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 charged with the conservation and management of wildlife and fishery resources in the state, including aquatic and terrestrial vertebrate and invertebrate species. LDWF 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.

1. Mission Statement:

The Louisiana Department of Wildlife and Fisheries (LDWF) is charged with the conservation and management of Louisiana's natural resources, including both aquatic and terrestrial species and habitats. LDWF's mission is to manage, conserve, and promote wise utilization of Louisiana's renewable fish and wildlife resources and their supporting habitats for the social and economic benefit of current and future generations; to provide opportunities for study, utilization, and enjoyment of these resources; and to promote a safe and healthy environment for the users of the resources.

B. Problem and Need for a Wildlife Action Plan

1. Background:

Early in the twentieth century, many of America's once numerous fish and wildlife species were on the verge of extinction. 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. Many 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 Dingle-Johnson and Wallop-Breaux Acts (Sport Fish Restoration Program).

Despite these successes, very little attention was given to species that were not hunted or fished. By the time many nongame species were recognized as being in serious decline, some were on the brink, and a few had been driven to extinction. In 1973, the Endangered Species Act (ESA) was enacted by bipartisan majorities in the U.S. 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 1500 species federally-listed as endangered or threatened, 43 of which occur 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 in nature, and crisis-driven. 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:

The State Wildlife Grants Program (SWG) was created as a compromise to the defeat of the Conservation and Reinvestment Act of 2000 (CARA) and was 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 this new funding source, Congress also required each state and territory to develop a Wildlife Action Plan (WAP) by October 1, 2005. States are required to review and, if necessary, revise their WAP by October 1, 2015. This document represents the 1st comprehensive review and revision of the Louisiana WAP since the approval of the 2005 WAP.

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

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 WAP in Louisiana

1. Purpose:

The purpose of this WAP is to develop a blueprint for guiding LDWF and conservation partners in the development and implementation of management actions for Louisiana's fish and wildlife species with emphasis on species of conservation concern and associated habitats they depend upon. The WAP has now been in place for 10 years, and much progress has been made, which necessitated a comprehensive review and update of the 2005 WAP. For more information about accomplishments of the WAP and SWG in Louisiana since 2005, please refer to Appendix A. Additionally, conservation needs and priorities are fluid, and many data gaps, research needs, and conservation opportunities have emerged since the WAP was approved in 2005. The focus of the WAP is Species of Greatest Conservation Need (SGCN) and the natural communities utilized by SGCN. More information on SGCN and their habitats can be found in Chapters 4 and 5, respectively.

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

3. Goals and Objectives:

The goals and objectives presented below are the ideas developed 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 while insuring that commonly occurring species do not experience declines.

Objective 1
Conduct a comprehensive review of the current status of all species in Louisiana with a focus on SGCN.

Objective 2
Develop management strategies which focus on SGCN and their associated habitats as identified in the WAP.

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 vital for the continued survival of SGCN.

Objective 1
Utilize the LNHP database to identify habitat types which are important to the conservation of SGCN, and continually evaluate and update the status of these habitats to direct conservation and restoration efforts.

Objective 2
Determine and monitor threats to terrestrial and aquatic habitats utilized by SGCN.

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
Develop and implement management strategies to abate the threat of invasive species to SGCN and their habitats.

Objective 6

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

Goal 3: Public Outreach and Education

Support educational efforts to improve the understanding by the general public and conservation stakeholders regarding SGCN 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 SGCN and associated habitats.

Objective 3
Enhance the user's educational experience on WMAs and refuges to promote an understanding and appreciation for wildlife, including SGCN.

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, academia and the general public

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.

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 SGCN in the state

- Provide updated public information on the current amount of available habitat for SGCN
- Serve as a means to readily identify the threats/stressors to the habitats these species depend upon and ways of addressing 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 WAP is written with a 10-year implementation cycle in mind. This process will allow for continual assessment of the effectiveness of the WAP, and allow for modifications that may be necessary in order to reach the goal of halting species declines in Louisiana. 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 WAP is working as a planning resource and guidance document. By using both qualitative and quantitative success criteria, we will evaluate the success of the WAP and respond to the diverse nature, scope, and scale of the strategies presented herein.

When the 2025 WAP revision occurs, the Technical Committees will meet and the status of all SGCN will be reevaluated. It will be critical to identify criteria to guide the 10-year review, review the major elements of the WAP 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 WAP Coordinator for placing the revisions into the WAP. External review is especially important during the revision, both for transparency 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 forested uplands 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 dominated by marshes and forested wetlands. 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 distributary 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, 80% of Louisiana’s surface area consists of Quaternary Period sediments. 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 Period sediments, 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 40% (USGS 2014) 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 in the United States. 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 mammals, shorebirds, waterbirds, overwintering waterfowl, and countless other species of vertebrates and invertebrates.

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), with losses averaging 16.76 sq miles per year from 1985-2010 (CPRA 2012). Since the 1930s, coastal Louisiana has lost over 1.2 million acres of land. Coastal Louisiana may lose up to 1,120,000 acres of land over the next 50 years (CPRA 2012). 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).

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 1985 and 2010, wetland loss was approximately 17 square miles per year- that is the equivalent of approximately one football field lost every hour. The projected loss over the next 50 years, with current restoration efforts taken into account, is estimated to be approximately 1750 square miles (CPRA 2012)).

Population Living in the Coastal Parishes - In 2012, over 2 million residents- more than 60% of the state's population according to U.S. Census Bureau (USCB) estimates- lived in Louisiana's coastal parishes (USCB 2014).

Louisiana Energy Facts - Among the 50 states, the following are some statistics for Louisiana's Primary Energy Production for 2012. Although production is statewide, much comes from the coastal parishes.

	Crude Oil	**Natural Gas**
Including Outer Continental Shelf Production	Ranks 2nd	Ranks 2nd
Excluding Outer Continental Shelf Production	Ranks 7h	Ranks 3rd

Waterborne Commerce - Louisiana coastal wetlands provide storm protection for ports that carry nearly 450 million tons of waterborne commerce annually, which accounts for 20% of all waterborne commerce in the United States each year. Five of the top fifteen largest ports in the United States are located in Louisiana (USACE 2010).

Commercial Fishing - In 2013 Louisiana commercial landings exceeded 1 billion pounds with a dockside value of $399 million,that accounts for approximately 30% of the total catch by weight in the lower 48 States (NOAA 2013).

Fur Harvest - Trapping in Louisiana coastal wetlands generates approximately $1.75 million annually (LDWF 2008b).

Alligator Harvest - The Louisiana alligator harvest is valued at approximately $109 million annually (LDWF 2008a).

Waterfowl - Louisiana's coastal wetlands provide habitat for over 5 million migratory waterfowl (LDWF 2011).

Note: The above listed coastal zone facts change regularly and are only current as of 01/15/2015.

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). For information on potential changes to Louisiana’s climate and possible impacts to SGCN, please refer to Chapter 7.

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% (13.8 million acres) of the state’s land area (LDAF 2004). 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:

Louisiana experienced a 1.4% increase in its population from 2000-2010 (USCB 2014). Much of this increase stems from urbanization of cities and is not reflective of an overall parish-wide population increase. Areas of the state that 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. 2.1) Habitat fragmentation, degradation, 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.

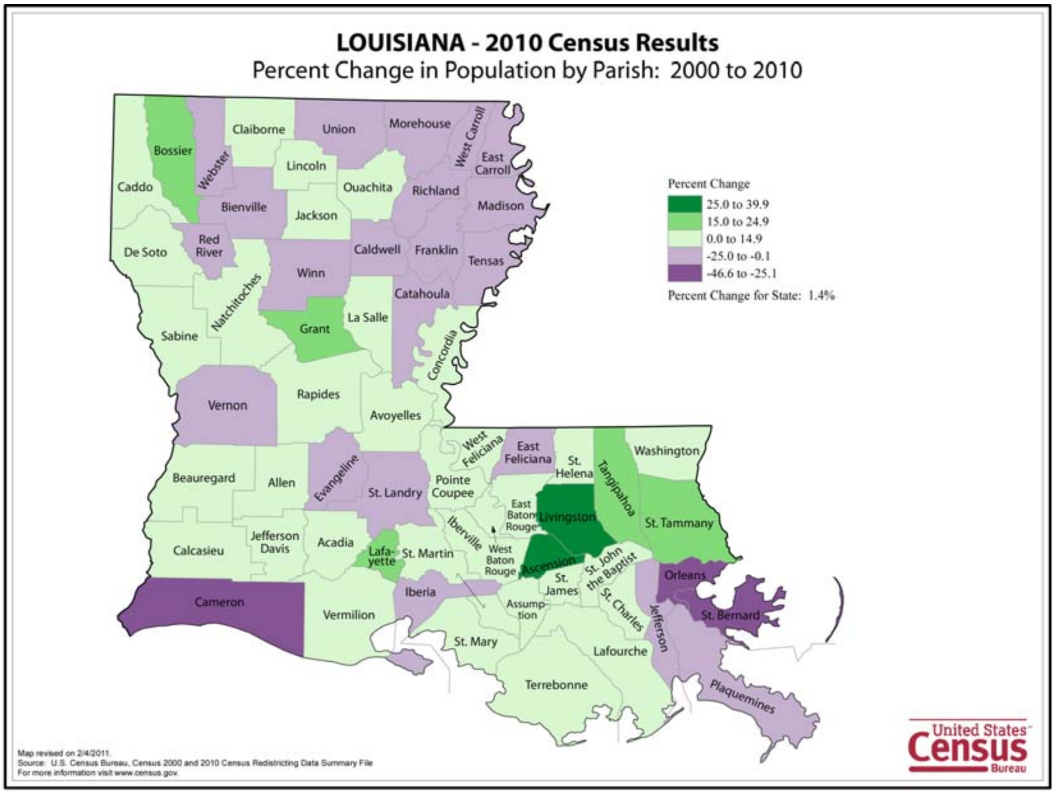

Figure 2.1. Louisiana's population trends by parish from 2000 to 2010.

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

Sportspersons and wildlife watchers across the United States spend $144.7 billion annually, 1 percent of the Nation's gross domestic product. In the southeastern region of the country, 16 percent of the population identify themselves as anglers, 7 percent are hunters, and 26 percent of the population participates in wildlife viewing activities (DOI et al. 2011).

Data provided by the latest National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (DOI et al. 2011) show that for the year 2011, 1.7 million people participated in fishing, hunting, and wildlife-watching activities in Louisiana. These activities resulted in roughly $2.2 billion in expenditures with the majority spent on equipment (45%) and trip-related (45%) expenses. A total of 825,000 sportspersons participated in fishing and 18.1 million recreational fishing trips were made. Total expenditures were $807 million with 66% trip-related, 30% for equipment, and 4% for other expenses. A total of 277,000 sportspersons participated in hunting and 5.2 million hunting trips were made. Total hunting expenditures were $564 million with 43% trip-related, 31% spent on equipment, and 25% for other expenses. A total of 1,010,000 people participated in wildlife-watching activities and 4.9 million trips were made. Total expenditures were $543 million with 51% spent on equipment, 41% trip-related and 8% 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 WAP 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 SGCN. For 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). Below are summaries of each ecoregion and major public landowners.

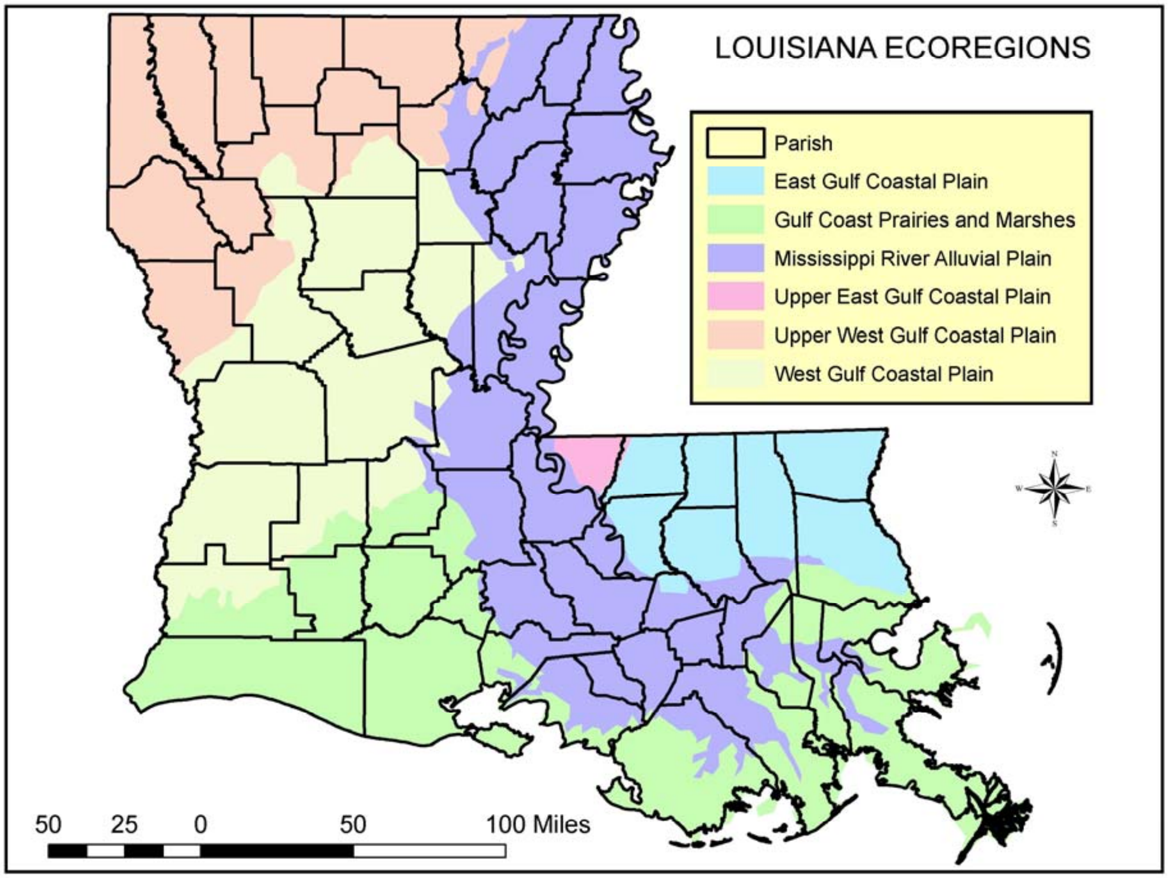

Figure 2.3. Ecoregions of Louisiana.

. East Gulf Coastal Plain

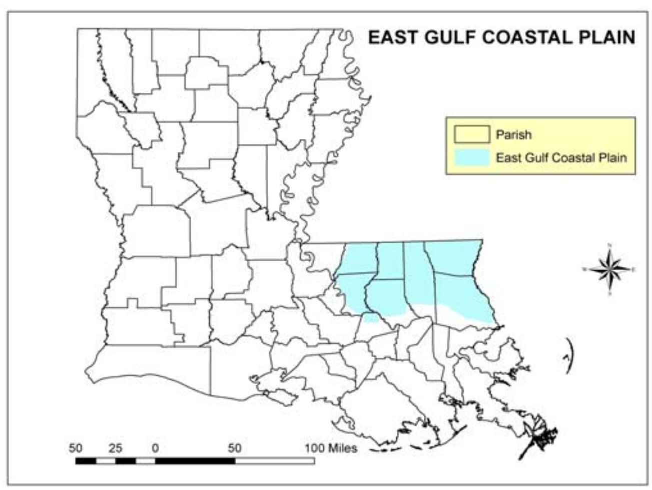

Figure 2.4. East Gulf Coastal Plain Ecoregion.

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 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 SGCN 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	Crustacean	Fish	Insect	Mammal	Mollusk	Plant	Reptile	Total
Eastern Longleaf Pine Savanna	6	18	3	0	9	5	0	33	6	80
Eastern Upland Longleaf Pine Woodland	3	17	1	0	6	6	0	21	8	62
Mixed Hardwood-Loblolly Pine/Hardwood Slope Forest	4	17	0	0	1	12	0	41	6	81
Shortleaf Pine/Oak-Hickory Woodland	4	19	2	0	1	13	0	0	8	47
Bottomland Hardwood Forest	5	19	1	0	5	10	1	15	3	59
Small Stream Forest	6	15	10	11	8	13	8	14	9	94
Slash Pine-Pondcypress/Hardwood Woodland	7	9	1	0	2	9	0	6	5	39
Live Oak-Pine-Magnolia Forest	0	9	2	0	0	7	0	0	6	24
Bayhead Swamp/Forested Seep	2	9	1	0	13	8	0	14	0	47
Cypress-Tupelo-Blackgum Swamp	3	9	0	0	4	6	0	11	3	36
Spruce Pine-Hardwood Flatwood	3	10	1	0	0	9	0	0	4	27
Batture	0	18	0	0	0	7	0	2	6	33
Coastal Live Oak-Hackberry Forest	0	16	0	0	2	0	0	0	3	21
Southern Mesophytic Hardwood Forest	2	11	0	0	3	11	0	3	18	48
Canebrake	0	5	0	0	2	4	0	0	1	12
Flatwoods Pond	8	0	12	0	2	0	0	7	1	30
Xeric Sandhill Woodland	2	10	1	0	6	7	0	41	7	74
Eastern Hillside Seepage Bog	2	4	2	0	2	3	0	17	0	30

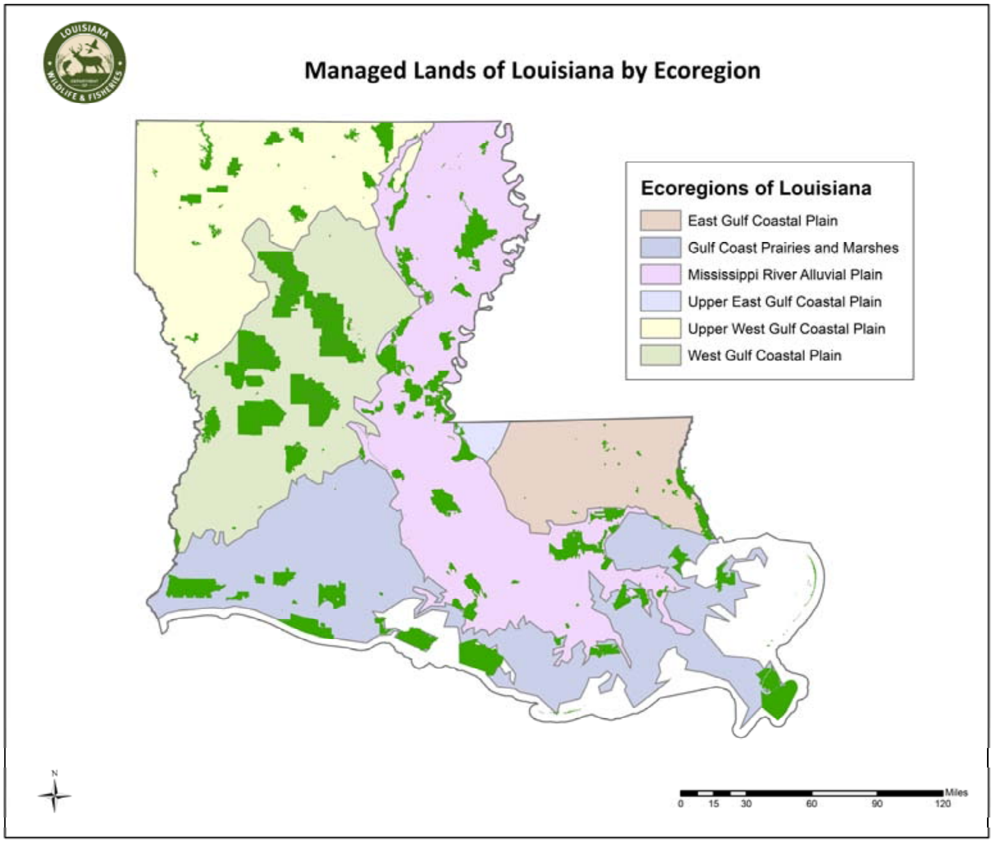

Figure 2.5. Managed areas in Louisiana by Ecoregion

Managed areas within Louisiana comprise 3.3 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 and Refuges include Hutchinson Creek, Sandy Hollow, Waddill, Lake Ramsey, Tangipahoa Parish School Board, Pearl River, and St Tammany Refuge. 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.

b. Upper East Gulf Coastal Plain

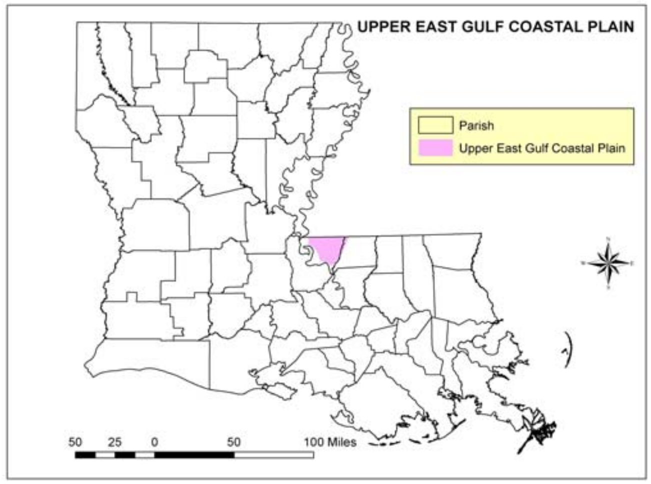

Figure 2.6. Upper East Gulf Coastal Plain Ecoregion.

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 – 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 SGCN occurring within these habitats. The only state WMA in this ecoregion is Tunica Hills WMA. State historic sites include Locust Grove and Audubon. State parks include Tunica Hills State Park. (Fig. 2.5).

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	Crustacean	Fish	Insect	Mammal	Mollusk	Plant	Reptile	Total
Southern Mesophytic Hardwood Forest	2	11	0	0	3	11	0	3	18	48
Small Stream Forest	6	15	10	11	8	13	8	14	9	94
Mixed Hardwood-Loblolly Pine/Hardwood Slope Forest	4	17	0	0	1	12	0	41	6	81
Cypress-Tupelo-Blackgum Swamp	3	9	0	0	4	6	0	11	3	36
Bottomland Hardwood Forest	5	19	1	0	5	10	1	15	3	59

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, 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 SGCN occurring within each habitat.

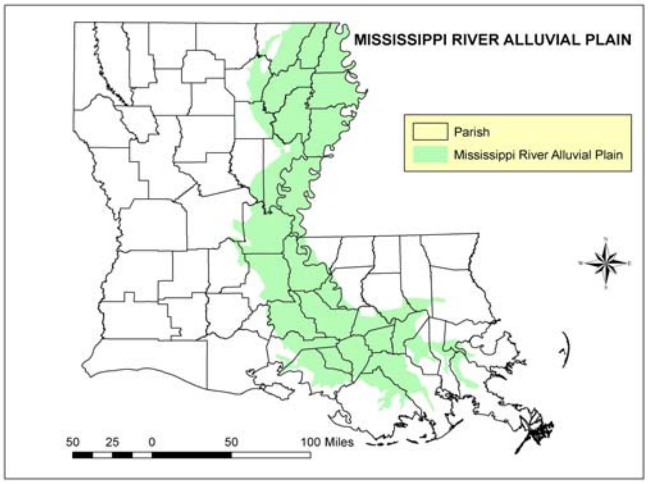

Figure 2.7. Mississippi River Alluvial Plain Ecoregion.

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

Habitat	Amphibian	Bird	Crustacean	Fish	Insect	Mammal	Mollusk	Plant	Reptile	Total
Barrier Island Live Oak Forest	0	15	0	0	1	0	0	0	1	17
Bottomland Hardwood Forest	5	19	1	0	5	10	1	15	3	59
Batture	0	18	0	0	0	7	0	2	6	33
Cypress-Tupelo-Blackgum Swamp	3	9	0	0	4	6	0	11	3	36
Hardwood Flatwoods	2	9	0	0	2	11	0	8	3	35
Live Oak Natural Levee Forest	0	18	0	0	0	5	0	0	4	27
Salt Dome Hardwood Forest	0	17	0	0	2	3	0	9	2	33
Coastal Mangrove-Marsh Shrubland	0	9	0	0	1	0	0	0	2	12
Brackish Marsh	0	36	1	7	5	1	0	1	2	53
Canebrake	0	5	0	0	2	4	0	0	1	12
Freshwater Floating Marsh	0	17	0	0	1	1	0	2	1	22
Freshwater Marsh	0	32	0	4	1	1	0	8	2	48
Intermediate Marsh	0	37	0	8	1	1	0	0	0	47
Mississippi Terrace Prairie	1	12	0	0	3	3	0	0	4	23
Salt Marsh	0	35	1	3	5	1	0	1	3	49
Vegetated Pioneer Emerging Delta	0	31	0	0	0	1	0	1	0	33
Macon Ridge Green Ash Pond	8	0	12	0	2	0	0	7	1	30
River Delta Freshwater Submersed Aquatic Vegetation	0	5	0	5	0	1	5	4	5	25
Sandbar	0	7	0	0	3	0	0	4	6	20

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, Big Lake, Buckhorn, Boeuf, Dewey W. Wills, Richard K. Yancey, Grassy Lake, Spring Bayou, Pomme De Terre, Thistlethwaite, Sherburne, Joyce, Manchac, Maurepas Swamp, Acadiana Conservation Corridor, Attakapas Island, and Elm Hall. Ben Lily Conservation Area is located in this ecoregion. State parks include Chemin A Haut, Lake Bruin, Lake Fausse Point, and Cypremort Point. State historic sites include Winter Quarters, Marksville, and Longfellow-Evangeline (Fig. 2.5). Poverty Point is a World Heritage site located in Pioneer, LA.

d. Upper West Gulf Coastal Plain

The Upper West Gulf Coastal Plain (UWGCP) ecoregion extends from south-central and south-western 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).

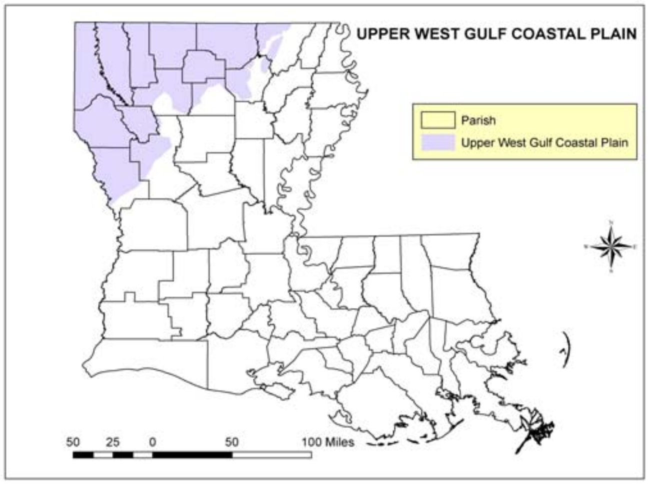

Figure 2.8. Upper West Gulf Coastal Plain Ecoregion.

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. 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 SGCN occurring within each habitat.

Federal lands include the upper parts of Red River, Upper Ouachita, and D'Arbonne NWRs, and the Caney Ranger District of Kisatchie National Forest (KNF). Military lands include Barksdale Air Force Base (AFB), and the Louisiana Army National Guard's Camp Minden. Wildlife Management Areas include Soda Lake, Bayou Pierre, Bodcau, Sabine, 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).

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	Crustacean	Fish	Insect	Mammal	Mollusk	Plant	Reptile	Total
Shortleaf Pine/Oak-Hickory Woodland	4	19	2	0	1	13	0	0	8	47
Mixed Hardwood-Loblolly Pine/Hardwood Slope Forest	4	17	0	0	1	12	0	41	6	81
Western Upland Longleaf Pine Woodland	4	15	1	0	17	8	0	18	5	68
Small Stream Forest	6	15	10	11	8	13	8	14	9	94
Bottomland Hardwood Forest	5	19	1	0	5	10	1	15	3	59
Bayhead Swamp/Forested Seep	2	9	1	0	13	8	0	14	0	47
Cypress-Tupelo-Blackgum Swamp	3	9	0	0	4	6	0	11	3	36
Xeric Sandhill Woodland	2	10	1	0	6	7	0	41	7	74
Hardwood Flatwoods	2	9	0	0	2	11	0	8	3	35
Calcareous Prairie	2	9	0	0	5	2	0	33	2	53
Calcareous Forest	0	8	0	0	4	11	0	18	2	43
Batture	0	18	0	0	0	7	0	2	6	33
Canebrake	0	5	0	0	2	4	0	0	1	12
Sandstone Glade/Barren	1	4	0	0	4	0	0	4	4	17
West Gulf Coastal Plain Muck Bog	0	5	1	0	6	2	0	1	1	16
Western Hillside Seepage Bog	0	5	0	0	4	1	0	14	0	24
Sparta Sand Pond	8	0	12	0	2	0	0	7	1	30
Saline Prairie	0	9	0	0	4	5	0	21	5	44

e. Lower West Gulf Coastal Plain

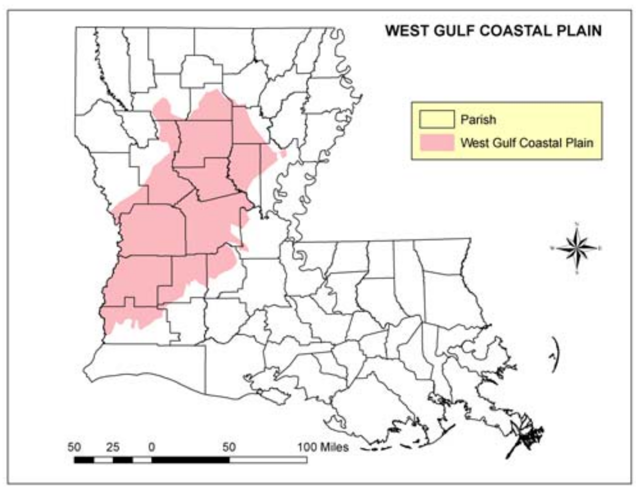

Figure 2.9. Lower West Gulf Coastal Plain Ecoregion.

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 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 SGCN 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	Crustacean	Fish	Insect	Mammal	Mollusk	Plant	Reptile	Total
Hardwood Flatwoods	2	9	0	0	2	11	0	8	3	35
Shortleaf Pine/Oak-Hickory Woodland	4	19	2	0	1	13	0	0	8	47
Mixed Hardwood-Loblolly Pine/Hardwood Slope Forest	4	17	0	0	1	12	0	41	6	81
Western Upland Longleaf Pine Woodland	4	15	1	0	17	8	0	18	5	68
Small Stream Forest	6	15	10	11	8	13	8	14	9	94
Bottomland Hardwood Forest	5	19	1	0	5	10	1	15	3	59
Western Longleaf Pine Savanna	2	17	1	0	5	3	0	3	17	48
Bayhead Swamp/Forested Seep	2	9	1	0	13	8	0	14	0	47
Cypress-Tupelo-Blackgum Swamp	3	9	0	0	4	6	0	11	3	36
Calcareous Prairie	2	9	0	0	5	2	0	33	2	53
Xeric Sandhill Woodland	2	10	1	0	6	7	0	41	7	74
Calcareous Forest	0	8	0	0	4	11	0	18	2	43
Saline Prairie	0	9	0	0	4	5	0	21	5	44
Sandstone Glade/Barren	1	4	0	0	4	0	0	4	4	17
Canebrake	0	5	0	0	2	4	0	0	1	12
Coastal Prairie	1	24	1	0	3	4	0	15	4	52
West Gulf Coastal Plain Muck Bog	0	5	1	0	6	2	0	1	1	16
Flatwoods Pond	8	0	12	0	2	0	0	7	1	30
Batture	0	18	0	0	0	7	0	2	6	33
Sparta Sand Pond	8	0	12	0	2	0	0	7	1	30
Western Hillside Seepage Bog	0	5	0	0	4	1	0	14	0	24

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 Clear Creek, Sabine Island, Walnut Hills, Marsh Bayou, Alexander State Forest, West Bay, Little River, Elbow Slough, and Sicily Island. State Parks include Jimmy Davis, Chicot, South Toledo Bend, Hodges Gardens, and Sam Houston Jones (Fig. 2.5).

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,

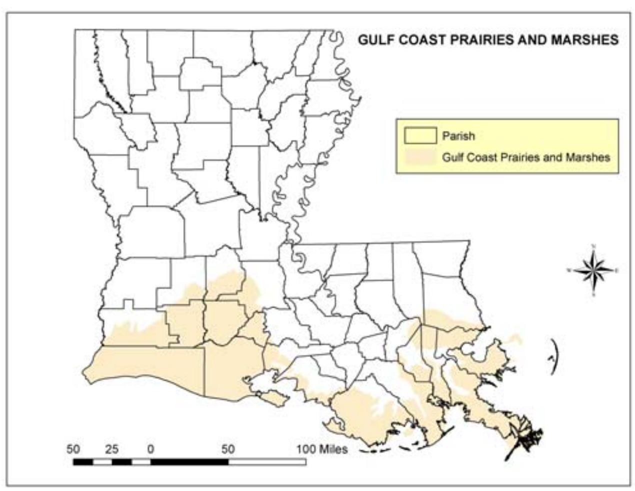

Figure 2.10. Gulf Coast Prairies and Marshes Ecoregion.

Vermilion, Iberia, St. Mary, Terrebonne, La Fourche, St. Charles, St. John the Baptist, Jefferson, 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 approximately 3,000 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 SGCN 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, Elmer's Island, and Biloxi. State Parks include Bayou Segnette, Cheniere au Tigre, Grande Isle, Palmetto Island, and St. Bernard (Fig. 2.5).

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	Crustacean	Fish	Insect	Mammal	Mollusk	Plant	Reptile	Total
Brackish Marsh	0	36	1	7	5	1	0	1	2	53
Batture	0	18	0	0	0	7	0	2	6	33
Freshwater Marsh	0	32	0	4	1	1	0	8	2	48
Intermediate Marsh	0	37	0	8	1	1	0	0	0	47
Salt Marsh	0	35	1	3	5	1	0	1	3	49
Barrier Island	0	33	2	0	5	0	5	7	8	60
Coastal Prairie	1	24	1	0	3	4	0	15	4	52
Vegetated Pioneer Emerging Delta	0	31	0	0	0	1	0	1	0	33
Bottomland Hardwood Forest	5	19	1	0	5	10	1	15	3	59
Coastal Live Oak-Hackberry Forest	0	16	0	0	2	0	0	0	3	21
Salt Dome Hardwood Forest	0	17	0	0	2	3	0	9	2	33
Coastal Dune Grassland/Shrub Thicket	0	12	0	0	1	0	0	5	3	21
Cypress-Tupelo-Blackgum Swamp	3	9	0	0	4	6	0	11	3	36
Coastal Mangrove-Marsh Shrubland	0	9	0	0	1	0	0	0	2	12
Live Oak Natural Levee Forest	0	18	0	0	0	5	0	0	4	27
Bayhead Swamp/Forested Seep	2	9	1	0	13	8	0	14	0	47
Live Oak-Pine-Magnolia Forest	0	9	2	0	0	7	0	0	6	24
Small Stream Forest	6	15	10	11	8	13	8	14	9	94
Western Longleaf Pine Savanna	2	17	1	0	5	3	0	3	17	48
Xeric Sandhill Woodland	2	10	1	0	6	7	0	41	7	74
Prairie Pothole	8	0	12	0	2	0	0	7	1	30
Flatwoods Pond	8	0	12	0	2	0	0	7	1	30
Freshwater Floating Marsh	0	17	0	0	1	1	0	2	1	22
Louisiana Beach	0	22	2	0	3	0	0	9	3	39
Sandbar	0	7	0	0	3	0	0	4	6	20
Western Hillside Seepage Bog	0	5	0	0	4	1	0	14	0	24
Barrier Island Live Oak Forest	0	15	0	0	1	0	0	0	1	17

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 2012). The Mississippi River and its major tributary the Red River, along with other major river systems (Ouachita, Black, Calcasieu, Atchafalaya, Sabine, Pearl, Vermilion, 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 Apple Snail, Rio Grande Cichlid, Zebra Mussel, and five species of Asian carp (LDWF 2004).

A vast array of levees has 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 it's outfall at the Mississippi River. The Sabine, Pearl, Atchafalaya, Ouachita and Black Rivers have all undergone alterations to their natural flow regime.

Man-made 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 2012. A total of 479 water body management subsegments within the state were monitored once per month for a full year (LDEQ 2012). 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 5, only the designated use that is deemed most relevant to SGCN is addressed, which is fish and wildlife propagation.

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

	Fully Supporting	Not Supporting	Not Assessed	Total Size for Designated Use
Rivers and Streams	2,661 (88)	6,574 (248)	32 (3)	9,267 (339)
Lakes	39,458 (11)	616,430 (50)	2,322 (4)	658,210 (65)
Estuaries	1,212 (17)	3,742 (35)	0	4,954 (52)
Wetlands	622,720 (3)	402,560 (3)	51,733 (10)	1,077,053 (16)

Source: Louisiana Department of Environmental Quality (2012)

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 unique state river protection initiatives. It encompasses 57 streams or stream segments and is over 3,000 miles in length (LDWF 2014) (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 clear-cutting of timber within 100 feet of the low water mark
- Use of a motor vehicle or other wheeled or tracked vehicle
- Any use requiring a permit where a permit has not been obtained

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.

		Scenic Streams		Major Land Uses (%)		
Basin	Area (miles)^2	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 datatbase

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 SGCN (Table 2.9).

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

Basin	Amphibian	Crustacean	Freshwater Fish	Insect	Marine Fish	Mollusk	Reptile	Total
Atchafalaya	1	1	19	0	14	4	11	50
Barataria	0	4	4	0	15	1	8	32
Calcasieu	1	8	7	2	10	7	11	46
Mermentau	1	5	6	1	10	2	11	36
Mississippi	0	6	14	0	14	15	12	61
Ouachita	1	4	16	9	0	21	5	56
Pearl	1	8	23	2	13	12	13	72
Pontchartrain	1	6	19	3	14	14	10	67
Red	2	9	15	9	0	9	5	49
Sabine	1	10	10	1	10	9	12	53
Terrebonne	0	7	1	0	15	1	11	35
Vermilion — Teche	0	5	2	0	14	1	11	33

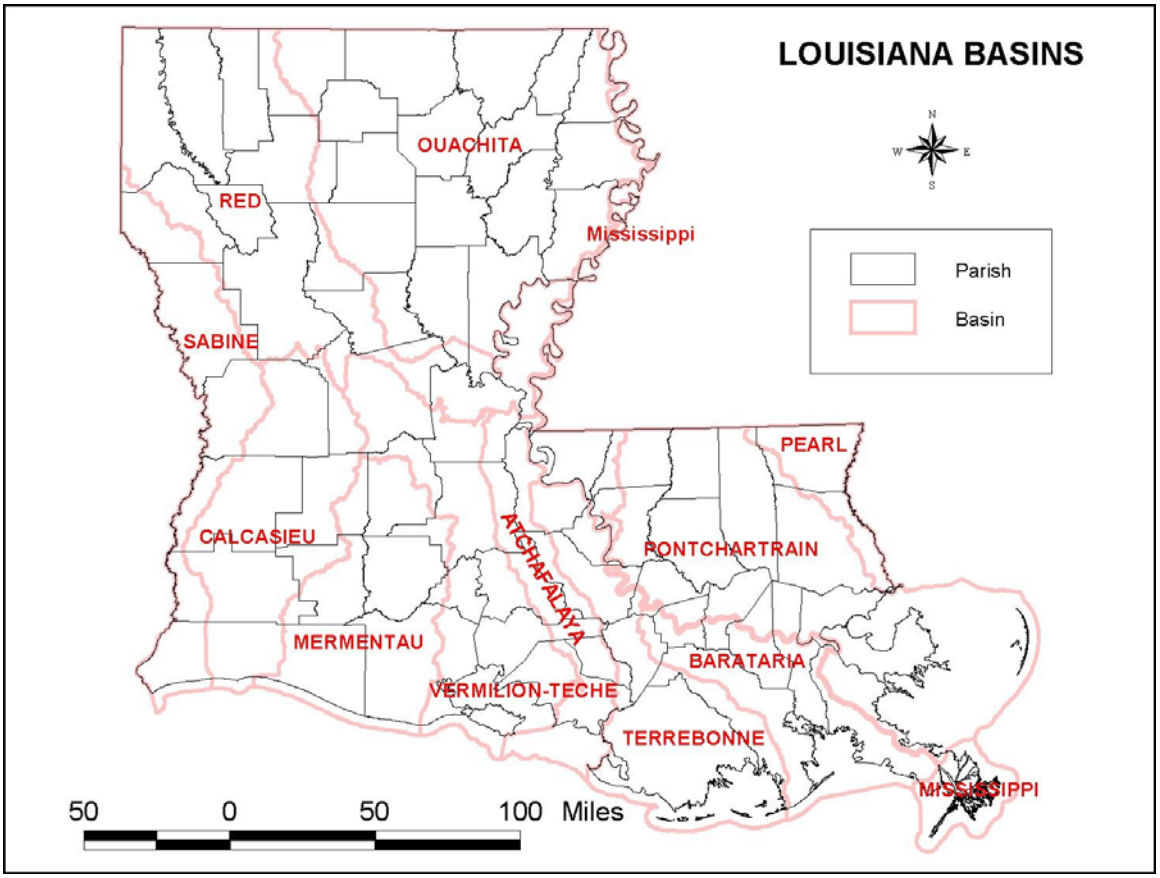

Figure 2.11. Aquatic basins in Louisiana.

