF Marine Fisheries trawl surveys for distribution estimates. Initiate surveys in vicinity of recent trawl captures to assess current population abundance.

**Species Conservation Strategies:**

1. Sampling is needed to identify trends in the range and abundance of invasive fish species (especially carp). Incorporate recommendations of State Management Plan for Aquatic Invasive Species (LDWF 2004b) to control invasive fish species.
2. Crustaceans:
  - Develop strategies to abate further degradation of streams known to contain populations of crawfish species of conservation concern derived from SWG project T10 (Walls 2003).
  - Continue to monitor known populations through periodic surveys to maintain current database records.

**Threats Affecting Basin:**

The following table illustrates the threats identified for the Mermentau Basin and the sources of these threats. This represents all threats and sources of threats identified for this basin.

Source of Threat	Threat								
	Altered Composition/Structure	Altered Water Quality	Habitat Fragmentation	Modification of Water Levels; Changes in Natural Flow Patterns	Nutrient Loading	Salinity Alteration	Sedimentation	Toxins/Contaminants	
Channelization of rivers or streams	XXX	XXX	XXX	XXX		XXX	XXX		
Commercial/industrial development	XXX		XXX				XXX	XXX	
Construction of ditches, drainage or diversion systems	XXX		XXX	XXX		XXX			
Conversion to agriculture or other forest types		XXX		XXX	XXX		XXX		
Crop production practices	XXX	XXX		XXX	XXX		XXX	XXX	
Development/maintenance of pipelines, roads or utilities	XXX	XXX	XXX	XXX	XXX		XXX		
Incompatible forestry practices		XXX					XXX	XXX	
Industrial discharge		XXX						XXX	
Livestock production practices	XXX	XXX		XXX			XXX	XXX	
Operation of drainage or diversion systems	XXX	XXX		XXX	XXX	XXX	XXX		
Residential development	XXX	XXX	XXX	XXX			XXX	XXX	

**Basin Conservation Strategies:**

1. Work with LANSTF to identify and address threats related to invasive species.
2. Develop partnerships with regulatory agencies to share data on habitat threats and to ensure compliance of existing regulations.
3. Partner with federal and state agencies to address water quality issues in the Mermentau Basin (USGS, NRCS, LDEQ, LFA, LSU Ag Extension).
4. Support current initiatives and develop new programs where necessary that help reduce siltation and sedimentation throughout the Mermentau Basin.

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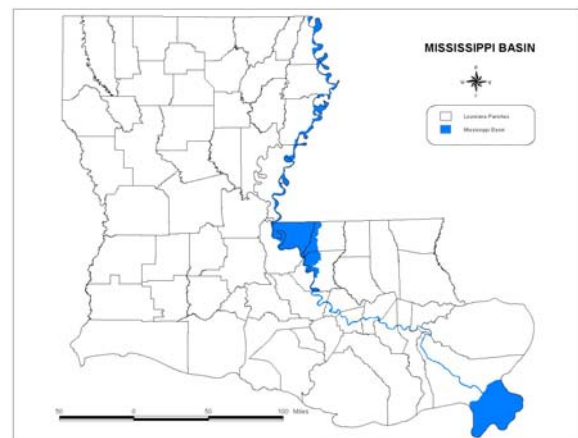
## e. Mississippi Basin

### *General Description:*

The portion of the Mississippi River which occurs in Louisiana is part of the Lower Mississippi Drainage Basin which extends from from Cairo, Illinois to Head-of-Passes in the Gulf of Mexico. Within Louisiana, the Mississippi Basin is comprised of the Mississippi river along with West Feliciana Parish, portions of East Feliciana Parish east of Redwood Creek, portions of East Baton Rouge Parish east of the Comite River and the city of Baton Rouge, and the delta. The river is completely leveed on its western side from the Arkansas line to Venice and on its eastern side from Baton Rouge to Venice.



The primary habitat types within the basin are batture lands, bottomland hardwood forests, and sandbars. The basin also contains all of the southern mesophytic forest found in Louisiana. The delta is characterized by river channels with attendant channel banks, natural bayous, and man-made canals which are interspersed with intermediate and fresh marshes.



The Mississippi River contains at least 260 different species of fish which comprises 25% of all fish species in North America (NPS 2004). There are roughly 54 species of freshwater fishes (W. Kelso, personal communication), 3 species of mussels (Vidrine 1993), and 13 species of crawfish (J. Walls, personal communication) found within the Mississippi Basin in Louisiana.

### *Water Quality:*

The 2004 Water Quality Inventory Report (LDEQ 2004) indicated that, of the 17 water body subsegments within the basin, the 3 water body subsegments comprising the Mississippi River from the Arkansas state line to the Head-of-Passes were fully supporting their three primary designated uses, 6 subsegments were partially meeting or not meeting their designated uses, and 8 had insufficient or no data. Of the 10 subsegments for which data was collected, 40% were not supporting their designated use for fish and wildlife propagation. The suspected causes for these water quality problems include: metals, nutrients, polychlorinated biphenyls (PCBs), hexachlorobenzene, fecal

coliform, organic enrichment and low concentration of dissolved oxygen, oil and grease, non-native aquatic plants, and turbidity. The suspected sources of the water quality problems include: home sewage systems, agriculture, silviculture, urban storm water runoff, and dredging.

MISSISSIPPI BASIN SPECIES OF CONSERVATION CONCERN (14)		
<b>CRUSTACEANS</b>	Chub Shiner	<b>MUSSELS</b>
Vernal Crawfish	Blunface Shiner	Fat Pocketbook
	Blue Sucker	
<b>FRESHWATER FISH</b>	Gulf Pipefish	<b>REPTILES</b>
Pallid Sturgeon	Rainbow Darter	Alligator Snapping Turtle
Paddlefish	Bigscale Logperch	Ouachita Map Turtle
Central Stoneroller		Mississippi Diamond-backed Terrapin

***Priority Species Research and Survey Needs:***

Pallid Sturgeon: Conduct research to assess current population abundance and genetic integrity of this species in the lower Mississippi River as recommended in WCRP project R1 (Bart and Rios 2003).

Blue Sucker: Additional surveys are needed, specifically targeting its preferred habitat as recommended in WCRP project R1 (Bart and Rios 2003).

Fat Pocketbook and Vernal Crawfish: Intensive surveys are needed to update current population distribution and abundance of these species in the LNHP database. Research is needed to evaluate current habitat threats and develop management strategies to abate these threats.

Alligator Snapping Turtle: Baseline mark-release data were obtained during the late 1990s. New surveys are needed to obtain population trend data for this species.

***Species Conservation Strategies:***

1. Turtles: Monitor the effects of the pet trade on population densities and determine the effects of human disturbance on nesting areas. Incorporate current management guidelines (i.e., PARC) and develop new guidelines to address data gaps.
2. Work with landowners to initiate or continue the implementation of conservation plans developed for amphibians and reptiles along with USFWS threatened and endangered species recovery plans over the next 10 years.

***Threats Affecting Basin:***

The following table illustrates the threats identified for the Mississippi Basin and the sources of these threats. This represents all threats and sources of threats identified for this basin.



Source of Threat	Threat						
	Altered Composition/ Structure	Altered Water Quality	Habitat Disturbance	Modification of Water Levels; Changes in Natural Flow Patterns	Nutrient Loading	Sedimentation	Toxins/ Contaminants
Channelization of rivers or streams	XXX	XXX	XXX	XXX		XXX	
Commercial/industrial development		XXX					XXX
Construction of ditches, drainage or diversion systems	XXX	XXX	XXX	XXX		XXX	
Construction of navigable waterways	XXX	XXX	XXX	XXX		XXX	
Crop production practices		XXX			XXX		XXX
Industrial discharge		XXX					XXX
Invasive/alien species	XXX		XXX				
Livestock production practices		XXX			XXX		
Mining practices	XXX	XXX	XXX			XXX	XXX
Oil or gas drilling	XXX	XXX	XXX			XXX	XXX
Shoreline stabilization	XXX	XXX	XXX	XXX		XXX	

***Basin Conservation Strategies:***

1. Develop a comprehensive survey methodology for the Mississippi River and its tributaries.
2. Develop partnerships with regulatory agencies to share data on habitat threats and to ensure compliance of existing regulations.
3. Work with LANSTF to identify and address threats related to invasive species.
4. Prepare educational material on importance of access to the Mississippi River.
5. Work with local agencies and the public to develop access to the river.
6. Continue LDWF involvement in the environmental review process of all river related projects. Identify potential impacts and recommend appropriate mitigation.
7. Work with Lower Mississippi River Conservation Committee (LMRCC) on important river issues.

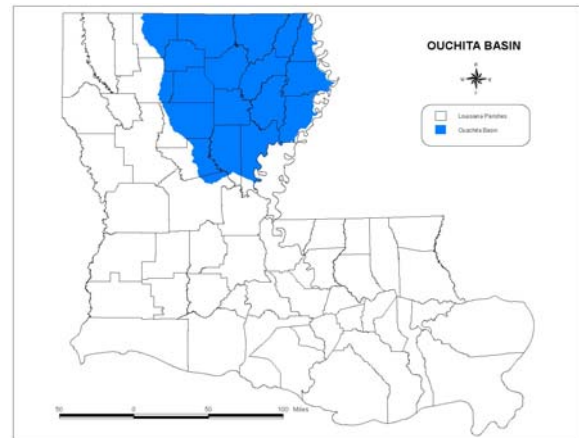
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## f. Ouachita Basin

### *General Description:*

The Ouachita River system is the principal drainage for south Arkansas and northeast Louisiana, draining an approximate area of 26,000 square miles. The source of the river is found in the Ouachita Mountains of west-central Arkansas near the Oklahoma border. The river flows south through northeast Louisiana and joins with the Tensas River north of the town of Jonesville to form the Black River, which empties into the Red River. The total length of the river is 542 miles. In Louisiana, the Ouachita Basin covers 10,000 square miles of drainage area (LDEQ 1993) which mostly consists of rich alluvial plains cultivated in soybeans, cotton, and corn. The northwest corner of the basin is forested in pine, much of which is commercially harvested. Bayou Bartholomew and Bayou D'Arbonne are the major tributaries of the Ouachita.



There are two lock and dams on the Ouachita in Louisiana. The Jonesville and Columbia lock and dams were constructed by the COE and opened to navigation in 1972. Each structure impounds a slack-water pool approximately 100 miles long. Benefits to fish and wildlife of the Ouachita-Black navigation project in Louisiana include the Catahoula Diversion Channel and Control Structure and the Little River Closure Dam. The diversion channel and structure and closure dams are located in the Jonesville Lock and Dam pool southwest of Jonesville. The diversion channel diverts flows from Catahoula Lake into Black River, downstream from the lock and dam. The control structure is used to regulate the flow entering the diversion channel from the lake. The closure dam is located on Little River. These features allow for regulation of stages in the lake to permit its continued use as a resting and feeding area for migratory waterfowl (COE 1998).

There are roughly 118 species of freshwater fishes (W. Kelso, personal communication), 49 species of mussels (Vidrine 1993), and 19 species of crawfish (J. Walls, personal communication) found within the Ouachita Basin.

### *Water Quality:*

The 2004 Water Quality Inventory Report (LDEQ 2004) indicated that 22% of the 61 water body subsegments within the basin were fully supporting their three primary designated uses. However, 76% of the subsegments were not supporting their designated use for fish and wildlife propagation. The suspected causes for these water quality problems include: metals, pesticides, nutrients, fecal coliform, organic enrichment and

low concentration of dissolved oxygen, oil and grease, non-native aquatic plants, sedimentation/siltation, and turbidity. The suspected sources of the water quality problems include: home sewage systems, agriculture, silviculture, urban storm water runoff, surface mining, and dredging.

OUACHITA BASIN SPECIES OF CONSERVATION CONCERN (24)			
<b>CRUSTACEANS</b>	Bluehead Shiner	Pink Mucket	Rabbitsfoot
	Vernal Crawfish	Fatmucket	Monkeyface
	Elegant Crawfish	<b>MUSSELS</b>	Squawfoot
		Mucket	
<b>FRESHWATER FISH</b>	Western Fanshell	Black Sandshell	
	Butterfly	Hickorynut	<b>REPTILES</b>
	Bigeye Shiner	Pyramid Pigtoe	Alligator Snapping Turtle
	Steelcolor Shiner	Fat Pocketbook	Ouachita Map Turtle
	Ebonysshell	Ouachita Kidneyshell	

***Priority Species Research and Survey Needs:***

Crustaceans: Continue surveys to update historic locality records in order to update abundance and distribution data for inclusion in the LNHP database.

Mussels: Surveys are needed to update historic occurrence records and develop new baseline data on current species population distributions and abundance.

Alligator Snapping Turtle: Baseline mark-release data were obtained during the late 1990s. New surveys are needed to obtain population trend data for this species.



Alligator Snapping Turtle

***Species Conservation Strategies:***

1. Develop a comprehensive survey methodology to determine long term trends in freshwater fish population abundances of the entire Ouachita Basin.
2. Mussels: Implement conservation and management strategies from SWG project T10 upon completion.

***Threats Affecting Basin:***

The following table illustrates the threats identified for the Ouachita Basin and the sources of these threats. This represents all threats and sources of threats identified for this basin.

Source of Threat	Threat									
	Altered Composition/ Structure	Altered Water Quality	Competition for Resources	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation	Modification of Water Levels; Changes in Natural Flow Patterns	Nutrient Loading	Sedimentation	Toxins/ Contaminants
Channelization of rivers or streams				XXX	XXX	XXX			XXX	
Construction of ditches, drainage or diversion systems				XXX	XXX	XXX	XXX		XXX	
Construction of navigable waterways				XXX	XXX		XXX		XXX	
Conversion to agriculture or other forest types				XXX			XXX	XXX	XXX	
Crop production practices		XXX	XXX	XXX	XXX		XXX	XXX		XXX
Dam construction	XXX			XXX	XXX		XXX		XXX	
Development/maintenance of pipelines, roads or utilities				XXX	XXX	XXX	XXX		XXX	
Incompatible forestry practices				XXX	XXX				XXX	XXX
Industrial discharge		XXX								XXX
Invasive/alien species			XXX							
Levee or dike construction				XXX	XXX		XXX		XXX	
Livestock production practices		XXX			XXX			XXX	XXX	
Oil or gas drilling					XXX	XXX				
Operation of dams or reservoirs					XXX		XXX		XXX	
Operation of drainage or diversion systems					XXX		XXX		XXX	
Mining practices				XXX	XXX				XXX	XXX
Residential development		XXX		XXX	XXX	XXX		XXX		
Wetland fill					XXX				XXX	

***Basin Conservation Strategies:***

1. Improve partnerships with LDEQ, NRCS, TNC, LSU CoOp Extension Service and others to share data on threats to this watershed and participate in the development of future strategies to abate these identified threats.
2. Work with LANSTF to identify and address threats related to invasive species.
3. Prepare educational material on potential impacts of invasive species to the Ouachita River and its tributaries.
4. Continue LDWF involvement in the environmental review process of all river related projects. Identify potential impacts and recommend appropriate mitigation.
5. Develop education and outreach programs with NRCS to reduce sediments and nutrient loading within the Ouachita Basin.
6. Work with LMRCC on important river issues.

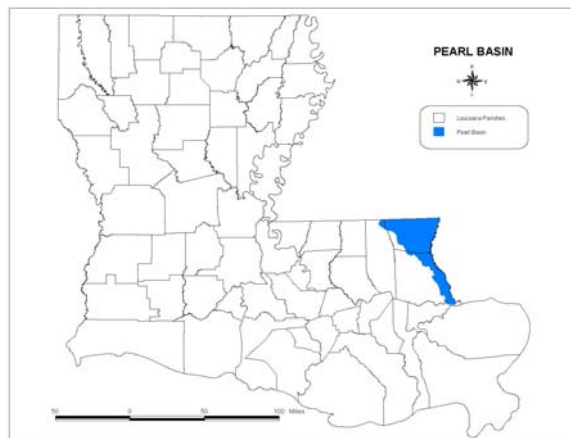
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- VIDRINE, M. F. 1993. The historical distribution of freshwater mussels in Louisiana. Gail Q. Vidrine Collectables. Eunice, LA. 225 pp.

## **g. Pearl Basin**

### ***General Description:***

The Pearl River basin's drainage area covers about 7,800 square miles (Storm 2005) and lies within two states, Mississippi and Louisiana. Land use within the basin is predominately agriculture and forestry. Urbanization is steadily increasing as residents from the metropolitan areas of New Orleans continue to emigrate into St. Tammany and Washington Parishes.



The East Pearl River system is one of Louisiana and Mississippi's principal rivers, draining an approximate area of 8,760 square miles. The river divides into distinct channels west of Picayune, Mississippi where the main stream is known as the West Pearl River. The East Pearl River is formed by a confluence of the Hobolochitto Creek and Farris Slough, and forms the boundary between Mississippi and Louisiana. The East Pearl River drains into Lake Borgne and eventually into the Mississippi Sound.

The Pearl River Basin is the most unaffected of all the state's river basins, however future development pressures and changes in land use practices could seriously degraded the habitat in this basin. Main channel and side channel habitats throughout the basin are threatened by the operation of dams or reservoirs. Threats such as the headwater dam (Ross Barnett Reservoir) at Jackson, Mississippi have changed normal historic flow patterns in the lower Pearl Basin. Future proposals for new reservoirs south of Jackson will further compound the interruption of normal flow patterns to that portion of the river below these reservoirs. Degradation of other habitats (tributaries, backwaters, and swamps) have been less severe primarily due to a lack of accessibility to most of these areas. Erosion and sedimentation, aided by farming practices, are the prime contributors to non-point source pollution effecting habitat loss. Historic mining practices on the Pearl and Bogue Chitto Rivers have interfered with the spawning cycle of the Alabama Shad. Removal of sand and gravel has greatly reduced the available substrates necessary for this species reproduction.

The COE project "Pearl River Navigation Channel" completed in the 1950's has had a lasting impact on the habitat of the basin. The placement of 2 low water sills and 3 navigation locks on the Pearl River have altered the historic migration routes and the overall life cycles of the Gulf Sturgeon. The Alabama Shad, which has experienced significant declines in the last century, has had its spawning routes blocked by the placement of these structures. Historic Paddlefish spawning and rearing areas have been altered due to these structures. With the decline of commercial traffic in the 70's, maintenance dredging was suspended and the locks were placed in caretaker status. A

request by local business interests in Slidell and Bogalusa to reevaluate the economic and environmental feasibility of maintaining the locks and navigation channel was submitted to the COE in the 80's and dredging of the river began in 1989. However, dredging was discontinued due to environmental concerns and the project is currently awaiting concurrence from federal and state regulators before it will continue (COE 1998).

Construction of Interstate-10 has had an impact on the bottomlands located along the Pearl River north of the highway. The ground-level sections of the highway act as a dam and have altered the natural hydrology and substantially increased sedimentation in many areas within Pearl River WMA.

The Pearl Basin, along with the Pontchartrain Basin, contains some of the greatest aquatic species diversity found in Louisiana. There are roughly 108 species of freshwater fishes (W. Kelso, personal communication), 20 species of mussels (Vidrine 1993), and 15 species of crawfish (J. Walls, personal communication) found within the Pearl Basin.

**Water Quality:**

The 2004 Water Quality Inventory Report (LDEQ 2004) indicated that 10% of the 23 water body subsegments within the basin were fully supporting their three primary designated uses. However, 78% of the subsegments were not supporting their designated use for fish and wildlife propagation. The suspected causes for these water quality problems include: metals, nutrients, fecal coliform, organic enrichment and low concentration of dissolved oxygen, pH levels, and turbidity. The suspected sources of the water quality problems include: home sewage systems, agriculture (particularly pasturelands), silviculture, urban storm water runoff, and surface mining.

PEARL BASIN SPECIES OF CONSERVATION CONCERN (26)		
<b>CRUSTACEANS</b>	Silverjaw Minnow	Elephant-Ear
Ribbon Crawfish	River Redhorse	Mississippi Pigtoe
Plain Brown Crawfish	Frecklebelly Madtom	Inflated Heelsplitter
Flatwoods Digger	Crystal Darter	Southern Rainbow
	Channel Darter	
<b>FRESHWATER FISH</b>	Freckled Darter	<b>REPTILES</b>
Gulf Sturgeon	Pearl Darter	Alligator Snapping Turtle
Paddlefish	Gulf Logperch	Ringed Map Turtle
Alabama Shad		Pascagoula Map Turtle
Flagfin Shiner	<b>MUSSELS</b>	Mississippi Diamond-backed Terrapin
Bluenose Shiner	Rayed Creekshell	Stripe-necked Musk Turtle

**Priority Species Research and Survey Needs:**

Fish: Conduct surveys to determine the presence of species of conservation concern within their historic ranges in the basin.

Crustaceans: Continue surveys to update historic locality records in order to update abundance and distribution data for inclusion in the LNHP database.



Mussels: Surveys are needed to update historic occurrence records and develop new baseline data on current species population distributions and abundance.

Alligator Snapping Turtle: Baseline mark-release data were obtained during the late 1990s. New surveys are needed to obtain population trend data for this species.

***Species Conservation Strategies:***

1. Alabama Shad: Reintroduce species to its original Louisiana drainages.
2. Gulf Sturgeon:
  - Implement conservation actions recommended in SWG project T8 (LDWF 2005) and recovery plan (USFWS et al. 1995c).
  - Prepare "white paper" on the importance of access for sturgeon to spawning areas in the Pearl Basin. Meet with COE and USFWS to discuss fish passage issues.
3. Mussels: Implement conservation and management strategies from SWG project T10 upon completion.
4. Support and expand the fish passage study currently being conducted in the Mississippi portion of the Pearl River.
5. Develop a comprehensive survey methodology for the Pearl River and its tributaries to fill data gaps for this critical drainage basin.



***Threats Affecting Basin:***

The following table illustrates the threats identified for the Pearl Basin and the sources of these threats. This represents all threats and sources of threats identified for this basin.

Source of Threat	Threat						
	Altered Composition/Structure	Altered Water Quality	Habitat Destruction or Conversion	Habitat Disturbance	Modification of Water Levels; Changes in Natural Flow Patterns	Nutrient Loading	Sedimentation
Channelization of rivers or streams	XXX	XXX	XXX	XXX	XXX		XXX
Construction of ditches, drainage or diversion systems	XXX	XXX		XXX	XXX	XXX	XXX
Construction of navigable waterways	XXX		XXX				
Incompatible forestry practices	XXX	XXX		XXX	XXX		XXX
Mining practices	XXX	XXX		XXX	XXX		XXX
Operation of dams or reservoirs	XXX	XXX	XXX	XXX	XXX		XXX
Operation of drainage or diversion systems	XXX		XXX		XXX		XXX

***Basin Conservation Strategies:***

1. Coordinate with COE, MDWFP, MDEQ, LDEQ, NRCS, TNC and others to develop a comprehensive management strategy for the entire Pearl River.
2. Partner with LDEQ, the Lake Pontchartrain Basin Foundation (LPBF), TNC to address water quality issues in the Pearl River Basin.
3. Develop an internal procedure to distribute information on proposed reservoirs to LDWF district biologists and incorporate their input into official LDWF comments.
4. Support establishing levee breaks or set-backs to develop or replenish backwater areas.
5. Develop programs to eliminate entanglement gear in the Pearl River and its tributaries.
6. Encourage alternative bridge design to lessen impacts to aquatic habitats (pilings vs. culverts).
7. Promote public awareness concerning soil erosion problems resulting from construction activities. Provide the public with contact information ( e.g., hotline number) to report violations/problem sites.

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## h. Pontchartrain Basin

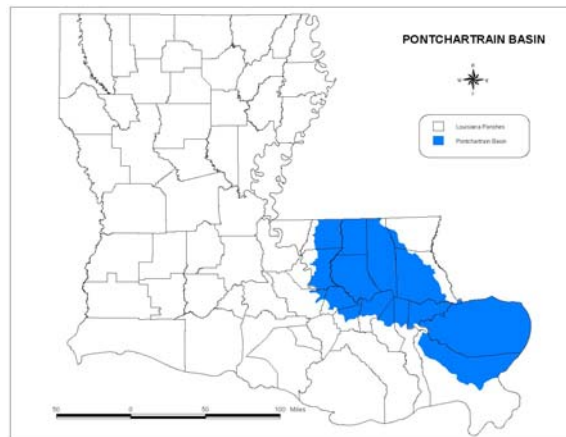
### *General Description:*

The Lake Pontchartrain Basin is a 4,700 square mile watershed in southeast Louisiana and southwest Mississippi. The topography of the basin ranges from more than 300 feet above sea level in the rolling hills along the Louisiana and Mississippi state line to sea level throughout the coastal wetlands to more than 10 feet below sea level in some areas of New Orleans.



Gulf sturgeon

The northern half of the basin is commonly referred to as the Florida Parishes and it contains all or portions of 7 parishes: East Baton Rouge, East Feliciana, Livingston, St. Helena, St. Tammany, Tangipahoa, and Washington. Many rivers drain the Florida Parishes, introducing fresh water into Lakes Maurepas, Pontchartrain and Borgne. The largest of these, the Pearl and Amite Rivers, have headwaters in Mississippi. The rivers of this basin have eroded and incised the uplands to form distinct river valleys.



Lakes Maurepas, Pontchartrain and Borgne form a shallow brackish receiving basin for fresh water from the Amite, Tickfaw, Blind, Tangipahoa, Tchefuncte, and Pearl Rivers, as well as Bayou Lacombe and Bayou Bonfouca. Fresh water is also introduced through regional drainage and diversion canals while salt water enters these lakes from the Gulf of Mexico via the Mississippi Sound, Mississippi River Gulf Outlet (MRGO), Chef Pass, and Rigolets Pass. The Mississippi River Deltaic Plain lies to the south of these lakes.

Land use within this basin is varied, ranging from high-density urban areas that drain through metropolitan Baton Rouge and New Orleans drainage canals to rural pastures and dairies in the Florida Parishes. In 1995, the LPBF released a comprehensive management plan for the basin that details management strategies to address sewage and agricultural runoff, stormwater runoff, and saltwater intrusion/wetland loss.

The Pontchartrain Basin, along with the Pearl Basin, contains some of the greatest aquatic species diversity found in the state. There are roughly 109 species of freshwater fishes (W. Kelso, personal communication), 35 species of mussels (Vidrine 1993), and 13

species of crawfish (J. Walls, personal communication) found within the Pontchartrain Basin.

**Water Quality:**

The 2004 Water Quality Inventory Report (LDEQ 2004) indicated that 37% of the 84 water body subsegments within the basin were fully supporting their three primary designated uses. However, 48% of the subsegments were not supporting their designated use for fish and wildlife propagation. The suspected causes for these water quality problems include: metals, nutrients, benzo(a)pyrene (a polycyclic aromatic hydrocarbon or PAH), fecal coliform, non-native aquatic plants, organic enrichment and low concentration of dissolved oxygen, oil and grease, dissolved and suspended solids, pH levels, sedimentation/siltation, and turbidity. The suspected sources of the water quality problems include: home sewage systems, agriculture (particularly pasturelands), silviculture, urban development, urban storm water runoff, industry, and sand and gravel mining.

PONTCHARTRAIN BASIN SPECIES OF CONSERVATION CONCERN (19)		
<b>CRUSTACEANS</b>	River Redhorse	Alabama Hickorynut
Ribbon Crawfish	Broadstripe Topminnow	Mississippi Pigtoe
Plain Brown Crawfish	Gulf Logperch	Inflated Heelsplitter
Flatwoods Digger		Southern Rainbow
	<b>MUSSELS</b>	<b>REPTILES</b>
<b>FRESHWATER FISH</b>	Rayed Creekshell	Alligator Snapping Turtle
Gulf Sturgeon	Elephant-Ear	Mississippi Diamond-backed Terrapin
Paddlefish	Southern Pocketbook	
Flagfin Shiner	Southern Hickorynut	

**Priority Species Research and Survey Needs:**

Mussels: Surveys are needed to update historic records and develop new baseline data on current species population distributions and abundance.

Alligator Snapping Turtle: Baseline mark-release data were obtained during the late 1990s. New surveys are needed to obtain population trend data for this species.

**Species Conservation Strategies:**

1. Implement species conservation strategies detailed in the LPBF plan (Maygarden et al. 2004).
2. Mussels:
  - Inflated Heelsplitter: Work with sand and gravel interests to restore and maintain habitat within the Amite River.
  - Implement conservation and management strategies from SWG project T10 upon completion.

**Threats Affecting Basin:**

The following table illustrates the threats identified for the Pontchartrain Basin and the sources of these threats. This represents all threats and sources of threats identified for this basin.

Source of Threat	Threat						
	Altered Composition/Structure	Altered Water Quality	Competition for Resources	Habitat Disturbance	Modification of Water Levels; Changes in Natural Flow Patterns	Nutrient Loading	Sedimentation
Channelization of rivers or streams	XXX	XXX		XXX	XXX		XXX
Construction of ditches, drainage or diversion systems	XXX	XXX		XXX	XXX		XXX
Conversion to agriculture or other forest types				XXX			
Crop production practices		XXX				XXX	
Development/maintenance of pipelines, roads or utilities				XXX			
Incompatible forestry practices	XXX	XXX		XXX			XXX
Invasive/alien species			XXX				
Livestock production practices						XXX	
Mining practices	XXX	XXX		XXX	XXX		XXX
Operation of dams or reservoirs	XXX	XXX			XXX		XXX
Operation of drainage or diversion systems		XXX		XXX	XXX		XXX
Recreational use/vehicles		XXX					XXX
Residential development		XXX				XXX	XXX
Shoreline stabilization				XXX			

**Basin Conservation Strategies:**

1. Develop a comprehensive stream survey methodology for the Pontchartrain Basin.
2. Develop partnerships with regulatory agencies to share data on habitat threats and to ensure compliance of existing regulations.
3. Work with LPBF and NRCS to promote conservation efforts/water quality/education/etc.
4. Implement habitat conservation strategies presented in LPBF plan.

***References:***

LOUISIANA DEPARTMENT ENVIRONMENTAL QUALITY. 2004. Louisiana Water Quality Inventory: Integrated Report. Water Quality Assessment Division, Standards Assessment and Nonpoint Source Section. Baton Rouge, LA. 110 pp.

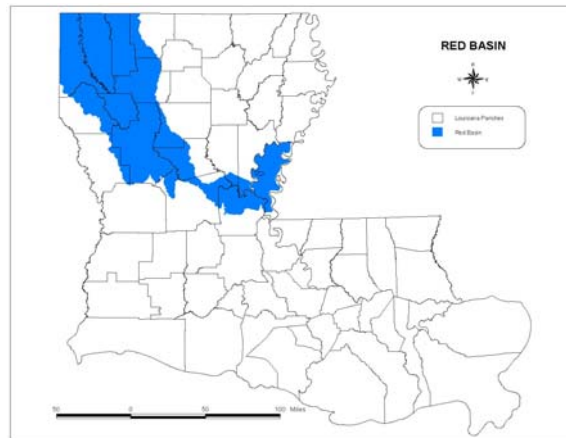
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VIDRINE, M. F. 1993. The historical distribution of freshwater mussels in Louisiana. Gail Q. Vidrine Collectables. Eunice, LA. 225 pp.

## **i. Red Basin**

### ***General Description:***

The Red River is one of Louisiana's major river systems and is located in the Mississippi drainage basin. The headwaters of the Red River begin in Curry County, New Mexico and it ends 1,360 miles downstream at the Mississippi River. The Red River watershed is 69,200 square miles (44,287,823 acres) (Ken Guidry, personal communication) and receives drainage from 5 states including New Mexico, Texas, Oklahoma, Arkansas, and Louisiana. The Red River drains approximately 7,760 square miles within Louisiana (COE 1998).



The Red River enters Louisiana from Arkansas in the northwest portion of the state and follows a southeasterly course, passing through or forming the boundary of 10 parishes, until it reaches its mouth at the Mississippi River. Shreveport and Alexandria are the principle cities located along the river. The Red River received its name from the high concentration of red soil present in the river following flood periods. Much of the basin is forested and agriculture lands are primarily located within the Red River's historic floodplain.

Navigational improvements on the Red River began in the early part of the 19<sup>th</sup> century. The most recent improvements, part of the \$1.9 billion Red River Waterway Project (RRWP) authorized by Congress with the Rivers and Harbors Act of 1968, consisted of dredging a channel 9 feet deep and 200 feet wide and adding a series of five lock and dam complexes to improve navigation from the Mississippi River to Shreveport. Other improvements within the RRWP consisted of developing a comprehensive plan for bank stabilization from the Denison Dam on the Texas/Oklahoma boarder to the Mississippi River.

There are roughly 99 species of freshwater fishes (W. Kelso, personal communication), 36 species of mussels (Vidrine 1993), and 18 species of crawfish (J. Walls, personal communication) found within the Red Basin.

### ***Water Quality:***

The 2004 Water Quality Inventory Report (LDEQ 2004) indicated that 23% of the 71 water body subsegments within the basin were fully supporting their three primary designated uses. However, 75% of the subsegments were not supporting their designated use for fish and wildlife propagation. The suspected causes for these water quality



problems include: metals, nutrients, polychlorinated biphenyls (PCBs), fecal coliform, non-native aquatic plants, organic enrichment and low concentration of dissolved oxygen, dissolved and suspended solids, pH levels, sedimentation/siltation, and turbidity. The suspected sources of the water quality problems include: forestry activities, crop production, pasture lands, home sewage systems, land development and urban runoff, channelization or dredging of streams, removal of riparian vegetation, and road construction.

RED BASIN SPECIES OF CONSERVATION CONCERN (17)		
<b>CRUSTACEANS</b>	Chub Shiner	<b>MUSSELS</b>
Kisatchie Painted Crawfish	Suckermouth Minnow	Louisiana Pearlshell
Javelin Crawfish	Bluehead Shiner	Louisiana Pigtoe
Vernal Crawfish	Blue Sucker	
Twin Crawfish	River Redhorse	<b>REPTILES</b>
	Crystal Darter	Alligator Snapping Turtle
<b>FRESHWATER FISH</b>	Western Sand Darter	Ouachita Map Turtle
Pallid Sturgeon		
Paddlefish		

Louisiana pearlshell

***Priority Species Research and Survey Needs:***

Crystal Darter: First recorded in the Red River in 2002, extending the documented range of this species westward (Pezold and Antwine 2003). Continue to survey its preferred habitat to determine its current distribution.

Louisiana Pearlshell: Research needed on host fish species.

Alligator Snapping Turtle: Baseline mark-release data were obtained during the late 1990s. New surveys are needed to obtain population trend data for this species.



***Species Conservation Strategies:***

1. Crustaceans: Develop a protocol to monitor abundance, distribution patterns, and habitat quality using baseline data obtained in SWG project T10 (Walls 2003).
2. Louisiana Pearlshell:
  - Develop a survey protocol to monitor the remaining populations, especially in streams located within the KNF.
  - Partner with the USFWS to implement conservation recommendations in the recovery plan (USFWS 1989).
  - Work with landowners to maintain water quality in the streams inhabited by the Louisiana pearlshell.

**Threats Affecting Basin:**

The following table illustrates the threats identified for the Red Basin and the sources of these threats. This represents all threats and sources of threats identified for this basin.

Source of Threat	Threat								
	Altered Composition/ Structure	Competition for Resources	Habitat Destruction or Conversion	Habitat Disturbance	Modification of Water Levels; Changes in Natural Flow Patterns	Nutrient Loading	Sedimentation	Toxins/ Contaminants	
Channelization of rivers or streams	XXX		XXX	XXX	XXX		XXX		
Commercial/industrial development							XXX	XXX	
Construction of ditches, drainage or diversion systems	XXX					XXX	XXX		
Construction of navigable waterways	XXX				XXX		XXX		
Crop production practices	XXX		XXX			XXX	XXX		
Dam construction	XXX		XXX	XXX	XXX	XXX	XXX		
Incompatible forestry practices			XXX	XXX			XXX		
Industrial discharge								XXX	
Invasive/alien species	XXX	XXX	XXX	XXX					
Levee or dike construction	XXX		XXX				XXX		
Management of/for certain species			XXX	XXX					
Operation of dams or reservoirs	XXX		XXX	XXX	XXX		XXX		
Operation of drainage or diversion systems	XXX		XXX				XXX		

**Basin Conservation Strategies:**

1. Develop a comprehensive survey methodology for the Red River Basin.
2. Conduct a detailed inventory of the Red River above Shreveport that focuses on habitats and species of conservation concern.
3. Develop partnerships with regulatory agencies to share data on habitat threats and to ensure compliance of existing regulations.
4. Work with LANSTF to identify and address threats related to invasive species.
5. Prepare educational material on potential impacts invasive species to the Red River.
6. Continue LDWF involvement in the environmental review process for all river basin related projects and identify appropriate mitigation methods.
7. Develop education and outreach programs with NRCS to reduce sediments and nutrient loading within the Red River Basin.

**References:**

LOUISIANA DEPARTMENT ENVIRONMENTAL QUALITY. 2004. Louisiana Water Quality Inventory: Integrated Report. Water Quality Assessment Division, Standards Assessment and Nonpoint Source Section. Baton Rouge, LA. 110 pp.

PEZOLD, F., AND M. ANTWINE. 2003. Status of rare and protected Inland Fishes of Louisiana. Final report submitted to Louisiana Natural Heritage Program, Louisiana Department of Wildlife and Fisheries. Baton Rouge, LA.

U.S. ARMY CORPS OF ENGINEERS. 1998. Water resources development in Louisiana. U.S. Army Corps of Engineers, New Orleans District. 191 pp.

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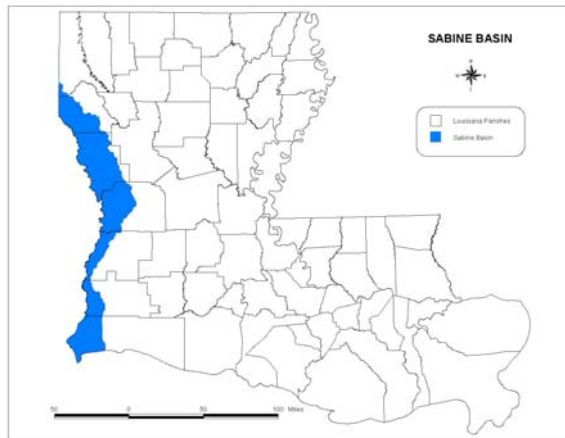
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WALLS, J. G. 2003. Survey of localities fourteen threatened crawfish species in Louisiana. Final report to the Louisiana Natural Heritage Program. Louisiana Department of Wildlife and Fisheries. Baton Rouge, LA.

## **j. Sabine Basin**

### ***General Description:***

The Sabine River arises in northern Hunt County and eastern Collin and Rockwall counties in north central Texas, and flows in an easterly direction to the Texas and Louisiana boundary near Logansport, Louisiana. The Sabine flows as boundary waters between the 2 states for some 270 river miles to the Gulf of Mexico. The Sabine River drains an area of approximately 9,700 square miles of which, 7,190 square miles are above the Toledo Bend Reservoir (A.I.D. Associates 1981). Roughly 2,510 square miles of drainage are situated below the dam which is located at river mile 200. The entire basin drains 3,257 square miles within the state. The Toledo Bend Reservoir was constructed in the 1960's and became operational in 1969. Operation of the hydroelectric plant has affected water flows on the lower portions of the river since that time. Sand and silt are the predominant substrates below the dam to the Gulf of Mexico.



The northern and central portions of the basin are primarily forested with scattered agriculture lands throughout. Most of the basin is pinelands with the majority of hardwoods located along principle drainages. Along the coastal zone almost all of the freshwater marsh was converted to intermediate and brackish marsh by the late 1970s as a result of saltwater intrusion and increased tidal influence (LaCoast 2005).

There are roughly 89 species of freshwater fishes (W. Kelso, personal communication), 33 species of mussels (Vidrine 1993), and 13 species of crawfish (J. Walls, personal communication) found within the Sabine Basin.

### ***Water Quality:***

The 2004 Water Quality Inventory Report (LDEQ 2004) indicated that 47% of the 19 water body subsegments within the basin were fully supporting their three primary designated uses. 68% of the subsegments were supporting their designated use for fish and wildlife propagation. The suspected causes for these water quality problems include: metals, fecal coliform, non-native aquatic plants, organic enrichment and low concentration of dissolved oxygen, and turbidity. The suspected sources of the water quality problems include: major industrial point sources, harvesting/reforestation, surface mining, agriculture, and urban runoff.

<b>SABINE BASIN SPECIES OF CONSERVATION CONCERN (14)</b>		
<b>CRUSTACEANS</b>	Suckermouth Minnow	Texas Heelsplitter
Calcasieu Painted Crawfish	Western Sand Darter	Southern Creekmussel
Kisatchie Painted Crawfish	Bigscale Logperch	
Twin Crawfish		
<b>FRESHWATER FISH</b>	<b>MUSSELS</b>	<b>REPTILES</b>
Paddlefish	Sandbank Pocketbook	Alligator Snapping Turtle
	Louisiana Pigtoe	Sabine Map Turtle
		Mississippi Diamond-backed Terrapin

***Priority Species Research and Survey Needs:***

Western Sand Darter and Suckermouth Minnow:

Surveys are needed to assess their current distribution and abundance.



Mussels: Surveys are needed to update historic records and develop new baseline data on current species population distributions and abundance.

Crustaceans: Continue surveys to update historic locality records in order to update abundance and distribution data for inclusion in the LNHP database.

Mississippi Diamondback Terrapin: The status of this species is unknown. Endangered Species Act candidate status is pending. Evaluate trawl data from LDWF Marine Fisheries trawl surveys for distribution estimates. Initiate surveys in vicinity of recent trawl captures to assess current population abundance.

***Species Conservation Strategies:***

1. Western Sand Darter and Suckermouth Minnow: Develop partnerships with Texas Department of Parks and Wildlife to monitor populations of these species throughout the Sabine drainage basin.

***Threats Affecting Basin:***

The following table illustrates the threats identified for the Sabine Basin and the sources of these threats. This represents all threats and sources of threats identified for this basin.

Source of Threat	Threat									
	Altered Composition/ Structure	Altered Water Quality	Change in Land- Use Practices	Habitat Destruction or Conversion	Habitat Disturbance	Loss of Genetic Diversity	Modification of Water Levels; Changes in Natural Flow Patterns	Salinity Alteration	Sedimentation	Toxins/ Contaminants
Channelization of rivers or streams	XXX	XXX						XXX		
Commercial/industrial development		XXX					XXX			
Construction of ditches, drainage or diversion systems							XXX	XXX		
Conversion to agriculture or other forest types			XXX	XXX	XXX				XXX	
Crop production practices			XXX		XXX					
Dam construction	XXX			XXX	XXX		XXX			
Development/maintenance of pipelines, roads or utilities					XXX					
Excessive groundwater withdrawal							XXX			
Incompatible forestry practices					XXX					
Industrial discharge										XXX
Invasive/alien species	XXX				XXX	XXX				
Operation of dams or reservoirs	XXX	XXX				XXX	XXX	XXX	XXX	
Operation of drainage or diversion systems							XXX			
Residential development			XXX	XXX	XXX		XXX			

**Basin Conservation Strategies:**

1. Support initiatives and programs that help reduce siltation and sedimentation throughout the basin.
2. Work with LANSTF to identify and address threats related to invasive species.
3. Develop partnerships with regulatory and other agencies to share data on habitat threats.
4. Develop an internal procedure to distribute information on proposed reservoirs to LDWF district biologists and incorporate their input into official LDWF comments.

**References:**

A. I. D. ASSOCIATES. 1981. Report prepared for Sabine River Authorities of Texas and Louisiana. Toledo Bend Dam and Reservoir.

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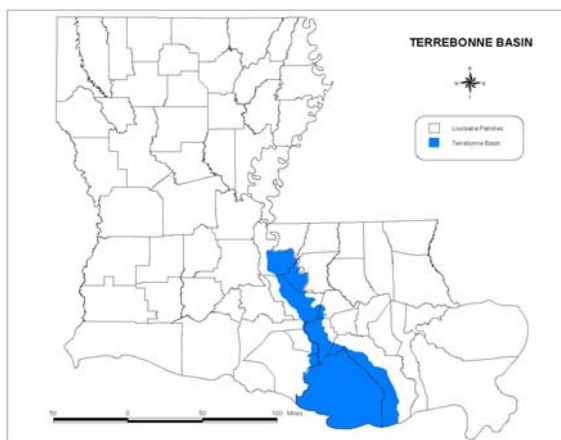
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VIDRINE, M. F. 1993. The historical distribution of freshwater mussels in Louisiana. Gail Q. Vidrine Collectables. Eunice, LA. 225 pp.

## k. Terrebonne Basin

### *General Description:*

The Terrebonne Basin covers approximately 1,712,500 acres in south-central Louisiana (LCWRCTF 1993), bordered by Bayou Lafourche to the east, the Atchafalaya Basin floodway to the west, the Mississippi River to the north, and the Gulf of Mexico to the south. It includes all of Terrebonne Parish and parts of Lafourche, Assumption, St. Martin, St. Mary, Iberville, and Ascension Parishes.



The extreme northern portion of the basin is primarily agriculture lands which continue south along its eastern edge within the historic floodplains of the Mississippi River and Bayou Lafourche. The western half of the basin consists of bottomland hardwood forests and cypress-tupelo-blackgum swamps. The coastal zone consists of fresh and intermediate marsh inland to brackish and salt marsh near the bays and gulf (LaCoast 2005). Approximately 729,000 acres of the Terrebonne Basin are wetlands which consist of about 21% freshwater swamp and 79% marsh (LaCoast 2005). The two primary water sources that enter this system are rain water and flood water from the Atchafalaya River containing nutrient-rich sediments which inundate the southwestern coastal marshes (LaCoast 2005).

There are roughly 57 species of freshwater fishes (W. Kelso, personal communication), 12 species of mussels (Vidrine 1993), and 10 species of crawfish (J. Walls, personal communication) found within the Terrebonne Basin.

### *Water Quality:*

The 2004 Water Quality Inventory Report (LDEQ 2004) indicated that 31% of the 60 water body subsegments within the basin were fully supporting their three primary designated uses. However, 66% of the subsegments were not supporting their designated use for fish and wildlife propagation. The suspected causes for these water quality problems include: metals, pesticides, nutrients, fecal coliform, non-native aquatic plants, organic enrichment and low concentration of dissolved oxygen, dissolved and suspended solids, pH levels, sedimentation/siltation, and turbidity. The suspected sources of the water quality problems include: non-irrigated crop production, pasture land, urban runoff, hydromodification, combined sewers and unsewered areas, surface runoff, and spills.



TERREBONNE BASIN SPECIES OF CONSERVATION CONCERN (3)	
<b>FRESHWATER FISH</b> Paddlefish	<b>REPTILES</b> Alligator Snapping Turtle Mississippi Diamond-backed Terrapin

**Priority Species Research and Survey Needs:**

Alligator Snapping Turtle: Baseline mark-release data were obtained during the late 1990s. New surveys are needed to obtain population trend data for this species.

Mississippi Diamondback Terrapin: The status of this species is unknown. Endangered Species Act candidate status is pending. Evaluate trawl data from LDWF Marine Fisheries trawl surveys for distribution estimates. Initiate surveys in vicinity of recent trawl captures to assess current population abundance.

**Species Conservation Strategies:**

1. Develop data base containing baseline data on current composition and abundance of all species with a focus on species of conservation concern.
2. Sampling is needed to identify trends in range and abundance of native and invasive species throughout the Terrebonne Basin.

**Threats Affecting Basin:**

The following table illustrates the threats identified for the Terrebonne Basin and the sources of these threats. This represents all threats and sources of threats identified for this basin.

Source of Threat	Threat								
	Altered Composition/ Structure	Altered Water Quality	Change in Land Use Practices	Competition for Resources	Habitat Disturbance	Habitat Fragmentation	Modification of Water Levels; Changes in Natural Flow Patterns	Nutrient Loading	Sedimentation
Channelization of rivers or streams		XXX			XXX		XXX		
Construction of ditches, drainage or diversion systems		XXX	XXX				XXX		XXX
Construction of navigable waterways						XXX	XXX		XXX
Conversion to agriculture or other forest types			XXX				XXX	XXX	XXX
Crop production practices		XXX	XXX				XXX	XXX	XXX
Development/maintenance of pipelines, roads or utilities									XXX
Industrial discharge		XXX						XXX	
Invasive/alien species				XXX					
Levee or dike construction	XXX	XXX	XXX				XXX	XXX	XXX
Oil or gas drilling						XXX	XXX		
Residential development		XXX	XXX				XXX		XXX

***Basin Conservation Strategies:***

1. Promote oil spill prevention regulations SPC and natural resource response mechanisms NRDA.
2. Promote the use of BMP's for water runoff. Promote enforcement of sanitary regulations.
3. Promote methods to restore historical flow regimes within the Terrebonne Basin.
4. Work with LDEQ and USGS to increase monitoring of nutrient inputs and overall water quality within the Terrebonne Basin.
5. Support research efforts.
6. Prepare educational material on the potential impacts of invasive species to the Terrebonne Basin.
7. Coordinate with the Atchafalaya Basin Program (LDNR) and BTNEP to abate identified threats to this basin.