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 Hardwood Forest 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 Salt 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 levee-created Batture lands, contains mostly bottomland hardwoods and a small amount of agricultural 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 Freshwater 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 the highest concentration of listed SGCN.

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 Hardwood Forests, and Brackish and Salt 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 that 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 Salt 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 Section (Fig. 2.12).

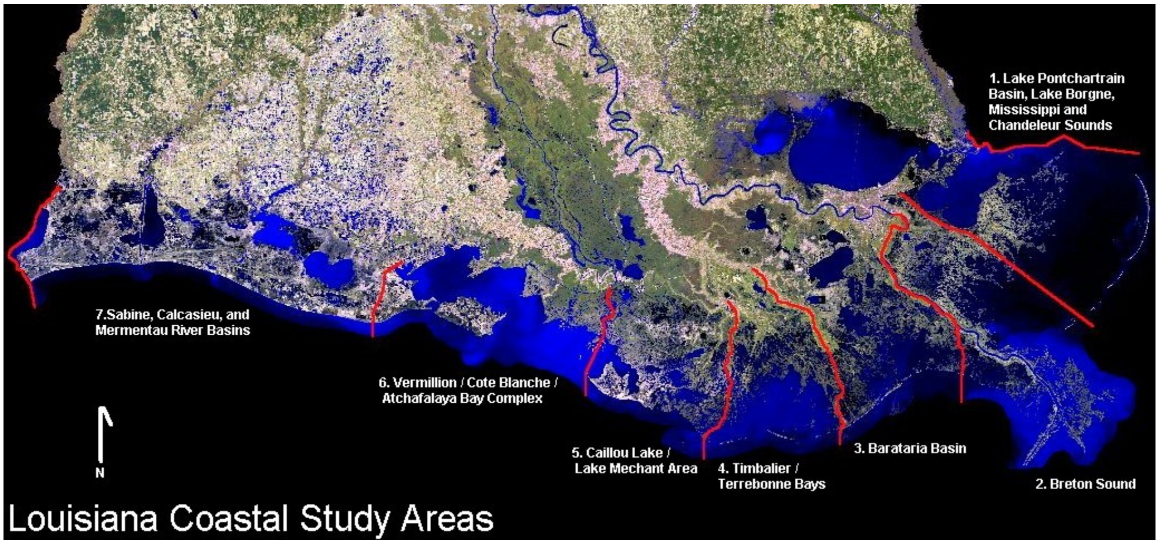

Figure 2.12. Louisiana’s coastal study areas.

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CHAPTER 3. APPROACH

The task of developing the WAP has been coordinated among LDWF staff from the Office of Wildlife and Office of Fisheries. 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. The revision of the WAP would not have been possible without their feedback.

A. Organizational Structure

1. Technical Committees

A. 2005 WAP

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

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

As elements of the WAP 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 shared a common commitment to ensuring the health and diversity of Louisiana's fish and wildlife resources.

B. 2015 WAP Revision

As in 2005, a core committee of LDWF staff (Appendix B) was formed to oversee the revision of the WAP. This committee included representatives from both the Office of Wildlife and Office of Fisheries and met monthly during the revision process to track progress and address emerging issues. This committee was responsible for reviewing each chapter of the 2005 WAP to identify any aspects of the WAP that required update. Additionally, this group was charged with developing additional chapters during the revision process. The core committee was also tasked with reviewing and editing each completed section of the revised WAP prior to agency-wide review. The core committee was also responsible for the development of SGCN ranking criteria discussed below.

In-house technical committees were also formed and focused on specific taxonomic groups, habitats, invasive species, climate change, and Conservation Opportunity Areas (Appendix B). These committees met as needed from 2012-2015.

2. Coordination with Other Government Agencies

A. 2005 WAP

Fifteen federal and state agencies were identified as having a potential role in the development of the WAP, and each was asked to designate a representative to be the primary contact for that agency. A list of those agencies and their representatives may be found in Appendix C.

B. 2015 WAP Revision

LDWF identified 26 government agencies as stakeholders in the development and implementation of the 2015 WAP (Appendix C). In 2015, those agencies were notified of the ongoing revision and were offered the opportunity to review and comment on the WAP prior to finalization. On June 15, 2015, the revised WAP was made available to all such agencies, and a 45-day window to submit input and feedback was provided. Once the 45-day window had closed, all comments were compiled and addressed, and the draft WAP was revised as needed to reflect the input of the other agencies, with additional consultation as required during this final revision process.

3. Public Involvement and Partnerships

A. 2005 WAP

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 in 2005 to inform the community of the WAP goals and to gather input. In order to garner further public involvement and develop partnerships, LDWF posted information about the WAP on its website (www.wlf.louisiana.gov), gave live television and radio interviews, and held statewide meetings to identify SGCN, 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 WAP were mailed to more than 40 non-government organizations (Appendix C).

B. 2015 WAP Revision

During the 2015 revision process, it was once again recognized that the Louisiana WAP would benefit from the input of both conservation partners and interested members of the general public. Therefore, the opportunity to provide input and comments was provided to 98 non-government organizations (Appendix C) following the same procedure as outlined above for federal and state agencies, including the same 45 day comment period.

Additionally, in order to afford the general public an opportunity to contribute to and comment on the revised WAP, the draft WAP was made available on the LDWF website http://www.wlf.louisiana.gov/wildlife/wildlife-action-plan. In order to inform the public about this opportunity, a press release was issued, and subsequently cross-posted onto LDWF's public media resources. After the comment period ended, all comments from the public were carefully reviewed and addressed as appropriate.

4. Cooperation with Other States

A. 2005 WAP

Meetings were held to coordinate development of the WAP, and to facilitate networking among states to solve WAP-related issues. LDWF also sponsored a meeting of adjacent states including Texas, Arkansas, and Mississippi to coordinate cross-border species and habitat issues.

B. 2015 WAP Revision

During the 2015 WAP revision process, neighboring states (Mississippi, Arkansas, and Texas) were afforded the opportunity to review and comment on the draft 2015 WAP. This was an important aspect of the revision process, as many of the conservation needs in Louisiana are shared with our border states and will best be addressed via a regional approach. Additionally, staff from LDWF attended two national Wildlife Action Plan summits during the revision process to facilitate coordination and consistency between all states for the 2015 WAPs.

B. Species of Greatest Conservation Need

1. Identifying SGCN

A. 2005 WAP

The primary focus of the WAP is Species of Greatest Conservation Need (SGCN), meaning those wildlife species, vertebrate and invertebrate, that show evidence of population declines within Louisiana. In order to ensure the long-term survival of SGCN and the habitats they depend upon, the 2005 plan focused on:

- Habitats in need of protection and restoration
- SGCN that depend upon these habitats
- Habitats that are presently secure but may be subject to future degradation and loss
- Species that are considered to be stable at the present but exhibit the potential for future population declines

The 2005 WAP followed 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 allowed for identification of those habitats subject to the greatest amount of stress/threats and most in need of conservation. It was anticipated that roughly 85%-90% of the species in Louisiana could be identified and protected within these habitats using this method (Hartley et al. 2000). The fine filter approach allowed 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 SGCN list for the WAP 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 LDWF Louisiana Natural Heritage Program (LNHP), assigns ranks to the state's natural communities, vascular and nonvascular plants, vertebrate, and invertebrate species. Each species or community is assigned a state rank (S1 to S5; Appendix D) 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, which represents the Natural Heritage Network (public-private network of independent heritage organizations) 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 formed the base list for the SGCN list in the 2005 WAP.

The 2005 WAP focused on those species that were experiencing population declines in Louisiana and in need of immediate conservation attention. In addition, the strategy focused on those species that are migratory (primarily birds, butterflies, and, to a lesser extent, marine mammals) and used habitats within Louisiana during some part of their life cycle. With regard to terrestrial and aquatic invertebrates, the strategy focused on butterflies, crawfish, and mussels in this first iteration. It was intended that future iterations of this strategy would attempt to construct conservation strategies for other groups of terrestrial and aquatic invertebrates in greater detail. However, it was expected that management strategies developed for the current taxonomic groups and their habitats would provide some benefit to terrestrial and aquatic invertebrates not mentioned in the first iteration of the WAP. The following criteria were used in the SGCN identification process in 2005:

- Species classified as state SGCN (S1-S2-S3)
- Species that were globally ranked as G1, G2, or G3
- Species that had 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 Management Plan
- Species which are locally endemic

The draft species list was developed and distributed to seven technical expert committees for review. These committees also provided input regarding species distributions by habitat type within Louisiana. No attempt was made to prioritize SGCN within the overall list in 2005.

B. 2015 WAP Revision

The SGCN list from the 2005 WAP was the starting point for the 2015 SGCN list. This list was reviewed internally by the taxonomic committees (Appendix B), and SGCN were suggested for removal or addition, as deemed appropriate. An effort was also made to reconcile differences between the SGCN list and the LNHP tracked species list, as many tracked (i.e., rare) species had not been included on the 2005 SGCN list. Once the in-house taxonomic committees had completed an initial revision of the SGCN lists, as well as Research Needs and Conservation Strategies for those SGCN, the information was provided to subject-matter experts outside of LDWF for their review and input. In total, the revised SGCN lists were sent to more than 100 taxonomic experts, and 42 responses were received (see Appendix E for a list of all respondents). Once all of the outside reviewer input had been compiled, the in-house committees met to discuss the recommendations of those experts and revise the SGCN lists accordingly. This proved to be a valuable process, as the external feedback resulted in SGCN being added to the list, as well as changes to the conservation status of multiple SGCN. Finally, during the internal LDWF review process, the SGCN list was further refined prior to the public and partner comment period.

A concerted effort was made during the 2015 WAP revision to consider invertebrate species for inclusion on the SGCN list. This included terrestrial and aquatic insects, arachnids, freshwater and marine crustaceans, and freshwater and marine mollusks. Additionally, although plants are not eligible for funding under the SWG program, LNHP staff used alternative funding to develop and include a list of plant SGCN, for two primary reasons. First, these species are in as much, if not more, need of conservation as many of the animal SGCN, and it is hoped that including these species in the WAP will raise their conservation profile. Secondly, by including these species in the 2015 WAP, the needed information will already be at hand in the event that these species become eligible for SWG in the future, or an alternative funding mechanism is identified.

2. Species Prioritization Process

A. 2015 WAP Revision

During the 2015 WAP revision process, a mechanism to prioritize SGCN was developed. The WAP is intended to provide guidance for the conservation of hundreds of different SGCN, as well as the natural communities that support those SGCN. However, since the completion of the 2005 WAPs, there has been a need for greater prioritization of SGCN (AFWA 2011), in order to allow state fish and wildlife agencies to more effectively plan conservation actions and to allocate limited funding to those SGCN that are most in need of conservation attention. Many different methods have been used by states to prioritize SGCN, with many states, including Louisiana, not prioritizing SGCN during the 2005 planning process. For this revision, LDWF has developed a set of Ranking Criteria (Table 3.1) that were applied to all SGCN. The Ranking Criteria generated a total score for each species that ranged from a minimum of 2 points to a maximum of 26 points. Once each SGCN had a total score, the interquartile of the range of scores were determined and were used to separate the SGCN into 3 Tiers within each taxonomic group. For each taxonomic group there are Tier I, Tier II, and Tier III SGCN. Those SGCN that were determined as Tier I, all else being equal, should be prioritized for conservation action over Tier II SGCN, and Tier II SGCN should likewise be prioritized over Tier III SGCN.

Table 3.1. Ranking Criteria for Louisiana SGCN

Criterion	Choices	Point Value
Global Rarity Rank		
	G1-G2	2
	G3-G4	1
	G5	0
State Rarity Rank		
	S1-S2 (and SH/SX)	6
	S3	4
	S4 (and SU)	2
	S5 (and SZ)	1
Eligibility for Other Funding		
	Not Eligible	3
	Endangered Species Funding	2
	Wildlife/Sport Fish Restoration	0
% of Population/Range in LA		
	80%-Endemic	6
	50-79%	4
	25-49%	2
	1-24%	1
Population Trend		
	Declining	3
	Unknown	2
	Stable	1
	Increasing	0
Knowledge Level in LA		
	Low	2
	Moderate	1
	High	0
Dependent on Rare/Vulnerable Habitat		
	Yes	2
	No	0
Climate Change Vulnerability		
	Extremely/Highly Vulnerable	2
	Moderately Vulnerable	1
	Not Vulnerable	0

C. Habitats

1. Identifying Important Habitats for SGCN Conservation

A. 2005 WAP

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

- Their importance to SGCN
- Threats facing each habitat
- The habitat's viability

Once this was is accomplished the habitats were then ranked.

The habitat types within the state were separated into terrestrial and aquatic systems. Separate categories allowed for a thorough review of habitats within the two systems and facilitated implementation of conservation actions based on similarity of management techniques and strategies. Terrestrial systems included all habitat types (wetlands and uplands) that were deemed important to birds, mammals, amphibians, reptiles, and butterflies. Aquatic systems included the bayous, streams, rivers, marshes, and lakes and bays that were deemed important to fish, mussels, crustaceans, and aquatic 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, created by TNC to address the needs of their conservation planning and programs, 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.

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. 2.11). 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/shell hash 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.

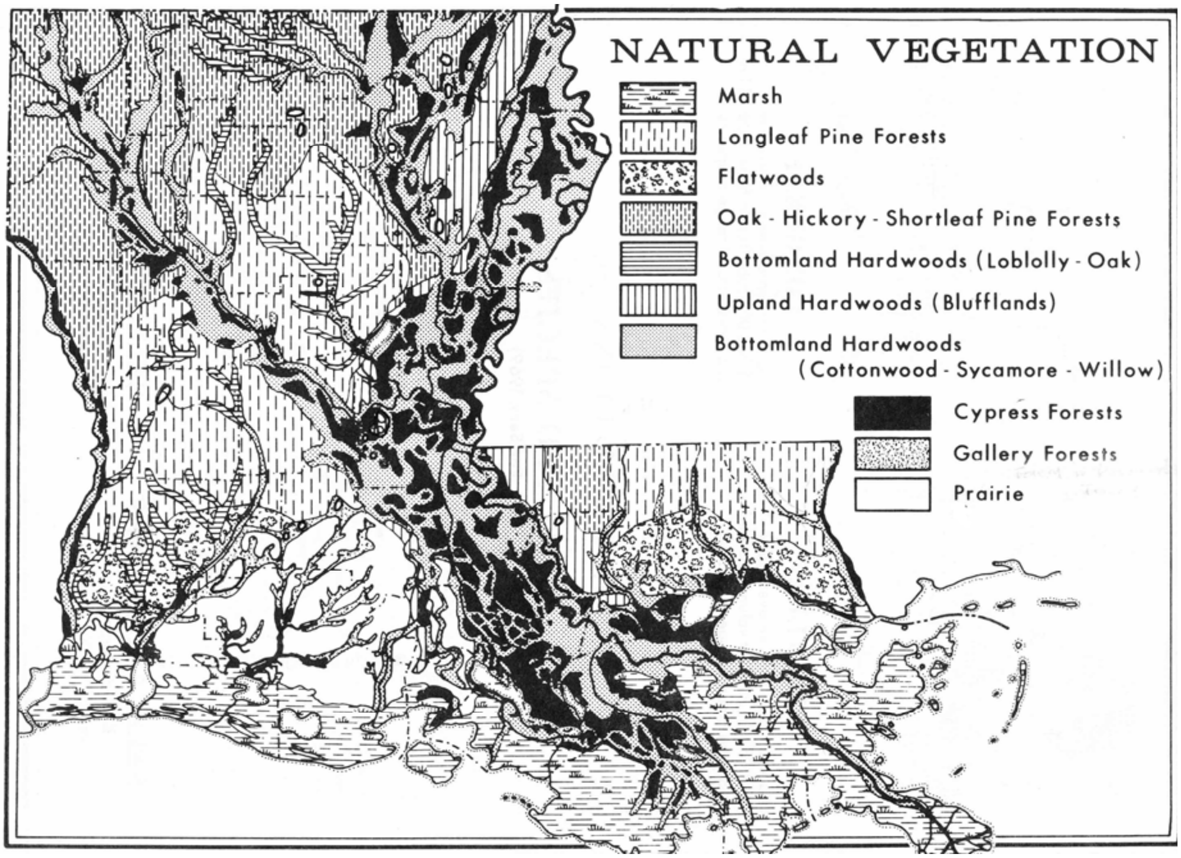

Figure 3.1. Primary natural vegetation types and presettlement distribution in Louisiana (Newton 1972).

B. 2015 WAP Revision

As with the SGCN list, the list of habitats from the 2005 WAP was the starting point for the revised list. The initial revision of the list was undertaken by the LDWF internal habitat committee (Appendix B).

No habitats from the 2005 list were removed. Additional habitats that were overlooked in 2005 were added, and some habitats were either split out of existing habitat types, or lumped together with other habitats, as appropriate. A total of 58 habitats, 12 river basins, and 5 marine substrate types are treated in the 2015 WAP.

Each habitat (or basin or substrate type) treatment was extensively reviewed and revised, and new treatments were written for those habitats that were added to the WAP. Threats (see below), research and survey needs, conservation strategies, and associated SGCN were also revised for each habitat or basin by internal committees, and then made available to partners and public for input during the comment period.

2. Prioritizing Habitats Important for SGCN Conservation

A. 2005 WAP

Conservation actions or strategies were developed for each terrestrial habitat and key SGCN 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 were intended to allow LDWF to direct conservation efforts to those wildlife habitats and associated species of concern that needed the most attention, and would 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 European 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.

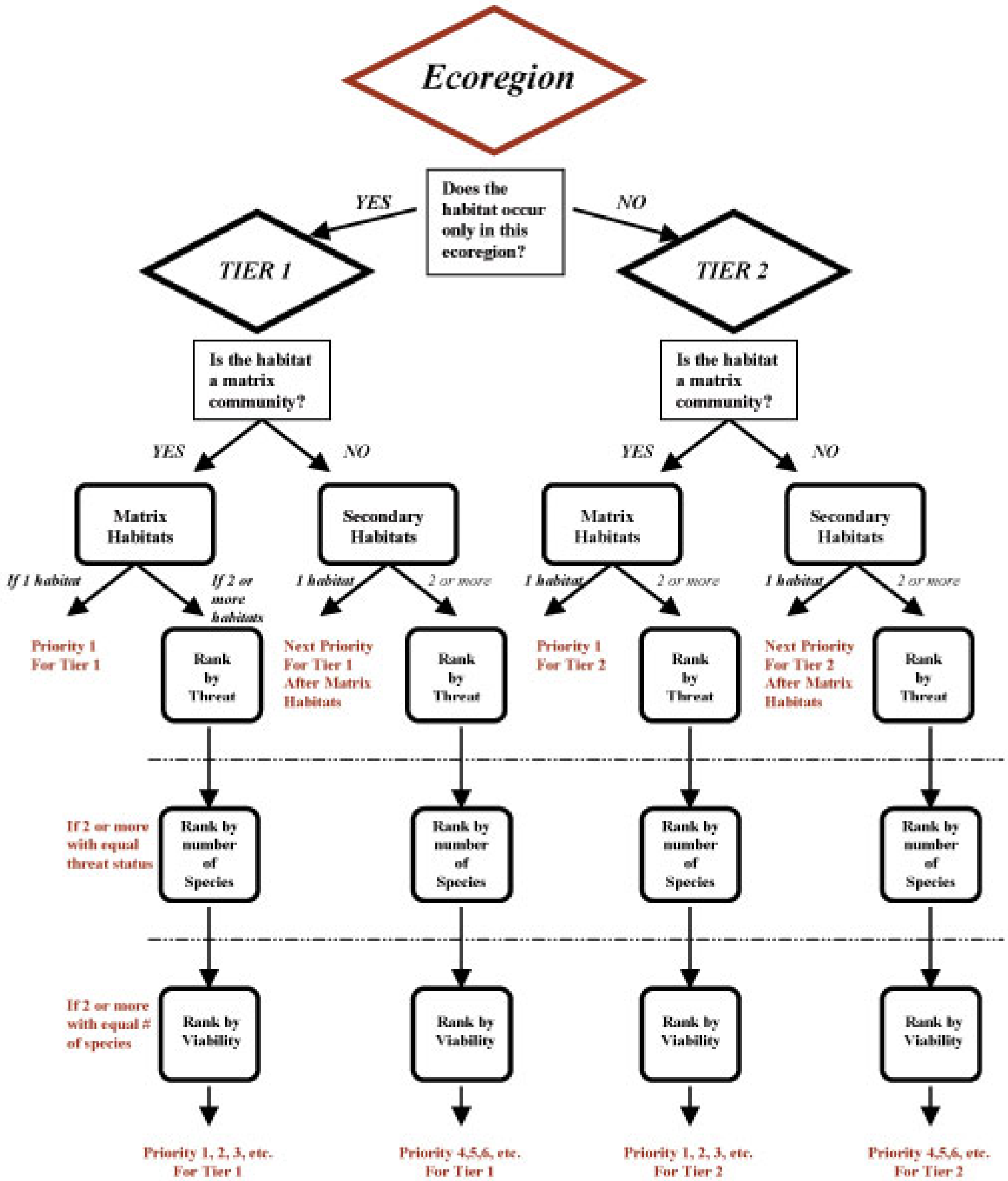

Chart 3.1. Terrestrial habitat prioritization process flowchart.

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

Those habitats with good viability had first preference, followed by rankings of fair and poor viability. 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 SGCN utilize this habitat type, strategies were developed to address threats to the habitat, and conservation actions were planned to implement the strategies.

Establishing priorities within aquatic habitats was difficult due to the overall lack of ecological and biological information for the majority of aquatic habitats and associated SGCN. With the first iteration in 2005, development of a priority process was not possible due to data gaps. Therefore, the highest priority for freshwater and marine systems was to initiate and support research on species assemblages to determine their ecological and biological needs.

B. 2015 WAP Revision

A habitat prioritization calculator (Table 3.2) was created to enable the most effectual expenditure of resources for habitat conservation. Criteria in this tool include rarity ranks, threats, historical and current estimated extents, ecological understanding, and number of associated SGCN. For rarity ranks, both global and state ranks are taken into consideration. Since the WAP is Louisiana-specific, state ranks are weighted more heavily than global ranks. Threats status is expressed in four levels (low, medium, high, very high) based on the threats assessment using the NatureServe Conservation Status Assessments: Rank Calculator, Version 3.186. The point values received by habitats experiencing high and very high levels of threat are two and three, respectively. These values are modest because the threats assessment protocol considers remaining habitat, not historical habitat loss, such that occurred during large-scale conversion to agriculture. Estimated historical extent and current remaining extent levels and values are based largely on Smith (1993). For estimated historical extent, the scale is curved to weight broad-scale (matrix) habitats and historically rare habitats more heavily than habitats of intermediate historical aerial coverage. This was done to increase conservation emphasis on matrix habitats while also accounting for small-scale habitats, many of which are unique and very diverse (e.g. hillside seepage bogs). Level of knowledge regarding identity and ecological processes varies among Louisiana’s habitats. A criterion accounting for this is included to provide a slight increase in emphasis on habitats that are poorly understood. The final criterion for habitat prioritization is number of SGCN associated with each habitat, which is expressed in five classes.

Table 3.1 Habitat Prioritization Criteria

Criterion	Levels	Point Values
Global Rarity Rank	G1-G2	2
	G3	1
	G4-G5	0
	Not Ranked	1
State Rarity Rank	S1-S2 (SH/SX)	6
	S3	4
	S4	2
	S5	1
Threat Status	Very High	3
	High	2
	Medium	1
	Low	0
Historical Extent (acres)	>4 M	5
	1-4 M	4
	100K – 1 M	3
	10K – 100K	4
	<10K	5
Percent of Habitat Remaining	≤5%	6
	6-25%	3
	26-50%	2
	51-75%	1
	>75%	0
Ecological Knowledge Level	Poorly known	2
	Moderately known	1
	Well understood	0
Number of SGCN	>75	8
	51-75	6
	26-50	4
	10-25	2
	<10	1

D. Threats Assessments to Species of Greatest Conservation Need and Related Habitats

A. 2005 WAP

1. Threats to SGCN 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. 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. During 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 on Louisiana's wildlife and associated 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 WAP Habitat Assessment Committee. 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 2.2). 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.

2. 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 that 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 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.

3. 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/reservoir 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

B. 2015 WAP Revision

For the 2015 WAP Revision, it was decided that, as recommended in the AFWA Best Practices document (AFWA 2011), that the standard threats lexicon described in Salafsky et al. 2008 would be adopted. The lexicon described by Salafsky et al. (2008) is a hierarchical system, in which there are multiple threat levels. The most general, or 1^{st} level, threats are comprehensive, as are the 2^{nd} level threats, which have a higher degree of specificity than do the 1^{st} level threats. For a complete list of 1^{st} and 2^{nd} threats presented in the standard lexicon, see Appendix F. For each habitat and basin treated in the 2015 WAP, 1^{st} and 2^{nd} level threats were assessed utilizing the NatureServe Conservation Status Assessment Rank Calculator (Version 3.186), as there is a threats calculator within that tool that incorporates the standard terminology of Salafsky et al. 2008.

Once all relevant 1^{st} level threats had been assessed for a given habitat (or basin), a formula was developed that took the calculated threat impact for each of those threats (determined by scope and severity) and assigned a point value for each threat that was calculated to be low impact (1 point), medium impact (2 points), high impact (3 points), and very high impact (4 points). Once this process had been completed for all habitats, the range of scores was analyzed to assign an overall threat impact to each habitat, based on the following breakdown of those scores:

- Very High – this category included those habitats with a threat score in the top 10% of all scores.
- High – this category included the next highest 15% of all scores.
- Medium – this category included the middle 50% of all scores.
- Low – this category included the bottom 25% of all scores.

E. Identifying Priority Subbasins for Conservation Opportunity Areas

A prioritization method is described here for assigning scores to 4-digit subbasins (developed by Louisiana Department of Environmental Quality) in Louisiana (see LDEQ 2004). These subbasins are hierarchically nested watersheds that drain larger river basins (e.g., Lake Pontchartrain or Calcasieu River Basins). To prioritize stream and tidal subbasins, only species ranked S1-S3 were used to assign scores to subbasins

First, a count was made for each of the 4-digit subbasins from LDEQ (2004) of all S1-S3 species of each taxonomic group. Using Natureserve.org and other distribution lists from various texts (e.g., *Inland Fishes of Mississippi*, *Crawfishes of Louisiana*, *Fishes of Arkansas*, *Fishes of Texas*), museum collections (e.g., Tulane Museum of Ichthyology, Fishnet2.net) and fisheries-independent data collected by LDWF (e.g., trawl, seine, gill net, electrofishing samples). A count was made for every species that occurred in that subbasin, based on the aforementioned sources, as well as expert opinion. Second, counts were categorized by S1 rank. This means that counts were made separately for S1 species, S2 species and S3 species.
Third, scores were calculated for each subbasin based on the number of S1, S2, and S3 species. For each subbasin, the total number of species from each S-rank was multiplied by a prioritization factor. For S1 species, the total number was multiplied by 3. For S2 species, the total number was multiplied by 2, and for S1 species the total number was multiplied by 1. This gave greater weights to those subbasins that supported rarer species. The scores for each subbasin were then summed across each S-rank to get a total score for that subbasin.

Lastly, the distribution of total scores was divided into five levels based on percentiles to create categories of relative priority. The five levels were as follows:

- Level 1 – Top 5% of scores
- Level 2 - Next 10% of scores
- Level 3 – Next 10% of scores
- Level 4 – Next 25% of scores
- Level 5 – Bottom 50% of scores

The first three levels were used in the creation of Conservation Opportunity Areas.

References

LDEQ (Louisiana Department of Environmental Quality). 2004. Basin Subsegments from LDEQ source data, Geographic NAD83, LOSCO (2004) [basin_subsegments_LDEQ_2004]: Louisiana Department of Environmental Quality, Baton Rouge, LA. <http://lagic.lsu.edu/data/losco/basin_subsegments_LDEQ_2004.zip>

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CHAPTER 4. SPECIES OF GREATEST CONSERVATION NEED

A. Species of Greatest Conservation Need

The primary focus of the Louisiana WAP is Species of Greatest Conservation Need (SGCN)**,** meaning those wildlife species that are in need of conservation action within Louisiana. SGCN may be species for which population declines have been documented, declines are suspected, that may be subject to declines within the next 10 years, or for which more data is needed in order to accurately determine their status. The identification of SGCN is Element #1 of the 8 Required Elements for State WAPs. This Chapter also addresses Elements # 3 (Priority research and survey needs for SGCN) and # 4 (Description of conservation actions necessary to conserve SGCN).

For details on the approach LDWF used to generate the SGCN list for the 2005 WAP as well as the approach used to revise the 2005 SGCN list during the 2015 revision, please refer to Chapter 3 (Approach). This Chapter contains the updated SGCN list for Louisiana, broken down by taxonomic group. For a complete list of SGCN in taxonomic order, see Appendix H. Within each taxonomic group the SGCN are broken into 3 Tiers, with Tier 1 containing those species that are most in need of conservation action. For detailed information on the factors and methodology used to determine these Tiers, please see Chapter 3. Research needs and conservation actions that have been developed for Louisiana SGCN can be found in section B below.

B. SGCN, Research Needs, and Conservation Actions

There are a total of 342 animal SGCN identified in this 2nd iteration of the Louisiana WAP, compared to 240 SGCN in the 2005 WAP. Ultimately, twenty-five SGCN identified in the 2005 WAP were removed from the list, and 126 SGCN were added. Almost half (61) of the newly identified SGCN are invertebrates, reflecting the fact that a more consistent effort to identify these species was made. Specific research needs and conservation actions are presented below for many SGCN. However, these actions are not exhaustive and are not intended to be interpreted as the only conservation priorities for these species.

1. Mollusks

North American freshwater mussels (Families Unionidae and Margaritiferidae) are currently one of the world's most imperiled taxonomic groups (Master et al. 2000). There are approximately 300 species of mussels recognized in the United States (Williams et al. 2008). The southeastern United States contains the greatest species diversity with around 270 species, of which at least 64 species (~ 21% of the U.S. total) are currently known to occur in Louisiana (Neves et al. 1997). Of these, 26 species are ranked as critically imperiled or imperiled in the state by the LNHP (2015). Federally-listed species include Rabbitsfoot, Pink Mucket (USFWS 1976), Fat Pocketbook (USFWS 1989), Inflated Heelsplitter (USFWS 1992), and Louisiana Pearlshell, the only mussel species endemic to Louisiana (USFWS 1989b). In addition to 33 freshwater mussels, there is 1 aquatic and 1 terrestrial snail included on the SGCN list. Finally, 5 marine mollusks are included due to their dependence on highly restricted habitats within Louisiana. At least 3 of the 5 marine mollusk SGCN are currently known only from Seagrass Beds at the Chandeleur Islands.

A. Mollusk SGCN

Common Name	**Scientific Name**	**G-Rank**	**S-Rank**
Tier I			
Sandbank Pocketbook	*Lampsilis satura*	G2	S2
Black Sandshell	*Ligumia recta*	G4G5	S1
Louisiana Pearlshell	*Margaritifera hembeli*	G1	S1
Southern Hickorynut	*Obovaria jacksoniana*	G2	S1S2
Pyramid Pigtoe	*Pleurobema rubrum*	G2G3	S2
Inflated Heelsplitter	*Potamilus inflatus*	G1G2Q	S1
Bay Scallop	*Argopecten irradians*	G5	S1
Sawtooth Pen Shell	*Atrina serrata*	G5	S1
Half-Naked Pen Shell	*Atrina seminuda*	GNR	S1
Tier II			
Butterfly	*Ellipsaria lineolata*	G4G5	S1
Pink Mucket	*Lampsilis abrupta*	G2	S1
Plain Pocketbook	*Lampsilis cardium*	G5	S1
Fatmucket	*Lampsilis siliquoidea*	G5	S2
White Heelsplitter	*Lasmigona complanata*	G5	S1
Hickorynut	*Obovaria olivaria*	G4	S1
Alabama Hickorynut	*Obovaria unicolor*	G3	S1
Mississippi Pigtoe	*Pleurobema beadleianum*	G3	S2
Louisiana Pigtoe	*Pleurobema riddellii*	G1G2	S1S2
Ouachita Kidneyshell	*Ptychobranchus occidentalis*	G3G4	S1
Rabbitsfoot	*Quadrula cylindrica*	G3G4	S1
Monkeyface	*Quadrula metanevra*	G4	S1
Southern Creekmussel	*Strophitus subvexus*	G3	S1
Silty Hornsnail	*Pleurocera canaliculata*	G5	S2
Channeled Whelk	*Busycotypus canaliculatus*	GNR	S1
Lightning Whelk	*Busycon contrarium*	GNR	S1
Tier III			
Mucket	*Actinonaias ligamentina*	G5	SH
Rayed Creekshell	*Anodontoides radiatus*	G3	S2
Western Fanshell	*Cyprogenia aberti*	G2G3Q	SH
Elephant-Ear	*Elliptio crassidens*	G5	S3
Spike	*Elliptio dilatata*	G5	S2S3
Ebonyshell	*Fusconaia ebena*	G4G5	S3
Southern Pocketbook	*Lampsilis ornata*	G5	S3
Texas Heelsplitter	*Potamilus amphichaenus*	G1G2	SH

Fat Pocketbook	*Potamilus capax*	G2	S1
Creeper	*Strophitus undulatus*	G5	S2
Southern Rainbow	*Villosa vibex*	G5Q	S2
Texas Pigtoe	*Fusconaia askewi*	G2G3	S3
Round Pearlshell	*Glebula rotundata*	G4G5	S4
Fawnsfoot	*Truncilla donaciformis*	G5	S3
Flamed Tigersnail	*Anguispira alternata*	G5	S1

B. Mollusk Research and Survey Needs

- Surveys are needed to update historic occurrence records and obtain baseline data on current distribution and abundance of all mussel SGCN, particularly in the Red River, Bayou Bartholomew, Tensas River, and any areas not surveyed within the last decade.

- Continue research to determine the host fish of mussel SGCN to aid in effective conservation.

- Continue monitoring of mussel SGCN in streams impacted by pollution events.

- Continue to discourage the creating of weirs, dams, and reservoirs on streams and rivers supporting mollusk SGCN.

- Develop and implement standard monitoring protocols for mollusk SGCN.

- Delineate marine mollusk habitat at the Chandeleur Islands.

<u>Black Sandshell, Western Fanshell, Fat Pocketbook, Rabbitsfoot, Pink Mucket</u>

- Intensive targeted surveys are needed to determine current status, distribution, population size, and threats.

<u>Louisiana Pearlshell</u>

- Continue to implement a long term monitoring protocol for existing populations, with an added emphasis on those occurring on private lands.

<u>Pen Shells, Whelks, and Bay Scallop</u>

- Conduct surveys to document the current status and distribution of these and other marine mollusks at the Chandeleur Islands.

<u>Flamed Tigersnail</u>

- Surveys are needed to determine the current status and distribution of this species.

Silty Hornsnail

- Surveys are needed to determine the current status and distribution of this species.

Western Fanshell, Mucket, Texas Heelsplitter

- Surveys are needed to determine if these species are extant in Louisiana.

Alabama Hickorynut and Mississippi Pigtoe

- Targeted surveys are needed to determine the current status and distribution of these species.

C. Mollusk Conservation Actions

- Partner with the Natchitoches Fish Hatchery to develop propagation and restocking techniques and begin restocking efforts where needed.

- Work with parishes and DOTD to minimize impacts of road/bridge/culvert construction and replacement on stream quality.

- Partner with parishes to encourage the retention of riparian buffers and discourage stream clearing for storm drainage.

- Work with timber companies to encourage placement of streamside management zones within actively managed areas.

- Maintain in-stream flows at levels that will support populations of rare mussels.

- Promote conservation and restoration of the Chandeleur Islands and adjacent, shallow-water habitats, such as SAV beds, which are important to marine mollusks.

- Take steps to limit or restrict the use of ORVs in streams.

- Work with DOTD, Parishes, and other partners to install oversized culverts below grade to allow for passage of host fish.

Inflated Heelsplitter

- Work with the Scenic Rivers Program to prevent negative impacts from sand and gravel mining in the Florida Parish rivers.

Louisiana Pearlshell

- Partner with USFWS to implement the Louisiana Pearlshell Recovery Plan date.

- Work with landowners to implement BMPs to improve water quality in streams inhabited by Louisiana Pearlshell.

2. Crustaceans

There are 338 crawfish species in the United States, with the southeast being the world's hotspot for crawfish diversity (Taylor et al. 1996). Thirty–five crawfish species are known to occur in Louisiana (Walls 2009). Twenty of these crawfish species are considered critically imperiled, imperiled, or rare and local by the LNHP (2015), including at least five endemic or apparently endemic species; the Teche Painted Crawfish, Calcasieu Painted Crawfish, Ouachita Fencing Crawfish, Caddo Chimney Crawfish, and Calcasieu Creek Crawfish. Population viability of many of these 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 extirpation or extinction (Taylor et al. 1996). In addition to crawfish, 4 species of shrimp are included on the SGCN list, primarily due to a lack of data for these species.