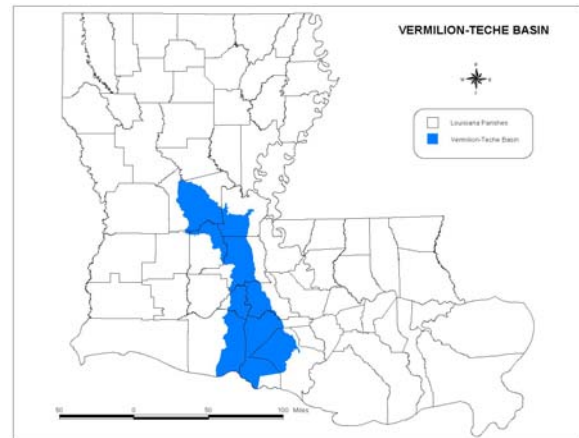
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- VIDRINE, M. F. 1993. The historical distribution of freshwater mussels in Louisiana. Gail Q. Vidrine Collectables. Eunice, LA. 225 pp.

## I. Vermilion-Teche Basin

### *General Description:*

The Vermilion-Teche basin's drainage area covers approximately 4,047 square miles. Habitats within the basin range from the upland pine forests, northwest of Alexandria, to agriculture lands consisting primarily of corn and soybeans, in its northern portion, and rice and sugarcane in its central and southern portion. The coastal zone is mostly freshwater marsh from Bayou Cypremort east to LA Hwy 317. Intermediate and brackish marsh occupy all of the coastal zone west of Bayou Cypremort with small areas of salt marsh on Marsh Island WMA and Paul J. Rainey Wildlife Sanctuary.



Water from the Atchafalaya River is diverted into the Vermilion-Teche River Basin through the Bayou Teche water project. Authorized by the Flood Control Act of 1966, this structure allows the diversion of supplemental fresh water from the Atchafalaya River upstream of Krotz Springs to the head of Bayou Teche at Port Barre. The supplemental fresh water is distributed among Bayou Teche, the Vermilion River, and the west side borrow pit along the Atchafalaya basin protection levee for municipal, industrial, irrigation, and water-quality control uses (COE 1998).

There are roughly 59 species of freshwater fishes (W. Kelso, personal communication), 30 species of mussels (Vidrine 1993), and 17 species of crawfish (J. Walls, personal communication) found within the Vermilion-Teche Basin.

### *Water Quality:*

The 2004 Water Quality Inventory Report (LDEQ 2004) indicated that 7% of the 44 water body subsegments within the basin were fully supporting their three primary designated uses. However, 91% of the subsegments were not supporting their designated use for fish and wildlife propagation. The suspected causes for these water quality problems include: metals, pesticides, nutrients, fecal coliform, non-native aquatic plants, organic enrichment and low concentration of dissolved oxygen, dissolved and suspended solids, sedimentation/siltation, and turbidity. The suspected sources of the water quality problems include: crop production, aquaculture, urban runoff, petroleum activities, hydromodification, surface mining, construction, and dredging.

VERMILION-TECHE BASIN SPECIES OF CONSERVATION CONCERN (8)		
<b>CRUSTACEANS</b>	<b>FRESHWATER FISH</b>	<b>REPTILES</b>
Teche Painted Crawfish	Paddlefish	Alligator Snapping Turtle
Kisatchie Painted Crawfish		Mississippi Diamond-backed Terrapin
Javelin Crawfish	<b>MUSSELS</b>	
Old Prairie Crawfish	Louisiana Pearlshell	

***Priority Species Research and Survey Needs:***

Paddlefish: Continue with stock assessment surveys.

Alligator Snapping Turtle: Baseline mark-release data were obtained during the late 1990s. New surveys are needed to obtain population trend data for this species.

Mississippi Diamondback Terrapin: The status of this species is unknown. Endangered Species Act candidate status is pending. Evaluate trawl data from LDWF Marine Fisheries trawl surveys for distribution estimates. Initiate surveys in vicinity of recent trawl captures to assess current population abundance.



Kisatchie Painted Crawfish

***Species Conservation Strategies:***

1. Develop database containing baseline data on current composition and abundance of all species with a focus on species of conservation concern.
2. Sampling is needed to identify trends in range and abundance of native and invasive species throughout the Vermilion-Teche Basin.

***Threats Affecting Basin:***

The following table illustrates the threats identified for the Vermilion-Teche Basin and the sources of these threats. This represents all threats and sources of threats identified for this basin.

Source of Threat	Threat								
	Altered Composition/ Structure	Change in Land Use Practices	Habitat Destruction or Conversion	Habitat Disturbance	Habitat Fragmentation	Modification of Water Levels; Changes in Natural Flow Patterns	Nutrient Loading	Sedimentation	Toxins/ Contaminants
Channelization of rivers or streams	XXX		XXX		XXX	XXX	XXX	XXX	
Commercial/industrial development	XXX		XXX			XXX	XXX	XXX	XXX
Construction of ditches, drainage or diversion systems	XXX		XXX	XXX	XXX	XXX	XXX	XXX	
Construction of navigable waterways					XXX	XXX		XXX	
Conversion to agriculture or other forest types		XXX						XXX	
Crop production practices	XXX		XXX	XXX	XXX		XXX	XXX	XXX
Grazing practices							XXX		XXX
Incompatible forestry practices			XXX	XXX				XXX	
Industrial discharge			XXX				XXX		XXX
Invasive/alien species	XXX		XXX	XXX			XXX		
Levee or dike construction	XXX		XXX		XXX	XXX		XXX	
Oil or gas drilling					XXX	XXX			
Operation of dams or reservoirs	XXX		XXX			XXX	XXX		
Residential septic systems			XXX				XXX	XXX	XXX
Shoreline stabilization	XXX					XXX		XXX	

**Basin Conservation Strategies:**

1. Develop a comprehensive survey methodology for the Vermillion-Teche Basin.
2. Conduct a detailed inventory of the Vermillion-Teche Basin that focuses on habitats and species of conservation concern.
3. Promote methods to restore historical flow regimes within the Vermillion-Teche Basin.
4. Develop education material on BMPs for land-use practices within the Vermillion-Teche Basin.
5. Develop partnerships with regulatory and other agencies to share data on habitat threats.
6. Work with LANSTF to identify and address threats related to invasive species.
7. Prepare educational material on the potential impacts of invasive species to the Vermillion-Teche Basin.

***References:***

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## 2. Marine Habitats

**Synonyms:** Coastal, Estuarine

### **General Description:**

The following marine habitats are all submerged, primarily non-vegetated habitats and are described based on characteristics such as seafloor composition and the presence of seagrass beds. The following habitat descriptions should be considered as general descriptors in the development of threat assessments to the various habitat types and for the development of conservation actions for the species that depend upon those habitats.

#### **a. Soft Mud Bottom**

Soft Mud Bottoms are estuarine water bottoms dominated by fine, relatively unconsolidated sediments, often high in organic matter. These habitats may be heavily used by fish and invertebrate species adapted to burrowing in these sediments, as well. In lower salinity regimes, these bottoms may be vegetated by *Myriophyllum* spp. (water milfoils), *Utricularia* spp. (bladderworts), *Ruppia maritima* (widgeon grass), *Najas guadalupensis* (southern naiad) and other submerged aquatic vegetation (SAV). The presence of SAVs provides additional structure, shelter, and food sources to the animals dependent upon these habitats. SAVs are more likely to be abundant in smaller, sheltered areas of soft mud bottom, and less likely to be present or abundant in areas where wave action or other turbulence and turbidity is persistent.



Soft mud bottoms are typically high in organic matter, and also form a substrate that is suited for easy burrowing. Animals may use this substrate both as a refuge from predators and as a food source. Productivity of animal biomass may be related to allochthonous or autochthonous sources, depending upon the productivity of SAVs, adjacent marshes, and phytoplankton production.

Soft mud bottoms of open lakes, bayous and bays tend to have higher levels of large predatory species (vertebrate and invertebrate) than do the more cryptic habitats of the soft mud bottoms of small ponds, marsh creeks and similar habitats. The more cryptic habitats therefore provide a more suitable area as nursery grounds for postlarvae or young juveniles. Predation within these cryptic habitats tends to be more from terrestrial sources (wading or shorebirds and mammals) than in more open-water habitats. One of the major issues associated with the ongoing changes to the geomorphology in the coastal zone is the loss of these cryptic habitats as water bodies expand and merge into larger areas, less suitable for nursery habitat.

## **b. Shell/Shell Hash Bottom**

Shell/Shell Hash Bottoms are estuarine water bottoms with significant coverage of mollusk shells. These bottoms may have potential for settlement of oysters, barnacles, or other invertebrate larvae that require hard substrates, and also serve as shelter for fish living in cryptic environments. These relatively hard substrates may reduce shoreline erosion along shallow, sloped shorelines, providing physical protection for the adjacent marshlands. They also may cause changes in currents, creating environments that are beneficial for many species of fish and invertebrates. In very low-salinity environments, relatively few species other than some small invertebrates are able to utilize the shell as a settlement substrate, but the other values of the habitat remain.



Oysters provide the majority of the shell substrate in Louisiana, and are also a major fishery resource. Mussels, barnacles, worms, fishes, and a variety of other animals are either found in increasing abundance around oyster reefs, or are dependent upon these types of bottoms to survive. Other shell bottoms include Rangia clam and mixed shell hash. A number of bivalve mollusk species can co-exist in a single area, providing a variety of food sources and substrates to the animal communities. Shell and shell hash bottoms tend to be more resistant to erosion than mud bottoms, creating relief to the bottom and modifying tidal currents, especially near passes.

## **c. Hard Mud/Clay Bottom**

Hard Mud/Clay Bottoms are estuarine and territorial sea water bottoms dominated by fine or coarse sediments, often relatively low in organic matter. These habitat types are often widely represented in larger lakes and bays, especially in areas where the sediments of the surrounding marshes are low in organic content. Productivity in these areas tends to be derived from terrestrial (marshland) allochthonous sources and phytoplankton.



An assumption among fishery managers in the Gulf of Mexico is that estuarine hard bottoms support more diverse, complex communities than adjacent soft bottoms. This assumption has led recently to the proliferation of recreational low profile artificial reefs. This has prompted private environmental organizations such as the Coastal Conservation Association (CCA), Recreational Fishing Research Institute (RFRI), and the LPBF in conjunction with the LDWF to construct low profile artificial reefs from limestone, shell and reef balls. Prior to large investments and efforts to create and restore historic shell



reefs, LDWF needs to get a better understanding of the real value and functionality of these hard bottom habitats to fishery and other aquatic resources.

#### **d. Sandy Bottom**

Sandy Bottoms are estuarine and territorial sea water bottoms dominated by coarse sediments, often relatively low in organic matter. These habitats are usually maintained by relatively high energy influences (waves, currents, etc.) that remove or prevent the deposition of finer sediment fractions. As such, there is a continuum of sediment types ranging from nearly pure sand to silt or clay bottoms with a relatively small fraction of sand. High energy sand bottoms are limited to the fore-shore environments of barrier islands, and to a lesser extent to beaches of the cheniere plain. Other sandy bottoms may be found in submerged sand bars, remnants of former barrier islands, and offshore shoals.



High-energy beaches are nursery areas for a unique suite of marine organisms, including the Florida pompano (*Trachinotus carolinus*), Gulf kingfish (*Menticihrus littoralis*) and broad flounder (*Paralichthys squamilentus*).

#### **e. State Territorial Open Water**

This comprises all open waters from the beach shoreline to the limit of state jurisdiction, the "3 mile limit". Habitats range from sandy beaches and shoals in relatively high-energy environments to soft mud bottoms in low-energy environments. Oyster reef environments are found offshore in the central area of the state, offshore of Marsh Island, one of the few areas where significant offshore oyster reefs occur in the eastern United States. Generally moderate slopes prevail from the beachline



outward, but very steep bottom slopes are found near the mouth of the Mississippi River. Conversely, very shallow slopes are found in the area between Vermilion Bay and Caillou Bay.

Salinities vary widely by location and by season. Near-freshwater conditions may be found near the mouths of the major rivers in high-water conditions, especially in the springtime, while salinities above 30 ppt. may be regularly found in the waters along the

Chandeleur and Timbalier Islands. Other areas of the state may have similar high salinities in years with drier conditions.

***Liquefied Natural Gas Terminals in the Gulf of Mexico:***

Congress passed the Marine Transportation Act of 2002 amending the Deepwater Port Act to include liquefied natural gas (LNG) terminals in the definition of deepwater ports. Oil and gas companies began to apply for new licenses to construct new terminals once the legislation was enacted. Currently there are 10 identified projects throughout the United States with 7 of these in the Gulf of Mexico and 6 in the waters offshore of Louisiana. Three licenses in the Exclusive Economic Zone offshore of Louisiana have already been granted, and 4 more in the Gulf of Mexico are currently being considered by the U.S. Department of Transportation's Maritime Administration (MARAD).

The process for vaporizing LNG in the Gulf of Mexico deepwater ports is a one way "open loop" system. The system uses seawater at ambient temperature treated with anti-fouling chemicals to vaporize the LNG and then discharges the seawater after use. The proposed "open loop" deepwater port facilities will use 100 million to 200 million gallons of seawater per day. Fisheries scientists and managers question whether the cumulative effect of processing that volume of water for each operating facility will negatively affect plankton and benthonic marine resources and ultimately stocks of ecologically and economically important species. Existing data are not sufficient to provide a good basis for estimating impacts, and since Congress mandated a 330-day licensing period, there is not enough time during the licensing application period to obtain additional data.

Research is needed to adequately characterize benthic communities and the seasonal and diel movement of various life stages of marine animals as they migrate through the areas where LNG facilities are located. Temporal and spatial variability of patchy meroplankton resources presents a practical problem in recognizing adverse impacts should they occur. Additional research is needed to better characterize the duration of life stages of ecologically and economically important species in the northwestern Gulf of Mexico. That research would provide the information needed to refine the recruitment models used for stock assessments which in turn are used to evaluate the effects of multiple LNG facilities on commercial and recreational stocks of marine wildlife. Research into the physical oceanographic forces that drive the movement of plankton and distribution of effluents from these offshore facilities is also needed.

Some baseline studies are currently being planned. Monitoring of the effects of licensed facilities is required by MARAD and the United States Coast Guard (USCG) in consultation with the National Oceanic and Atmospheric Administration's Fisheries Service (NOAA-Fisheries). Further planning and coordination with NOAA-Fisheries and other Gulf states is needed to ensure that the studies are adequate.

<b>MARINE SPECIES OF CONSERVATION CONCERN (19)</b>		
<b>MAMMALS</b>	Diamond Killifish	Broad Flounder
Sperm Whale	Texas Pipefish	Large-scaled Spinycheek Sleeper
Fin Whale	Chain Pipefish	Goliath Grouper
West Indian Manatee	Opossum Pipefish	
	Emerald Sleeper	<b>REPTILES</b>
<b>MARINE FISH</b>	Violet Goby	Loggerhead Seaturtle
Saltmarsh Topminnow	Gold Brotula	Green Seaturtle
Bayou Killifish	Longfin Mako	Leatherback Seaturtle

***Priority Species Research & Survey Needs:***

West Indian Manatee: Initiate surveys of population sizes and distribution in Louisiana waters.

Whales and Dolphins: Continue to monitor the effects of seismic activity and marine transportation activities on whale and dolphin populations, especially near the mouth of the Mississippi River.

Fishes: Develop and test methods to evaluate species distributions, environmental influences on diversity, evenness and richness of communities, and identify abiotic factors that influence changes in offshore fish communities.

***Species Conservation Strategies:***

1. Manatees:
  - Incorporate recommendations of the manatee recovery plan for Louisiana populations (note: manatee population increases in recent years have been related to a lack of cold weather over the last 15 years. Severe freezes, such as those in 1984 and 1989 cause severe or total loss of the species in the state, after which it seems to re-colonize from peninsular Florida. Increased utilization of warm-water discharges from coastal power plants and industrial sources also helps with local survival of the species).
  - Intensify public awareness of manatee presence in Louisiana to encourage the public to report manatee sightings to the LNHP.
  - Continue and support the Manatee/Sea Grass Bed Program created by LNHP in 2003.
  - Continue education and public awareness of the presence of manatees in Louisiana through signs, pamphlets, and public events.
2. Evaluate methods to monitor changes in sea turtle and marine mammal populations.

Table 4.1 provides a listing of marine species of conservation concern and associated habitats.

Table 4.1. Marine species of conservation concern and the aquatic habitats in which they occur.

Marine Species		Aquatic Habitats by Salinity				Estuarine / Marine Habitats by Bottom					State
COMMON NAME	SCIENTIFIC NAME	Salt Marsh	Brackish Marsh	Intermediate Marsh	Freshwater Marsh	Shell / Shell Hash Bottom	Soft Mud Bottom	Hard Mud/Clay Bottom	Submerged Aquatic Vegetation	Sandy Bottom	Territorial Open Water
Bayou Killifish	<i>Fundulus pulvereus</i>	X	X	X	X		X		X		
Saltmarsh Topminnow	<i>Fundulus jenkinsi</i>			X	X		X		X		
Diamond Killifish	<i>Adinia xenica</i>	X	X	X	X	X			X		
Chain Pipefish	<i>Syngnathus louisianae</i>	X	X	X					X		
Texas Pipefish	<i>Syngnathus affinis</i>	X	X						X		
Opossum Pipefish	<i>Microphis brachyurus</i>		X	X					X		
Gold Brotula	<i>Gunterichthys longipennis</i>						X				
Emerald Sleeper	<i>Eretelis smaragdus</i>		X	X			X	X			
Large-scaled Spinycheek Sleeper	<i>Eleotris amblyopsis</i>						X				
Violet Goby	<i>Gobioides broussoneti</i>		X	X			X	X			
Broad Flounder	<i>Paralichthys squamilentus</i>							X		X	X
Goliath Grouper	<i>Epinephelus itajara</i>										X
Longfin Mako	<i>Isurus paucus</i>										X

### ***Threats and Habitat Conservation Strategies:***

Marsh loss and associated changes in wetland, estuarine, and marine habitats has occurred at extraordinary rates across the Louisiana coast within the last 50 years, and such changes are expected to continue for the foreseeable future. Additionally, as human populations continue to utilize these areas for living, transportation, industrial uses, commercial and recreational harvest of natural resources and other uses, increased and new stresses will be placed on these environments.

The following summary illustrates the threats identified for those habitat types. This represents all threats identified throughout the coastal zone where these habitats might occur. Sources of threats, as described under the terrestrial and aquatic basin systems was not defined in the same manner, as it was deemed to be less pertinent to addressing these issues.

### **SOFT MUD BOTTOM/ SUBMERGED AQUATIC VEGETATION**

#### **A. Marsh Degradation –**

1. Adopt coastal restoration strategies when developed/finalized.

#### **B. Boating –**

1. Recommend maximum boat horsepower uses in particular sensitive areas such as shallow SAV beds.
2. Established marked channels in sensitive areas.
3. Educate boaters about ways to minimize impacts to SAV.

#### **C. Dredging –**

1. Use existing project review process to minimize miles channeled. Mitigate for the channels impacts when they are constructed.

#### **D. Residential Development –**

1. Improve zoning laws on the north shore of Lake Pontchartrain to address water quality issues.
2. Review permits to evaluate the potential impacts of proposed actions.
3. Education – generate greater public awareness of need/importance of SAVs.

### **SHELL/SHELL HASH BOTTOM**

#### **A. Extractive Activities –**

1. Identify activity windows appropriate for resource extraction to minimize impacts to wildlife. Use existing process of project reviews to identify issues during pre-application meetings.
2. Minimize spatial and temporal impacts arising from this threat. (esp. sand and gravel extraction related)
3. Work with other state/federal agencies to monitor these activities.

B. Timing and Volume of Fresh and Saltwater Releases –

1. Manage man-made structures to mimic natural hydrologic systems. Conduct a review of established structures to insure they are meeting permit requirements. Recommend appropriate changes as needed.
2. Review pre-permitted marsh management plans to determine their impacts. Coordinate with LDNR and USFWS refuges to allow for tidal exchange.
3. Review proposed structures that require Coastal Use Permit (CUP) and COE permits.

C. Hypoxic Conditions –

1. Support installation of low sill, raised berm, or other structure development on channel bottoms to slow high salinity encroachment in estuarine areas where hypoxia is exacerbated by stratification.

D. Channelization –

1. Use existing project review process to minimize miles channeled. Mitigate when it occurs.

E. Operation of Dams/Reservoirs –

1. Manage man-made structures to mimic natural hydrologic systems. Conduct a review of established structures to insure they are meeting permit requirements. Recommend appropriate changes as needed.
2. Review pre-permitted marsh management plans to determine their impacts. Coordinate with LDNR and USFWS refuges to allow for tidal exchange.
3. Review proposed structures that require CUP and COE permits.

F. Levee, Dike, and Weir Construction –

1. Manage man-made structures to mimic natural hydrologic systems. Conduct a review of established structures to insure they are meeting permit requirements. Recommend appropriate changes as needed.
2. Review pre-permitted marsh management plans to determine their impacts. Coordinate with LDNR and USFWS refuges to allow for tidal exchange.
3. Review proposed structures that require CUP and COE permits.

G. Bulkheading –

1. Meet with COE to encourage them to require permit for these structures. Determine if they are covered currently as nationwide permit.
2. In areas where there are local zoning laws, coordinate with local governments to identify alternative means of shoreline stabilization.
3. Promote native riparian conservation.

H. River Diversions –

1. Promote natural seasonality and water flow regimes.

I. Invasive/Exotic Species –

1. Adopt LANSTF plan for management and control of these species.

### **HARD MUD/CLAY BOTTOM**

#### A. Dredging –

1. Use existing project review process to minimize miles channeled. Mitigate when it occurs.

### **SANDY BOTTOM**

#### A. Mining –

1. Work with other state/federal agencies to influence these activities.

### **STATE TERRITORIAL OPEN WATER**

#### A. Dredging –

1. Use existing project review process to minimize miles channeled. Mitigate when it occurs.

#### B. Industrial Development –

1. Work with LDEQ, LDNR and other state agencies to incorporate LDWF recommendations into the permitting process.
2. Fill data gaps regarding status quo of species and habitats in existing open water areas. Develop a better understanding of potential future impacts of mariculture, LNG development, and other industrial impacts in this habitat.

#### C. Sediment Starvation –

1. Support river diversion projects.
2. Support research to identify alternative diversion techniques were needed.

#### D. Hypoxia –

1. Continue with coastal research and monitoring to increase our understanding of the processes of hypoxia and anoxia development and their effects on vertebrate and invertebrate species populations and movements.
2. LDWF will continue to coordinate with the Gulf of Mexico Program and the Mississippi River Basin Alliance in drafting guidelines and management recommendations to address this issue. LDWF will ensure that efforts are coordinated and strategies are highly defined.
3. Support education of upstream agricultural and landscape users regarding the effects of fertilization runoff and its effects on the Gulf of Mexico and its estuaries.
4. Support development of methods to reduce discharge of excess nutrients into waters off coastal Louisiana, including floodplain management, freshwater diversions through wetlands, regulatory measures for fertilizer users, etc.

***General Habitat Conservation Strategies:***

1. Data Gaps – Initiate new research and monitoring projects for all marine habitats to identify their locations, assess their current condition and extent, and develop management recommendations.
2. Develop conservation plans for marine habitats and incorporate BMPs for restoration activities.
3. Additional monitoring is needed to better assess impacts of navigation and access channels to public water bottoms.
4. Map distribution and community composition of SAV.
5. Additional monitoring should be included before and after implementation of projects involving hydrological modifications. Those monitoring efforts should extend for an adequate period of time to better assess habitat changes associated with those hydrological changes. Before hydrologic projects are implemented, a system-wide model of the basin (above and below the proposed footprint of the project) should be developed which includes direct and indirect impacts to existing hydrologic flows and barriers (e.g., levees, floodgates, CWPPRA projects) in the system.
6. Adequate monitoring is needed of community composition throughout the coastal zone.
7. Evaluate options to optimize the statistical power of current biological and environmental sampling designs.
8. Develop and implement workshops in cooperation with partner agencies for identification of estuarine/marine species in life history stages when they inhabit estuarine/nearshore territorial sea waters in order to enhance data quality.
9. Evaluate the distribution of existing sampling locations, especially with regard to habitat type, and develop and implement a process to ensure sampling coverage of habitats over time. Use Barataria Bay as a pilot study area for implementation.
10. Evaluate existing data to possibly identify surrogate species for monitoring cryptic species.
11. Work with university researchers to monitor and verify status of cryptic species by periodically confirming presence, habitat use, life history characteristics, etc.

***Partners:***

NOAA Fisheries, Gulf of Mexico Fishery Management Council, Gulf States Marine Fisheries Commission, US Fish and Wildlife Service, US Geological Survey, Barataria-Terrebonne National Estuary Program, Louisiana Department of Natural Resources, Louisiana Department of Environmental Quality, Louisiana Department of Health and Hospitals, Louisiana State University, University of New Orleans, Tulane University, University of Louisiana at Lafayette, Coastal Conservation Association, Recreational Fishing Research Institute, Lake Pontchartrain Basin Foundation.



## **CHAPTER 5. GENERAL CONSERVATION STRATEGIES**

### **A. General Strategies**

Strategies to address declines in target species were determined during a series of public meetings held in the spring of 2005 (this process is described in Chapter 3). Strategies were either specific to a particular habitat type or were general, and therefore applicable to multiple habitats and ecoregions. Aquatic and terrestrial general strategies are listed below. A complete listing of all conservation strategies for terrestrial species is found in Appendix N. All aquatic and marine species conservation strategies appear in Appendix O.

#### **1. Aquatic Summary**

Working with LDEQ and other entities to continue to protect streams from sediment and nutrient input is important. Reservoirs are becoming more frequent and a number of new reservoir projects are proposed. LDWF will disseminate information about proposed reservoirs to interested organizations and continue to supply data on natural communities and species that will be affected by these projects. Strengthening and expanding LDWF's Natural and Scenic Streams program will provide stronger protection for streams in the program.

#### **2. Terrestrial Summary**

The terrestrial general strategies have been categorized below. However, they are highly interrelated and often overlap. For example, development of educational materials for habitats might involve several categories by engaging partners to create the materials and then providing them to private landowners.

Since so much of Louisiana is privately owned, industrial landowners (particularly forest products companies) and private citizens are vital to the conservation of our wildlife habitats. One frequently-mentioned strategy involved providing an incentive, such as a tax benefit, to landowners who protect and provide stewardship for a particular habitat type on their land. The existing Louisiana Natural Areas Registry Program could be expanded to include such a benefit. Acquiring sites with high-quality habitat by purchasing conservation easements or fee title from willing landowners is another important conservation tool. Many important areas for wildlife occur on WMAs, National Forests, NWRs, State Parks and other public lands.

Numerous federal and state agencies, private industry groups, NGOs and others share with LDWF the interest in protecting and managing Louisiana's wildlife. Developing partnerships with these agencies and groups will greatly advance implementation of the CWCS. These partnerships will allow for a more efficient use of resources including funding and staffing to successfully accomplish the strategy goals. In addition,

coordination of efforts among these groups will prevent unnecessary duplication of programs.

LDWF will provide education and outreach to governmental and non-governmental organizations, and to the general public. Providing information and training is an important first step in informing landowners and managers about conserving target wildlife species and habitats. Publications on such topics as waterbird nesting colonies, shorebird food/habitat requirements, natural communities of Louisiana, identification of rare species and habitats, etc., would be valuable to various groups. One novel education strategy involves promoting “master naturalist” programs through universities to provide more thorough training on Louisiana’s biological diversity and ecology.

Invasive species cause tremendous ecological and economic damage in Louisiana. Providing public education about their detrimental effects and supporting existing educational programs is important. Broadening the scope of the Invasive Species Task Force to include terrestrial species was suggested as a strategy. Wild hogs are particularly damaging to native habitats. LDWF will work with hunting clubs on hog eradication. LDWF will also promote use of FLEP and other state and federal cost share programs that offset costs for landowners to control invasive species.

LDWF will conduct a geographical analysis to determine where best to create new conservation areas in the state based on habitat protection needs. There are several gaps in our knowledge of some groups of animals. LDWF will support additional research on bats in Louisiana and on migratory patterns of birds across the state. There is little known about the diversity and ecology of butterflies and moths, aquatic insects, and other groups of invertebrates. Gaining a better understanding of these groups and how they relate to other species of wildlife and to the environment is necessary to maintain and restore ecosystem function and biological diversity.

## **B. Aquatic General Strategies:**

- Coordinate with LDEQ to review permitted discharges for nitrates and ammonium in Louisiana waters, and to evaluate impacts of these levels near shore regarding hypoxia problems.
- Encourage legislation for a statewide water rights/use plan.
- Participate in state groundwater task force committee to express LDWF’s concerns regarding the impact of reservoir projects (contact: Gary Hansen).
- Partner with LDEQ and EPA to broaden public awareness concerning water quality and related issues.
- Disseminate information to interest groups/agencies about reservoir projects (include interstate cooperation).
- Provide information and data regarding species/natural communities of concern that will be affected by proposed reservoir projects.
- Expand and strengthen the LDWF Natural and Scenic River System and permit review programs.

- Utilize and encourage enforcement of existing regulations regarding streams (work with LDEQ on this).
- Work with DOTD, LDEQ, parish road maintenance crews, pipelines, private developers, etc. to combat sediment and erosion runoff into streams and other sensitive wetland habitats.

### **C. Terrestrial General Strategies**

(The six categories are arranged in descending order of priority. However, each category of general strategies should be regarded as very important. The bullet lists within each category are not ordered by priority)

#### **1. Working with Private Landowners:**

- Participate in NRCS cost-share program subcommittee meetings to coordinate efforts and to provide incentives to landowners to maintain wildlife habitat.
- Provide information to landowners about incentive programs/cost share opportunities to control invasive species.
- Develop a plan for natural forests in Louisiana including alternatives for landowners interested in conservation.
- Promote landowner awareness of the LFA committee drafting BMPs.
- Provide conservation incentives for landowners (i.e., tax breaks, etc.).
- Identify interest groups (hunting clubs/landowners) and encourage their participation in public meetings and forums dealing with reservoir issues.
- Support and promote ecotourism by private landowners. Emphasize unique species (crawfish, etc.) (International Ecotourism Society – Martha Honey, Director).
- Expand Natural Areas Registry Program to include incentives such as tax breaks, conservation easements, management assistance, etc.
- Purchase conservation easements and leases from willing landowners to conserve high priority habitat types (possibly as part of Natural Areas Registry Program).
- Acquire important sites from willing landowners, especially those sites that are adjacent to existing conservation areas.

#### **2. Creating Partnerships:**

- Partner with LDEQ and EPA to broaden public awareness concerning water-related issues.
- Maintain and create new partnerships with forest industry and other private landowners to obtain access to lands for habitat surveys.
- Continue to work with LDEQ to investigate oil spills and other similar complaints.
- Encourage master planning at the parish level, especially in areas where residential expansions is occurring.
- Integrate CWCS target species with coastal initiatives such as those of LCA, TNC, LDNR, etc.
- Work with LDAF, LFA, etc. to address prescribed burning issues (i.e., liability problems and insurance, lack of providers, costs, etc.).

- Work with local parish planning commissions and LDNR to change zoning and redirect development sites in areas with target species.
- Work with state and local parks and nature centers to provide information on species/habitats of concern and their management.
- Partner with LFA to develop tools for working with private landowners in conserving and maintaining habitat types of concern.
- Work with USFS, DOTD, DOD to design bat friendly bridges or use bat attachments when old bridges are replaced.
- Work with DOTD on a project basis when species of concern are identified.

### **3. Education/Outreach:**

- Provide educational information on Louisiana's habitats to landowners/land managers including web based educational resources.
- Provide public education regarding waterbird nesting colonies, shorebird feeding areas and the effects of recreational and other uses on these areas.
- Develop training materials for LFA workshops regarding conservation of native habitats.
- Develop web-based training programs for continuing education of teachers, wildlife professionals, foresters, etc.
- Educate land managers/hunting clubs/extension agents, etc to discourage food plot location in sensitive habitats.
- Conduct outreach to local sheriff's offices to encourage enforcement of ATV regulations and educate sheriffs about ATV issues in sensitive habitats.
- Include information on target species in LDWF's responses to proposed projects.
- Provide local and parish planning boards with information regarding sensitive habitats and species in their areas, and work to redirect the development of these areas.
- Develop educational information, including BMPs, regarding ephemeral ponds (include management techniques) and related species of concern, and make this information available to landowners/land managers.
- Utilize existing educational programs such as those in use by NRCS, Ag Extension, LA Sea Grant, USFS, USFWS, etc, regarding CWCS targets.
- Work with universities that provide training to urban planners to educate future planning board members on the conservation of habitats and species of concern.
- Educate policy makers about the problems associated with mercury methylation in streams considered for reservoirs and emphasize the potential affects on species of concern.
- Develop a publication on the Natural Communities of Louisiana.
- Encourage university curricula to incorporate sensitive natural areas into student studies (especially landscape architecture and courses for planners).
- Complete an identification guides for plant and animal species (ranked S1, S2, or S3) in Louisiana.
- Develop an identification key to potential areas for all S1 and S2 natural communities for LFA to use and disseminate.

- Produce a set of BMPs for improving wildlife habitat in utility ROW.
- Develop a comprehensive management plan for use of dredge materials to create new habitat for target species.
- Provide fact sheets on LDWF web site for all species of concern, and update them regularly.
- Promote native plant use by the public and growers/landscapers.
- Provide information to developers on ecosystem values and functions which benefit species of concern, and encourage the integration of ecosystem functions into developments.
- Encourage the development of a “master naturalist” program, through the Cooperative Extension Service and/or universities, which would train students on the wildlife and plant resources of Louisiana, their diversity, importance, and conservation.

#### **4. Invasive Species:**

- Develop and disseminate educational materials on the detrimental effects of invasive exotic species.
- Promote utilization of state and federal cost share programs (FLEP and NRCS programs) to address invasive species problems.
- Partner with local hunting clubs through DMAP to support wild hog eradication.
- Encourage broadening the scope of the Invasive Species Task Force to include terrestrial invasive species such as wild hogs, Chinese tallow tree, and cogon grass.
- Work with the Invasive Species Task Force and others to develop a noxious plant species list, and educate the public regarding this information.
- Work with utility ROW contractors in order to prevent the spread of invasive species through their construction and maintenance activities.
- Provide public education and support existing efforts/programs regarding invasive species. Coordinate these efforts with Louisiana Ag Extension, NRCS, LA Sea Grant (rapid assessment projects).
- Develop a program to promote invasive eradication/prevention following timber harvesting, and provide this information to landowners.

#### **5. Working with Legislators:**

- Legislate tax break incentives for landowners in order to encourage the conservation of native habitat types, possibly as an expansion of the Natural Areas Registry Program.
- Encourage legislation for a statewide water use plan.
- Encourage legislation for a statewide water rights plan.
- Encourage legislation to prevent the further introduction and translocation of hogs.

## **6. Research Strategies:**

- Support research on bats in Louisiana.
- Support research on migratory bird patterns across the state.
- Continue to support research to fill data gaps that focus on declines in waterfowl in coastal marshes.
- Continue to support rookery surveys to update database for these species.
- Conduct geographical analysis to identify gaps where managed areas are lacking in the state, relative to protection needs of Tier 1 habitats and important focal areas discussed in the habitat accounts in Chapter 4. Produce a map showing these areas where land acquisition and the establishment of conservation areas would be the most valuable.
- Support research on the diversity and ecology of the lesser-known groups of invertebrates such as butterflies and moths, aquatic insects, zooplankton, snails, arachnids, beetles, etc.

## CHAPTER 6. DEVELOPING PARTNERSHIPS

The CWCS will be valuable as a steering mechanism that will direct and track wildlife conservation for species and habitats at risk over the next 10 years in Louisiana. Its value in arresting the declines of species in need of conservation will be considerable. Of equal value will be the partnerships expanded or developed by this endeavor. The CWCS offers us new opportunities to initiate dialog with organizations with whom LDWF historically has not had interactions. In addition, LDWF will continue conversations and cooperative agreements with our current partners. The list of organizations LDWF invited to focus meetings (Chapter 3, Section A.2) illustrates a new attempt at expanding its partnerships.

There are 4 federally recognized Indian Tribes in Louisiana: Chitimacha Tribe of Louisiana, Coushatta Tribe of Louisiana, Jena Band of Choctaw Indians, and Tunica-Biloxi Indian Tribe. In addition, there are 4 state-recognized Tribal Nations: Choctaw-Apache of Ebarb, Clifton Choctaw, Louisiana Choctaw, and United Houma Nation. None of these Tribes manages significant land and water areas within Louisiana and most land holdings are in casino/resort development. Attempts to solicit input from Tribes resulted in no response. As future partnership opportunities with state recognized Tribes arise during the implementation of the CWCS, LDWF will attempt to coordinate with these Tribes on joint conservation projects where feasible.

In developing the CWCS, LDWF identified multiple strategies associated with strengthening partnerships. These are detailed below. The CWCS initiative outlines numerous partnerships with state and federal agencies and organizations or groups. Landowners are expected to play a crucial role in the implementation of the plan. Nearly 40 strategies, involving private landowner partnerships, were developed during the writing of the CWCS. LDWF's partnerships with landowners will be a key factor in reversing downward trends in the populations of species of conservation concern.

<b>PARTNER/associated habitat</b>	<b>STRATEGY</b>
<b>BARATARIA-TERREBONNE NATIONAL ESTUARY PROGRAM</b>	
BRACKISH MARSH COASTAL DUNE GRASSLAND/SHRUB THICKET SALT MARSH	Work with NRCS Plant Materials Center and BTNEP to develop viable cultivars for marsh restoration efforts.
BARRIER ISLAND BARRIER ISLAND LIVE OAK FOREST COASTAL MANGROVE-MARSH SHRUBLAND	Work with NRCS Plant Materials Center, BTNEP, and the Office of State Parks to develop a restoration program for this habitat.
<b>BLACK BEAR CONSERVATION COMMITTEE</b>	
BATTURE	Work with BBCC, DOTD, NRCS, USFWS, USFS, private landowners, etc. to promote corridors for black bears and other wildlife species.

<b>PARTNER/associated habitat</b>	<b>STRATEGY</b>
<b>DUCKS UNLIMITED</b>	
BALDCYPRESS TUPELO-BLACKGUM SWAMP	Work with COE, DU and other groups to enhance swamp hydrologic conditions to control invasives on Caddo Lake and Catahoula Lake.
<b>LANDOWNERS</b> (corporations and individuals)	
EASTERN HILLSIDE SEEPAGE BOG SLASH PINE-PONDCYPRESS/HARDWOOD FOREST WESTERN HILLSIDE SEEPAGE BOG	Continue to encourage landowners to implement BMPs and SFI standards in the management of this habitat type.
SLASH PINE-PONDCYPRESS/HARDWOOD FOREST WESTERN LONGLEAF PINE SAVANNAH	Develop educational information regarding the importance of ephemeral ponds for species of concern, and make this information available to landowners/land managers through technical pamphlets and the LDWF website.
SMALL STREAM FOREST	Develop educational information that focuses on the importance of streamside zones as wildlife corridors. Distribute this information to landowners/land managers through technical pamphlets and the LDWF website.
BRACKISH MARSH COASTAL LIVE OAK-HACKBERRY FOREST	Develop methods to encourage landowners to remove cattle and manage the land for wildlife conservation.
EASTERN LONGLEAF PINE SAVANNAH EASTERN UPLAND LONGLEAF PINE FOREST SLASH PINE-PONDCYPRESS/HARDWOOD FOREST WESTERN UPLAND LONGLEAF PINE FOREST	Educate landowners, adjacent residents, developers, and the general public about the crucial role of prescribed burning in the management of this system (multi-agency, multi-group effort).
SHORTLEAF PINE/OAK-HICKORY FOREST	Encourage LDAF and other growers to produce shortleaf pine seedlings for distribution to landowners interested in restoring this habitat type.
SPRUCE PINE-HARDWOOD FOREST	Encourage LDAF and other growers to produce spruce pine seedlings for distribution to landowners interested in restoring this habitat type.
EASTERN LONGLEAF PINE SAVANNAH EASTERN UPLAND LONGLEAF PINE WESTERN LONGLEAF PINE SAVANNAH WESTERN UPLAND LONGLEAF PINE FOREST	Encourage longer rotation ages when compatible with the landowner's management objectives.
MIXED HARDWOOD-LOBLOLLY PINE/HARDWOOD SLOPE FOREST	Encourage the use of existing NRCS, USFWS programs in providing cost share incentives to landowners for invasive species control.
EASTERN LONGLEAF PINE SAVANNAH EASTERN UPLAND LONGLEAF PINE FOREST WESTERN LONGLEAF PINE SAVANNAH WESTERN UPLAND LONGLEAF PINE FOREST	Investigate the availability of additional cost-share funding opportunities for landowners to reduce the cost of longleaf pine management.
EASTERN HILLSIDE SEEPAGE BOG WESTERN HILLSIDE SEEPAGE BOG	Once bogs are identified, conduct landowner surveys to aid in the development of management strategies for these sites.
EASTERN LONGLEAF PINE SAVANNAH WESTERN LONGLEAF PINE SAVANNAH	Once savannahs are identified conduct landowner surveys to aid in the development of management strategies for these sites.
BARRIER ISLAND LIVE OAK FOREST	Partner with NGOs (TNC, LOS, NOS), state and federal agencies, industry, and private landowners to promote the conservation of remaining barrier island live oak forests.



<b>PARTNER/associated habitat</b>	<b>STRATEGY</b>
<b>LANDOWNERS (cont)</b>	
LIVE OAK- PINE-MAGNOLIA FOREST	Partner with NGOs, OSP, private landowners, etc. to initiate restoration and preservation efforts of live oak – pine – magnolia forests and continue to encourage landowners to enroll this habitat type in the Natural Areas Registry Program.
SPRUCE PINE-HARDWOOD FOREST	Partner with NGOs, OSP, private landowners, etc. to initiate restoration and preservation efforts of spruce pine – hardwood flatwood forests and continue to encourage landowners to enroll this habitat type in the Natural Areas Registry Program.
COASTAL DUNE GRASSLAND/SHRUB THICKET	Partner with NGOs, private landowners, etc. to promote protection of coastal dune grasslands and shrub thickets and continue to encourage landowners to enroll this habitat type in the Natural Areas Registry Program.
LIVE OAK NATURAL LEVEE FOREST	Partner with NGOs, private landowners, etc. to promote protection of live oak forests and continue to encourage landowners to enroll this habitat type in the Natural Areas Registry Program.
COASTAL PRAIRIE	Partner with NGOs, state and federal agencies, private landowners, etc. to promote the protection, restoration, and expansion of coastal prairie habitat.
COASTAL LIVE OAK-HACKBERRY FOREST	Partner with state and federal agencies, NGOs, private landowners, etc. to increase conservation of cheniers.
SALT DOME HARDWOOD FOREST	Partner with state and federal agencies, NGOs, private landowners, etc. to promote conservation and restoration of salt dome hardwood forests.
BARRIER ISLAND COASTAL DUNE GRASSLAND/SHRUB THICKET	Partner with state and federal agencies, NGOs, private landowners, etc. to promote the protection and restoration of barrier islands.
EASTERN UPLAND LONGLEAF PINE FOREST WESTERN UPLAND LONGLEAF PINE FOREST	Promote value-added products produced from longleaf pine to encourage landowners to replant longleaf pine instead of off-site pine.
BRACKISH MARSH	Promote waterfowl management as an alternative to livestock production by providing incentives to landowners.
EASTERN HILLSIDE SEEPAGE BOG EASTERN LONGLEAF PINE SAVANNAH EASTERN UPLAND LONGLEAF PINE FOREST SLASH PINE-PONDCYPRESS/HARDWOOD FOREST SANDBARS WESTERN LONGLEAF PINE SAVANNAH WESTERN UPLAND LONGLEAF PINE FOREST	Provide additional cost share funds for landowners to drastically reduce or eliminate costs associated with conducting prescribed burns on their property.
COASTAL LIVE OAK-HACKBERRY FOREST	Provide information to landowners about incentive programs/cost share opportunities to control invasives.
SOUTHERN MESOPHYTIC FOREST	Provide loggers and landowners with updated BMPs for harvesting timber in this habitat type.
BOTTOMLAND HARDWOOD FOREST	Work with BBCC, DOTD, NRCS, USFWS, USFS, private landowners, etc. to promote corridors for black bears and other wildlife species.
SALINE PRAIRIE	Work with hunting clubs and other landowners to restrict ATV use to existing trails.

PARTNER/associated habitat	STRATEGY
<b>LANDOWNERS (cont)</b>	
BARRIER ISLAND LIVE OAK FOREST CALCAREOUS PRAIRIE CALCAREOUS FOREST COASTAL LIVE OAK-HACKBERRY FOREST COASTAL MANGROVE-MARSH SHRUBLAND COASTAL PRAIRIE HARDWOOD FLATWOODS LIVE OAK NATURAL LEVEE FOREST SALT DOME HARDWOOD FOREST SANDSTONE GLADE/BARREN SALINE PRAIRIE WESTERN XERIC SANDHILL WOODLAND	<p>Provide educational information on this habitat type and its importance to species of conservation concern to landowners/land managers through technical pamphlets and the LDWF website.</p>
SPRUCE PINE-HARDWOOD FOREST	<p>Work with interested groups to promote SFI guidelines and develop new BMPs specific to this habitat. Distribute these guidelines to landowners/land managers through technical pamphlets and the LDWF website.</p>
INTERMEDIATE MARSH	<p>Work with landowners to develop alternatives to livestock production in this habitat.</p>
CYPRESS TUPELO-BLACKGUM SWAMP	<p>Work with landowners/land managers to promote conservation of habitat sites that may not regenerate naturally after logging due to changes in hydrology, herbivory, and other factors. Promote the use of “condition classes” as defined by the Governor’s Science Working Group on Coastal Wetland Forest Conservation and Use to define these target swamp habitat areas in need of conservation attention.</p>
BAYHEAD SWAMP SMALL STREAM FOREST	<p>Work with LFA to produce a publication regarding SMZs and BMPs, and landowner rights regarding logging on their property.</p>
SMALL STREAM FOREST	<p>Work with LFA to produce occasional publications that focus on recent developments in SMZ management, improved BMPs, and rights of landowner regarding use of their property.</p>
BARRIER ISLAND LIVE OAK FOREST COASTAL DUNE GRASSLAND/SHRUB THICKET COASTAL MANGROVE-MARSH SHRUBLAND LIVE OAK NATURAL LEVEE FOREST	<p>Work with the legislature to develop tax incentives and conservation easements or leases for landowners to encourage conservation of this habitat type.</p>
CALCAREOUS PRAIRIE CALCAREOUS FOREST COASTAL LIVE OAK-HACKBERRY FOREST COASTAL PRAIRIE EASTERN HILLSIDE SEEPAGE BOG HARDWOOD FLATWOODS MIXED HARDWOOD-LOBLOLLY PINE/HARDWOOD SLOPE FOREST SOUTHERN MESOPHYTIC FOREST SALINE PRAIRIE SPRUCE PINE-HARDWOOD FOREST SHORTLEAF PINE/OAK-HICKORY FOREST SLASH PINE-POND CYPRESS/HARDWOOD FOREST WESTERN HILLSIDE SEEPAGE BOG WESTERN XERIC SANDHILL WOODLAND	<p>Work with the legislature to provide incentives (tax breaks, etc.) to landowners to retain the natural state of areas where this habitat occurs.</p>

<b>PARTNER/associated habitat</b>	<b>STRATEGY</b>
<b>LEVEE BOARDS</b>	
BATTURE	Work with COE and local levee boards to maintain the natural ecology of batture areas and to educate these organizations on the productivity of this habitat in meeting the needs of resident and migratory wildlife species.
<b>LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY</b>	
SMALL STREAM FOREST	Form a committee composed of gravel mining interests, DEQ, LDNR, TNC, and other interested groups to develop BMPs for current and proposed gravel mines to prevent or reduce their impacts to streams and surrounding forest habitat.
SALT MARSH	Review oversight capabilities of DOTD, LDEQ, LDNR and other agencies to enforce specifications and recommendations contained in permits.
BATTURE	Work with LDEQ, EPA, and other state and federal agencies to fill data gaps concerning ecological system processes and water quality/discharge impacts on this habitat.
<b>LOUISIANA DEPARTMENT OF NATURAL RESOURCES</b>	
SMALL STREAM FOREST	Form a committee composed of gravel mining interests, LDEQ, LDNR, TNC, and other interested groups to develop BMPs for current and proposed gravel mines to prevent or reduce impacts to streams and the surrounding forest habitat.
SALT MARSH	Review oversight capabilities of DOTD, LDEQ, LDNR and other agencies to enforce specifications and recommendations contained in permits.
COASTAL DUNE GRASSLAND/SHRUB THICKET BARRIER ISLAND BARRIER ISLAND LIVE OAK FOREST COASTAL LIVE OAK-HACKBERRY FOREST COASTAL MANGROVE-MARSH SHRUBLAND INTERMEDIATE MARSH LIVE OAK NATURAL LEVEE FOREST SALT DOME HARDWOOD FOREST SALT MARSH	Support NRCS and LDNR efforts for shoreline stabilization and habitat restoration.
VEGETATED PIONEER EMERGING DELTA	Work with COE, LDNR, and other interested groups to develop improved management techniques for this habitat type.
LIVE OAK NATURAL LEVEE FOREST	Work with local parish planning commissions and LDNR to change zoning classifications to reduce development within this habitat type.
<b>LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT</b>	
COASTAL PRAIRIE	Partner with DOTD and federal agencies to promote the planting of native prairie species in ROWs, in areas where historic native prairies occurred.

<b>PARTNER/associated habitat</b>	<b>STRATEGY</b>
<b>LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT (cont)</b>	
SALT MARSH	Review oversight capabilities of DOTD, LDEQ, LDNR and other agencies to enforce specifications and recommendations contained in permits.
BOTTOMLAND HARDWOOD FOREST	Work with BBCC, DOTD, NRCS, USFWS, USFS, private landowners, etc. to promote corridors for black bears and other wildlife species.
<b>LOUISIANA FORESTRY ASSOCIATION</b>	
BAYHEAD SWAMP SMALL STREAM FOREST	Work with LFA to produce a publication regarding SMZs and BMPs, and landowner rights regarding logging on their property.
SMALL STREAM FOREST	Work with LFA to produce occasional publications that focus on recent developments in SMZ management, improved BMPs, and rights of landowner regarding use of their property.
BOTTOMLAND HARDWOOD FOREST	Work with NRCS and LFA to promote economic value of hardwood lumber to encourage management/restoration of this habitat.
<b>LOUISIANA OFFICE OF STATE LANDS</b>	
SHORTLEAF PINE/OAK-HICKORY FOREST	Work with USFS, DOD, and Office of State Lands to encourage the conservation and restoration of this habitat where it exists on public lands.
<b>LOUISIANA OFFICE OF STATE PARKS</b>	
LIVE OAK- PINE-MAGNOLIA FOREST	Partner with NGOs, OSP, private landowners, etc. to initiate restoration and preservation efforts of live oak – pine – magnolia forests and continue to encourage landowners to enroll this habitat type in the Natural Areas Registry Program.
SPRUCE PINE-HARDWOOD FOREST	Partner with NGOs, OSP, private landowners, etc. to initiate restoration and preservation efforts of spruce pine – hardwood flatwood forests and continue to encourage landowners to enroll this habitat type in the Natural Areas Registry Program.
SOUTHERN MESOPHYTIC FOREST	Partner with OSP to design nature/recreational trails for state parks lands and develop similar trails on Tunica Hills WMA.
BARRIER ISLAND BARRIER ISLAND LIVE OAK FOREST COASTAL MANGROVE-MARSH SHRUBLAND	Work with NRCS Plant Materials Center, BTNEP, and OSP to develop restoration program for this habitat.
<b>LSU COOPERATIVE EXTENSION</b>	
CALCAREOUS PRAIRIE EASTERN UPLAND LONGLEAF PINE FOREST WESTERN UPLAND LONGLEAF PINE FOREST	Educate land managers/hunting clubs/extension agents, etc concerning food plot location in sensitive habitats to discourage this practice.
AGRICULTURAL CROPLAND GRASSLAND	Partner with LSU Ag Extension to develop and implement strategies in this habitat.
SALT MARSH	Provide public education and support existing efforts/programs regarding invasive species; coordinate these efforts with LSU Ag Extension agents, NRCS, Sea Grant (rapid assessment projects – Calcasieu), etc.

<b>PARTNER/associated habitat</b>	<b>STRATEGY</b>
<b>NATURAL RESOURCES CONSERVATION SERVICE</b>	
AGRICULTURAL CROPLAND GRASSLAND	Actively participate in NRCS state advisory technical committee (TAC).
AGRICULTURAL CROPLAND GRASSLAND	Develop and distribute promotional materials on federal/state incentive programs beneficial to wildlife.
AGRICULTURAL CROPLAND GRASSLAND	Encourage planting of native species along field borders and filter strips to create micro-habitat for wildlife species (CP33 – NRCS program).
FRESHWATER MARSH INTERMEDIATE MARSH	Encourage the NRCS Plant Materials Center and other growers to produce a greater variety of plant species for the restoration of coastal habitats.
MIXED HARDWOOD-LOBLOLLY PINE/HARDWOOD SLOPE FOREST	Encourage the use of existing NRCS, USFWS programs in providing cost share incentives to landowners for invasive species control.
COASTAL PRAIRIE	Partner with NRCS to encourage farmers to plant native prairie plant species on agricultural buffer areas.
SPRUCE PINE-HARDWOOD FOREST	Promote the use of federal cost share programs (NRCS) to control invasive species.
EASTERN HILLSIDE SEEPAGE BOG EASTERN LONGLEAF PINE SAVANNAH EASTERN UPLAND LONGLEAF PINE FOREST SLASH PINE-POND Cypress/HARDWOOD WESTERN HILLSIDE SEEPAGE BOG WESTERN LONGLEAF PINE SAVANNAH WESTERN UPLAND LONGLEAF PINE FOREST	Promote the utilization of federal cost share programs (NRCS) to address invasive species problems.
SALT MARSH	Provide public education and support existing efforts/programs regarding invasive species. Coordinate these efforts with LSU Ag Extension agents, NRCS, LA Sea Grant (rapid assessment projects – Calcasieu), etc.
AGRICULTURAL CROPLAND GRASSLAND	Secure funding for LDWF positions to be located at NRCS regional offices to provide wildlife recommendations to NRCS District Conservationists as they develop farm conservation plans.
COASTAL DUNE GRASSLAND/SHRUB THICKET BARRIER ISLAND BARRIER ISLAND LIVE OAK FOREST COASTAL LIVE OAK-HACKBERRY FOREST COASTAL MANGROVE-MARSH SHRUBLAND INTERMEDIATE MARSH LIVE OAK NATURAL LEVEE FOREST SALT DOME HARDWOOD FOREST SALT MARSH	Support NRCS and LDNR efforts for shoreline stabilization and habitat restoration
BOTTOMLAND HARDWOOD FOREST	Work with BBCC, DOTD, NRCS, USFWS, USFS, private landowners, etc. to promote corridors for black bears and other wildlife species.
COASTAL LIVE OAK-HACKBERRY FOREST LIVE OAK NATURAL LEVEE FOREST	Work with COE and NRCS to develop better strategies for the placement of dredge materials as a restoration method for this habitat type.

<b>PARTNER/associated habitat</b>	<b>STRATEGY</b>
<b>NATURAL RESOURCES CONSERVATION SERVICE (cont)</b>	
BOTTOMLAND HARDWOOD FOREST	Work with NRCS and LFA to promote economic value of hardwood lumber to encourage management/restoration of this habitat.
BRACKISH MARSH COASTAL DUNE GRASSLAND/SHRUB THICKET SALT MARSH	Work with NRCS Plant Materials Center and BTNEP to develop viable cultivars for marsh restoration efforts.
BARRIER ISLAND BARRIER ISLAND LIVE OAK FOREST COASTAL MANGROVE-MARSH SHRUBLAND	Work with NRCS Plant Materials Center, BTNEP, and OSP to develop restoration program for this habitat.
COASTAL LIVE OAK-HACKBERRY FOREST	Work with NRCS to promote use of dredge materials to develop new areas to restore this habitat type
<b>NGOs (NON-GOVERNMENTAL ORGANIZATIONS)</b>	
MIXED HARDWOOD-LOBLOLLY PINE/HARDWOOD SLOPE FOREST SOUTHERN MESOPHYTIC FOREST SHORTLEAF PINE/OAK-HICKORY FOREST	Develop partnerships with federal and state agencies, NGOs and others to identify potential parcels of this habitat type for acquisition and conservation.
BARRIER ISLAND LIVE OAK FOREST	Partner with NGOs (TNC, LOS, NAS), state and federal agencies, industry, and private landowners to promote the conservation of remaining barrier island live oak forests.
LIVE OAK- PINE-MAGNOLIA FOREST	Partner with NGOs, OSP, private landowners, etc. to initiate restoration and preservation efforts of live oak – pine – magnolia forests and continue to encourage landowners to enroll this habitat type in the Natural Areas Registry Program.
SPRUCE PINE-HARDWOOD FOREST	Partner with NGOs, OSP, private landowners, etc. to initiate restoration and preservation efforts of spruce pine – hardwood flatwood forests and continue to encourage landowners to enroll this habitat type in the Natural Areas Registry Program.
COASTAL DUNE GRASSLAND/SHRUB THICKET	Partner with NGOs, private landowners, etc. to promote protection of coastal dune grasslands and shrub thickets and continue to encourage landowners to enroll this habitat type in the Natural Areas Registry Program.
LIVE OAK NATURAL LEVEE FOREST	Partner with NGOs, private landowners, etc. to promote the protection of live oak forests and continue to encourage landowners to enroll this habitat type in the Natural Areas Registry Program.
COASTAL PRAIRIE	Partner with NGOs, state and federal agencies, private landowners, etc. to promote the protection, restoration, and expansion of coastal prairie habitat.
COASTAL LIVE OAK-HACKBERRY FOREST	Partner with state and federal agencies, NGOs, private landowners, etc. to increase the conservation efforts in cheniers.
SALT DOME HARDWOOD FOREST	Partner with state and federal agencies, NGOs, private landowners, etc. to promote the conservation and restoration of salt dome hardwood forests.

<b>PARTNER/associated habitat</b>	<b>STRATEGY</b>
<b>NGOs (NON-GOVERNMENTAL ORGANIZATIONS)</b> (cont)	
BARRIER ISLAND	Partner with state and federal agencies, NGOs, private landowners, etc. to promote the protection and restoration of barrier islands.
<b>THE NATURE CONSERVANCY</b>	
BARRIER ISLAND LIVE OAK FOREST	Partner with NGOs (TNC, LOS, NAS), state and federal agencies, industry, and private landowners to promote the conservation of the remaining barrier island live oak forests.
SMALL STREAM FOREST	Form a committee composed of gravel mining interests, LDEQ, LDNR, TNC, and other interested groups to develop BMPs for current and proposed gravel mines to prevent or reduce impacts to streams and the surrounding forest habitat.
SMALL STREAM FOREST	Work with TNC and other partners to develop guidelines and funding mechanisms for the restoration of abandoned gravel mines.
<b>US ARMY CORPS OF ENGINEERS</b>	
COASTAL LIVE OAK-HACKBERRY FOREST LIVE OAK NATURAL LEVEE FOREST	Work with COE and NRCS to develop better strategies for the placement of dredge materials as a restoration method for this habitat type.
VEGETATED PIONEER EMERGING DELTA	Work with COE and NRCS to develop better strategies for the placement of dredge materials as a restoration method for this habitat type. Promote appropriate use of dredge material to develop new areas for nesting sites, general stopover sites, and to enhance aquatic species habitat.
VEGETATED PIONEER EMERGING DELTA	Work with COE and others to manage water levels to create new high quality habitat and benefit existing delta habitat.
BATTURE	Work with COE and the various levee boards to maintain the natural ecology of batture areas and to educate these organizations on the productivity of this habitat in meeting the needs of resident and migratory wildlife species.
BRACKISH MARSH	Work with COE & state agencies to insure that water control structures provide the maximum benefit to brackish marsh.
INTERMEDIATE MARSH	Work with COE and state agencies to insure that water control structures provide the maximum benefit to intermediate marsh.
SALT MARSH	Work with COE and state agencies to insure that water control structures provide the maximum benefit to salt marsh.
SANDBARS	Work with COE to develop MOU regarding sandbar management.
CYPRESS TUPELO-BLACKGUM SWAMP FRESHWATER MARSH	Work with COE to influence water levels in the Atchafalaya Basin to benefit this habitat type.
VEGETATED PIONEER EMERGING DELTA	Work with COE, LDNR, and other interested groups to develop improved management techniques for this habitat type.

<b>PARTNER/associated habitat</b>	<b>STRATEGY</b>
<b>US ARMY CORPS OF ENGINEERS (cont)</b>	
CYPRESS TUPELO-BLACKGUM SWAMP	Work with COE, DU and other groups to enhance swamp hydrologic conditions to control invasives on Caddo Lake and Catahoula Lake.
<b>US DEPARTMENT OF DEFENSE</b>	
SHORTLEAF PINE/OAK-HICKORY FOREST	Work with USFS, DOD, and Office of State Lands to encourage the conservation and restoration of this habitat where it exists on public lands.
<b>US FISH &amp; WILDLIFE SERVICE</b>	
MIXED HARDWOOD-LOBLOLLY PINE/HARDWOOD SLOPE FOREST	Encourage use of existing NRCS, USFWS programs in providing cost share incentives to landowners for invasive species control.
AGRICULTURAL CROPLAND GRASSLAND	Partner with LMVJV, GCJV, USFWS and other interested groups to encourage farmers to manage water levels to provide habitat for shorebirds during migration, with an emphasis on early fall migration.
BRACKISH MARSH	Support and encourage expansion of the mini-refuge system administered by USFWS refuges.
BOTTOMLAND HARDWOOD FOREST	Work with BBCC, DOTD, NRCS, USFWS, USFS, private landowners, etc. to promote corridors for black bears and other wildlife species.
<b>US FOREST SERVICE</b>	
BOTTOMLAND HARDWOOD FOREST	Work with BBCC, DOTD, NRCS, USFWS, USFS, private landowners, etc. to promote corridors for black bears and other wildlife species.
SHORTLEAF PINE/OAK-HICKORY FOREST	Work with USFS, DOD, and Office of State Lands to encourage the conservation and restoration of this habitat where it exists on public lands.



## CHAPTER 7. CONSERVATION PRIORITIES

### A. Terrestrial Habitats

The development of conservation priorities is driven by a need to focus efforts on wildlife habitats and associated species of conservation concern currently experiencing the greatest population declines and where actions would bring the greatest benefits to the maximum number of species. Terrestrial habitats were prioritized for conservation action within ecoregion, and the process used to create the following habitat priority lists is described in detail in Chapter 3, Section I and in Appendix M. The following table is a listing of terrestrial habitat priorities by ecoregion and tier group.

Table 7.1. Terrestrial habitat priorities by ecoregion and tier group.

<b>ECOREGION</b>	<b>TIER I HABITATS</b>	<b>TIER II HABITATS</b>
<b>EGCP</b>		
	Eastern longleaf pine savannah	Mixed hardwood-loblolly pine/hardwood slope forest
	Eastern upland longleaf pine forest	Shortleaf pine/oak-hickory forest
	Slash pine-pondcypress hardwood forest	Bottomland hardwood forest
	Live oak-pine-magnolia forest	Small stream forest
	Spruce pine-hardwood flatwood	Bayhead swamp/forested seep
	Eastern hillside seepage bog	Cypress-tupelo-blackgum swamp
		Agriculture-crop-grassland
<b>UWGCP</b>		
	Shortleaf pine/oak-hickory forest	
	Mixed hardwood-loblolly pine/hardwood slope forest	
	Hardwood flatwood	
	Western xeric sandhill woodland	
	Small stream forest	
	Bottomland hardwood forest	
	Bayhead swamp/forested seep	
	Cypress-tupelo-blackgum swamp	
	Calcareous prairie	
	Calcareous forest	
	Saline prairie	
	Agriculture-crop-grassland	
<b>LWGCP</b>		
	Western longleaf pine savannah	Shortleaf pine/oak-hickory forest
	Western upland longleaf pine forest	Mixed hardwood-loblolly pine/hardwood slope forest
	Sandstone glade/barren	Small stream forest
	Western hillside seepage bog	Saline prairie

<b>ECOREGION</b>	<b>TIER I HABITATS</b>	<b>TIER II HABITATS</b>
<b>LWGCP cont...</b>		
		Bottomland hardwood forest
		Bayhead swamp/forested seep
		Cypress-tupelo-blackgum swamp
		Calcareous prairie
		Western xeric sandhill woodland
		Calcareous forest
		Agriculture-crop-grassland
<b>MRAP</b>		
	Sandbar	Bottomland hardwood forest
	Batture	Cypress-tupelo-blackgum swamp
		Live oak natural levee forest
		Hardwood flatwood
		Agriculture-crop-grassland
<b>GCPM</b>		
	Intermediate marsh	Live oak natural levee forest
	Salt marsh	Bottomland hardwood forest
	Coastal prairie	Cypress-tupelo-blackgum swamp
	Brackish marsh	Agriculture-crop-grassland
	Freshwater marsh	
	Barrier island live oak forest	
	Barrier islands	
	Coastal live oak-hackberry forest	
	Salt dome hardwood forest	
	Vegetated pioneer emerging delta	
	Coastal dune grassland/shrub thicket	
	Coastal mangrove-marsh shrubland	
<b>UEGCP</b>		
	Southern mesophytic forest	Small stream forest
		Agriculture-crop-grassland

## **B. Aquatic Habitats**

Establishing priorities within aquatic habitats is difficult due to the overall lack of ecological and biological information for the majority of aquatic habitats and their associated species of conservation concern. With this first iteration, development of a priority process was not possible due to these data gaps. Therefore, the first priority for freshwater and marine systems is to initiate and support research on species assemblages and their ecological and biological needs.

## CHAPTER 8. RESEARCH AND MONITORING

Research and monitoring aspects of this plan are complex. Clearly they should be:

- Hypothesis-driven with clearly defined objectives
- Based on sensitive indicators of change
- Based on mechanistic or causal relations between indicators and system state
- A sampling strategy appropriate for detecting change
- A format and framework for organizing, analyzing, and storing, and retrieving monitoring data
- A procedure for incorporating monitoring results into future decision making

During the development of the CWCS, one issue that surfaced repeatedly from researchers, managers, and the public in general was the critical need for a depository for wildlife issues and information in Louisiana. Specifically, a database is needed that contains current statewide research or monitoring efforts with specifics such as principal investigator or primary contact, organization, research methods, target species and habitats, etc. It was evident that university researchers, federal and state agency biologists, and the public wanted and could benefit from having access to this information. In light of this, LDWF developed a list of projects on federal and state-managed lands. This quickly expanded to include all research in the state that could provide additional information on habitats or species of conservation concern outlined in the CWCS. Appendix P lists more than 500 biological research and monitoring projects currently under way in the state and this list, in an expanded version that includes cooperators, principal investigator, and project date, will be made available on the LDWF web site. These projects include monitoring species populations and habitat conditions. Much of the list is current biological monitoring occurring on federal and state managed areas (refuges, management areas, parks, etc.). In addition, Appendix Q discusses coastal restoration and monitoring efforts currently ongoing or proposed in Louisiana's coastal zone. LDWF is committed to continuing monitoring projects currently ongoing within the agency or funded by this agency, to developing new monitoring projects tailored to species in conservation need and their habitats, and to annually updating this list, and making it available on our web site.

A comprehensive monitoring plan arguably includes review at both the biological and programmatic levels. As an agency with a mandate to conserve our wildlife and its habitat, LDWF tends to stress biological monitoring. Though necessary, this approach is expensive. In fact, the development and implementation of a monitoring plan may very well consume the bulk of available SWG funds. The development of any detailed monitoring plan will address the issues of scale (geographic and temporal), but its depth will be ultimately determined by affordability. The development of the CWCS has helped to solidify the need for a detailed comprehensive monitoring plan for wildlife species of conservation concern. To achieve this goal, our adaptive management approach will track that identified by Schoonmaker and Luscombe (2005).

## **A. Research**

The CWCS is divided into 38 habitat types across 6 ecoregions, 12 aquatic basins, and 6 estuarine habitat types. Research needs are often provided within each basin/habitat type description (Chapter 4). As such, the CWCS will drive most of the research and monitoring activities funded through Louisiana's share of the SWG program. However, this was certainly not intended to be a complete list and the topics considered are fluid. Conceptually, LDWF views allocation of SWG funds for research and monitoring as a three-tiered program:

- LDWF-developed research and monitoring projects based on species and/or habitat needs specified in the CWCS
- Partnerships with outside contractors (universities, NGO's, industry, etc.) to develop projects based on species and/or habitat needs specified in the CWCS
- Proposals submitted to LDWF from the research community, business community, and the public based on species and/or habitat needs specified in the CWCS

Priorities for SWG projects are determined through a combination of factors including: relevance to species and/or habitat priorities identified in the CWCS, project design, feasibility and cost, and the amount of currently available funding. The LDWF SWG Core Committee will rank project proposals using the above set of defined criteria along with other criteria still under development. Table 8.1 contains a list of all past and current SWG projects in the state.

However, as exemplified by the 500-plus monitoring and research projects which are almost exclusively funded without SWG funds, other research activities will continue to provide vital data of fish and wildlife resources in the state. With the development of the CWCS, many academia, state, and federal staff were able to provide input into research needs. The SWG program will only be able to fund a fraction of the work that will be an integral part of expanding our knowledge base for accomplishing our goals. It is recognized that each individual institution will have its own research and monitoring interests and specialties. Nonetheless, we believe that the CWCS will serve to focus everyone on the conservation needs while allowing institutions to continue to maximize the use of their expertise.

## **B. Database Needs**

Currently there is no single data management system in Louisiana. Although over 500 habitat and species oriented studies are currently being conducted in the state, the availability of data for modeling, determination of habitat changes, species abundance by habitats, etc. are not stored in the same database management systems, collected with the same protocols, easily retrievable, nor available for the entire wildlife community. Developing a central data storage/retrieval system is of paramount importance for accurate assessments (baseline and long-term) to be made. It may be possible to utilize

Table 8.1. State Wildlife Grants Projects from 2002 to 2004.

Year*	Grant #	Project Title	Status
<b>2002</b>	T-1	Planning Grant (involving multiple projects)	Closed 06/30/03
	T-2	Implementation Grant (involving multiple projects)	Closed 06/30/03
	T-3	Avian/Herp WMA Studies (Ouachita, Russell Sage, Sicily Island Hills, Buckhorn)	Completed - 06/30/05
	T-4	Wood Thrush Study	Completed - 06/30/05
	T-5	Avian/Herp WMA Studies (Sherburne, Sandy Hollow, Ben's Creek)	Completed - 06/30/05
	T-6	Avian/Herp WMA Studies (Big Lake, Dewey W. Wills, Red River, Three Rivers)	Completed - 06/30/05
<b>2003</b>	T-7	SWG Coordination and CWCS Development	Ongoing - ends 06/30/06
	T-8	Gulf Sturgeon Winter Habitat Study	Completed - 06/30/05
	T-9	Identifying Swallow-tailed Kite Activity Centers	Completed - 06/30/06
	T-10	Statewide S1/S2/S3 Species Research	Ongoing - ends 12/31/06
	T-11	Statewide Wading Bird and Seabird Nesting Inventory	Ongoing - ends 06/30/06
	T-12	Database for Tracking S1-S2-S3 Species	Ongoing - ends 06/30/06
	T-13	Breeding Bird Surveys Improvements	Completed - 06/30/05
	T-14	Louisiana Marine Animal Stranding Network	Completed - 06/30/05
	T-15	Louisiana Statewide RCW Safe Harbor Agreement	Ongoing - ends 12/31/06
	T-16	Natural Areas Registry Program	Ongoing - ends 06/30/06
	T-17	Avian/Herp WMA Studies (Spring Bayou, Pomme de Terre, Tunica Hills, Pearl River)	Ongoing - ends 06/30/06
	T-18	Waterbird Study	Ongoing - ends 06/30/06
	T-19	Statewide Big River Fish Inventory	Ongoing - ends 06/30/06
	T-20	Ornate Box Turtle, Crested Caracara and Burrowing Owl Habitat Study	Completed - 06/30/04
	T-21	Natural Heritage Statewide Workshop	Completed - 06/30/05
	T-22	Savanna Sparrows Project	Ongoing - ends 06/30/06
	T-23	Lake Maurepas Ecosystem Breeding Bird Study	Ongoing - ends 06/30/06
T-24	Herp WMA Studies (Bayou Pierre, Loggy Bayou, Jackson-Bienville)	Ongoing - ends 06/30/06	
T-25	Avian WMA Studies (Bayou Pierre, Loggy Bayou, Jackson-Bienville)	Ongoing - ends 06/30/06	
<b>2004</b>	T-26	Avian/Herp/Mammal WMA Studies (Bayou Macon, Boeuf)	Ongoing - ends 06/30/07
	T-27	Identifying, Prioritizing, and Conserving Important Bird Areas in Louisiana	Ongoing - ends 06/30/08
	T-28	Survey for S1 Amphibians in St. Tammany Parish	Ongoing - ends 06/30/06
	T-29	Alligator Snapping Turtle Study	Ongoing - ends 12/31/06
	T-30	Sherburne WMA Bird Productivity and Survivorship Study	Ongoing - ends 06/30/06
	T-31	WMA Water Management for Migrating Shorebirds	Ongoing - ends 06/30/06
	T-32	Statewide Henslow's Sparrow Study	Ongoing - ends 06/30/08

\* Based on the fiscal year beginning July 1

existing systems such as the National Biological Information Infrastructure (NBII). Whichever system is used, it must allow easy access to data for appropriate baseline and impact assessments yet must be secure enough so that data utilization without permission can not occur.

As important as establishing a data clearinghouse is, it is just as important to understand how the data were collected and what the data mean. If different protocols for studies are used in the data collection phase, pooling across data sets may not be appropriate. This could result in the erroneous interpretation of results thus negatively impacting assessment efforts. As such, it is extremely important that monitoring efforts be standardized whenever possible. When the first SWG funds were allocated, LDWF worked collaboratively with academia, the USFWS, and the USGS to develop standardized protocols. These were consistent with the most current methodological practices and would allow for comparisons among sites within and outside of Louisiana. Further, if standardization is not possible, collection protocols for each data set must be documented to allow for appropriate interpretation or application and allowance of acknowledgement of weaknesses. There are a number of sources for standardized protocols including the USGS through its Status and Trends of Biological Resources Program (USGS 2005).

### **C. Biological Monitoring**

The primary goals of our biological monitoring are to guide the ongoing management of populations and habitats, and to detect long-term population changes in species. Monitoring was divided into 2 major categories: terrestrial and aquatic. Terrestrial monitoring/population estimation will be conducted on the ecoregional scale, and, in some instances, across ecoregions. For aquatic habitat monitoring, freshwater systems were divided into drainage basins while estuarine/marine systems follow the 7 coastal study areas (Fig. 2.12) as currently defined by the LDWF's Marine Fisheries Division. We also recognize that localized research and monitoring will provide critical data for species of restricted range and small populations. However, conceptually, the bigger long-term question that we want to address is whether we impacted the ecoregion and not one small specific site.

#### **1. Terrestrial Habitats and Species**

Identification of changes in habitat is critical to the assessment of the effectiveness of the CWCS for wildlife species. Currently the location and size of many of the LNHP habitat types are not explicitly identified spatially or quantitatively. Providing this information in both spatial and tabular format will be one of the first actions undertaken by LDWF, and SWG funds have already been allocated to begin this task. However, it is likely that even broader habitat categories will be used for determination of habitat status for some wildlife species with less specific habitat needs. From some faunal perspectives, the habitat type per se is probably less important than the structural composition of that habitat. Other sources of habitat data include the USFS Inventory and Analysis (FIA), the NRCS National Resources Inventory (NRI), and the Louisiana GAP analysis. In addition,

a number of state and federal agencies monitor programs designed for habitat enhancement and/or restoration. These include, but are not limited to, NRCS, FSA, USFWS, and LDAF, which have programs that encourage reforestation and forest management as well as native grass planting and wetland restoration. Habitat monitoring is an integral part of the CWCS because our underlying premise, as with most habitat programs, is like that of the film *Field of Dreams*—“build it and they will come”.

### **Bird Monitoring**

In considering species issues, a number of different approaches for monitoring avian trends/densities for breeding birds were evaluated for the CWCS and 3 are presented in this initial draft because they provide a means of evaluating change at the landscape level. Additionally, we believe the 3 methods provide a mechanism to confirm apparent trends suggested by Breeding Bird Survey (BBS) data and fit well into population goal assessments for programs such as PIF. However, it should be recognized that the All Bird Monitoring Program protocols, which are not finalized as yet, might become the prominent avian monitoring program. Further, specific research projects on Louisiana’s avian species of concern resulting from implementation of strategies and research needs listed within specific habitats will provide other indices as to their current status on more local scales.

#### **Bird Monitoring - Approach A.**

The current BBS design has approximately 4 routes per degree block in Louisiana for a total of 59 routes. These data, along with data collected throughout the United States, Canada and Mexico, are currently used to make inferences relative to the current status and trends of bird populations. Based on minimum point sampling provided by USGS guidance, this should be more than sufficient to identify trends within an ecoregion. However, from an avian perspective, BBS data for Louisiana often are only analyzed within 4 broad habitat strata: Coastal Prairie, Coastal Flatwoods, Upper Coastal Plain, and Mississippi River Alluvial Plain. One drawback with BBS routes is the expertise required to run the routes. As a consequence, limitations in personnel/volunteers frequently result in some routes not being run from year to year. Nonetheless, we believe this can provide a good index for breeding bird abundance trends within ecoregions or the 4 broad habitat strata. In addition, a concerted effort will be made to recruit enough people with sufficient proficiency in bird identification to run all BBS routes in Louisiana every year. One of the SWG projects was to provide monetary compensation to BBS volunteers to cover a portion of their expenses associated with running their routes.

#### **Bird Monitoring - Approach B.**

This approach would use a group of umbrella species to determine the status of species of concern. One advantage of this approach is that it does not require someone who has the expertise to identify all birds by song. As such, LDWF staff/volunteers could more easily be trained and all BBS routes would have a better chance of being run each

year. Additional routes could be added in the future to provide better estimates by ecoregion.

### **Bird Monitoring - Approach C.**

A more complicated approach could provide more quantitative estimates of impacts. This approach would involve developing density estimates for broad habitat types (pine sawtimber, pine poletimber, pine sapling/seedling, etc.--something that could be derived from the FIA data or GAP data) based on the various fixed and variable distance point counts that have been made across the state by different researchers/agencies. Mid-cycle data or net changes of other conservation practices in the state could be used for re-estimation. For example, a number of agencies have programs that contribute to positive habitat impacts. One such agency is the NRCS. Increases in acres of habitat x (such as longleaf pine) could be tracked over 5-year intervals and estimates of the expected impact could be projected based on fixed and variable distance point counts for that habitat type and its successional stage. Obtaining adequate data for this estimation may necessitate pooling across ecoregions. This should not be an unrealistic assumption from a bird perspective, particularly in light of BBS data analyses often conducted at only 4 broad strata for Louisiana. This evaluation provides an estimate independent of the BBS and can serve as a verification tool of trends exhibited in approaches A and B that use BBS protocol.

### **Other Bird Monitoring**

Not all birds lend themselves to detection with BBS-type surveys. Rookeries, bald eagles, and swallow-tailed kites will continue to be monitored by aerial and on-the-ground surveys. Additionally, monitoring programs for shore birds will be done through continued and expansion of counts using Program for Regional and International Shorebird Monitoring (PRISM) protocols. Colonial waterbirds will be monitored by air and on the ground via LDWF personnel and contractors. Some form of monitoring program must also be developed to track nocturnal bird species.

### **Amphibian, Reptile, and Small Mammal Monitoring**

Amphibian, reptile, and small mammal species are more problematic in their monitoring for a number of reasons including:

- the need to have access to private properties for many of the surveys
- non-random or limited distribution of many species of conservation concern
- relatively small population sizes of many species of conservation concern

However, there are several systems in place for the monitoring of amphibians and reptiles such as North American Amphibian Monitoring Program (NAAMP), Louisiana Amphibian Monitoring Program (LAMP) and PARC. We propose to recruit a group of volunteers across the state to implement a comprehensive amphibian monitoring program. Additionally, SWG projects as well as other sources provided estimates of



abundance (or at minimum presence/absence) for amphibian, reptiles, and small mammals on various habitats in Louisiana. Similar to that of breeding birds, density estimates are available for various broad habitat types. By tracking programs that add acres of a habitat, an estimate of its impact on the amphibian, reptiles, and small mammal communities can be made. Research projects directed towards specific species, whether funded through the SWG process or not, will continue to provide valuable data at a local scale for these faunal species of concern.

## **2. Aquatic Habitats and Species**

### **a. Freshwater**

Due to the diverse nature of the freshwater ecosystems and the lack of recent fish population data on the species of conservation concern listed in this strategy, the starting point of the monitoring efforts will focus around enumeration and identification of population structure and habitat types.

The initial monitoring efforts will focus on areas in southeast Louisiana in the Pearl, Mississippi, and Pontchartrain Basins. These basins represent habitat types for 77% of the listed species of conservation concern. Of all species listed, 40% occur only in these basins. New initiatives would focus on the Alabama shad and its reintroduction. Information needed on species occurrence within these basins include species trends and abundance with emphasis on several species of darters (channel, freckle and pearl). Since species occurrence has been documented for the shiners, monitoring the populations of the Blunt face and Bluenose shiners and the effects of habitat changes on their populations is essential. An established monitoring framework has been devised for the Gulf sturgeon and partnerships with MDWFP and USFWS have been established and will continue to aid in monitoring the recovery of this species.

Systems such as the Red, Mississippi, and Ouachita Basins serve as a major conduit for the inflow of invasive fish and mussel species into the waters of Louisiana. Monitoring efforts will be geared toward identifying trends in the current range and abundance of these species, particular the Asian carp and Zebra mussel, and what impact they are having on native species.

Due to the locks and dams on the Red River and the impoundment of the Sabine River at Toledo Bend, initial taxonomic surveys are needed to identify populations in these systems. Impoundments and the effects of navigational and flood control projects lead to habitat alterations and LDWF will partner with the COE to monitor their effect on species of conservation concern.

Coastal basins such as the Mermentau, Barataria, and Calcasieu offer unique and ever changing habitats. Coastal restoration projects such as Davis Pond and Caernarvon have been documented from a marine aspect but the impacts on freshwater species and habitats are relatively unknown. Long-term monitoring of these areas is essential. The effects of

barrier placements in streams and river bottoms to protect from saltwater intrusion and the impacts on the freshwater habitat and species must be monitored.

Habitat degradation in several portions of the Terrebonne, Vermillion-Teche, and Mermentau Basins has led to a reduction in fish species. Due primarily to land use practices, these basins struggle due to poor water quality. LDWF will continue to partner with LDEQ to monitor long term water quality within these basins. Data will provide indices to show the direction the habitat is heading and allow managers the opportunity to work towards corrective measures. Very little recent data exist on the proposed listed species of conservation concern. Initial monitoring efforts should be geared toward identifying: species occurrences, species abundance, habitat preference associated with each species, available habitat, and effects of habitat changes on these species.

Monitoring will be structured in 5 to 10 year increments with reevaluation of goals and objectives after 5 years. In the development of the CWCS, monitoring strategies were written to address freshwater aquatic species found in each river basin and are listed in Table 8.2.

For crustaceans and molluscs, intensive inventories are needed to better understand the distribution and status of each species. Additional life history studies need to be completed as well, especially for crustaceans. To stop the declines of species of concern, we will attempt to manage at the ecosystem level instead of at the local level, since water quality and other issues are frequently affected by factors outside the immediate area.

## **b. Marine**

The status of the various marine species of conservation concern are closely related to habitat threats in the coastal ecosystem, especially marsh loss and degradation, and therefore may be some of the first species to exhibit population declines. Table 4.1 provides a list of marine species of concern and their associated habitats. Habitat threats are at a critical level in the coastal zone, and LDWF Marine Fisheries Division has decided to prioritize these habitat threats rather than having a species-oriented focus. Data developed through this process will provide indices to community structure within and across habitats, and trends in population abundances by habitat type.

Fixed-location stations, stratified by habitat type, are established in each study area, and fishing gear appropriate to that station is used to collect physical, chemical and biological data, as appropriate. Sampling gear is deployed and data collected and recorded according to standard protocol established in the Marine Fisheries Division Field Procedures Manual.

The basic framework for marine/estuarine monitoring in Louisiana was established in 1968 with the Gulf-wide Cooperative Gulf of Mexico Estuarine Inventory (GMEI) and Study (Perret 1971, Perret et al. 1971), and further refined with the implementation of the watershed-based Coastal Study Area (CSA) management system for penaeid shrimp (White and Boudreaux 1977) that also was adapted for finfish monitoring in 1985. Other

Table 8.2 Monitoring needs for individual aquatic basins in Louisiana.

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**Atchafalaya Basin**

Monitor population trends of species of conservation concern  
Develop long-term water quality monitoring sites  
Develop long-term monitoring sites for species of conservation concern

**Barataria Basin**

Monitor the effects of freshwater diversions in the basin

**Calcasieu Basin**

Monitor annual salinity wedge in the river above the salt water barrier

**Mermentau Basin**

Monitor population trends of species of conservation concern  
Develop long-term water quality monitoring sites  
Develop long-term monitoring sites for species of conservation concern

**Mississippi Basin**

Sampling is needed to identify trends in range and abundance of invasive species  
Monitor trends of invasive species catch in commercial fisheries landings

**Ouachita Basin**

Conduct pre-impoundment taxonomic survey of proposed impoundments  
Conduct sampling to identify trends in range and abundance of invasive species  
Monitor trends of invasive species catch in commercial fisheries landings

**Pearl Basin**

Develop long-term water quality monitoring sites  
Develop long-term monitoring sites for species of concern  
Develop protocol for gear-type to ensure sampling is repeatable  
Partner with academia to monitor populations of species of conservation concern

**Pontchartrain Basin**

Monitor the effects of freshwater diversions in the basin

**Red Basin**

Conduct pre-impoundment taxonomic survey of proposed impoundments  
Conduct sampling to identify trends in range and abundance of invasive species  
Monitor trends of invasive species catch in commercial fisheries landings  
Monitor the effectiveness of mitigation features  
Monitor the effects of navigation and flood control projects on species of conservation concern

**Sabine Basin**

Evaluate the impacts of dam operations on fish populations

**Terrebonne Basin**

Develop long-term water quality monitoring sites  
Develop monitoring protocols to determine population trends of species of conservation concern  
Develop long-term monitoring sites for species of conservation concern  
Sampling is needed to identify trends in range and abundance of invasive species

**Vermilion-Teche Basin**

Sampling is needed to identify trends in range and abundance of invasive species

long-term projects collecting species/habitat data within the overall study area are the Caernarvon (1987 to present) and Davis Pond (1994 to present) Freshwater Diversion Monitoring Projects located in CSA 2 and 3, respectively. All projects rely on sampling with standardized gear over a range of habitats to characterize biological and environmental conditions. The general system for data collection established in 1968 has been used continuously since that time. The focus of the GMEI and CSA projects was primarily to document and monitor the importance of Louisiana's estuaries as contributors to Gulf of Mexico recreational and commercial fisheries. In their implementation all collected taxa were recorded, thus establishing a long-term data sequence for the various habitats and fish and invertebrate species in Louisiana coastal habitats.

Many marine and estuarine species are not well known, and long-term trends in their abundance are seldom well-described. It will be necessary to identify methods to monitor and verify status of cryptic species by periodically confirming presence, habitat use, life history characteristics, etc. This type of monitoring must be in addition to and linked to the evaluation of more well-known species for validation of trends seen in both types of monitoring programs.

Habitats are rapidly changing in the Louisiana coastal zone, due to a multiplicity of factors, both natural and anthropogenic. Methods to evaluate those changes and their effects on the aquatic and terrestrial populations that depend on them will be important in understanding trends in productivity of the habitats and the dynamics of the populations. This may require such methods as remote sensing, environmental constant data recorders, etc. to evaluate the rates and magnitude of these changes.

A variety of conservation efforts is underway to protect, enhance, or modify coastal wetlands. These projects will also affect their associated aquatic habitats and the fauna associated with those habitats, sometimes in ways that are not predictable or that are poorly understood at present. Special purpose assessment and monitoring studies must be developed and maintained to assess the performance of these actions on the maintenance of both the terrestrial and aquatic ecosystems involved in those actions.

Areas may be identified for habitat conservation and/or restoration purposes through a variety of assessment procedures. Selection criteria may include species diversity (current or potential), unique nature of the habitat in the state or region, and areas recognized by previous national or state prioritization processes (e.g., CWPPRA).

### **c. Coastal Restoration**

To date 467 coastal restoration projects (Appendix Q) have been constructed under the authority of the Louisiana Department of Natural Resources/Office of Coastal Restoration and Management/Coastal Restoration Division at an approximate cost of \$500 million. Funding for these projects comes from a variety of sources including: the Coastal Wetlands Planning Protection and Restoration Act (CWPPRA), the Water Resources Development Act (WRDA), and the state of Louisiana Wetlands Trust Fund.

These projects use a variety of techniques to achieve their goals. A complete list of projects including cost, size, and type can be found in the Coastal Restoration Annual Project Reviews (Stead and Hill 2004). Often times the projects result in a change in habitat type (open water to marsh, salt marsh to intermediate marsh, non vegetated area to planted area, etc.). While the primary goals of these projects generally are ecosystem restoration, secondary benefits include enhancement of critical fish and wildlife habitat.

Most coastal restoration projects are constructed through the CWPPRA program, where design and implementation is overseen by the LDNR/OCRM in cooperation with the following federal agencies: COE, USDA, U.S. Department of Commerce (Commerce), USDI, and the EPA. Typically, concerns regarding fish and wildlife habitat are resolved during the engineering and design phase. During this time, the various federal agencies have the opportunity to comment on project aspects that may have an impact on species they regulate. For example, the NMFS, under Commerce, will oversee project impacts on essential fish habitat, while the USFWS will address project impacts on other fish and wildlife issues. Furthermore, the LDNR/OCRM has implemented measures to examine the ecological impacts of projects. Through the "Ecological Review" process, the projects' ecological benefits can be assessed during the design phase of a project. By having engineers work with ecologists in the project design phase, the likelihood of a project successfully achieving its intended ecological goals is improved.

The Biological Monitoring Section of LDNR/OCRM/CRD is responsible for the management of all biological monitoring activities associated with coastal restoration projects. This includes monitoring plan development and implementation (data collection and storage, statistical analysis, quality control and data interpretation), and report generation. These activities provide a scientific evaluation of the effectiveness of each coastal wetlands restoration project in achieving long-term solutions to coastal wetlands loss in Louisiana. Data collected are used to determine the success or failure of existing projects, to determine if existing projects require modifications, and to support future decisions on selection of proposed coastal restoration projects. Currently over 40 variables are measured at over 3,000 locations. Data types include: hydrography, vegetation, sediment elevation, shoreline change, soil properties, and elevation. Although these stations are currently distributed by project location, LDNR/OCRM/CRD is transitioning towards a large-scale programmatic monitoring effort called Coastwide Reference Monitoring System (CRMS-Wetlands). Implementation of CRMS-Wetlands will provide a cost-effective means of evaluating individual projects and the collective effects of projects at the hydrologic basin and ecosystem scale. Information gathered by the program will be used for planning activities, adaptive management, and predicting future changes in Louisiana's coastal ecosystems with an increased degree of accuracy, and will help guide future management decisions.

### D. Measuring Strategy Success

Success of the Louisiana CWCS will rest on implementation of the various conservation actions or strategies developed in the writing of the plan. These strategies present explicit and concise approaches to addressing the identified threats to Louisiana’s species of conservation concern and their associated habitats. The conservation actions or strategies fall into several categories including:

- Land protection efforts
- Information management
- Partnerships
- Education and outreach
- Technical interactions
- Restoration efforts
- Surveys and research
- Monitoring
- Conservation design

In order to accurately measure the success of these strategies, a series of performance indicators was devised (Tables 8.3 through 8.7). These performance indicators give concrete, quantitative measures on which LDWF can base its evaluation of the success of the CWCS. A specific schedule for reporting on the implementation of strategies and a database of the corresponding performance indicators is essential. Tables 8.8 and 8.9 present the schedules for accomplishing these tasks.