A. Crustacean SGCN

Common Name	Scientific Name	G-Rank	S-Rank
Tier I			
Calcasieu Painted Crawfish	*Orconectes blacki*	G2	S1
Caddo Chimney Crawfish	*Procambarus machardyi*	G1G2	S1
Pine Hills Digger	*Fallicambarus dissitus*	G4	S2
Tier II			
Teche Painted Crawfish	*Orconectes hathawayi*	G3	S3
Kisatchie Painted Crawfish	*Orconectes maletae*	G2	S2
Ribbon Crawfish	*Procambarus bivittatus*	G5	S2
Javelin Crawfish	*Procambarus jaculus*	G4	S1
Elegant Crawfish	*Procambarus elegans*	G4	S2
Twin Crawfish	*Procambarus geminus*	G3G4	S2
Old Prairie Digger	*Fallicambarus macneesei*	G3	S2
Flatwoods Digger	*Fallicambarus oryktes*	G4	S2
Sabine Fencing Crawfish	*Faxonella beyeri*	G4	S2
Ouachita Fencing Crawfish	*Faxonella creaseri*	G2	S2
Calcasieu Creek Crawfish	*Procambarus pentastylus*	G3	S3
Pearl Blackwater Crawfish	*Procambarus penni*	G3	S3
Flatnose Crawfish	*Procamabarus planirostris*	G4	S3

Pontchartrain Painted Crawfish	*Orconectes hobbsi*	G4Q	S3
Southwestern Creek Crawfish	*Procambarus dupratzi*	G5	S2
Tier III			
Vernal Crawfish	*Procambarus viaeviridis*	G5	S1
Gulf Crawfish	*Procambarus shermani*	G4	S2
Beach Ghost Shrimp	*Callichirus islagrande*	GNR	SU
Carolinian Ghost Shrimp	*Callichirus major*	GNR	SU
Peppermint Shrimp	*Lysmata wurdemanni*	GNR	SU
Estuarine Ghost Shrimp	*Lepidophthalmus louisianensis*	GNR	SU

B. Crustacean Research and Survey Needs

- Research is needed on the life history strategies of all crawfish SGCN. Specific research needs include:
    - Size/age at maturity, longevity, and survivorship.
    - Habitat requirements & preferences, including microhabitat preferences.
    - Population estimates & trends.
    - Reproductive ecology (including fecundity & behavior of ovigerous ("in berry") females).
    - Behavior, including migratory patterns, competition, and niche partitioning.

- Conduct drainage-wide surveys for all crawfish SGCN, including surveys beyond bridge crossings and historical localities.

- Research is needed to determine the appropriate in-stream characteristics that should be targeted during stream restoration activities (dissolved oxygen levels, depth, flow, canopy cover, submerged structure).

- Research is needed to examine the feasibility of providing artificial cover in areas devoid of sufficient cover.

- Lab studies are needed to determine the lethal levels of common pollutants on crawfish.

- Monitor streams and other occurrences of rare crawfishes for the presence of non-native crawfishes.

- Occurrences should be monitored for signs of disease.

- Develop standard sampling protocols for monitoring known occurrences of rare crawfishes to track population trends and improve understanding of population dynamics.

- Research is needed to evaluate current habitat threats and develop strategies to abate those threats.

- Investigate the impacts of Chinese Tallow on Ephemeral Pond dwelling rare crawfishes.

C. Crustacean Conservation Actions

- Work with parishes, highway departments, and DOTD to minimize negative impacts of new stream crossings.

- Work with partners to replace culverts with submerged culverts to benefit crawfish and other aquatic species.

- Work with landowners and NRCS to encourage the retention of riparian buffers.

- Ensure the presence of adequate cover (wood, vegetation, artificial debris) in streams known to harbor rare crawfish.

- Maintain in-stream flows and water depths at levels that will support populations of rare crawfish.

- Degraded streams within the known range of one or more rare crawfish should be targeted for experimental restoration.

- Education/outreach materials should be developed concerning the unique native crawfishes of Louisiana, and the potential threats posed by non-native crawfishes and habitat degradation.

- Ephemeral wetlands should be protected & restored for the benefit of primary and secondary burrowing species.

- Encourage the retention of vegetation in known ditch occurrences of rare crawfishes.

- Develop Habitat Suitability Indices for rare crawfishes.

<u>Pine Hills Digger and Flatwoods Digger</u>

- Continue efforts to protect and restore mesic/wet open pine systems.

3. Insects and other Arthropods

Unlike many more well-known taxa, there is no readily available number of species of insects or other non-crustacean arthropods in Louisiana. Fifty-seven insects are included as SGCN, along with 1 spider and 1 scorpion. For the majority of these SGCN, the primary need is baseline data, as this group is the most poorly known of Louisiana’s fauna. Indeed, attempts to engage subject-matter experts for this taxonomic group resulted in very limited feedback. The list of butterfly SGCN from the 2005 WAP, along with the list of insects currently tracked by the LNHP, form the backbone of this list. Baseline studies of these taxa to address data gaps may lead to large-scale revision of this list for the next iteration of the WAP.

A. Insect SGCN

Common Name	**Scientific Name**	**G-Rank**	**S-Rank**
Tier I			
Yellow Brachycercus Mayfly	*Brachycercus flavus*	G4Q	S2
Pitcher Plant Spiketail	*Cordulegaster sarracenia*	G1	S1
Texas Emerald	*Somatochlora margarita*	G2	S2
Louisiana Needlefly	*Leuctra szczytkoi*	G2	S1
Comanche Harvester Ant	*Pogonomyrmex comanche*	G2	S2
Schoolhouse Springs Net-spinning Caddisfly	*Diplectrona rossi*	G1	S1
Spring-loving Psiloneuran Caddisfly	*Agarodes libalis*	G3	S1
Bay Skipper	*Euphyes bayensis*	G2	S1
Louisiana Eyed Silkmoth	*Automeris Louisiana*	G1G3	S1
Tier II			
Southern Unstriped Scorpion	*Vaejovis carolinianus*	G5	S1
Hodges Clubtail	*Gomphus hodgesi*	G3	S1
Southern Snaketail	*Ophiogomphus australis*	G1G2	S1
Texas Forestfly	*Amphinemura texana*	G3	S3
Masked Springfly	*Helopicus bogaloosa*	G3	S2
Eastern Beach Tiger Beetle	*Cicindela dorsalis venusta*	G4T3T4	S2
Sandbar Tiger Beetle	*Cicindela blanda*	G3G4	S3
Cajun Tiger Beetle	*Cicindela pilatei*	G4	S3
Saline Prairie Scarab Beetle	*Ataenius robustus*	GNR	S1
Little Dubiraphian Riffle Beetle	*Dubiraphia parva*	G1G3	S1
Six-banded Longhorn Beetle	*Dryobius sexnotatus*	GNR	S1
Florida Harvester Ant	*Pogonomyrmex badius*	G5	S1
Morse's Net-spinning Caddisfly	*Cheumatopsyche morsei*	G1G3	S1
Holzenthal's Philopotamid Caddisfly	*Chimarra holzenthali*	G1G2	S1
Ceraclean Caddisfly	*Ceraclea spongillovorax*	G3G4	S2
Molson's Microcaddisfly	*Hydroptila molsonae*	G2G3	S1
Schoolhouse Springs Purse Casemaker Caddisfly	*Hydroptila ouachita*	G1G2	S1
Hydroptilad Caddisfly	*Hydroptila poirrieri*	G2	S2
Creole Pearly Eye	*Enodia creola*	G3G4	S3
Georgia Satyr	*Neonympha areolata*	G3G4	S3
Wild Indigo Duskywing	*Erynnis baptisiae*	G5	S2S3

Lace Winged Roadside Skipper	*Amblyscirtes aesculapius*	G3G4	S3
Dusky Roadside Skipper	*Amblyscirtes alternata*	G2G3	S2S3
Celia's Roadside Skipper	*Amblyscirtes celia*	G4	SU
Arogos Skipper	*Atrytone arogos*	G3	S1
Dusted Skipper	*Atrytonopsis hianna*	G4G5	S3
Palatka Skipper	*Euphyes pilatka*	G3G4	S1
Dion Skipper	*Euphyes dion*	G4	SU
Obscure Skipper	*Panoquina panoquinoides*	G5	S1
Meske's Skipper	*Hesperia meskei*	G3G4	S1
Western Pygmy Blue	*Brephidium exile*	G5	S1S2
Eastern Pygmy Blue	*Brephidium pseudofea*	G5	S1S2
Gulf Pine Sphinx	*Lapara phaeobrachycerous*	G3G4	S3
A Noctuid Moth	*Bagisara brouana*	G3	S3
Brou's Underwing	*Catocala atocala*	G3G4	S1S2
Tier III			
Texas Brown Tarantula	*Aphonopelma hentzi*	GNR	S3
White Sand Tiger Beetle	*Cicindela wapleri*	G3G4	S2S3
American Bumblebee	*Bombus pensylvanicus*	G3G4	S3S4
Frosted Elfin	*Callophrys irus*	G3	S2S3
Little Metalmark	*Calephelis virginiensis*	G4	S4
Mottled Duskywing	*Erynnis martialis*	G3	S3
Pepper and Salt Skipper	*Amblyscirtes hegon*	G5	SU
Cobweb Skipper	*Hesperia metea*	G4G5	SU
Yucca Giant Skipper	*Megathymus yuccae*	G5	S1
Strecker's Giant Skipper	*Megathymus streckeri*	G5	S1
Falcate Orangetip	*Anthocharis midea*	G4G5	S4?
Seminole Texan Crescent	*Anthanassa texana seminole*	G5	S3
King's Hairstreak	*Satyrium kingi*	G3G4	SU
Appalachian Brown	*Satyrodes appalachia*	G4	SU
Monarch	*Danaus plexippus*	G4	S4

B. Invertebrate Research and Survey Needs

- Surveys are needed to clarify the current distribution, status, and limiting factors of all insect SGCN to fill knowledge gaps for Louisiana and provide baseline data for future assessments.

- Investigate the use of pollinators (including native bees) as indicators of habitat quality and changes in vegetative communities.

- Conduct surveys and other studies of pollinators, including native bees, to determine potential future SGCN.

Harvester Ants

- Research is needed to determine threats and limiting factors for both species.

Arogos Skipper

- Investigate potential negative impacts of Red Imported Fire Ants (RIFA) on this and other grass-dwelling skippers.

Texas Emerald

- Ecological studies are needed for this species, including nymphal ecology and determining habitat preferences.

Pitcher Plant Spiketail

- Baseline ecological studies are needed, including research on movements, habitat use, demography, and life history.

Southern Snaketail

- Baseline ecological studies are needed, as well as research to determine the effects of flooding and water pollution on larvae.

C. Invertebrate Conservation Actions

- Include insect conservation (with emphasis on rare insects and pollinators) in public education and outreach efforts.

Butterflies, Skippers, and Native Bees

- Provide refugia during prescribed burning efforts by burning in sections whenever possible.
- Promote the retention and planting of native plants on Right-of-ways.
- Support efforts to develop reliable, affordable, sources of pollinator friendly native plant material and seed.
- Determine and implement mowing schedules on WMAs that will benefit butterflies, skippers, and native bees.
- Develop recommendations for the seasonal timing of mowing to avoid negative impacts to butterflies and skippers.

- Retain habitat features such as soil mounds, bare soil patches, and snags on LDWF properties to benefit these species.
- Avoid application of insecticides (particularly neonicotinoids) and broadleaf herbicides on LDWF properties when possible.
- Restrict honey-bee hives from LDWF properties.

Schoolhouse Springs Endemics

- Partner with TNC to conserve and monitor rare insects at Schoolhouse Springs.

Sandbar Species

- Work with partners to protect/restore sandbars in Louisiana rivers.
- Control exotic plants and animals on sandbars.
- Work to reduce the use of ATVs and other ORVs on sandbars.

Tiger Beetles

- Promote the use of prescribed fire to maintain appropriate habitat.

Stream-dwelling Insects

- Work with parishes, highway departments, and DOTD to minimize negative impacts of new bridge crossings and maximize benefits.

- Work with landowners and NRCS to encourage the retention of riparian buffers.

- Encourage the retention of woody debris in streams supporting rare insects.

- Maintain in-stream flows at levels that will support populations of rare insects.

- Work with the Scenic Rivers Program to prevent negative impacts from sand and gravel mining.

- Buffer odonate breeding habitat during timber harvest.

- Work with partners such as LDEQ to address impairments to streams that will negatively impact stream dwelling insects.

Texas Brown Tarantula

- Maintain habitat at Kisatchie National Forest and other occurrences with prescribed fire.

Southern Unstriped Scorpion and Giant Red-headed Centipede

- Promote the retention of woody debris by land managers to benefit these species.

Pitcher Plant Spiketail

- Maintain and restore pitcher plant bogs within known and potential range.

Southern Snaketail, Hodges Clubtail, Masked Springfly, and Molson's Microcaddisfly

- Work with partners on watershed-level conservation efforts to benefit these blackwater stream species.
- Encourage the retention of riparian buffers, and conservation of Small Stream Forests for these species.

Saline Prairie Scarab Beetle

- Continue efforts towards saline prairie conservation and management to benefit this species.

Six-banded Longhorn Beetle

- Conserve mature hardwood forests wherever found within the range of this species.

- Retain large overmature trees and snags in floodplains and mesic forests.

Harvester Ants

- Promote the control of RIFA near known occurrences of these species using methods that are not detrimental to other SGCN.

- Promote the use of prescribed fire to maintain open pine systems to benefit these species.

- Monitor and, if necessary, buffer timber harvest activities around known occurrences to reduce negative impacts from heavy machinery such as soil compaction.

Frosted Elfin, Wild Indigo Duskywing, Strecker's Giant Skipper

- Promote the use of prescribed fire to maintain appropriate habitat.

Arogos Skipper

- Continue and expand efforts towards Coastal Prairie restoration and management.

Gulf Pine Sphinx and Dusky Roadside Skipper

- Continue and expand efforts towards longleaf pine management and restoration.

Dusted Skipper

- Continue and expand efforts towards the management and restoration of prairie and savanna habitats.

Creole Pearly Eye, Lace-winged Roadside Skipper, and Yucca Giant Skipper

- Conserve and restore Canebrakes to provide habitat for these species.

Monarch

- Encourage the planting of native milkweed species in landscaping, mitigation, and habitat restoration efforts to benefit Monarchs.
- Discourage the planting of non-native milkweed species, and provide outreach about the negative impacts of these species on Monarchs.
- Determine and implement proper mowing schedule on WMAs and other LDWF properties to avoid negative impacts to Monarchs.
- Avoid application of insecticides (particularly neonicotinoids) on LDWF properties and public lands when possible.
- Continue efforts towards the conservation of native grasslands within the state.

Louisiana Eyed Silkmoth

- Determine the distribution and status of this species.
- Promote conservation of large patches of unfragmented saltmarsh.

4. Inland Fishes

Louisiana's high diversity of inland fishes 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. At least 195 species have been recorded from freshwater habitats in Louisiana. Thirty-one species of inland fishes are considered critically imperiled, imperiled, or rare and local (LNHP 2015), and 39 species are considered SGCN. 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 (USFWS et al. 1995c) and Pallid Sturgeon (USFWS 1993). The Pearl Darter has a historical range within the state but is now considered extirpated (Suttkus et al. 1994).

A. Inland Fish SGCN

Common Name	Scientific Name	G-Rank	S-Rank
Tier I			
Bluehead Shiner	*Pteronotropis hubbsi*	G3	S2
Flagfin Shiner	*Pteronotropis signipinnis*	G5	S2
Bluenose Shiner	*Pteronotropis welaka*	G3G4	S2
Southeastern Blue Sucker	*Cycleptus meridionalis*	G3G4	S1
Broadstripe Topminnow	*Fundulus euryzonus*	G3	S2
Gumbo Darter	*Etheostoma thompsoni*	GNR	S2
Tier II			
Gulf Sturgeon	*Acipenser oxyrinchus desotoi*	G3T2	S1
Pallid Sturgeon	*Scaphirhynchus albus*	G2	S1
Alabama Shad	*Alosa alabamae*	G2G3	S1
Central Stoneroller	*Campostoma anomalum*	G5	S2
Bluntface Shiner	*Cyprinella camura*	G5	S2
Steelcolor Shiner	*Cyprinella whipplei*	G5	S2
Clear Chub	*Hybopsis winchelli*	G5	S3
Shoal Chub	*Macrhybopsis hyostoma*	G5	S3
Bigeye Shiner	*Notropis boops*	G5	S3
Chub Shiner	*Notropis potteri*	G4	S3
Suckermouth Minnow	*Phenacobius mirabilis*	G5	S1
Blue Sucker	*Cycleptus elongatus*	G3G4	S3
River Redhorse	*Moxostoma carinatum*	G4	S1
Frecklebelly Madtom	*Noturus munitus*	G3	S1
Western Sand Darter	*Ammocrypta clara*	G3	S2
Crystal Darter	*Crystallaria asprella*	G3	S2
Rainbow Darter	*Etheostoma caeruleum*	G5	S2
Pearl Darter	*Percina aurora*	G1	SH
Channel Darter	*Percina copelandi*	G4	S2
Freckled Darter	*Percina lenticula*	G3	S1
Bigscale Logperch	*Percina macrolepida*	G5	S2
Gulf Logperch	*Percina suttkusi*	G5	S2
Tier III			
Shovelnose Sturgeon	*Scaphirhynchus platorynchus*	G4	S4
Paddlefish	*Polyodon spathula*	G4	S4
American Eel	*Anguilla rostrata*	G4	S4
Sturgeon Chub	*Macrhybopsis gelida*	G3	SU
Sicklefin Chub	*Macrhybopsis meeki*	G3	SU
Longjaw Minnow	*Notropis amplamala*	G5	S3

Ironcolor Shiner	*Notropis chalybaeus*	G4	S3
Gulf Pipefish	*Syngnathus scovelli*	G5	S4
Redspot Darter	*Etheostoma artesiae*	G5	S3
Stargazing Darter	*Percina uranidea*	G3	SU
Saddleback Darter	*Percina vigil*	G5	S3

B. Inland Fishes Research and Survey Needs

Paddlefish

- Conduct additional sampling in coastal rivers to determine the status of this species in those areas.
- Determine spawning and nursery habitat locations within rivers.

Blue Sucker

- Continue current tracking efforts in the Sabine River.
- Survey preferred habitat in Anacoco Creek to accurately determine the current distribution, habitat requirements, and status in this important Sabine River tributary.
- Surveys should be continued, specifically targeting preferred habitat for spawning and rearing juveniles.

River Redhorse & Alabama Shad

- Targeted surveys are needed to determine if these species are still extant in the Lake Ponchartrain basin.
- Conduct surveys to determine the presence/absence and status of the River Redhorse in other basin, especially the Ouachita basin.

Suckermouth Minnow

- Targeted surveys are needed to determine if this species is still extant in the Red and Ouachita River systems.

Frecklebelly Madtom & Freckled Darter

- Targeted surveys are needed to determine if these species are still extant in the Pearl River system.

American Eel

- Studies are needed to determine distribution and population status in Louisiana.

Gulf Pipefish

- Conduct a comparison of genetic structure among river-oxbow populations of this species and estuarine-gulf populations.

S1 & S2 Species

- Survey preferred habitat to accurately determine the current distribution, habitat requirements, and status, including population trend.

All Fishes

- Ongoing sampling is needed to determine the trends in the range and abundance of invasive fishes.

- Incorporate recommendations of State Management Plan for Aquatic Invasive Species (LDWF 2005) to control invasive fishes.

- Investigate the impacts of sill removal on all fish SGCN in the Pearl River; including surveys before and after removal.

- Research is needed to resolve the impacts of in-stream flow alterations on fish SGCN.

- Modeling approaches are needed to determine optimal habitat conditions for fish SGCN.

- Research is needed to determine which habitat characteristics are most important for restoration activities.

- Investigate the impacts of land-use on fish community structure.

- Implement or continue, where applicable, long-term monitoring of all fish SGCN.

- Support research into habitat requirements, population trends, and distribution of all fish SGCN.

- Develop Habitat Suitability Indices for SGCN to aid in future conservation efforts.

C. Inland Fishes Conservation Actions

Gulf Sturgeon

- Support the implementation of the federal recovery plan (1995) for Gulf Sturgeon.

Pallid Sturgeon

- Support the implementation of the federal recovery plan (1993 and 2014 revision) for Pallid Sturgeon.

American Eel

- Support the installation of eel ladders at dams throughout the state to aid passage.
- Support the removal of sills from the Pearl River.

Western Sand Darter and Suckermouth Minnow

- Develop partnerships with Texas Department of Parks and Wildlife for the conservation of these species.

S1 & S2 Species

- Develop Habitat Suitability Indices and develop predictive habitat models for these species to aid in restoration and conservation actions.

All Fishes

- Promote the removal of non-essential dams in Louisiana watersheds, and discourage the building of new dams.

- Promote the retention of riparian buffers and the use of Best Management Practices (BMPs) for Streamside Management Zones by working with parishes, private landowners, and industrial interests (e.g. timber or petrochemical companies).

- Develop recommendations to improve fish passage through low-head dams.

- Increase outreach/education efforts on the importance of riparian zones.

- Coordinate more closely with DEQ and DNR to protect stream fishes from anthropogenic threats, including treated and untreated wastewater, non-point surface runoff, and water withdrawals for public and industrial water supplies.

- Continue work towards limiting use of ORVs in streams.

- Work with DOTD, parishes, and other partners to encourage the installation of oversized culverts below grade to promote fish passage.

5. Marine Fishes

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. The Smalltooth Sawfish is the only federally listed marine fish, although no critical habitat has been designated at this time (NMFS, 2009). Eighteen species of marine fishes have been identified as SGCN during the 2015 WAP revision. Many of these SGCN are very poorly known, due to a lack of appropriate sampling. Therefore, for many of these species, the collection of baseline data is of high priority.

A. Marine Fishes SGCN

Common Name	Scientific Name	G-Rank	S-Rank
Tier I			
Smalltooth Sawfish	*Pristis pectinata*	G1G3	SH
Saltmarsh Topminnow	*Fundulus jenkinsi*	G3	S3
Texas Pipefish	*Syngnathus texanus*	G1	SU
Goliath Grouper	*Epinephelus itajara*	G2	SH
Tier II			
Diamond Killifish	*Adinia xenica*	G5	S4
Bayou Killifish	*Fundulus pulvereus*	G5	S4
Opossum Pipefish	*Microphis brachyurus*	G4G5	SU
Chain Pipefish	*Syngnathus louisianae*	GNR	S4
Tier III			
Tarpon	*Megalops atlanticus*	G5	S3
Gold Brotula	*Gunterichthys lonigpenis*	GQ	SU
Dwarf Seahorse	*Hippocampus zosterae*	GNR	SNR
Large-scaled Spinycheek Sleeper	*Eleotris amblyopsis*	G5	S4
Emerald Sleeper	*Erotelis smaragdus*	GNR	SU
Frillfin Goby	*Bathygobius soporator*	GNR	S4
Violet Goby	*Gobioides broussonnetii*	G5	S4
Broad Flounder	*Paralichthys squamilentus*	GNR	SU
Southern Puffer	*Sphoeroides nephelus*	G5	S5
Lemon Shark	*Negaprion brevirostris*	GNR	S3

B. Marine Fishes Research and Survey Needs

- Focused surveys using appropriate gear (traps, oyster trays, etc.) are needed to accurately determine the status of little known marine fishes (Frillfin Goby, Violet Goby, Emerald Sleeper, Large-scaled Spinycheek Sleeper) and to determine habitat preferences of these species.

- 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.

- Support research into the habitat value of sandy shoals off of Louisiana for SGCN.

Smalltooth Sawfish and Goliath Grouper

- Research is needed to determine if there are reproducing populations of either species in Louisiana.

Texas Pipefish

- Targeted surveys are needed to determine the current status and range of this species in Louisiana.

Broad Flounder

- Conduct research to determine the status of this and other small flatfishes.

Tarpon

- Initiate sampling efforts in blackwater habitat using appropriate gear (e.g., cast nets, stop-nets, etc) to determine status and habitat use.

- Support research into the conservation genetics of Tarpon in Louisiana.

Southern Puffer

- Develop sampling methods and conduct targeted surveys to determine current status.

Lemon Shark

- Determine species distribution in Louisiana.
- Research is needed on the Lemon Shark nursery at the Chandeleur Islands.

C. Marine Fishes Conservation Actions

- Continue efforts for the conservation and restoration of Barrier Islands.

- Partner with the USACE to encourage the beneficial use of dredge spoil.

- Work with CPRA to incorporate strategies for SGCN into future coastal restoration efforts.

Pipefishes

- Continue efforts for the conservation and restoration of marsh habitat and SAV beds.

Goliath Grouper

- Support the construction and retention of artificial reefs.

Smalltooth Sawfish

- Support implementation of the Smalltooth Sawfish Recovery Plan.

Large-scaled Spinycheek Sleeper

- Continue oyster reef restoration efforts to benefit this species.

Saltmarsh Topminnow

- Support the creation and maintenance of emergent marsh islands in the Atchafalaya Delta to benefit this species.

Tarpon

- Conserve blackwater habitat where found to benefit juvenile Tarpon.

6. Amphibians and Reptiles

There are 140 species of amphibians and reptiles occurring within Louisiana and its adjacent waters (Dundee and Rossman 1989, LNHP 2015). However, Louisiana is unique among high-diversity states in that it has no endemic species. Most SGCN 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 102 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.

Sixteen species of amphibians (10 salamanders, 6 frogs) and 34 species of reptiles (17 turtles, 5 lizards, 12 snakes) are considered SGCN by the LNHP (2015). The Dusky Gopher Frog and the Ornate Chorus Frog are considered extirpated in Louisiana (last observed in 1967 and 1954, respectively) and recent surveys have been unable to relocate them at known or additional sites (Siegel and Doody 1992, Thomas 1996, Leonard et al. 2003). All of the marine turtles occurring in Louisiana are federally and state listed: four of the 5 are considered endangered and 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), Ringed Map Turtle (USFWS 1986), and Dusky Gopher Frog (USFWS 2001). The Eastern Diamondback Rattlesnake, Black Pine Snake and Louisiana Pine Snake are candidate species for federal listing.

A. Amphibian and Reptile SGCN

Common Name	**Scientific Name**	**G-Rank**	**S-Rank**
Tier I			
Louisiana Slimy Salamander	*Plethodon kisatchie*	G3G4	S1
Four-toed Salamander	*Hemidactylium scutatum*	G5	S1
Southern Crawfish Frog	*Lithobates areolatus areolatus*	G4	S1
Tier II			
Eastern Tiger Salamander	*Ambystoma tigrinum tigrinum*	G5	S1
Southern Dusky Salamander	*Desmognathus auriculatus*	G5	S1
Webster's Salamander	*Plethodon websteri*	G3G4	S1
Gulf Coast Mud Salamander	*Pseudotriton montanus flavissimus*	G5	S1
Southern Red Salamander	*Pseudotriton ruber vioscai*	G5	S2
Gulf Coast Waterdog	*Necturus beyeri*	G4	S3
Ornate Chorus Frog	*Pseudacris ornata*	G5	SH
Dusky Gopher Frog	*Lithobates sevosus*	G1	SH
Tier III			
Southern Red-backed Salamander	*Plethodon serratus*	G5	S1
Red River Mudpuppy	*Necturus maculosus louisianensis*	G5	S3
Strecker's Chorus Frog	*Pseudacris streckeri*	G5	S1
Eastern Spadefoot	*Scaphiopus holbrookii*	G5	S3
Hurter's Spadefoot	*Scaphiopus hurterii*	G5	SU

Common Name	**Scientific Name**	**G-Rank**	**S-Rank**
Tier I			
Ringed Map Turtle	*Graptemys oculifera*	G2	S2
Pearl Map Turtle	*Graptemys pearlensis*	G2G3	S3
Western Chicken Turtle	*Deirochelys reticularia miaria*	G5	S2
Ornate Box Turtle	*Terrapene ornata ornata*	G5T5	S1

Black Pine Snake	*Pituophis melanoleucus lodingi*	G4T2T3	S1
Louisiana Pine Snake	*Pituophis ruthveni*	G2	S2
Eastern Diamond-backed Rattlesnake	*Crotalus adamanteus*	G4	S1
Texas Horned Lizard	*Phrynosoma cornutum*	G4G5	SX
Tier II			
Loggerhead Seaturtle	*Caretta caretta*	G3	S1B, S3N
Green Seaturtle	*Chelonia mydas mydas*	G3T3	S1N
Kemp's Ridley Seaturtle	*Lepidochelys kempii*	G1	S1B, S3N
Sabine Map Turtle	*Graptemys sabinensis*	G5T5	S3
Mississippi Diamond-backed Terrapin	*Malaclemys terrapin pileata*	G4T3Q	S3
Stripe-necked Musk Turtle	*Sternotherus minor peltifer*	G5	S1
Gopher Tortoise	*Gopherus polyphemus*	G3	S1
Common Rainbow Snake	*Farancia erytrogramma erytrogramma*	G4	S2
Mole Kingsnake	*Lampropeltis calligaster rhombomaculata*	G5T5	S1S2
Gulf Saltmarsh Snake	*Nerodia clarkii clarkii*	G4	S3S4
Pine Woods Littersnake	*Rhadinaea flavilata*	G4	S1
Southeastern Crowned Snake	*Tantilla coronata*	G5	S1
Harlequin Coralsnake	*Micrurus fulvius*	G5	S2
Tier III			
Atlantic Hawksbill Seaturtle	*Eretmochelys imbricata imbricata*	G3T3Q	SZ
Alligator Snapping Turtle	*Macrochelys temminckii*	G3G4	S3
Smooth Softshell	*Apalone mutica*	G5	S3
Leatherback Seaturtle	*Dermochelys coriacea*	G2	SZ
Ouachita Map Turtle	*Graptemys ouachitensis ouachitensis*	G5	S3
Razor-backed Musk Turtle	*Sternotherus carinatus*	G5	S4
Western Slender Glass Lizard	*Ophisaurus attenuatus attenuatus*	G5T5	S3
Eastern Glass Lizard	*Ophisaurus ventralis*	G5	S3
Southern Prairie Skink	*Plestiodon septentrionalis obtusirostris*	G5T5	S1
Coal Skink	*Plestiodon anthracinus*	G5	S3
Western Worm Snake	*Carphophis vermis*	G5	S1
Timber Rattlesnake	*Crotalus horridus*	G4	S3S4
Eastern Hog-Nosed Snake	*Heterodon platirhinos*	G5	S3

B. Amphibian Research and Survey Needs

Eastern Tiger Salamander

- Intensive, targeted surveys to determine current status and distribution in Louisiana.
- Conduct surveys for new breeding ponds.
- Conduct intensive, long-term monitoring of known breeding ponds.

Four-toed Salamander

- Locate gum ponds used by this species.

Southern Dusky Salamander

- Surveys are needed to clarify the current distribution and status of this and other *Desmognathus* species in Louisiana.
- Investigate possible causes of decline for this species and other salamanders, including new or emergent diseases.

Southern Red-backed Salamander

- Baseline surveys are needed to document occurrences and clarify distribution.
- Investigate possible causes of decline for this species and other salamanders, including new or emergent diseases.

Webster's Salamander

- Surveys needed to determine the current status of this species in the state, particularly in West Feliciana parish.

Louisiana Slimy Salamander

- Surveys needed to generate population estimate and monitor population trends.

Gulf Coast Mud Salamander and Southern Red Salamander

- Intensive, targeted surveys needed to determine current distribution and status.

Gulf Coast Waterdog and Red River Mudpuppy

- Intensive sampling needed to determine current distribution and abundance of both *Necturus* species.

Ornate Chorus Frog

- Targeted, intensive surveys to clarify current status in the state.
- Determine the presence and location of suitable habitat in the state.

Strecker's Chorus Frog

- Targeted, intensive surveys are needed in Northwest Louisiana to clarify current status in the state.

Eastern Spadefoot Toad

- Intensive surveys needed to determine current breeding locations.

Dusky Gopher Frog

- Surveys needed to locate suitable ponds for reintroduction or areas for the creation of ponds (including Bogue Chitto NWR and Lake Ramsey WMA).

Southern Crawfish Frog

- Intensive, targeted surveys to determine current status and distribution in Louisiana.
- Conduct intensive, long-term monitoring of known breeding ponds.
- Conduct surveys to locate potential reintroduction sites.
- Conduct surveys throughout historic range to locate new breeding ponds.
- Encourage timber companies to use Best Management Practices (including the use of prescribed fire and elimination of bedding) when managing Crawfish Frog habitat.

C. Amphibian Conservation Actions

- Implement habitat management recommendations of PARC to benefit amphibians SGCN whenever possible on LDWF managed lands, and promote the implementation of such recommendations to private landowners.

Eastern Tiger Salamander

- Work with partners and private landowners to conserve breeding habitat (Ephemeral Ponds).
- Work with partners (DOTD, Parishes, etc.) to improve connectivity between breeding ponds (e.g., culverts and fences).
- Encourage timber companies to use BMPs (including the use of prescribed fire and elimination of bedding) when managing Eastern Tiger Salamander habitat.
- Promote the conservation and potential creation of open-canopy ponds (e.g., flatwoods ponds & other ephemeral wetlands) to benefit this and other amphibian species.

Four-Toed Salamander

- Buffer gum ponds from anthropogenic impacts.

Southern Red-backed Salamander

- Encourage timber companies to use BMPS for Hardwood Slope Forest to benefit this species.

Webster's Salamander

- Work with landowners to conserve Webster's Salamander on private property.

Louisiana Slimy Salamander

- Encourage the use of BMPs in appropriate habitat, including the retention of snags and logs.
- Promote the use of Streamside Management Zones to benefit this species.

Gulf Coast Mud Salamander and Southern Red Salamander

- Encourage the use of BMPs to beneficially manage habitat for these species.

Gulf Coast Waterdog and Red River Mudpuppy

- Promote conservation compatible land-use around known occurrences.
- Work with appropriate partners to address water quality issues in streams where occurrence is documented or suspected.
- Encourage/promote the use of SMZs to protect water quality in watersheds where these species are found.
- Promote the retention of submerged woody debris.

Eastern Spadefoot Toad

- Work with timber companies to implement BMPs in appropriate habitats.
- Work with landowners to preserve known breeding locations (ephemeral wetlands).

Dusky Gopher Frog

- Create breeding ponds in suitable habitat for reintroduction attempts.
- Work with partners (TNC, etc.) to provide education and outreach about this species to the public, including landowners.
- Explore opportunities for propagation and reintroduction of the species into Louisiana.

Southern Crawfish Frog

- Explore opportunities for reintroduction of the species into suitable habitat.
- Work to restrict the use of bedding during forestry activity in suitable or historic habitat.

D. Reptile Research and Survey Needs

Kemp’s Ridley and Loggerhead

- Assess beach habitat statewide for nesting suitability and prioritize areas for nesting surveys.
- Conduct nesting surveys to document occurrence and level of nesting activity.

Alligator Snapping Turtle

- Collect needed data to construct life-history table.
- Continue range wide surveys to monitor population trends throughout the state.

Ringed & Pearl Map Turtles

- Ecological studies of nest success and recruitment.
- Intensive surveys needed to generate population estimates.

Western Chicken Turtle

- Surveys needed to determine current occurrence, distribution, and habitat preference.
- Studies needed to determine nesting ecology.
- Radio telemetry studies to determine habitat use, movements, and activity patterns.

Diamond-Backed Terrapin

- Continue to conduct nesting surveys to determine nesting ecology in Louisiana.
- Collect life history data necessary to construct life-history tables.

Ornate Box Turtle

- Conduct intensive surveys of historical localities and suitable habitat to determine current status in Louisiana.
- Intensive life-history studies are needed of any extant populations that are located.

Stripe-necked Musk Turtle

- Conduct surveys to determine the current status of this species in the state.

Gopher Tortoise

- Conduct surveys to generate a population estimate and determine exact distribution in the state.
- Intensive monitoring of reproduction and recruitment is needed.
- Assess nest depredation, including impacts of mammalian predators and RIFA, in known nesting areas.

Razorback Musk Turtle

- Surveys are needed to determine the status of this species in LA and to determine the effect of commercial harvest on populations.

Western Slender Glass Lizard

- Conduct research to determine habitat requirements, particularly the relationship between this species and grassy swales.

Southern Prairie Skink

- Surveys needed to determine the current status of this species in the state.

Coal Skink

- Studies needed to determine presence/absence and habitat preferences.

Western Worm Snake

- Intensive surveys needed within historical range to determine current status and distribution.

Common Rainbow Snake

- Intensive surveys needed to determine current status and distribution, as well as basic ecology.
- Research needed to determine the best trapping methods for this species.

Mole Kingsnake

- Intensive baseline surveys are needed to determine current status and distribution.

Black Pinesnake

- Survey historical range within the state to determine the current status of this species.

Louisiana Pinesnake

- Determine the limits of the species range and population size in Louisiana.
- Research needed on nesting ecology, nest success, and other basic life-history factors.
- Research needed on best methods for detection and monitoring.
- Determine the extent to which Rights-of-Way are used, and the condition of snakes using ROWS.
- Investigate impacts of timber harvesting on the species, particularly roller chopping.
- Investigate the effects of various land uses on the species.

Pinewoods Littersnake

- Surveys are needed to determine status, distribution, and basic life-history traits.

Southeastern Crowned Snake

- Basic ecology studies are needed.
- Conduct research to determine what factors are contributing to the declining range of this species.

Harlequin Coral Snake

- Intensive surveys needed to determine if this species is extant in Louisiana.

Eastern Diamond-backed Rattlesnake

- Intensive surveys needed to determine if there are any viable populations of this species in Louisiana.

Timber Rattlesnake

- Monitor for the presence of disease in Timber Rattlesnakes.

Texas Horned Lizard

- Intensive surveys needed to determine current status and document any extant occurrences.

Eastern Hog-nosed Snake

- Intensive surveys needed to determine current status and distribution in Louisiana.
- Research needed to determine limiting factors and potential causes of decline.

E. Reptile Conservation Actions

- Encourage the use of wildlife friendly erosion control blankets.
- Provide education and outreach to reduce the wanton killing of snakes.

Sea Turtles

- Promote the use of Turtle Excluder Devices.
- Provide educational/outreach materials and services regarding sea turtles in Louisiana.
- Protect potential and documented nesting beaches in Louisiana.
- Promote/undertake restoration and stewardship activities to improve habitat quality of Louisiana beaches.

- Consider and address potential impacts to these species during Environmental Permit reviews.

Kemp’s Ridley and Loggerhead

- Protection/restoration of coastal dune habitat.
- Work with partners to protect the area west of the mouth of the Mississippi where females gather prior to breeding season from dredging operations.

Alligator Snapping Turtle

- Continue headstarting and restocking efforts.
- Implement control of nest predators (including RIFA) in known nesting areas.
- Promote the retention of riparian buffers.
- Promote retention of emergent and submerged woody debris.
- Discourage winter drawdowns to increase hatchling survival.

Smooth Softshell and Map Turtles

- Work with partners to protect/restore sandbars in Louisiana rivers.
- Control exotic plants and animals on sandbars.
- Work to reduce the use of ATVs on sandbars, especially during nesting season.
- Partner with USACE to reduce the impacts of dredging and channelization on sandbar-nesting turtles.
- Work with the Scenic Rivers Program and other partners to minimize the impacts of gravel mining on sandbar-nesting turtles.
- Encourage retention of snags in waterways/provide education about the importance of snags to turtles.

Smooth Softshell and Sabine Map Turtle

- Work with Toledo Bend to manage water levels in a manner compatible with sandbar-nesting turtles.

Western Chicken Turtle

- Locate and protect ephemeral wetlands in important nesting areas.
- Encourage the incorporation of adjacent uplands into wetland protection & restoration efforts.
- Work with landowners to promote the implementation of BMPs to benefit chicken turtles, particularly no bedding.

Diamond-Backed Terrapin

- Conserve/restore coastal dune and shrub-scrub habitat to ensure availability of adequate nesting sites.
- Continue efforts to remove derelict crab traps from coastal waters to limit incidental mortality of Diamond-Backed Terrapins.
- Implement/continue the use of TEDS on crab traps.

Ornate Box Turtle

- Continue conservation & restoration efforts for coastal prairie.

Gopher Tortoise

- Work with landowners to manage habitat for the benefit of Gopher Tortoises.
- Provide education and outreach regarding Gopher Tortoise in Louisiana, and importance of leaving tortoises in native habitat.
- Develop a comprehensive waif tortoise plan for the state.
- Continue efforts towards habitat management and restoration.
- Translocate isolated tortoises to areas of concentration to bolster reproduction.
- Implement predator control and assess nest depredation in important tortoise areas as needed.
- Investigate the feasibility of re-stocking tortoises from other states.

Western Slender Glass Lizard

- Continue conservation efforts for longleaf pine, Coastal Prairies, and Cheniers, including restoration and management of native grasses.

Eastern Glass Lizard

- Management for marsh-open pine transitional ecotone with tall grass (especially at Grand Isle and Big Branch Marsh NWR).

Mole Kingsnake

- Management and restoration of open-pine habitats.

Black Pinesnake

- Continue to manage and restore open-pine habitat within the historical range of this species.

Louisiana Pinesnake

- Maintain/restore open pine habitat within the species range.
- Continue partnership with the Louisiana Pine Snake Working Group.

- Continue to work with zoos on reintroduction projects.

Southeastern Crowned Snake

- Maintain hardwood areas within open pine habitats within this species range.

Timber Rattlesnake

- Provide public education and outreach about rattlesnakes.
- Promote corridors linking Bottomland Hardwood Forest fragments.

Texas Horned Lizard

- Investigate the possibility of reintroduction.

7. Birds

Approximately 160 species of birds are year-round residents or probable confirmed breeders in Louisiana (Wiedenfeld and Swan 2000), and more than 300 additional species are known to migrate through or winter in the state or its immediate adjacent waters (Cardiff et al. 2014). There are 89 species on the SGCN list of which 49 species are considered critically imperiled, imperiled, or rare and local by the LNHP (2015). Recovery plans have been developed by the USFWS for federally-listed avian species found in Louisiana including the Whooping Crane, Red-Cockaded Woodpecker, Piping Plover, and Interior Least Tern (USFWS 1994, 1986, 1990b, 2003; LDWF 2005). The Brown Pelican was delisted in the U.S. Atlantic coast, Florida, and Alabama in 1985, and was delisted in the rest of its range, including Louisiana, in 2009. The bald eagle was delisted in 2007.

Five of the 9 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 credible report occurring in the spring of 1999. Subsequent attempts to document its presence in Louisiana were unsuccessful (Fitzpatrick 2002), and it is no longer considered to occur in Louisiana. With the presumed discovery of this species in Arkansas in 2004 (Fitzpatrick 2005), LDWF made the decision to include the Ivory-Billed Woodpecker on the WAP species list in the event that it may have been rediscovered in the state. The species is removed from the list of SGCN for this revision, due to the lack of recent, verifiable sightings. Other species with historical range in Louisiana but now considered extirpated include Atwater's Greater Prairie Chicken, Bachman's Warbler, and Eskimo Curlew. Efforts are currently underway to reintroduce the Whooping Crane to Louisiana.

A. Bird SGCN

Common Name	**Scientific Name**	**G-Rank**	**S-Rank**
Tier I			
Reddish Egret	*Egretta rufescens*	G4	S1

White-tailed Kite	*Elanus leucurus*	G5	S1B, S1S2N
Yellow Rail	*Coturnicops noveboracensis*	G4	S3S4N
Black Rail	*Laterallus jamaicensis*	G4	S2N, S1B
Whooping Crane	*Grus americana*	G1	SH
Snowy Plover	*Charadrius nivosus*	G3	S1B,S2N
Wilson's Plover	*Charadrius wilsonia*	G5	S2B, S1N
Piping Plover	*Charadrius melodus*	G3	S2N
American Oystercatcher	*Haematopus palliatus*	G5	S1
Red Knot	*Calidris canutus*	G4	S2N
Sooty Tern	*Onychoprion fuscatus*	G5	S1B
Interior Least Tern	*Sternula antillarum athalassos*	G4T2Q	S1B
Gull-billed Tern	*Gelochelidon nilotica*	G5	S2
Caspian Tern	*Hydroprogne caspia*	G5	S1S2B,S3N
Common Tern	*Sterna hirundo*	G5	S1B,S3N
Black Skimmer	*Rynchops niger*	G5	S3
Common Ground-Dove	*Columbina passerina*	G5	S1B,S2N
Southeastern American Kestrel	*Falco sparverius paulus*	G5T4	S2
Sprague's Pipit	*Anthus spragueii*	G4	S2N
Smith's Longspur	*Calcarius pictus*	G5	S1N
Golden-winged Warbler	*Vermivora chrysoptera*	G4	S2N
Cerulean Warbler	*Setophaga cerulea*	G4	S2N
Bachman's Sparrow	*Peucaea aestivalis*	G3	S3
Grasshopper Sparrow	*Ammodramus savannarum*	G5	S1B,S3N
Tier II			
Mottled Duck	*Anas fulvigula*	G4	S4
Northern Bobwhite	*Colinus virginianus*	G5	S3
Wood Stork	*Mycteria americana*	G4	S3N
Brown Pelican	*Pelecanus occidentalis*	G4	S3
American Bittern	*Botaurus lentiginosus*	G4	S4N
Little Blue Heron	*Egretta caerulea*	G5	S3N, S4B
Glossy Ibis	*Plegadis falcinellus*	G5	S2
Roseate Spoonbill	*Platalea ajaja*	G5	S3
Swallow-tailed Kite	*Elanoides forficatus*	G5	S1S2B
King Rail	*Rallus elegans*	G4	S3B, S4N
Sandhill Crane	*Grus canadensis*	G5	S2N
Upland Sandpiper	*Bartramia longicauda*	G5	S4N
Long-billed Curlew	*Numenius americanus*	G5	S5N

Hudsonian Godwit	*Limosa haemastica*	G4	S3N
Marbled Godwit	*Limosa fedoa*	G5	S4N
Buff-breasted Sandpiper	*Calidris subruficollis*	G4	S3N
Short-billed Dowitcher	*Limnodromus griseus*	G5	S5N
American Woodcock	*Scolopax minor*	G5	S1B, S5N
Coastal Least Tern	*Sternula antillarum*	G4	S4B
Forster's Tern	*Sterna forsteri*	G5	S5
Royal Tern	*Thalasseus maximus*	G5	S5
Sandwich Tern	*Thalasseus sandvicensis*	G5	S4B
Greater Roadrunner	*Geococcyx californianus*	G5	S3
Short-eared Owl	*Asio flammeus*	G5	S3N
Chuck-Will's-Widow	*Antrostomus carolinensis*	G5	S4B
Chimney Swift	*Chaetura pelagica*	G5	S5B
Red-cockaded Woodpecker	*Picoides borealis*	G3	S2
Crested Caracara	*Caracara cheriway*	G5	S1
Peregrine Falcon	*Falco peregrinus*	G4	S3N
Loggerhead Shrike	*Lanius ludovicianus*	G4	S4
Bell's Vireo	*Vireo bellii*	G5	S1B
Warbling Vireo	*Vireo gilvus*	G5	S1B
White-breasted Nuthatch	*Sitta carolinensis*	G5	S3
Marsh Wren	*Cistothorus palustris*	G5	S4
Wood Thrush	*Hylocichla mustelina*	G5	S4B
Worm-eating Warbler	*Helmitheros vermivorum*	G5	S3B
Louisiana Waterthrush	*Parkesia motacilla*	G5	S3B
Prothonotary Warbler	*Protonotaria citrea*	G5	S5B
Swainson's Warbler	*Limnothlypis swainsonii*	G4	S4B
Kentucky Warbler	*Geothlypis formosa*	G5	S4B
Prairie Warbler	*Setophaga discolor*	G5	S4B
Yellow-throated Warbler	*Setophaga dominica*	G5	S4B
Field Sparrow	*Spizella pusilla*	G5	S4BS5N
Lark Sparrow	*Chondestes grammacus*	G5	S3
Henslow's Sparrow	*Ammodramus henslowii*	G4	S3N
Le Conte's Sparrow	*Ammodramus leconteii*	G4	S4N
Seaside Sparrow	*Ammodramus maritimus*	G4	S4
Rusty Blackbird	*Euphagus carolinus*	G4	S3N
Tier III			
Northern Pintail	*Anas acuta*	G5	S5N
Canvasback	*Aythya valisineria*	G5	S4N

Redhead	*Aythya americana*	G5	S4N
Lesser Scaup	*Aythya affinis*	G5	S5N
Least Bittern	*Ixobrychus exilis*	G5	S5B
Osprey	*Pandion haliaetus*	G5	S3
Bald Eagle	*Haliaeetus leucocephalus*	G5	S3
Clapper Rail	*Rallus crepitans*	G5	S5
Dunlin	*Calidris alpina*	G5	S5N
Red-headed Woodpecker	*Melanerpes erythrocephalus*	G5	S4
Yellow-throated Vireo	*Vireo flavifrons*	G5	S4B
Brown-headed Nuthatch	*Sitta pusilla*	G5	S5
Sedge Wren	*Cistothorus platensis*	G5	S4N
Hooded Warbler	*Setophaga citrina*	G5	S5B
Nelson's Sparrow	*Ammodramus nelsoni*	G5	S5N
Painted Bunting	*Passerina ciris*	G5	S5B
Dickcissel	*Spiza americana*	G5	S4B

B. Bird Research and Survey Needs

Mottled Duck

- Support and conduct research on nesting success, brood rearing and brood success rates, molting habitat needs, annual recruitment and survival rates, and limiting factors.

Northern Bobwhite

- Continue to monitor populations through breeding bird, call count, and hunter harvest surveys.
- Monitor Northern Bobwhite response to habitat management.

Red Knot

- Conduct genetic analysis of wintering Red Knot to clarify which subspecies are found in Louisiana.
- Conduct satellite telemetry studies of Red Knots to elucidate habitat use and migratory routes of Red Knots that winter in Louisiana to promote more efficient full life cycle conservation of this species.

American Woodcock

- Develop protocols to monitor winter abundance of American Woodcock.
- Conduct research to determine limiting factors on wintering grounds.

Brown Pelican

- Collect baseline life-history data to allow for the construction of life-history tables.
- Continue long-term monitoring to detect population trends and guide management decisions.

Colonial Nesting Waterbirds

- Collect baseline life-history data to allow for the construction of life-history tables.
- Continue to conduct rookery/colony surveys to update database information and monitor population status and trends.

Reddish Egret

- Locate nesting and foraging areas to prioritize conservation actions.

Reddish Egret & American Oystercatcher

- Conduct targeted surveys (including nesting surveys) to accurately determine population size or index.
- Conduct research to assess the limiting factors on reproduction of these two species.

Swallow-tailed Kite

- Continue efforts to inventory and monitor this species on public and private lands to fill data gaps in distribution and abundance.

Bald Eagle

- Continue research into stopover sites, migration routes, and threats to Bald Eagles.
- Implement long-term monitoring of active bald eagle nests, successful breeding pairs, and fledged birds.

Rails

- Support research to clarify the relative number of year-round residents vs. winter residents.
- Initiate intensive surveys (including callback surveys & nest surveys) to determine population densities and distribution statewide.

Black Rail

- Determine current winter distribution and abundance as well as breeding status.

Yellow Rail

- Support research into the habitat needs of this species.
- Investigate the use and value of rice fields to Yellow Rails pre- and post-harvest.
- Determine current winter distribution and abundance.

Shorebirds

- Collect data on prey availability and other baseline data to improve understanding of species' requirements.

Snowy Plover & Wilson's Plover

- Continue and expand efforts to monitor breeding and non-breeding populations statewide.

Piping Plover

- Continue long-term non-breeding season surveys to monitor trends in abundance and distribution.

Shorebirds & Terns

- Conduct surveys to determine habitat use and develop management recommendations for inclusion in coastal restoration plans.

Terns

- Continue research into limiting factors for nesting terns.
- Monitor disturbance and effects of disturbance at nesting colonies.

Landbirds

- Continue to support population monitoring programs such as Breeding Bird Surveys and Christmas Bird Counts.

Common Ground-dove

- Conduct baseline studies, including studies to clarify distribution and abundance.

Greater Roadrunner

- Conduct baseline studies, including studies to clarify distribution and abundance.

Chuck-Will's-Widow

- Participate in the national Nightjar Survey Network program to collect population data.

- Work with Louisiana Amphibian Monitoring Program to increase collection of data for this species, as it is not well-surveyed by other monitoring programs.
- Support research focusing on distribution patterns, habitat availability and use, nesting success, and territory size requirements.

Southeastern American Kestrel

- Conduct baseline studies, including studies to clarify distribution and abundance.

Loggerhead Shrike

- Collect baseline data on distribution, reproductive success, and availability of suitable nesting habitat.
- Evaluate changes in available habitat over time.
- Initiate research into causes of decline.

Neotropical Migrant Songbirds

- Implement energetics study of food resources on Cheniers and other critical stop-over habitats.

Bell's Vireo

- Initiate surveys to determine population abundance and distribution in the northern portion of the state and develop species management recommendations.

Sprague's Pipit

- Collect baseline data, including distribution, habitat use, and habitat requirements.

Bachman's Sparrow

- Intensive surveys are needed to produce estimates of current distribution and population size statewide.
- Support research to determine the relationship between population size and vegetation succession on quality sites.
- Support research to determine if management activities can create a mosaic of adjacent sites that provide continuously occupied habitat.
- Determine dispersal behavior to maximize the benefits of future habitat management.
- Monitor reproductive success to determine limiting factors.

Field Sparrow

- Surveys are needed to determine breeding and wintering population abundances and to assess the amount and quality of available habitat statewide.

Grasshopper Sparrow

- Surveys are needed to determine breeding and wintering population abundances and to assess the amount and quality of available habitat statewide.

Seaside Sparrow & Nelson's Sparrow

- Conduct surveys to determine current abundance and distribution in relation to habitat changes.

Rusty Blackbird

- Determine wintering population abundances and habitat use.

Birds

- Promote the use of standardized monitoring protocols for birds such as the national protocol for secretive marshbirds, the Breeding Bird Survey protocol, and others.

C. Bird Conservation Actions

Waterfowl

- Continue to encourage the creation/enhancement/maintenance of high-quality habitat across Louisiana.
- Work with Ducks Unlimited, Delta Waterfowl, NRCS, and USFWS to ensure that quality habitat is distributed across the landscape.
- Encourage rice farming north of coastal marshes rather than conversion to crops with lower wildlife value, including the substitution of dry-seeded rice for traditional rice production methods.
- Continue partnerships with DU, DW, USFWS, and other partners to conserve habitat on the northern breeding grounds.

Northern Bobwhite

- Develop partnerships for habitat management with LCCs and JVs.
- Promote habitat management to benefit this species through the Private Lands Program.
- Support the implementation of recommended habitat restoration actions specified in the NCBI.
- Promote and conduct habitat management to benefit this species on WMAs, NWRs, National Forests, and other public lands where appropriate.

Colonial Nesting Waterbirds

- Continue efforts for the conservation and restoration of barrier islands.

- Monitor colonies for impacts of predators and conduct targeted removal as needed.

Swallow-tailed Kite

- Provide recommendations to minimize forestry impacts on nesting or roosting birds, including the importance of retaining large canopy and super-emergent trees, as well as timing timber harvest activities to avoid critical periods.

Bald Eagle

- Continue coordination with timber companies for Bald Eagle management plans.

Rails

- Work with NRCS to promote and maintain the presence of working wetlands on the landscape.
- Promote crawfish aquaculture and rice production to maintain suitable habitat for rails.

Whooping Crane

- Continue to support the establishment of a resident population of Whooping Cranes in Louisiana.
- Continue education and outreach activities related to the Whooping Crane reintroduction.

Shorebirds

- Identify, conserve, and monitor shorebird stopover and wintering locations.
- Partner with LCCs, JVs, USFWS, NRCS, and other interested groups to encourage land-owners to manage water levels to provide habitat for shorebirds during migration.
- Continue to manage moist soil units on WMAs and refuges to provide suitable stopover habitat where appropriate.

American Woodcock

- Develop partnerships with state and federal agencies, NGOs, and the private sector to implement the American Woodcock Management Plan.
- Promote habitat management to benefit this species on state, federal, and private lands where appropriate.

Plovers and Coastal Least Tern

- Work with landowners/parishes to exclude grazing livestock from beaches.
- Control feral hogs on and around known nesting beaches.
- Promote the exclusion of ATVs and other off-road vehicles from nesting areas during nesting season.

- Conserve and restore mainland beach and barrier island habitats.
- Promote the use of signs, stewards, and symbolic fencing to protect nesting birds.
- Develop a comprehensive survey methodology to determine long-term trends in population abundances.

Interior Least Tern

- Work with partners to protect/restore sandbars in Louisiana rivers.
- Control exotic plants and animals on sandbars.
- Work to reduce the use of ATVs or other off-road vehicles on sandbars, especially during nesting season.
- Partner with USACE to reduce negative impacts of dredging and channelization on sandbars.
- Work with the Scenic Rivers Program and partners to minimize the impacts of gravel mining on sandbars.
- Implement conservation recommendations of the USFWS recovery plan (USFWS 1990) and Interior Least Tern Five-Year Review (2013).
- Work with USACE to regulate water levels during breeding season to avoid negative impacts.
- Determine the feasibility of using abandoned barges as artificial nesting habitat.
- Secure funding to support long-term efforts to locate and monitor nesting colonies.

Terns

- Develop partnerships to strengthen the protection and restoration of Barrier Islands.

Shorebirds & Seabirds

- Work with CPRA, USACE, and other partners to continue the beneficial use of dredge material.

Waterbirds

- Provide public education regarding the importance of waterbird nesting colonies and shorebird staging/feeding areas to reduce the negative effects of recreational use on these areas.
- Work with landowners to implement management and conservation recommendations for waterbirds.
- Coordinate with the LCCs and JVs to implement recommendations of shorebird and wading bird conservation plans.
- Develop new and improve existing partnerships for protection and restoration of coastal marshes.
- Work with LCA, CPRA, USACE, and other partners to incorporate strategies specifically targeting important nesting areas in all future coastal restoration efforts.

Landbirds

- Promote the utilization of PIF documents for habitat management.
- Work with partners (NRCS, USFWS, USFS, etc.) to develop and distribute outreach materials concerning the importance of early successional habitats for SGCN.
- Continue operation of existing MAPS stations to examine productivity and survivorship of landbirds.
- Promote and conduct forest management practices that benefit landbirds.

Neotropical Migrant Songbirds

- Promote sustainable land-use practices on remaining Cheniers.
- Work with landowners to exclude or reduce grazing livestock from Cheniers.
- Continue efforts to conserve and restore Chenier habitats, including reforestation where appropriate.
- Promote and conduct management and restoration of Bottomland Hardwood Forest within the MAV.
- Design and implement a network of VHF telemetry towers along the coast to allow for more consistent monitoring of these species.

Grassland Birds

- Partner with NRCS and the Louisiana Native Plant Initiative to promote establishment of native grasses, including local ecotypes.
- Promote the economic benefits of using privately-owned prairies to produce hay.
- Continue efforts to support prescribed burning of prairies and other grassland habitats.

Brown-headed Nuthatch & Red-headed Woodpecker

- Continue to support the use of prescribed fire in maintaining open pine systems.
- Promote the use of Open Pine Desired Forest Conditions and the Open Pine Decision Support Tool in the management of open pine habitats.
- Encourage landowners to use group-selection and single-tree selection harvesting methods and maintain or increase the number of standing snags.

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 (2nd Revision).
- Encourage the establishment of new RCW populations.
- Investigate potential land acquisition to increase and support RCW populations.
- Encourage longer longleaf pine rotation ages when compatible with the landowner’s management objectives.

Henslow's Sparrow & Bachman's Sparrow

- Work with landowners to encourage use of BMPs for prescribed fire management and timber harvesting techniques to improve habitat quality.
- Encourage the conservation and restoration of longleaf pine grassland habitats.

Birds

- Provide comments on proposed wind energy projects to minimize impacts, utilizing the USFWS voluntary guidelines for siting wind energy.
- Conduct education/outreach on the negative impacts of feral cats on bird populations.
- Promote the design and construction of bird-friendly buildings.
- Develop partnerships for habitat management with LCCs and JVs.
- Promote habitat management to benefit these species through the Private Lands Program.
- Initiate and/or support efforts to update the Louisiana Breeding Bird atlas.

9. Mammals

Seventy mammal species have been recorded in Louisiana or its immediate adjacent waters (Lowery 1974). Thirteen species are considered critically imperiled, imperiled, or rare and local by the LNHP (2015). There are ten federally-listed mammal species in Louisiana. Recovery plans for the Louisiana Black Bear (USFWS 1995b) and West Indian Manatee (USFWS 2001) have been developed by the U. S. Fish and Wildlife Service. Both the Red Wolf (*Canis rufus*) and Florida Panther (*Puma concolor*) have been removed from the SGCN list, as they no longer occur in the state. Three of the four whale species included on the 2005 SGCN list have also been removed, as they do not regularly occur in state waters, and therefore cannot be impacted by conservation actions within Louisiana.

A. Mammal SGCN

Common Name	**Scientific Name**	**G-Rank**	**S-Rank**
Tier I			
Southeastern Shrew	*Sorex longirostris*	G5	S2
Northern Long-eared Bat	*Myotis septentrionalis*	G1G3	S1
Oak Ridge Pocket Gopher	*Geomys breviceps breviceps*	G5	S4T1
Eastern Spotted Skunk	*Spilogale putorius*	G5	S1
Tier II			
Southeastern Myotis	*Myotis austroriparius*	G3G4	S4
Big Brown Bat	*Eptesicus fuscus*	G5	S2
Eastern Chipmunk	*Tamias striatus*	G5	S3
Bachman's Fox Squirrel	*Sciurus niger bachmanii*	G5	S5T3

Hispid Pocket Mouse	*Chaetodipus hispidus*	G5	S2
Eastern Harvest Mouse	*Reithrodontomys humulis*	G5	S3
Prairie Vole	*Microtus ochrogaster*	G5TX	SH
Louisiana Black Bear	*Ursus americanus luteolus*	G5T2	S3
Ringtail	*Bassariscus astutus*	G5	S1
Long-tailed Weasel	*Mustela frenata*	G5	S3
West Indian Manatee	*Trichechus manatus*	G2	S1N
Tier III			
Silver-haired Bat	*Lasionycteris noctivagans*	G5	SZ
Rafinesque's Big Eared Bat	*Corynorhinus rafinesquii*	G3G4	S4
Eastern Pipistrelle	*Perimyotis subflavus*	G5	S4
Baird's Pocket Gopher	*Geomys breviceps sagittalis*	G5	S4
Golden Mouse	*Ochrotomys nuttalli*	G5	S4
Northern Pygmy Mouse	*Baiomys taylori*	G4G5	SU
Bottlenose Dolphin	*Tursiops truncatus*	G5	S5
Sperm Whale	*Physeter macrocephalus*	G3G4	SZ

B. Mammals Research and Survey Needs

- Implement or develop standard protocols for monitoring mammal populations to determine trends.

Southeastern Shrew

- Intensive surveys are needed to determine status, distribution, and habitat use.
- Research investigating the impacts of RIFA on this species is needed.

Long-tailed Weasel

- Intensive surveys needed to determine current status and distribution.
- Research needed to determine the habitat preferences and requirements of this species.

Bats

- Conduct surveys statewide in order to locate important roost sites.
- Monitor for the presence of White Nose Syndrome at known roost sites.

Southeastern Myotis

- Telemetry studies needed to determine locations of large winter roosts.

Northern Long Eared Bat

- Conduct additional surveys to determine current status, distribution, and habitat use.
- Telemetry studies needed to determine habitat use and foraging ecology.

Big Brown Bat

- Conduct life history studies to address data gaps for this species in the state.
- Conduct telemetry studies to determine habitat, foraging ecology, and day roost locations.

Hispid Pocket Mouse

- Targeted surveys needed to determine current occurrence and abundance.
- Support research on habitat requirements.
- Support research to determine basic life history data.

Eastern Harvest Mouse

- Targeted surveys needed to determine current occurrence and abundance.
- Research needed on life history and habitat requirements.

Golden Mouse

- Targeted surveys needed to determine current abundance and occurrence.
- Research needed on habitat requirements and preferences.

Northern Pygmy Mouse

- Targeted surveys needed to determine current abundance and occurrence.

Sperm Whale

- Collect data from stranded whales to increase knowledge of this species in state waters.

Bottlenose Dolphin

- Continue to document mortality events and track mortality rates.
- Continue data collection to allow for population estimates.
- Collect genetic and other samples from stranded animals.
- Continue and expand efforts to create and maintain a photo catalogue of individual animals to allow for population monitoring.

Ringtail & Eastern Spotted Skunk

- Intensive, targeted surveys are needed within the historic range to determine current status in state.

Prairie Vole

- Intensive, targeted surveys are needed in historical range to determine current status in state.

Bachman's Fox Squirrel

- Document the current extent of range in Louisiana and collect baseline population data.
- Utilize or modify hunter harvest surveys to monitor harvest rates for this subspecies.

Baird's Pocket Gopher

- Research the role of prescribed fire regime on population dynamics.
- Develop a protocol for estimating population size.
- Conduct studies on food habits, specific habitat preferences, and limiting factors.
- Investigate usage of utility ROWs, especially within the range of the Louisiana Pine Snake.
- Investigate methods to increase colonization rates of clearcuts or restored habitat.

Oak Ridge Pocket Gopher

- Conduct surveys to determine the current status and distribution of this subspecies in Louisiana.
- Support research on the natural history of this subspecies in Louisiana.

Eastern Chipmunk

- Determine the current distribution and status of this species in Louisiana.
- Support research on habitat requirements and potential limiting factors.

C. Mammals Conservation Actions

Southeastern Myotis and Rafinesque's Big Eared Bat

- Promote the use of Desired Stand Conditions and BMPs found in the LMVJV document "Restoration, Management, and Maintenance of Forest Resources in the MAV", including the retention of snags.
- Work with landowners to implement proper habitat management to benefit these species.

Bats

- Partner with DOTD to implement the use of bat-friendly bridges during bridge replacements.

- Promote the benefits of bat colonies and develop partnerships with landowners to protect roosts.

Hispid Pocket Mouse

- Continue to support the use of prescribed fire to maintain appropriate habitat.

Golden Mouse

- Include the retention of vertical structure (vines, tangles, etc.) in habitat management recommendations/BMPs.

Bottlenose Dolphin

- Support outreach/education on this species in LA, particularly how to minimize human impacts on species.

Louisiana Black Bear

- Continue to support efforts to increase connectivity through the establishment and maintenance of corridors.
- Partner with DOTD to provide road crossings to limit road mortality.
- Support outreach & education to increase public acceptance of bears and reduce nuisance behavior.
- Work with landowners to manage habitat to benefit this species.
- Continue to work with USFWS and other partners to implement the recovery plan for this species.

West Indian Manatee

- Raise public awareness of this species to increase reporting of sightings to the LHNP.
- Provide educational/outreach materials about this species.

Prairie Vole

- Continue efforts to conserve and restore coastal prairie.

Bachman's Fox Squirrel

- Develop habitat management recommendations to benefit this subspecies.

Baird's Pocket Gopher

- Develop a Habitat Suitability Index for pocket gophers in Louisiana.
- Continue efforts to promote prescribed fire and restore open pine habitat within the range of this species.

Oak Ridge Pocket Gopher

- Develop Best Management Practices for Calcareous Prairies where this subspecies is found.

Eastern Chipmunk

- Conserve Southern Mesophytic Forests to provide habitat for this species.

10. General Conservation Actions

Rather than being specific to a single SGCN or particular suite of SGCN, the following actions will provide benefits to many or all SGCN or are of relevance to many or all natural communities, thereby benefitting large numbers of SGCN. As with the conservation actions presented earlier in this chapter, this list should be considered a starting point, rather than an exhaustive list. The actions are divided into five categories: Partnerships, Education, Research and Inventory, Habitat Impact Avoidance, and Stewardship Implementation.

A. Partnerships

- Partner with NGOs, state and federal agencies, industry, and private landowners to promote conservation of natural communities.
- Utilize social media outlets to engage, inform, and interact with the public about wildlife habitats and their conservation.
- Work with the legislature to develop tax incentives for landowners to encourage conservation of rare habitat types.
- Direct the curricula of the local chapters of the Louisiana Master Naturalist Program; ensure that students are being trained in relevant subjects; frequently utilize certified Master Naturalists to help accomplish conservation projects.
- Increase support for landowner outreach and citizen-based voluntary conservation initiatives such as the Natural Areas Registry Program.
- Work closely with Interagency Review Team to ensure that proposed mitigation banks will have the highest possible ecological value; interact with mitigation bank sponsors to assist with decision making, if requested.

B. Education

- Provide educational information on natural communities and their importance to SGCN to landowners and managers through participation in outreach events, presentations, and workshops, and through the LDWF website.
- Encourage the design of university curricula that emphasize natural habitat diversity in fields of applied science (e.g. landscape architecture, landscape and urban planning, and renewable natural resources conservation); communicate the need for field biology training to University department heads and administrators.

- Promote education about the impact of invasive plant and animal species on natural habitats and methods to eradicate or control invasives through literature, radio and television, and interactive workshops.
- Continue to provide information on WAP species of concern and associated habitats for teachers and other workshops (Future Farmers of America (FFA), Envirothon, etc.) to ensure their use in Louisiana schools.
- Develop and publish information regarding beneficial management practices and/or desired habitat conditions for all habitat types.
- Increase number of publications picturing and describing Louisiana wildlife, plants, and habitats (e.g. field guides, accounts of flora and fauna of particular sites or habitats).
- Establish a television program that takes the audience across Louisiana, introducing them to diverse habitats, many of which are surely not or poorly known to the average citizen.

C. Research and Inventory

- Intensify surveys to determine the current conservation status of all natural communities and to gain additional information about poorly-known habitats.
- Engage the public in documenting and reporting habitat occurrences through citizen science initiatives.
- Continue survey work to document “up-and-coming” exotic invasive species that are expected to eventually have a negative impact on Louisiana’s biological resources.
- Use remote sensing to determine location and extent of habitats, incorporating ground truthing and involvement of scientists sufficiently versed in plant ecology.

D. Habitat Impact Avoidance

- Inform appropriate planning commissions about types of habitats and their locations to avoid impact to these habitats.
- Provide habitat information to oil, gas, and seismic companies and encourage resource survey and mining techniques that avoid or minimize impacts to wildlife habitats.
- Create a web-based biodiversity information server to allow clients to determine species and habitats potentially impacted by their proposed development projects.

E. Stewardship Implementation

- Promote the utilization of federal cost share programs (NRCS) to address habitat conservation issues such as invasive species problems and implementation of stewardship practices (e.g. prescribed burning).
- Provide funding and assistance to landowners for exotic species control in high quality habitat occurrences.
- Increase the number of cost share/cost elimination programs that apply stewardship practices on the landscape (e.g. Prescribed Burn Initiative); expand existing programs to apply to additional habitats and increase their geographic reach.

- Increase LDWF’s capability to apply stewardship on private lands by having more certified prescribed fire applicators and more staff certified to apply herbicides.

CHAPTER 5. HABITAT CONSERVATION

A. Introduction.

This chapter provides information on the wildlife habitats of Louisiana. Habitats are named and described based on vegetation, landscape position, soils, and ecological processes. Most habitats treated here support terrestrial vegetation, while several are aquatic habitats and landscape features. The habitat information presented here is largely drawn from The Natural Communities of Louisiana (LNHP 2009), which is the latest natural community classification available for Louisiana. This chapter also addresses anthropogenic (man-made) habitats, and natural communities that we have learned of since 2009. Habitats below are arranged according to the following broader categories:

Forests **–** habitats that, in their natural state, are dominated by trees and have a canopy cover of greater than 75 percent. Herbaceous understory plants are shade-loving.

Savannas and Woodlands – habitats that are wooded with trees but whose canopies are naturally open, allowing development of a light-loving, often grassy understories. Savannas are very open, with a canopy cover of less than 50 percent. Woodlands are more densly wooded, but are still relatively open, having 50-75 percent canopy cover. Fire is a key process that historically maintained all of Louisiana's savannas and woodlands.

Shrublands – habitats that are wooded with shrubs and small trees. Also included in this category is canebrake, which is dominated by a woody grass in the bamboo group.

Grasslands – habitats that are practically treeless, such as prairies, barrens, glades, bogs, beaches, marshes, etc. In most cases, grasses and grass-like plants dominate in these habitats.

Ephemeral Ponds – habitats that occupy isolated depressions which are seasonally inundated, and often drawn-down completely during dry periods. This category includeds wooded and non-wooded ponds.

Lentic Water Bodies – natural lakes, reservoirs, and natural and man-made ponds.

Submersed Aquatic Vegetation (SAV) – vegetated habitats dominated by submersed plants. Submersed Aquatic Vegetation may occupy a variety of settings such as permanent ponds and lakes, bayous, and estuarine and marine waters.

Subterranean Habitat – this category includes one habitat: cave.

Geologic Feature – this category captures barrier islands, which support several habitat types.

Anthropogenic Habitats – habitats that are a result of human activity, including agricultural fields, aquaculture ponds, and pine plantations (tree farms).

In each account, the habitat is described and characteristic plants and associated SGCN are listed. Threats to each habitat and habitat conservation actions are also presented. The geographic distribution of each habitat is expressed as a parish distribution map. Threats assessments were completed using the NatureServe Conservation Status Assessments: Rank Calculator, Version 3.186. Habitat conservation actions for each habitat are proposed.

This account of habitats is not final and in many cases we are lacking knowledge. On today's landscape, habitat alteration and interruption of natural processes, such as fire and flooding, has made habitat classification a difficult task. Since the arrival of Europeans, many landscape alterations have occurred. Therefore, the landscape is full of ecological "noise", and understanding habitats in the presence of this "noise" is important since we need to understand the factors that drove the evolution of our biota, and are responsible for biodiversity maintenance. Following completion of this plan, our understanding of Louisiana's habitats will improve, and additional threats and needed conservation strategies will become evident.

1. FORESTS

1.1 Barrier Island Live Oak Forest

Rarity Ranks: S1/G1Q
Synonyms: Maritime Forest
Ecological Systems: CES203.513 Mississippi Delta Maritime Forest

General Description:

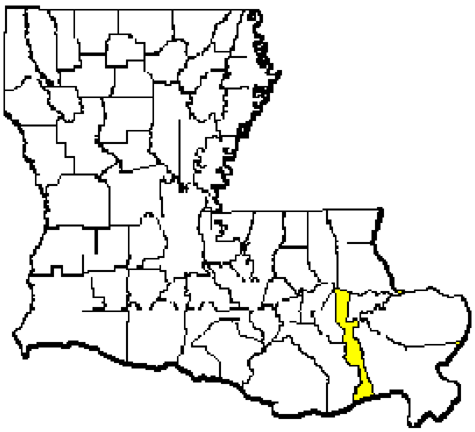
This forest is restricted to interior portions of Grand Isle, where it is sufficiently buffered from the harsh shoreline environment. Trees in Barrier Island Live Oak Forests can exhibit the effects of saltwater spray and wind, having a stunted appearance and leaning away from the prevailing wind (West 1938, Brown 1930). This community is impacted by development, exotic species, vehicle traffic, clearing of understory vegetation, and habitat fragmentation. Conservation of this system is imperative to the survival of Neotropical migratory birds, which use this habitat for stopover during migration.

Barrier Island Live Oak Forest on Grand Isle, Jefferson Parish.

Barrier Island Live Oak Forest: Characteristic Plant Species	
Common Name	**Scientific Name**
Live Oak	*Quercus virginiana*
Sugarberry	*Celtis laevigata*
Yaupon	*Ilex vomitoria*
Toothache Tree	*Zanthozylum clava-herculis*

Current Extent and Status:

Barrier Island Live Oak Forest is restricted to Grand Isle where it occupies a small area (approximately 20 acres). There is no complete information regarding the pre-settlement extent of this natural community type on Louisiana's Barrier Islands (Smith 1993). This habitat probably occupied less than 1,000 acres, perhaps closer to 500 acres. Most of its historical extent has been destroyed for residential and commercial development. TNC's Lafitte Woods Preserve protects 8 acres of this forest.



Barrier Island Live Oak Forest SGCN (17)	
BIRDS	Swainson's Warbler
Chuck-Will's-Widow	Kentucky Warbler
Chimney Swift	Hooded Warbler
Yellow-Throated Vireo	Cerulean Warbler
Warbling Vireo	Yellow-throated Warbler
Wood Thrush	Painted Bunting
Worm-eating Warbler	
Louisiana Waterthrush	**INSECTS**
Golden-winged Warbler	Monarch
Prothonotary Warbler	
	REPTILES
	Eastern Glass Lizard

Threats Affecting Habitat:

Remaining examples of this habitat are threatened by disturbance by humans, invasive plants, and subsidence.

<u>Barrier Island Live Oak Forest Threats Assessment:</u>			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	Small	Extreme	Low
Agriculture/Aquaculture	N/A	N/A	N/A
Energy Production & Mining	Small	Extreme	Low
Transportation & Service Corridors	Small	Extreme	Low
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Pervasive	Serious	High
Natural System Modification	Pervasive	Serious	High
Invasive & other Problematic Species	Large	Moderate	Medium
Pollution	Large	Slight	Low
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	Pervasive	Slight	Low
Overall Calculated Threat Impact: Medium			

Habitat Conservation Actions:

1. Partner with NGOs, state and federal agencies, industry, and private landowners to promote conservation of remaining barrier island live oak forest and to promote and facilitate removal of invasive plant and animal species.
2. Pursue reforestation on Grand Isle to expand this habitat type.
3. Promote propagation and planting of coastal ecotypes of Live Oak, Tooth-ache Tree, and other native species on Grand Isle.
4. Support NRCS, LDNR, and CPRA efforts for shoreline stabilization and habitat restoration.
5. Work with local governing boards to recommend limits on vehicle use in this habitat.

1.2 Batture Forest

Rarity Rank: S3/G4G5

Synonyms: Riverfront Pioneer Forest, Cottonwood-Willow Forest

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:

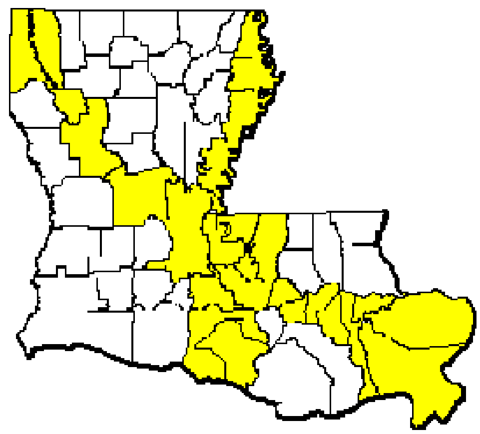
Batture Forest develops on the slope between the natural (or man-made) levee crest and major streams/rivers. Batture areas are periodically scoured when river levels rise, and depending on sediment particle size, new sediment may be deposited when river levels fall. Historically, meandering rivers naturally shifted laterally (a process now inhibited by man-made levees and water control structures) via sediment erosion. As a river shifted course, the distance between the Batture and river channel increased, allowing the Batture Forest to undergo succession into other bottomland forest associations. In large rivers such as the Mississippi, the area between the man-made levee and the river channel remains unstable and thus supports a Batture Forest containing early successional plant species.

Batture Forest along the Mississippi River, West Feliciana Parish.