**Table 8.3. Performance indicators for general conservation actions.**

Strategy	Performance Indicator (tracked annually)
Surveys and research	# of areas surveyed; # of new survey sites; # of species located; # of new locations of species of concern; new estimates of population size; measures of life history metrics; # of technical committee meetings/workshops
Monitoring	# of new monitoring sites or species protocols established; # of species for which trend information can be assessed; # of species for which population targets can be assigned; trends in habitats necessary for species of conservation concern; # of projects for which monitoring information led to adaptive management
Land protection efforts	# of acres protected through conservation servitudes, acquisition, etc. by LDWF or other partner; # Natural Areas Registry sites enrolled; # of cooperative projects with LDWF and partners
Information management	# of species tracked; # of species with new data being collected; # of data exchanges with partners or users; # of projects completed for species of concern
Partnerships	# of partnerships extended or created; # of information exchanges via meetings, reports, data, etc; # of MOUs developed or renewed
Education and outreach	# of news releases; # of public presentations; # of participants in Natural Areas Registry Program; # of reports generated; # of positive/negative comments from public and partners
Technical interactions	# of private lands visited to discuss species of concern; # of measures implemented; # of permits reviewed; # of BMPs developed or recommended
Restoration efforts	# of acres reforested; # of projects funded; # coastal projects funded; # projects implemented; # of restoration projects completed
Conservation design	# of workshops/meetings hosted; # conservation plans written; # recovery plans developed

**Table 8.4. Goal 1. Species Conservation.**

Goal	Objectives	Strategies	Performance Indicators	Threats Addressed
<p>Provide the habitat and ecosystem functions that support healthy and viable populations of all species, avoiding the need to list additional species under the Endangered Species Act</p>	<p>Conduct a comprehensive review of the current status of all wildlife in Louisiana with a focus on species of conservation concern</p>	<p>Inventory and survey for species of conservation concern which have limited or no baseline occurrence data</p> <p>Inventory and survey for species of conservation concern to update historic occurrence data</p> <p>Support research which focuses on life history, reproductive success, and mortality factors for species of conservation concern</p> <p>Support research on the diversity and ecology of the lesser-known groups of invertebrates such as butterflies and moths, aquatic insects, snails, arachnids, beetles, etc.</p>	<p># of species for which baseline data has been collected</p> <p># of species for which threats are definitively identified</p> <p># new and updated species EOs entered into database</p> <p># of species for which life history, reproductive success, and mortality factors are assessed</p> <p># of research projects focusing on lesser-known species</p>	<p>Data gaps</p> <p>Limited knowledge</p> <p>Lack of data</p>
	<p>Develop concrete management strategies which focus on species of conservation concern and their associated habitats identified in the CWCS</p>	<p>Expand current knowledge of habitat trends and priority habitat needs for species of conservation concern</p> <p>Continue and expand monitoring of priority species/groups to formulate conservation strategies and management decisions</p> <p>Conduct geographical analysis to identify gaps where managed areas are lacking in the state, relative to protection needs of Tier 1 habitats and important focal areas discussed in the habitat accounts in Chapter 4</p> <p>Produce maps showing areas where land acquisition and the establishment of conservation areas would be the most valuable conservation tool</p>	<p># of habitats assessed</p> <p># of habitat threats for which specific strategies have been developed and implemented</p> <p># of species/populations monitored</p> <p># of new monitoring strategies developed</p> <p># of projects initiated</p> <p># of identified areas</p> <p># of maps produced</p>	<p>Data gaps</p> <p>Limited knowledge</p> <p>Lack of data</p> <p>Few defined strategies</p>
	<p>Formulate partnerships with federal and state agencies, national and local non-governmental organizations, universities, businesses, and the public in the development and implementation of these strategies</p>	<p>Continue to develop and improve contacts with all potential partners in the state</p> <p>Hold species strategy meetings and invite all interested partners</p>	<p># of partners contacted</p> <p># of contacts developed</p> <p># of meetings held and commitments given to implement recommended conservation strategies</p>	<p>Lack of species and habitat conservation strategy coordination</p>

**Table 8.5. Goal 2. Habitat Conservation.**

Goal	Objectives	Strategies	Performance Indicators	Threats Addressed
<p>Identify, conserve, manage, and restore terrestrial and aquatic habitats which are a priority for the continued survival of species of conservation concern</p>	<p>Utilize Natural Heritage Program database to identify habitat types which are important to the conservation of species of concern, and continually evaluate and update the status of these habitats to direct conservation and restoration efforts</p>	<p>Increase data collection in habitats important to species of conservation concern, expanding resources and staff to meet this need</p> <p>Expedite input of field data on habitats of concern, expanding resources and staff to meet this need</p> <p>Improve spatial data available for habitats and species of conservation concern (mapping of species locations and habitat coverages)</p> <p>Utilize the Natural Heritage database and other sources to identify priority sites for habitat conservation and restoration efforts through acquisition and conservation servitudes</p> <p>Develop and publish species lists (including both wildlife and plants) for WMAs, refuges, and state parks</p> <p>Step-up surveys in aquatic habitats to fill data gaps regarding: Species diversity Rare or endemic species Ecosystem processes Areas critical to survival of species of concern</p>	<p># of new sites surveyed</p> <p># of known sites surveyed to update status</p> <p># field survey days</p> <p># new and updated EOs entered into database</p> <p># of GIS mapping projects initiated</p> <p># of habitats accurately mapped</p> <p># of comprehensive habitat status surveys or research projects initiated</p> <p># of priority sites/acres identified for protection</p> <p># of species publications for WMAs and refuges</p>	<p>Data gaps</p> <p>Limited knowledge</p> <p>Lack of data</p>
	<p>Monitor threats to terrestrial and aquatic habitats of priority concern</p>	<p>Complete habitat threats analysis every 5 years</p> <p>Create a database of threats and continually consider and incorporate new information concerning threats into this database</p>	<p>Documentation of habitat threats analysis</p> <p># of threats identified for key habitats</p> <p>Incorporate information into threats database quarterly or as available</p>	<p>Basing decisions on outdated threat information</p>
	<p>Promote and support terrestrial and aquatic habitat protection efforts</p>	<p>Protect or restore key areas supporting or having the potential to support priority habitats (Table 7.1) through acquisition and conservation servitudes</p> <p>Expand Natural Areas Registry Program to include incentives such as tax breaks, conservation servitudes, management assistance, etc.</p> <p>Provide local and parish planning boards with information regarding sensitive terrestrial and aquatic habitats and species of concern, and work to redirect development of these areas</p> <p>Continue to support LA RCW Safe Harbor Program and associated habitat protection efforts</p>	<p># of sites/acres acquired or protected</p> <p># of long-term cooperative projects initiated to protect priority habitats</p> <p># of active registries/acres in the Natural Areas Registry Program</p> <p># of meetings/contacts with planning boards</p> <p># sites/acres where development redirected</p> <p># acres enrolled in LIP; RCW Safe Harbor Prg</p>	<p>Habitat destruction or conversion</p> <p>Habitat fragmentation</p> <p>Residential and commercial development</p>



**Table 8.5. Goal 2. Habitat Conservation cont.**

Goal	Objectives	Strategies	Performance Indicators	Threats Addressed
<p>Identify, conserve, manage, and restore terrestrial and aquatic habitats which are a priority to the continued survival of species of conservation concern</p>	<p>Develop and implement terrestrial and aquatic habitat conservation and management recommendations</p>	<p>Provide management guidelines and technical assistance to non-industrial private landowners to benefit habitats and species of conservation concern</p> <p>Provide management guidelines and technical assistance to public agencies/land managers (e.g., state parks, state lands, parish parks) to benefit habitats and species of concern</p>	<p># of technical guidance interactions with private landowners</p> <p># of technical guidance interactions with public agencies/land managers</p>	<p>Habitat degradation</p> <p>Incompatible management practices</p>
	<p>Monitor distribution and impacts of invasive/alien species and develop management strategies to abate this threat</p>	<p>Work with Invasive Species Task Force, LA Sea Grant Program and others to monitor occurrences and spread of invasive/alien species</p> <p>Provide public education and support existing efforts/programs regarding invasive species, working through the Invasive Species Task Force</p> <p>Promote use of state and federal cost share programs to address invasive species problems</p> <p>Partner with local hunting clubs through DMAP to support wild hog eradication</p>	<p># of specimens of invasive plant species collected and deposited in herbaria</p> <p># of monitoring and survey projects initiated</p> <p># of technical guidance interactions with private and public land managers</p> <p># of eradication projects initiated</p>	<p>Altered structure and composition</p> <p>Habitat disturbance</p>
	<p>Promote reintroduction and continued use of prescribed fire in fire-dependent habitats</p>	<p>Educate landowners, adjacent residents, developers, and the general public about the crucial role of prescribed fire in the management of: Longleaf pine systems and imbedded habitats Shortleaf pine-Oak-Hickory Forests Coastal and Calcareous Prairies Coastal Marsh types Western Xeric Sandhill Woodlands</p> <p>Provide additional cost share funds through programs such as FLEP in order to drastically reduce or eliminate landowners' costs associated with conducting prescribed burns</p> <p>Encourage burning on state lands to perpetuate fire-dependent habitats (e.g., state parks, state lands office)</p>	<p># of educational programs</p> <p># of sites/acres burned on private lands</p> <p># of sites/acres burned on state lands</p> <p>Amount of funding for cost share programs used to support prescribe burning on private lands</p>	<p>Altered structure and composition</p> <p>Incompatible forestry practices</p>

**Table 8.6. Goal 3. Public Outreach and Education.**

Goal	Objectives	Strategies	Performance Indicators	Threats Addressed
Support educational efforts to improve the understanding by the general public and conservation stakeholders regarding species of conservation concern and related habitats	Provide educational information using various media types	<p>Improve, maintain and develop web-based resources to share information on priority habitats and species of conservation concern</p> <p>Develop field guides for habitats and species of conservation concern</p> <p>Develop manual to the flora of Louisiana</p> <p>Develop publication on natural communities of Louisiana</p>	<p># of web-based resources developed or enhanced</p> <p># of “hits” for web-based educational resources</p> <p># of field guides for habitats and species of concern published</p> <p># of audiences reached</p> <p># of requests for educational materials</p>	<p>Inefficient information exchange</p> <p>Public indifference</p> <p>Fear/misunderstanding</p> <p>Lack of information</p>
	Increase direct interactions between biologists and public and private stakeholders regarding species of concern and associated habitats	<p>Provide presentations and workshops to various groups interested in wildlife and plant resources</p> <p>Provide educational field trips for the general public or various organization</p> <p>Meet one-on-one with public and private landowners to discuss possibilities for habitat improvement and management needs (utilize existing programs such as Natural Areas Registry, Forest Stewardship, DMAP, etc.)</p>	<p># of presentations or workshops conducted</p> <p># of educational field trips conducted</p> <p># of landowners interactions</p> <p># of acres enhanced</p>	<p>Public indifference</p> <p>Fear/misunderstanding</p> <p>Lack of information</p>
	Enhance the user’s educational experience on WMAs and refuges	Develop animal and plant species lists for WMAs and refuges, and disseminate this information to interested persons	<p># of lists requested</p> <p># of comments regarding lists</p>	<p>Public indifference</p> <p>Lack of information</p>

**Table 8.7. Goal 4. Partnerships.**

Goals	Objectives	Strategies	Performance Indicators	Threats Addressed
Improve existing partnerships and develop new partnerships between LDWF and State and Federal natural resource agencies, non-governmental organizations and environmental groups, private industry, academia, and the general public	Improve cooperative efforts to achieve common goals, improve efficiency, and prevent duplication of efforts	Develop MOUs regarding species of conservation concern and their habitats  Partner with the Louisiana Forestry Association to develop web-based educational materials on target species and their habitats  Organize workshops with partners to discuss mutual issues	# of MOUs developed/implemented  Completion of web-based material  # of workshops held  # of partner participants	Habitat fragmentation  Habitat conversion/destruction  Incompatible forestry practices  Altered composition and structure
	Improve data collection, data management, and the dissemination of information between conservation partners	Develop Data Utilization agreements  Develop database of research and monitoring projects	# of agreements developed  Completion of database	Habitat conversion
	Increase collaboration and communication with local, state, and regional conservation partners	Organize workshops, hold regular meetings, and distribute results through appropriate media releases (print, website, radio, TV, etc.)	# of meetings held  # of workshops implemented/attended  # news releases sent	Habitat disturbance/destruction/conversion/fragmentation

**Table 8.8. Effectiveness of the strategies**

Work Level	Time Scale	Types of Evaluation Questions	Conducted By
Individual Projects	Semi-annual reporting	Did the project occur? Did it stay within budget? Did it use funds as planned? Are budgeting proportions accurate? Who did the work?	District Biologists; Program Supervisors, and staff
Adaptive management of project	Annually	Based on evaluation, how should future projects be changed or retained?	District Biologists; Program Supervisors, and staff
CWCS conservation actions (Program-level strategies)	Annually	What is the status of the desired outcomes associated with each activity, as measured by performance indicators?  Are the performance indicators valid measures?  Are the individual projects meeting the conservation actions called for in the CWCS?	Program supervisors, Core Committee
Adaptive management of conservation actions	Annually	Based on evaluation, how should future program-level activities and projects be changed or retained?	Program supervisors, Core Committee
CWCS goals	Every 10 years	Are the conservation actions meeting the state's goals of the Louisiana CWCS?	Program supervisors, Core Committee

**Table 8.9. Evaluation and Reporting Schedule**

<b>Component</b>	<b>Time Frame</b>	<b>Methodology</b>
<b>Investments</b> (time and money)	Acquired quarterly, reported annually on fiscal year cycle	Cost accounting system tracking by project cost center
<b>Activities</b> (strategies in Tables 8.2-8.7)	Acquired quarterly, reported annually on fiscal year cycle	Cost accounting system tracking by project cost center
<b>Outputs</b> (see Performance Indicators in Tables 8.2-8.7)	Acquired quarterly, reported annually on fiscal year cycle	District biologists and project managers report on outputs of implementing conservation strategies
<b>Outcomes</b> (improved populations of target species and their habitats; improved public satisfaction)	5-year report 10-year report	Reports based on performance indicators; surveys of public attitudes

**E. Adaptive Management**

An important aspect, if not the most important aspect, of research and monitoring is to ascertain whether strategies and management approaches that are proven to be beneficial to species of conservation concern are incorporated into LDWF’s management practices and promoted among all state and federal natural resource agencies that manage or have an impact on Louisiana’s fish and wildlife resources. LDWF’s major land management programs are in the coastal marshes and forest habitats (predominantly bottomland hardwoods) which are owned by the department. Forest management has been and will continue to be an important research issue within the CWCS. The LDWF forest management program is an example of how our agency promotes sound habitat management programs. It led the nation in the development of bottomland hardwood restoration techniques and has hosted many workshops and field days to showcase effective management practices. Initial findings of supported research already suggest that the agency’s forest management program is moving in the direction that positively impacts many species of conservation concern. The primary objective of LDWF’s forest management program is wildlife habitat enhancement, and future research resulting from recommendations in the CWCS will continue to be considered in the development of forest prescriptions. Additionally, longer-term monitoring of avian, amphibian, and reptilian species will continue. As new forest management techniques are implemented, monitoring programs will be implemented concurrently to determine if these techniques provide better habitat for species of conservation concern than older techniques. This is essential since habitat improvement, after all, is the overall goal of our management practices.

Undoubtedly some management practices that provide good habitat enhancement for species of conservation concern will not be implemented. An evaluation to determine the success of approaches will routinely be conducted on a specific timetable, such as every 5 years. It will be necessary to determine why these practices were not selected despite promotion through various strategies. For these practices, LDWF must review its targeted audience, as well as, who was the delivering agency. Surveys of both groups must be made to determine what it would take to make the practices viable. A number of factors could be involved. Was the message unclear? Were the incentives insufficient? Was the practice not sufficiently pushed by the agency responsible for practice implementation? Or even, was the wrong audience targeted? After ascertaining the reason certain beneficial practices were not used, new strategies addressing prior deficiencies would be developed and implemented. Re-evaluation would occur again on the previously determined schedule.

LDWF proposes to complete a comprehensive revision of the CWCS in ten years, and to review, evaluate and update sections annually through the existing Federal Assistance reporting system and SWG grant administration process. Further, a database is being developed to track each aspect of progress on species of conservation concern and their habitats. Any changes in status will be entered annually, both in the database and spatially. Progress on conservation actions, research, surveys, and monitoring will be captured annually, and will be tracked annually. The database will provide for information tracking, management and dissemination to internal and external partners. The Core Committee will be responsible for implementing this annual review and evaluation.

The USFWS requires establishment of procedures to review the CWCS at intervals not to exceed ten years. LDWF will comprehensively revise this CWCS in 2015. Meanwhile, we will sponsor workshops and symposia and utilize scientific review to update our species of conservation concern, key habitats, and conservation actions in preparation for the next iteration of the CWCS. This level of effort will guarantee our commitment to involving conservation partners and interested stakeholders in the CWCS process.

Over the next ten years, LDWF will utilize both short- and long-term iterative, existing mechanisms and processes with built-in review and evaluation to maximize opportunities for both internal and external implementation. Each program in the agency will report no less than annually on implementation progress. These will be summarized annually as part of existing federal aid requirements, and integrated into the CWCS for each annual review. The Core Team is the responsible party for implementing this annual evaluation.

Perhaps the most efficient and effective outcome of the Louisiana CWCS will be the incorporation of priority conservation strategies into future LDWF's strategic plans and the plans of its partners. This is expected to produce a ripple effect for conservation efforts across the state, and will lead to a consistent, more unified approach to conservation in Louisiana.

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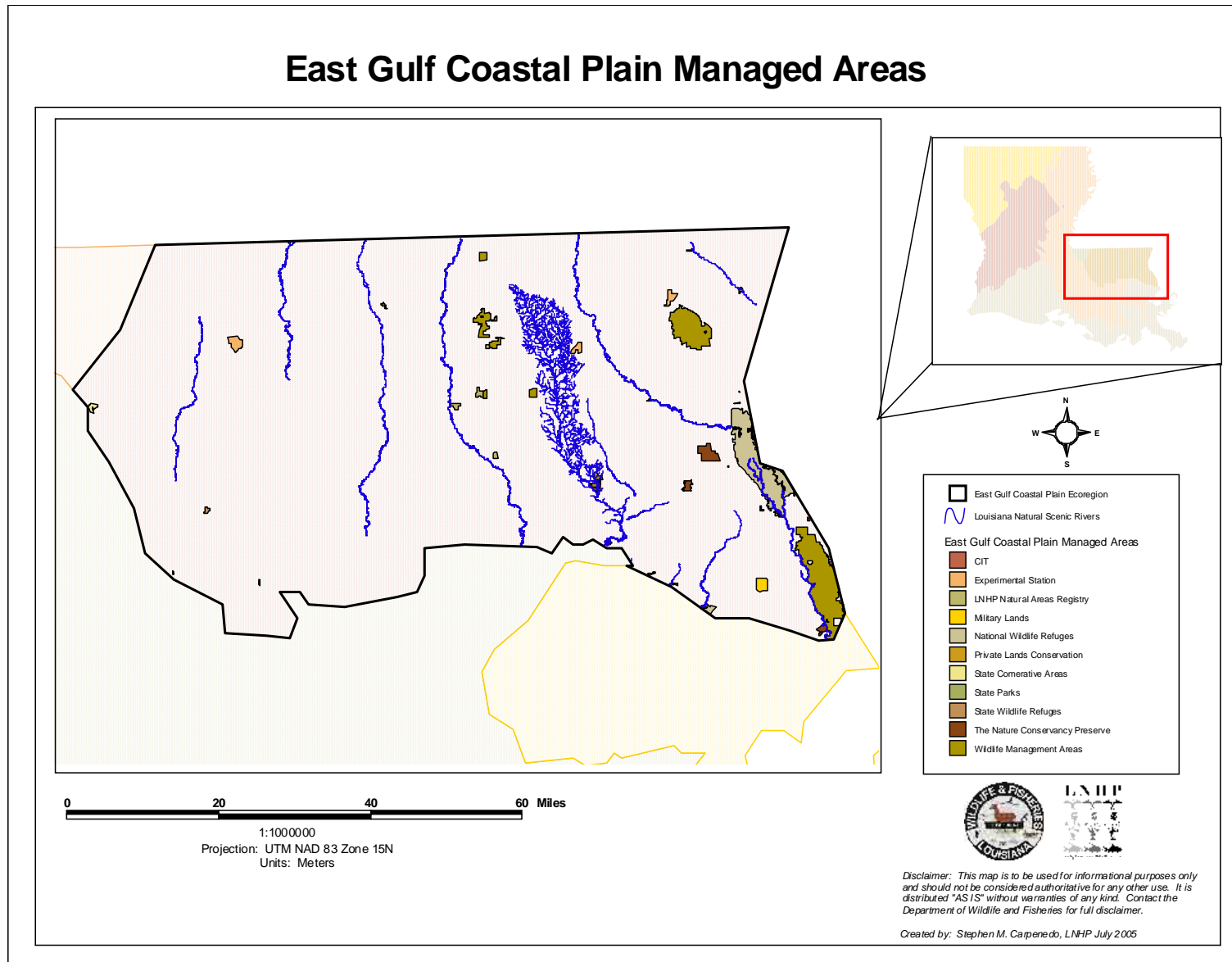
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APPENDIX A. Managed Areas by Ecoregion



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<b>Ecoregions</b>	<b>Name</b>	<b>Owner</b>	<b>Area (in acres)</b>	<b>River Length (in Miles)</b>
<b>East Gulf Coastal Plain</b>				
	<b>CIT</b>			
	Bluebonnet Swamp	The Nature Conservancy	61.4	
	<b>Experiment Stations</b>			
	State University Forest	Louisiana State University	1,094.3	
	<b>LNHP Natural Areas Registry</b>			
	Private	Private	2,034.0	
	<b>Military Lands</b>			
	Camp Villere	National Guard	1,669.6	
	<b>National Audubon Society</b>			
	John James Audubon	John James Audubon Foundation	82.0	
	<b>National Wildlife Refuges</b>			
	Big Branch Marsh	U. S. Fish & Wildlife Service	1,064.8	
	Bogue Chitto	U. S. Fish & Wildlife Service	30,864.7	
	<b>Natural and Scenic Rivers</b>			
	Abita River	State of Louisiana		15.4
	Amite River	State of Louisiana		73.6
	Bayou Chinchuba	State of Louisiana		0.4
	Bayou LaCombe	State of Louisiana		35.9
	Bogue Chitto River	State of Louisiana		124.6
	Bogue Falaya River	State of Louisiana		28.6
	Bradley Slough (Bayou)	State of Louisiana		8.9
	Cane Bayou	State of Louisiana		5.4
	Comite River	State of Louisiana		65.4
	Holmes Bayou	State of Louisiana		9.0
	Morgan River	State of Louisiana		2.9
	Pushepatapa Creek	State of Louisiana		21.2



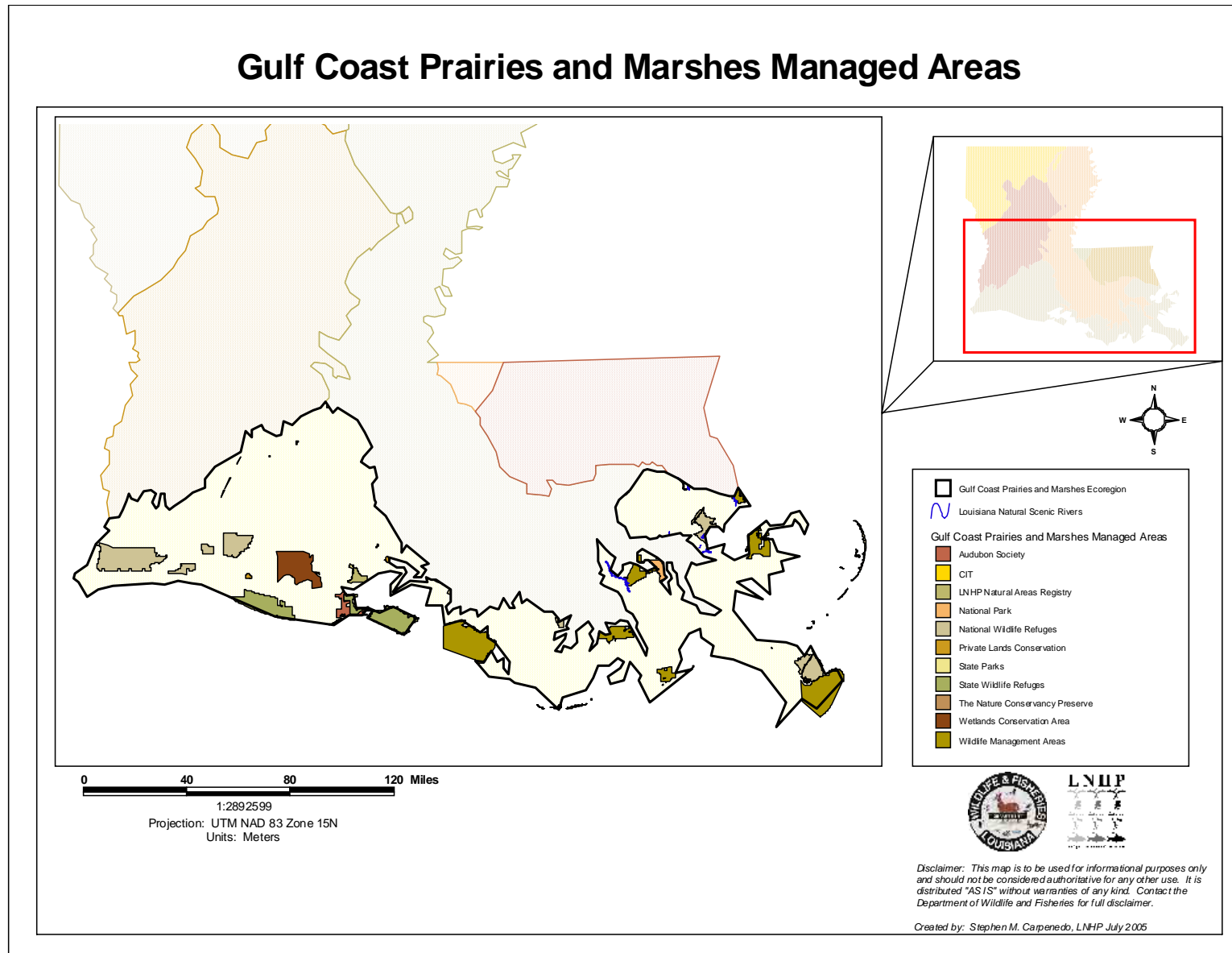
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<b>East Gulf Coastal Plain</b>				
	Tangipahoa River	State of Louisiana		150.2
	Tchefuncte River and its Tributaries	State of Louisiana		574.6
	Tickfaw River	State of Louisiana		106.2
	West Pearl River	State of Louisiana		70.4
	Wilson Slough (Bayou)	State of Louisiana		7.0
	<b>State Commemorative Areas</b>			
	Centenary	Office of State Lands	3.3	
	Port Hudson	Office of State Lands	607.2	
	<b>State Parks</b>			
	Fairview Riverside	Office of State Lands	100.5	
	Fontainebleu	Office of State Lands	87.2	
	<b>State Wildlife Management Areas</b>			
	Ben's Creek	Weyerhaeuser Corporation	13,019.9	
	Hutchinson Creek	Department of Wildlife and Fisheries	129.0	
	Lake Ramsay Savannah	Department of Wildlife and Fisheries	796.0	
	Pearl River	Department of Wildlife and Fisheries	26,992.9	
	Sandy Hollow	Department of Wildlife and Fisheries	3,515.2	
	Tangipahoa Parish School Board	Tangipahoa Parish School Board	1,662.5	
	<b>State Wildlife Refuges</b>			
	St Tammany Wildlife Refuge	Department of Wildlife and Fisheries	29.0	

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<b>East Gulf Coastal Plain</b>				
	Waddill Wildlife Refuge	Department of Wildlife and Fisheries	243.9	
	<b>The Nature Conservancy Preserves</b>			
	Abita Creek Flatwoods	The Nature Conservancy	858.5	
	Charter Oak Baygall	The Nature Conservancy	156.6	
	Lake Ramsay	The Nature Conservancy	596.4	
	Pushepatapa Creek	The Nature Conservancy	18.4	
	Talisheek Pine Wetlands	The Nature Conservancy	2,732.5	
	White Kitchen	The Nature Conservancy	654.6	
	<b>Total Managed Area, East Gulf Coast Plain (in acres):</b>		<b>89,074.2</b>	
	<b>Total Natural and Scenic River Miles (National Wild and Scenic Rivers Included):</b>			<b>1299.7</b>

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<b>Ecoregions</b>	<b>Name</b>	<b>Owner</b>	<b>Area (in acres)</b>	<b>River Length (in Miles)</b>
<b>Gulf Coast Prairies &amp; Marshes</b>				
	<b>CIT</b>			
	Grand Isle Port Commission		33.5	
	Tuten Nature Park		48.6	
	<b>LNHP Natural Areas Registry</b>			
	Private	Private	15,320.2	
	<b>National Audubon Society</b>			
	Paul J. Rainey	National Audubon Society	23,046.6	
	Peveto Woods	Baton Rouge Audubon Society	31.2	
	<b>National Parks</b>			
	Jean Lafitte National Historical Park and Preserve	National Park Service	14,279.3	
	<b>National Wildlife Refuges</b>			
	Bayou Sauvage	U. S. Fish & Wildlife Service	30,964.7	
	Bayou Teche	U. S. Fish & Wildlife Service	2,108.8	
	Big Branch Marsh	U. S. Fish & Wildlife Service	321.2	
	Breton	U. S. Fish & Wildlife Service	7,933.0	
	Cameron Prairie	U. S. Fish & Wildlife Service	9,613.4	
	Delta	U. S. Fish & Wildlife Service	49,407.1	
	Lacassine	U. S. Fish & Wildlife Service	50,889.3	
	Mandalay	U. S. Fish & Wildlife Service	5,240.3	
	Sabine	U. S. Fish & Wildlife Service	143,022.7	
	Shell Keys	U. S. Fish & Wildlife Service	3.9	
	<b>Natural and Scenic Rivers</b>			
	Bashman Bayou	State of Louisiana		4.3
	Bayou Bienvenue	State of Louisiana		6.1
	Bayou Chaperon	State of Louisiana		1.4
	Bayou DesAllemands	State of Louisiana		44.5

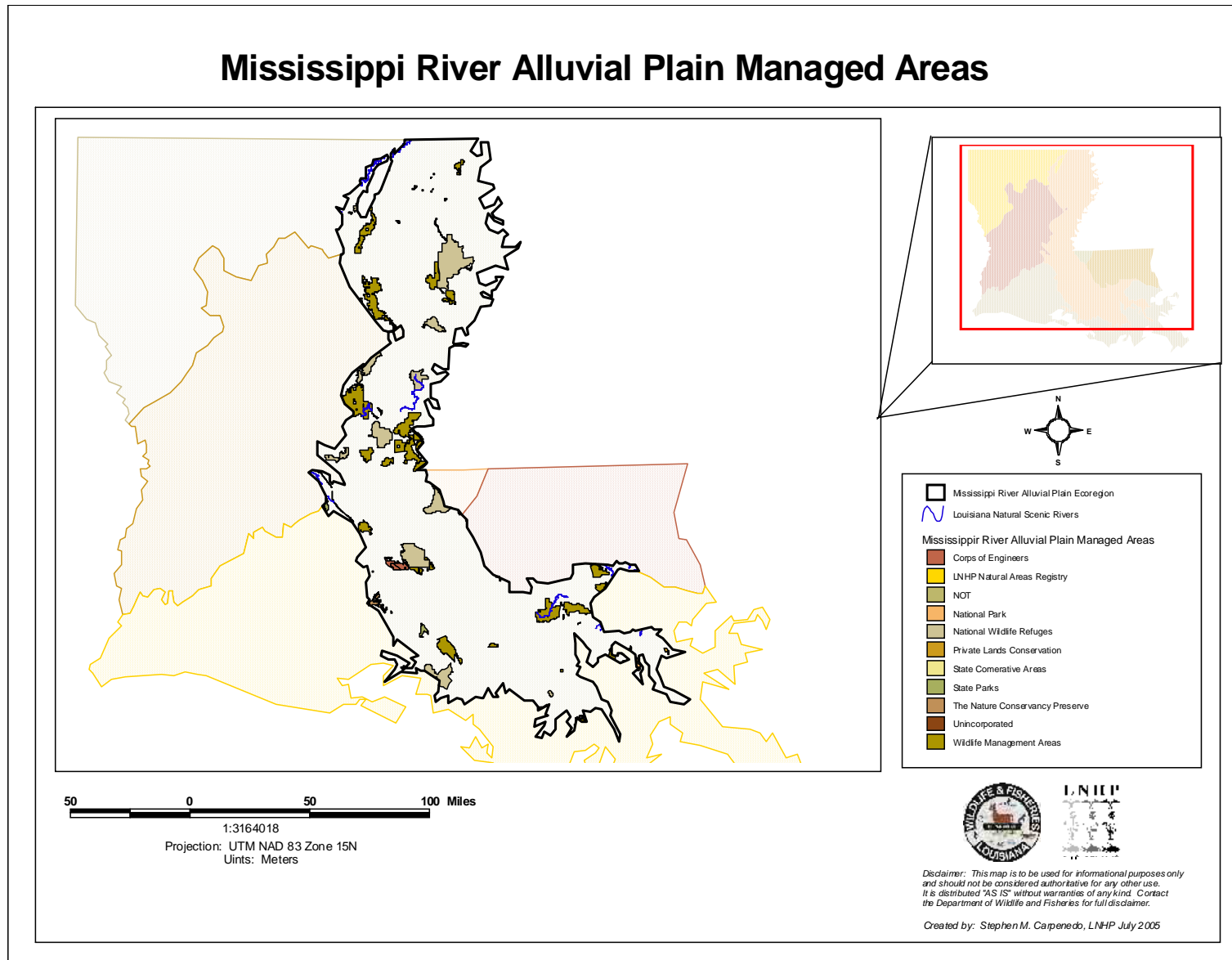
APPENDIX A. Managed Areas by Ecoregion

<b>Ecoregions</b>	<b>Name</b>	<b>Owner</b>	<b>Area (in acres)</b>	<b>River Length (in Miles)</b>
<b>Gulf Coast Prairies &amp; Marshes</b>				
	Bayou Dupre	State of Louisiana		1.1
	Bayou LaCombe	State of Louisiana		5.4
	Bayou St. John	State of Louisiana		3.2
	Cane Bayou	State of Louisiana		0.9
	Lake Borgne Canal (Violet Canal)	State of Louisiana		4.9
	Pirogue Bayou	State of Louisiana		4.8
	Terre Beau Bayou	State of Louisiana		3.4
	West Pearl River	State of Louisiana		11.4
<b>Private Lands Conservation</b>				
	Avery Island Jungle Gardens and Bird Sanctuary	McIlhenny family	1,820.7	
	Little Pecan Island	Jim Flores	1,859.2	
<b>State Parks</b>				
	Bayou Segnette	Office of State Lands	54.8	
	Cheniere au Tigre	Office of State Lands	1,000.9	
	Chicot	Office of State Lands	329.7	
	Cypremort Point	Office of State Lands	84.9	
	Grand Isle	Office of State Lands	209.0	
	Fort Macomb	Office of State Lands	14.9	
	Palmetto Island	Office of State Lands	1,283.5	
<b>State Wildlife Management Areas</b>				
	Atchafalaya Delta	State of Louisiana	137,000.0	
	Biloxi	Biloxi Marsh Lands Corporation	39,583.0	
	Manchac	Department of Wildlife and Fisheries	154.1	
	Pass A Loutre	Department of Wildlife and Fisheries	110,000.0	
	Pearl River	Department of Wildlife and Fisheries	8,057.3	

APPENDIX A. Managed Areas by Ecoregion

<b>Ecoregions</b>	<b>Name</b>	<b>Owner</b>	<b>Area (in acres)</b>	<b>River Length (in Miles)</b>
<b>Gulf Coast Prairies &amp; Marshes</b>				
	Pointe Aux Chenes	Department of Wildlife and Fisheries	30,179.3	
	Salvador	Department of Wildlife and Fisheries	26,905.0	
	Timken	Orleans City Park Improvement Association	2,527.6	
	Wisner	Edward Wisner Donation Advisory Committee	15,048.5	
<b>State Wildlife Refuges</b>				
	Marsh Island Wildlife Refuge	State of Louisiana	70,733.1	
	Rockefeller Wildlife Refuge	State of Louisiana	85,745.8	
	St Tammany Wildlife Refuge	Department of Wildlife and Fisheries	922.9	
	State Wildlife Refuge	State of Louisiana	14,804.3	
	Terrebonne Barrier Islands Refuge	Department of Wildlife and Fisheries	4310.5	
<b>The Nature Conservancy Preserves</b>				
	Lafitte Woods	The Nature Conservancy	12.1	
<b>Wetlands Conservation Areas</b>				
	White Lake	State of Louisiana	104,071.6	
<b>Total Managed Area, Gulf Coast Plains and Marshes (in acres):</b>			<b>1,008,976.5</b>	
<b>Total Natural and Scenic River Miles (National Wild and Scenic Rivers Included):</b>				<b>91.5</b>

# APPENDIX A. Managed Areas by Ecoregion



APPENDIX A. Managed Areas by Ecoregion

<b>Ecoregions</b>	<b>Name</b>	<b>Owner</b>	<b>Area (in acres)</b>	<b>River Length (in Miles)</b>
<b>Mississippi River Alluvial Plain</b>				
	<b>Atchafalaya Basin</b>			
	Indian Bayou	U. S. Army Corps of Engineers	13,351.4	
	Indian Bayou - Bayou Fardoche State Natural Area	U. S. Army Corps of Engineers	3,964.7	
	<b>LNHP Natural Areas Registry</b>			
	Private	Private	5,788.1	
	<b>National Parks</b>			
	Jean Lafitte National Historical Park and Preserve	National Park Service	3,360.9	
	<b>National Wildlife Refuges</b>			
	Bayou Cocodrie	U. S. Fish & Wildlife Service	23,075.2	
	Bayou Teche	U. S. Fish & Wildlife Service	34,274.8	
	Black Bayou	U. S. Fish & Wildlife Service	3,301.3	
	Cat Island	U. S. Fish & Wildlife Service	33,557.0	
	Catahoula	U. S. Fish & Wildlife Service	25,173.4	
	D'Arbonne	U. S. Fish & Wildlife Service	722.0	
	Glade Woods	U. S. Fish & Wildlife Service	16,930.6	
	Grand Cote	U. S. Fish & Wildlife Service	12,890.5	
	Handy Brake	U. S. Fish & Wildlife Service	542.3	
	Lake Ophelia	U. S. Fish & Wildlife Service	37,246.1	
	Mandalay	U. S. Fish & Wildlife Service	3,628.5	
	Tensas River	U. S. Fish & Wildlife Service	111,697.8	
	<b>Natural and Scenic Rivers</b>			
	Bayou Bartholomew	State of Louisiana		112.1
	Bayou Chinchuba	State of Louisiana		2.3
	Bayou Cocodrie	State of Louisiana		92.4



APPENDIX A. Managed Areas by Ecoregion

<b>Ecoregions</b>	<b>Name</b>	<b>Owner</b>	<b>Area (in acres)</b>	<b>River Length (in Miles)</b>
<b>Mississippi River Alluvial Plain</b>				
	Bayou Des Allemands	State of Louisiana		0.1
	Bayou Labranche	State of Louisiana		7.2
	Bayou St. John	State of Louisiana		5.8
	Bayou Trepagnier	State of Louisiana		3.7
	Blind River	State of Louisiana		48.6
	D'Arbonne Bayou	State of Louisiana		7.3
	Saline Bayou	State of Louisiana		31.3
	Tangipahoa River	State of Louisiana		22.3
	Tchefuncte River and its Tributaries	State of Louisiana		5.9
	<b>NOT</b>			
	Ivanhoe	The Nature Conservancy	658.4	
	<b>Private Lands Conservation</b>			
	Avery Island Jungle Gardens and Bird Sanctuary	Mcllhenny family	130.5	
	Copenhagen Hills Easement	Scott Paper	201.1	
	Copenhagen Hills Environmental Preserve	International Paper	134.5	
	English Turn Wilderness Park	English Turn Club	948.7	
	<b>State Commemorative Areas</b>			
	Longfellow	Office of State Lands	163.6	
	Evangeline			
	Marksville	Office of State Lands	39.9	
	Port Hudson	Office of State Lands	28.5	
	Poverty Point	Office of State Lands	326.5	
	<b>State Parks</b>			
	Bayou Segnette	Office of State Lands	498.4	

APPENDIX A. Managed Areas by Ecoregion

<b>Ecoregions</b>	<b>Name</b>	<b>Owner</b>	<b>Area (in acres)</b>	<b>River Length (in Miles)</b>
<b>Mississippi River Alluvial Plain</b>				
	Chemin A Haut	Office of State Lands	9.4	
	Chicot	Office of State Lands	3,461.2	
	Cypremort Point	Office of State Lands	151.7	
	Lake Bruin	Office of State Lands	41.3	
	Lake Fausse Pointe	Office of State Lands	6,015.2	
	St. Bernard	Office of State Lands	316.5	
<b>State Wildlife Management Areas</b>				
	Acadiana Conservation Corridor	Department of Wildlife and Fisheries	2,143.5	
	Attakapas Island	State of Louisiana	25,730.0	
	Bayou Macon	Department of Wildlife and Fisheries	6,940.0	
	Big Colewa Bayou	Department of Wildlife and Fisheries	910.0	
	Big Lake	Department of Wildlife and Fisheries	19,221.0	
	Boeuf	Department of Wildlife and Fisheries	48,596.0	
	Buckhorn	Department of Wildlife and Fisheries	9,817.3	
	Dewey W Wills	Department of Wildlife and Fisheries	58,092.3	
	Elbow Slough	Department of Wildlife and Fisheries	148.5	
	Elm Hall	Department of Wildlife and Fisheries	2,853.1	
	Floy McElroy	Department of Wildlife and Fisheries	688.5	
	Grassy Lake	Department of Wildlife and Fisheries	12,982.7	
	Joyce	Department of Wildlife and Fisheries	15,909.9	

APPENDIX A. Managed Areas by Ecoregion

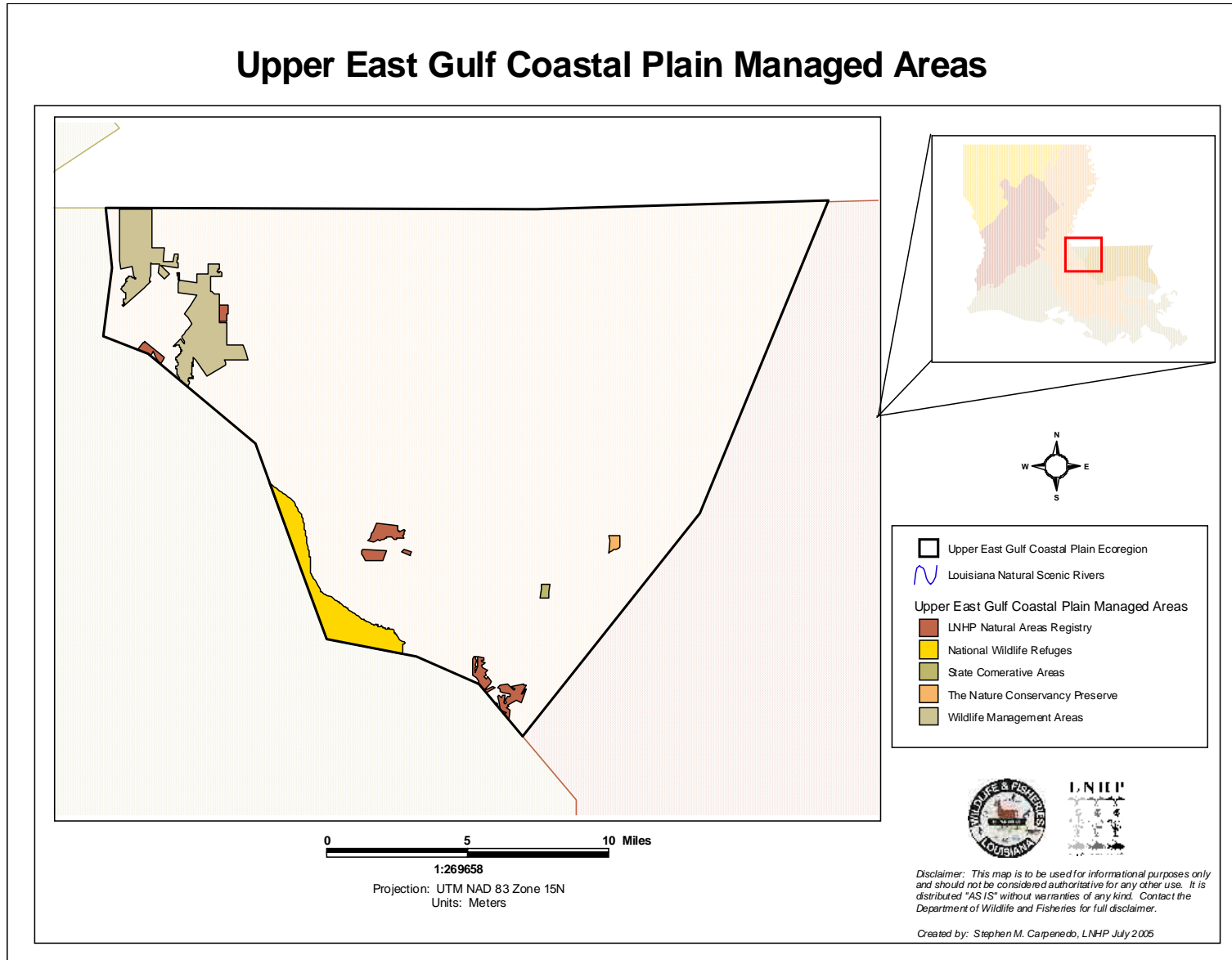
<b>Ecoregions</b>	<b>Name</b>	<b>Owner</b>	<b>Area (in acres)</b>	<b>River Length (in Miles)</b>
<b>Mississippi River Alluvial Plain</b>				
	Lake Boeuf	Department of Wildlife and Fisheries	801.9	
	Manchac	Department of Wildlife and Fisheries	8,170.9	
	Maurepas Swamp (Eastern Tract)	Department of Wildlife and Fisheries	23,346.8	
	Maurepas Swamp (Western Tract)	Department of Wildlife and Fisheries	37,163.3	
	Ouachita	Department of Wildlife and Fisheries	8,745.5	
	Pointe Aux Chenes	Department of Wildlife and Fisheries	3,308.7	
	Pomme de Terre	Department of Wildlife and Fisheries	6,434.8	
	Red River	Department of Wildlife and Fisheries	36,210.2	
	Russell Sage	Department of Wildlife and Fisheries	17,063.2	
	Salvador	Department of Wildlife and Fisheries	3,274.5	
	Sherburne Complex	Department of Wildlife and Fisheries/ U. S. Army Corps of Engineers/ U. S. Fish & Wildlife Service	40,999.7	
	Sicity Island Hills	Department of Wildlife and Fisheries	800.0	
	Spring Bayou	Department of Wildlife and Fisheries	12,505.9	
	Thistlethwaite	Thistlethwaite Heirs	11,100.0	
	Three Rivers	Department of Wildlife and Fisheries	28,124.9	

APPENDIX A. Managed Areas by Ecoregion

<b>Ecoregions</b>	<b>Name</b>	<b>Owner</b>	<b>Area (in acres)</b>	<b>River Length (in Miles)</b>
<b>Mississippi River Alluvial Plain</b>				
	Timken	Orleans City Park Improvement Association	339.6	
	Tunica Hills (South Tract)	Department of Wildlife and Fisheries	1.5	
<b>The Nature Conservancy Preserves</b>				
	Copenhagen Hills	The Nature Conservancy	397.4	
	Cypress Island	The Nature Conservancy	9,856.4	
	Frederick Woods	The Nature Conservancy	104.5	
<b>Unincorporated<sup>1</sup></b>				
	Chauvin LeDoux Tract	Department of Wildlife and Fisheries	19.1	
	Chauvin Swamp Tract	Department of Wildlife and Fisheries	407.1	
<b>Total Managed Area, Mississippi River Alluvial Plain (in acres):</b>			<b>795,838.4</b>	
<b>Total Natural and Scenic River Miles (National Wild and Scenic Rivers Included):</b>				<b>339.0</b>

1: Unincorporated are state lands that have been acquired but not yet incorporated into State Wildlife Refuges or State Wildlife Management Areas.

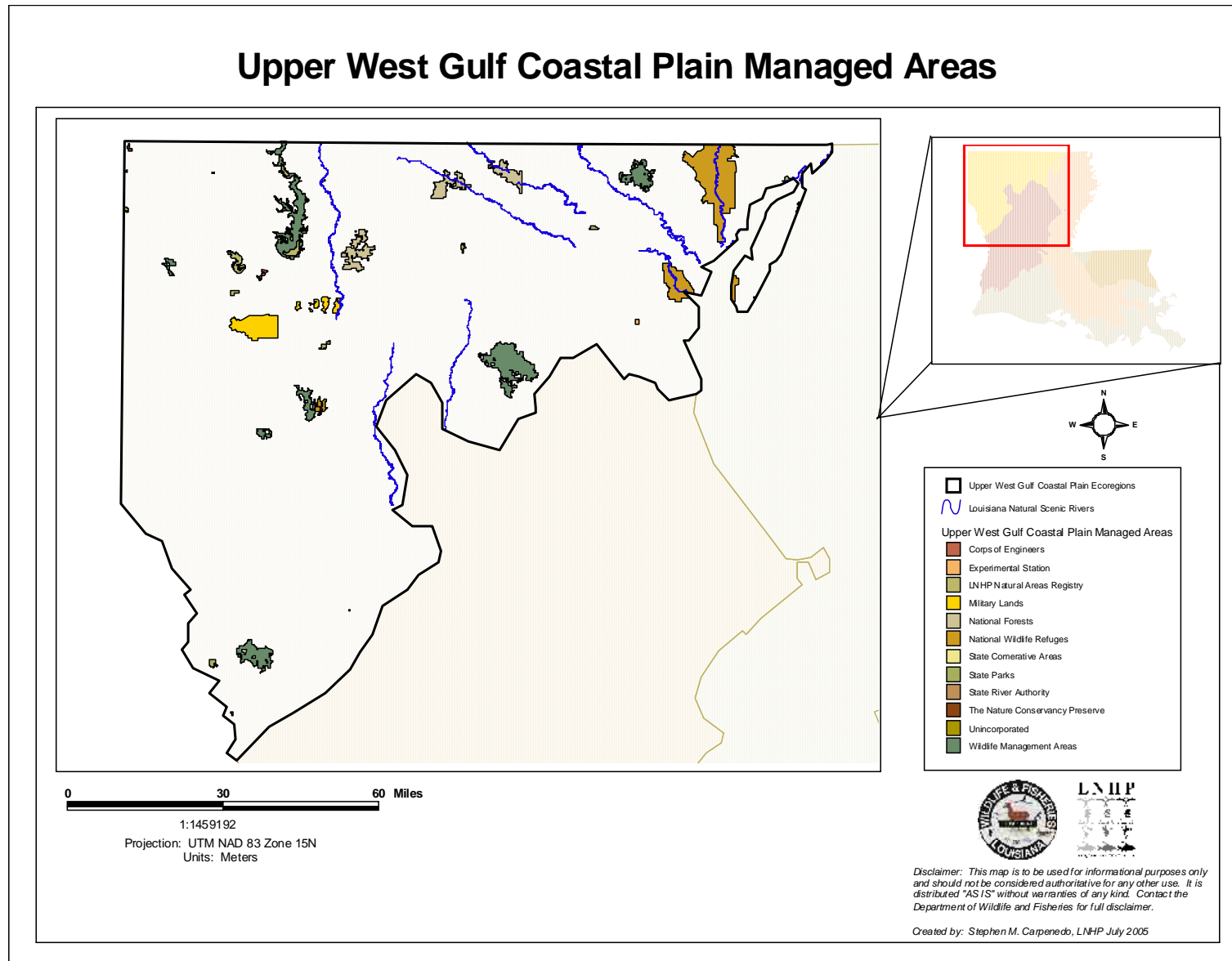
# APPENDIX A. Managed Areas by Ecoregion



APPENDIX A. Managed Areas by Ecoregion

<b>Ecoregions</b>	<b>Name</b>	<b>Owner</b>	<b>Area (in acres)</b>	<b>River Length (in Miles)</b>
<b>Upper East Gulf Coastal Plain</b>				
	<b>LNHP Natural Areas Registry</b>			
	Private	Private	1,487.2	
	<b>National Wildlife Refuges</b>			
	Cat Island	U. S. Fish & Wildlife Service	3,337.0	
	<b>State Commemorative Areas</b>			
	Audubon	Office of State Lands	97.8	
	<b>State Wildlife Management Areas</b>			
	Tunica Hills (South Tract)	Department of Wildlife and Fisheries	3,256.2	
	Tunica Hills (Angola Tract)	Department of Wildlife and Fisheries	2,293.0	
	<b>The Nature Conservancy Preserves</b>			
	Mary Ann Brown	The Nature Conservancy	115.9	
	<b>Total Managed Area, Upper East Gulf Coastal Plain (in acres):</b>		<b>10,587.1</b>	
	<b>Total Natural and Scenic River Miles (National Wild and Scenic Rivers Included):</b>			<b>0.0</b>

APPENDIX A. Managed Areas by Ecoregion



APPENDIX A. Managed Areas by Ecoregion

<b>Ecoregions</b>	<b>Name</b>	<b>Owner</b>	<b>Area (Acres)</b>	<b>River Length (in Miles)</b>
<b>Upper West Gulf Coastal Plain</b>				
	<b>Corps of Engineers</b>			
	Bayou Bodcau	The Nature Conservancy	746.3	
	Bodcau	U.S. Army Corps of Engineers	4,458.3	
	<b>Experiment Stations</b>			
	North Louisiana Experiment Station	unknown	412.1	
	<b>LNHP Natural Areas Registry</b>			
	Private	Private	9,396.5	
	<b>Military Lands</b>			
	Barksdale Air Force Base	U. S. Air Force	21,896.5	
	La Army Ammunition Plant	Louisiana National Guard	5,956.3	
	<b>National Forests</b>			
	Kisatchie - Caney District	U.S. Forest Service	32,381.7	
	<b>National Wildlife Refuges</b>			
	Black Bayou	U. S. Fish & Wildlife Service	2,803.2	
	D'Arbonne	U. S. Fish & Wildlife Service	17,101.5	
	Handy Brake	U. S. Fish & Wildlife Service	345.0	
	Red River - Tensas Conservancy Easement	U. S. Fish & Wildlife Service	660.0	
	Red River	U. S. Fish & Wildlife Service	2,249.5	
	Upper Ouachita	U. S. Fish & Wildlife Service	61,643.3	
	<b>Natural and Scenic Rivers</b>			
	Bayou Bartholomew	State of Louisiana		33.0
	Bayou D'Loutre	State of Louisiana		121.2
	Bayou Dorcheat	State of Louisiana		117.1
	Black Lake Bayou	State of Louisiana		94.4



APPENDIX A. Managed Areas by Ecoregion

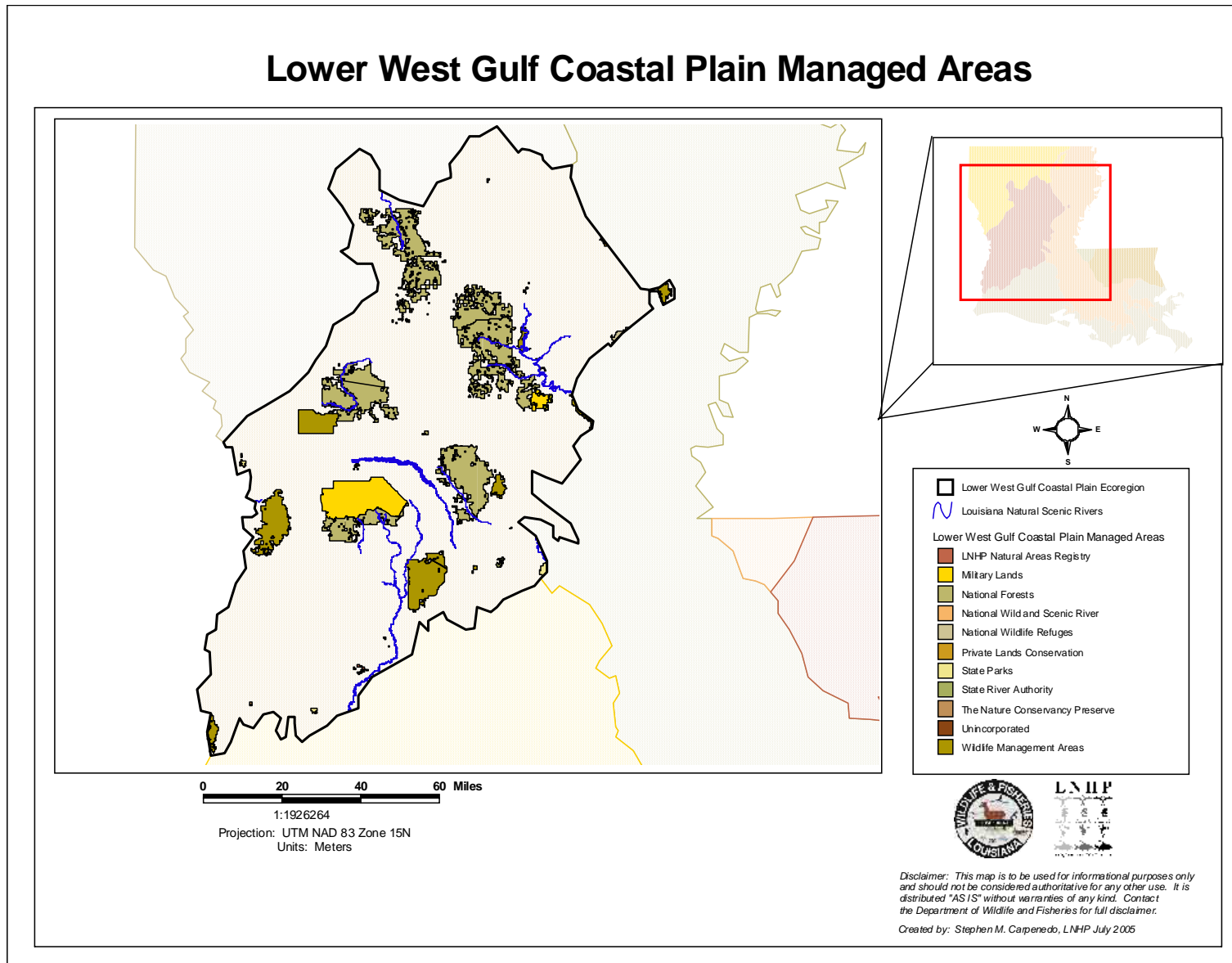
<b>Ecoregions</b>	<b>Name</b>	<b>Owner</b>	<b>Area (Acres)</b>	<b>River Length (in Miles)</b>
<b>Upper West Gulf Coastal Plain</b>				
	Corney Bayou	State of Louisiana		97.6
	D'Arbonne Bayou	State of Louisiana		49.2
	Middle Fork of Bayou D'Arbonne	State of Louisiana		82.4
	Ouachita River	State of Louisiana		54.8
	Saline Bayou	State of Louisiana		46.8
	<b>State Commemorative Areas</b>			
	Los Adaes (North Unit)	Office of State Lands	10.7	
	Los Adaes (South Unit)	Office of State Lands	6.5	
	<b>State Parks</b>			
	Chemin A Haut	Office of State Lands	516.5	
	D'Arbonne	Office of State Lands	706.9	
	Lake Bistineau	Office of State Lands	851.3	
	Lake Claiborne	Office of State Lands	624.0	
	North Toledo Bend	Office of State Lands	1,033.4	
	Big Cypress State Reservation Area	Office of State Lands	7.1	
	<b>State River Authority</b>			
	Sabine River Authority	Office of State Lands	111.7	
	<b>State Wildlife Management Areas</b>			
	Bayou Pierre	Department of Wildlife and Fisheries	2,212.0	
	Bodcau	U.S. Army Corps of Engineers	29,896.6	
	Jackson Bienville	Weyerhaeuser	32,185.0	
	Loggy Bayou	Department of Wildlife and Fisheries	6,566.0	

APPENDIX A. Managed Areas by Ecoregion

<b>Ecoregions</b>	<b>Name</b>	<b>Owner</b>	<b>Area (Acres)</b>	<b>River Length (in Miles)</b>
<b>Upper West Gulf Coastal Plain</b>				
	Russell Sage	Department of Wildlife and Fisheries	58.6	
	Sabine	Boise Cascade Corporation	13,706.4	
	Soda Lake	U.S. Army Corps of Engineers /Caddo Levee Board	2,500.0	
	Union	Plum Creek Timber	12,851.9	
<b>The Nature Conservancy Preserves</b>				
	Bayou Dorcheat	The Nature Conservancy	39.5	
	Caddo Black Bayou	The Nature Conservancy	464.5	
	Schoolhouse Springs	The Nature Conservancy	28.5	
	Summerfield Springs	The Nature Conservancy	697.2	
<b>Unincorporated<sup>1</sup></b>				
	Black Bayou Lake Tract	Department of Wildlife and Fisheries	5.6	
<b>Total Managed Area, Upper West Gulf Coastal Plain (in acres):</b>			<b>265,129.9</b>	
<b>Total Natural and Scenic River Miles (National Wild and Scenic Rivers Included):</b>				<b>696.4</b>

1: Unincorporated are state lands that have been acquired but not yet incorporated into State Wildlife Refuges or State Wildlife Management Areas.

APPENDIX A. Managed Areas by Ecoregion



APPENDIX A. Managed Areas by Ecoregion

<b>Ecoregions</b>	<b>Name</b>	<b>Owner</b>	<b>Area (in acres)</b>	<b>River Length (in Miles)</b>
<b>Lower West Gulf Coastal Plain</b>				
	<b>LNHP Natural Areas Registry</b>			
	Private	Private	2,919.5	
	<b>Military Lands</b>			
	Camp Beauregard	National Guard	9,833.3	
	Fort Polk	U.S. Army	105,884.2	
	<b>National Forests</b>			
	Kisatchie – Calcasieu District	U.S. Forest Service	134,345.7	
	Kisatchie - Catahoula District	U.S. Forest Service	122,749.1	
	Kisatchie - Kisatchie District	U.S. Forest Service	102,436.3	
	Kisatchie - Winn District	U.S. Forest Service	166,619.3	
	<b>National Wild and Scenic Rivers</b>			
	Saline Bayou National Wild and Scenic River	U.S. Forest Service		19.0
	<b>National Wildlife Refuges</b>			
	Catahoula	U. S. Fish & Wildlife Service	3,085.1	
	<b>Natural and Scenic Rivers</b>			
	Bayou Cocodrie	State of Louisiana		16.5
	Big Creek	State of Louisiana		24.5
	Calcasieu River	State of Louisiana		383.7
	Fish Creek	State of Louisiana		18.9
	Kisatchie Bayou	State of Louisiana		44.3
	Little River	State of Louisiana		133.6
	Pearl Creek	State of Louisiana		2.3
	Saline Bayou	State of Louisiana		34.4

APPENDIX A. Managed Areas by Ecoregion

<b>Ecoregions</b>	<b>Name</b>	<b>Owner</b>	<b>Area (in acres)</b>	<b>River Length (in Miles)</b>
<b>Lower West Gulf Coastal Plain</b>				
	Six Mile Creek	State of Louisiana		47.3
	Spring Creek	State of Louisiana		32.8
	Ten Mile Creek	State of Louisiana		52.9
	Trout Creek	State of Louisiana		16.6
	Whiskey Chitto Creek	State of Louisiana		82.7
	<b>Private Lands Conservation</b>			
	Copenhagen Hills Easement	Scott Paper	85.0	
	Copenhagen Hills Environmental Preserve Easement	International Paper	332.3	
	<b>State Parks</b>			
	Caney Creek Lake	Office of State Lands	319.3	
	Chicot	Office of State Lands	2,514.1	
	Sam Houston Jones	Office of State Lands	1,053.5	
	South Toledo Bend	Office of State Lands	1,192.5	
	Big Cypress State Reservation Area	Office of State Lands	10.3	
	<b>State River Authority</b>			
	Crooked Creek	Office of State Lands	1,244.4	
	Sabine River Authority	Office of State Lands	173.1	
	<b>State Wildlife Management Areas</b>			
	Alexander State Forest	Department of Agriculture and	8,158.4	
	Boise Vernon	Boise Cascade Corporation	55,671.6	

APPENDIX A. Managed Areas by Ecoregion

<b>Ecoregions</b>	<b>Name</b>	<b>Owner</b>	<b>Area (in acres)</b>	<b>River Length (in Miles)</b>
<b>Lower West Gulf Coastal Plain</b>				
	Camp Beauregard (outside of classified Military lands)	Louisiana National Guard	2,762.5	
	Dewey W. Wills	Department of Wildlife and Fisheries	2,183.7	
	Elbow Slough	Department of Wildlife and Fisheries	24.3	
	Fort Polk (classified under military lands)	U.S. Army; U.S. Forest Service	0.0	
	Little River	Department of Wildlife and Fisheries	4,727.7	
	Marsh Bayou	Department of Wildlife and Fisheries	655.0	
	Peason Ridge	U.S. Army	33,010.0	
	Sabine Island	Office of State Lands	8,688.0	
	Sicity Island Hills	Department of Wildlife and Fisheries	6,685.5	
	Walnut Hill	Department of Wildlife and Fisheries	595.0	
	West Bay	Boise Cascade Corporation	63,511.0	
<b>The Nature Conservancy Preserves</b>				
	Cc Road Savanna	The Nature Conservancy	473.2	
	Copenhagen Hills	The Nature Conservancy	196.0	
	Lake Cocodrie	The Nature Conservancy	167.8	
	Persimmon Gully	The Nature Conservancy	189.6	
<b>Unincorporated<sup>1</sup></b>	DOTD Transferred Tracts (Little River)	Department of Wildlife and Fisheries	571.0	
<b>Total Managed Area, Lower West Gulf Coastal Plain (in acres):</b>			<b>1,373,433.5</b>	
<b>Total Natural and Scenic River Miles (National Wild and Scenic Rivers included):</b>				<b>909.6</b>
1: Unincorporated are state lands that have been acquired but not yet incorporated into State Wildlife Refuges or State WMAs				

## APPENDIX A. Managed Areas by Ecoregion

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### **GIS MAP AND TABLES DISCLAIMER**

The information contained on these maps and tables are intended to be used to identify and inventory Management Areas in the State of Louisiana for informational purposes only and are NOT to be construed or used as a “legal description.” Map and table information is believed to be accurate but accuracy is not guaranteed. Any errors or omissions should be reported to Louisiana Department of Wildlife and Fisheries. In no event will the State of Louisiana, the Department of Wildlife and Fisheries, the Wildlife and Fisheries Commission, or any of the state’s agencies, boards, or commissions be liable for any damages for any reason, including, but not limited to, loss of data, lost profits, business interruption, loss of business information or other pecuniary loss that might arise from the use of this map or the information it contains.

## APPENDIX A. Managed Areas by Ecoregion

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## APPENDIX B. CWCS Core Committee

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### Louisiana Department of Wildlife & Fisheries

<b>Name</b>	<b>Division</b>
Albert, Doug	Fur & Refuge
Anthony, Jimmy	Wildlife
Blanchet, Harry	Marine Fisheries
Boundy, Jeff	Fur & Refuge
Burke, Marianne	Public Information
Carloss, Mike	Fur & Refuge
Faulkner, Patti	Fur & Refuge
Hanifen, Jim	Marine Fisheries
Higginbotham, Nancy	Fur & Refuge
Lester, Gary	Fur & Refuge
Maxit, Ines	Fur & Refuge
Morrison, Tim	Inland Fisheries
Olinde, Mike	Wildlife
Reid, Chris	Fur & Refuge
Ribbeck, Kenny	Wildlife
Sorensen, Stephen	Fur & Refuge

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## APPENDIX C. CWCS Technical Committees

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### CWCS Technical Committee--Birds

<u>Name</u>		<u>Organization</u>
Baldwin	Michael	USGS
Barrow	Wylie	USGS
Beck	James	
Borden-Billot	Diane	USFWS
Brantley	Chris	COE
Cardiff	Steven	LSU
Cordes	Carroll	USGS
Delahoussaye	Jim	LDEQ
DeMay	Richard	BTNEP
Dittmann	Donna	LSU
Floyd	Marty	USDA
Fontenot	Bill	Acadiana Park Nature Station
Gabrey	Steven	NSU
Hamel	Paul	USFS
Haraway	Maury	
Henry	Donata	
Hervey	Hubert	Bird Study Group
Hunter	Chuck	USFWS
Landry	Gary	ULL
Martin	Richard	TNC
Maxit	Inés	LDWF
Muth	David	USPS
Ouchley	Keith	TNC
Ousset	Glen	
Overby	Rosalie	
Pardieck	Keith	USGS
Patton	Dave	
Pontiff	Gary	
Purrington	Dan	Tulane
Reed	Bobby	LDWF
Rettig	Virginia	USFWS
Seidler	Rosemary	Centenary
Shively	Steve	USFS
Sorensen	Stephen	LDWF
Stouffer	Phil	LSU
Trahan	Jeff	Centenary
Vermillion	Bill	USFWS
Woodrey	Mark	MSU

APPENDIX C. CWCS Technical Committees cont.

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**CWCS Technical Committee--Crustaceans**

<u>Name</u>		<u>Organization</u>
Bauer	Raymond	ULL
Maxit	Inés	LDWF
Martin	Richard	TNC
Shively	Steve	USFS
Vermillion	Bill	USFW
Walls	Jerry	Louisiana Fauna Project

**CWCS Technical Committee--Fish**

<u>Name</u>		<u>Organization</u>
Aku,	Peter	ULM
Bart, Jr.	Hank	Tulane
Blanchet	Harry	LDWF
Cashner	Robert	UNO
Heins	David	Tulane
Hoese	Dick	Retired
Kelso	Bill	LSU
Konikoff	Mark	ULL
LaPeyre	Megan	LSU
Maxit	Inés	LDWF
Morrison	Tim	LDWF
Pezold	Frank	ULM
Piller	Kyle	SELU
Shively	Steve	USFS
Thompson	Bruce	LSU
Vermillion	Bill	USFWS

**CWCS Technical Committee--Herps**

<u>Name</u>		<u>Organization</u>
Boundy	Jeff	LDWF
Bowler	Kevin	Audubon Institute
Carr	John	ULM
Conzelmann	Paul	USNPS
Crother	Brian	SELU
Dundee	Harold	Tulane
Elsey	Ruth	LDWF
Fontenot	Cliff	SELU

APPENDIX C. CWCS Technical Committees cont.

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**CWCS Technical Committee--Herps cont.**

<u>Name</u>		<u>Organization</u>
Liner	Ernie	
Martin	Richard	TNC
Maxit	Inés	LDWF
McCallum	Malcolm	LSUS
Messinger	Martha Ann	LAMP
Moon	Brad	ULL
Pechmann	Joe	UNO
Rudolph	Craig	USFS
Seigel	Richard	Towson Univ.
Shively	Steve	USFS
Stevens	Terry	Thibodaux Live Supply
Thomas	Bob	Loyola
Vermillion	Bill	USFWS
Walls	Susan	USGS
Williams	Avery	LSUE

**CWCS Technical Committee--Insects**

<u>Name</u>		<u>Organization</u>
Dyer	Lee	Tulane
Martin	Richard	TNC
Maxit	Inés	LDWF
Penz	Carla	UNO
Prowell	Dorothy	LSU
Ramsey	Paul	La Tech
Shively	Steve	USFS
Vermillion	Bill	USFWS

**CWCS Technical Committee--Mammals**

<u>Name</u>		<u>Organization</u>
Gore	Jeff	Southeastern Bat Conservation Network
Hafner	Mark	LSU
Hunt	Howard	La Tech
Leberg	Paul	ULL
Martin	Richard	TNC
Maxit	Inés	LDWF
Shively	Steve	USFS
Tolsen	Kim	ULM
Vermillion	Bill	USFWS

**APPENDIX C. CWCS Technical Committees cont.**

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**CWCS Technical Committee--Mussels**

<b><u>Name</u></b>		<b><u>Organization</u></b>
Brown	Ken	LSU
Hartfield	Paul	USFWS
Hill	Anna	ULM
Kandl	Karen	UNO
Martin	Richard	TNC
Maxit	Inés	LDWF
Minton	Russell	ULM
Shively	Steve	USFS
Vidrine	Malcom	LSUE

## APPENDIX D. Comprehensive Wildlife Conservation Strategy

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### **Schedule of Public Workshops**

#### **Monroe**

April 12, 2005, 9:00-5:00  
Ouachita Parish Library  
1800 Stubbs Ave., Monroe, LA

#### **Shreveport**

April 13, 2005, 8:30-5:00  
LSU-S  
Directions to LSU-S can be found at <http://www.lsus.edu/about/directions.htm>  
The meeting will be in the Caddo/Bossier Rooms # 211/212 at the University Center (building # 6 on map (<http://www.lsus.edu/map/>)), with parking in the lot across from the Business and Education building (# 11 on map).

#### **Alexandria**

April 14, 2005, 8:30-5:00  
Rapides Parish Learning Center  
1410 Neel Kearby Blvd.  
off Hwy 28 West, near the airport.

#### **Lake Charles**

April 19, 2005, 8:30-5:00  
Best Western Richmond Suites Hotel  
2600 Moeling Steet  
off US 171, north of Interstate 10

#### **Baton Rouge**

April 21, 2005, 8:30-5:00  
Louisiana Dept. Wildlife and Fisheries headquarters  
2000 Quail Drive  
1<sup>st</sup> floor, Louisiana Room

#### **Lafayette**

April 25, 2005, 8:30-5:00  
Estuarine Habitats and Coastal Fisheries Center  
646 Cajundome Blvd  
first floor conference room

#### **New Orleans**

April 26, 2005, 8:30-5:00  
University of New Orleans  
Lindy Boggs Conference Center, Room 256  
Directions to site: <http://conferences.uno.edu/directions.htm>

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## APPENDIX E. Explanation of Rankings

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### EXPLANATION OF RANKING CATEGORIES EMPLOYED BY NATURAL HERITAGE PROGRAMS NATIONWIDE

Each element is assigned a single global rank as well as a state rank for each state in which it occurs. Global ranking is done under the guidance of NatureServe, Arlington, VA. State ranks are assigned by each state's Natural Heritage Program, thus a rank for a particular element may vary considerably from state to state. Federal ranks are designated by the U.S. Fish & Wildlife Service under the provisions of the Endangered Species Act of 1973.

#### FEDERAL RANKS (ESA FIELD):

LE = Listed Endangered

LT = Listed Threatened

PE = Proposed endangered

PT = Proposed Threatened

C = Candidate

PDL = Proposed for delisting

E (S/A) or T (S/A) = Listed endangered or threatened because of similarity of appearance

XE = Essential experimental population

XN = Nonessential experimental population

No Rank = Usually indicates that the taxon does not have any federal status. However, because of potential lag time between publication in the Federal Register and entry in the central databases and state databases, some taxa may have a status which does not yet appear.

(Rank, Rank) = Combination values in parenthesis = The taxon itself is not named in the Federal Register as having U.S. ESA status; however, all of its infraspecific taxa (worldwide) do have official status. The statuses shown in parentheses indicate the statuses that apply to infraspecific taxa or populations within this taxon. THE SPECIES IS CONSIDERED TO HAVE A COMBINATION STATUS IN LOUISIANA

(PS) = partial status= Status in only a portion of the species range. Typically indicated in a "full" species record where an infraspecific taxon or population has U.S. ESA status, but the entire species does not. THE SPECIES DOES NOT HAVE A STATUS IN LOUISIANA

(PS: Rank) = partial status= Status in only a portion of the species range. The value of that status appears because the entity with status does not have an individual entry in Natureserve. THE SPECIES MAY HAVE A STATUS IN LOUISIANA

#### GLOBAL ELEMENT RANKS:

G1 = critically imperiled globally because of extreme rarity (5 or fewer known extant populations) or because of some factor(s) making it especially vulnerable to extinction

G2 = imperiled globally because of rarity (6 to 20 known extant populations) or because of some factor(s) making it very vulnerable to extinction throughout its range

## APPENDIX E. Explanation of Rankings cont.

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G3 = either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range (e.g., a single physiographic region) or because of other factors making it vulnerable to extinction throughout its range (21 to 100 known extant populations)

G4 = apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery (100 to 1000 known extant populations)

G5 = demonstrably secure globally, although it may be quite rare in parts of its range, especially at the periphery (1000+ known extant populations)

GH = of historical occurrence throughout its range; i.e., formerly part of the established biota, with the possibility that it may be rediscovered (e.g., Bachman's Warbler)

GU = possibly in peril range-wide, but status uncertain; need more information

G? = rank uncertain or a range (e.g., G3G5?) delineates the limits of uncertainty

GQ = uncertain taxonomic status

GX = believed to be extinct throughout its range (e.g., Passenger Pigeon) with virtually no likelihood that it will be rediscovered

T = subspecies or variety rank (e.g., G5T4 applies to a subspecies with a global species rank of G5, but with a subspecies rank of G4)

### STATE ELEMENT RANKS:

S1 = critically imperiled in Louisiana because of extreme rarity (5 or fewer known extant populations) or because of some factor(s) making it especially vulnerable to extirpation

S2 = imperiled in Louisiana because of rarity (6 to 20 known extant populations) or because of some factor(s) making it very vulnerable to extirpation

S3 = rare and local throughout the state or found locally (even abundantly at some of its locations) in a restricted region of the state, or because of other factors making it vulnerable to extirpation (21 to 100 known extant populations)

S4 = apparently secure in Louisiana with many occurrences (100 to 1000 known extant populations)

S5 = demonstrably secure in Louisiana (1000+ known extant populations)

(B or N may be used as qualifier of numeric ranks and indicating whether the occurrence is breeding or nonbreeding)

SA = accidental in Louisiana, including species (usually birds or butterflies) recorded once or twice or only at great intervals hundreds or even thousands of miles outside their usual range

SH = of historical occurrence in Louisiana, but no recent records verified within the last 20 years; formerly part of the established biota, possibly still persisting

SR = reported from Louisiana, but without conclusive evidence to accept or reject the report

SU = possibly in peril in Louisiana, but status uncertain; need more information

SX = believed to be extirpated from Louisiana

SZ = transient species in which no specific consistent area of occurrence is identifiable

APPENDIX F. Species of Conservation Concern in Louisiana

COMMON NAME	SCIENTIFIC NAME	GLOBAL RANK	STATE RANK	Federal Status	EGCP	UEGCP	ECOREGION <sup>1</sup>			
							MRAP	GCPM	LWGCP	UWGCP
<b>Amphibians</b>										
Eastern Tiger Salamander	<i>Ambystoma tigrinum tigrinum</i>	G5	S1		X				X	
Southern Dusky Salamander	<i>Desmognathus auriculatus</i>	G5	S4		X		X	X	X	X
Four-toed Salamander	<i>Hemidactylium scutatum</i>	G5	S1		X					
Webster's Salamander	<i>Plethodon websteri</i>	G3	S1			X				
Louisiana Slimy Salamander	<i>Plethodon kisatchie</i>	G5	S1S2						X	X
Gulf Coast Mud Salamander	<i>Pseudotriton montanus flavissimus</i>	G5	S1		X					
Southern Red-backed Salamander	<i>Plethodon serratus</i>	G5	S1						X	X
Southern Red Salamander	<i>Pseudotriton ruber vioscai</i>	G5	S2		X					
Oak Toad	<i>Bufo quercicus</i>	G5	S3S4		X					
Barking Treefrog	<i>Hyla gratiosa</i>	G5	S3S4		X	X				
Ornate Chorus Frog	<i>Pseudacris ornata</i>	G5	S1		X					
Strecker's Chorus Frog	<i>Pseudacris streckeri</i>	G5	S1							X
Eastern Spadefoot	<i>Scaphiopus holbrookii</i>	G5	S4		X	X				
Southern Crawfish Frog	<i>Rana areolata areolata</i>	G4	S3				X	X	X	X
Dusky Gopher Frog	<i>Rana sevosa</i>	G1	SH	E	X					
<b>Birds</b>										
Brown Pelican	<i>Pelecanus occidentalis</i>	G4	S2	E				X		
American Bittern	<i>Botaurus lentiginosus</i>	G4	S4N			X	X	X	X	X
Reddish Egret	<i>Egretta rufescens</i>	G4	S2B,S2N					X		
Yellow-crowned Night-Heron	<i>Nyctanassa violacea</i>	G5	S2N,S5B		X		X	X	X	X
Wood Stork	<i>Mycteria americana</i>	G4	SZN				X	X		
Mottled Duck	<i>Anas fulvigula</i>	G4	S4				X	X		
Northern Pintail	<i>Anas acuta</i>	G5	S5N				X	X		X
Canvasback	<i>Aythya valisineria</i>	G5	S4N				X	X	X	
Redhead	<i>Aythya americana</i>	G5	S4N					X		

<sup>1</sup>Ecoregions:

EGCP – East Gulf Coastal Plain

UEGCP – Upper East Gulf Coastal Plain

MRAP – Mississippi River Alluvial Plain

GCPM – Gulf Coast Prairies Marshes

LWGCP – Lower West Gulf Coastal Plain

UWGCP – Upper West Gulf Coastal Plain

APPENDIX F. Species of Conservation Concern in Louisiana cont.

COMMON NAME	SCIENTIFIC NAME	GLOBAL RANK	STATE RANK	Federal Status	ECOREGION <sup>1</sup>					
					EGCP	UEGCP	MRAP	GCPM	LWGCP	UWGCP
Lesser Scaup	<i>Aythya affinis</i>	G5	S5N					X		
Swallow-tailed Kite	<i>Elanoides forficatus</i>	G5	S1S2B		X	X	X		X	
Bald Eagle	<i>Haliaeetus leucocephalus</i>	G4	S3B	T	X		X	X	X	X
Northern Harrier	<i>Circus cyaneus</i>	G5	S5		X	X	X	X	X	X
Northern Bobwhite	<i>Colinus virginianus</i>	G5	S5		X	X	X	X	X	X
Yellow Rail	<i>Coturnicops noveboracensis</i>	G4	S3S4N		X		X	X	X	
Black Rail	<i>Laterallus jamaicensis</i>	G4	S1S2N				X	X	X	
Clapper Rail	<i>Rallus longirostris</i>	G5	S5					X		
King Rail	<i>Rallus elegans</i>	G4	S4		X		X	X	X	
Sandhill Crane	<i>Grus canadensis</i>	G5	S1N				X	X	X	
Whooping Crane	<i>Grus americana</i>	G1	SH					X		
Snowy Plover	<i>Charadrius alexandrinus</i>	G4	S1B,S2N					X		
Wilson's Plover	<i>Charadrius wilsonia</i>	G5	S1S3B,S3N					X		
Piping Plover	<i>Charadrius melodus</i>	G3	S2N	E/T				X		
American Oystercatcher	<i>Haematopus palliatus</i>	G5	S1					X		
Marbled Godwit	<i>Limosa fedoa</i>	G5	S4N					X		
Dunlin	<i>Calidris alpina</i>	G5	S5N				X	X	X	X
Short-billed Dowitcher	<i>Limnodromus griseus</i>	G5	S5N				X	X	X	X
American Woodcock	<i>Scolopax minor</i>	G5	S1B,S3S5N		X	X	X	X	X	X
Gull-billed Tern	<i>Sterna nilotica</i>	G5	S2B,S2S3N					X		
Caspian Tern	<i>Sterna caspia</i>	G5	S1S2B,S3N					X		
Royal Tern	<i>Sterna maxima</i>	G5	S5					X		
Sandwich Tern	<i>Sterna sandvicensis</i>	G5	S4B					X		
Common Tern	<i>Sterna hirundo</i>	G5	S1B,S2N		X		X	X	X	X
Forster's Tern	<i>Sterna forsteri</i>	G5	S5				X	X	X	

<sup>1</sup>Ecoregions:

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APPENDIX F. Species of Conservation Concern in Louisiana cont.

COMMON NAME	SCIENTIFIC NAME	GLOBAL RANK	STATE RANK	Federal Status	ECOREGION <sup>1</sup>					
					EGCP	UEGCP	MRAP	GCPM	LWGCP	UWGCP
Interior Least Tern	<i>Sterna antillarum athalassos</i>	G4T2Q	S1B	E			X	X		X
Black Skimmer	<i>Rynchops niger</i>	G5	S5					X		
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	G5	S5B		X	X	X	X	X	X
Short-eared Owl	<i>Asio flammeus</i>	G5	S2S3N		X	X	X	X	X	X
Chuck-Will's-Widow	<i>Caprimulgus carolinensis</i>	G5	S4B		X	X	X		X	X
Red-cockaded Woodpecker	<i>Picoides borealis</i>	G2	S2	E	X				X	X
Ivory-billed Woodpecker	<i>Campephilus principalis</i>	GH	SX	E	X		X			
Scissor-tailed Flycatcher	<i>Tyrannus forficatus</i>	G5	S4B					X	X	X
Brown-headed Nuthatch	<i>Sitta pusilla</i>	G5	S5		X	X			X	X
Sedge Wren	<i>Cistothorus platensis</i>	G5	S4N		X	X	X	X	X	X
Wood Thrush	<i>Hylocichla mustelina</i>	G5	S4B		X	X	X	X	X	X
Spragues Pipit	<i>Anthus spragueii</i>	G4	S3S4N					X	X	X
Loggerhead Shrike	<i>Lanius ludovicianus</i>	G4	S4		X	X	X	X	X	X
Bell's Vireo	<i>Vireo bellii</i>	G5	S1B							X
Yellow-throated Vireo	<i>Vireo flavifrons</i>	G5	S4B		X	X	X		X	X
Northern Parula	<i>Parula americana</i>	G5	S5B		X	X	X	X	X	X
Prairie Warbler	<i>Dendroica discolor</i>	G5	S4B		X				X	X
Prothonotary Warbler	<i>Protonotaria citrea</i>	G5	S5B		X	X	X		X	X
Worm-eating Warbler	<i>Helmitheros vermivorus</i>	G5	S4B			X	X		X	X
Swainson's Warbler	<i>Limnothlypis swainsonii</i>	G4	S4B		X	X	X		X	X
Louisiana Waterthrush	<i>Seiurus motacilla</i>	G5	S3S4B				X		X	X
Kentucky Warbler	<i>Oporornis formosus</i>	G5	S4B		X	X	X		X	X
Hooded Warbler	<i>Wilsonia citrina</i>	G5	S5B		X	X	X		X	X
Painted Bunting	<i>Passerina ciris</i>	G5	S5B		X	X	X	X	X	X
Dickcissel	<i>Spiza americana</i>	G5	S4B		X	X	X		X	X
Bachman's Sparrow	<i>Aimophila aestivalis</i>	G3	S3		X				X	X

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APPENDIX F. Species of Conservation Concern in Louisiana cont.

COMMON NAME	SCIENTIFIC NAME	GLOBAL RANK	STATE RANK	Federal Status	ECOREGION <sup>1</sup>					
					EGCP	UEGCP	MRAP	GCPM	LWGCP	UWGCP
Field Sparrow	<i>Spizella pusilla</i>	G5	S4BS5N		X	X	X	X	X	X
Grasshopper Sparrow	<i>Ammodramus savannarum</i>	G5	S3N		X	X	X	X	X	X
Henslow's Sparrow	<i>Ammodramus henslowii</i>	G4	S3N		X	X	X	X	X	X
Le Conte's Sparrow	<i>Ammodramus leconteii</i>	G4	S4N		X	X	X	X	X	X
Seaside Sparrow	<i>Ammodramus maritimus</i>	G4	S4					X		
Nelson's Sharp-tailed Sparrow	<i>Ammodramus nelsoni</i>	G5	SZN					X		
Smith's Longspur	<i>Calcarius pictus</i>	G5	SNR							X
Rusty Blackbird	<i>Euphagus carolinus</i>	G4	S5N		X	X	X	X	X	X
Orchard Oriole	<i>Icterus spurius</i>	G5	S5B		X	X	X	X	X	X
<b>Mammals</b>										
Southeastern Shrew	<i>Sorex longirostris</i>	G5	S2S3		X	X	X			X
Southeastern Myotis	<i>Myotis austroriparius</i>	G3G4	S3		X	X	X	X	X	X
Northern Myotis	<i>Myotis septentrionalis</i>	G4	S1S2						X	
Silver-haired Bat	<i>Lasionycteris noctivagans</i>	G5	S1						X	X
Big Brown Bat	<i>Eptesicus fuscus</i>	G5	S1S2		X	X			X	X
Hispid Pocket Mouse	<i>Chaetodipus hispidus</i>	G5	S2						X	X
Eastern Harvest Mouse	<i>Reithrodontomys humulis</i>	G5	S3S4		X				X	X
Sperm Whale	<i>Physeter macrocephalus</i>	G3G4	SAN	E						
Finback Whale	<i>Balaenoptera physalus</i>	G3G4	SAN	E						
Sei Whale	<i>Balaenoptera borealis</i>	G3	SAN	E						
Blue Whale	<i>Balaenoptera musculus</i>	G3G4	SAN	E						
Red Wolf	<i>Canis rufus</i>	G1	SX	E			X	X	X	
Louisiana Black Bear	<i>Ursus americanus luteolus</i>	G5T2	S2	T	X	X	X			
Ringtail	<i>Bassariscus astutus</i>	G5	SH							X
Long-tailed Weasel	<i>Mustela frenata</i>	G5	S2S4		X	X	X		X	X
Eastern Spotted Skunk	<i>Spilogale putorius</i>	G5	S1		X	X	X	X	X	

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APPENDIX F. Species of Conservation Concern in Louisiana cont.

COMMON NAME	SCIENTIFIC NAME	GLOBAL RANK	STATE RANK	Federal Status	EGCP	ECOREGION <sup>1</sup>					UWGCP
						UEGCP	MRAP	GCPM	LWGCP		
Florida Panther	<i>Puma concolor coryi</i>	G5T1	SH	E	X		X	X	X		
West Indian Manatee	<i>Trichechus manatus</i>	G2	SZN	E	X		X	X			
<b>Reptiles</b>											
Loggerhead Seaturtle	<i>Caretta caretta</i>	G3	S1	T				X			
Green Seaturtle	<i>Chelonia mydas mydas</i>	G3T3	SZN	E/T				X			
Atlantic Hawksbill Seaturtle	<i>Eretmochelys imbricata imbricata</i>	G3T3	SZN	E				X			
Kemp's Ridley Seaturtle	<i>Lepidochelys kempii</i>	G1	SZN	E				X			
Alligator Snapping Turtle	<i>Macrochelys temminckii</i>	G3G4	S3		X	X	X	X	X	X	
Leatherback Seaturtle	<i>Dermochelys coriacea</i>	G2	SZN	E				X			
Ringed Map Turtle	<i>Graptemys oculifera</i>	G2	S2	T	X						
Ouachita Map Turtle	<i>Graptemys ouachitensis ouachitensis</i>	G5	S5				X		X	X	
Sabine Map Turtle	<i>Graptemys ouachitensis sabinensis</i>	G5T5	S3S4						X	X	
Pascagoula Map Turtle	<i>Graptemys gibbonsi</i>	G3G4	S3		X						
Mississippi Diamond-backed Terrapin	<i>Malaclemys terrapin pileata</i>	G4T3	S2					X			
Ornate Box Turtle	<i>Terrapene ornata ornata</i>	G5T5	S1					X			
Stripe-necked Musk Turtle	<i>Sternotherus minor peltifer</i>	G5	S1		X						
Gopher Tortoise	<i>Gopherus polyphemus</i>	G3	S1	T	X						
Western Slender Glass Lizard	<i>Ophisaurus attenuatus attenuatus</i>	G5T5	SU					X	X	X	
Eastern Slender Glass Lizard	<i>Ophisaurus attenuatus longicaudus</i>	G5T5	SU		X						
Eastern Glass Lizard	<i>Ophisaurus ventralis</i>	G5	S3		X			X			
Southern Prairie Skink	<i>Eumeces septentrionalis obtusirostris</i>	G5T5	S1								X
Western Worm Snake	<i>Carphophis vermis</i>	G5T5	S1								X
Northern Scarlet Snake	<i>Cemophora coccinea copei</i>	G5T5	S3S4		X				X	X	
Common Rainbow Snake	<i>Farancia erythrogramma erythrogramma</i>	G5T5	S2		X						
Mole Kingsnake	<i>Lampropeltis calligaster rhombomaculata</i>	G5T5	S1S2		X						
Scarlet Kingsnake	<i>Lampropeltis triangulum elapsoides</i>	G5T5	SU		X	X					

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APPENDIX F. Species of Conservation Concern in Louisiana cont.

COMMON NAME	SCIENTIFIC NAME	GLOBAL RANK	STATE RANK	Federal Status	EGCP	ECOREGION <sup>1</sup>				
						UEGCP	MRAP	GCPM	LWGCP	UWGCP
Black Pine Snake	<i>Pituophis melanoleucus lodingi</i>	G4T3	S1	C	X					
Louisiana Pine Snake	<i>Pituophis ruthveni</i>	G2	S2	C					X	X
Pine Woods Littersnake	<i>Rhadinaea flavilata</i>	G4	S1		X					
Southeastern Crowned Snake	<i>Tantilla coronata</i>	G5	S3S4		X					
Harlequin Coralsnake	<i>Micrurus fulvius</i>	G5	S2		X					
Eastern Diamond-backed Rattlesnake	<i>Crotalus adamanteus</i>	G4	S1		X					
Timber Rattlesnake	<i>Crotalus horridus</i>	G4	S3S4		X	X	X		X	X
<b>Freshwater Fish</b>										
Gulf Sturgeon	<i>Acipenser oxyrinchus desotoi</i>	G3T2	S1S2	T	X*		X	X		
Pallid Sturgeon	<i>Scaphirhynchus albus</i>	G1	S1	E			X*			
Paddlefish	<i>Polyodon spathula</i>	G4	S3		X	X	X	X	X	X
Alabama Shad	<i>Alosa alabamae</i>	G3	S1		X*		X	X		
Central Stoneroller	<i>Campostoma anomalum</i>	G5	S2			X	X			X
Bigeye Shiner	<i>Notropis boops</i>	G5	S3				X			X
Chub Shiner	<i>Notropis potteri</i>	G4	S3				X		X	X*
Suckermouth Minnow	<i>Phenacobius mirabilis</i>	G5	S1		X			X	X	X
Bluntnose Shiner	<i>Cyprinella camura</i>	G5	S2S3			X				
Steelcolor Shiner	<i>Cyprinella whipplei</i>	G5	S2S3			X				
Bluehead Shiner	<i>Pteronotropis hubbsi</i>	G3	S2				X*	X	X	X*
Flagfin Shiner	<i>Pteronotropis signipinnis</i>	G5	S3		X*			X		
Bluenose Shiner	<i>Pteronotropis welaka</i>	G3G4	S1S2		X*			X		
Silverjaw Minnow	<i>Ericymba buccata</i>	G5	S2S4		X*			X		
Blue Sucker	<i>Cycleptus elongatus</i>	G3G4	S2S3		X		X	X	X*	X
Southeastern Blue Sucker	<i>Cycleptus meridionalis</i>	G3G4	S1		X*			X		
River Redhorse	<i>Moxostoma carinatum</i>	G4	S1S3		X*			X		

<sup>1</sup>Ecoregions:

EGCP – East Gulf Coastal Plain  
UEGCP – Upper East Gulf Coastal Plain

MRAP – Mississippi River Alluvial Plain  
GCPM – Gulf Coast Prairies Marshes

LWGCP – Lower West Gulf Coastal Plain  
UWGCP – Upper West Gulf Coastal Plain



APPENDIX F. Species of Conservation Concern in Louisiana cont.

COMMON NAME	SCIENTIFIC NAME	GLOBAL RANK	STATE RANK	Federal Status	ECOREGION <sup>1</sup>					
					EGCP	UEGCP	MRAP	GCPM	LWGCP	UWGCP
Frecklebelly Madtom	<i>Noturus munitus</i>	G3	S2S3		X*			X		
Broadstripe Topminnow	<i>Fundulus euryzonus</i>	G2	S2		X*		X			
Gulf Pipefish	<i>Syngnathus scovelli</i>	G5	S4				X			
Crystal Darter	<i>Crystallaria asprella</i>	G3	S2S3		X*	X	X			
Western Sand Darter	<i>Ammocrypta clara</i>	G3	S2				X	X	X*	X
Rainbow Darter	<i>Etheostoma caeruleum</i>	G5	S2S3			X				
Channel Darter	<i>Percina copelandi</i>	G4	S1S2		X					
Freckled Darter	<i>Percina lenticula</i>	G2	S1		X*			X		
Bigscale Logperch	<i>Percina macrolepida</i>	G5	S1S2					X	X*	X
Pearl Darter	<i>Percina aurora</i>	G1	SH	C	X*			X		
Gulf Logperch	<i>Percina suttkusi</i>	G5	SU		X*					
* = primary location occurrence										
<b>Marine Fish</b>										
Saltmarsh Topminnow	<i>Fundulus jenkinsi</i>	G2	G2G3					X		
Bayou Killifish	<i>Fundulus pulvereus</i>	G5	S3S4					X		
Diamond Killifish	<i>Adinia xenica</i>	G5	S4					X		
Texas Pipefish	<i>Syngnathus affinis</i>	G1	SU					X		
Chain Pipefish	<i>Syngnathus louisianae</i>	GNR	S4					X		
Opossum Pipefish	<i>Micropphis brachyurus</i>	G4G5	SU					X		
Emerald Sleeper	<i>Erotelis smaragdus</i>	GNR	S4					X		
Violet Goby	<i>Gobioides broussoneti</i>	G5	S4					X		
Gold Brotula	<i>Gunterichthys longipenis</i>	GQ	SU					X		
Longfin Mako	<i>Isurus paucus</i>	GQ	SU					X		
Broad Flounder	<i>Paralichthys squamilentus</i>	GQ	SU					X		
Large-scaled Spinycheek Sleeper	<i>Eleotris amblyopsis</i>	GQ	SU					X		
Goliath Grouper	<i>Epinephalus itajara</i>	GQ	SU					X		

<sup>1</sup>Ecoregions:

EGCP – East Gulf Coastal Plain

UEGCP – Upper East Gulf Coastal Plain

MRAP – Mississippi River Alluvial Plain

GCPM – Gulf Coast Prairies Marshes

LWGCP – Lower West Gulf Coastal Plain

UWGCP – Upper West Gulf Coastal Plain

APPENDIX F. Species of Conservation Concern in Louisiana cont.