Batture Forest: Characteristic Plant Species	
Common Name	**Scientific Name**
Boxelder	*Acer negundo*
Silver Maple	*Acer saccharinum*
Lead Plant	*Amorpha fruticosa*
Buttonbush	*Cephalanthus occidentalis*
Swamp Privet	*Forestiera acuminata*
American Sycamore	*Platanus occidentalis*
Eastern Cottonwood	*Populus deltoides*
Sandbar Willow	*Salix interior*
Black Willow	*Salix nigra*

Current Extent and Status:

Batture Forest occurs primarily along the Mississippi River but also along the Atchafalaya, Red, Ouachita, Pearl, and other rivers. The acreage and number of intact sites is unknown. Substantial portions of the Atchafayala Basin may support forest that is referrable to this habitat.



Batture Forest SGCN (33)		
BIRDS	Swainson's Warbler	**REPTILES**
Wood Stork	Kentucky Warbler	Alligator Snapping Turtle
Little Blue Heron	Hooded Warbler	Smooth Softshell
Swallow-tailed Kite	Painted Bunting	Ringed Map Turtle
Bald Eagle	Rusty Blackbird	Ouachita Map Turtle
American Woodcock		Sabine Map Turtle
Chuck-Will's-Widow	**MAMMALS**	Pearl Map Turtle
Chimney Swift	Southeastern Myotis	
Yellow-throated Vireo	Big Brown Bat	**PLANTS**
Warbling Vireo	Rafinesque's Big-eared Bat	Western Umbrella Sedge
Wood Thrush	Eastern Pipistrelle	Square-stemmed Monkey-Flower
Worm-eating Warbler	Bachman's Fox Squirrel	
Louisiana Waterthrush	Ringtail	
Prothonotary Warbler	Long-tailed Weasel	

Threats Affecting Habitat:

Batture Forests occurring along large rivers are restricted to narrow corridors by operation of man-made levees (natural system modification). This habitat is threatened by human-related disturbance from several sources, and by invasive plants and animals.

<u>Batture Threats Assessment:</u>

First Level Threat	Scope	Severity	Impact
Residential/Commercial Development	Small	Serious	Low
Agriculture/Aquaculture	Restricted	Extreme	Medium
Energy Production & Mining	Restricted	Moderate	Low
Transportation & Service Corridors	Restricted	Extreme	Medium
Biological Resource Use	Small	Serious	Low
Human Intrusion/Disturbance	Small	Slight	Low
Natural System Modification	Pervasive	Serious	High
Invasive & other Problematic Species	Pervasive	Moderate	Medium
Pollution	Slight	Pervasive	Low
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	N/A	N/A	N/A
Overall Calculated Threat Impact: Medium			

Habitat Conservation Actions:

1. Conduct habitat inventories especially in the Atchafalya Basin.
2. Work with COE, local levee boards, city planning commissions and local conservation groups to promote development of batture reserves to retain natural habitats and to provide education on the importance of this habitat for both resident and migratory wildife.
3. 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.
4. Work with COE to minimize impacts of dredging and water discharges on batture habitats.
5. Promote the maintanence and restoration of natural hydologic regimes.

1.3 Bayhead Swamp (Including 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:

Bayhead Swamp and Forested Seep are described as distinct communities in LNHP (2009). They are combined here due to their floristic similarity and common management needs. Bayhead Swamps are forested wetlands occupying acidic, often seepage-influenced, areas embedded in pine woodlands and savannas of the coastal plain ecoregions. Soils are often saturated and spongy even during dry periods. The flora of Bayhead Swamps includes several broad-leaved evergreen trees and shrubs such as Sweetbay Magnolia and Red Bay. Ferns and living peat moss (*Sphagnum*) are often conspicuous in the understories of Bayhead Swamps. Landscape position can vary from broad depressions or stream bottoms in flatwoods to narrow stream valleys in hilly terrain, sometimes even occurring on upper slopes. Bayhead Swamps are typically flanked by fire-dependent pine grasslands and often serve as natural fire breaks. These forests naturally vary from a few acres to more than 100 acres in size (Brooks et al 1993, Smith 1996).

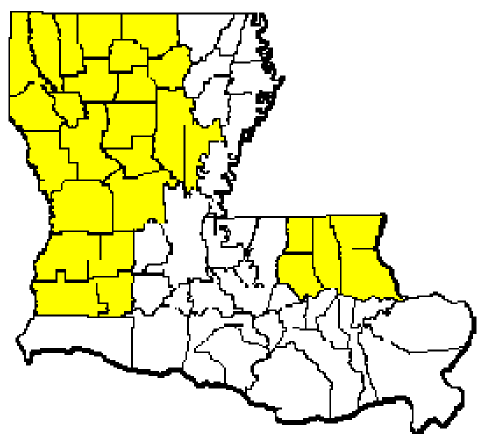
Bayhead Swamp, Schoolhouse Springs, Jackson Parish.

Bayhead Swamp: Characteristic Plants	
Common Name	**Scientific Name**
White Titi	*Cyrilla racemiflora*
Fetterbush	*Lyonia lucida*
Sweetbay Magnolia	*Magnolia virginiana*
Swamp Blackgum	*Nyssa biflora*
Cinnamon Fern	*Osmunda cinnamomea*
Royal Fern	*Osmunda regalis*
Red Bay	*Persea palustris*
Laurel Greenbrier	*Smilax laurifolia*
Pondcypress	*Taxodium ascendens* (EGCP)
Baldcypress*	*Taxodium distichum*
Poison Sumac	*Toxicodendron vernix*
Possumhaw	*Viburnum nudum*
Netted Chain Fern	*Woodwardia areolata*

* Baldcypress is characteristic of Bayhead Swamps/Forested Seeps in the Upper West Gulf Coastal Plain, where it can occur with seepage on middle and upper slopes. Baldcypress is not a typical component in this habitat elsewhere in the state.

Current Extent and Status:

Bayhead Swamps are associated with older landscapes generall supporting a pine-dominated matrix. High-quality Bayhead Swamps are fairly easy to find in all portions of the habitat's range, on conservation areas and private lands.



Bayhead Swamp SGCN (48)

AMPHIBIANS
Southern Dusky Salamander
Gulf Coast Mud Salamander

BIRDS
American Woodcock
Yellow-throated Vireo
Wood Thrush
Prothonotary Warbler
Swainson's Warbler
Kentucky Warbler
Hooded Warbler
Painted Bunting
Rusty Blackbird

CRUSTACEANS
Flatnose Crawfish

INSECTS
Texas Emerald
Texas Forestfly
Louisiana Needlefly
Schoolhouse Springs Net-Spinning Caddisfly
Morse’s Net-Spinning Caddisfly
Holzenthal’s Philopotamid Caddisfly
Spring-Loving Psiloneuran Caddisfly
Schoolhouse Springs Purse Casemaker Caddisfly
Hydroptalid Caddisfly
Pepper and Salt Skipper
Arogos Skipper
Monarch

MAMMALS
Southeastern Shrew
Southeastern Myotis
Big Brown Bat
Rafinesque’s Big-eared Bat
Eastern Pipistrelle
Bachman’s Fox Squirrel
Golden Mouse
Long-tailed Weasel

PLANTS
Baygall Caric Sedge
Bird-bill Spike Grass
Black Titi
Bog Moss
Bog Spicebush
Canby’s Bulrush
Louisiana Quillwort
Millet Beak Sedge
Myrtle Holly
Northern Burmannia
Odorless Bayberry
Rooted Spike Sedge
Sarvis Holly
Swamp-forest Beak Sedge
Three-way Sedge
Tussock Sedge
Yellowroot

Threats Affecting Habitat:

Soil and canopy disturbances associated with timber harvesting, mineral extraction, and other sources occasionally affect this habitat. The most serious threat comes from invasive species, especially feral hogs.

Bayhead Swamp/Forested Seep Threats Assessment:			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	Small	Slight	Low
Agriculture/Aquaculture	Small	Extreme	Low
Energy Production & Mining	Restricted	Moderate	Low
Transportation & Service Corridors	Restricted	Moderate	Low
Biological Resource Use	Restricted	Serious	Medium
Human Intrusion/Disturbance	Small	Slight	Low
Natural System Modification	Restricted	Slight	Low
Invasive & other Problematic Species	Pervasive	Serious	High
Pollution	Small	Slight	Low
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	Large	Slight	Low
Overall Calculated Threat Impact: Medium			

Habitat Conservation Actions:

1. Encourage landowners and managers to utilize Bayhead Swamps as fire breaks and to not install fire lines along them. This habitat will not burn and is not in need of protection from fire. The upper edges of Bayhead Swamps historically experienced fire and likely support species to which a fire-frequent edge is important.

1.4 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. These forests are found throughout Louisiana, and are the predominant natural community type of the Mississippi River Alluvial Plain. Bottomland Hardwood Forests are characterized and maintained by a natural hydrologic regime of alternating wet and dry periods generally following seasonal flooding events. They are important natural communities for maintenance of water quality, providing a productive habitat for a variety of fish and wildlife species, and regulating flooding and stream recharge (LNHP 2009). Unlike many coastal stopover sites, Neotropical migratory birds utilize Bottomland Hardwood Forests as full-service hotels, which provide food, water, and shelter during their perilous journey (Mehlman *et al.* 2005). 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 based on environmental factors such as physiography, topography, soils, and moisture regime (Allen 1997, The Nature Conservancy 2004).

Bottomland Hardwood Forest, Big Lake WMA, Tensas Parish

The following are three associations recognized by the LNHP in Bottomland Hardwood Forests of Louisiana (LNHP1986-2009):

1). **<u>Overcup Oak-Water Hickory Bottomland Hardwood Forest</u>**

Overcup Oak and Water Hickory are codominants of this floodplain forest which occurs on low-lying poorly drained flats, sloughs in backwater basins, and on low ridges with clay soils that are subject to inundation. Semi-permanently inundated or saturated soils are generally present for a major portion of the growing season. This community type has a long successional stage.

Overcup Oak-Water Hickory Bottomland Hardwood Forest: Characteristic Plants	
Common Name	**Scientific Name**
Water Hickory	*Carya aquatica*
Swamp Privet	*Forestiera acuminata*
Waterlocust	*Gleditisia aquatica*
Planertree	*Planera aquatica*
Overcup Oak	*Quercus lyrata*
Nuttall Oak	*Quercus texana*
Red Grape	*Vitis palmata*

2). **<u>Hackberry-American Elm-Green Ash Bottomland Hardwood Forest</u>**

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.

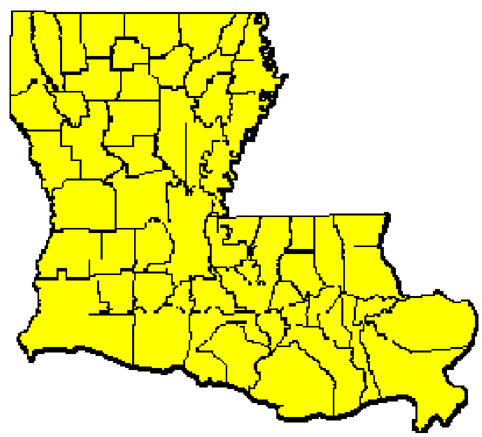
Hackberry-American Elm-Green Ash Bottomland Hardwood Forest: Characteristic Plants	
Common Name	**Scientific Name**
Water Hickory	*Carya aquatica*
Hackberry	*Celtis laevigata*
Green Ash	*Fraxinus pennsylvanica*
Honeylocust	*Gleditsia triacanthos*
American Elm	*Ulmus americana*

3). **<u>Sweetgum-Water Oak Bottomland Hardwood Forest</u>**

This is the driest Bottomland Hardwood Forest type, occuring often on low ridges. Plant diversity generally increases with shorter hydroperiod, so this type is also the richest in plant species of the Bottomland Hardwood Forest types.

Sweetgum-Water Oak Bottomland Hardwood Forest: Characteristic Plants	
Common Name	**Scientific Name**
Cherokee Caric Sedge	*Carex cherokeensis*
Caric sedges	*Carex spp.*
Deciduous Holly	*Ilex decidua*
Sweetgum	*Liquidambar styraciflua*
Red Mulberry	*Morus rubra*
Water Oak	*Quercus nigra*
Cherrybark Oak	*Quercus pagoda*
Southern Shield Fern	*Thelypteris kunthii*
Poison Ivy	*Toxicodendron radicans*

Current Extent and Status:



Bottomland Hardwood Forest loss is estimated to be 50 to 75 percent of the original pre-settlement 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 decline of this habitat type. Large tracts of Bottomland Hardwood Forest remain, but most are either second or third growth stands. The U.S. Army Corps of Engineers (COE) oversees the Atchafalaya Basin Floodway which is the largest remaining block of floodplain forest and swamp in the U.S. 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. Much of this acreage is contained within the Bogue Chitto NWR, managed by the USFWS, and Pearl River WMA, operated by LDWF. While some sizeable blocks of bottomland hardwoods remain, altered hydrology is causing observable shifts in plant species composition (DeWeese et. al. 2007). Reconnecting fragmented forest blocks and restoration of wetland forest functions are the major challenges to reforestation efforts but are essential to providing adequate wildlife habitat in alluvial settings.

Bottomland Hardwood Forest SGCN (58)

AMPHIBIANS
Southern Dusky Salamander
Louisiana Slimy Salamander
Strecker's Chorus Frog
Eastern Spadefoot
Southern Crawfish Frog

BIRDS
Wood Stork
Roseate Spoonbill
Osprey
Swallow-tailed Kite
Bald Eagle
American Woodcock
Chimney Swift
Yellow-throated Vireo
Wood Thrush
Worm-eating Warbler
Louisiana Waterthrush
Golden-winged Warbler
Prothonotary Warbler
Swainson's Warbler
Kentucky Warbler
Hooded Warbler
Cerulean Warbler
Painted Bunting
Rusty Blackbird

CRUSTACEANS
Javelin Crawfish

INSECTS
Six-banded Longhorn Beetle
'Seminole' Texan Crescent
Creole Pearly-eye
Lace-winged Roadside Skipper
Brou’s Underwing

MAMMALS
Southeastern Shrew
Southeastern Myotis
Northern Long-eared Bat
Rafinesque’s Big Eared Bat
Eastern Pipistrelle
Big Brown Bat
Louisiana Black Bear
Ringtail
Long-tailed Weasel
Eastern Spotted Skunk

MOLLUSKS
Flamed Tigersnail

REPTILES
Alligator Snapping Turtle
Eastern Diamond-backed Rattlesnake
Timber Rattlesnake

PLANTS
Broad-leaved Spiderwort
Burr Oak
Climbing Bittersweet
Cypress-knee Sedge
Fowl Manna Grass
Hairy Comb Fern
Long-sepaled False Dragon-head
Low Erythrodes
Nodding Pogonia
Pondberry
Sink-hole Fern
Snow Melanthera
Southern Shield Wood Fern
Swamp Thistle

Threats Affecting Habitat:

Many Bottomland Hardwood Forests are experiencing drier site conditions due to modifications to hydrology, resulting in changes in species composition. Invasive plants and animals also seriously threaten this habitat.

Bottomland Hardwood Forest Threats Assessment:			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	Small	Slight	Low
Agriculture/Aquaculture	Pervasive	Moderate	Medium
Energy Production & Mining	Restricted	Slight	Low
Transportation & Service Corridors	Large	Slight	Low
Biological Resource Use	Restricted	Moderate	Low
Human Intrusion/Disturbance	Restricted	Slight	Low
Natural System Modification	Pervasive	Serious	High
Invasive & other Problematic Species	Large	Serious	High
Pollution	Small	Slight	Low
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	Pervasive	Slight	Low
Overall Calculated Threat Impact: High			

Habitat Conservation Actions:

1. Promote use of appropriate silvicultural techniques and BMPs (e.g, the LMVJV desired forest conditions report, *Restoration, Management, and Monitoring of Forest Resources in the Mississippi Alluvial Valley: Recommendations for Enhancing Wildlife Habitat*) to restore and manage BLH forests for wildlife (include importance of tree species diversity), den trees for birds and mammals, etc.
2. Work with adjoining states to address water management issues that affect bottomland hardwood habitat in Louisiana.
3. Continue to work with partners to promote corridors of Bottomland Hardwood Forests for wildlife species.
4. Work with NRCS to incorporate long-term planning for reforested CRP and WRP sites.
5. Implement floodplain reintroductions and diversions to restore natural hydrology to Bottomland Hardwood Forests.

1.5 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.

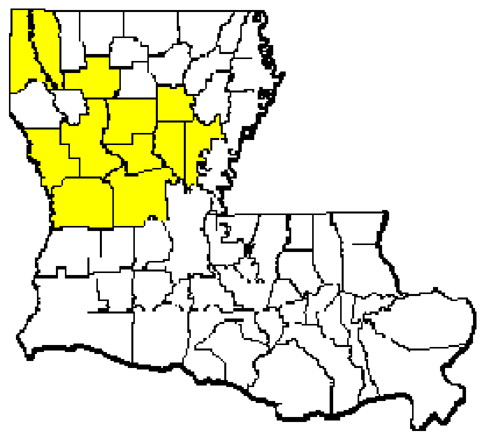
This community occurs on calcareous soils in the uplands of central, western and northwest Louisiana. Most known examples occur on hills and slopes on either side of small creeks, downslope from calcareous prairies. Structure likely varies based on slope position, with more mesic examples on steep slopes and in stream valleys having a closed (or nearly so) canopy. Calcareous Forests on upper slopes and ridge tops were likely more like woodlands, where dry site conditions and fire maintained an open canopy. Soils are stiff calcareous clays, not quite as alkaline as in the prairies (surface pH ~ 6.5-7.5), with high shrink-swell characteristics.

Calcareous Forest, Bodcau WMA, Bossier Parish.

Calcareous Forest: Characteristic Plants	
Common Name	**Scientific Name**
Cherokee Caric Sedge	*Carex cherokeensis*
Nutmeg Hickory	*Carya myristiciformis*
Eastern Redbud	*Cercis canadensis*
White Ash	*Fraxinus americana*
Tuberous Puccoon	*Lithospermum tuberosum*
Chinquapin oak	*Quercus muhlenbergii*
Shumard Oak	*Quercus shumardii*
Post Oak	*Quercus stellata*
Aromatic Sumac	*Rhus aromatica*
Rusty Blackhaw	*Viburnum rufidulum*

***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 pre-settlement times and that 25 to 50 percent remain today (Smith 1993). There are several high quality occurences 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 SGCN (43)		
BIRDS	**MAMMALS**	Stiff Tickseed
American Woodcock	Northern Long-eared Bat	Three-flowered Hawthorn
Greater Roadrunner	Southeastern Myotis	Wahoo
Chuck-Will's-Widow	Silver-haired Bat	Purple Boneset
Chimney Swift	Big Brown Bat	Virginia Strawberry
Wood Thrush	Rafinesque's Big-eared Bat	Oglethorpe Oak
Yellow-throated Vireo	Eastern Pipistrelle	Durand Oak
Kentucky Warbler	Bachman's Fox Squirrel	Lance-leaved Buckthorn
Hooded Warlber	Golden Mouse	Three-lobed Coneflower
	Northern Pygmy Mouse	Yellow Pimpernell
INSECTS	Ringtail	Downy Yellow Violet
Six-banded Longhorn Beetle	Long-tailed Weasel	Northern Prickly Ash
Frosted Elfin		Nuttall Death Camas
Wild Indigo Duskywing	**PLANTS**	
Brou's Underwing	Purple Milkweed	**REPTILES**
	Atlantic Camas	Western Worm Snake
	Tall Bellflower	Timber Rattlesnake
	Yellow-wood	
	White-leaved Leather Flower	

Threats Affecting Habitat:

This habitat is threatened mainly by disturbance associated with timber harvesting and oil and gas extraction (including roads and infrastructure). Inadequate fire threatens Calcareous Forests on upper slopes and ridge tops.

Calcareous Forest Threats Assessment:

First Level Threat	Scope	Severity	Impact
Residential/Commercial Development	Restricted	Moderate	Low
Agriculture/Aquaculture	Restricted	Extreme	Medium
Energy Production & Mining	Large	Moderate	Medium
Transportation & Service Corridors	Large	Moderate	Medium
Biological Resource Use	Restricted	Moderate	Low
Human Intrusion/Disturbance	Small	Slight	Low
Natural System Modification	Restricted	Moderate	Low
Invasive & other Problematic Species	Large	Slight	Low
Pollution	Small	Slight	Low
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	N/A	N/A	N/A

Habitat Conservation Actions:

1. Conduct studies to relate vegetation to landscape position and soil characteristics to further understand processes accounting for and maintaining this habitat type.
2. Conduct zoological inventories to determine utilization of this habitat type.
3. Prioritize the development of management plans and recommendations for this habitat type.
4. Promote fire as management tool for Calcareous Forests occuring on higher landscape positions.

1.6 Coastal Live Oak-Hackberry Forest

Rarity Rank: S1/G2

Synonyms: Chenier, Maritime Forest, Chenier Maritime Forest

Ecological Systems: CES203.466 West Gulf Coastal Plain Chenier and Upper Texas Coastal Fringe Forest and Woodland
CES203.503 East Gulf Coastal Plain Maritime Forest

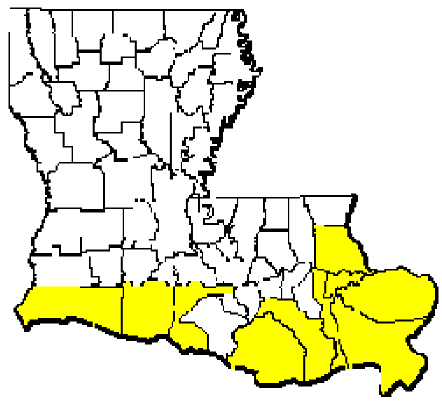
General Description:

Coastal Live Oak-Hackberry Forests develop mainly on Cheniers (French for "place of oaks"), which are abandoned beach ridges defining the Chenier Plain of southwest Louisiana and adjacent Texas. Cheniers occur on the Deltaic Plain as well, but are rare here. 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. Cheniers are important storm barriers limiting saltwater intrusion into marshes. Typically, marshes north of Cheniers are fresher than those Gulf-ward. This community also provides important wildlife habitat and serves as vital resting habitat for trans-Gulf-migrating birds (Mueller 1990). Hundreds of thousands of birds (around 100 species) use Cheniers as stopover points during migration. Native American shell middens also support this habitat type, which is considered a distinct habitat by NatureServe (2015), Gulf Coast Shell Midden Woodland (G2G3).

Coastal Live Oak–Hackberry Forest, Marsh Island, Vermilion Parish; photo taken in late 1980s.

Coastal Live Oak-Hackberry Forest: Characteristic Plant Species	
Common Name	**Scientific Name**
Hackberry	*Celtis laevigata*
Green Ash	*Fraxinus pennsylvanica*
Hairy Gromwell	*Onosmodium molle* (shelly substrate)
Texas Prickly Pear	*Opuntia lindheimeri* (deep sand)
Live Oak	*Quercus virginiana*
Palmetto	*Sabal minor*
Heartleaf Skullcap	*Scutellaria ovata*

Current Extent and Status:



Coastal Live Oak – Hackberry Forests occur in the Chenier Plain from Iberia Parish westward across Vermilion and Cameron parishes, and on a few true cheniers in the Deltaic Plain. This habitat also occurs on Native American shell middens. Since this forest type is found on elevated sites, most examples were developed or highly altered relatively early during European exapansion. Many shell middens have been mined for fill material. Of the original 100,000 to 500,000 acres in Louisiana, only 2,000 to 10,000 acres remain — 2-10 percent of pre-settlement extent (Smith 1993). True remaining extent is likely much closer to the lower end of this range.

Few examples of this habitat are protected. The Nature Conservancy protects Holister Chenier Preserve (ca. 30 acres) in Cameron Parish, owned by TNC. Establishment of this habitat on an artificial ridge near Fourchon is being carried out by BTNEP using plant materials propagated from nearby Grand Isle. Several Native American shell middens are protected on Jean Lafitte National Historical Park and Preserve.

COASTAL LIVE OAK - HACKBERRY FOREST SGCN (24)		
BIRDS	Prothonotary Warbler	**REPTILES**
American Woodcock	Swainson's Warbler	Ornate Box Turtle
Chuck-Will's-Widow	Kentucky Warbler	Western Slender Glass Lizard
Chimney Swift	Hooded Warbler	Timber Rattlesnake
Yellow-Throated Vireo	Cerulean Warbler	
Warbling Vireo	Yellow-throated Warbler	**PLANTS**
Wood Thrush	Painted Bunting	Narrow-leaved Puccoon
Worm-eating Warbler		Wedge-leaf Whitlow-grass
Louisiana Waterthrush	**INSECTS**	Saw Palmetto*
Golden-winged Warbler	Celia's Roadside Skipper	
	Falcate Orangetip	

*Saw Palmetto occurs on several relict barrier islands on the Detltaic Plain of southeast Louisiana and on the North Shore of Lake Pontchartrain.

Importance to Neotropical Migratory Landbirds:

It must be noted that the Chenier Plain Coastal Live Oak-Hackberry Forests are extremely important as stopover habitat for Neotropical migratory landbirds 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. During fall migration cheniers provide important corridors and staging areas for both trans-Gulf and circum-Gulf migrants, whchmove along the coast through Texas and around the Gulf of Mexico on their journey to Central and South America.

Threats Affecting Habitat:

This forest type is threatened by potential residential and commercial development, sand and shell mining, and invasive plants and animals. Erosion and subsidence of surrounding coastal marsh will increase the exposure of this habitat to wave action and storm surges.

<u>Coastal Live Oak-Hackberry Forest Threats Assessment:</u>			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	Large	Extreme	High
Agriculture/Aquaculture	Large	Moderate	Medium
Energy Production & Mining	Large	Moderate	Medium
Transportation & Service Corridors	Large	Slight	Low
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Restricted	Slight	Low
Natural System Modification	N/A	N/A	N/A
Invasive & other Problematic Species	Large	Slight	Low
Pollution	N/A	N/A	N/A
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	Large	Moderate	Medium
Overall Calculated Threat Impact: Medium			

Habitat Conservation Actions:

1. Partner with state and federal agencies, NGOs, private landowners, etc. to restore cheniers.
2. Support NRCS and CPRA efforts for shoreline stabilization and habitat restoration.
3. Work with COE and NRCS to develop better strategies for the placement of dredged materials as a restoration method for this habitat type.
4. 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. Develop methods to encourage landowners to remove cattle from cheniers or promote rotational grazing and manage the land for wildlife conservation.

5. Support protection of high quality examples of this habitat that have the potential for long term sustainability through cooperative agreements of purchase from willing sellers.
6. Construct coastal hummocks by partnering with CPRA or USACE to use sediment pipeline delivery or other sediment delivery methods to build land sufficient to support Coastal Live Oak-Hackberry Forests in both Chenier and Deltaic Plains.
7. Conduct habitat inventories and assessments on Native American shell middens; work with Native American tribes and managers of lands supporting shell middens to accomplish protection of shell middens and enhancement of associated habitat.
8. Support exotic plant and animal control on all expressions of Coastal Live Oak-Hackberry Forest by providing funding for direct control of these organisms.

1.7 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:

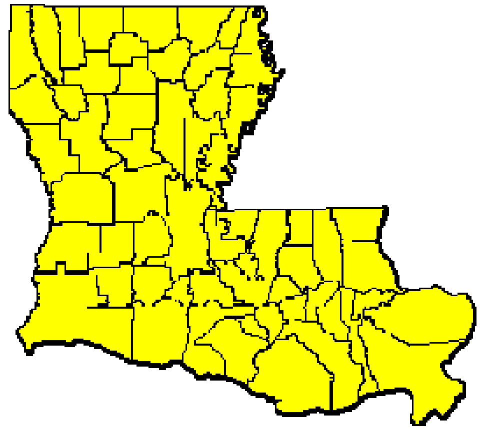
Baldcypress Swamp (S4), Baldcypress-Tupelo Swamp (S4), Tupelo-Blackgum Swamp (S4), Pondcypress/Blackgum Swamp (S1), Scrub/Shrub Swamp (S4S5), and Shrub Swamp (S4S5) are described as distinct communities in Natural Communities of Louisiana (LNHP 2009). They are combined here due to their similarity and common conservation needs.

Cypress-Tupelo-Blackgum Swamps are forested, usually alluvial swamps occuring on intermittently exposed soils, most commonly along rivers and streams but also 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 2009). Baldcypress Swamps generally occur on mucks and clays, but also on silts and sands with underlying clay layers (Conner and Buford 1998). Cypress-Tupelo-Blackgum Swamps have relatively low floristic diversity. The composition of associate species may vary widely from site to site. Undergrowth is often sparse because of low light intensity and a long hydroperiod. Neither Baldcypress nor Tupelogum seeds germinate underwater, nor can young seedlings of these trees survive long submergence. Seedling recruitment can only occur during draw-down periods. 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. Near-permananent impoundment of Cypress-Tupelo-Blackgum Swamps is a major threat affecting sustainability of these forests. Those areas dominanted by Tupelo and Blackgum are also alluvial but occur on higher topographic positions than baldcypress dominated swamps. 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 and in depressions in flatwoods landscapes, in places much removed from active stream channels. They are related to and often grade into Baldcypress Swamps which have greater influence from river flooding (Smith 1999).

Baldcypress Swamp, Caddo Parish

Cypress-Tupelo-Blackgum Swamp: Characteristic Plants	
Common Name	**Scientific Name**
Drummond Red Maple	*Acer rubrum* var. *drummondii*
Buttonbush	*Cephalanthus occidentalis*
Carolina Ash	*Fraxinus caroliniana*
Virginia-willow	*Itea virginica*
Tupelogum	*Nyssa aquatica*
Swamp Blackgum	*Nyssa biflora*
Savanna Panicum	*Phanopyrum gymnocarpon*
Lizard's Tail	*Saururus cernuus*
Pondcypress	*Taxodium ascendens* (EGCP)
Baldcypress	*Taxodium distichum*

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 percent of the original pre-settlement 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 Hardwood Forest. Large tracts can also be found in the EGCP in areas of the Amite, Tickfaw, and lower Tangipahoa rivers and lands surrounding Lakes Pontchartrain and Maurepas (Governor's Science Working Group on Coastal Wetland Forest Conservation and Use 2005).

All of Louisiana's swamps are threatened by altered hydrology, 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, coastal erosion, and saltwater intrusion. All of these factors combine to promote rapid loss and prevent adequate regeneration of these swamps.

Cypress – Tupelo -- Blackgum Swamp SGCN (35)		
AMPHIBIANS	**INSECTS**	Eastern Diamond-backed Rattlesnake
Four-toed Salamander	Creole Pearly Eye	
Southern Dusky Salamander	Seminole Texan Crescent	**PLANTS**
	King's Hairstreak	Hall's Pocket Moss
Ornate Chorus Frog	Appalachian Brown	Cypress-knee Sedge
		Floating Antler-fern
BIRDS	**MAMMALS**	Log Fern
Wood Stork	Southeastern Shrew	Fowl Manna Grass
Roseate Spoonbill	Southeastern Myotis	Abbeville Red Iris
Osprey	Big Brown Bat	Pondspice
Swallow-tailed Kite	Rafinesque's Big Eared Bat	Yellow Water-crowfoot
Bald Eagle	Louisiana Black Bear	Hemlock Water-parsnip
Chimney Swift	Long-tailed Weasel	Willdenow's Fern
Yellow-throated Vireo		
Prothonotary Warbler	**REPTILES**	
Yellow-throated Warbler	Alligator Snapping Turtle	
	Western Chicken Turtle	

Threats Affecting Habitat:

Coastal Cypress-Tupelo Swamps are threatened by altered hydrology, specifically complete or partial impoundment which limits tree seedling recruitment. Coastal swamps are also affected by subsidence, resulting in conversion to marsh. Pondcypress Swamps face threat from introduction of nutrients, which alters species composition of this acidic and oligotrophic habitat.

Cypress-Tupelo-Blackgum Swamps Threats Assessment:			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	Small	Serious	Low
Agriculture/Aquaculture	N/A	N/A	N/A
Energy Production & Mining	Restricted	Slight	Low
Transportation & Service Corridors	Restricted	Slight	Low
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Restricted	Slight	Low
Natural System Modification	Large	Moderate	Medium
Invasive & other Problematic Species	Pervasive	Moderate	Medium
Pollution	Large	Moderate	Medium
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	Pervasive	Moderate	Medium
Overall Calculated Threat Impact: Medium			

Habitat Conservation Actions:

1. Establish and maintain long-term monitoring sites within coastal wetland forests.
2. Promote use of LMJV Desired Forest Conditions to restore/manage swamps for wildlife.
3. Continue to work with Cypress Legacy Program and other environmental groups to identify old-growth areas where conservation actions can be implemented.
4. Work with adjoining states to address water management issues that affect Cypress-Tupelo-Blackgum swamps in Louisiana.
5. Discourage introduction of partially trearted municipal waste water into Pondcypress-Swamp Blackgum swamps; this type of swamp is acidic and oligotrophic and can be degraded by nutrient input.
6. Work with COE to manage water levels in the Atchafalaya Basin to benefit this habitat type.

1.8 Hardwood Flatwoods

Rarity Ranks: Mesic hardwood flatwoods: S2S3
Wet hardwood flatwoods: S2S3
Prairie Terrace Loess Forest: S1/G2?

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
CES203.476 Southern Coastal Plain Mesic Slope Forest

General Description:

Hardwood Flatwoods occur on flat, poorly drained settings on older (Pleistocene) landscapes. Mesic Hardwood Flatwoods and Prairie Terrace Loess Forest, also a mesic type, occur on slightly higher and better drained sites. While species composition may overlap substantially with various types of Bottomland Hardwood Forest, Hardwood Flatwoods do not occupy floodplains. Hardwood Flatwoods are also found on sodic (alkali) soils.

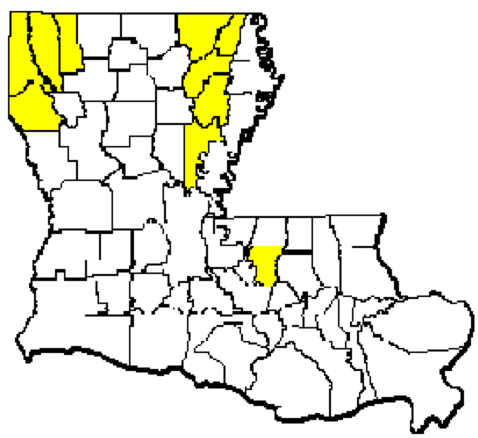
Wet Hardwood Flatwoods and Mesic Hardwood Flatwoods are described as two distinct communities in the LNHP community classification system but are combined here. Also included in this habitat is Prairie Terrace Loess Forest, a mesic flatwoods type which is restricted to East Baton Rouge Parish.

Hardwood Flatwoods on Macon Ridge, northeast Louisiana.

Hardwood Flatwoods: Characteristic Plants (* wet, ** mesic, + both)	
Common Name	**Scientific Name**
Devil's Walking Stick	*Aralia spinosa* **
Giant Cane	*Arundinaria gigantea* **
Cherokee Caric Sedge	*Carex cherokeensis* **
Mockernut Hickory	*Carya alba* **
Shagbark hickory	*Carya ovata* *
Hackberry	*Celtis laevigata* +
Leather Flower	*Clematis crispa* *
Flowering Dogwood	*Cornus florida* **
Green Ash	*Fraxinus pennsylvanica* *
Eastern Hophornbeam	*Ostrya virginiana* **
White Oak	*Quercus alba* **
Cherrybark Oak	*Quercus pagoda* **
Willow Oak	*Quercus phellos* *
Delta Post Oak	*Quercus similis* *
Palmetto	*Sabal minor* +
Cedar Elm	*Ulmus crassifolia* *

Current Extent and Status:

Most known occurrences of Hardwood Flatwoods are on the Macon Ridge in northeast Louisiana and on the Prairie Terrace in the northwest part of the state. A small amount of this habitat is captured by Bodcau WMA in Bossier Parish. The Louisiana Army Ammunition Plant in Bossier and Webster Parishes supports high quality Hardwood Flatwoods (McInnis and Martin 1995). In addition to East Baton Rouge, Prairie Terrace Loess Forest may have been present in the adjacent parishes of East Feliciana and Livingston. Ecology of Hardwood Flatwoods is a major knowledge gap in Louisiana.



Hardwood Flatwoods SGCN (35)		
AMPHIBIANS	**INSECTS**	**REPTILES**
Southern Dusky Salamander	Monarch	Western Worm Snake
Eastern Spadefoot	Brou's Underwing	Eastern Hog-nosed Snake
		Timber Rattlesnake
BIRDS	**MAMMALS**	
American Woodcock	Southeastern Shrew	**PLANTS**
Chuck-Will's-Widow	Southeastern Myotis	Virginia Anemone
Yellow-throated Vireo	Big Brown Bat	Enchanter's Nightshade
Wood Thrush	Rafinesque's Big-eared Bat	Eastern Manna Grass
Prothonotary Warbler	Eastern Pipistrelle	Three-lobed Coneflower
Swainson's Warbler	Eastern Chipmunk	Yellowleaf Tinker's-weed
Kentucky Warbler	Golden Mouse	Arkansas Caric Sedge
Hooded Warbler	Louisiana Black Bear	Wolf Spike Sedge
Painted Bunting	Ringtail	Upland Swamp Privet
	Long-tailed Weasel	
	Eastern Spotted Skunk	

Threats Affecting Habitat:

This habitat faces potential residential and commercial development and conversion to anthropogenic habitat types. Disturbance associated with increased human interface, and invasive plants and animals also threatens this habitat.

<u>Hardwood Flatwoods Threats Assessment:</u>

First Level Threat	Scope	Severity	Impact
Residential/Commercial Development	Restricted	Serious	Medium
Agriculture/Aquaculture	Restricted	Extreme	Medium
Energy Production & Mining	Small	Moderate	Low
Transportation & Service Corridors	Restricted	Slight	Low
Biological Resource Use	Restricted	Serious	Medium
Human Intrusion/Disturbance	N/A	N/A	N/A
Natural System Modification	N/A	N/A	N/A
Invasive & other Problematic Species	Large	Moderate	Medium
Pollution	Large	Slight	Low
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	Pervasive	Slight	Low
Overall Calculated Threat Impact: Medium			

Habitat Conservation Actions:

1. Implement research on ecology, classification, and extent of this habitat type.
2. Designate this habitat as a high priority for inventory.
3. Seek habitat protection opportunities through cooperative easements and acquisition from willing sellers.

1.9 Live Oak Natural Levee Forest

Rarity Rank: S1/G2

Synonyms: Natural Levee Forest, Frontland Forest

Ecological Systems: CES203.512 Lower Mississippi River Bottomland and Floodplain Forest

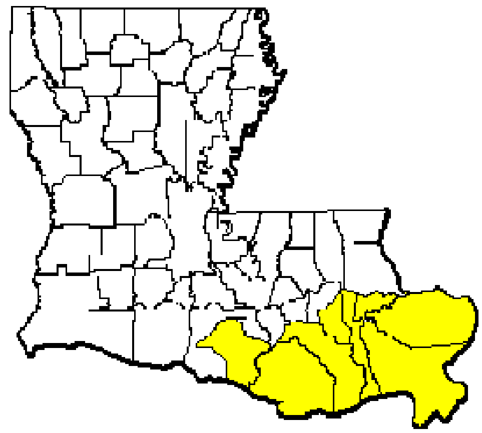
General Description:

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. 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. The herbaceous layer is often poorly developed. Vines are usually prominent, and epiphytes are significant community members. Several introduced species have become serious invaders of this habitat, including Japanese Climbing Fern (*Lygodium japonicum*), Chinese Tallow Tree (*Triadica sebifera*), Chinaberry (*Melia azederach*), and Japanese Honeysuckle (*Lonicera japonica*).