COMMON NAME	SCIENTIFIC NAME	GLOBAL RANK	STATE RANK	Federal Status	ECOREGION <sup>1</sup>					
					EGCP	UEGCP	MRAP	GCPM	LWGCP	UWGCP
<b>Crawfish</b>										
Calcasieu Painted Crawfish	<i>Orconectes blacki</i>	G2	S2						X	
Teche Painted Crawfish	<i>Orconectes hathawayi</i>	G3	S3				X	X		
Kisatchie Painted Crawfish	<i>Orconectes maletae</i>	G2	S2					X	X	
Ribbon Crawfish	<i>Procambarus bivittatus</i>	G4	S1S2		X					
Javelin Crawfish	<i>Procambarus jaculus</i>	G4	S1S2				X	X		
Vernal Crawfish	<i>Procambarus viaeviridis</i>	G5	S2S3			X	X			
Elegant Crawfish	<i>Procambarus elegans</i>	G4	S2				X			X
Twin Crawfish	<i>Procambarus geminus</i>	G3G4	S2S3							X
Plain Brown Crawfish	<i>Procambarus shermani</i>	G4	S2		X					
Pine Hills Crawfish	<i>Fallicambarus dissitus</i>	G4	S2					X	X	
Old Prairie Crawfish	<i>Fallicambarus macneesei</i>	G3	S2				X	X		
Flatwoods Digger	<i>Fallicambarus oryctes</i>	G4	S2S3		X					
Sabine Fencing Crawfish	<i>Faxonella beyeri</i>	G4	S1S2					X	X	
Ouachita Fencing Crawfish	<i>Faxonella creaseri</i>	G2	S2					X		
<b>Butterflies</b>										
Wild Indigo Duskywing	<i>Erynnis baptisiae</i>	G5	SU				X	X	X	X
Neamathla Skipper	<i>Nastra neamathla</i>	G5	SU				X			
Cobweb Skipper	<i>Hesperia metea</i>	G4G5	SU		X			X	X	
Arogos Skipper	<i>Atrytone arogos</i>	G3G4	SU		X					
Palatka Skipper	<i>Euphyes pilatka</i>	G3G4	SU				X			
Dion Skipper	<i>Euphyes dion</i>	G4	SU				X			
Dusted Skipper	<i>Atrytonopsis hianna</i>	G4G5	SU		X			X	X	
Pepper and Salt Skipper	<i>Amblyscirtes hegon</i>	G5	SU					X	X	
Celia's Roadside Skipper	<i>Amblyscirtes celia</i>	G4	SU				X			

<sup>1</sup>Ecoregions:

EGCP – East Gulf Coastal Plain

UEGCP – Upper East Gulf Coastal Plain

MRAP – Mississippi River Alluvial Plain

GCPM – Gulf Coast Prairies Marshes

LWGCP – Lower West Gulf Coastal Plain

UWGCP – Upper West Gulf Coastal Plain

APPENDIX F. Species of Conservation Concern in Louisiana cont.

COMMON NAME	SCIENTIFIC NAME	GLOBAL RANK	STATE RANK	Federal Status	ECOREGION <sup>1</sup>					
					EGCP	UEGCP	MRAP	GCPM	LWGCP	UWGCP
Dusky Roadside Skipper	<i>Amblyscirtes alternata</i>	G3G4	SU		X					
Obscure Skipper	<i>Panoquina panoquinoides</i>	G5	SU					X		
Yucca Giant Skipper	<i>Megathymus yuccae</i>	G5	SU		X	X				
Great Southern White	<i>Ascia monuste</i>	G5	SU					X		
Falcate Orangetip	<i>Anthocharis midea</i>	G4G5	S4?		X	X		X	X	X
Harvester	<i>Feniseca tarquinius</i>	G4	SU				X	X		X
Western Pygmy-Blue	<i>Brephidium exilis</i>	G5	SU					X		
Eastern Pygmy Blue	<i>Brephidium isophthalma</i>	G5	SU					X		
Reakirt's Blue	<i>Hemiargus isola</i>	G5	SU					X	X	
Little Metalmark	<i>Calephelis virginiensis</i>	G4	S4?		X			X	X	X
'Seminole' Texan Crescent	<i>Anthanassa texana seminole</i>	G5	SU		X		X	X		
Creole Pearly Eye	<i>Lethe creola</i>	G3G4	S4		X	X				
Appalachian Brown	<i>Satyrodes appalachia</i>	G4	SU		X					
Southern Dogface	<i>Colias cesonia</i>	G5	S5					X	X	X
<b>Mussels</b>										
Mucket	<i>Actinonaias ligamentina</i>	G5	SH					X		
Rayed Creekshell	<i>Anodontoides radiatus</i>	G3	S2		X					
Western Fanshell	<i>Cyprogenia aberti</i>	G2	SH					X		
Butterfly	<i>Ellipsaria lineolata</i>	G4	S1					X		
Elephant-Ear	<i>Elliptio crassidens</i>	G5	S2S3		X					
Spike	<i>Elliptio dilatata</i>	G5	S2S3					X		X
Ebonyshell	<i>Fusconaia ebena</i>	G4G5	S3					X		
Pink Mucket	<i>Lampsilis abrupta</i>	G2	S1	E				X		
Southern Pocketbook	<i>Lampsilis ornata</i>	G5	S3					X		
Sandbank Pocketbook	<i>Lampsilis satura</i>	G2	S2		X					
Plain Pocketbook	<i>Lampsilis cardium</i>	G5	S1							X

<sup>1</sup>Ecoregions:

EGCP – East Gulf Coastal Plain

UEGCP – Upper East Gulf Coastal Plain

MRAP – Mississippi River Alluvial Plain

GCPM – Gulf Coast Prairies Marshes

LWGCP – Lower West Gulf Coastal Plain

UWGCP – Upper West Gulf Coastal Plain

APPENDIX F. Species of Conservation Concern in Louisiana cont.

COMMON NAME	SCIENTIFIC NAME	GLOBAL RANK	STATE RANK	Federal Status	EGCP	UEGCP	ECOREGION <sup>1</sup>			
							MRAP	GCPM	LWGCP	UWGCP
Fatmucket	<i>Lampsilis siliquoidea</i>	G5	S1S3				X			
White Heelsplitter	<i>Lasmigona complanata</i>	G5	S1				X			
Black Sandshell	<i>Ligumia recta</i>	G5	S1				X			
Louisiana Pearlshell	<i>Margaritifera hembeli</i>	G1	S1	T					X	
Southern Hickorynut	<i>Obovaria jacksoniana</i>	G1G2	S1S2		X					
Hickorynut	<i>Obovaria olivaria</i>	G4	S1				X			
Alabama Hickorynut	<i>Obovaria unicolor</i>	G3	S1		X					
Mississippi Pigtoe	<i>Pleurobema beadleanum</i>	G2G3	S2		X					
Pyramid Pigtoe	<i>Pleurobema rubrum</i>	G2	S2				X			
Louisiana Pigtoe	<i>Pleurobema riddellii</i>	G1G2	S1S2						X	X
Texas Heelsplitter	<i>Potamilus amphichaenus</i>	G1	SH						X	
Fat Pocketbook	<i>Potamilus capax</i>	G1	S1	E			X			
Inflated Heelsplitter	<i>Potamilus inflatus</i>	G1	S1	T	X					
Ouachita Kidneyshell	<i>Ptychobranchus occidentalis</i>	G3G4	S1				X			
Rabbitsfoot	<i>Quadrula cylindrica</i>	G3	S1				X			
Monkeyface	<i>Quadrula metanevra</i>	G4	S1				X			
Southern Creekmussel	<i>Strophitus subvexus</i>	G3	S1							
Squawfoot	<i>Strophitus undulatus</i>	G5	S2				X		X	X
Southern Rainbow	<i>Villosa vibex</i>	G4Q	S2		X					

<sup>1</sup>Ecoregions:

EGCP – East Gulf Coastal Plain

UEGCP – Upper East Gulf Coastal Plain

MRAP – Mississippi River Alluvial Plain

GCPM – Gulf Coast Prairies Marshes

LWGCP – Lower West Gulf Coastal Plain

UWGCP – Upper West Gulf Coastal Plain

## Appendix G. Louisiana's Terrestrial Habitats

TERRESTRIAL HABITAT	State Rank	Global Rank	ECOREGION <sup>1</sup>					
			UWGCP	LWGCP	MRAP	UEGCP	GCPM	EGCP
<b>ESTUARINE</b>								
Salt Marsh	S3S4	G5					X	
Brackish Marsh	S3S4	G4?					X	
Intermediate Marsh	S3S4	G4?					X	
Coastal Mangrove-Marsh Shrubland	S3	G2?					X	
Vegetated Pioneer Emerging Delta	S2S3	G3G4					X	
Barrier Island	NR <sup>2</sup>	NR					X	
<b>PALUSTRINE</b>								
Freshwater Marsh	S1S2	G3G4					X	
Coastal Prairie	S1	G2Q					X	
Eastern Hillside Seepage Bog	S2	G2						X
Western Hillside Seepage Bog	S2	G2G3		X				
Cypress-Tupelo-Blackgum Swamp	S4	G3G5	X	X	X		X	X
Bottomland Hardwood Forest	S4	G4G5	X	X	X		X	X
Live Oak Natural Levee Forest	S1S2	G2			X		X	
Hardwood Flatwoods	S2S3	G2G3	X		X			
Bayhead Swamp/Forested Seep	S3	G3?	X	X				X
Slash Pine-Pondcypress/Hardwood Forest	S2S3	G3?						X
Eastern Longleaf Pine Savannah	S1	G1						X
Western Longleaf Pine Savannah	S1S2	G2G3		X				
Small Stream Forest	S3	G3	X	X		X		X
<b>RIVERINE</b>								
Batture	S4S5	G4G5	X	X	X			
Sand Bar	S4S5	G4			X			
<b>UPLAND</b>								
Coastal Dune Grassland/Shrub Thicket	S1S2	G2G3					X	
Calcareous Prairie	S1	G1	X	X				
Saline Prairie	S1	G1G2	X	X				
Southern Mesophytic Forest	S2S3	G1G2				X		
Calcareous Forest	S2	G2?Q	X	X				
Salt Dome Hardwood Forest	S1	G1					X	
Coastal Live Oak-Hackberry Forest	S1S2	G2					X	
Barrier Island Live Oak Forest	S1	G1					X	
Shortleaf Pine/Oak-Hickory Forest	S2S3	G2G3	X	X				X
Mixed Hardwood-Loblolly Pine/Hardwood Slope Forest	S3S4	G4	X	X				X
Live Oak-Pine-Magnolia	S2	G2G3						X
Spruce Pine-Hardwood Flatwood	S1	G1G2						X
Eastern Upland Longleaf Pine Forest	S1S2	G1G2						X
Western Upland Longleaf Pine Forest	S2S3	G2G3	X	X				
Western Xeric Sandhill Woodland	S2S3	G2G3	X	X				
Sandstone Glade/Barren	S1S2	G1G2		X				
Agriculture-Cropland-Grassland	NR	NR	X	X	X	X	X	X
<sup>1</sup> UWGCP=Upper West Gulf Coastal Plain LWGCP=Lower West Gulf Coastal Plain MRAP=Mississippi River Alluvial Plain UEGCP=Upper East Gulf Coastal Plain GCPM=Gulf Coast Prairies and Marshes EGCP=East Gulf Coastal Plain <sup>2</sup> NR = Not Ranked								

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## APPENDIX H. Habitat Viability & Threats Assessment Meetings Participants

### **CWCS - Habitat Viability and Threats Assessment Participants**

Note: In order to complete terrestrial and aquatic habitat assessments, several meetings were held at the Louisiana Department of Wildlife and Fisheries headquarters in Baton Rouge, and three meetings were held at satellite locations including: Shreveport, Monroe, and Alexandria (Woodworth). The following is a combined list of all meeting participants:

<u>Name</u>		<u>Organization</u>
Blanchet	Harry	LDWF
Booth	Charlie	LDWF
Bordelon	Jonathan	LDWF
Burchfield	Bill	LDWF
Carloss	Mike	LDWF
Coleman	Kevin	TNC
Faulkner	Patti	LDWF
Finley	Heather	LDWF
Hanks	John	LDWF
Hayden	David	LDWF
Hebert	Steve	LDWF
Jeffrey	Johnson	LDWF
Johnson	Leslie	LDWF
Kimmel	Fred	LDWF
Leblanc	Emile	LDWF
Lester	Gary	LDWF
Locascio	Donald	LDWF
Martin	Richard	TNC
Maxit	Inés	LDWF
McInnis	Nelwyn	TNC
McMullan	Richard	LDWF
Melancon	George	LDWF
Moak	Lowery	LDWF
Mouton	Edward	LDWF
Myers	Randy	LDWF
Newland	Czerny	LDWF
Olinde	Mike	LDWF
Owens	Jerry	LDWF
Raymond	Larry	Parish of Caddo-Parks Dept
Reid	Chris	LDWF
Ribbeck	Kenny	LDWF
Robinette	John	LDWF
Ruiz	Manuel	LDWF
Savage	Larry	LDWF
Smith	Latimore	TNC
Smith	Wendell	LDWF
Sorensen	Stephen	LDWF
Telesco	Dave	BBCC
Tuma	Tommy	LDWF
Ulmer	Ronnie	TNC
Vidrine	Tony	LDWF
Weber	Dan	TNC

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## APPENDIX I. Strategies Development Participants

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### CWCS - Strategies Development Participants

Note: Development of conservation strategies to effectively address threats to species of concern and associated habitats was completed through a series of statewide meetings. Two meetings were held at the Louisiana Department of Wildlife and Fisheries headquarters in Baton Rouge, and six additional meetings were held at satellite locations including: Shreveport, Monroe, Alexandria, Lake Charles, Lafayette, and New Orleans. The following is a combined list of all meeting participants:

<u>Name</u>		<u>Organization</u>
Baka	Eric	LDWF
Bambarger	Raynie	LSU
Banks	Patrick	LDWF
Barrow	Wylie	USGS
Blackburn	John	Smurfit-Stone
Blanchet	Harry	LDWF
Boustany	Ron	NRCS
Brown	Cindy	TNC
Brown	Ken	LSU
Bryan	Rick	LA Audubon Council & LWF
Carloss	Mike	LDWF
Cashner	Bob	UNO
Chouinard	Tina	USFWS - Central LA Refuges
Clayton	Chris	Roy O. Martin
Coulson	Jennifer	Orleans Audubon Society
Courville	Chad	DU
Crain	Butch	TNC
Crossett	Richard	USFWS - Central LA Refuges
Daigle	Doug	MRBA
Dancak	Ken	USFS - KNF
Davey	Miriam	Citizen
David	Jody	LDWF
Davidson	Maria	LDWF
Davis	Kris	NRCS
DeMay	Richard	BTNEP
Faulkner	Patti	LDWF
Finley	Heather	LDWF
Floyd	Marty	NRCS
Fontenot	Bill	LCG
Garner	Lindy	USFWS
Gooding	Gypsy	USFWS
Granfell	Jan	DOTD
Green	Clay	ULL
Greig	Richard	CEI
Hanifen	Jim	LDWF
Hanks	John	LDWF
Harbison	Michael	LDWF

APPENDIX I. Strategies Development Participants cont.

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<u>Name</u>		<u>Organization</u>
Hardy	Mac	LSUS
Hartman	Rick	NOAA
Harvey	Joe	USACE
Hayden	David	LDWF
Hein	Stephen	LDWF
Hervey	Hubert	Bird Study Group
Huner	Jay	ULL
Jacobs	Skip	USACE
Jeske	Clint	USGS
Kleinpeter	Bill	LFA
Kohl	Barry	LA Audubon Council
LaLonde	Neil	USACE
Lanctot	Randy	LWF
Leberg	Paul	ULL
Lester	Gary	LDWF
Lueck	Daniel	FCP
Mallach	Troy	NRCS
Martin	Richard	TNC
Maxit	Inés	LDWF
McInnis	Nelwyn	TNC
McMahon	Paul	Weyerhaeuser
Miller	Brad	LDNR
Morrison	Tim	LDWF
Murry	Harold	Central LA Audubon
Muth	David	NPS
Myers	Ed	Smurfit-Stone & LFA
Nilles	Peter	USFS - KNF
O'Connell	Martin	UNO
Odom	Suzanne	USACE
Ouchley	Keith	TNC
Parplee	Adam	USACE
Pechmann	Joe	UNO
Pezold	Frank	ULM
Piehler	Chris	LDEQ
Prowell	Dorothy	LSU
Raymond	Larry	Parish of Caddo - Parks Dept.
Reed	Bobby	LDWF
Reed	Don	LSU - Ag Center
Reid	Chris	LDWF
Reynolds	Chris	Weyerhaeuser
Rios	Nelson	Tulane - Museum of Natural History
Rogillio	Howard	LDWF
Ross	Gary N.	LSU - Retired
Ruiz	Manuel	LDWF
Ruth	Ron	LDWF
Saucier	Michael	USACE
Segura	Martha	NPS

## APPENDIX I. Strategies Development Participants cont.

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<u>Name</u>		<u>Organization</u>
Sheldon	Fred	LSU
Shively	Steve	USFS - KNF
Smith	Latimore	TNC
Sorensen	Stephen	LDWF
Stich	Richard	Plum Creek
Stouffer	Phil	LSU
Stone	Stephen	USACE
Telesco	David	BBCC
Thompson	Bruce	LSU - Coastal Fisheries Institute
Ulmer	Ronnie	TNC
Vermillion	Bill	GCJV
Walters	Nancy	NPS
Weber	Dan	TNC
Wood	Mike	LDWF

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APPENDIX J. Example of Threats Assessment – EGCP

## East Gulf Coastal Plain (EGCP) - Terrestrial Habitats

Habitat Viability	Size	Condition	Landscape Context	Viability Rank
	Grade	Grade	Grade	
Eastern Longleaf Pine Savannah	Fair	Fair	Fair	Fair
Eastern Upland Longleaf Pine Forest	Fair	Fair	Fair	Fair
Slash Pine-Pondcypress-Hardwood Forest	Fair	Fair	Fair	Fair
Spruce Pine-Hardwood Flatwood	Poor	Fair	Fair	Fair
Live Oak-Pine-Magnolia Forest	Fair	Fair	Fair	Fair
Eastern Hillside Seepage Bog	Poor	Poor	Poor	Poor
Bayhead Swamp/Forested Seep	Fair	Fair	Poor	Fair
Shortleaf Pine/Oak-Hickory Forest	Poor	Poor	Poor	Poor
Small Stream Forest	Good	Fair	Fair	Fair
Mixed Hardwood-Loblolly Pine/Hardwood Slope Forest	Poor	Fair	Poor	Poor
Cypress-Tupelo-Blackgum Swamps	Good	Good	Good	Good
Bottomland Hardwood Forest	Good	Good	Fair	Good

APPENDIX J. Example of Threats Assessment – EGCP

**EGCP - Bayhead Swamp/Forested Seep**

Threats	Severity	Scope	Stress
Altered composition/structure	High	Very High	High
Altered water quality	High	Medium	Medium
Sedimentation	High	Low	Low
Habitat destruction or conversion	Very High	High	High
Habitat disturbance	High	Very High	High
Habitat fragmentation	High	Very High	High
Modification of water levels; changes in natural flow patterns	High	High	High

Sources of Threat		Altered composition structure		Altered water quality		Sedimentation		Habitat destruction or conversion		Habitat disturbance		Habitat fragmentation		Modification of water levels; changes in natural flow patterns		Threat to System Rank
		High	Medium	Low	Low	High	High	High	High	High	High					
Conversion to agriculture or other forest types	Contribution			Low		High		High		High		High				High
	Irreversibility	-	-	Medium	-	High	High		-	High	High		-			
	Source	-	-	Low	-	High			-	High			-			
Development of pipelines, roads or utilities	Contribution			Medium		Low		Medium		Medium		Low		Medium		Medium
	Irreversibility	-	-	Medium	Low	Very High	Medium	High	Medium	High	Medium	High	Medium	High	Medium	
	Source	-	-	Medium		Medium		Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	
Incompatible forestry practices	Contribution	High		Low		High				Very High				Medium		High
	Irreversibility	Medium	Medium	Medium	Low	Medium	Low		-	Medium	High		-	Medium	Medium	
	Source	Medium		Low		Medium				High				Medium		
Invasive/alien species	Contribution	Medium								Medium						Medium
	Irreversibility	High	Medium							High	Medium					
	Source	Medium								Medium						
Residential development	Contribution					Medium		Medium		Medium		High				High
	Irreversibility	-	-	Low	-	Very High	High	Medium	Medium	High	High					
	Source	-	-	Low		High		Medium	Medium	High						
Channelization of rivers or streams	Contribution	High				High		Medium		Medium				Very High		High
	Irreversibility	High	High			High	Low	High	Medium	High	Medium			High	High	
	Source	High				High		Medium	Medium	Medium	Medium			Very High		
Construction of ditches, drainage or diversion systems	Contribution	High				High		Low		Medium				High		Medium
	Irreversibility	Medium	Medium			Medium	Low	Medium	Low	Medium	Medium			Medium	Medium	
	Source	Medium				Medium		Low		Medium	Medium			Medium		
Fire suppression	Contribution	Low														Low
	Irreversibility	Medium	Low													
	Source	Low														

APPENDIX J. Example of Threats Assessment – EGCP

**EGCP - Bottomland Hardwood Forest**

Threats	Severity	Scope	Stress
Altered composition/structure	High	Very High	High
Modification of water levels; changes in natural flow patterns	High	High	High
Habitat destruction or conversion	Very High	Medium	Medium
Habitat disturbance	Medium	High	Medium
Habitat fragmentation	Medium	High	Medium

Sources of Threat		Altered composition structure		Modification of water levels; changes in natural flow patterns		Habitat destruction or conversion		Habitat disturbance		Habitat fragmentation		Threat to System Rank
		High	High	Medium	Medium	Medium	Medium	Medium	Medium			
Channelization of rivers or streams	Contribution		-	Medium	Medium		-		-		-	Medium
	Irreversibility			High	Medium							
	Source	-		Medium		-		-		-		
Construction of ditches, drainage or diversion systems	Contribution	Medium	Medium	High	Medium		-		-		-	Medium
	Irreversibility	Medium		Medium	Medium							
	Source	Medium		Medium		-		-		-		
Development of pipelines, roads or utilities	Contribution		-	Medium	Medium	Medium	Medium	Medium	High	Low	Medium	Medium
	Irreversibility			High	Medium	Very High	Medium	High	Low	High	Low	
	Source	-		Medium		High		Medium		Medium		
Operation of dams or reservoirs	Contribution	Medium	Medium	Very High	High		-		-		-	High
	Irreversibility	High		High	High							
	Source	Medium		Very High		-		-		-		
Incompatible forestry practices	Contribution	High	Medium		-		-	Medium	Low		-	Medium
	Irreversibility	Medium						Medium				
	Source	Medium		-		-		Medium	Low	-		
Invasive/alien species	Contribution	High	High		-		-		-		-	High
	Irreversibility	High										
	Source	High		-		-		-		-		
Conversion to agriculture or other forest types	Contribution		-		-	Very High	Medium		-	Very High	Medium	Medium
	Irreversibility					High				High		
	Source	-		-		Very High		-		Very High		
Residential development	Contribution		-		-	Medium	Medium	Medium	High	Low	Medium	Medium
	Irreversibility					Very High		High	Low	Very High		
	Source	-		-		High		Medium		High		

APPENDIX J. Example of Threats Assessment – EGCP

**EGCP - Cypress-Tupelo-Blackgum Swamp**

Threats	Severity	Scope	Stress
Altered composition/structure	High	High	High
Sedimentation	High	Medium	Medium
Habitat destruction or conversion	Very High	Medium	Medium
Habitat disturbance	Medium	Medium	Medium
Habitat fragmentation	Medium	Low	Low
Modification of water levels; changes in natural flow patterns	High	High	High

Sources of Threat		Altered composition structure		Sedimentation		Habitat destruction or conversion		Habitat disturbance		Habitat fragmentation		Modification of water levels; changes in natural flow patterns		Threat to System Rank
		High		Medium		Medium		Medium		Low		High		
Channelization of rivers or streams	Contribution		-	Medium	Low		-		-		-	Medium	Medium	Medium
	Irreversibility			High								High		
	Source	-		Medium		-		-		-		Medium		
Construction of ditches, drainage or diversion systems	Contribution	Medium	Medium	Medium	Low		-		-		-	Medium	Medium	Medium
	Irreversibility	Medium		Medium								Medium		
	Source	Medium		Medium		-		-		-		Medium		
Development of pipelines, roads or utilities	Contribution		-	Low	Low	Medium	Medium	Medium	Low	Medium	Low	Medium	Medium	Medium
	Irreversibility			Medium		Very High		High		High		High		
	Source	-		Low		High		Medium		Medium		Medium		
Operation of dams or reservoirs	Contribution	Medium	Medium	Medium	Low		-		-		-	Very High	High	High
	Irreversibility	High		High								High		
	Source	Medium		Medium		-		-		-		Very High		
Incompatible forestry practices	Contribution	High	Medium	Low	Low		-	Medium	Low		-		-	Medium
	Irreversibility	Medium		Medium										
	Source	Medium		Low		-		Medium		-				
Invasive/alien species	Contribution	Medium	Medium		-		-		-		-		-	Medium
	Irreversibility	High												
	Source	Medium		-		-		-		-		-		



APPENDIX J. Example of Threats Assessment – EGCP

**EGCP - Eastern Hillside Seepage Bog**

Threats	Severity	Scope	Stress
Altered composition/structure	High	Very High	High
Habitat destruction or conversion	Very High	Very High	Very High
Habitat disturbance	High	Very High	High
Modification of water levels; changes in natural flow patterns	Very High	Medium	Medium

Sources of Threat		Altered composition structure		Habitat destruction or conversion		Habitat disturbance		Modification of water levels; changes in natural flow patterns		Threat to System Rank
		High		Very High		High		Medium		
Conversion to agriculture or other forest types	Contribution		-	Very High	Very High		-		-	Very High
	Irreversibility Source			High						
Fire suppression	Contribution	Very High	High		-		-		-	High
	Irreversibility Source	Medium								
Incompatible forestry practices	Contribution	Medium	Medium		-	High	Medium	Low	Low	Medium
	Irreversibility Source	Medium				Medium		Medium		
Invasive/alien species	Contribution	Medium	Medium		-		-		-	Medium
	Irreversibility Source	High								
Residential development	Contribution		-	Medium	Very High	Low	Medium		-	Very High
	Irreversibility Source			Very High				High		
Development of pipelines, roads or utilities	Contribution		-		-	Low	Medium		-	Medium
	Irreversibility Source					High				
Construction of ditches, drainage or diversion systems	Contribution	Low	Low		-	Low	Low	Very High	Medium	Medium
	Irreversibility Source	Medium						Medium		
		Low				Low		High		

APPENDIX J. Example of Threats Assessment – EGCP

**EGCP - Eastern Longleaf Pine Savannah**

Threats	Severity	Scope	Threat
Altered composition/structure	High	Very High	High
Habitat destruction or conversion	Very High	Very High	Very High
Habitat disturbance	High	Very High	High
Modification of water levels; changes in natural flow patterns	High	Medium	Medium
Habitat fragmentation	High	Very High	High

Sources of Threat		Altered composition structure	Habitat destruction or conversion	Habitat disturbance	Modification of water levels; changes in natural flow patterns	Habitat fragmentation	Threat to System Rank
		High	Very High	High	Medium	High	
Conversion to agriculture or other forest types	Contribution		Medium			Medium	High
	Irreversibility Source	-	High	-	-	High	
Fire suppression	Contribution	Very High					High
	Irreversibility Source	Medium	High	-	-	-	
Incompatible forestry practices	Contribution	Medium		High	Low		Medium
	Irreversibility Source	Medium	Medium	Medium	Low	Low	
Invasive/alien species	Contribution	Medium					Medium
	Irreversibility Source	High	Medium	-	-	-	
Residential development	Contribution		Very High	Medium		Very High	Very High
	Irreversibility Source	-	Very High	Very High	Medium	Medium	
Development of pipelines, roads or utilities	Contribution		Medium	Low		Medium	Very High
	Irreversibility Source	-	Very High	Very High	Low	Low	
Construction of ditches, drainage or diversion systems	Contribution	Low	Low	Low	Very High		High
	Irreversibility Source	High	Medium	High	High	Medium	
Commercial/industrial development	Contribution		High			Low	Very High
	Irreversibility Source	-	Very High	Very High	-	Medium	

APPENDIX J. Example of Threats Assessment – EGCP

**EGCP - Eastern Upland Longleaf Pine Forest**

Threats	Severity	Scope	Stress
Altered composition/structure	High	Very High	High
Habitat fragmentation	High	Very High	High
Habitat disturbance	Medium	Medium	Medium
Habitat destruction or conversion	Very High	Very High	Very High

Sources of Threat		Altered composition structure		Habitat fragmentation		Habitat disturbance		Habitat destruction or conversion		Threat to System Rank
		High		High		Medium		Very High		
Conversion to agriculture or other forest types	Contribution			Very High				Very High		Very High
	Irreversibility		-	High	High		-	High	Very High	
	Source	-		Very High		-		Very High		
Fire suppression	Contribution	Very High								High
	Irreversibility	Medium	High		-		-		-	
	Source	High		-		-		-		
Incompatible forestry practices	Contribution	Medium				High				Medium
	Irreversibility	Medium	Medium		-	Medium	Low		-	
	Source	Medium		-		Medium		-		
Invasive/alien species	Contribution	Medium								Medium
	Irreversibility	High	Medium		-		-		-	
	Source	Medium		-		-		-		
Residential development	Contribution			High		Medium		High		Very High
	Irreversibility		-	Very High	High	Medium	Low	Very High	Very High	
	Source	-		High		Medium		High		
Development of pipelines, roads or utilities	Contribution			Low		Low		Medium		Very High
	Irreversibility		-	High	Medium	Medium	Low	Very High	Very High	
	Source	-		Medium		Low		High		
Commercial/industrial development	Contribution							Medium		Very High
	Irreversibility		-		-		-	Very High	Very High	
	Source	-		-		-		High		

APPENDIX J. Example of Threats Assessment – EGCP

**EGCP - Live Oak-Pine-Magnolia Forest**

Threats	Severity	Scope	Stress
Altered composition/structure	Very High	Very High	Very High
Habitat fragmentation	High	Very High	High
Habitat destruction or conversion	Very High	Very High	Very High
Habitat disturbance	High	Very High	High

Sources of Threat		Altered composition structure		Habitat fragmentation		Habitat destruction or conversion		Habitat disturbance		Threat to System Rank
		Very High		High		Very High		High		
Conversion to agriculture or other forest types	Contribution		-	Very High	High	Very High	Very High		-	Very High
	Irreversibility			High		High				
	Source	-		Very High		Very High				
Incompatible forestry practices	Contribution	Low	Medium		-		-	Low	Low	Medium
	Irreversibility	Medium								
	Source	Low		-		-				
Invasive/alien species	Contribution	High	Very High		-		-	High	High	Very High
	Irreversibility	High								
	Source	High		-		-				
Residential development	Contribution		-	Very High	High	Very High	Very High	Medium	Medium	Very High
	Irreversibility			Very High		Very High				
	Source	-		Very High		Very High				
Development of pipelines, roads or utilities	Contribution		-	Low	Medium	Medium	Very High	Low	Low	Very High
	Irreversibility			High		Very High				
	Source	-		Medium		High				

APPENDIX J. Example of Threats Assessment – EGCP

**EGCP - Mixed Hardwood-Loblolly Pine/Hardwood Slope Forests**

Threats	Severity	Scope	Stress
Altered composition/structure	High	Very High	High
Habitat fragmentation	High	Very High	High
Habitat destruction or conversion	Very High	Very High	Very High
Habitat disturbance	High	Very High	High

Sources of Threat		Altered composition structure		Habitat fragmentation		Habitat destruction or conversion		Habitat disturbance		Threat to System Rank
		High		High		Very High		High		
Conversion to agriculture or other forest types	Contribution		-	Very High	High	Very High	Very High		-	Very High
	Irreversibility			High		High				
	Source	-		Very High		Very High				
Development of pipelines, roads or utilities	Contribution		-	Medium	Medium		-	Medium	Medium	Medium
	Irreversibility			High						
	Source	-		Medium		-				
Incompatible forestry practices	Contribution	High	Medium	Medium	Medium		-	Medium	Medium	Medium
	Irreversibility	Medium		Medium						
	Source	Medium		Medium		-				
Invasive/alien species	Contribution	High	High		-		-		-	High
	Irreversibility	High								
	Source	High		-		-				
Residential development	Contribution		-	High	Medium	High	Very High	Medium	Medium	Very High
	Irreversibility			Medium		Very High				
	Source	-		Medium		High				

APPENDIX J. Example of Threats Assessment – EGCP

**EGCP - Spruce Pine-Hardwood Flatwood**

Threats	Severity	Scope	Stress
Altered composition/structure	High	Very High	High
Modification of water levels; changes in natural flow patterns	High	Medium	Medium
Habitat destruction or conversion	Very High	Very High	Very High
Habitat disturbance	Medium	Medium	Medium
Habitat fragmentation	High	Very High	High

Sources of Threats		Altered composition structure		Modification of water levels; changes in natural flow patterns		Habitat destruction or conversion		Habitat disturbance		Habitat fragmentation		Threat to System Rank
		High	Medium	High	Medium	Very High	Medium	High	High			
Conversion to agriculture or other forest types	Contribution					High	Very High			High	Very High	
	Irreversibility		-		-	High			-	High		
	Source	-		-		High			-	High		
Incompatible forestry practices	Contribution	Very High	High	Low	Low		-	High	Low		-	High
	Irreversibility	Medium		Medium		Medium				Medium		
	Source	High		Low				Medium				
Invasive/alien species	Contribution	High	High		-		-		-		-	High
	Irreversibility	High										
	Source	High										
Residential development	Contribution		-		-	Very High	Very High	Medium	Low	Very High	High	Very High
	Irreversibility					Very High		Medium		Very High		
	Source	-				High		Low		Very High		
Development of pipelines, roads or utilities	Contribution		-		-	Medium	Very High	Low	Low	Low	Medium	Very High
	Irreversibility					Very High		Medium		High		
	Source	-				High		Low		Medium		
Construction of ditches, drainage or diversion systems	Contribution	Medium	Medium	Very High	Medium		-	Low	Low		-	Medium
	Irreversibility	Medium		Medium		Medium				Medium		
	Source	Medium		High				Low				
Commercial/industrial development	Contribution		-		-	Low	High		-		-	High
	Irreversibility							Very High				
	Source	-						Medium				

APPENDIX J. Example of Threats Assessment – EGCP

**EGCP - Shortleaf Pine/Oak-Hickory Forest**

Threats	Severity	Scope	Stress
Altered composition/structure	High	Very High	High
Habitat fragmentation	High	Very High	High
Habitat destruction or conversion	Very High	Very High	Very High
Habitat disturbance	High	Very High	High

Sources of Threat		Altered composition structure		Habitat fragmentation		Habitat destruction or conversion		Habitat disturbance		Threat to System Rank
		High		High		Very High		High		
Conversion to agriculture or other forest types	Contribution		-	Very High	High	Very High	Very High		-	Very High
	Irreversibility			High		High				
	Source	-		Very High		Very High				
Development of pipelines, roads or utilities	Contribution		-	Medium	Medium	Low	High	Medium	Medium	High
	Irreversibility			High		Very High		High		
	Source	-		Medium		Medium		Medium		
Incompatible forestry practices	Contribution	High	Medium		-		-	Very High	High	High
	Irreversibility	Medium						Medium		
	Source	Medium						High		
Invasive/alien species	Contribution	High	High		-		-		-	High
	Irreversibility	High								
	Source	High								
Residential development	Contribution		-	Medium	High	High	Very High	High	Medium	Very High
	Irreversibility			Very High		Very High		Medium		
	Source	-		High		High		Medium		
Fire suppression	Contribution	High	Medium		-		-		-	Medium
	Irreversibility	Medium								
	Source	Medium								

APPENDIX J. Example of Threats Assessment – EGCP

**EGCP - Slash Pine-Pondcypress-Hardwood Forest**

Threats	Severity	Scope	Stress
Altered composition/structure	High	Very High	High
Modification of water levels; changes in natural flow patterns	Medium	Medium	Medium
Habitat destruction or conversion	Very High	Very High	Very High
Habitat disturbance	High	Very High	High
Habitat fragmentation	High	Very High	High

Sources of Threat		Altered composition structure		Modification of water levels; changes in natural flow patterns		Habitat destruction or conversion		Habitat disturbance		Habitat fragmentation		Threat to System Rank
		High	Medium	High	Medium	Very High	High	High	High			
Conversion to agriculture or other forest types	Contribution					High	Very High			High	High	Very High
	Irreversibility					High				High		
	Source	-				High				High		
Incompatible forestry practices	Contribution	High	Medium	Low	Low		-	High	Medium		-	Medium
	Irreversibility	Medium		Medium				Medium				
	Source	Medium		Low				Medium				
Invasive/alien species	Contribution	Medium	Medium		-		-		-		-	Medium
	Irreversibility	High										
	Source	Medium										
Residential development	Contribution		-		-	Medium	Very High	Medium	Medium	High	High	Very High
	Irreversibility					Very High		Medium		Very High		
	Source	-				High		Medium		High		
Development of pipelines, roads or utilities	Contribution		-		-	Low	High	Low	Low	Low	Medium	High
	Irreversibility					Very High		Medium		High		
	Source	-				Medium		Low		Medium		
Construction of ditches, drainage or diversion systems	Contribution	Low	Medium	Very High	Medium		-	Low	Low		-	Medium
	Irreversibility	High		Medium				Medium				
	Source	Medium		High				Low				
Commercial/industrial development	Contribution		-		-	Low	High		-		-	High
	Irreversibility					Very High						
	Source	-				Medium						
Fire suppression	Contribution	Medium	Medium		-		-		-		-	Medium
	Irreversibility	Medium										
	Source	Medium										



APPENDIX J. Example of Threats Assessment – EGCP

**EGCP - Small Stream Forest**

Threats	Severity	Scope	Stress
Altered composition/structure	High	Very High	High
Altered water quality	Medium	Medium	Medium
Sedimentation	Medium	Medium	Medium
Habitat destruction or conversion	Very High	High	High
Habitat disturbance	High	Very High	High
Habitat fragmentation	High	Very High	High
Modification of water levels; changes in natural flow patterns	High	High	High

Sources of Threat		Altered composition structure		Altered water quality		Sedimentation		Habitat destruction or conversion		Habitat disturbance		Habitat fragmentation		Modification of water levels; changes in natural flow patterns		Threat to System Rank
		High	Medium	Medium	Low	Medium	Low	High	Medium	High	Medium	High	Medium	High		
Channelization of rivers or streams	Contribution	Medium	Medium	-	-	High	Medium	Medium	Medium	Medium	Medium	-	-	Very High	High	High
	Irreversibility	High	Medium	-	-	High	Medium	High	Medium	High	Medium	-	-	High	High	High
	Source	Medium	Medium	-	-	High	Medium	Medium	Medium	Medium	Medium	-	-	Very High	High	High
Development of pipelines, roads or utilities	Contribution	-	-	-	-	Medium	Low	Low	Medium	Medium	Medium	Low	Medium	-	-	Medium
	Irreversibility	-	-	-	-	Medium	Low	Medium	Medium	High	Medium	High	Medium	-	-	Medium
	Source	-	-	-	-	Medium	Low	Medium	Medium	High	Medium	High	Medium	-	-	Medium
Incompatible forestry practices	Contribution	High	Medium	Low	Low	Low	Low	-	-	High	Medium	-	-	-	-	Medium
	Irreversibility	Medium	Medium	Low	Low	Low	Low	-	-	High	Medium	-	-	-	-	Medium
	Source	Medium	Medium	Low	Low	Low	Low	-	-	High	Medium	-	-	-	-	Medium
Gravel mining	Contribution	-	-	Very High	Medium	Very High	Medium	Very High	High	-	-	-	-	-	-	High
	Irreversibility	-	-	Very High	Medium	Very High	Medium	Very High	High	-	-	-	-	-	-	High
	Source	-	-	Very High	Medium	Very High	Medium	Very High	High	-	-	-	-	-	-	High
Livestock production practices	Contribution	Medium	Medium	High	Low	-	-	-	-	-	-	-	-	-	-	Medium
	Irreversibility	Medium	Medium	Medium	Low	-	-	-	-	-	-	-	-	-	-	Medium
	Source	Medium	Medium	Medium	Low	-	-	-	-	-	-	-	-	-	-	Medium
Residential development	Contribution	-	-	-	-	Medium	Low	Medium	High	Medium	Medium	Medium	High	-	-	High
	Irreversibility	-	-	-	-	Low	Low	Very High	High	Medium	Medium	Very High	High	-	-	High
	Source	-	-	-	-	Low	Low	High	High	Medium	Medium	High	High	-	-	High
Commercial/industrial development	Contribution	-	-	-	-	Medium	Low	Medium	High	-	-	Low	Medium	-	-	High
	Irreversibility	-	-	-	-	Low	Low	Very High	High	-	-	Very High	Medium	-	-	High
	Source	-	-	-	-	Low	Low	High	High	-	-	Medium	Medium	-	-	High
Invasive/alien species	Contribution	High	High	-	-	-	-	-	-	Medium	Medium	-	-	-	-	High
	Irreversibility	High	High	-	-	-	-	-	-	High	Medium	-	-	-	-	High
	Source	High	High	-	-	-	-	-	-	High	Medium	-	-	-	-	High

## APPENDIX J. Example of Threats Assessment – EGCP

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## APPENDIX K. Definitions of Threats

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**Altered composition/structure** – Changes in the natural/native landscape of aquatic and terrestrial systems; (examples include removal of fire from the landscape which leads to successional changes, stream channelization which reduces underwater habitat, invasive/alien species which can alter the existing plant and/or animal species composition.)

**Altered water quality** – Changes in the naturally occurring water composition or chemistry; (examples might include point/non-point source runoff pollution resulting in, elevated nutrient levels, turbidity, changes in pH, dissolved O<sub>2</sub> level, temperature etc.)

**Change in landuse practices** – Changes to a landscape that occur due to land use needs; (examples include agriculture lands replaced by urban expansion, increasing crop production practices due to market factors by putting more land into production.)

**Competition for resources** – Competition for resources such as food, water, or living space; (examples include the introduction of invasive species or reduction/loss of habitat thereby forcing species into closer confines/contact.)

**Groundwater depletion** – Loss of groundwater resulting from over-extraction; (examples include agriculture, industrial, and urban needs.)

**Habitat destruction or conversion** – Habitat which is permanently altered so that it no longer functions in its historical form.

**Habitat disturbance** – Habitat which is affected by short-term actions but still able to function in its historical form; (examples include incompatible agriculture or forestry practices which increase sediment load of a stream, effects from off-road vehicles, roads & utilities construction.)

**Habitat fragmentation** – Habitat which losses its connectivity by removal or alteration of portions of the habitat.

**Herbivory** – Alteration/changes to the natural landscape primarily the result of grazing practices, invasive animals, or over population of native animals; (examples include cattle grazing in a native grassland environment, nutria damage to marshland, deer over-browse in a forested environment, carp damage to SAV habitat.)

**Loss of genetic diversity** – Reduction in the available gene pool of a species; primarily the result of habitat loss or fragmentation thereby lessening the ability of disjunct populations from freely intermingling.

## APPENDIX K. Definitions of Threats cont.

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**Modification of water levels; changes in natural flow patterns** – Actions which alter the natural state of a stream, wetland, lake, etc; (examples include dams or impoundments and resultant releases, channelization for commerce or flood control, leveeing for flood control.)

**Nutrient loading** – Elevation of the naturally occurring nutrient levels; primarily the result of agriculture and urban runoff along with industrial discharges.

**Predation/parasitism/disease** – Factors which cause a reduction in a population due to initiation of predation, parasitism or diseases. Effects may be exacerbated by certain land-use management practices.

**Resource depletion** – Results from the over harvesting of animal species, the removal of natural resources, or invasive species; (examples include over fishing of feeder stocks which may impact higher food chain species; the extraction of oil & gas which results in land subsidence; invasive species which out-compete native species.)

**Salinity alteration** – Changes in the salinity of a body of water; (examples include the influx of saltwater into a freshwater habitat; increases/changes from industrial/urban sources/runoff.)

**Sedimentation** – The increase in the suspended particle load of a stream, river, lake, wetland, etc. or the decrease in water depth due to the accretion of sediments within streams and lakes; (examples may include agriculture and forestry practices, road and utility creation, recreational vehicle use, etc.)

**Thermal alteration** – Relates primarily to temperature changes in aquatic systems; (examples may include industrial discharges; lack of appropriate SMZ practices.)

**Toxins/contaminants** – Changes in the natural chemical make-up of a terrestrial or aquatic habitat; (examples include increased levels of chemicals from agriculture and forestry practices, industrial discharges, disturbances from gravel/shell mining, effects of channelization, and water releases from a dam or impoundment.)

## APPENDIX L. Definitions for Sources of Threats

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**Borrow pits** – a hole that’s been excavated as a source of fill dirt. These pits can be a site of severe erosion and sediment runoff to adjacent streams and wetlands.

**Channelization of rivers or streams** – The process of altering the naturally occurring contours of a river or stream; primarily a result of economic development and undertaken by the COE; also pertains to the secondary effects of dredging such as spoil placement and the continued maintenance of the river or stream

**Commercial/industrial development** – development which is derived through the construction/expansion of plants, warehouses, box stores, etc and results in habitat loss and disturbance

**Construction of ditches, drainage or diversion systems** – the initial building of these structures and the effects this building process will have on the hydrology and environment

**Construction of navigable waterways** – the creation of artificial waterways for waterborne commerce. The primary example is the Intercoastal waterway in the Gulf Coast Prairies and Marshes

**Conversion to agriculture or other forest types** – habitat which is lost to farming or commercial forestry use and therefore has lost its ability to support those species which were the original inhabitants. The possibility does exist that these lands can be converted back to their original habitat although the associated costs could be high

**Crop production practices** – the effect these practices have on the environment; including the use of chemicals, effects of farm machinery, the methods by which farm land is used or laid out

**Dam construction** – effects from the actual construction of the dam (increased sedimentation loads, terrestrial habitat lost and associated disturbances) and the after effects (reduces aquatic species ability to migrate or intermingle which may lead to loss of genetic diversity)

**Development and maintenance of pipelines, roads or utilities** – the actual effects the construction has on the environment (disturbance, destruction) and the associated after-effects (fragmentation, vectors for invasive/alien species introduction)

**Excessive groundwater withdrawal** – removal of groundwater for farming or human consumption the effects of which can lead to the loss or alteration of a habitat

**Fire suppression** – eliminating the use of fire to maintain a habitat’s natural condition; primarily influenced by increasing urban development, the threat of lawsuits, and a general lack of knowledge regarding the historic role fire has played in maintaining many habitat types

**Grazing practices** – negative effects of domesticated herbivore management (cattle)

## APPENDIX L. Definitions for Sources of Threats cont.

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**Incompatible forestry practices** – methods used by the commercial forestry industry; examples include chemical use, effects of harvesting equipment, non-use of Best Management Practices

**Industrial discharge** – releases of harmful chemicals or gases into the environment from effluent discharges; can be considered to be both point and non-point in origin

**Invasive/alien species** – species of plants and animals which are not native to the U.S. or a particular region; can also refer to the spread of native plant or animal species in increased numbers or where they are not naturally found due to certain types of development, management, or construction practices

**Landfill construction or operation** – the continued development of landfills and the associated impacts on the environment

**Levee or dike construction** – includes both the historic and present day construction; for historic events the primary effect is the loss of natural processes which served to replenish or increase certain types of habitat; for present day activities the primary interest is the effects construction has on the environment such as habitat loss or disturbance; can also be related to effects on the natural flow of water

**Livestock production practices** – this threat includes all effects from the commercial raising of cattle, hogs, sheep, etc.; of primary concern are water quality issues resulting from runoff

**Log deck debris** – debris leftover after removal of trees

**Management of/for certain species** – effects which result from the management of game, non-game or exotic species; used to address areas where species management has a negative influence on a particular habitat (i.e., deer over-browse, beaver influences, etc)

**Mining practices** – this threat relates to surface, subsurface, or in-stream activities and tends to have the biggest impact on the state's aquatic habitats. Excessive stream and river sedimentation is the main problem along with other issues such as terrestrial habitat destruction, disturbance, and altered composition of aquatic habitats

**Oil or gas drilling** – this threat relates to both the initial construction activities such as road building, canal dredging, site development etc., and the effects oil or gas well can have on the environment once it is put into production such as contamination from spills, leaks etc.

**Operation of dams or reservoirs** – this threat is specific to the actual operation and includes such activities as timing of releases which can impact the hydrologic regime of rivers and streams and disturb or alter the composition of adjoining terrestrial habitat

## APPENDIX L. Definitions for Sources of Threats cont.

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**Operation of drainage or diversion systems** – this threat includes all the major diversion projects designed to control water levels in rivers and lakes which have a negative impact on fish and wildlife habitat

**Parasites/pathogens** – includes native and non-native sources which are influenced/compounded by external activities such as drought conditions, changes in hydrologic regimes, etc

**Recreational use** – this threat relates to all human recreational activities which have a detrimental effect on the habitat such as erosion from hiking/biking, dumping or improper disposal of trash, damage to vegetation, etc.

**Recreational vehicles** – primarily includes all types of motorized and non-motorized vehicles (i.e., atvs, jet skies, boats, horses, motorcycles, cars, trucks etc.)

**Residential development** – this threat includes all activities such as subdivision development, urban and rural single residence development, hunting and fishing camps

**Residential septic systems** – this threat relates to the non-point and point source pollution derived from outdated or unregulated rural sewerage practices

**Resort development** – this threat includes activities which relate to the development of golf courses and casinos and the associated after-effects such as pollution issues

**Saltwater intrusion** – this threat relates specifically to low water levels in rivers, streams or anywhere along the coast which allows saltwater to move into areas were it is normally not found; can also be introduced during hurricanes and other coastal weather events

**Shoreline erosion** – this threat relates to both inland and coastal habitat loss primarily as a result of weather disturbances and the effects of boat wake from commercial and recreational activities; vegetative loss is also a factor

**Shoreline stabilization** – this threat relates to the effects that stabilization activities have on the adjoining habitat from machinery which can disturb habitat, the placement of dredge material which can destroy habitat and disrupt hydrology

**Wastewater treatment** – this threat relates to effluent flows from industry and urban waste treatment sources

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## APPENDIX M. Terrestrial Habitat Priorities

### EAST GULF COASTAL PLAIN

Systems(Target) Viability	Size		Condition		Landscape Context		Viability Rank		Occur only in EGCP	Matrix (M) Secondary (S)	State Rank	Global Rank
	Grade		Grade		Grade							
Eastern Longleaf Pine Savannah	Fair		Fair		Fair		Fair		X	M	S1	G1
Eastern Upland Longleaf Pine Forest	Fair		Fair		Fair		Fair		X	M	S1S2	G1G2
Mixed Hardwood-Loblolly Pine/Hardwood Slope Forest	Poor		Fair		Poor		Poor			S	S3S4	G4
Shortleaf Pine/Oak-Hickory Forest	Poor		Poor		Poor		Poor			S	S2S3	G2G3
Bottomland Hardwood Forest	Good		Good		Fair		Good			S	S4	G4G5
Small Stream Forest	Good		Fair		Fair		Fair			S	S3	G3
Slash Pine-Pondcypress-Hardwood Forest	Fair		Fair		Fair		Fair		X	S	S2S3	G3?
Live Oak-Pine-Magnolia Forest	Fair		Fair		Fair		Fair		X	S	S2	G2G3
Bayhead Swamp/Forested Seep	Fair		Fair		Poor		Fair			S	S3	G3?
Cypress-Tupelo-Blackgum Swamps	Good		Good		Good		Good			S	S4	G3G5
Spruce Pine-Hardwood Flatwood	Poor		Fair		Fair		Fair		X	S	S1	G1G2
Eastern Hillside Seepage Bog	Poor		Poor		Poor		Poor		X	S	S2	G2
Agriculture/Cropland/Grassland												

HABITAT PRIORITIES	TIER 1						TIER 2						
	1	2	3	4	5	6	1	2	3	4	5	6	7
<b>Active Threats - East Gulf Coastal Plain</b>	Eastern Longleaf Pine Savannah	Eastern Upland Longleaf Pine Forest	Slash Pine-Pondcypress-Hardwood Forest	Live Oak-Pine-Magnolia Forest	Spruce Pine-Hardwood Flatwood	Eastern Hillside Seepage Bog	Mixed Hardwood-Loblolly Pine/Hardwood Slope Forest	Shortleaf Pine/Oak-Hickory Forest	Bottomland Hardwood Forest	Small Stream Forest	Bayhead Swamp/Forested Seep	Cypress-Tupelo-Blackgum Swamps	Ag - Crop - Grassland
Residential development	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Medium	High	High	-	-
Conversion to agriculture or silviculture	High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Medium	-	High	-	-
Development of pipelines, roads or utilities	Very High	Very High	High	Very High	Very High	Medium	Medium	High	Medium	Medium	Medium	Medium	-
Invasive/alien species	Medium	Medium	Medium	Very High	High	Medium	High	High	High	High	Medium	Medium	-
Commercial/industrial development	Very High	Very High	High	-	High	-	-	-	High	High	-	-	-
Forestry practices	Medium	Medium	Medium	Medium	High	Medium	Medium	High	Medium	Medium	High	Medium	-
Fire suppression	High	High	Medium	-	-	High	-	Medium	-	-	Low	-	-
Construction of ditches, drainage or diversion systems	High	-	Medium	-	Medium	Medium	-	-	Medium	-	Medium	Medium	-
Operation of dams or reservoirs	-	-	-	-	-	-	-	-	High	-	-	High	-
Channelization of rivers or streams	-	-	-	-	-	-	-	-	Medium	High	-	Medium	-
Gravel mining	-	-	-	-	-	-	-	-	-	High	-	-	-
Livestock production practices	-	-	-	-	-	-	-	-	-	Medium	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>Threat Status</b>	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	High	High	High	High	-
<b># of Species of Concern</b>	<b>37</b>	<b>33</b>	<b>22</b>	<b>19</b>	<b>13</b>	<b>8</b>	<b>33</b>	<b>29</b>	<b>28</b>	<b>26</b>	<b>18</b>	<b>17</b>	<b>22</b>

APPENDIX M. Terrestrial Habitat Priorities cont.

**GULF COAST PRAIRIES AND MARSHES**

Systems(Target) Viability	Size		Condition		Landscape Context		Viability Rank		Occur only in GCPM	Matrix (M) Secondary (S)	State Rank	Global Rank
	Grade		Grade		Grade							
Brackish Marsh	Fair		Fair		Fair		Fair		X	M	S3S4	G4?
Freshwater Marsh	Fair		Fair		Poor		Fair		X	M	S1S2	G3G4
Intermediate Marsh	Poor		Poor		Poor		Poor		X	M	S3S4	G4?
Salt Marsh	Poor		Poor		Poor		Poor		X	M	S3S4	G5
Barrier Islands	Poor		Good		Poor		Fair		X	S	N/A	N/A
Vegetated Pioneer Emerging Delta	Fair		Good		Fair		Fair		X	M	S1	G2Q
Coastal Prairie	Poor		Poor		Poor		Poor			S	S4	G4G5
Bottomland Hardwood Forest	Good		Good		Fair		Good		X	S	S1	G1
Salt Dome Hardwood Forest	Good		Fair		Good		Good		X	S	S1S2	G2
Coastal Live Oak-Hackberry Forest	Poor		Poor		Poor		Poor		X	S	S2S3	G3G4
Coastal Dune Grassland/Shrub Thicket	Fair		Fair		Good		Fair		X	S	S1S2	G2G3
Cypress-Tupelo-Blackgum Swamp	Good		Fair		Fair		Fair			S	S4	G3G5
Coastal Mangrove-Marsh Shrubland	Fair		Good		Fair		Fair		X	S	S3	G2?
Live Oak Natural Levee Forest	Poor		Fair		Poor		Poor			S	S1S2	G2
Barrier Island Live Oak Forest	Poor		Poor		Poor		Poor		X	S	S1	G1
Agriculture/Cropland/Grassland												

HABITAT PRIORITIES	TIER 1											TIER 2				
	1	2	3	4	5	6	7	8	9	10	10	11	1	2	3	4
Active Threats - Gulf Coast Prairies & Marshes	Intermediate Marsh	Salt Marsh	Coastal Prairie	Brackish Marsh	Freshwater Marsh	Barrier Island Live Oak Forest	Barrier Islands	Coastal Live Oak-Hackberry Forest	Salt Dome Hardwood Forest	Vegetated Pioneer Emerging Delta	Coastal Dune Grassland/Shrub Thicket	Coastal Mangrove-Marsh Shrubland	Live Oak Natural Levee Forest	Bottomland Hardwood Forest	Cypress-Tupelo-Blackgum Swamp	Ag - Crop - Grassland
Saltwater intrusion	Very High	-	-	High	High	-	-	-	-	High	-	High	Very High	-	Low	-
Levee or dike construction	High	Very High	-	High	High	-	-	-	-	-	-	-	Very High	-	-	-
Development of pipelines, roads or utilities	High	High	Very High	Medium	Medium	High	-	-	Medium	-	Medium	-	High	Low	Low	-
Invasive/alien species	Medium	High	Very High	Medium	Medium	High	-	High	Medium	Medium	Medium	Medium	High	Medium	Low	-
Residential development	Medium	High	-	Medium	Low	Very High	-	Medium	-	-	Medium	-	High	-	Low	-
Construction of navigable waterways	-	Very High	-	Very High	-	-	-	-	-	-	-	-	-	-	-	-
Commercial/industrial development	-	High	-	-	-	Very High	-	-	Medium	-	-	-	-	-	-	-
Grazing practices	Low	-	Very High	Low	Low	-	-	High	-	-	High	-	-	-	-	-
Channelization of rivers or streams	Very High	-	-	-	High	-	-	-	-	Medium	-	-	-	-	-	-
Construction of ditches, drainage or diversion systems	Very High	-	-	-	High	-	-	-	-	-	-	-	-	Low	Low	-
Fire suppression	-	-	Very High	Medium	-	-	-	-	-	-	-	-	-	-	-	-
Shoreline erosion	-	-	-	-	-	-	Very High	Medium	-	-	-	-	-	-	-	-
Conversion to agriculture or silviculture	-	-	Very High	-	-	-	-	-	-	-	-	-	-	-	-	-
Recreational vehicles	-	-	-	-	-	Medium	-	-	-	-	-	-	-	Low	-	-
Operation of drainage or diversion systems	-	-	-	-	-	-	-	-	-	Medium	-	-	-	-	-	-
Mining practices	-	-	-	-	-	-	-	Low	Low	-	-	-	-	-	-	-
Recreational use	-	-	-	-	-	-	-	-	-	Low	-	Low	-	-	-	-
Crop production practices	-	-	-	-	-	-	-	-	-	-	-	-	-	Low	-	-
Forestry practices	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Low	-
Oil or gas drilling	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>Threat Status</b>	Very High	Very High	Very High	High	High	Very High	High	High	Medium	Medium	Medium	Medium	Very High	Low	Low	-
<b># of Species of Concern</b>	<b>31</b>	<b>26</b>	<b>21</b>	<b>36</b>	<b>31</b>	<b>4</b>	<b>25</b>	<b>12</b>	<b>12</b>	<b>11</b>	<b>11</b>	<b>8</b>	<b>7</b>	<b>18</b>	<b>11</b>	<b>35</b>

APPENDIX M. Terrestrial Habitat Priorities cont.

LOWER WEST GULF COASTAL PLAIN

Systems(Target) Viability	Size		Condition		Landscape Context		Viability Rank		Occur only in LWGCP	Matrix (M) Secondary (S)	State Rank	Global Rank
	Grade		Grade		Grade							
Shortleaf Pine/Oak-Hickory Forest	Fair		Poor		Fair		Fair			M	S2S3	G2G3
Mixed Hardwood-Loblolly/Hardwood Slope Forest	Fair		Fair		Fair		Fair			M	S3S4	G4
Western Upland Longleaf Pine Forest	Fair		Fair		Fair		Fair	X		M	S2S3	G2G3
Small Stream Forest	Good		Fair		Fair		Fair			S	S3	G3
Bottomland Hardwood Forest	Good		Good		Good		Good			S	S4	G4G5
Western Longleaf Pine Savannah	Poor		Fair		Fair		Fair	X		M	S1S2	G2G3
Bayhead Swamp/Forested Seep	Good		Good		Fair		Good			S	S3	G3?
Cypress-Tupelo-Blackgum Swamp	Good		Good		Fair		Good			S	S4	G3G5
Calcareous Prairie	Good		Good		Fair		Good			S	S1	G1
Western Xeric Sandhill Woodland	Fair		Poor		Poor		Poor			S	S2S3	G2G3
Calcareous Forest	Fair		Fair		Fair		Fair			S	S2	G2?Q
Saline Prairie	Fair		Fair		Fair		Fair			S	S1	G1G2
Sandstone Glade/Barren	Good		Good		Good		Good	X		S	S1S2	G1G2
Western Hillside Seepage Bog	Good		Fair		Good		Good	X		S	S2	G2G3
Agriculture/Cropland/Grassland												

HABITAT PRIORITIES	Tier 1				Tier 2										
	1	2	3	4	1	2	3	4	5	6	7	8	9	10	11
<b>Active Threats - Lower West Gulf Coastal Plain</b>	Western Longleaf Pine Savannah	Western Upland Longleaf Pine Forest	Sandstone Glade/Barren	Western Hillside Seepage Bog	Shortleaf Pine/Oak-Hickory Forest	Mixed Hardwood-Loblolly/Hardwood Slope Forest	Small Stream Forest	Saline Prairie	Bottomland Hardwood Forest	Bayhead Swamp/Forested Seep	Cypress-Tupelo-Blackgum Swamp	Calcareous Prairie	Western Xeric Sandhill Woodland	Calcareous Forest	Ag - Crop - Grassland
Forestry practices	High	Medium	Low	Low	Medium	Medium	Medium	Medium	Medium	Low	-	Low	Low	Low	
Residential development	High	-	-	-	-	-	-	-	-	-	-	-	-	-	
Fire suppression	High	Low	Low	Low	Medium	-	-	-	-	-	-	Low	Low	Low	
Invasive/alien species	Medium	Low	-	Medium	Low	Medium	Medium	Medium	Low	-	Low	Medium	-	Low	
Development of pipelines, roads or utilities	High	Medium	-	-	-	-	Low	-	Low	-	Low	-	-	-	
Commercial/industrial development	High	-	-	-	-	-	-	-	-	-	-	-	-	-	
Dam construction	-	-	-	-	-	-	-	High	-	-	-	-	-	-	
Recreational vehicles	-	Low	Low	Low	Low	Low	Low	Medium	Low	-	-	Low	Low	Low	
Conversion to agriculture or silviculture	-	-	-	-	-	Medium	-	-	-	-	-	Low	Medium	-	
Recreational use	-	-	-	-	-	-	-	Medium	-	-	-	-	-	-	
Mining practices	-	-	-	-	-	-	Low	-	-	-	-	-	-	-	
Oil or gas drilling	-	Low	-	-	-	-	-	-	-	-	-	-	-	-	
Operation of dams or reservoirs	-	-	-	-	-	-	-	-	Low	-	-	-	-	-	
<b>Threat Status</b>	High	Medium	Low	Low	Medium	Medium	Medium	Medium	Low	Low	Low	Low	Low	Low	
<b># of Species of Concern</b>	24	28	6	3	34	30	26	6	25	17	14	12	12	7	35

APPENDIX M. Terrestrial Habitat Priorities cont.

MISSISSIPPI RIVER ALLUVIAL PLAIN

Systems(Target) Viability	Size		Condition		Landscape Context		Viability Rank		Occur only in MRAP	Matrix (M) Secondary (S)	State Rank	Global Rank	
	Grade		Grade		Grade								
Bottomland Hardwood Forest	Fair		Fair		Fair		Fair			M	S4	G4G5	
Batture	Good		Fair		Fair		Fair	X		S	S4S5	G4G5	
Hardwood Flatwoods	Poor		Fair		Poor		Poor			S	S2S3	G2G3	
Cypress-Tupelo-Blackgum Swamp	Good		Good		Good		Good			M	S4	G3G5	
Live Oak Natural Levee Forest	Poor		Fair		Poor		Poor			S	S1S2	G2	
Sandbars	Good		Fair		Good		Good	X		S	S4S5	G4	
Agriculture/Cropland/Grassland													
<b>HABITAT PRIORITIES</b>	<b>Tier 1</b>		<b>Tier 2</b>										
	1	2	1	2	3	4	5						
<b>Active Threats - Mississippi River Alluvial Plain</b>	Sandbars	Batture	Bottomland Hardwood Forest	Cypress-Tupelo-Blackgum Swamp	Live Oak Natural Levee Forest	Hardwood Flatwoods	Ag - Crop Grassland						
Operation of drainage or diversion systems	Very High	High	Medium	Low	-	-							
Invasive/alien species	-	Medium	Medium	High	High	Medium							
Residential development	-	-	Medium	Low	Very High	Medium							
Development of pipelines, roads or utilities	-	-	Medium	Low	Very High	-							
Levee or dike construction	Very High	-	-	Low	-	-							
Shoreline stabilization	Very High	-	-	-	-	-							
Recreational use	High	-	-	-	-	-							
Saltwater intrusion	-	-	-	High	High	-							
Industrial discharge	-	Medium	-	-	-	-							
Channelization of rivers or streams	-	-	High	-	-	-							
Conversion to agriculture or silviculture	-	-	-	-	-	High							
Forestry practices	-	-	Medium	Medium	-	Medium							
Commercial/industrial development	-	Medium	Medium	Medium	-	-							
Borrow pits	-	Medium	-	-	-	-							
Construction of ditches, drainage or diversion systems	-	Medium	-	Medium	-	-							
Management of/for certain species	-	Medium	-	-	-	-							
Oil or gas drilling	-	-	Medium	Low	-	-							
Crop production practices	-	-	Medium	-	-	-							
Mining practices	-	Low	-	-	-	-							
<b>Threat Status</b>	Very High	Medium	Medium	Medium	Very High	Medium							
<b># of Species of Concern</b>	5	17	27	17	16	17	30						

APPENDIX M. Terrestrial Habitat Priorities cont.

UPPER EAST GULF COASTAL PLAIN

Systems(Target) Viability	Size		Condition		Landscape Context		Viability Rank		Occur only in UEGCP	Matrix (M) Secondary (S)	State Rank	Global Rank
	Grade		Grade		Grade							
Southern Mesophytic Forest	Fair		Good		Fair		Fair		X	M	S2S3	G1G2
Small Stream Forest	Good		Fair		Fair		Fair			S	S3	G3
Agriculture/Cropland/Grassland												

HABITAT PRIORITIES	TIER 1 1	TIER 2 1	2
<b>Active Threats - Upper East Gulf Coastal Plain</b>	Southern Mesophytic Forest	Small Stream Forest	Ag - Crop - Grassland
Forestry practices	Medium	Medium	
Conversion to agriculture or silviculture	Medium	Medium	
Invasive/alien species	Medium	Medium	
Residential development	Medium	-	
Recreational use	Low	Low	
Recreational vehicles	Low	Low	
<b>Threat Status</b>	Medium	Medium	
<b># of Species of Concern</b>	<b>24</b>	<b>22</b>	<b>20</b>

APPENDIX M. Terrestrial Habitat Priorities cont.

UPPER WEST GULF COASTAL PLAIN

Systems(Target) Viability	Size		Condition		Landscape Context		Viability Rank	Occur only in UWGCP	Matrix (M) Secondary (S)	State Rank	Global Rank
	Grade		Grade		Grade						
Shortleaf Pine/Oak-Hickory Forest	Poor		Poor		Poor		Poor		M	S2S3	G2G3
Mixed Hardwood-Loblolly Pine/ Hardwood Slope Forest	Poor		Poor		Poor		Poor		M	S3S4	G4
Small Stream Forest	Fair		Poor		Poor		Poor		S	S3	G3
Bottomland Hardwood Forest	Poor		Fair		Poor		Poor		S	S4	G4G5
Bayhead Swamp/Forested Seep	Good		Fair		Good		Good		S	S3	G3?
Western Xeric Sandhill Woodland	Fair		Poor		Poor		Poor		S	S2S3	G2G3
Cypress-Tupelo-Blackgum Swamp	Fair		Fair		Fair		Fair		S	S4	G3G5
Hardwood Flatwoods	Poor		Fair		Poor		Poor		S	S2S3	G2G3
Calcareous Prairie	Poor		Poor		Poor		Poor		S	S1	G1
Saline Prairie	Poor		Poor		Poor		Poor		S	S1	G1G2
Calcareous Forest	Fair		Poor		Fair		Fair		S	S2S3	G2?Q
Agriculture/Cropland/Grassland											

HABITAT PRIORITIES (NO TIER DIVISIONS FOR UWGCP)	1 2 3 4 5 6 7 8 9 10 11 12											
	Shortleaf Pine/Oak-Hickory Forest	Mixed Hardwood-Loblolly Pine/Hardwood Slope Forests	Hardwood Flatwoods	Western Xeric Sandhill Woodland	Small Stream Forest	Bottomland Hardwood Forest	Bayhead Swamp/Forested Seep	Cypress-Tupelo-Blackgum Swamp	Calcareous Prairie	Calcareous Forest	Saline Prairie	Ag - Crop Grassland
Conversion to agriculture or silviculture	Very High	Very High	Very High	High	Medium	Low	-	-	High	High	-	-
Residential development	Very High	Very High	-	High	Medium	Medium	-	Medium	Medium	-	-	-
Forestry practices	High	High	High	High	Medium	Low	Low	Low	-	Low	-	-
Development of pipelines, roads or utilities	High	-	Very High	High	Low	-	Medium	-	-	-	Low	-
Invasive/alien species	Medium	Low	Low	-	-	Low	-	-	Medium	-	High	-
Dam construction	-	-	-	-	Medium	Medium	-	High	-	-	-	-
Parasites/pathogens	-	-	Low	Medium	Medium	Low	-	Medium	-	-	-	-
Fire suppression	Low	-	-	-	-	-	-	-	Medium	-	-	-
Commercial/industrial development	-	-	-	Medium	Low	-	-	-	-	-	-	-
Construction of ditches, drainage or diversion systems	-	-	Medium	-	-	-	-	-	-	-	-	-
Excessive groundwater withdrawal	-	-	-	-	-	-	Medium	-	-	-	-	-
Mining practices	Medium	-	-	-	-	-	-	-	-	-	-	-
Operation of drainage or diversion systems	-	-	-	-	-	Medium	-	-	-	-	-	-
Recreational vehicles	-	-	-	-	-	-	-	-	Medium	-	-	-
Oil or gas drilling	-	-	-	Low	Low	-	-	-	Low	-	Low	-
Log deck debris	-	-	-	-	-	-	-	-	Low	-	-	-
Management of/for certain species	-	-	-	-	-	-	-	-	Low	-	-	-
Recreational use	-	-	-	-	-	-	-	-	-	-	Low	-
<b>Threat Status</b>	Very High	Very High	Very High	High	Medium	Medium	Medium	Medium	Medium	Medium	Medium	
<b># of Species of Concern</b>	37	32	14	15	28	26	19	15	11	6	6	32

APPENDIX N. Terrestrial Species Strategies

Habitat Code*	STRATEGY
	<b>BIRD-RELATED STRATEGIES</b>
ACG	<b>Early Successional Bird Species:</b> Continue to encourage landowners to maintain areas in early successional stage to benefit these species.
ACG CaP ELPS EULPF WLPS WULPF	<b>Northern Bobwhite and Grassland Birds:</b> Support implementation of recommended habitat restoration actions specified in NBCI and by LDWF quail and grassland bird task force.
FM LONLF MHLPHSF VPED	<b>Bald Eagle:</b> Continue with long-term monitoring of active bald eagle territories, successful breeding pairs, and fledged eagles.
B HF LONLF	Identify <b>IBA's</b> or potential IBA's and partner with BRAS, OAS, and the National Audubon Society to implement conservation recommendations from SWG project T27 upon completion.
B BHF CTBS LONLF SPPCHF	<b>Swallow-tailed Kite:</b> Implement conservation and management recommendations of SWG project T9 (Coulson 2004).
	<b>Terns:</b>
BI BM IM SM	· Disturbance and loss of nesting habitat are major threats; develop partnerships to strengthen the protection and restoration of barrier islands.
BI BM IM SM	· Develop a comprehensive survey methodology to determine long term trends in population abundances.
	<b>Shorebirds, Wading Birds:</b>
BI BM CoP FM IM SM VPED	· Provide public education regarding the importance of waterbird nesting colonies and shorebird feeding areas. Reduce the negative effects on these areas from recreational and other uses.
BI BM FM IM SM VPED	· Coordinate with GCJV to implement recommendations of shorebird and wading bird conservation plans.
BM FM IM SM	· Disturbance and loss of nesting habitat are major threats. The continued protection and restoration of coastal marshes are top priorities. Develop new and/or improve existing partnerships to achieve this goal.
ACG	Partner with farmers in ag/aquaculture lands to institute a management strategy to manipulate water levels to benefit <b>Shorebirds</b> during migration.
ACG BM CoP FM IM SM	Work with landowners to implement management and conservation recommendations for <b>waterbirds (especially rails)</b> of SWG project T18 upon completion.
BI BM CDGST VPED	<b>Brown Pelican:</b> Continue with long-term monitoring of nesting colonies.
BILOF	<b>Migratory Birds:</b> Continue efforts to support conservation of remaining habitat.
	<b>Waterfowl:</b>
BM CoP FM IM	· Continue to encourage the creation/enhancement/maintenance of high-quality habitat across Louisiana.
BM CoP FM IM	· Work with DU, DW, and USFWS to assuring that quality habitat, including refuge from hunting and other disturbance, is distributed across the landscape.
BM CoP FM IM	· Encourage maintenance of rice agriculture and discourage conversion to crops with lower value to waterfowl.
BM CoP FM IM	· Continue LDWF partnerships with DU, DW, USFWS, and state wildlife management agencies to conserve habitat on the northern breeding grounds.
BM CoP FM IM	· Accelerate acquisition of wetland and grassland easements from private landowners in the prairie pothole region.

APPENDIX N. Terrestrial Species Strategies cont.

Habitat Code*	BIRD-RELATED STRATEGIES cont.
CF	<b>Wood Thrush:</b> Develop a monitoring program (i.e., MAPS) to assess relative abundance in this habitat.
CMMS	Provide public education regarding the importance of <b>waterbird nesting colonies</b> and <b>shorebird</b> feeding areas. Reduce the negative effects on these areas from recreational and other uses.
ACG CoP	Partner with LSU and ULL to develop/update management guidelines/BMP's for species of conservation concern that occur in lands cultivated for rice and sugarcane.
	<b>Red-cockaded Woodpecker:</b>
ELPS EULPF WLPS WULPF	· Continue to support implementation of Statewide RCW Safe Harbor Program.
ELPS EULPF WLPS WULPF	· Support USFWS recovery efforts outlined in the RCW recovery plan.
ELPS EULPF WLPS WULPF	· Encourage the establishment of new RCW populations.
ELPS EULPF WLPS WULPF	· Investigate potential land acquisition of this habitat type to increase and support new populations.
EULPF SPOHF WULPF	<b>Brown-headed Nuthatch:</b> Encourage landowners to use group-selection and single-tree selection harvesting methods and maintain or increase the number of standing snags.
HF LOPMF MHLPHSF SGB SPOHF WXSX	<b>Chuck-Will's-Widow:</b> Work with federal agencies and bird conservation organizations to produce technical pamphlets highlighting the habitat and management requirements of this species and make available to landowners.
IM	Continue to work with USFWS/LSU in efforts to reintroduce <b>Whooping Crane</b> to Louisiana.
AGC BS BHF LOPMF SPOHF SSF SPHF	<b>Rusty Blackbird:</b> Initiate surveys to determine wintering population abundances and habitat use to augment Christmas Bird Counts.
LOPMF	<b>Songbirds:</b>
MHLPHSF	· Continue to encourage landowners to maintain areas in early successional stage to benefit bird species which depend on this habitat.
MHLPHSF	· Work with NRCS, USFWS, USFS to develop and distribute technical pamphlets which contain information about the importance of early successional habitat for species of conservation concern.
MHLPHSF	· Continue to monitor songbird abundance and reproductive success (with emphasis on species of conservation concern) in this habitat through the establishment of MAPS stations.
CF	Develop a monitoring program (i.e., MAPS) to assess relative abundances in this habitat.
MHLPHSF	· Continue to encourage landowners to maintain areas in early successional stage to benefit bird species which depend on this habitat.
	<b>Interior Least Tern:</b>
SB	· Implement conservation recommendations of USFWS recovery plan (USFWS 1990b).
SB	· Work with COE to regulate water levels during breeding season.
SB	· Determine feasibility of using abandoned barges as artificial nesting habitat (Hervey 2001).
SB	· Provide funding to support long term efforts to locate and monitor nest colonies.



APPENDIX N. Terrestrial Species Strategies cont.

Habitat Code*	BIRD-RELATED STRATEGIES cont.
	<b>Henslow's Sparrow, Bachman's Sparrow:</b>
ELPS EULPF SPOHF WLPS WULPF	· Work with landowners to encourage use of BMPs for prescribed fire management and timber harvesting techniques to improve habitat quality.
EHSB ELPS EULPF SPOHF WLPS WULPF	· Implement conservation and management recommendations of SWG projects T22 and T32 upon completion.
ELPS EULPF SPOHF WLPS WULPF	· Monitor reproductive success of <b>Bachman's Sparrows</b> to determine limiting factors.
ELPS EULPF SPOHF WLPS WULPF	· Work with landowners to encourage use of BMPs for prescribed fire management and timber harvesting techniques to improve habitat quality.
	<b>HERP-RELATED STRATEGIES</b>
ELPS EULPF	<b>Eastern Slender Glass Lizard, Northern Scarlet Snake, Mole Kingsnake, Scarlet Kingsnake, Southeastern Crowned Snake, Harlequin Coralsnake:</b> Promote increased acreage and natural management of longleaf pine as a timber resource and substitute for loblolly
	<b>Amphibians:</b>
ELPS	· Develop educational information and management techniques to address ephemeral ponds and their importance to all amphibians, with emphasis on species of conservation concern, and make this info available to landowners/land managers through technical
ELPS	· Promote management recommendations developed by PARC.
SPOHF	<b>Southern Crawfish Frog:</b> Locate and buffer potential breeding sites.
SDHF	<b>Louisiana Slimy Salamander:</b> Requires intact, relatively old-growth forest. Encourage timber companies to designate no-cut zones, especially on slopes and riparian borders.
MHLPHSF	<b>Louisiana Slimy Salamander, Southern Red-backed Salamander, Western Worm Snake:</b> This guild of species occurs in isolated slope sites, and appears to be intolerant of habitat alteration. Encourage timber companies to designate no-cut zones (especially on slopes, slope crests, and riparian borders)
SP	<b>Louisiana Slimy Salamander:</b> Requires intact, relatively old-growth forest. Encourage timber companies to designate no-cut zones in riparian bottoms.
SPHF	<b>Four-toed Salamander:</b> Locate gum ponds and buffer from anthropogenic modification to perpetuate reproduction.
	<b>Western Slender Glass Lizard, Louisiana Pine Snake:</b>
WULPF WXS	· Continue to work with timber industry, NFS, and USFWS to promote habitat and species conservation strategies to increase populations on quality sites.
WULPF WXS	· Implement conservation and management recommendations of SWG project T10 upon completion.
	<b>Louisiana Pine Snake:</b>
WXS	· Maintain open canopy pine woodland in xeric sandhill community.
WXS	· Eliminate root chopping at sites under timber management.

APPENDIX N. Terrestrial Species Strategies cont.

Habitat Code*	HERP-RELATED STRATEGIES cont.
HF	<b>Timber Rattlesnake:</b> Naturally low-occurring population levels and persecution make persistence in isolated forest blocks untenable. Prohibit killing; retain connectivity of flatwoods.
LONLF	<b>Timber Rattlesnake:</b> Naturally low-occurring population levels and persecution make persistence in isolated forest blocks untenable. Prohibit killing; reduce vehicular travel where possible.
SDHF	<b>Timber Rattlesnake:</b> Naturally low-occurring population levels and persecution make persistence on isolated domes untenable. Prohibit killing or removal from salt domes.
SMF HF	<b>Timber Rattlesnake:</b> Naturally low-occurring population levels and persecution make persistence tenuous. Prohibit killing and removal; reduce vehicular traffic in sensitive areas.
SB	<b>Map Turtles:</b> Sandbars and beaches provide primary nesting sites, and submerged portions are used for foraging on mussels. Eliminate off-road vehicle use on sandbars and beaches during nesting periods.
ACG	Determine current use of agricultural lands by <b>crawfish frogs</b> in Louisiana, and determine which land practices enable persistent use by frogs.
	<b>MAMMAL-RELATED STRATEGIES</b>
BHF CTBS HF MHLPHSF SDHF SPOHF	<b>Louisiana Black Bear:</b> Partner with the BBCC, USFWS and continue to support the implementation of recovery efforts for this species.
MHLPHSF	Establish monitoring systems and protocols for target <b>bats</b> species and other mammal species associated with mixed hardwood-loblolly pine/hardwood slope forest.
SPPCHF	Establish monitoring systems and protocols which focus on <b>small mammal</b> population abundances and trends.
	<b>MULTI-GROUP SPECIES STRATEGIES</b>
	Promote use of appropriate silvicultural techniques to restore/manage hardwoods flatwoods for wildlife (include importance of tree species diversity, den trees for <b>birds and mammals</b> , leaf litter, etc). Snags should be retained during logging operations to
BHF	Promote use of appropriate silvicultural techniques to restore/manage BLH forests for wildlife (include importance of tree species diversity, den trees for <b>birds and mammals</b> , leaf litter, etc). Snags should be retained during logging operations to increas
WULPF	Promote use of appropriate silvicultural techniques to restore/manage western upland longleaf pine forests for wildlife (include importance of tree species diversity, den trees for <b>birds and mammals</b> , leaf litter, etc). Snags should be retained during logg
ELPS LOPMF	Snags should be retained during logging operations to increase the numbers available for cavity-using wildlife species. Efforts need to be made to maintain sufficient levels of woody debris in stands for <b>reptiles, amphibians and small mammals</b> .
B BHF CLOHF CTBS EHSB EULPF LONLF MHLPHSF SMF SPHF SPOHF SPPCHF SSF WHSB	Work with landowners to initiate or continue the implementation of PIF <b>bird</b> conservation plans, conservation plans developed for <b>amphibians and reptiles</b> , and USFWS <b>endangered and threatened species</b> recovery plans over the next 10 years.

APPENDIX N. Terrestrial Species Strategies cont.

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<b>Habitat Code*</b>	<b>MULTI-GROUP SPECIES STRATEGIES cont.</b>
SPOHF	Recommend retention of snags during logging operations to increase the numbers available for cavity-using wildlife species. Efforts need to be made to maintain sufficient levels of woody debris in stands for reptiles, amphibians and small mammals.
SPHF	Examine the demographics, habitat-use patterns, and impacts of feral hogs on ground nesting birds, salamanders and small mammals (Warren and Ford 1997).
EULPF WULPF	Promote use of appropriate silvicultural techniques to restore/manage western upland longleaf pine forests for wildlife (include importance of tree species diversity, den trees for <b>birds and mammals</b> , leaf litter, etc). Snags should be retained during logg
WHSB	· Implement conservation and management recommendations of SWG projects T22 and T32 upon completion.
WLPS	· Work with landowners to encourage use of BMPs for prescribed fire management and timber harvesting techniques to improve habitat quality.
WULPF	Document the habitat relationships of species of conservation concern and how dependent they are upon eastern longleaf pine savannah, relative to other habitat types.
	Recommend retention of snags during logging operations to increase the numbers available for cavity-using wildlife species. Efforts need to be made to maintain sufficient levels of woody debris in stands for <b>reptiles, amphibians and small mammals</b> .

APPENDIX N. Terrestrial Species Strategies cont.

**\*Habitat**

<b>Code</b>	<b>Habitat</b>
ACG	AGRICULTURAL CROPLAND GRASSLAND
B	BATTURE
BHF	BOTTOMLAND HARDWOOD FOREST
BI	BARRIER ISLAND
BILOF	BARRIER ISLAND LIVE OAK FOREST
BM	BRACKISH MARSH
BS	BAYHEAD SWAMP
CaP	CALCAREOUS PRAIRIE
CDGST	COASTAL DUNE GRASSLAND / SHRUB THICKET
CF	CALCAREOUS FOREST
CLOHF	COASTAL LIVE OAK-HACKBERRY FOREST
CMMS	COASTAL MANGROVE-MARSH SHRUBLAND
CoP	COASTAL PRAIRIE
CTBS	CYPRESS TUPELO-BLACKGUM SWAMP
EHSB	EASTERN HILLSIDE SEEPAGE BOG
ELPS	EASTERN LONGLEAF PINE SAVANNAH
EULPF	EASTERN UPLAND LONGLEAF PINE FOREST
FM	FRESHWATER MARSH
HF	HARDWOOD FLATWOODS
IM	INTERMEDIATE MARSH
LONLF	LIVE OAK NATURAL LEVEE FOREST
LOPMF	LIVE OAK-PINE- MAGNOLIA FOREST
MHLPHSF	MIXED HARDWOOD-LOBLOLLY PINE / HARDWOOD SLOPE FOREST
SB	SAND BAR
SDHF	SALT DOME HARDWOOD FOREST
SGB	SANDSTONE GLADE/BARREN
SM	SALT MARSH
SMF	SOUTHERN MESOPHYTIC FOREST
SP	SALINE PRAIRIE
EHSB	STRATEGIES
SPHF	SPRUCE PINE-HARDWOOD FOREST
SPOHF	SHORTLEAF PINE / OAK-HICKORY FOREST
SPPCHF	SLASH PINE-POND CYPRESS / HARDWOOD FOREST
SSF	SMALL STREAM FOREST
VPED	VEGETATED PIONEER EMERGING DELTA
WHSB	WESTERN HILLSIDE SEEPAGE BOG
WLPS	WESTERN LONGLEAF PINE SAVANNAH
WULPF	WESTERN UPLAND LONGLEAF PINE FOREST
WXSW	WESTERN XERIC SANDHILL WOODLAND

APPENDIX O. Aquatic Species Strategies

Habitat Code*	STRATEGY
	<b>FISH-RELATED STRATEGIES</b>
ATCH	Develop "white paper" on issues associated with Old River control structure as it affects on <b>pallid sturgeon</b> and address these issues with the COE.
CALC	Identify sites where low head dams are present and evaluate their effects on fish distribution/dispersal patterns. Develop recommendations to improve fish passage through low head dams.
PEAR	<b>Alabama Shad:</b> Reintroduce species to its original Louisiana drainages.
	<b>Gulf Sturgeon:</b>
PEAR	· Implement conservation actions recommended in SWG project T8 (LDWF 2005) and recovery plan (USFWS et al. 1995c)
PEAR	· Prepare "white paper" on the importance of access for sturgeon to spawning areas in the Pearl Basin. Meet with COE and USFWS to discuss fish passage issues.
SAB	<b>Western Sand Darter</b> and <b>Suckermouth Minnow:</b> Develop partnerships with Texas Department of Parks and Wildlife to monitor populations of these species throughout the Sabine drainage basin.
	<b>HERP-RELATED STRATEGIES</b>
BARA	<b>Mississippi Diamondback Terrapin:</b> Conservation of coastal dune habitat is paramount to terrapin reproduction. Continued removal of abandoned crab traps will drastically reduce incidental mortality.
MISS	<b>Turtles:</b> Monitor the effects of the pet trade on population densities and determine the effects of human disturbance on nesting areas. Incorporate current management guidelines (i.e., PARC) and develop new guidelines to address data gaps.
	<b>MAMMAL-RELATED STRATEGIES</b>
	<b>Manatees:</b>
MARINE	· Incorporate recommendations of the manatee recovery plan for Louisiana populations (note: manatee population increases in recent years have been related to a lack of cold weather over the last 15 years. Severe freezes, such as those in 1984 and 1989 cause severe or total loss of the species in the state, after which it seems to re-colonize from peninsular Florida. Increased utilization of warm-water discharges from coastal power plants and industrial sources also helps with local survival of the species).
MARINE	· Intensify public awareness of manatee presence in Louisiana to encourage the public to report manatee sightings to the Louisiana Natural Heritage Program.
MARINE	· Continue and support the Manatee/Sea Grass Bed Program created by Louisiana Natural Heritage Program in 2003.
MARINE	· Continue education and public awareness of the presence of manatees in Louisiana through signs, pamphlets, and public events.

APPENDIX O. Aquatic Species Strategies cont.

Habitat Code*	<b>CRUSTACEAN-RELATED STRATEGIES</b>
	<b>Crustaceans:</b>
MERM	· Develop strategies to abate further degradation of streams known to contain populations of crawfish species of conservation concern derived from SWG project T10 (Walls 2003).
MERM	· Continue to monitor known populations through periodic surveys to maintain current database records.
RED	<b>Crustaceans:</b> Develop a protocol to monitor abundance, distribution patterns, and habitat quality using baseline data obtained in SWG project T10 (Walls 2003).
	<b>MUSSEL-RELATED STRATEGIES</b>
	<b>Mussels:</b>
PONT	· <b>Inflated Heelsplitter:</b> Work with sand and gravel interests to restore and maintain habitat within the Amite River.
OUCH PEAR PONT	· Implement conservation and management strategies from SWG project T10 upon completion.
RED	<b>Louisiana Pearshell:</b>
RED	· Develop a survey protocol to monitor the remaining populations, especially in streams located within the Kisatchie NF.
RED	· Partner with the USFWS to implement conservation recommendations in the recovery plan (USFWS 1989).
RED	· Work with landowners to maintain water quality in the streams inhabited by the Louisiana pearlshell.
	<b>GENERAL / MULTI-GROUP SPECIES STRATEGIES</b>
BARA	Initiate long-term sampling to identify trends in the distribution and abundance of native and invasive species within the Barataria Basin.
BARA	Work with LCA, CWPPRA to incorporate strategies developed for aquatic species of conservation concern into future coastal restoration efforts.
CALC MERM	Sampling is needed to identify trends in the range and abundance of invasive fish species (especially carp). Incorporate recommendations of State Management Plan for Aquatic Invasive Species (LDWF 2005) to control invasive fish species.
MISS	Work with landowners to initiate or continue the implementation of conservation plans developed for amphibians and reptiles along with USFWS endangered and threatened species recovery plans over the next 10 years.
OUAC	Develop a comprehensive survey methodology to determine long term trends in freshwater fish population abundances of the entire Ouachita Basin.
PEAR	Support and expand the fish passage study currently being conducted in the Mississippi portion of the Pearl River.
PEAR	Develop a comprehensive survey methodology for the Pearl River and its tributaries to fill data gaps for this critical drainage basin.
PONT	Implement species conservation strategies detailed in the LPBF plan (Maygarden et al. 2004).
TERR VERM	Develop data base containing baseline data on current composition and abundance of all species with a focus on species of conservation concern.
TERR VERM	Sampling is needed to identify trends in range and abundance of native and invasive species throughout the Terrebonne and Vermilion-Teche Basins.
MARINE	Evaluate methods to monitor changes in sea turtle and marine mammal populations.

APPENDIX O. Aquatic Species Strategies cont.

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<b>*Habitat</b>	
<b>Code</b>	<b>Basin</b>
ATCH	ATCHAFALYA
BARA	BARATRIA
CALC	CALCASIEU
MERM	MERMENTAU
MISS	MISSISSIPPI
OUAC	OUACHITA
PEAR	PEARL
PONT	PONTCHARTRAIN
RED	RED
SAB	SABINE
TERR	TERREBONNE
VERM	VERMILION-TECHE

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## APPENDIX P. Wildlife Research and Monitoring Projects in Louisiana as of June 30, 2005.

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Project title	Project title
A benthic macroinvertebrate survey of lotic systems on the Fort Polk military complex	Christmas Bird Count
A compilation of mammalian occurrences for the Fort Polk military complex.	Collecting gnats/midges to investigate links to Bluetongue virus in deer
A herpetofaunal inventory of occurrences for the Fort Polk military complex.	Community ecology of bats, rodents, and insectivores
Aerial photography @ Pointe-aux-Chenes WMA	Conduct aerial/ground surveys of bird nestings
Age/growth & reproductive biology re finfish	Conduct field survey re abundance of avian
Alligator disease research	Conduct field survey re Henslow's Sparrows
Alligator hide & leather quality study	Conduct field surveys for avian & herpetofauna
Alligator snapping turtle nest productivity	Conduct forest inventory on WMAs
Ambrosia beetles on National Guard facilities in Louisiana	Contaminant and disease surveys all species
Amphibian and Reptile Monitoring along Highway 51	Crayfish DNA study
Amphibian and Reptile Monitoring in the Lake Pontchartrain Basin	Deer Browse Surveys
Analyses of records of rare species of fish in Louisiana coastal and estuarine waters - expansion of the work of Bart and Pezold to shallow marine ecosystems - including evaluation of occurrence of Texas pipefish ( <i>Syngnathus affinis</i> ) - evaluate habitat and	Density survey for the Louisiana Pine Snake
Analysis of current and historic classification of estuarine sampling sites occupied by long-term LDWF fishery-independent sampling, and re-analysis of the relationships of marsh-dependent species in those environment types	Design aircraft runway at Rockefeller Wildlife Refuge
Analysis of habitat usage by marsh-resident fish and crustacean species	Design surveys and experiments
Analysis of spotted sea trout feeding habits	Determine breeding bird distribution
Anuran call survey	Determine geotech.& biol. properties for artificial reef
Assist, guide & educate re fisheries resources	Determine geotechnical & biological properties
Avian point counts	Determine infectivity of LPSA in alligators
Avian research	Develop and implement SARP program
Bald Eagle Nest Monitoring on Calcasieu District, Kisatchie NF	Develop design for nature drive at Rockefeller WMA
Bathymetric survey of marsh at Rockefeller WMA	Develop population estimates for bobwhite quail
Behavioral research of skinks and geckos	Develop strategy to suppress nutria
Bobcat home range and seasonal habitat use on Fort Polk	Differential prey selection in <i>Lythrus umbratilis</i> and <i>Lythrus fumeus</i>
Bobwhite quail and fire ant relationships	Disease surveillance in birds
Bog distribution and inventory on DOD lands associated with the Fort Polk	Distribution and Habitat Selection of Louisiana Pine Snakes at Fort Polk
Breeding bird point counts	Distribution and species occurrence of crayfish at Fort Polk.
Canada goose Survey	Diversity in isolation (4-toed salamander)
Census and Analysis of Louisiana Pine Snakes and Baird's Pocket Gopher Populations as a Tool for Habitat Conservation	DNA study for systematics of Gulf Coast Plain salamanders
Characterization of Gulf Sturgeon nursery areas - identify key links in life history and sampling strategies for making management recommendations based on knowledge base of species in Louisiana	Dove Survey
	Eagle nest monitoring for nest productivity
	Effect of blackbirds on rice crops
	Effect of fire ants on small mammals and reptiles
	Effect of storm water discharge on marsh vegetation and water quality
	Effects of habitat disturbance on hybridization, abundance, and distribution of <i>Bufo nebulifer</i> and <i>B. woodhousii</i>
	Effects of roads on vehicular traffic on snake populations associated with the Fort Polk complex
	Effects of sea level rise and salinity intrusion on fishery organisms

APPENDIX P. Wildlife Research and Monitoring Projects in Louisiana as of  
June 30, 2005.