Live Oak Natural Levee Forest, Plaquemines Parish

Live Oak Natural Levee Forest: Characteristic Plants	
Common Name	**Scientific Name**
Hackberry	*Celtis laevigata*
Deciduous Holly	*Ilex decidua*
Sweetgum	*Liquidambar styraciflua*
Red Bay	*Persea palustris*
Water Oak	*Quercus nigra*
Live Oak	*Quercus virginiana*
Palmetto	*Sabal minor*
Muscadine	*Vitis rotundifolia*
White Crownbeard	*Verbesina virginica*

Current Extent and Status:



Louisiana’s Live Oak Natural Levee Forests occur in the Deltaic Plain of the 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 swamps and marshes, they were the first areas to be cleared for agricultuire and residential development. Of the original 500,000 to 1,000,000 acres in Louisiana, currently, only 10,000 to 50,000 acres remain, which is 1-5 percent of pre-settlement extent (Smith 1993). The majority of natural levee forests are in private ownership. A portion of the extant acreage is protected within Jean Lafitte National Historical Park and Preserve and Bayou Sauvage NWR. There are also a few remnant strips of this habitat on Wisner, Pointe-aux-Chenes, and Salvador WMAs. Numerous spoil banks occur within the Live Oak Natural Levee Forest range, and some of these have recruited Live Oak and are supporting habitat referrable to this type.

Live Oak Natural Levee Forest SGCN (27)		
BIRDS	Prothonotary Warbler	Eastern Pipistrelle
Wood Stork	Swainson's Warbler	Long-tailed Weasel
Roseate Spoonbill	Kentucky Warbler	
Swallow-tailed Kite	Hooded Warbler	**REPTILES**
Bald Eagle	Cerulean Warbler	Western Slender Glass Lizard
American Woodcock	Painted Bunting	
Chimney Swift	Rusty Blackbird	Eastern Glass Lizard
Yellow-throated Vireo		Eastern Hog-nosed Snake
Wood Thrush	**MAMMALS**	Timber Rattlesnake
Worm-eating Warbler	Southeastern Myotis	
Louisiana Waterthrush	Big Brown Bat	
Golden-winged Warbler	Rafinesque’s Big-eared Bat	

Threats Affecting Habitat:

The majority of the remnant Live Oak Natural Levee Forest are altered and fragmented, and destruction and habitat distrubance continues from residential development, and road and utility installation. Invasive plants and animals also threaten this habitat. Subsidence of natural levees results in wetter site conditions which alters forest species composition. Subsidence of surrounding wetlands exposes Live Oak Natural Levee Forests to greater storm impacts.

Live Oak Natural Levee Forest Threats Assessment:

First Level Threat	Scope	Severity	Impact
Residential/Commercial Development	Restricted	Extreme	Medium
Agriculture/Aquaculture	N/A	N/A	N/A
Energy Production & Mining	N/A	N/A	N/A
Transportation & Service Corridors	Restricted	Slight	Low
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Large	Slight	Low
Natural System Modification	N/A	N/A	N/A
Invasive & other Problematic Species	Pervasive	Serious	High
Pollution	Restricted	Slight	Low
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	Pervasive	Serious	High
Overall Calculated Threat Impact: Medium			

Habitat Conservation Actions:

1. Support NRCS and CPRA efforts for shoreline stabilization and habitat restoration.
2. Work with LCA and CPRA to broaden coastal restoration prioritiess to include Live Oak Forests.
3. Work with local parish planning commissions and DNR to change zoning classifications to reduce development within this habitat type.
4. Make this community type a priority for land acquistion, protection, and management efforts.
5. Prioritize surveys for this community type to determine current extent and status.
6. Establish this habitat on artificial elevated land surfaces such as spoil banks.
7. Assess quality of habitats forming on artificial surfaces such as spoil banks; work with managing authorities to preserve high quality forests on spoil banks.
8. Provide funding for control of exotic plants (especially Chinese Tallow Tree and Chinaberry) and feral hogs in Live Oak Natural Levee Forests, including examples of this habitat that have developed on dredged materials (spoil banks).

1.10 Live Oak-Pine-Magnolia Forest

Rarity Rank: S1/G2G3

Synonyms: Maritime Forest, Maritime Mesophytic Forest

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

General Description:

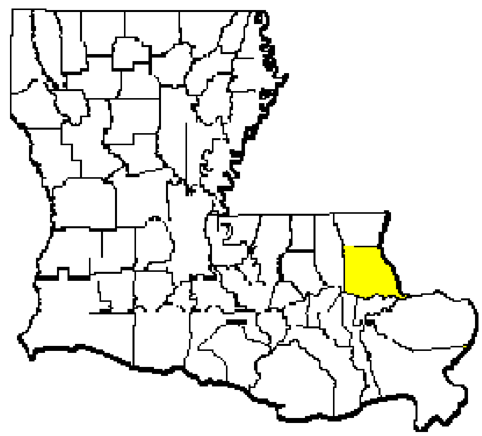
This community is known in Louisiana from southern St. Tammany Parish within 2 miles of Lake Pontchartrain where the Pleistocene Prairie Terrace meets the Lake. Soils typically are sandy in nature. The community may exhibit site-to-site variation in species composition and physiognomy depending on soil 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 Lake Pontchartrain. The canopy structure of natural stands is believed to be more open than present-day stands. This natural community may in reality be a transitonal 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. Alternatively, this forest type may be an artificial aggregation, with the original species complement disproportionately represented in extant occurrences. 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.

Live Oak-Pine-Magnolia Forest, Fontainebleau State Park, St. Tammany Parish

Live Oak-Pine-Magnolia Forest: Characteristic Plants	
Common Name	**Scientific Name**
Live Oak	*Quercus virginiana*
Longleaf Pine	*Pinus palustris*
Slash Pine	*Pinus elliottii*
Loblolly Pine	*Pinus taeda*
Southern Magnolia	*Magnolia grandiflora*
Willdenow's Sedge	*Carex basiantha*
White Ash	*Fraxinus americana*

Current Extent and Status:

This community is very restricted in its occurrence in Louisiana, and is known only from St. Tammany Parish along the northshore of Lake Pontchartrain. Pre-settlement estimates of this habitat type are from 10,000 to 50,000 acres, but only 10 to 25 percent of the original extent remains today (Smith 1993). Small portions of this habitat are protected at Big Branch Marsh NWR, Fontainebleau State Park, and Northlake Nature Center.



Live Oak – Pine – Magnolia Forest SGCN (26)		
BIRDS	**CRUSTACEANS**	**REPTILES**
Common Ground-Dove	Flatwoods Digger	Eastern Glass Lizard
Chuck-Will's-Widow	Flatnose Crawfish	Eastern Hog-nosed Snake
Chimney Swift		Pine Woods Littersnake
Yellow-throated Vireo	**MAMMALS**	Southeastern Crowned Snake
Wood Thrush	Southeastern Myotis	Harlequin Coralsnake
Swainson's Warbler	Big Brown Bat	Timber Rattlesnake
Kentucky Warbler	Rafinesque's Big-eared Bat	
Hooded Warbler	Eastern Pipistrelle	**PLANTS**
Rusty Blackbird	Bachman's Fox Squirrel	Louisiana Spikemoss
	Long-tailed Weasel	Silky Camellia
	Eastern Spotted Skunk	

Threats Affecting Habitat:

This habitat occurs in a rapidly developing part of the state and is threatened by this development and disturbance associated with increased human interface. Potential increased tropical storm frequency and severity associated with climate change also threatens this habitat.

Live Oak-Pine-Magnolia Forest Threats Assessment:

First Level Threat	Scope	Severity	Impact
Residential/Commercial Development	Restricted	Serious	Medium
Agriculture/Aquaculture	N/A	N/A	N/A
Energy Production & Mining	Small	Moderate	Low
Transportation & Service Corridors	Restricted	Moderate	Low
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Restricted	Slight	Low
Natural System Modification	N/A	N/A	N/A
Invasive & other Problematic Species	Large	Moderate	Medium
Pollution	N/A	N/A	N/A
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	Large	Serious	High
Overall Calculated Threat Impact: Medium			

Habitat Conservation Actions:

1. Support and conduct inventory and research to identify general ecological characteristics and processes of this habitat.
2. Support invasive species control in this habitat.

1.11 Mixed Hardwood-Loblolly Pine/Hardwood Slope Forest

Rarity Rank: Mixed Hardwood-Loblolly Pine Forest- S3/G3G4
Hardwood Slope Forest - S3/G2G3

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

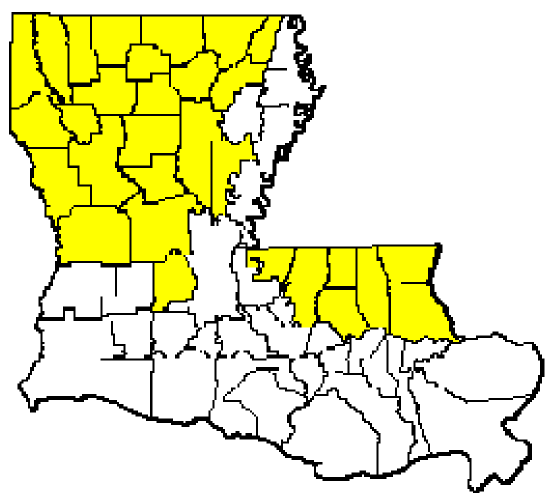
General Description:

Hardwood Slope Forests and Mixed Hardwood - Loblolly Pine Forests are described as distinct communities in the Natural Communities of Louisiana (LNHP 2009). They are combined here due to their often close spatial proximity, floristic similarity, and similar conservation 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 uplands statewide. Hardwood Slope Forests occur on slopes (often steep) rising out of stream floodplains. Mixed Hardwood - Loblolly Pine Forests are found upslope and, depending on moisture regime, on low ridge tops. 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, American Beech and Southern Magnolia are typically conspicuous. However, in north Louisiana, Southern Magnolia may be infrequent or absent. Loblolly Pine may be present sporadically in the overstory, and *Pinus glabra* (Spruce Pine) is an occassional associate in the Florida Parishes.

Hardwood Slope Forest, Vernon Parish

Mixed Hardwood-Loblolly Pine/Hardwood Slope Forest: Characteristic Plants	
Common Name	**Scientific Name**
Caric Sedges	*Carex* spp.
Woods Oats	*Chasmanthium laxum* ssp. *laxum*
American Holly	*Ilex opaca*
Sweetgum	*Liquidambar styraciflua*
Blackgum	*Nyssa sylvatica*
Loblolly Pine	*Pinus taeda*
White Oak	*Quercus alba*
Poison Ivy	*Toxicodendron radicans*
Elliott's Blueberry	*Vaccinium elliottii*
Pawpaw	*Asimina triloba*
American Beech	*Fagus grandifolia*
Southern Magnolia	*Magnolia grandiflora*
Christmas Fern	*Polystichum acrostichoides*

Current Extent and Status:



Mixed Hardwood-Loblolly Pine Forest is estimated to occuppied 500,000 to 1,000,000 acres historically, with an estimated 25 to 50 percent still remains (Smith 1993). Hardwood Slope Forest is estimated to have occupied 100,000 to 500,000 acres historically, with 25 to 50 percent estimated to remain today (Smith 1993). Occurrences are scattered in the WGCP of central Louisiana and EGCP in the eastern Florida Parishes. There are a few occurences known from Macon Ridge in the Mississippi River Alluvial Valley. Mixed Hardwood-Loblolly Pine Forest was probably historically more extensive on Macon Ridge. A number of occurrences are protected on Kisatchie National Forest and Fort Polk. Hardwood Slope Forests are sometimes completely contained within streamside management zones on industrial forest lands.

Mixed Hardwood – Loblolly Pine/Hardwood Slope Forest SGCN (80)

AMPHIBIANS
Louisiana Slimy Salamander
Southern Red-backed Salamander
Southern Red Salamander
Eastern Spadefoot

BIRDS
American Woodcock
Chuck-Will's-Widow
Chimney Swift
Bell's Vireo
Yellow-throated Vireo
Warbling Vireo
White-breasted Nuthatch
Brown-headed Nuthatch
Wood Thrush
Worm-eating Warbler
Louisiana Waterthrush
Swainson's Warbler
Kentucky Warbler
Hooded Warbler
Prairie Warbler
Yellow-throated Warbler
Field Sparrow

INSECTS
Lace Winged Roadside Skipper

MAMMALS
Southeastern Shrew
Southeastern Myotis
Northern Long-eared Bat
Big Brown Bat
Rafinesque's Big-eared Bat
Bachman's Fox Squirrel
Eastern Chipmunk
Golden Mouse
Louisiana Black Bear
Ringtail
Long-tailed Weasel
Eastern Spotted Skunk

REPTILES
Coal Skink
Western Worm Snake
Eastern Hog-nosed Snake
Harlequin Coralsnake
Eastern Diamond-backed Rattlesnake
Timber Rattlesnake

PLANTS
American Pinesap
Autumn Coral-root
Barbed Rattlesnake-root
Bloodroot
Carpenter's Ground-cherry
Crested Coral-root
Enchanter's Nightshade
Fairy Wand
Fire Pink
Granite Gooseberry
Indian Cucumber-root
Mullein Foxglove
Purple Boneset
Reflexed Trillium
Scarlet Woodbine
Shadow-witch Orchid
Silky Camellia
Single-head Pussytoes
Southern Lady's-slipper
Starry Campion
Upland Swamp Privet
Virginia Saxifrage
American Alumroot
American Hazelnut
Common Shooting-star
Downy Yellow Violet
Eastern Leatherwood
False Soloman's-seal
Green-fringe Orchid
Long-horned Habenaria
Louisiana Blue Star
Ozark Chinquapin
Perfoliate Tinker's-weed
Sicklepod
Southern Hairy Woodrush
Stagger-bush
Turk's Cap Lily
White Trout-lily
Wild Crane's-bill
Zigzag Goldenrod

Threats Affecting Habitat:

Conversion to other forest types, disturbance from human activities, and invasive plants and animals pose substantial threats to these habitats.

Mixed Hardwood-Loblolly Pine Forest Threats Assessment:

First Level Threat	Scope	Severity	Impact
Residential/Commercial Development	Small	Slight	Low
Agriculture/Aquaculture	Restricted	Extreme	Medium
Energy Production & Mining	Restricted	Moderate	Low
Transportation & Service Corridors	Restricted	Moderate	Low
Biological Resource Use	Restricted	Moderate	Low
Human Intrusion/Disturbance	Small	Slight	Low
Natural System Modification	Large	Moderate	Medium
Invasive & other Problematic Species	Pervasive	Serious	High
Pollution	Small	Slight	Low
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	N/A	N/A	N/A
Overall Calculated Threat Impact: Medium			

Hardwood Slope Forest Threats Assessment:

First Level Threat	Scope	Severity	Impact
Residential/Commercial Development	N/A	N/A	N/A
Agriculture/Aquaculture	Small	Extreme	Low
Energy Production & Mining	N/A	N/A	N/A
Transportation & Service Corridors	Small	Moderate	Low
Biological Resource Use	Restricted	Serious	Medium
Human Intrusion/Disturbance	N/A	N/A	N/A
Natural System Modification	N/A	N/A	N/A
Invasive & other Problematic Species	Restricted	Moderate	Low
Pollution	Small	Slight	Low
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	N/A	N/A	N/A
Overall Calculated Threat Impact: Low			

Habitat Conservation Actions:

1. Develop and implement DFCs for restoration of this habitat type including appropriate herbicide treatments.
2. Encourage use of broader Streamside Management Zones (SMZs) to protect this habitat.
3. Promote use of fire in Mixed Hardwood-Loblolly Pine Forests, to include discouraging the practice of placing fire lines along stream valley, allowing fire to burn into riparian habitats.

1.12 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
CES203.513 Mississippi Delta Maritime Forest

General Description:

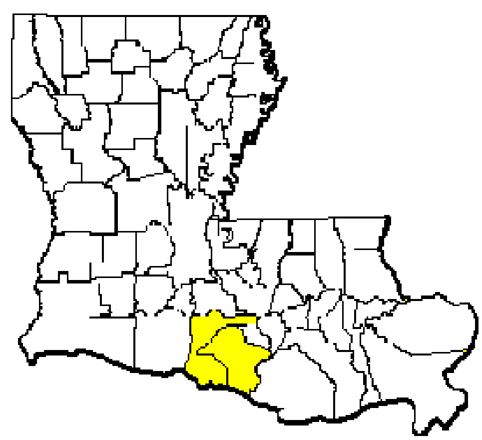
In the Mississippi Interior Salt Basin, salt domes occur where large, underground salt deposits (deposited by evaporating seas in the Jurassic Period) have risen to or near to the surface (Stern et. al. 2011). Louisiana contains approximately 425 salt domes on the mainland and offshore, varying in depth from the Earth's surface (Beckman and Williamson 1990). In cases such as coastal Louisiana's "Five Islands" (Jefferson Island, Avery Island, Weeks Island, Cote Blanche Island, and Belle Isle), the salt domes have raised the surface, creating ridges that rise up from the surrounding marsh habitat. Soils covering most of the islands are very fertile and loess-derived. The hardwood forests of these islands are hilly with deep, shaded ravines, up to 60 feet deep in some places. Ravines are dominated by ferns and in many areas the canopy supports lianas (woody vine species that utilize trees for support and as a means to reach the canopy), giving these forests a tropical appearance (Reese and Thieret 1966). Typically, the herbaceous layer is sparse and consists of several Caric sedges (*Carex* spp.) and other shade loving herbs.

Salt Dome Hardwood Forest, Cote Blanche Island, St. Mary Parish

Salt Dome Hardwood Forest: Characteristic Plants	
Common Name	**Scientific Name**
Paw Paw	*Asimina triloba*
Thicket Caric Sedge	*Carex abscondita*
Bitternut hickory	*Carya cordiformis*
Sweetgum	*Liquidambar styraciflua*
Southern Magnolia	*Magnolia grandiflora*
Cherrylaurel	*Prunus caroliniana*
Water Oak	*Quercus nigra*
Cherrybark Oak	*Quercus pagoda*
Live Oak	*Quercus virginiana*
Palmetto	*Sabal minor*

Current Extent and Status:

Saltdome Hardwood Forests are only known from five salt domes having surface expression located in Iberia and St. Mary parishes. The "Five Islands" are situated in a line extending northwest to southeast. Currently, Cote Blanche and Weeks support some high quality forest. Belle Isle is much smaller with less topographic variation. Habitat on Belle Isle is intact, but is not really comparable to forest on the other islands. Only a small tract of forest remains on Jefferson Island. Avery Island has lost much forest habitat and has problems with exotic speices. There is apparently a substantial amount of forest remaining on private parcels of land which are in need of exploration.



Salt Dome Hardwood Forest SGCN (33)		
BIRDS	**INSECTS**	**PLANTS**
Bald Eagle	Celia's Roadside Skipper	Broad-leaved Spiderwort
American Woodcock	Wild Indigo Duskywing	Climbing Bittersweet
Chuck-Will's-Widow		Croomia
Chimney Swift	**MAMMALS**	Lance-leaved Glade Fern
Yellow-Throated Vireo	Southeastern Myotis	Scarlet Woodbine
Warbling Vireo	Rafinesque's Big-eared Bat	Snow Melanthera
Wood Thrush	Louisiana Black Bear	Southern Shield Wood Fern
Worm-eating Warbler		Three-lobed Coneflower
Louisiana Waterthrush	**REPTILES**	Woodland Bluegrass
Golden-winged Warbler	Eastern Hog-nosed Snake	
Prothonotary Warbler	Timber Rattlesnake	
Swainson's Warbler		
Kentucky Warbler		
Hooded Warbler		
Cerulean Warbler		
Yellow-throated Warbler		
Painted Bunting		

Threats Affecting Habitat:

At present, invasive plants and animals pose the most serious threat to this habitat. Disturbance from mineral extraction and other aspects of human interface is also a threat.

Salt Dome Hardwood Forest Threats Assessment:

First Level Threat	Scope	Severity	Impact
Residential/Commercial Development	Pervasive	Slight	Low
Agriculture/Aquaculture	N/A	N/A	N/A
Energy Production & Mining	Pervasive	Moderate	Medium
Transportation & Service Corridors	N/A	N/A	N/A
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Pervasive	Slight	Low
Natural System Modification	N/A	N/A	N/A
Invasive & other Problematic Species	Pervasive	Serious	High
Pollution	Restricted	Moderate	Low
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	N/A	N/A	N/A
Overall Calculated Threat Impact: Low			

Habitat Conservation Actions:

1. Establish conservation servitudes protecting Salt Dome Hardwood Forest.
2. Support aggressive control of invasive species in this habitat, including problematic plants and feral hogs.

1.13 Small Stream Forest

Rarity Rank: S2/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:

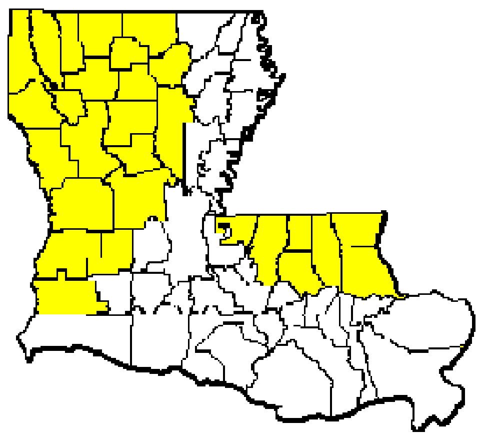
Small Stream Forests are relatively narrow wetland forests occurring along rivers and streams in central, western, southeastern, and northern Louisiana. These forests are seasonally flooded for brief periods. The percentage of sand, silt, calcareous clay, acidic clay, and organic material in the soil 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). Spruce Pine (*Pinus glabra*) is a common associate in the Florida Parishes, and Baldcypress (*Taxodium distichum*) and Loblolly Pine (*Pinus taeda*) are occassional associates statewide.

Small Stream Forest, Fort Polk Military Reservation and WMA, Vernon Parish

Small Stream Forest: Characteristic Plants	
Common Name	**Scientific Name**
Slender Caric Sedge	*Carex debilis*
Bluebeech	*Carpinus caroliniana*
American Beech	*Fagus grandifolia*
Silverbell	*Halesia diptera*
Sweetgum	*Liquidambar styraciflua*
Southern Magnolia	*Magnolia grandiflora*
Laurel Oak	*Quercus laurifolia*
Cow Oak	*Quercus michauxii*
Water Oak	*Quercus nigra*
Cherrybark Oak	*Quercus pagoda*
Candle Berry	*Sebastiana fruticosa*

Current Extent and Status:

Small Stream Forests are widely distributed in broad uplands. An estimated 25 to 50 percent of Louisiana's original Small Stream Forests is estimated to remain intact (Smith 1993). A number of high-quality occurrences are captured by Kisatchie National Forest and Fort Polk.



SMALL STREAM FOREST SGCN (95)

AMPHIBIANS
Southern Dusky Salamander
Webster's Salamander
Louisiana Slimy Salamander
Southern Red-backed Salamander
Red River Mudpuppy
Eastern Spadefoot

BIRDS
American Woodcock
Chuck-Will's-Widow
Chimney Swift
Bell's Vireo
Yellow-throated Vireo
Warbling Vireo
Wood Thrush
Worm-eating Warbler
Louisiana Waterthrush
Prothonotary Warbler
Swainson's Warbler
Kentucky Warbler
Hooded Warbler
Yellow-throated Warbler
Rusty Blackbird

CRUSTACEANS
Calcasieu Painted Crawfish
Teche Painted Crawfish
Kisatchie Painted Crawfish
Ribbon Crawfish
Twin Crawfish
Ouachita Fencing Crawfish
Caddo Chimney Crawfish
Calcasieu Creek Crawfish
Pearl Blackwater Crawfish
Southwestern Creek Crawfish

FRESHWATER FISHES
American Eel
Central Stoneroller
Ironcolor Shiner
Bluehead Shiner
Flagfin Shiner
Bluenose Shiner
Rainbow Darter
Channel Darter
Redspot Darter
Clear Chub
Gumbo Darter

INSECTS
Yellow Brachycercus Mayfly
Hodge’s Clubtail
Southern Snaketail
Little Dubiraphian Riffle Beetle
Masked Springfly
Ceraclean Caddisfly
Molson’s Microcaddisfly
Pepper and Salt Skipper

MAMMALS
Southeastern Shrew
Southeastern Myotis
Northern Long-eared Bat
Silver-haired Bat
Big Brown Bat
Rafinesque’s Big-eared Bat
Eastern Pipistrelle
Bachman’s Fox Squirrel
Eastern Chipmunk
Golden Mouse
Ringtail
Long-tailed Weasel
Eastern Spotted Skunk

MUSSELS
Rayed Creekshell
White Heelsplitter
Louisiana Pearlshell
Southern Hickorynut
Louisiana Pigtoe
Southern Creekmussel
Creeper
Southern Rainbow

REPTILES
Alligator Snapping Turtle
Stripe-necked Musk Turtle
Razor-backed Musk Turtle
Coal Skink
Western Worm Snake
Eastern Hog-nosed Snake
Common Rainbow Snake
Harlequin Coralsnake
Timber Rattlesnake

PLANTS
Broadleaf Barbara's-buttons
Canby’s Bulrush
Dwarf Filmy Fern
Florida Hedgehyssop
Green-fringe Orchid
Indian Cucumber-root
Louisiana Blue Star
Louisiana Quillwort
Mountain Laurel
New York Fern
Nodding Pogonia
Pyramid Magnolia
White Trout-lily
Windflower
Yellowroot

Threats Affecting Habitat:

The most impactful threat to this habitat is invasive species. Smaller-scale threats include impoundment of streams for reservoirs and human-related disturbance.

Small Stream Forest Threats Assessment:

First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	N/A	N/A	N/A
Agriculture/Aquaculture	Small	Extreme	Low
Energy Production & Mining	Restricted	Moderate	Low
Transportation & Service Corridors	Small	Moderate	Low
Biological Resource Use	Restricted	Moderate	Low
Human Intrusion/Disturbance	N/A	N/A	N/A
Natural System Modification	Restricted	Moderate	Low
Invasive & other Problematic Species	Large	Serious	High
Pollution	N/A	N/A	N/A
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	Pervasive	Slight	Low
Overall Calculated Threat Impact: Low			

Habitat Conservation Actions:

1. Conduct a comprehensive statewide inventory on the status and condition of Louisiana's streams, including ownership patterns, landscape context and uses.
2. Work with partners to develop guidelines and funding mechanisms for restoration of abandoned gravel mines.
3. Form a committee composed of gravel mining interests, LDEQ, LDNR, 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. Promote the control of invasive species in this community type.
5. Discourage reservoirs whose footprint would destroy this habitat type, especially those that would affect high-quality streams.

1.14 Southern Mesophytic Hardwood Forest

Rarity Rank: S2/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:

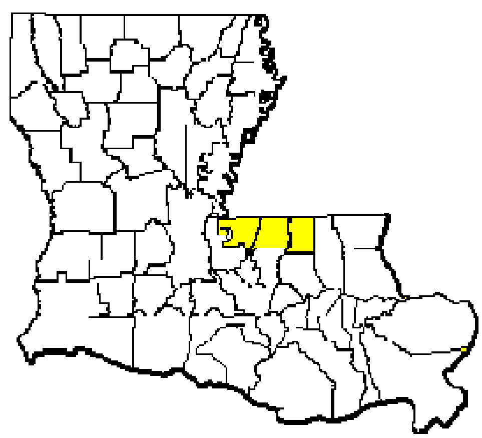
Southern Mesophytic Hardwood Forest is currently recognized in Louisiana only in the northwestern Florida Parishes, primarily in the Tunica Hills. This hardwood forest develops on deep, fertile, circum-neutral to slightly alkaline loessial deposits that have eroded over thousands of years to form a characteristic 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.

Southern Mesophytic Hardwood Forest, East Feliciana Parish

Southern Mesophytic Hardwood Forest: Characteristic Plants	
Common Name	**Scientific Name**
Switchcane	*Arundinaria gigantea*
Pawpaw	*Asimina triloba*
Cherokee Caric Sedge	*Carex cherokeensis*
American Beech	*Fagus grandifolia*
American Holly	*Ilex opaca*
Yellow Poplar	*Liriodendron tulipera*
Southern Magnolia	*Magnolia grandiflora*
Red Mulberry	*Morus rubra*
Cherrybark Oak	*Quercus pagoda*
Foetid Trillium	*Trillium foetidissimum*

Current Extent and Status:

Currently only about 25 percent (50,000 to 100,000 acres) of Louisiana's Southern Mesophytic Forests remain intact (Smith 1993). Clearing for agriculture, forest type conservsion, 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, particulary erosion stemming from any form of disturbance, such as logging or road building. In such cases, the very steep slopes and loess-derived soil experience frequent landslides (Quigley and Platt 1996). The largest protected tract of this habitat in Louisiana is found on Tunica Hills WMA which is 5,231 acres.



SOUTHERN MESOPHYTIC HARDWOOD FOREST SGCN (48)		
AMPHIBIANS	Yucca Giant Skipper	**PLANTS**
Webster's Salamander		Allegheny-spurge
Eastern Spadefoot	**MAMMALS**	American Alumroot
	Southeastern Shrew	American Ginseng
ARACHNIDS	Southeastern Myotis	Canada Wild-ginger
Southern Unstriped	Big Brown Bat	Carolina Gentian
Scorpion	Rafinesque's Big Eared Bat	Carpenter's Ground-cherry
	Eastern Pipistrelle	Climbing Bittersweet
BIRDS	Bachman's Fox Squirrel	Crested Coral-root
American Woodcock	Eastern Chipmunk	Enchanter's Nightshade
Chuck-Will's-Widow	Golden Mouse	Glade Fern
Chimney Swift	Louisiana Black Bear	Low Erythrodes
Yellow-throated Vireo	Long-tailed Weasel	Pyramid Magnolia
Wood Thrush	Eastern Spotted Skunk	Scarlet Woodbine
Worm-eating Warbler		Shadow-witch Orchid
Louisiana Waterthrush	**REPTILES**	Silvery Glade Fern
Swainson's Warbler	Coal Skink	Virginia Saxifrage
Kentucky Warbler	Eastern Hog-nosed Snake	White Baneberry
Hooded Warbler	Timber Rattlesnake	Woodland Bluegrass
Yellow-throated Warbler		
INSECTS		
Yellow Brachycercus		
Mayfly		

Threats Affecting Habitat:

Conversion of this habitat to anthropogenic forests is expected to continue. Disturbance from several human sources, as well as invasive species, pose threats to this habitat.

Southern Mesophytic Forest Threats Assessment:			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	Restricted	Extreme	Medium
Agriculture/Aquaculture	Restricted	Extreme	Medium
Energy Production & Mining	Restricted	Moderate	Low
Transportation & Service Corridors	Restricted	Moderate	Low
Biological Resource Use	Restricted	Serious	Medium
Human Intrusion/Disturbance	Restricted	Moderate	Low
Natural System Modification	N/A	N/A	N/A
Invasive & other Problematic Species	Large	Slight	Low
Pollution	N/A	N/A	N/A
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	N/A	N/A	N/A
Overall Calculated Threat Impact: Medium			

Habitat Conservation Actions:

1. Invest in protection of this habitat through land acquisition and conservation servitudes.
2. Partner with OSP to manage this habitat type on Tunica Hills State Preservation Area.
3. Provide funding for the control of invasive species in this habitat type.

1.15 Spruce Pine-Hardwood Flatwoods

Rarity Rank: S1/G1G2

Synonyms: Pine-Hardwood Flatwoods

Ecological Systems: CES203.557 East Gulf Coastal Plain Southern Loblolly-Hardwood Flatwoods

General Description:

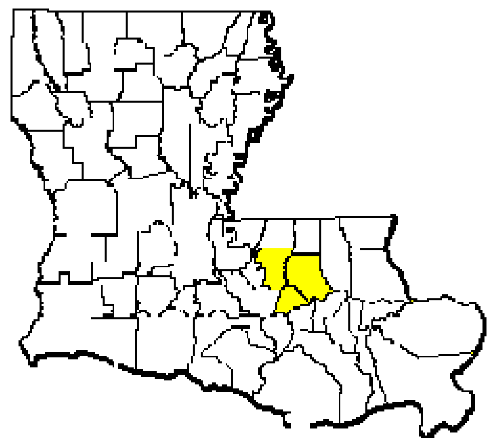
This flatwoods type is a natural mixed forest community endemic to the western Florida Parishes. A wetland variant of this community occupies poorly drained flats, depressional areas and small drainages (sometimes called “slashes”) that lay in a mosaic with higher, non-wetland areas. Such higher areas support a mesic Spruce Pine-Hardwood Flatwood forest. Both variants are distinguished by the prevalence of Spruce Pine over Loblolly Pine (*Pinus taeda*), although Loblolly Pine is usually present at some level. Hardwoods usually dominate the forest, but Spruce Pine can dominate areas within a 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 in the eastern Florida Parishes (Smith 1996). This edaphic factor may have precluded longleaf from this community type. Historically, fire was likely not a major component in this community as the constituent plant species are not fire adapted and fuel conditions are not conducive to fire. Spruce Pine-Hardwood Flatwoods typically have a dense canopy resulting in heavy shading and, usually, a sparse understory. Palmetto is often an understory dominant.

Spruce Pine Hardwood Flatwoods, Frenchtown Road Conservation Area, East Baton Rouge Parish

Spruce Pine-Hardwood Flatwoods: Characteristic Plants	
Common Name	**Scientific Name**
Switchcane	*Arundinaria gigantea*
Pignut Hickory	*Carya glabra*
Sweetgum	*Liquidambar styraciflua*
Spruce Pine	*Pinus glabra*
Laurel Oak	*Quercus laurifolia*
Cow Oak	*Quercus michauxii*
Cherrybark Oak	*Quercus pagoda*
Willow Oak	*Quercus phellos*
Palmetto	*Sabal minor*

Current Extent and Status:

Spruce Pine-Hardwood Flatwoods are restricted to Louisiana, occupying a narrow range in Livingston, East Baton Rouge and, potentially, Ascension Parishes. Pre-settlement acreage is estimated at 50,000 to 100,000 acres with only 10 percent currently remaining (Smith 1993). Protected occurrences of this habitat occur on Tickfaw State Park and Frenchtown Road Conservation Area.



SPRUCE PINE – HARDWOOD FLATWOODS SGCN (27)

AMPHIBIANS
Southern Dusky Salamander
Four-toed Salamander
Gulf Coast Mud Salamander

BIRDS
American Woodcock
Chuck-Will's-Widow
Chimney Swift
Yellow-throated Vireo
Wood Thrush
Prothonotary Warbler
Swainson's Warbler
Kentucky Warbler
Hooded Warbler
Rusty Blackbird

CRUSTACEANS
Flatnose Crawfish

MAMMALS
Southeastern Shrew
Southeastern Myotis
Big Brown Bat
Rafinesque's Big-eared Bat
Eastern Pipistrelle
Bachman's Fox Squirrel
Golden Mouse
Long-tailed Weasel
Eastern Spotted Skunk

REPTILES
Coal Skink
Eastern Hog-nosed Snake
Pine Woods Littersnake
Timber Rattlesnake

Threats Affecting Habitat:

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. Other major factors threatening this association include conversion to commercial pine plantations and hydrological alterations. Invasive species further threaten this habitat.

Spruce Pine-Hardwood Flatwood Threats Assessment:			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	Pervasive	Extreme	Very High
Agriculture/Aquaculture	Large	Extreme	High
Energy Production & Mining	Restricted	Slight	Low
Transportation & Service Corridors	Large	Moderate	Medium
Biological Resource Use	Restricted	Slight	Low
Human Intrusion/Disturbance	Restricted	Slight	Low
Natural System Modification	N/A	N/A	N/A
Invasive & other Problematic Species	Pervasive	Serious	High
Pollution	N/A	N/A	N/A
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	N/A	N/A	N/A
Overall Calculated Threat Impact: High			

Habitat Conservation Actions:

1. Continue surveys to determine the current extent and condition of this habitat type.
2. Elevate this habitat as a priority for protection efforts such as cooperative agreements with landowners (e.g. servitudes) and acquisition from willing sellers.
3. Provide resources to public and private landowners for exotic species control in this habitat (especially for Chinese Tallow Tree and Chinese Privet).
4. Encourage LDAF and other growers to produce Spruce Pine seedlings for distribution to landowners interested in restoring this habitat type.

2 . SAVANNAS AND WOODLANDS

2.1 Eastern Longleaf Pine Savanna

Rarity Rank: S1/G1
Synonyms: Pine Savanna, 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 Savannas (Pine Savannas) are herb-dominated wetlands that are naturally sparsely stocked with longleaf pine. This community is most often dominated by numerous grasses and sedges, and is noted for very high plant diversity, including insectivorous plants and showy orchids and lilies. Pine Savannas historically dominated the Gulf Coastal Plain flatwoods regions of southeast and southwest Louisiana. (Smith 1996).

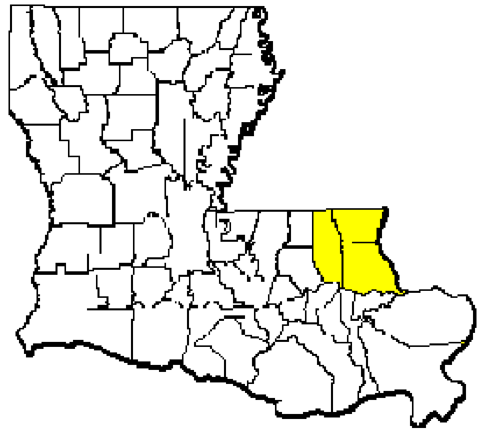
Pine Savannas are found naturally on broad "flats" occupying poorly drained and seasonally saturated/flooded depressional areas. These communities are subject to a highly fluctuating water table, from surface saturation and shallow flooding in late fall/winter/early spring to growing-season drought. In the EGCP Pine Savannas are commonly associated with mesic pine flatwoods intermingled on low ridges and typically transition downslope to Slash Pine-Pondcypress/Hardwood Forest, Bayhead Swamp and/or Small Stream Forest (LNHP 2009). Soils in Eastern Longleaf Savannas are hydric, very strongly acidic, nutrient-poor fine sandy loams and silt loams that are low in organic matter. The surface soils may be underlain by an impeding, slowly permeable soil layer.

Fire, soil conditions and a seasonally high water table work in concert to control community structure in Longleaf Pine Flatwood Savannas, but fire is considered the critical element in their maintenance. All of the species indigenous to pine savannas have evolved over millennia within a regime of frequent (once every 1 to 4 years) surface fires, and most depend on fire for perpetuation. Fire stimulates flowering and fruit/seed production of savanna herbs and shrubs, deters invasion by fire-intolerant woody vegetation, and exposes mineral soil for herb and Longleaf Pine seedlings to become established. In the absence of frequent burning, pine savannas quickly succeed into shrub/tree thickets, and sun-loving herbs are reduced and eventually eliminated (Smith 1996).

Eastern Longleaf Pine Savanna, Abita Creek Flatwoods Preserve, St. Tammany Parish

Eastern Longleaf Pine Savanna: Characteristic Plants	
Common Name	**Scientific Name**
Bristleleaf Chaffhead	*Carphephorus pseudoliatris*
Toothache Grass	*Ctenium aromaticum*
Cutover Muhly	*Muhlenbergia expansa*
Switch Grass	*Panicum virgatum*
Longleaf Pine	*Pinus palustris*
Savanna Meadow Beauty	*Rhexia alifanus*
Yellow Meadow Beauty	*Rhexia lutea*
Beak Sedges	*Rhynchospora* spp.
Yellow Trumpet Pitcher Plant	*Sarracenia alata*
Little Bluestem	*Schizachyrium scoparium*
Coastal Plain Yellow-eyed-grass	*Xyris ambigua*
Kral's Yellow-eyed Grass	*Xyris stricta* var. *obscura*

Current Extent and Status:



Savanna remnants today are relatively limited in size compared to the broad expanses that once existed. Historically, the eastern Florida Parishes of Louisiana were dominated by extensive stands of Longleaf Pine. Now barely 1 percent of the original estimated 100,000 to 500,000 acres of Longleaf Pine Savannas remains (Smith 1993). Habitat 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 longleaf savanna 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 savanna. Big Branch NWR, Bogue Chitto NWR, and Pearl River WMA collectively contain "pine flatwoods" with remnants of savanna herbaceous layers, and some of these sites are in the process of being restored to longleaf pine systems. Wetland mitigation banking has become a valuable tool for restoring Longleaf Pine Flatwoods Savannas, and several mitigation banks located in close proximity to TNC preserves are protecting and restoring this habitat.

Eastern Longleaf Pine Savanna SGCN (82)

AMPHIBIANS
Eastern Tiger Salamander
Southern Dusky Salamander
Four-toed Salamander
Ornate Chorus Frog
Eastern Spadefoot
Dusky Gopher Frog

BIRDS
Northern Bobwhite
Yellow Rail
American Woodcock
Common Ground-Dove
Chuck-Will's-Widow
Chimney Swift
Red-headed Woodpecker
Red-cockaded Woodpecker
Southeastern American Kestrel
Loggerhead Shrike
Brown-headed Nuthatch
Sedge Wren
Prairie Warbler
Bachman's Sparrow
Field Sparrow
Grasshopper Sparrow
Henslow's Sparrow
Le Conte's Sparrow

CRUSTACEANS
Gulf Crawfish
Flatwoods Digger
Flatnose Crawfish

INSECTS
American Bumblebee
Little Metalmark
Georgia Satyr
Lace Winged Roadside Skipper
Arogos Skipper
Yucca Giant Skipper
Monarch
Gulf Pine Sphinx
Pineland Noctuid Moth

MAMMALS
Southeastern Shrew
Bachman's Fox Squirrel
Eastern Harvest Mouse
Long-tailed Weasel
Eastern Spotted Skunk

REPTILES
Eastern Glass Lizard
Eastern Hog-nosed Snake
Mole Kingsnake
Pine Woods Littersnake
Southeastern Crowned Snake
Harlequin Coralsnake

PLANTS
Coastal Plain False-Foxglove
Purple False-foxglove
Flax-leaf False-foxglove
Michaux's Milkweed
Many-Flowered Grass-Pink
Pale Grass-Pink
Leconte's Thistle
Spreading Pogonia
Tracy's Sundew
Shortleaf Sneezeweed
Leggett's Pinweed
Southern Red Lily
Gig Fruit Flax
Golden Crest
Staghorn Clubmoss
Bog Flame Flower
Yellow Butterwort
Yellow Fringeless Orchid
Boykin's Milkwort
Littleleaf Milkwort
Chapman's Milkwort
Scalloped Milkwort
Hooker's Milkwort
Chapman's Beak Sedge
Ciliate Beak Sedge
Flat-fruit Beak Sedge
Savanna Beak Sedge
Night-flowering Wild-petunia
Parrot Pitcher Plant
Low Nut Sedge
Hoary Pea
Coastal False-Asphodel
Death Camus

Threats Affecting Habitat:

This habitat occurs in a rapidly developing part of the state, and is threatened by residential and commercial development and disturbance from human interface. This habitat is fire-dependent, and is threatened by fire exclusion and inadequate fire. Invasive species also pose a threat.

Eastern Longleaf Pine Savanna Threats Assessment:

First Level Threat	Scope	Severity	Impact
Residential/Commercial Development	Restricted	Extreme	Medium
Agriculture/Aquaculture	Restricted	Extreme	Medium
Energy Production & Mining	Large	Moderate	Medium
Transportation & Service Corridors	Restricted	Slight	Low
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Small	Slight	Low
Natural System Modification	Large	Serious	High
Invasive & other Problematic Species	Pervasive	Moderate	Medium
Pollution	Restricted	Serious	Medium
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	N/A	N/A	N/A
Overall Calculated Threat Impact: High			

Habitat Conservation Actions:

1. Prioritize this habitat type for inventory to determine extent and condition with a focus on identifying the surrounding landscape context (e.g., residential developments, etc.) that might be affected by prescribed burning management.
2. Carry out habitat assessments and botanical and zoological surveys on mitigation banks supporting this habitat; work with USACE and mitigation bank sponsors to maximize ecological value of this habitat on mitigation banks.
3. Educate landowners, adjacent residents, developers, parishes, and the general public about the crucial role of prescribed burning in the management of longleaf pine systems and promote the advantages of growing Longleaf Pine and associated herbaceous ground cover.
4. Work with the Longleaf Alliance to incorporate their strategies for longleaf pine management and restoration into current restoration efforts.
5. Target this habitat for acquisition from willing sellers, protection (e.g. servitudes), and stewardship implementation. This includes pursuing tracts that are degraded but restorable with timber harvesting and prescribed fire, i.e. recoverable with management, and not requiring re-establishment of herbaceous ground cover plants “from scratch”.

2.2 Eastern Upland Longleaf Pine Woodland

Rarity Rank: S1/G1G2

Synonyms: Sandhill Pine Forest

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

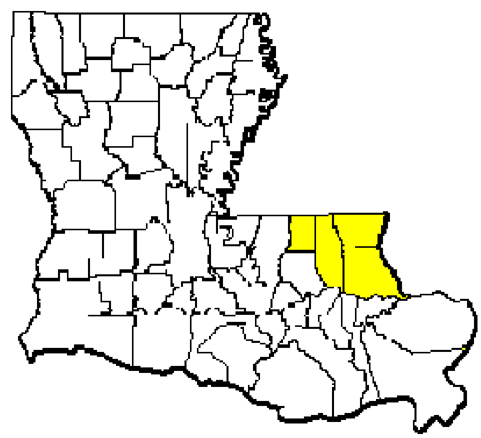
General Description:

This community type occurs in the hilly uplands of the central and eastern Florida Parishes of Louisiana. It occurs on acidic sandy loams, loamy sands, and acid clays associated with Pleistocene terraces. This community is characteristically dissected by small to large creek bottoms. Longleaf Pine is the dominant overstory species, and 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. The herbaceous flora may be exceedingly diverse if fire has frequently occurred. Grasses, composites, legumes, and mints are predominant in the ground layer. This community is home to the Gopher Tortoise (*Gopherus polyphemus*), a federally-listed threatened species, which depends on the sandy soils and open herbaceous understory for survival.

Eastern Upland Longleaf Pine Woodland, Sandy Hollow WMA, Tangipahoa Parish

Eastern Upland Longleaf Pine Woodland: Characteristic Plants	
Common Name	**Scientific Name**
Split-Beard Bluestem	*Andropogon ternarius*
Arrowfeather Threeawn	*Aristida purpurascens* var. *virgata*
Roundhead Lespedeza	*Lespedeza capitata*
Longleaf Pine	*Pinus palustris*
Bracken Fern	*Pteridium aquilinum*
Southern Red Oak	*Quercus falcata*
Blackjack Oak	*Quercus marilandica*
Post Oak	*Quercus stellata*
Little Bluestem	*Schizachyrium scoparium*
Slender Bluestem	*Schizachyrium tenerum*
Goat's Rue	*Tephrosia virginiana*

Current Extent and Status:



Historically, the eastern Florida Parishes of Louisiana were dominated by extensive stands of Longleaf Pine. Now only 1 to 5 percent of the original estimated 1 to 2 million acres of Upland Longleaf Pine Woodland remain (Smith 1993, 1999). Habitat conversion, development, and fire exclusion are factors in this habitat loss. Today there are a few thousand acres in small blocks scattered across this area. LDWF owns and manages Sandy Hollow WMA which is the largest tract of Eastern Upland Longleaf Forest remaining in Louisiana. LDWF also manages a Longleaf Pine tract owned by the Tangipahoa Parish School Board. Other areas containing high quality Eastern Upland Longleaf Pine Woodland include Camp Whispering Pines, owned by the Girl Scout Council of Southeast Louisiana and Louisiana State University's Lee Memorial Forest. There are several tracts of recoverable habitat on private lands scattered in the eastern Florida Parishes, some of which are enrolled in the NRCS Longleaf Pine Initiative which provides funding for habitat restoration, and some properties have and may continue to receive assistance with prescribed fire through LDWF programs.

Eastern Upland Longleaf Pine Woodland SGCN (57)		
AMPHIBIANS Ornate Chorus Frog Eastern Spadefoot Dusky Gopher Frog **BIRDS** Northern Bobwhite American Woodcock Common Ground-Dove Chuck-Will's-Widow Chimney Swift Red-headed Woodpecker Red-cockaded Woodpecker Southeastern American Kestrel Loggerhead Shrike Brown-headed Nuthatch Sedge Wren Prairie Warbler Bachman's Sparrow Field Sparrow Grasshopper Sparrow Henslow's Sparrow Le Conte's Sparrow **CRUSTACEANS** Flatwoods Digger	**INSECTS** Florida Harvester Ant American Bumblebee Mottled Duskywing Dusky Roadside Skipper Yucca Giant Skipper Monarch **MAMMALS** Southeastern Shrew Big Brown Bat Eastern Pipistrelle Bachman's Fox Squirrel Long-tailed Weasel Eastern Spotted Skunk **REPTILES** Gopher Tortoise Eastern Glass Lizard Eastern Hog-nosed Snake Mole Kingsnake Black Pine Snake Southeastern Crowned Snake Harlequin Coralsnake Eastern Diamond-backed Rattlesnake	**PLANTS** Alabama Grape-fern Boykin's Milkwort Broomrape Carolina Fluff Grass Dwarf Gray Willow Fly-poison Illinois Pinweed Incised Agrimony Lady Lupine Michaux's Milkweed Narrowleaf Aster Sand Hickory Scarlet Oak Thyme-leaf Pinweed Wild Coco Orchid

Threats Affecting Habitat:

Most of the historical extent of this habitat has already been converted to anthropogenic forests, and much has been lost to residential and commercial development. The most pressing threats to remaining occurrences are inadequate fire and invasive species.

Eastern Upland Longleaf Pine Woodland Threats Assessment:			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	Restricted	Moderate	Low
Agriculture/Aquaculture	Small	Extreme	Low
Energy Production & Mining	Small	Moderate	Low
Transportation & Service Corridors	Restricted	Moderate	Low
Biological Resource Use	Small	Moderate	Low
Human Intrusion/Disturbance	Small	Slight	Low
Natural System Modification	Large	Serious	High
Invasive & other Problematic Species	Large	Moderate	Medium
Pollution	Small	Slight	Low
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	N/A	N/A	N/A
Overall Calculated Threat Impact: Medium			

Habitat Conservation Actions:

1. Educate landowners, adjacent residents, developers, and the general public about the crucial role of prescribed burning in the management of longleaf pine systems, the advantages of growing Longleaf Pine and associated herbaceous ground cover, and promote value-added products produced from Longleaf Pine to encourage landowners to replant Longleaf Pine instead of Loblolly Pine.
2. Continue to provide cost share funds through programs such as PBI to reduce or eliminate landowners' costs associated with conducting prescribed burns on their property.
3. Work with the Longleaf Alliance to incorporate their strategies for Longleaf Pine management and restoration into current restoration efforts.
4. Target this habitat for acquisition from willing sellers, protection (e.g. servitudes), and stewardship implementation. This includes pursuing tracts that are degraded but restorable with timber harvesting and prescribed fire, i.e. recoverable with management, and not requiring re-establishment of herbaceous ground cover plants "from scratch".

2.3 Shortleaf Pine/Oak-Hickory Woodland

Rarity Rank: S1/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:

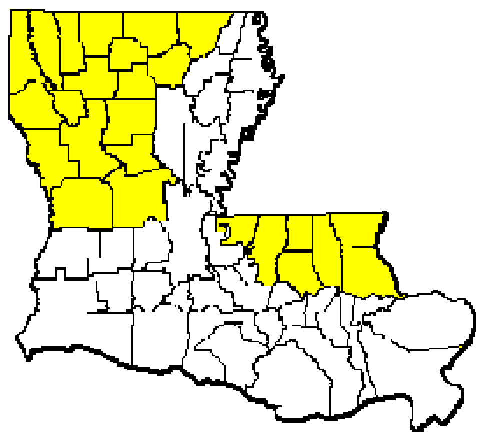
The Shortleaf Pine/Oak-Hickory Woodland community occurs on dry hills, principally in central and northern Louisiana, as well as in the Florida Parishes. In the Upper West Gulf Coastal Plain, this was the most prevalent habitat on the landscape (i.e., it was the matrix community). The overstory is composed of a combination of Shortleaf Pine and various dry-sited hardwood species. The ground cover was historically grassy and similar to that of Longleaf Pine systems. However, the ground cover in Shortleaf Pine/Oak-Hickory Woodlands was likely variable and possessed some shaded areas with associated shade-loving plants, versus large continuous stands of sun-loving plants such as found in Longleaf Pine grasslands. Fire is an important process in this community. Historical fire frequency is thought to have been 5 to 15 years (Martin and Smith 1993).

Shortleaf Pine/Oak-Hickory Woodland, Lincoln Parish

Shortleaf Pine/Oak-Hickory Woodland: Characteristic Plants	
Common Name	**Scientific Name**
Mockernut Hickory	*Carya alba*
Black Hickory	*Carya texana*
Woods Oats	*Chasmanthium laxum* var. *sessiliflorum*
Rattlesnake Master	*Eryngium yuccifolium*
Shortleaf Pine	*Pinus echinata*
Southern Red Oak	*Quercus falcata*
Bluejack Oak	*Quercus incana*
Post Oak	*Quercus stellata*
Little Bluestem	*Schizachyrium scoparium*
Tree Huckleberry	*Vaccinium arboreum*

Current Extent and Status:

There was an estimated 4,000,000 to 6,000,000 acres of Shortleaf Pine/Oak-Hickory Forest in Louisiana and, of this original extent, 5 to 10 percent is thought to remain today (Smith 1993). Most of this acreage was in northwestern Louisiana in the UWGCP. Shortleaf Pine/Oak-Hickory Forests possessing both the overstory and characteristic herbaceous ground cover are extremely rare.



SHORTLEAF PINE – OAK – HICKORY WOODLAND SGCN (47)		
AMPHIBIANS Southern Red-backed Salamander Louisiana Slimy Salamander Strecker's Chorus Frog Southern Crawfish Frog **BIRDS** American Woodcock Greater Roadrunner Red-headed Woodpecker Chuck-Will's-Widow Chimney Swift Red-cockaded Woodpecker Yellow-throated Vireo White-breasted Nuthatch Brown-headed Nuthatch Wood Thrush Worm-eating Warbler Swainson's Warbler	Kentucky Warbler Hooded Warbler Bachman's Sparrow Field Sparrow Henslow's Sparrow Painted Bunting Rusty Blackbird **CRUSTACEANS** Flatwoods Digger Pine Hills Digger **INSECTS** Lace Winged Roadside Skipper **MAMMALS** Southeastern Shrew Big Brown Bat Rafinesque's Big-eared Bat Eastern Pipistrelle	Bachman's Fox Squirrel Eastern Chipmunk Baird's Pocket Gopher Oak Ridge Pocket Gopher Golden Mouse Louisiana Black Bear Ringtail Long-tailed Weasel Eastern Spotted Skunk **REPTILES** Western Slender Glass Lizard Eastern Glass Lizard Southern Prairie Skink Coal Skink Western Worm Snake Eastern Hog-nosed Snake Mole Kingsnake Timber Rattlesnake

Threats Affecting Habitat:

Due to prior conversion to anthropogenic forests and fire exclusion, this habitat is extremely rare today. Habitat conversion and inadequate fire continue to threaten remaining occurrences. Habitat destruction, disturbance, and fragmentation from mineral extraction operations also impact this habitat.

Shortleaf Pine/Oak Hickory Woodland Threats Assessment:

First Level Threat	Scope	Severity	Impact
Residential/Commercial Development	Restricted	Serious	Medium
Agriculture/Aquaculture	Restricted	Extreme	Medium
Energy Production & Mining	Large	Serious	High
Transportation & Service Corridors	Large	Slight	Low
Biological Resource Use	Restricted	Moderate	Low
Human Intrusion/Disturbance	N/A	N/A	N/A
Natural System Modification	Large	Moderate	Medium
Invasive & other Problematic Species	Large	Slight	Low
Pollution	N/A	N/A	N/A
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	N/A	N/A	N/A
Overall Calculated Threat Impact: Medium			

Habitat Conservation Actions:

1. Continue surveys to determine the current extent and condition of this habitat type.
2. Develop DFCs 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. Support the production and planting of locally adapted Shortleaf Pine seedlings for restoration efforts.
5. Develop partnerships with federal and state agencies, NGO's and others to form a Shortleaf Pine Initiative.
6. Prioritize this habitat type for stewardship efforts on private lands; include this habitat in future prescribed burn initiatives.
7. Prioritize this community type for protection efforts such as cooperative agreements and acquisition from willing sellers; in addition to high-quality examples of this habitat, these efforts should target large blocks of land currently not supporting identifiable examples which can then be recreated by aggressive harvesting of off-site pine species, replanting of Shortleaf Pine, and prescribed burning.

2.4 Slash Pine-Pondcypress/Hardwood Woodland

Rarity Rank: S2/G2?
Synonyms: Slash Pine-Hardwood
Ecological Systems: CES203.375 East Gulf Coastal Plain Near-Coast Pine Flatwoods

General Description:

This wetland habitat is restricted to the wet, acidic flatwoods on the far eastern Pleistocene Prairie Terrace of Louisiana's EGCP. Slash Pine-Pondcypress/Hardwood Woodlands are situated in a hydrologic/topographic transitional zone between the higher, "drier" Longleaf Pine Flatwoods Savannas and the lower, wetter Bayhead Swamps. This habitat 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 Woodlands 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, and early spring, and after rains during the growing season.

This habitat seems to vary considerably in structure and somewhat in composition from one site to another, apparently as a consequence of minor variations in topography, soil conditions, and hydrology, and fire regimes (LNHP 2009; Teague et al. 1995). Existing examples of this habitat encompasses both dense-canopied forested wetlands as well as open sunny savanna-like areas supporting lush grass and sedge dominated understories. Whether woodland or savanna conditions prevail is dependent on fire, disturbance, or other factors that impact tree recruitment and growth.

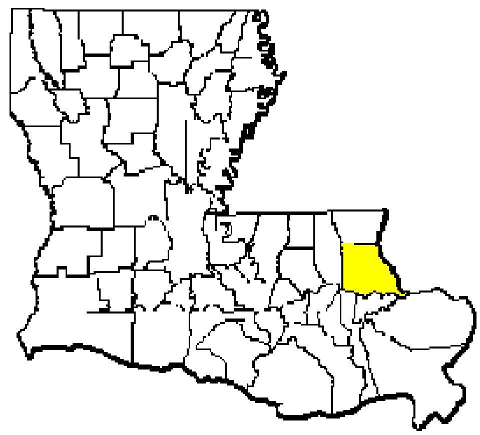
Slash Pine-Pondcypress/Hardwood Woodlands evolved with recurrent lightning-season ground fires, and regular light surface fire appears critical in maintaining this community. Both Slash Pine and Pondcypress are fire-adapted species and can survive fires once they attain a certain size; however, neither 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. This frequency would periodically allow for the regeneration of Slash Pine, Pondcypress, and associated hardwoods during the longer fire return intervals, as well as preclude complete dominance of the site by hardwoods (Smith 1996).

Slash Pine-Pondcypress/Hardwood Woodland, St. Tammany Parish

Slash Pine-Pondcypress/Hardwood Woodland: Characteristic Plants	
Common Name	**Scientific Name**
White Titi	*Cyrilla racemiflora*
Big Gallberry	*Ilex coriacea*
Myrtle Holly	*Ilex myrtifolia*
Foxtail Clubmoss	*Lycopodiella alopecuroides*
Sweetbay Magnolia	*Magnolia virginiana*
Swamp Blackgum	*Nyssa biflora*
Slash Pine	*Pinus elliotii*
Broadfruit Horned Beak Sedge	*Rhynchospora careyana*
Yellow Trumpet Pitcher Plant	*Sarracenia alata*
Pondcypress	*Taxodium ascendens*
Pineland Yellow-eyed-grass	*Xyris stricta* var. *stricta*

Current Extent and Status:

In the EGCP of Louisiana, the Slash Pine-Pondcypress/Hardwood Woodland is primarily associated with Eastern Longleaf Pine Flatwoods Savanna and Bayhead Swamp. Pre-settlement extent of this habitat is estimated at 50,000 to 100,000 acres, with only 10 to 25 percent currently remaining (Smith 1993, Smith 1999). Protected examples occur of TNC's Talisheek Pine Wetlands and Abita Flatwoods Preserves, as well as several nearby mitigation banks.



SLASH PINE – PONDCYPRESS – HARDWOOD WOODLAND SGCN (39)		
AMPHIBIANS	Hooded Warbler	Eastern Spotted Skunk
Eastern Tiger Salamander	Yellow-throated Warbler	
Four-toed Salamander		**REPTILES**
Southern Dusky Salamander	**CRUSTACEANS**	Eastern Glass Lizard
	Flatnose Crawfish	Coal Skink
Gulf Coast Mud Salamander		Eastern Hog-nosed Snake
	INSECTS	Pine Woods Littersnake
Ornate Chorus Frog	Arogos Skipper	Eastern Diamond-backed Rattlesnake
Eastern Spadefoot	Pineland Noctuid Moth	
Dusky Gopher Frog		
	MAMMALS	**PLANTS**
BIRDS	Southeastern Shrew	Georgia Tickseed
Swallow-tailed Kite	Southeastern Myotis	Late Yellow-eyed grass
American Woodcock	Big Brown Bat	Parrot Pitcher Plant
Chuck-Will's-Widow	Rafinesque's Big-eared Bat	Pineland Yellow-eyed-grass
Chimney Swift		Pink Bog Button
Yellow-throated Vireo	Eastern Pipistrelle	Spoon-Leaved Sundew
Prothonotary Warbler	Bachman's Fox Squirrel	
Kentucky Warbler	Golden Mouse	
	Long-tailed Weasel	

Threats Affecting Habitat:

This habitat has some inherent resilience because of its wetness. However, conversion to anthropogenic habitats has affected this habitat and is expected to continue, along with fire exclusion and disturbance from human activities.

Slash Pine-Pondcypress/Hardwood Woodland Threats Assessment:			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	Small	Slight	Low
Agriculture/Aquaculture	Restricted	Serious	Medium
Energy Production & Mining	Restricted	Moderate	Low
Transportation & Service Corridors	Restricted	Moderate	Low
Biological Resource Use	Small	Moderate	Low
Human Intrusion/Disturbance	Small	Slight	Low
Natural System Modification	Restricted	Moderate	Low
Invasive & other Problematic Species	Large	Moderate	Medium
Pollution	Restricted	Slight	Low
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	Pervasive	Slight	Low
Overall Calculated Threat Impact: Medium			

Habitat Conservation Actions:

1. Conduct surveys to determine the extent and condition of this habitat type with a focus on identifying the surrounding landscape context (e.g., residential developments, etc.) that might be affected by prescribed burning.
2. Continue to provide cost share funds for landowners to reduce or eliminate costs associated with conducting prescribed burns on their property.
3. Continue to work with USACE, other mitigation bank regulatory bodies, and mitigation bank sponsors to ensure correct identification and maximal ecological value of this habitat.
4. Create opportunities for acquisition and stewardship of this habitat type, including targeting occurrences that are degraded but recoverable with timber harvesting and prescribed fire.

2.5 Western Longleaf Pine Flatwoods Savanna

Rarity Rank: Acidic - S2/G2G3; Saline - S1/G1;

Synonyms: Open Savanna, Pine Flatwoods, Coastal Meadow, Pine Meadow, Pine Barren

Ecological Systems: CES203.191 West Gulf Coastal Plain Wet Longleaf Pine Savanna and Flatwoods

***General Description*:**

Western Longleaf Pine Flatwoods Savanna includes both acidic (S1S2) and saline (sodic) types (S1). Sodic Pine Savannas occur mainly on Brimstone Silt Loam. Pine Savannas are floristically rich, herb-dominated wetlands that are naturally sparsely stocked with Longleaf Pine (*Pinus palustris*). Pine Savannas historically dominated the Gulf Coastal Plain flatwood regions of southeast and southwest Louisiana. The term “savanna” is classically used to describe expansive grassland areas possessing scattered trees. Wet savannas in the WGCP occupy the poorly drained and seasonally saturated/flooded depressional areas and low flats, whereas the non-wetland flatwoods occupy better drained low ridges. Essentially Upland Longleaf Pine Woodland is found on pimple mounds within the flatwoods. Pimple mounds are small soil mounds resulting from wind deposition of soil during historical droughts (Siefert et al. 2009). Pine Savannas experience a highly fluctuating water table, ranging from surface saturation/shallow flooding in late fall/winter/early spring to growing season drought. Soils are hydric, very strongly acidic, nutrient poor, fine sandy loams and silt loams, and are low in organic matter. The surface soils for both eastern and western types may be underlain by slowly permeable subsoil, which causes water to run off the surface gradually.

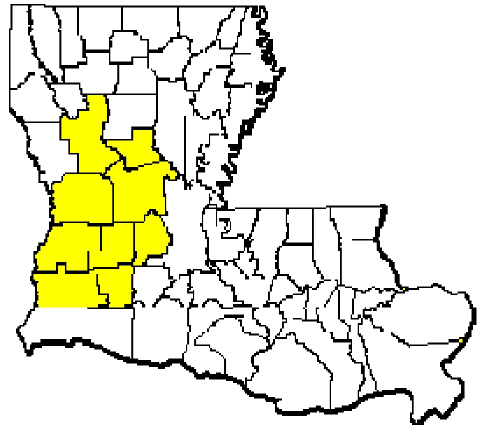
The only known extant Louisiana occurrences of *Schwalbea americana* (American Chaffseed), which is federally-listed as endangered, is found on pimple mounds in Longleaf Pine Flatwoods Savannas in Allen and Beauregard Parishes. This species is also known historically from Calcasieu and Rapides Parishes. Various species belonging to the lily family (Liliaceae), sunflower family (Asteraceae), and orchid family (Orchidaceae) are also prominent. Club-mosses (*Lycopodium* spp.) and peat moss (*Sphagnum* spp.) are often conspicuous. Frequent fire is a major factor controlling species occurrence and community structure. Without frequent fire (particularly growing season burns which more accurately mimic historical fire regimes), shrubs and trees, especially Loblolly and Slash Pines, will gain dominance and eliminate most of the herbaceous flora.

Western Longleaf Pine Flatwoods Savanna, Beauregard Parish

Western Longleaf Pine Flatwoods Savanna: Characteristic Plants	
Common Name	**Scientific Name**
Acidic	
Cutover Muhly	*Muhlenbergia expansa*
Savanna Meadow Beauty	*Rhexia alifanus*
Yellow Meadow Beauty	*Rhexia lutea*
Beak Sedges	*Rhynchospora* spp.
Little Bluestem	*Schizachyrium scoparium*
Slender Bluestem	*Schizachyrium tenerum* (pimple mounds)
Coastal Plain Yellow-eyed-grass	*Xyris ambig*ua
Carolina Yellow-eyed-grass	*Xyris caroliniana* (pimple mounds)
Saline (Sodic)	
Rayless Goldenrod	*Bigelowia nuttallii*
Yellow Puff	*Neptunia lutea*
Silveus Dropseed	*Sporobolus silveanus*
Gulf cordgrass	*Spartina spartinae*

Current Extent and Status:

Western Longleaf Pine Flatwoods Savannas and embedded habitats 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 pre-settlement times with an estimated 1 to 5 percent remaining (Smith 1993).



Most extant Longleaf Pine Savannas occur on private land. A combination of factors has favored them during the last 100 years, including utilization as rangeland (involving frequent burning). Several examples are captured by conservation lands owned by TNC, and several sites are protected in wetland mitigation banks. Wetland mitigation banking is emerging as an important tool for conservation of this habitat. Habitat restoration on mitigation banks involves harvesting off-site pine species and prescribed burning. With reintroduction of fire, much of the diverse herbaceous ground cover often returns.

WESTERN LONGLEAF PINE FLATWOODS SAVANNA SGCN (47)		
AMPHIBIANS Eastern Tiger Salamander Southern Crawfish Frog **ARACHNIDS** Texas Brown Tarantula **BIRDS** Northern Bobwhite Yellow Rail American Woodcock Greater Roadrunner Chuck-Will's-Widow Red-headed Woodpecker Red-cockaded Woodpecker White-breasted Nuthatch Brown-headed Nuthatch Sedge Wren Loggerhead Shrike Prairie Warbler Bachman's Sparrow Field Sparrow Grasshopper Sparrow	Henslow's Sparrow Le Conte's Sparrow **CRUSTACEANS** Pine Hills Digger **INSECTS** American Bumblebee Little Metalmark Monarch Gulf Pine Sphinx **MAMMALS** Eastern Harvest Mouse Long-tailed Weasel Eastern Spotted Skunk **REPTILES** Western Slender Glass Lizard Eastern Hog-nosed Snake Western Chicken Turtle	**PLANTS** American Chaffseed Arkansas Leastdaisy Boykin's Milkwort Chapman's Milkwort Dotted Blazing Star Flat-fruit Beak Sedge Oklahoma Grass-pink Purple False-foxglove Rosinweed Sunflower Savanna Beak Sedge Scalloped Milkwort Silveus Dropseed Small-fruited Water-willow Spreading Beak Sedge Wand Blackroot Wild Coco Orchid

Threats Affecting Habitat:

Threats include conversion to Slash or Loblolly Pine plantations, residential/commercial development, fire exclusion or inappropriate fire regime, hydrological alterations, contamination by chemicals (herbicides, fertilizers), and physical damage from timber harvesting/planting activities (Smith 1996). Invasive species also threaten this habitat.

Western Longleaf Pine Flatwoods Savanna Threats Assessment:

First Level Threat	Scope	Severity	Impact
Residential/Commercial Development	Large	Moderate	Medium
Agriculture/Aquaculture	Large	Extreme	High
Energy Production & Mining	Large	Moderate	Medium
Transportation & Service Corridors	Large	Moderate	Medium
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Small	Slight	Low
Natural System Modification	Large	Serious	High
Invasive & other Problematic Species	Pervasive	Serious	High
Pollution	N/A	N/A	N/A
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	N/A	N/A	N/A

Habitat Conservation Actions:

1. Continue surveys to determine the extent and condition of this habitat type.
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. Target this habitat for acquisition from willing sellers, protection (e.g. servitudes), and stewardship implementation. This includes pursuing tracts that are degraded but restorable with timber harvesting and prescribed fire, i.e. recoverable with management, and not requiring re-establishment of herbaceous ground cover plants "from scratch".
4. Continue to promote advantages of growing Longleaf Pine and associated herbaceous ground cover by working with the Longleaf Alliance and incorporate their strategies for Longleaf Pine management and restoration into restoration efforts.
5. Continue to work with USACE, other mitigation bank regulatory bodies, and mitigation bank sponsors to ensure correct identification and maximal ecological value of this habitat. This includes discouraging establishment of inappropriate vegetation types on the flatwoods landscape such as Bottomland Hardwood Forest.

2.6 Western Upland Longleaf Pine Woodland

Rarity Rank: S3/G2G3

Synonyms: Sandhill Pine Forest, Clayhill Pine Forest

Ecological Systems: CES203.293 West Gulf Coastal Plain Upland Longleaf Pine Forest and Woodland

General Description:

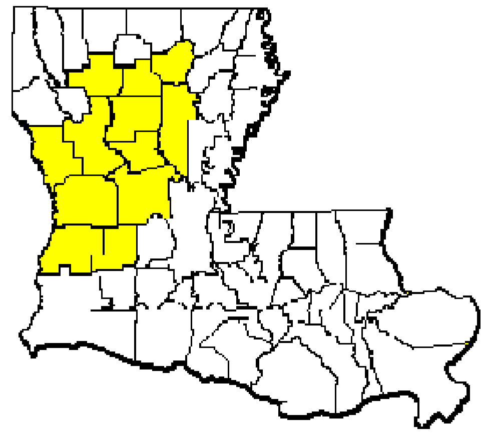
This habitat occurs in the hilly uplands in western and central Louisiana. It occurs on acidic loamy sands to acid clays associated with Pleistocene or Tertiary formations. Soil moisture regimes range from dry-mesic to xeric. The community is characteristically dissected by small to large creek bottoms. Longleaf Pine (*Pinus palustris)* 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. The herbaceous flora may be exceedingly diverse if fire has frequently occured. Grasses, composites, and legumes are predominant in the ground layer.

Western Upland Longleaf Pine Woodland, Fort Polk Military Reservation and WMA, Vernon Parish

Western Upland Longleaf Pine Woodland: Characteristic Plants	
Common Name	**Scientific Name**
Dry-Mesic	
Split-beard Bluestem	*Andropogon ternarius*
Roundhead Lespedeza	*Lespedeza capitata*
Blazing Stars	*Liatris* spp.
Pitchfork Crown Grass	*Paspalum bifidum*
Grassleaf Golden Aster	*Pityopsis graminifolia*
Bracken Fern	*Pteridium aquilinum*
Little Bluestem	*Schizachyrium scoparium*
Slender Bluestem	*Schizachyrium tenerum*
Fragrant Goldenrod	*Solidago odora*
Goat's Rue	*Tephrosia virginiana*
Texas Ironweed	*Vernonia texana*
Xeric Sandy Soils	
Curly Threeawn	*Aristida desmantha*
Texas Bullnettle	*Cnidoscolus texana*
Scratch Daisy	*Croptilon divaricatum*
Bristly Flat Sedge	*Cyperus hystricinus*
Plukenet's Flat Sedge	*Cyperus plukenetii*
Illinois Flat Sedge	*Cyperus grayoides*
Plains Snakecotton	*Froelichia floridana*
Camphorweed	*Heterotheca subaxillaris*
Prickly Pear	*Opuntia* sp.
Bluejack Oak	*Quercus incana*
Downy Spiderwort	*Tradescantia reverchonii*

Current Extent and Status:

Western Upland Longleaf Pine Woodlands historically dominated large areas in the LWGCP. However, much of this area has been converted to other forest types or developed. The estimated pre-settlement acreage of this habitat is 2,000,000 to 4,000,000 with an estimated 10 to 25 percent remaining (Smith 1993). Currently, the largest tracts of this community are found on the Vernon unit of Kisatchie National Forest, Fort Polk Military Reservation and WMA.



WESTERN UPLAND LONGLEAF PINE WOODLAND SGCN (70)

AMPHIBIANS
Eastern Tiger Salamander
Southern Red-backed Salamander
Hurter's Spadefoot
Southern Crawfish Frog

ARACHNIDS
Texas Brown Tarantula

BIRDS
Northern Bobwhite
American Woodcock
Greater Roadrunner
Red-headed Woodpecker
Red-cockaded Woodpecker
Loggerhead Shrike
White-breasted Nuthatch
Brown-headed Nuthatch
Sedge Wren
Prairie Warbler
Bachman's Sparrow
Field Sparrow
Grasshopper Sparrow
Henslow's Sparrow
Le Conte's Sparrow

CRUSTACEANS
Pine Hills Digger

INSECTS
Yellow Brachycercus Mayfly
Texas Emerald
Comanche Harvester Ant
American Bumblebee
Frosted Elfin
Little Metalmark
Georgia Satyr
Mottled Duskywing
Wild Indigo Duskywing
Dusky Roadside Skipper
Dusted Skipper
Meske's Skipper
Yucca Giant Skipper
Strecker's Giant Skipper
Falcate Orangetip
Monarch

MAMMALS
Northern Long-eared Bat
Big Brown Bat
Eastern Pipistrelle
Baird's Pocket Gopher
Hispid Pocket Mouse
Golden Mouse
Ringtail
Long-tailed Weasel

REPTILES
Western Slender Glass Lizard
Coal Skink
Eastern Hog-nosed Snake
Louisiana Pine Snake
Timber Rattlesnake

PLANTS
Dry-Mesic
American Chaffseed
Broomrape
Culver's-Root
Dwarf Gray Willow
Oklahoma Grass-pink
Rosinweed Sunflower
Slender Gay-feather
Thyme-Leaf Pinweed
Wild Coco Orchid
Xeric Sandy Soils
American Jointweed
Illinois Flat Sedge
Louisiana Square-head
Manyflowered Wild-Buckwheat
October Flower
Sand Spikemoss
Silver Croton
Smooth Twistflower
Soxman's Milkvetch

Threats Affecting Habitat:

Most of the historical acreage of this habitat now support anthropogenic forests. Due to rarity and limited opportunity, habitat conversion is expected to be infrequent but to have severe consequences where it does occur. This habitat is mainly threatened by inadequate fire. Several sources of human disturbance also degrade this habitat.

Western Upland Longleaf Pine Woodland Threats Assessment:

First Level Threat	Scope	Severity	Impact
Residential/Commercial Development	Restricted	Moderate	Low
Agriculture/Aquaculture	Restricted	Extreme	Medium
Energy Production & Mining	Restricted	Moderate	Low
Transportation & Service Corridors	Restricted	Moderate	Low
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Small	Slight	Low
Natural System Modification	Large	Serious	High
Invasive & other Problematic Species	Pervasive	Slight	Low
Pollution	N/A	N/A	N/A
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	N/A	N/A	N/A
Overall Calculated Threat Impact: Medium			

Habitat Conservation Actions:

1. Continue surveys to determine the extent and condition of this habitat.
2. Educate landowners, adjacent residents, developers, and the general public about the crucial role of prescribed burning in the management of Longleaf Pine.
3. Continue to promote advantages of growing Longleaf Pine and associated herbaceous ground cover in cooperation with the Longleaf Alliance and incorporate their strategies for restoration into new and ongoing restoration efforts.
4. Promote value-added products produced from Longleaf Pine to encourage landowners to replant Longleaf Pine instead of off-site pine species.
5. Support and provide cost-share opportunities to offset costs to landowners for management activities such as prescribed burning, brush control, and invasive species control in this habitat.
6. Target this habitat for acquisition from willing sellers, protection (e.g. servitudes), and stewardship implementation. This includes pursuing tracts that are degraded but restorable with timber harvesting and prescribed fire, i.e. recoverable with management, and not requiring re-establishment of herbaceous ground cover plants “from scratch”.

2.7 Xeric Sandhill Woodland

Rarity Rank: S1/G2G3
Synonyms: Oak-Farkleberry Sandy Lands
Ecological Systems: CES203.056 West Gulf Coastal Plain Sandhill Oak and Shortleaf Pine Forest and Woodland

General Description:

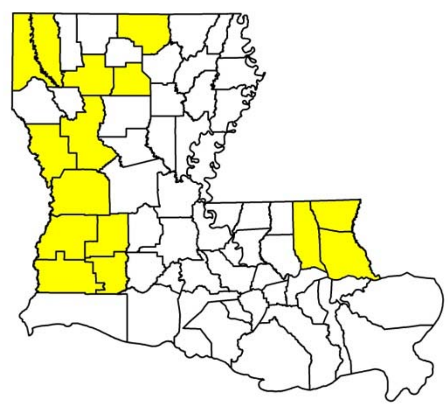
Xeric Sandhill Woodlands develop on deep sandy soils on Tertiary uplands and Pleistocene stream terraces. Most occurrences are in the latter setting. Soils are nutrient-poor, excessively well-drained loamy fine sands. Fire may be an important process maintaining some examples of this community. However, some Xeric Sandhill Woodlands may be isolated by landscape features such as stream bottoms which naturally protect them from fire, or may have sparse fine fuels which will not carry fire well. Drought-related tree and shrub mortality may play a role in creating canopy gaps that allow light-loving herbaceous plants to persist. The vegetation composition of Xeric Sandhill Woodlands overlaps considerably with that of Upland Longleaf Pine Woodlands that occur on deep xeric sandy soils. However, vegetation structure often differs between these two habitats, with Xeric Sandhill Woodlands appearing more "scrub-like". Xeric Sandhill Woodlands tend to be small-scale, inclusional habitats, while the xeric phase of Upland Longleaf Pine Woodlands is typically more expansive.