Effects of sedimentation on lotic communities in a coastal plain stream
Effects of timber stand structure on resin flow
Encephalitis surveillance
Engineering services at Rockefeller Refuge
Enhance protect restore waterfowl habitat
Estimate population of black bears in LA
Evaluate fish use of habitat from erosion project
Evaluate hatchling success for gopher tortoises
Evaluate nutria grazing damage & recovery
Evaluate public oyster seed beds
Evaluate tech./effects of rice production on waterbirds
Evaluation of alligator food, habits re nutria
Evaluation of nutria damage control
Evaluation of the compatibility of existing Rapid Bioassessment Protocols in selected southwest Louisiana streams.
Evolution of <i>Anolis</i>
Examining inflated heelsplitter and LA pearlshell muscles
Field investigation of latitud. origin of wintering rails
Field surveys for avian & herp. fauna on WMA
Field surveys for avian & herp. fauna on WMA
Field surveys re abundance of herpetofauna
Field surveys re abundance of herpetofauna
Field surveys to gather data on abundance of avian
Fish disease diagnostic capability to hatcheries
Fish survey re artificial reef habitat
Fishery organism collections to assist in development of brown shrimp population model
Fishery-independent sampling of Louisiana Territorial Sea
General Condition of Deer Herd
Genetic analysis of <i>sirenidae</i> , <i>amphiumidae</i> , <i>proteidae</i>
Geographic Variation in Salinity Tolerance in the Green TreeFrog ( <i>Hyla cinerea</i> )
Gopher tortoise surveys
Gopher tortoise surveys
Habitat and prey availability survey for the Louisiana Pine snake on Fort Polk
Habitat specific occurrences for small mammals on Fort Polk
Hair-snare sampling for bears
Hawk Watch
Henslow's Sparrow research
Herp surveys
Herpteofaunal surveys
Honey bee research
Host specificity for LA Pearlshell Mussel

Identification workshops for identification of marine organisms. (Finfish, crustacean, molluscan, potential invasive species including plants and algae)
Identify areas for protection of birds
Identifying essential fish habitats-Barataria Bay
Influences of disturbance on macroinvertebrate drift
Interspecific nest fidelity in Eastern Blue birds
Interspecific site fidelity and dispersion in the Southeastern American Kestrel ( <i>Falco sparverius paulus</i> )
Interspecific site fidelity in Henslow's Sparrow
Investigate Marsh Terracing on Refuges
Investigate water quality issues
Investigating the use of "man-made habitats" on the Main Delta by fishery organisms
Investigation of availability of waterfowl foods
Investigation of stock structure
King rail research
Kisatchie NF Bobwhite Abundance
Kisatchie NF Deer Abundance on Select Ranger Districts
Kisatchie NF Land Management Proposed Project Monitoring in compliance with NEPA requirements
Kisatchie NF Landbird Monitoring
Kisatchie NF Squirrel Abundance Estimation
Kisatchie NF Wild Turkey Abundance
LA black bear and gopher tortoise research
LA black bear monitoring
LA black bear repatriation
LA black bear research
LA black bear research
LA black bear translocations
LA pine snake research
Lake Pontchartrain Fish Monitoring
LAMP surveys
Legal services re boundary dispute
Life cycle of <i>Centrohynchus</i> spp.
Loggerhead shrike and American Kestrel census
Longleaf pine ecosystem restoration on the Kisatchie NF
Louisiana native irises
Louisiana Pine snake Abundance on Kisatchie NF
LSU 2575 Biological control of common Salvinia
LSU1064 Environmental investigation of the long term use of ship shoal
LSU1085 Landscape fire models for the Avon park air force range
LSU1089 The effects of forest fragmentation on seed dispersal in the cent
LSU1090 A comparison of herpetofauna biomass across the Amazon basin

## APPENDIX P. Wildlife Research and Monitoring Projects in Louisiana as of June 30, 2005.

LSU1092 Conservation strategies across the Amazon basin: how many neotrop
LSU1120 Modeling risk of Chinese tallow invasion in an heterogeneous
LSU1125 Inventory of freshwater mussels in three Florida parish rivers
LSU1133 Enhancement of the collections and web site at the LSU herbaria
LSU1399 Marsh upwelling system demonstration project in the bayou Segnett
LSU1404 Evaluating the non-point source pollution and the role of the urban
LSU1416 Ground water contaminant transport following flooding events: imp
LSU1421 Economic assessments of best management practices and environment
LSU1422 Marsh dieback & nutria control emergency response - task 2.6 couple
LSU1423 Modeling impacts of climate change on wetland ecosystems
LSU1430 Probabilistic assessment of the effectiveness of bmps in coastal
LSU1431 Total mercury and methymercury in Louisiana fresh, brackish and
LSU1433 Digitize field data for Ouachita sub segments & create fgdc compl
LSU1438 Louisiana spatial reference center
LSU1461 History of offshore oil development in the Gulf of Mexico - phase 1
LSU1473 Addis and reservoir characterization (Area 3)
LSU1477 Field investigation and digital mapping of pipeline crossings of
LSU1479 Design and production of the Barataria - Terrebonne estuary tidal g
LSU1507 Biocorder: a biodiversity inventory tracking system
LSU1529 Assisted reproduction in endangered species - amend #12 to umbrella
LSU1530 Alligator disease research
LSU1533 Evaluating reproductive and hatchling success of Louisiana gopher
LSU1538 West Nile virus challenge study of vaccinated red tail hawks
LSU1570 GIS digital map resource database
LSU1598 Cross sectional study for the description of west Nile virus in Louisiana
LSU1600 <i>Perkinsus marinus</i> evaluation for managing LA's public & private o
LSU1604 Louisiana clean marina program, second phase
LSU1605 Louisiana coastal ports specialist
LSU1606 Sarp aquatic nuisance species management plans coordinator
LSU1607 Education on current issues related to domestic shrimp industry
LSU1610 2003-2004 Louisiana rural tourism research
LSU1611 Review and revision of cmd mitigation regulations

LSU1612 Legal impediments to coastal restoration in Louisiana and suggest
LSU1614 R/E-23 Stakeholder Support
LSU1615 R/MMR - Coastal wetland restoration
LSU1623 E/ENV - 03 marine education resources
LSU1635 R/SRS - 01 satellite-based remote sensing of flood impacts
LSU1659 R/EAN - 01 nutria population control
LSU1660 R/SA - 03 sex pheromones in shrimp
LSU1661 R/EAN - 01 economic analysis of nutria population control
LSU1666 A conceptual model for integrated coastal management in the gulf
LSU1670 R/EFH - 07 Brown shrimp modeling measurement
LSU1693 Evaluating sport fish use of created wetlands in the Atchafalaya
LSU1694 Evaluating sport fish use of habitats created by coastal restoration
LSU1695 Shark nursery ground delineation in Louisiana coastal waters
LSU1696 Expanding the delineation of shark nursery grounds in Louisiana
LSU1697 Provide an update on the conservation status of the federal candi
LSU1707 Thin-mat marsh enhancement
LSU1708 CWPPRA technical advisory group ecological assistance
LSU1709 Marsh dieback & nutria control emergency response - task 3.3
LSU1710 An evaluation of nutria grazing damage and natural recovery
LSU1711 Distribution and ecological characteristics of floating marshes i
LSU1712 Modeling coastal processes and landscape dynamics in the Louisiana
LSU1715 Integrative approach to understanding the cause of salt marsh die
LSU1718 Potential for restoration and remediation of oil - impacted habitat
LSU1720 Water quality of upper Barataria basin: impact of non-point source
LSU1721 Continuation of spatial influence of Davis Pond freshwater introduction
LSU1722 Mercury contamination in Louisiana freshwater lakes
LSU1724 Mercury contamination in Louisiana freshwater lakes: total mercur
LSU1725 Total mercury, methyl mercury and other toxic metals in Lake Pontchartrain
LSU1728 Restoration trajectories of backfilled canals
LSU1729 Multi-stress: cumulative coastal stressors: northern Gulf of Mexico
LSU1730 N - Gomex 2002, hypoxia studies in the northern Gulf of Mexico
LSU1731 Backfill dead-end canals too restore marsh-phase 1 - wetlands restoration

## APPENDIX P. Wildlife Research and Monitoring Projects in Louisiana as of June 30, 2005.

LSU1732 Hydrologic characterization and monitoring of flow dynamics in br	LSU1778 Response of larval fish to dimethylsulfide: an experiment to dete
LSU1733 Continuation of surface water hydrology in upper Breton Sound bas	LSU1779 Identifying essential fish habitats in Barataria Bay, study phase
LSU1734 Collaborative research: are carbon fluxes from marine sediments e	LSU1781 Short-term movement, home range, and behavior of red snapper around
LSU1735 Physical mechanisms governing circulation in Mississippi river d	LSU1782 Stable isotopes as traces of patterns in habitat utilization by j
LSU1736 Quantification of adjective benthic processes contributing n and	LSU1783 Analysis of vermilion snapper
LSU1738 Incorporation of benthic survey data into obis: phase one of a no	LSU1784 Environmental investigation of the long term use of ship shoal sa
LSU1739 Enhanced exploration of lower slope extreme environments in the g	LSU1785 Environmental investigation of the long-term use of ship shoal sa
LSU1740 A base line analysis of the benthic community in proposed wetland	LSU1786 Ship shoal: sand and shrimp and sea trout
LSU1741 Comarge: coastal margin ecosystems	LSU1787 Collaborative research: itr: interactive software systems for exp
LSU1742 Completion of a comprehensive assessment of inner-seep and seep - B	LSU1788 Collaborative research: shelf-basin exchange of plankton and biogen
LSU1744 The role of very large, infrequent diversions in the formation, m	LSU1789 Assessin trophic linkage between platforms and pelagic fishes using
LSU1745 Modeling environmental stressors in the swamps of Lake Maurepas	LSU1790 Evaluation of the artificial light field near petroleum platforms
LSU1746 restoration assessment of a forested watershed using a regional m	LSU1792 Multistress: cumulative coastal stressors: northern gulf of mexico
LSU1747 Developing a comprehensive demonstration program for restoration	LSU1793 Task #15: bottlenose dolphin food habits in the northern Gulf of Mexico
LSU1749 Jefferson parish marsh monitoring	LSU1794 Task 14: habitat use and population structure patterns of bottlen
LSU1750 Conceptual ecological models for planning and evaluating the Louisiana	LSU1795 Multistress: cumulative coastal stressors: northern gulf of Mexico
LSU1751 Restoration assessment of a forested watershed using a regional m	LSU1796 Variability of deep water mass properties and the loop current in
LSU1752 Utilizing Mississippi river diversions for nutrient management in	LSU1797 Observation of deep water manifestation of loop current rings
LSU1754 Pluses - the importance of pulsed physical events for watershed sustainability	LSU1798 Observation of deep water manifestation of loop current rings
LSU1756 The role of hydro period and the stem densities in determining fisheries	LSU1799 Transport processes through the bab el mandab strait - data analysis
LSU1757 Platform recruited reef fish phase 1: do platforms provide habitats	LSU1800 Coastal marine environmental modeling
LSU1759 Modeling water quality effects on estuarine fish populations	LSU1801 Analysis of fine structures of flows, hydrography, and fronts in
LSU1760 Application of high resolution acoustic survey technology for eva	LSU1802 Evaluation of a new sand resource for barrier island restoration
LSU1762 Fish biology technology/information transfer & continued investigation	LSU1812 Building the sedimentary record: physical and biological processes
LSU1763 Determination of geotechnical and biological properties in the la	LSU1813 The center for coastal zone assessment and remote sensing
LSU1769 The fidelity of red snapper to petroleum platforms and artificial	LSU1814 Advancing the training capabilities and satellite data access with
LSU1773 LSU surveys of w & t platforms	LSU1817 New remote sensing methodologies for the surveillance of ocean fe
LSU1774 Marine sport fish tagging study barataria bay, la	LSU1818 Assistance to the CWPPRA ppl - 15 program
LSU1775 Age and growth and reproductive biology studies of Louisiana mari	LSU1819 Determining the geographical distribution, maximum depth, and the gen
LSU1776 Sport fish utilization of artificial oyster reefs vs. Open water h	LSU1823 Continuation of beach and bathymetric surveys to quantify the imp
LSU1777 Identifying essential fish habitats in Barataria Bay	LSU1824 Wave-current online system for oil spill contingency

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LSU1825 Environmental investigation of the long term use of ship shoal
LSU1826 Assistance in identifying high quality sand resources for new cut
LSU1827 Environmental investigation of the long term use of ship shoal sa
LSU1828 Support and development of real time ocean observing systems off
LSU1829 Wave-bottom interaction and bottom boundary dynamics in evaluating
LSU1830 New theoretical formulations of wave dissipation and an in situ n
LSU1831 A continuous monitoring, shallow water hydrodynamic and meteorology
LSU1832 Support from naval research laboratory for a post doctoral research
LSU1833 National data buoy center enterprise wide response to accommodate
LSU1834 The sura coastal ocean observation and prediction program (scoop)
LSU1836 Sura scoop modeling grid initiative - phase II
LSU1837 Sura scoop modeling grid initiative: LSU phase 1
LSU1838 Implementation of a meteorological and oceanographic station in t
LSU1839 Modeling wave evolution in cohesive sedimentary environments
LSU1840 Coupled dynamics of waves and fluid mud layers
LSU1841 Wave forecasting in muddy coastal environments: model development
LSU1842 An evaluation of nutria damage control and vegetative restoration
LSU1843 Task 5.1 brown marsh vegetation response and remediation
LSU1844 Factors controlling the restoration of brown marsh sites task 5.4
LSU1845 Beneficial use of sediments for wetland rehabilitation and restore
LSU1846 Climate-linked alteration of ecosystem services in tidal marshes
LSU1847 Brown marsh vegetation response and remediation task 2.1
LSU1848 Multistress: cumulative coastal stressors: northern Gulf of Mexico
LSU1849 Soil cellulose decomposition study
LSU1850 Effects of sulfate loading on growth response of <i>Typha domingensi</i>
LSU1851 Value of north shore marshes in improving lake water quality: ass
LSU1852 Nutrient enrichment effects on belowground organic matter acc- ye
LSU1853 Coastal Louisiana ecosystem assessment and restoration (clear) pr
LSU1854 Utilizing Mississippi river diversions for nutrient management in
LSU1855 Coastal oligotrophic ecosystems research, the coastal everglades
LSU1856 Large scale assessment of landscape changes

and recovery in forest
LSU1857 Dentrification potential of Atchafalaya river basin sediment
LSU1866 Environmental sensitivity index (ESI) shoreline classification us
LSU1870 Louisiana geographic information center (lagic) 2004-05 - Year 6
LSU1871 Characterization & Synthesis of marsh die back and nutria control - t
LSU1872 Characterization & Synthesis of marsh die back - task 3.10
LSU1873 Support for the development of the barrier shoreline document to
LSU1874 Water level gages for river reintroduction into Maurepas swamp
LSU1875 Mitigating nonpoint source pollution in urban watersheds with spa
LSU1879 Scientific support for Mississippi delta restoration
LSU1884 The coastal restoration and enhancement through science and technology
LSU1885 N-Gomex 2002: mechanisms controlling hypoxia on the Louisiana she
LSU1886 Investigating mechanisms of action and ID of breast carcinogens by
LSU1887 Development of sar models to assess potential health effect of ne
LSU1891 Amite river basin drainage database development
LSU1895 Preliminary evaluation of natural dispersion and the effects of t
LSU1908 Identifying denitrifies and fermenters in riparian forests of the
LSU1909 Audubon center for research of endangered species (ACRES)
LSU1913 Fort Polk Mussel Project
LSU1948 Biological approaches to coastal wetlands restoration
LSU1977 Evaluating poultry litter influences on water quality, soils, and
LSU1978 Reducing nutrient input to watersheds from livestock production
LSU1981 Task V.V Brown marsh vegetative response and remediation
LSU1982 An evaluation of nutria damage control and vegetative restoration
LSU1983 Beneficial use of sediments for wetland rehabilitation and restoration
LSU1985 Establishment of vegetative plantings as a restoration measure on
LSU1986 A vegetative model for restoration, conservation, and habitat enhancement
LSU1987 Biological approaches to coastal wetlands restoration
LSU1988 A joint program of accelerated coastal vegetative restoration act
LSU2018 Assessment and Potential for vegetative remediation of selected bro
LSU2155 Assessment of tree stress along a

## APPENDIX P. Wildlife Research and Monitoring Projects in Louisiana as of June 30, 2005.

nutrient/salinity gradient in a
LSU2156 Assessment of bald cypress along a nutrient/salinity gradient in a
LSU2240 Assessment and Potential for vegetative remediation of selected bro
LSU2241 Biological approaches to coastal wetlands restoration
LSU2267 Management and habitat quality for Henslow's and Bachman's sparrows
LSU2268 Breeding bird distribution and reproduction in Lake Maurepas wetlands
LSU2269 Effects of burn regime on Henslow's sparrow abundance and distrib
LSU2270 David fox-effects of insectivorous birds on tree growth in the ma
LSU2271 Winter diet, seed selection and foraging behavior of the Henslow's sp
LSU2272 Effects of insectivorous birds on tree growth in the Maurepas swam
LSU2273 Monitoring the effectiveness of forestry bmp implementation in th
LSU2274 Assessment of terrestrial ecosystem carbon stocks and changes in
LSU2275 Analyses of Idaf 2003 survey on forestry bmp implementation in lo
LSU2276 Identifying nitrogen removal capacity of the Atchafalaya river ba
LSU2277 Landscape-level relationships between avian and herpetile communi
LSU2278 A continuing assessment of population and individual-level response
LSU2279 Hair-snare sampling for bears within Iberia and St. Mary parishes
LSU2280 Restoration of the Louisiana black bear to red river/three rivers
LSU2281 The continuing repatriation of the la black bear
LSU2282 Assessing relative abundance of white tailed deer on Kisatchie na
LSU2283 To monitor abundance and distribution of northern bobwhite, a kisat
LSU2284 Grad fellowship: effects of aversive conditioning on behavior of
LSU2285 Examining ecology of wild turkeys on Sherburne wildlife management area
LSU2286 Assessing vegetative and herpetofaunal response to site preparation
LSU2287 Repatriation of the Louisiana black bear into suitable habitats
LSU2288 Restoration, viability, and management of the Louisiana black bear
LSU2289 Ecology of gray foxes in longleaf pine ecosystems
LSU2306 Effectiveness of marsh terracing as a restoration technique: nekt
LSU2307 Comprehensive water and sediment budget analysis for the chenier
LSU2308 Determining the effects of marsh terraces on the abundance of sub
LSU2309 Quantify deer population and develop a hunting

LSU2310 Comparing waterbird density between unrestored marshes and marshes
LSU2311 Sare forest landowners
LSU2312 Forest management and avian and herps
LSU2313 Census and evaluation of breeding waterbirds in southwest Lou
LSU2316 Evaluating latitudinal origin of wintering rails in southwest Lou
LSU2317 Evaluation of aquatic macro-invertebrates available to wintering
LSU2318 Evaluation of impacts from excessive sediment deposition on bottom
LSU2319 Pre-assessment screen of devil's swamp, Louisiana
LSU2320 Evaluate habitat factors/NRCS wetland reserve program
LSU2335 Collection of fish tissue samples for radiological analysis
LSU2336 Stock identification of Louisiana's largemouth bass fishery
LSU2337 The relationship between nutrients, dissolved oxygen conditions,
LSU2338 Atchafalaya basin habitat, water quality, and fisheries monitoring
LSU2339 Develop, coordinate, and advance the implementation of water manage
LSU2340 IPA hale: assessment and management of the Atchafalaya river and
LSU2343 Water flux at different levels of scale within a loblolly pine stand
LSU2344 Local and long-range movements, habitat use and survival of the fema
LSU2345 Nutritional ecology of lesser scaup during spring migration in the
LSU2346 Ecology of Lesser Scaup in the Mississippi flyway: factors affect
LSU2348 Nutritional exology of Lesser Scaup during spring migration in the
LSU2403 Investigation of possible linkages between rainfall patterns and
LSU2404 Improving stream water quality in southern Louisiana by reducing
LSU2410 Animal health for fish and wildlife management
LSU2415 Technology and market development for the gulf coast satsuma mand
LSU2416 Biological approaches to coastal wetlands restoration
LSU733 Doctoral dissertation research: vegetation change and land degrad
LSU916 Understanding the interactions between pollutants and wetland nat
Mammalian biodiversity
Marine sport fish tagging study in Barataria Bay
Measure DNA components in alligators
Mechanisms of brown thrasher parasite egg rejection

## APPENDIX P. Wildlife Research and Monitoring Projects in Louisiana as of June 30, 2005.

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Mid winter Bald Eagle Survey
Mid-winter waterfowl survey
Molecular & morphological study of <i>Bufo americanus</i>
Monitor relocated black bears--repatriate
Monitoring Avian Productivity and Survivorship (MAPS)
Mosquito Abatement Disease Surveillance
Mosquito populations and predators
Movements of white pelicans and double crested cormorants
Nesting and Foraging Habitat Requirements of Breeding and Migrant American Kestrels in Eastern Texas
Nesting, reproduction and behavior of 3-toed box turtles
North American Breeding Bird Survey
Numerous migratory bird studies
Occurrence surveys of rodents and bats
Operate/maintain 15 hydrographic data platform
Pallid Sturgeon population dynamics at the Old River Control Complex, Concordia Parish
Parasite communities of marine vertebrates and invertebrates
Parasite distributions on small mammals, reptiles, and amphibians
Parasitology research
Participate in cost share grant for data collec.
Photographic documentation of breeding shorebirds, waterbirds, and sea birds
Phylogeography and population structure of diamond back watersnakes
Pocket gopher marking
Population genetics of herps
Preparation and submission of NAWCA grant
Prescribed burn mngmt for maint. of longleaf pine
Prey selection in brown madtoms ( <i>Noturus phaeus</i> ) on Fort Polk
Project Prairie Bird
Provide management expertise re: ducks
Quail Survey
Range extensions of amphibians and reptiles
RCW demographic monitoring
Reciprocal cross fostering of the Red Cockaded Woodpecker ( <i>Picoides borealis</i> )
Red-Cockaded Woodpecker Monitoring on Kisatchie NF
Reduce beaver damage to state property
Remove predators from duck nesting areas
Represent LDWF re Charles E. Reilly, et al
Represent LDWF re Pelts & Skins suit
Research biological control of common Salvinia
Research herpes virus/PIX disease in alligators

Research nutria population differences
Research nutria population differences at Chenier
Research on bobwhite quail
Research/monitor pocket gopher populations
Research/rescue marine mammals/sea turtles
Salinity as a stressor of the fresh water turtle
Sample mussel beds fro area rivers
Sampling of cryptic habitats within Louisiana marsh tidal zones (mangroves, soft-mud ponds, semi-vegetated marshes, oyster reefs)
Sandhill Crain wintering study
Sea turtle research
Sea turtle research
Seasonal use of bridges as day roosts by Rafinesque's big eared bat
Seasonal variability associated with benthic macroinvertebrate drift in a southwestern Louisiana stream
Shallow-tailed kite and songbird monitoring
Shorebird Survey
Side-scan sonar survey of 7 reef sites
Small mammal & bat population dynamics
Snow geese movements
Soil and water chemistry and plant phenology
Southeast Coopertive Wildlife Disease Project
Southeastern Cooperative Fish Kill Survey
Sp. Assemblages of forest ecosystems
Statistical support for fisheries management
Stock identification of largemouth bass
Study of migratory passerines
Study wintering female mallard habits
Survey critically imperiled amphibians
Survey for water management on Catahoula Lake
Survey of Louisiana anglers
Survey work at Rockefeller Wildlife Management Area
Systematic relationships among turtles
Tadpole survey
Terrestrial vertebrate research
Test skin lesions on alligators
The differential effect of stream crossing types on fish movement in low gradient coastal plains streams
The effects of highway bridge bat roosting on water quality, water chemistry, and aquatic life
To Monitor Abundance & Distribution of Northern Bobwhite, A Kisatchie NF Management Species
Treefrog study
Turkey Gobbler Survey

## APPENDIX P. Wildlife Research and Monitoring Projects in Louisiana as of June 30, 2005.

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Turtle & amphibian study
Turtle habitat identification
Update & consolidate info for Louisiana Natural Registry Program
Vegetation research
Vegetative studies to assess vertical accretion, soil fertility, and subsidence
Water snake and crawfish evolutionary history
West Nile monitoring

Wetland Impacts of Nutria grazing
Wild Turkey Brood Survey
Wildlife Disease Study
Winter philopatry in sparrows and the biology of loggerhead shrikes
Wood duck nest box program
Wood Duck Nest Box Surveys
Wood Thrush study in Atchafalaya Basin



## APPENDIX Q. Coastal Restoration Projects

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### *1. Coastal Zone:*

#### **Impacts To The United States And Louisiana**

Coastal wetland loss in Louisiana negatively affects the economies of both the United States and Louisiana. Thus, what happens to Louisiana's coastal wetlands should be of concern to all Americans.

Energy is the lifeblood of the American economy, and Louisiana's coastal wetlands are the main artery. America's economic growth, and, therefore, the economic well-being of America's consumers, depends on access to a stable, secure, and dependable source of energy. Louisiana's coastal wetlands and its network of energy facilities, in the aggregate, accommodate the movement of over 26% of the nation's natural gas supply, as well as, over 26% of the nation's crude oil supply. Together with the facilities in the rest of the state, nearly 34% of the nation's natural gas supply, and over 29% of the nation's crude oil supply, moves through the state of Louisiana and is connected to nearly 50% of U. S. refining capacity. Not considering other value, this volume of crude oil and natural gas flowing through Louisiana's Energy Corridor represents, approximately, \$150 billion in annual energy value, equivalent to about \$50,000 per acre of wetlands (about \$30,000,000 per square mile). In 2001, the U.S. federal government collected over \$5 billion in oil and gas revenues from offshore Louisiana. (**Source: *Louisiana Energy Facts, Annual 2003 and 2004 Reports, LA Department of Natural Resources, Technology Assessment Division***) Louisiana's coastal wetlands and barrier islands protect this oil and gas infrastructure which includes approximately 14,000 miles of onshore pipelines.

Louisiana's flat, marshy coastline makes tropical storms and hurricane surges especially dangerous. Wetlands work in tandem with flood control levees to provide a natural buffer during storms. Scientists estimate that every 2.7 miles of wetlands reduce storm surge by one foot. A Category 3 hurricane that creates a wall of water 10 feet high today could produce walls of water 18 to 20 feet high in the future if wetlands and barrier islands continue to disappear. Continued wetland loss will result in more devastation from hurricanes possibly threatening the energy supply of the nation and causing extensive loss of life and property for the citizens of Louisiana.

Most of Louisiana's navigation system is located in coastal areas. The Mississippi River carries more commerce than any other waterway in the nation. Five of the 15 busiest ports in the U.S., ranked by total tons, are located in south Louisiana and handle approximately 484 million tons, valued at over \$75 billion. South Louisiana ports carry 21% of the waterborne commerce in the U.S. and ship approximately 57% of all U.S. grain exports. Continued coastal wetland loss negatively affects the economies of the U.S. and Louisiana by increasing costs associated with delays in shipping and with maintaining the nearly 3,000 miles of deep- and shallow-draft channels built with billions of dollars of public investment.

## APPENDIX Q. Coastal Restoration Projects cont.

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Louisiana's coastal wetlands can also play an important role in combating the "dead zone" in the Gulf of Mexico. Scientists estimate that approximately one million metric tons of nitrogen from the Mississippi River flow into the Gulf of Mexico every year, most of which is from human sources throughout the entire Mississippi River basin. This is strongly linked to the growing "dead zone" in the Gulf of Mexico. Reintroducing nutrient rich river water into Louisiana's coastal wetlands to restore them could have a significant beneficial impact on Gulf hypoxia. A team of prominent national scientists recently concluded that large-scale restoration of wetlands along coastal Louisiana, combined with improved nutrient management practices in the nation's heartland, could reduce nitrogen inputs into the Gulf by as much as 40 percent. Reduction in nitrogen loads of this magnitude from the Mississippi River would significantly reduce the "dead zones" in the Gulf.

The Louisiana coastal wetland system represents critical breeding, spawning, foraging, and/or nursery grounds for a variety of fish and shellfish species. No other state or area in the country supports the number and kind of species Louisiana produces. Louisiana is the nation's largest shrimp (~36%), oyster (~50%), and blue crab (~26%) producer. Dockside revenues for commercial fisheries in coastal Louisiana were \$342 million in 2001, the latest year for which statistics are available. The fish and shellfish harvested from Louisiana waters are shipped to local, state, national, and international markets. Coastal Louisiana's wetlands contain a diversity of habitats and populations of fish and wildlife resources enjoyed by humans. In 2001, 1.6 million people engaged in fishing, hunting and wildlife watching activities, expending a total of \$1.6 billion in Louisiana. Total recreational retail sales for hunting, fishing, boating, and wildlife watching in 2001 was estimated at \$3.1 billion, with a total economic benefit of \$6.2 billion. Dramatic declines in the commercial fishing species have been predicted due to coastal wetland loss. Additionally, there are 25 threatened or endangered species in the Louisiana coastal zone, including offshore Gulf waters, that are dependent on coastal wetlands for their continued existence.

A study of Louisiana's coastal infrastructure in 2004 indicated a total asset value of \$95.9 billion. As coastal wetland loss continues, communities will need to retreat inland abandoning their infrastructure or relocating it. Both of these alternatives would cost enormous amounts of money.

Another issue related to wetland deterioration is the increasing threat to public water supplies in coastal Louisiana due to saltwater intrusion. Salty Gulf water now reaches farther north than ever before, affecting water for drinking supplies, agriculture and other commercial uses. In 1999, saltwater intrusion in the GIWW forced Terrebonne Parish to switch its raw water source for drinking water. Wetlands losses are so severe that some towns in the Barataria-Terrebonne estuary will need alternative sources for drinking water by the year 2013.

## APPENDIX Q. Coastal Restoration Projects cont.

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### *2. Louisiana Coastal Restoration Efforts:*

#### **Early State and Federal Coastal Restoration Efforts**

Louisiana has been responding to wetlands loss issues since the early 1930s. Early efforts include projects on various lands owned or managed by the State (such as state wildlife refuges), investments by private landowners to protect their properties from erosion, and the development of state and federal regulatory programs to reduce impacts associated with development activities. Coastal planning efforts escalated in the 1970s with the passage of the Federal Coastal Zone Management Act of 1972. Louisiana adopted and began participating in the federal program in 1978. The State significantly increased its commitment to coastal restoration in 1989 with the passage of Act 6. This law created both the State Wetland Authority (a cabinet level committee to advise the Governor regarding coastal issues) within the Office of the Governor, and the Office of Coastal Restoration and Management within the Department of Natural Resources. Act 6 also created a statutorily dedicated Wetlands Conservation and Restoration Trust Fund which dedicates a portion of the state's revenues from severance taxes on mineral production (e.g., oil and gas) to finance coastal restoration efforts. Currently, the fund provides approximately \$25 million per year. The general public of Louisiana strongly believes in the State's investment in coastal restoration. In 2003, Louisiana voters approved a constitutional amendment establishing the Louisiana Coastal Restoration Fund wherein up to 20% of securitized revenues from the Master Tobacco Settlement Agreement may be used to match federal funds for coastal restoration.

#### **Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA)**

In November 1990, as a federal response to the State's commitment to undertaking an aggressive coastal restoration program, the Coastal Wetlands Planning, Protection and Restoration Act (Title III of Public Law 101-646) was passed by Congress. The Act mandated the Secretary of the Army to convene a Task Force of five federal agencies and the State of Louisiana to initiate a process to identify and prepare a list of coastal wetlands restoration projects in Louisiana to provide for the long-term conservation of such wetlands and dependent fish and wildlife. The Task Force accomplishes this mandate by approving restoration projects on annual Priority Project Lists (PPLs).

The original CWPPRA authorization extended through FY 1999. Subsequent legislation has extended authorization through FY 2019. Dedicated funding for CWPPRA is provided by the Budget Reconciliation Act of 1990 (Public Law 101-508, Section 11211) and comes from an excise tax on fishing equipment and fuel taxes on motorboats and small engines. Thus, CWPPRA does not compete for annual funding dollars as do typical civil works projects.

Under the current authorization and funding, about \$50 - \$60 million in federal funds are received per year for the CWPPRA program. Thus, over the life of the currently authorized program approximately \$2 billion will be available, including non-federal matching funds or

## APPENDIX Q. Coastal Restoration Projects cont.

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in-kind services. The State of Louisiana, serving as the local sponsor to all CWPPRA projects through its Department of Natural Resources, is the primary party responsible for ensuring the long-term operation, maintenance, and monitoring for constructed projects. In general, the federal funds are matched at a cost sharing ratio of 15% non-federal in the CWPPRA program, including the long-term operation, maintenance, and monitoring efforts.

Despite the successes of the CWPPRA program, it became evident in the late 1990s that Louisiana's coastal restoration needs were far greater than could be addressed by CWPPRA. At that time it was estimated that CWPPRA would prevent less than 15% of the predicted wetland loss in coastal Louisiana.

### **CWPPRA Program Structure**

Section 303(a)(1) of the CWPPRA directs the Secretary of the Army to convene the Louisiana Coastal Wetlands Conservation and Restoration Task Force, to consist of one member each from five federal agencies and the local cost share sponsor, which is the State of Louisiana. The federal agencies of CWPPRA include: (1) the U.S. Department of the Interior represented by the U.S. Fish & Wildlife Service (USFWS), (2) the U.S. Department of Agriculture represented by the Natural Resources Conservation Service (NRCS), (3) the U.S. Department of Commerce represented by the National Oceanic and Atmospheric Administration (NOAA) Fisheries Service, (4) the U.S. Department of the Army represented by the U.S. Army Corps of Engineers, and (5) the U.S. Environmental Protection Agency. The Louisiana Governor's Office represents the State of Louisiana on the Task Force.

The Task Force established several interagency committees and working groups (i.e., Technical Committee, Planning and Evaluation Subcommittee, Environmental and Engineering Work Groups, etc.) to do the actual project planning and engineering. While the agencies sitting on the Task Force possess considerable expertise regarding Louisiana's coastal wetlands problems, the Task Force recognized the need to incorporate another invaluable resource: the state's academic community. The Task Force therefore retained the services of well-qualified scientists through the Louisiana Universities Marine Consortium (LUMCON) to provide scientific advisors to aid various work groups and to help guide program direction.

### **Current CWPPRA Projects (Priority Project Lists 1-14)**

Currently, 116 projects (not including demonstration projects and three near-term LCA proposed projects: Mississippi River Reintroduction into Bayou Lafourche; River Reintroduction into Maurepas Swamp; and Delta Building Diversion at Myrtle Grove) have been selected on fourteen annual Priority Project Lists (PPLs). After selection on a PPL, projects proceed to design. If warranted, and if construction funds are available, projects are subsequently approved for construction.

## APPENDIX Q. Coastal Restoration Projects cont.

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Seventy-five projects have been constructed , are under construction or have been approved for construction across Louisiana's disappearing coastal wetlands; these projects will benefit (re-establish or protect) a total of 66,651 net acres at a cost of \$649.7 million. Another 40 projects are being designed; they will benefit an additional 34,094 net acres at a cost of \$890 million.

Along the Mississippi River, the CWPPRA projects focus on reintroduction of freshwater, nutrients and sediments to adjacent marshes and swamps. For example, south of Venice, Louisiana, the West Bay Sediment Diversion project will re-establish over 9,800 acres of marsh. This new marsh will help protect Venice and lower Plaquemines Parish from storm surges. Several river reintroduction projects in Breton Sound Basin will also help protect Plaquemines parish levees. In the Pontchartrain Basin, three projects have re-established and protected significant fish and wildlife habitat on the Bayou Sauvage National Urban Wildlife Refuge. These projects will improve the recreational opportunities for New Orleans metropolitan area residents.

The lower Barataria Basin is losing wetlands rapidly. Protection of the Barataria Basin Landbridge via a single project from a program with an annual budget of about \$40 to \$50 million would have been improbable. However, twelve projects, costing over \$253 million, have been selected over several PPLs to strengthen the landbridge that spans the basin from east to west. These projects will slow future marsh loss by re-establishing or protecting over 5,400 acres and thus help preserve infrastructure such as the GIWW, the Larose to Golden Meadow Hurricane Protection levee and Plaquemines Parish levees.

Terrebonne Basin's front line of defense against storms and hurricanes is its barrier islands and barrier shoreline. These islands absorb the most destructive element of tropical storms and hurricanes by reducing the height of storm surge, thereby helping to protect residents, infrastructure and wetlands of Terrebonne Basin. The islands are especially valuable in protecting oil and gas infrastructure in the bays behind the islands. In addition, these barrier islands provide valuable and rare wildlife habitat. To date, CWPPRA has selected 11 projects (along with two demonstration projects) on these islands costing over \$156 million. Over 20 miles and nearly 4,800 acres of barrier islands/shoreline will be reestablished or protected. Like the Barataria Basin Landbridge projects, these projects act in synergy to address regional or landscape level needs.

In the emerging Atchafalaya Delta, three projects increase the land-building capability of the Atchafalaya River. In the Chenier Plain, 33 projects have been selected on PPLs 1 -14. In this area of lower land loss with no major sediment source, CWPPRA projects focus on shoreline protection, marsh creation, and hydrologic restoration and will re-establish or protect a total of over 27,880 acres. Wetlands re-established or protected by these projects will help protect infrastructure such as towns, roads and the GIWW.

## APPENDIX Q. Coastal Restoration Projects cont.

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The 100,745 acres of wetlands benefited by CWPPRA projects on PPLs 1-14 will help protect Louisiana's citizens and infrastructure, including its energy corridor, from damaging storm surges as well as insure that Louisiana's nationally significant commercial fisheries will continue to provide fish and shellfish to the nation and the world.

### **Future CWPPRA Projects(Priority Project List 15 and beyond)**

Assuming that all projects on PPLs 1 through 14 will be built as money becomes available in future years, projects from PPLs 1 through 14 will cost \$51,700 for each acre reestablished or protected. Based on current estimates, through 2019, approximately \$350 million will be available to fund projects to be approved on PPLs 15 and beyond. Therefore, using the average cost cited above, the remaining CWPPRA authorization could result in an additional 6,770 acres re-established or protected.

### **Coast 2050, the Louisiana Coastal Area (LCA) Study and Other Restoration Efforts**

In response to this identified additional restoration need, the CWPPRA Task Force and the State Wetland Authority initiated development of the Coast 2050 Plan. The Plan, completed in December 1998, used a regional approach to strategic planning, involved the public through 65 workshops and provided an important long-term vision for coastal Louisiana. The Coast 2050 Regional and Coastwide Ecosystem Strategies have been used in CWPPRA project development and review since approval of the Coast 2050 Plan in 1998. The Coast 2050 Plan became the basis for the U.S. Army Corps of Engineers' May 1999 report, "*Analysis of the Louisiana Coastal Area, Louisiana—Ecosystem Restoration.*" This reconnaissance level effort expressed a federal interest in proceeding to the feasibility phase. In 2000, it was envisioned that a series of feasibility reports would be prepared by the Corps of Engineers and the State over a 10-year period.

In 2002, the Corps of Engineers and the State of Louisiana, with federal CWPPRA agency involvement, initiated the *Louisiana Coastal Area (LCA) Comprehensive Coastwide Ecosystem Restoration Study*. In FY 2004, recognition of scientific and engineering uncertainties pertaining to some of the restoration features under consideration led to the determination by the administration that the study should begin with the development and implementation of a near-term restoration plan that identifies highly cost effective restoration features that address the most critical needs of coastal Louisiana, as well as large-scale and long-term restoration concepts and a Science and Technology Program.

The LCA started as a comprehensive coastwide restoration plan with a cost of about \$14 billion. At the request of the administration, it is now a \$1.9 billion plan that focuses on near-term critical projects, a Science and Technology Board, demonstration projects and several long-term studies. Projects which operate under the WRDA (Water Resources Development Act) process such as LCA, could take significantly longer to begin construction than CWPPRA or

## APPENDIX Q. Coastal Restoration Projects cont.

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State projects. WRDA projects typically have a year of reconnaissance studies, three to five years of feasibility studies and three to four years of project design. The start of construction for WRDA projects is typically seven to ten years after authorization. LCA, while attempting to shorten this timeline, must operate within the constraints of the WRDA process.

Other state and federal programs are providing assistance by protecting and restoring wetlands in south Louisiana. Some examples include NRCS's Small Watershed Program, NOAA's Community Based Restoration program, and the Corps' Continuing Authorities Program; these programs complement ongoing restoration activities by providing mechanisms to "fill in the blanks" in the restoration landscape.

### **Need For Continued Action**

Life is changing every day in south Louisiana because of coastal land loss. Across the State's coastal zone, communities and a unique culture are threatened, jobs are being lost, and habitats are diminishing. Although the most immediate effects of land loss are felt in south Louisiana, the problem impacts the rest of the nation as well. Louisiana's coastal wetlands support the second largest fishery in the United States, are utilized by over five million migratory waterfowl, and provide critical stopover habitat to millions of neotropical migratory birds on their journey across the Gulf of Mexico. As this habitat disappears, all of these valuable functions will decline. Nearly 2 million people live in the coastal zone of Louisiana. The region's ports, inland navigation routes, and oil and gas infrastructure influence the flow of energy and other essential resources throughout the United States. Without the coastal Louisiana ecosystem, many of these residents and assets would be at increased risk from storms and flooding.

Restoration efforts such as CWPPRA will continue to operate in tandem with other existing and proposed restoration programs. If the LCA plan is authorized and funds for implementation are appropriated, it would fund large restoration projects that are generally beyond the current scope of current restoration efforts. While the large and complex projects planned to be implemented under LCA are vital to the long term sustainability of the coastal landscape, there is still a vital unmet need to address smaller hot-spots of land loss and habitat degradation which require more timely responses than are possible through traditional federal water resources planning. Without this ability to stabilize rapidly degrading areas through current restoration programs, long-term and large-scale restoration will become incrementally more difficult and costly to implement.

Deterioration of Louisiana's coastal wetlands is a complex problem requiring complex solutions. Effectively offsetting on-going wetland loss will require "all hands on deck." Continued implementation of state only projects, WRDA projects such as large-scale diversions, CWPPRA, and complete LCA implementation will be required to address the loss of Louisiana's coastal wetlands.

**APPENDIX Q. Coastal Restoration Projects cont.**

***LCA Monitoring:***

The LCA Science and Technology Program, because of its mission to reduce uncertainties associated with the restoration of coastal Louisiana’s ecosystems, will perform extensive modeling of the Louisiana Coastal Area, including; hydraulic, hydrologic, water quality, land building, habitat switching, and other aspects of the coast related to ecosystem restoration. This modeling requires extensive data sets to support the assessment of restoration efforts and ecosystem forecasting of system response. As such, Coastal Louisiana Ecosystem Assessment and Restoration (CLEAR), on behalf of LCA, has developed a system-wide assessment and monitoring plan to incorporate all on-going monitoring in the waters of coastal Louisiana. The result is the identification of relevant monitoring stations throughout the coastal area, as listed in the table below.

The following table lists examples of data acquisition and ecosystem forecasting systems with current applications in the northern Gulf of Mexico.

	<b>Program Title</b>	<b>Program Acronym</b>	<b>Web Site</b>
1	nowCOAST web mapping portal	NOAA	<a href="http://nowcoast.noaa.gov/">http://nowcoast.noaa.gov/</a>
2	U.S. Coastal Observing Systems Western Gulf of Mexico	NOAA	<a href="http://www.csc.noaa.gov/coos/texas_gulf.html">http://www.csc.noaa.gov/coos/texas_gulf.html</a>
3	USGS Water Resources	Hydrowatch	<a href="http://la.water.usgs.gov/hydrowatch.htm">http://la.water.usgs.gov/hydrowatch.htm</a>
4	USGS Water Resources	NWIS	<a href="http://waterdata.usgs.gov/nwis">http://waterdata.usgs.gov/nwis</a>
5	National Data Buoy Center	NDBC	<a href="http://www.ndbc.noaa.gov/">http://www.ndbc.noaa.gov/</a>
6	National Water Level Observation Network	NWLON	<a href="http://www.cops.nos.noaa.gov/d_nwlop.html">http://www.cops.nos.noaa.gov/d_nwlop.html</a>
7	ERDC Wave Data Sites	ERDC	<a href="http://sandbar.wes.army.mil/public_html/mab2web/htdocs/SouthEast.html">http://sandbar.wes.army.mil/public_html/mab2web/htdocs/SouthEast.html</a>
8	USACE Water Control Data	USACE	<a href="http://www.mvn.usace.army.mil/eng/edhd/watercon.htm">http://www.mvn.usace.army.mil/eng/edhd/watercon.htm</a>
9	USACE Navigation Data	USACE	<a href="http://www.iwr.usace.army.mil/ndc/data/data1.htm">http://www.iwr.usace.army.mil/ndc/data/data1.htm</a>
10	EPA Environmental Monitoring and Assessment	EMAP	<a href="http://www.epa.gov/emap/html/data.html">http://www.epa.gov/emap/html/data.html</a>
11	Louisiana Universities Marine Consortium	LUMCON	<a href="http://www.lumcon.edu/">http://www.lumcon.edu/</a>
12	LSU Earthscan Lab	LSU	<a href="http://www.esl.lsu.edu/">http://www.esl.lsu.edu/</a>
13	Louisiana Agriclimate Information	LSU	<a href="http://www.agctr.lsu.edu/weather/">http://www.agctr.lsu.edu/weather/</a>
14	UNO Coastal Research Laboratory	UNO	<a href="http://coastal.uno.edu/MapsNImagery.htm">http://coastal.uno.edu/MapsNImagery.htm</a>
15	Louisiana Department of Natural Resources Monitoring Program	LDNR	<a href="http://www.dnr.state.la.us/crm/coastres/monitoring.asp">http://www.dnr.state.la.us/crm/coastres/monitoring.asp</a>
16	Louisiana Department of Environmental Quality	LDEQ	<a href="http://www.deq.state.la.us/technology/tmdl/index.htm">http://www.deq.state.la.us/technology/tmdl/index.htm</a>



APPENDIX Q. Coastal Restoration Projects cont.

	<b>Program Title</b>	<b>Program Acronym</b>	<b>Web Site</b>
17	Wave-Current-Surge Information System	WAVCIS	<a href="http://wavcis.csi.lsu.edu/">http://wavcis.csi.lsu.edu/</a>
18	Long-Term Estuary Assessment Group	LEAG	<a href="http://leag.tulane.edu/">http://leag.tulane.edu/</a>
19	Louisiana Hydrometeorological Network	JOSS	<a href="http://www.joss.ucar.edu/gapp/networks/louisiana/">http://www.joss.ucar.edu/gapp/networks/louisiana/</a>
20	Ocean.US was created by the National Oceanographic Partnership Program - IOOS	IOOS	<a href="http://www.ocean.us/">http://www.ocean.us/</a>
21	Gulf of Mexico Coastal Ocean Observing System	GCOOS	<a href="http://www-ocean.tamu.edu/GCOOS/gcoos.html">http://www-ocean.tamu.edu/GCOOS/gcoos.html</a>
22	The Ocean Research Interactive Observatory Networks	ORION	<a href="http://www.orionocean.org/">http://www.orionocean.org/</a>
23	SURA Coastal Research Initiative	SCOOP	<a href="http://www.sura.org/programs/coastal.html">http://www.sura.org/programs/coastal.html</a>
24	Coastal Observation Technology System (COTS)	COTS	<a href="http://www.csc.noaa.gov/cots/">http://www.csc.noaa.gov/cots/</a>
25	Tributary Forecasts in the Lower Mississippi River Forecast Center	LMRFC	<a href="http://www.srh.noaa.gov/lmrfc/forecast/tributaries/index.shtml">http://www.srh.noaa.gov/lmrfc/forecast/tributaries/index.shtml</a>
26	Terrestrial Observation & Prediction System	TOPS	<a href="http://geo.arc.nasa.gov/sge/ecocast/research/tops.html">http://geo.arc.nasa.gov/sge/ecocast/research/tops.html</a>
27	NASA Ames, Ecological Forecasting Program	NASA	<a href="http://geo.arc.nasa.gov/sge/ecocast/index.html">http://geo.arc.nasa.gov/sge/ecocast/index.html</a>
28	An Agent-Based Interface to Terrestrial Ecological Forecasting	REaSON	<a href="http://geo.arc.nasa.gov/sge/ecocast/research/reason.html">http://geo.arc.nasa.gov/sge/ecocast/research/reason.html</a>
29	NOAA National Ocean Service Ecological Forecasting	NOAA	<a href="http://www.oceanservice.noaa.gov/topics/coasts/ecoforecasting/welcome.html">http://www.oceanservice.noaa.gov/topics/coasts/ecoforecasting/welcome.html</a>
30	NRL Gulf of Mexico Monitoring and Forecast Systems	NRL	<a href="http://www.7320.nrlssc.navy.mil/GOM_NFS/observations/observations.htm#_Aircraft_Salinity_Mapper">http://www.7320.nrlssc.navy.mil/GOM_NFS/observations/observations.htm#_Aircraft_Salinity_Mapper</a>
31	Applied Science Directorate – Stennis Space Center – Ecological Forecasting	NASA	<a href="http://www.asd.ssc.nasa.gov/application.aspx?app=ecological">http://www.asd.ssc.nasa.gov/application.aspx?app=ecological</a>
32	Geochemical and Environmental Research Group	GERG	<a href="http://www-gerg.tamu.edu/menu_research/gerg_current_research.htm">http://www-gerg.tamu.edu/menu_research/gerg_current_research.htm</a>
33	Global Observing Systems Information Center	GOSIC	<a href="http://www.gosic.org/">http://www.gosic.org/</a>
34	Central Gulf Ocean Observing System	CENGOOS	<a href="http://www.cengoos.org/">http://www.cengoos.org/</a>
35	Global Climate Observing System	GCOS	<a href="http://www.wmo.ch/web/gcos/gcoshome.html">http://www.wmo.ch/web/gcos/gcoshome.html</a>
36	Global Terrestrial Observing System	GTOS	<a href="http://www.fao.org/GTOS/">http://www.fao.org/GTOS/</a>
37	Dynalysis of Princeton	Dynalysis	<a href="http://www.dynalysis.com/">http://www.dynalysis.com/</a>
38	Consortium for Oceanographic Research and Education	CORE	<a href="http://www.nopp.org/dev2go.web?anchor=site_map&amp;jump=nopp#nopp">http://www.nopp.org/dev2go.web?anchor=site_map&amp;jump=nopp#nopp</a>