Xeric Sandhill Woodland, Caddo Parish

Xeric Sandhill Woodland: Characteristic Plants	
Common Name	**Scientific Name**
Curly Threeawn	*Aristida desmantha*
Texas Bullnettle	*Cnidoscolus texana*
Bristly Flat Sedge	*Cyperus hystricinus*
Plukenet's Flat Sedge	*Cyperus plukenetii*
Slender Crabgrass	*Digitaria filiformis*
Plains Snakecotton	*Froelichia floridana*
Prickly Pear	*Opuntia* sp.
Bluejack Oak	*Quercus incana*
Sand Post Oak	*Quercus margaretta*
Gray's beak sedge	*Rhynchospora grayi*
Louisiana Square-head	*Tetragonotheca ludoviciana*
Downy Spiderwort	*Tradescantia reverchonii*

Current Extent and Status:

Xeric Sandhill Woodlands are more frequent west of the Mississippi River. A few examples of this habitat are known from stream terraces (e.g. along Pushepatappa Creek) and broad uplands in the eastern Florida Parishes. Pre-settlement extent of Xeric Sandhill Woodland habitat is estimated to have been 50,000 to 100,000 acres, with 10 to 25 percent remaining today (Smith 1993). Most remaining Xeric Sandhill Woodlands in the WGCP are highly degraded (MacRoberts and MacRoberts 1995).



XERIC SANDHILL WOODLAND SGCN (75)

AMPHIBIANS
Strecker's Chorus Frog
Hurter’s Spadefoot

ARACHNIDS
Texas Brown Tarantula

BIRDS
Northern Bobwhite
American Woodcock
Greater Roadrunner
Chuck-Will's-Widow
Chimney Swift
Loggerhead Shrike
Bell’s Vireo
Prairie Warbler
Field Sparrow
Painted Bunting

CRUSTACEANS
Pine Hills Digger

INSECTS
Florida Harvester Ant
Comanche Harvester Ant
American Bumblebee
Cobweb Skipper
Monarch

MAMMALS
Big Brown Bat
Eastern Pipistrelle
Baird’s Pocket Gopher
Hispid Pocket Mouse
Golden Mouse
Ringtail
Long-tailed Weasel

REPTILES
Western Slender Glass Lizard
Texas Horned Lizard
Coal Skink
Southern Prairie Skink
Eastern Hog-nosed Snake
Louisiana Pine Snake
Timber Rattlesnake

PLANTS
Soxman’s Milk-vetch
Purple Poppymallow
Golden Wave Tickseed
Silver Croton
Illinois Flat Sedge
Slim-Spike Prairie-Clover
Silky Prairie-clover
Wedge-leaf Whitlow-grass
Long-leaved Wild-buckwheat
Many-flowered Wild-Buckwheat
Spreading Pygmyleaf
Summer Farewell (EGCP)
Perennial Sand Grass (EGCP)
Eared Greenbrier (EGCP)
Prairie Milkvine
Pale Umbrella-wort
Texas Palafoxia
Drummond’s Nailwort
Palm-leaf Scarf-pea
Awl-shaped Scarf-pea
Cupleaf Beardtongue
Sandhills Phacelia
Woolly Plantain
Large Clammyweed
American Jointweed
October Flower
Oklahoma Plum
Arkansas Oak
Heartleaf Skullcap
Riddell's Spike Moss
Texas ragwort
Scarlet Catchfly
Early Goldenrod
Smooth Twistflower
Prairie Flameflower
Louisiana Square-head
East Texas Greenthread
Culver's-root
Turkey Oak (EGCP)
Pine-woods Milkweed (EGCP)
Cottony Goldenaster (EGCP)
Viperina

Threats Affecting Habitat:

The main threats to this habitat are destruction by residential and commercial development and conversion to anthropogenic forests, and disturbance from several sources including mineral extraction and other human influences. Inadequate fire is also a threat to occurrences which are situated in a position on the landscape where fire was important in shaping the habitat, and occurrences that have ample fuel to carry fire.

Xeric Sandhill Woodland Threats Assessment:

First Level Threat	Scope	Severity	Impact
Residential/Commercial Development	Pervasive	Serious	High
Agriculture/Aquaculture	Large	Extreme	High
Energy Production & Mining	Pervasive	Serious	High
Transportation & Service Corridors	Large	Moderate	Medium
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Pervasive	Slight	Low
Natural System Modification	Pervasive	Moderate	Medium
Invasive & other Problematic Species	Pervasive	Slight	Low
Pollution	Restricted	Serious	Medium
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	N/A	N/A	N/A
Overall Calculated Threat Impact: Very High			

Habitat Conservation Actions:

1. Continue surveys to determine the current extent and condition of this habitat type.
2. Identify opportunities for stewardship and protection of this habitat, including cooperative agreements with landowners and land acquisition.

3. SHRUBLANDS

3.1 Canebrake

Rarity Rank: SX/G2?
Synonyms: Giant Cane Shrubland
Ecological Systems:
CES202.705 South-Central Interior Large Floodplain
CES202.706 South-Central Interior Small Stream and Riparian Forest
CES203.066 Southern Atlantic Coastal Plain Large River Floodplain Forest
CES203.190 Mississippi River Floodplain Forest
CES203.196 Mississippi River High Floodplain (Bottomland) Forest
CES203.304 Southern Atlantic Coastal Plain Non Riverine Swamp and Wet Hardwood Forest
CES203.488 West Gulf Coastal Plain Large River Floodplain Forest
CES203.489 East Gulf Coastal Plain Large River Floodplain Forest

General Description:

Canebrake in Tensas Parish near turn of the 20th century

Canebrakes are dense monotypic, thickets of Giant Cane (*Arundinaria gigantea*) that can reach heights of up to 40 feet. This habitat once occurred extensively on fertile alluvial soils across much of the southeastern United States in coastal plain and mountain ecoregions (NatureServe 2015). Early settlers and explorers recorded seeing miles and miles of impenetrable cane thickets (Noss 2013, Brantley and Platt 2001). Bison, black bears, turkeys, white-tailed deer, cougars, and other wildlife used Canebrakes for shelter and/or food. Giant Cane was used extensively by Native Americans for building materials and as a food source. Native Americans also managed Canebrakes with fire and increased cane extent when their abandoned agricultural fields reverted to cane. This anthropogenic influence is believed to account for the largest and most extensive Canebrakes (Noss 2013, Brantley and Platt 2001). It is hypothesized that the passenger pigeon (now an extinct species) also contributed to the establishment and expansion of Canebrakes. Huge flocks of passenger pigeons disturbed forests by breaking tree limbs and creating canopy openings. These sunny openings, plus large amounts of nutrient-rich excrement expelled by the birds, created the fertile conditions suitable for Giant Cane (Noss 2013). Canebrakes began to decline rapidly after European settlement and by the early 1900s they had nearly disappeared throughout the southeastern U.S. The extinction of the Passenger Pigeon, excessive grazing, altered burning regimes, agricultural land clearing, and flood control projects all contributed to the disappearance of the Canebrake ecosystem (Brantley and Platt 2001).

Canebrake: Characteristic Plant Species	
Common Name	**Scientific Name**
Giant Cane	*Arundinaria gigantea*

Current Extent and Status:

Canebrakes likely occurred statewide on rich alluvial soil in large and small floodplains and were probably most extensive in the Mississippi and Red River valleys.

CANEBRAKE SPECIES OF CONSERVATION CONCERN (10)		
BIRDS	**INSECTS**	**REPTILES**
Worm-eating Warbler	Creole Pearly-eye	Timber Rattlesnake
Louisiana Waterthrush	Lace-winged Roadside Skipper	
Swainson's Warbler		
Kentucky Warbler		
Hooded Warbler	**MAMMALS**	
	Louisiana Black Bear	
	Golden Mouse	
	Long-tailed Weasel	
	Eastern Spotted Skunk	

Habitat Conservation Actions:

1) Identify historical occurrences of Canebrakes using General Land Office land survey records and plat maps; concentrate search within the Mississippi River Alluvial Valley in areas that are currently captured by conservation areas.
2) Initiate research by conducting an experimental habitat restoration project on at least one site on an existing conservation area known to be a Canebrake based on historical evidence and where Giant Cane is still present. Document response by Giant Cane and responses of wildlife species to overstory removal and prescribed fire.

3.2 Coastal Mangrove-Marsh Shrubland

Rarity Rank: S2/G2?

Synonyms: Intertidal Saltwater Swamp, Saltwater Swamp, Mangrove Swamp

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

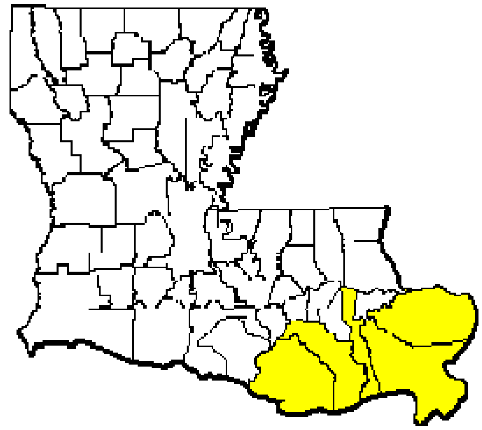
General Description:

Coastal Mangrove-Marsh Shrublands are estuarine communities dominated by 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). Mangrove habitats are an integral part 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 mangroves for nesting.

Coastal Mangrove-Marsh Shrubland, Lafourche Parish

Coastal Mangrove-Marsh Shrubland: Characteristic Plant Species	
Common Name	**Scientific Name**
Black Mangrove	*Avicennia germinans*
Salt-Wort	*Batis maritima*
Salt Grass	*Distichlis spicata*
Glassworts	*Salicornia* spp.
Smooth Cord Grass	*Spartina alterniflora*

Current Extent and Status:



Coastal Mangrove - Marsh Shrublands 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. Estimations of areal coverage by this habitat have varied widely. The limitations of past and present aerial photography technology and difficulties associated with ground-truthing can make estimating acreage problematic. Giri et al. (2011) estimated that mangrove shrubland covered ~5,386 acres in 1983. After a severe winter freeze in 1983-1984, acreage was reduced to ~539. Mild winters during the past decade have allowed expansion of this natural community in southeastern Louisiana. In 2010 mangrove coverage was estimated to be ~1,072 acres (Giri et. al. 2011).

Besides freezing weather, other factors affecting mangrove extent are erosion and land subsidence. The mangrove's 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. Large expanses of mangrove 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. This community can also be found on Isles Dernieres Refuge and Breton NWR.

Coastal Mangrove – Marsh Shrubland SGCN (12)	
BIRDS	**INSECTS**
Brown Pelican	Western Pygmy-Blue
Little Blue Heron	Louisiana Eyed Silkmoth
Reddish Egret	
Glossy Ibis	**REPTILES**
Roseate Spoonbill	Mississippi Diamond-backed Terrapin
Clapper Rail	Gulf Saltmarsh Snake
Marsh Wren	
Seaside Sparrow	
Nelson's Sparrow	

Threats Affecting Habitat:

This habitat is subjected to several sources of human disturbance, as well as subsidence and the effects of increased storm frequency and intensity potentially associated with climate change.

Coastal Mangrove-Marsh Shrubland Threats Assessment:			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	N/A	N/A	N/A
Agriculture/Aquaculture	N/A	N/A	N/A
Energy Production & Mining	Large	Slight	Low
Transportation & Service Corridors	Restricted	Slight	Low
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	N/A	N/A	N/A
Natural System Modification	N/A	N/A	N/A
Invasive & other Problematic Species	N/A	N/A	N/A
Pollution	N/A	N/A	N/A
Geological Events	Pervasive	Slight	Low
Climate Change & Severe Weather	Large	Slight	Low
Overall Calculated Threat Impact: Low			

Habitat Conservation Actions:

1. Promote the continued planting of mangrove as a soil stabilizer in habitat restoration projects.
2. Support NRCS and CPRA efforts for shoreline stabilization and habitat restoration.
3. Work with CPRA and LCA to support coastal restoration projects, specifically targeting important nesting habitat for species of conservation concern.
4. Work with local governments to recommend limits on recreational vehicle use in this habitat, particularly where it occurs on barrier islands

4. GRASSLANDS

4.1 Brackish Marsh

Rarity Rank: S3/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:

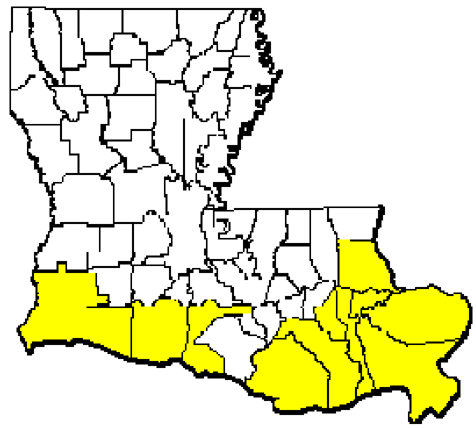
Brackish Marsh is usually found between Salt Marsh and Intermediate Marsh, although it may occasionally lie adjacent to the Gulf of Mexico. This community is irregularly tidally flooded and is dominated by salt-tolerant graminoids. Small pools or ponds may be scattered throughout. Plant diversity and soil organic matter content are higher in Brackish Marsh than in Salt Marsh. Brackish Marsh is typically dominated by Marshhay Cord Grass. Two other major autotrophic groups in Brackish Marsh are epiphytic algae and benthic algae. Vertebrate species population levels are generally 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, however this community may transition to other marsh types by shifts in salinity. Intrusion of salt water from the Gulf of Mexico via numerous waterways, and resulting wetland loss, exert a major influence in the configuration of the various marsh types.

Brackish Marsh, Jefferson Parish

Brackish Marsh: Characteristic Plant Species	
Common Name	**Scientific Name**
Leafy Bulrush	*Bolboschoenus robustus*
Salt Grass	*Distichlis spicata*
Black Needle rush	*Juncus roemerianus*
Leafy Three Square	*Schoenoplectus americanus*
Marshhay Cord Grass	*Spartina patens*

Current Extent and Status:

Pre-settlement 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 2009). However, stable, viable examples of Brackish Marsh are rare in Louisiana.



Federal conservation areas that support Brackish Marsh include Bayou Sauvage, Delta, and Sabine NWRs. Marsh Island and State Wildlife Refuges, managed by LDWF, contain large areas of Brackish Marsh, as does Biloxi WMA. Other refuges and WMAs containing Brackish Marsh, include Pointe-aux-Chenes and Rockefeller. Paul J. Rainey Sanctuary, owned by National Audubon Society, consists largely of Brackish Marsh with a small area of Intermediate Marsh. 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.

Brackish Marsh SGCN (53)

BIRDS
Mottled Duck
Northern Pintail
Canvasback
Redhead
Lesser Scaup
Brown Pelican
American Bittern
Least Bittern
Little Blue Heron
Reddish Egret
Glossy Ibis
Roseate Spoonbill
Osprey
White-tailed Kite
Bald Eagle
Yellow Rail
Black Rail
Clapper Rail
King Rail
Whooping Crane
Marbled Godwit
Dunlin
Short-billed Dowitcher
Coastal Least Tern
Gull-billed Tern
Caspian Tern
Sandwich Tern
Common Tern
Forster's Tern
Royal Tern
Black Skimmer
Short-eared Owl
Loggerhead Shrike
Le Conte’s Sparrow
Seaside Sparrow
Nelson's Sparrow

CRUSTACEANS
Ghost Shrimp

INSECTS
Bay Skipper
Palatka Skipper
Eastern Pygmy-Blue
Western Pygmy-Blue
Louisiana Eyed Silkmoth

MAMMALS
West Indian Manatee

MARINE FISH
Diamond Killifish
Bayou Killifish
Opposum Pipefish
Chain Pipefish
Texas Pipefish
Emerald Sleeper
Violet Goby

REPTILES
Mississippi Diamond-backed Terrapin
Gulf Saltmarsh Snake

PLANTS
Arrow-grass

Threats Affecting Habitat:

The main threats to this habitat include subsidence and effects of increased frequency and intensity of tropical storms which may potentially occur with anticipated climate change.

Brackish Marsh Threats Assessment:			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	N/A	N/A	N/A
Agriculture/Aquaculture	N/A	N/A	N/A
Energy Production & Mining	Small	Medium	Low
Transportation & Service Corridors	Restricted	Moderate	Low
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Restricted	Slight	Low
Natural System Modification	N/A	N/A	N/A
Invasive & other Problematic Species	Large	Serious	High
Pollution	N/A	N/A	N/A
Geological Events	Pervasive	Slight	Low
Climate Change & Severe Weather	Restricted	Serious	Medium
Overall Calculated Threat Impact: Low			

Habitat Conservation Actions:

1. Develop methods to encourage landowners to utilize rotational grazing in Brackish Marshes and manage the land for wildlife conservation.
2. Work with CPRA and other organizations to support coastal restoration projects, specifically targeting important waterbird nesting areas and species of conservation concern.
3. Work with COE and state agencies to insure water control structures and diversions provide the maximum benefit to Brackish Marsh.
4. Work with NRCS Plant Materials Center and BTNEP to develop viable cultivars for marsh restoration efforts.

4.2 Calcareous Prairie

Rarity Rank: S1/G1

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

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

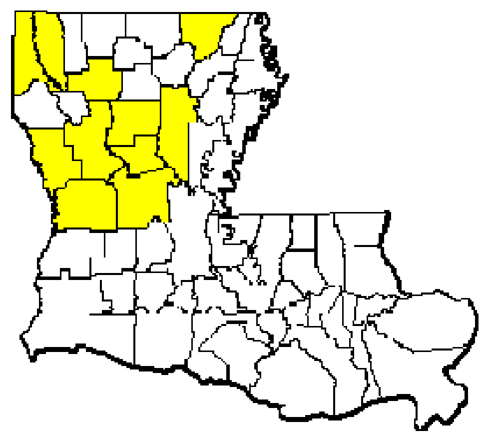
General Description:

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 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 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 mollusk shells, shark teeth, and gypsum crystals. The herbaceous flora is very diverse and dominated by grasses, composites, and legumes. Regularly-occurring fire, high soil pH, extreme physical soil properties, and drought stress among woody plants are postulated to have acted in concert to generate and perpetuate these upland clay prairies.

Morse Clay Calcareous Prairie, Bienville Parish

Calcareous Prairie: Characteristic Plants	
Common Name	**Scientific Name**
Big Bluestem	*Andropogon gerardii*
Mead's Caric Sedge	*Carex meadii*
Little Tooth Caric Sedge	*Carex microdonta*
White Prairie Clover	*Dalea candida*
Purple Prairie Clover	*Dalea purpurea*
Rattlesnake Master	*Eryngium yuccifolium*
Tall Blazing Star	*Liatris aspera*
Scaly Blazing Star	*Liatris squarrosa*
Little Bluestem	*Schizachyrium scoparium*
Compass Plant	*Silphium laciniatum*
Western Rough Goldenrod	*Solidago radula*
Stiff Goldenrod	*Solidago rigida*
Indian Grass	*Sorghastrum nutans*

Current Extent and Status:



Historically, there was an estimated 2,000 to 10,000 acres of Calcareous Prairie statewide, but only five to 10 percent of the original extent is thought to remain today (Smith 1993). Currently, protected Calcareous Prairies occur 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 a high concentration of Cook Mountain Calcareous Prairies on the Winn Ranger District of KNF (Keiffer Prairies). The USFS has been working to remove invading woody vegetation and expand these prairies' openings to their former extent. 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. Several Calcareous Prairies on industrial forest land are being well-managed and are of high quality, and other opportunities to work with forest industry to improve examples of this habitat are expected in the future.

There are 11 known Morse Clay Prairies in Bossier and Caddo Parishes. Two of these prairies are captured by Bodcau WMA, which is owned by COE and leased by LDWF, and Barksale Airforce Base. Most of the acreage of prairie on Bodacu WMA was at one time plowed for row crops. Currently, management involves fire and brush control, and the prairies are expected to improve in quality in the future. On Barksdale Airforce Base, most of the prairies 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.

Calcareous Prairie SGCN (53)		
AMPHIBIANS Strecker's Chorus Frog Southern Crawfish Frog **BIRDS** Northern Bobwhite American Woodcock Loggerhead Shrike Smith's Longspur Bachman's Sparrow Field Sparrow Grasshopper Sparrow Henslow's Sparrow Le Conte's Sparrow **INSECTS** American Bumblebee Frosted Elfin Wild Indigo Duskywing Dusted Skipper Monarch **MAMMALS** Eastern Harvest Mouse Long-tailed Weasel **REPTILES** Western Slender Glass Lizard	Eastern Hog-nosed Snake **PLANTS** Ten Petal Thimbleweed Narrow-leaved Milkweed Ground-Plum Side-Oats Grama Texas Grama Winecup Atlantic Camas Mead's Caric Sedge Little-tooth Sedge Prairie RedrOrchoot Evening Rainlily Stiff Tickseed Compact Prairie-Clover Wedge-leaf Whitlow-grass Purple Coneflower Slender Heliotrope Purple Bluet Coast Indigo June Grass	Spreading Bladderpod Texas Yellow-star Grooved Flax Narrow-leaved Puccoon Barbara's Buttons Pale Umbrella-wort Prairie Pleat-leaf Wiry Witchgrass Missouri Coneflower Brookweed Tumble Grass Great Plains Ladies'-tresses Meadowparsnip Nuttall Death Camas

Threats Affecting Habitat:

This naturally open habitat is seriously threatened by mineral extraction and associated infrastructure. Afforestation attempts, disturbance by other human activities, inadequate fire, and invasive species all pose additional threats.

Calcareous Prairie Threats Assessment:			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	Small	Extreme	Low
Agriculture/Aquaculture	Restricted	Serious	Medium
Energy Production & Mining	Large	Extreme	High
Transportation & Service Corridors	Restricted	Moderate	Low
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Small	Moderate	Low
Natural System Modification	Restricted	Moderate	Low
Invasive & other Problematic Species	Pervasive	Moderate	Medium
Pollution	N/A	N/A	N/A
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	N/A	N/A	N/A
Overall Calculated Threat Impact: Medium			

Habitat Conservation Actions:

1. Continue status surveys to determine the extent and condition of this habitat type.
2. Work with land managers/hunting clubs/extension agents, etc. to discourage the placement of food plots within this habitat type.
3. Promote and fund stewardship of this habitat on forest industry lands and on nonindustrial private lands, to include mechanical and chemical brush control and prescribed fire.
4. Support development of plant materials for prairie restoration.

4.3 Coastal Dune Grassland / Coastal Dune Shrub Thicket

Rarity Rank: S1/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

Ge***neral Description***:

This habitiat encompasses Coastal Dune Grasslands and Coastal Dune Shrub Thickets, which are described as distinct communities in Natural Communities of Louisiana (LNHP 2009). They are combined here due to close spatial proximity and succesional relationship. Coastal Dune Grassland occurs on beach dunes and relatively elevated backshore areas (ridges) above intertidal beaches on mainland Louisiana. 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 because of a limited amount of eolian sand. The sites are normally xeric, 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. 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. Hypothetically, if dunes remain stable, allowing natural succession to progress, then Coastal Dune Shrub Thickets are formed. These occur on established sand dunes

Coastal Dune Grassland, Cameron Parish

Coastal Dune Shrub Thicket, Jefferson Parish

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 development of coastal dunes. The sites are typically xeric and moderately exposed to salt spray. This community normally appears as a relatively dense stand of shrubs, often covered with a dense growth of lichens and various vines. This community may be destroyed by sand dune migration or erosion and may be replaced by coastal dune grassland.

Coastal Dune Grassland: Characteristic Plant Species	
Common Name	**Scientific Name**
Gulf Croton	*Croton punctatus*
Beach Primrose	*Oenothera drummondii*
Bitter Panicum	*Panicum amarum*
Gulf Dune Paspalum	*Paspalum monostachyum*
Marshhay Cord Grass	*Spartina patens*
Virginia Dropseed	*Sporobolus virginicus*
Amberique Bean	*Strophostyles helvula*

Coastal Dune Shrub Thicket: Characteristic Plant Species	
Common Name	**Scientific Name**
Coastal Scrub Wattle	*Acacia farnesiana*
Marine Vine	*Cissus incisa*
Spotted Bee Balm	*Monarda punctata*
Waxmyrtle	*Myrica cerifera*
Rattlebox	*Sesbania drummondii*
Toothache Tree	*Zanthozylum clava-herculis*

Current Extent and Status:

Coastal Dune Grasslands and Shrub Thickets are each estimated to have occupied less than 2,000 acres in pre-settlement times, with 50 to 75 percent thought to remain today (Smith 1993). The only example of well-developed Coastal Dune Grassland in Louisiana occurs in Cameron Parish on the Chenier Plain from Johnson Bayou westward nearly to Sabine Pass. The entire extent of this habitat occurs on private property.

Grand Isle supports 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.

Coastal Dune Grassland/ Coastal Dune Shrub Thicket SGCN (22)		
BIRDS	Marsh Wren	**PLANTS**
Brown Pelican	Grasshopper Sparrow	Gulf Bluestem
White-tailed Kite	Nelson's Sparrow	Mexican Hat
Wilson's Plover		Nuttall's Milk Vetch
Long-billed Curlew	**INSECTS**	Sea Oats
Short-eared Owl	Monarch	Wedge-leaf prairie-clover
Crested Caracara	Louisiana Eyed Silkmoth	
Peregrine Falcon		
Loggerhead Shrike	**REPTILES**	
Sedge Wren	Western Slender Glass Lizard	
	Eastern Glass Lizard	
	Mississippi Diamond-backed Terrapin	

Threats Affecting Habitat:

Both Coastal Dune Grasslands and Shrub Thickets are threatened by several sources of habitat distrubance, and may face increased tropical storm frequency and intensity potentially associated with climate change. Inadequate sand supply is a possible long term problem especially for Coastal Dune Grassland.

<u>Coastal Dune Grassland Threats Assessment:</u>

First Level Threat	Scope	Severity	Impact
Residential/Commercial Development	N/A	N/A	N/A
Agriculture/Aquaculture	Restricted	Serious	Medium
Energy Production & Mining	Restricted	Slight	Low
Transportation & Service Corridors	Restricted	Slight	Low
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Large	Moderate	Medium
Natural System Modification	Pervasive	Moderate	Medium
Invasive & other Problematic Species	Pervasive	Slight	Low
Pollution	N/A	N/A	N/A
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	Restricted	Moderate	Low
Overall Calculated Threat Impact: Medium			

Coastal Dune Shrub Thicket Threats Assessment:			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	N/A	N/A	N/A
Agriculture/Aquaculture	N/A	N/A	N/A
Energy Production & Mining	Restricted	Slight	Low
Transportation & Service Corridors	Restricted	Slight	Low
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Large	Slight	Low
Natural System Modification	Pervasive	Slight	Low
Invasive & other Problematic Species	Pervasive	Slight	Low
Pollution	N/A	N/A	N/A
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	Restricted	Slight	Low
Overall Calculated Threat Impact: Low			

Habitat Conservation Actions:

1. Support NRCS and CPRA efforts for shoreline stabilization and habitat restoration.
2. Work with local governments to recommend limits on recreational vehicle use in this habitat.
3. Work with NRCS Plant Materials Center and BTNEP to develop viable cultivars for coastal dune restoration efforts.
4. Review and research the effects of cattle grazing on sand dunes and encourage grazing practices that preserve the integrity of these habitats.
5. Work with partners to acquire and restore existing and historical occurences of this community, as well as identify and acquire areas where such habitats could be created as SLR swamps existing areas.
6. Support efforts to control the invasive exotic Saltcedar (*Tamarix* spp.), which poses a serious threat to this habitat.

4.4 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

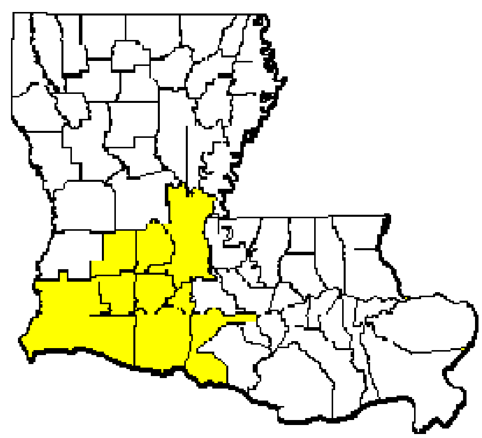
General Description:

Coastal Prairie is characterized by a diverse flora consisting of tall grasses and forbs. A combination of historical dry periods, clay-pan soils (which accentuate the effects of drought), and frequent fire are thought to account for the presence of tall-grass prairie in humid Louisiana. Studies of remnant prairie suggest there are three prairie types, based on moisture: wet (marsh-fringing) prairie, wet-mesic prairie, and dry-mesic prairie. Small circular soil mounds known as pimple mounds, that possibly formed by deposition of wind-blown soil during historical harsh droughts (Siefert et al. 2009), and embedded marshes and ponds (potholes) add to the habitat diversity of the prairie landscape.

Coastal Prairie, Calcasieu Parish

Coastal Prairie: Characteristic Plants	
Common Name	**Scientific Name**
Indian-plantain	*Arnoglossum ovatum*
False Indigos	*Baptisia alba, B. sphaerocarpa*
Little Tooth Caric Sedge	*Carex microdonta*
Rattlesnake Master	*Eryngium yuccifolium*
Ashy Sunflower	*Helianthus mollis*
Kansas Gayfeather	*Liatris pycnostachya*
Gulf Coast Muhly	*Muhlenbergia capillaris*
Switch Grass	*Panicum virgatum*
Brownseed Paspalum	*Paspalum plicatulum*
Narrowleaf Mountain Mint	*Pycnanthemum tenuifolium*
Texas Coneflower	*Rudbeckia texana*
Little Bluestem	*Schizachyrium scoparium*
Slender Bluestem	*Schizachyrium tenerum*
Compass Plant	*Silphium laciniatum*
Fragrant Goldenrod	*Solidago odora*
Indian Grass	*Sorghastrum nutans*
Marshhay Cord Grass	*Spartina patens* (wet prairie)
Eastern Gamma Grass	*Tripsacum dactyloides* (wet prairie)

Current Extent and Status:



Coastal Prairie historically occupied about 2.5 million acres in southwest Louisiana. Far less than one percent of the original Coastal Prairie remains today (Smith 1993). The marsh fringing prairie type is represented by several remnants and totals about 500 acres. Sabine National Wildlife Refuge and White Lake Wetlands Conservation Area support this wet prairie type. Six remnants totaling about 2,500 acres represent the wet-mesic prairie type. All of these remnants are on private lands in Calcasieu and Cameron Parishes. LDWF is currently working with owners of most of these sites to implement stewardship. The dry-mesic prairie type, which historically accounted for most of the prairie acreage, is now known only along railroads. All the railroad remnants are in various states of degradation due to woody encroachment and soil disturbance. Combining all types, Louisiana has ca. 3,500 acres of remnant Coastal Prairie, not including possible prairies in the Lake Charles area that have not yet been explored.

Coastal Prairie SGCN (52)

AMPHIBIANS
Southern Crawfish Frog

BIRDS
Mottled Duck
Northern Pintail
Northern Bobwhite
American Bittern
Little Blue Heron
White-tailed Kite
Yellow Rail
Black Rail
Sandhill Crane
Whooping Crane
Upland Sandpiper
Long-billed Curlew
Buff-breasted Sandpiper
American Woodcock
Short-eared Owl
Crested Caracara
Loggerhead Shrike
Sedge Wren
Marsh Wren
Sprague’s Pipit
Grasshopper Sparrow
Le Conte's Sparrow
Nelson’s Sparrow
Dickcissel

CRUSTACEANS
Old Prairie Digger

INSECTS
American Bumblebee
Celia’s Roadside Skipper
Monarch

MAMMALS
Baird’s Pocket Gopher
Eastern Harvest Mouse
Prairie Vole
Eastern Spotted Skunk

REPTILES
Western Chicken Turtle
Ornate Box Turtle
Western Slender Glass Lizard
Eastern Hog-nosed Snake

PLANTS
Berg's Panic Grass
Cryptic Flatsedge
Evening Rainlily
Limewater Brookweed
Little Tooth Caric Sedge
Low Nutrush
Meadow Evening Primrose
Mead's Caric Sedge
Oklahoma Grass-Pink
Scarlet Indian Paintbrush
Small Palafox
Texas Grama
Wand Blackroot
Western Horse-Nettle
Wild Coco Orchid

Threats Affecting Habitat:

Remaining occurrences of this very rare habitat are threatened by inaqequate fire, incompatible grazing management, and disturbance from human activities. Lack of fire is particularly acute in railroad prairie remnants, which are being severely encroached upon by brush.

Coastal Prairie Threats Assessment:			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	Small	Extreme	Low
Agriculture/Aquaculture	Pervasive	Serious	High
Energy Production & Mining	Restricted	Moderate	Low
Transportation & Service Corridors	Small	Moderate	Low
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Large	Moderate	Medium
Natural System Modification	Pervasive	Moderate	Medium
Invasive & other Problematic Species	Pervasive	Moderate	Medium
Pollution	Small	Serious	Low
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	Small	Extreme	Low
Overall Calculated Threat Impact: Medium			

Habitat Conservation Actions:

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 by providing funding for prescribed burning on prairie remnants and prairie-like grasslands within the historical range of Coastal Prairie.
3. Support initiatives to develope plant materials to facilitate re-establishment of Coastal Prairies, and help develop partnerships to secure long-term funding for plant materials centers.
4. Support research to determine prairie-compatible grazing schemes on Coastal Prairie rangeland.
5. Continue stewardship actions on Coastal Prairie on White Lake Wetlands Conservation Area.
6. Support and encourage aggressive feral hog control measures on Sabine National Wildlife Refuge, which supports marsh-fringing coastal prairie.
7. Work with USFWS at Cameron Prairie NWR to move forward with re-establishment of Coastal Prairie and to initiate an aggessive prescribed burning program.
8. Partner with railroad companies to protect and properly manage railroad prairie remnants.
9. Pursue long-term protection of Coastal Prairie remnants through cooperative agreements with landowners (e.g. leases, servitudes) or through land acquisition.

4.5 Eastern Hillside Seepage Bog

Rarity Rank: S1/G2
Synonyms: Pitcher Plant Bog, Herbaceous Bog, Bog, Hillside Seep, Hillside Bog
Ecological Systems: CES203.078 Southern Coastal Plain Herbaceous Seepage Bog

General Description:

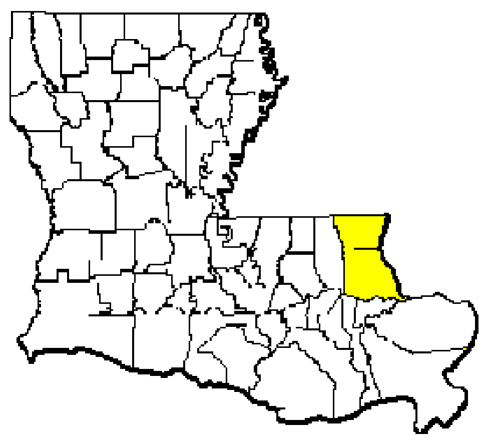
Hillside Seepage Bogs are open, mostly treeless, herb-dominated natural wetlands of hilly uplands historically dominated by Longleaf Pine in the East and West Gulf Coastal Plains of Louisiana. In the EGCP, these bogs occur on the Pleistocene high terraces in Washington and St. Tammany Parishes, arising 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).

These bogs are generally persistently wet from seepage and are variable in size, typically less than one acre and rarely exceeding 10 acres. EGCP bogs are underlain by an impervious clay layer that, when conditions are right, causes groundwater to constantly seep to the soil surface. The herbaceous groundcover is dense, continuous and floristically rich. It is dominated by sedges, grasses, and many kinds of unique forbs, including Pitcher Plants (*Sarracenia* spp.) and a variety of orchid species. Since hillside bogs are embedded in Longleaf Pine forests, they are fire-driven systems that evolved with frequent growing-season fires. Frequent fire prevents invasion by shrubs and trees and stimulates growth, flowering and seed production by bog herbs (Barker 1980). Bogs are extremely sensitive to surrounding land management activities and are easily degraded or destroyed by activities that alter natural hydrologic regimes.

Eastern Hillside Seepage Bog, Abita Creek Flatwoods Preserve, St. Tammany Parish

Eastern Hillside Seepage Bog: Characteristic Plants	
Common Name	**Scientific Name**
Mohr's Bluestem	*Andropogon mohrii*
Pineland Rayless Goldenrod	*Bigelowia nudata*
Toothache Grass	*Ctenium aromaticum*
Pineland Bog Button	*Lachnocaulon digynum*
Beak Sedges	*Rhynchospora* spp.
Yellow Trumpet Pitcher Plant	*Sarracenia alata*
Parrot Pitcher Plant	*Sarracenia psittacina*
Coastal Plain False Asphodel	*Tofieldia racemosa*
Coastal Plain Yellow-eyed-grass	*Xyris ambigua*
Kral's Yellow-eyed-grass	*Xyris stricta* var. *obscura*

Current Extent and Status:



Hillside Seepage Bogs in the EGCP of Louisiana are naturally small in size. Pre-settlement extent of seepage bogs in the EGCP of Louisiana is estimated at less than 2,000 acres, with only 10 to 25 percent currently remaining in St. Tammany and Washington Parishes (Smith 1993). The actual remaing acreage is probably less than 10 percent. These present day bogs are most often found surrounded by commercial timberlands because of their unsuitability for commercial tree production. Bog plant species can also be seen persisting along powerline and pipeline right-of-ways where management practices such as mowing keep woody vegetation under control (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. No bogs are known from federal or state public lands in the EGCP. One property capturing a portion of a bog is enrolled in LDWF's Natural Areas Registry.

Eastern Hillside Seepage Bog SGCN (29)		
AMPHIBIANS Gulf Coast Mud Salamander Southern Red Salamander **BIRDS** Sedge Wren Henslow's Sparrow Le Conte's Sparrow Grasshopper Sparrow **CRUSTACEANS** Flatwoods Digger Flatnose Crawfish	**INSECTS** Arogos Skipper Pineland Moth **MAMMALS** Southeastern Shrew Long-tailed Weasel Eastern Spotted Skunk **PLANTS** Pale Grass-pink Spoon-leaved Sundew Tracy's Sundew Pineland Bog Button	Southern Red Lily Gig Fruit Flax Staghorn Clubmoss Bog Flame Flower Yellow Butterwort White-fringe Orchid Chapman's Beak Sedge Coastal Plain Beak Sedge Parrot Pitcher Plant Purple Pitcher Plant Coastal False-asphodel Harper's Yellow-eyed- grass

Threats Affecting Habitat:

Eastern Hillside Seepage Bogs are very rare in Louisiana. Most existing occurrences are degraded by woody encroachment due to inadequate fire. Residential development is also a serious threat since this development is in close proximity to several bogs.

Eastern Hillside Seepage Bog Threats Assessment:

First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	Restricted	Serious	High
Agriculture/Aquaculture	Large	Serious	High
Energy Production & Mining	Small	Slight	Low
Transportation & Service Corridors	Restricted	Moderate	Low
Biological Resource Use	Restricted	Slight	Low
Human Intrusion/Disturbance	Small	Slight	Low
Natural System Modification	Large	Serious	High
Invasive & other Problematic Species	Large	Serious	High
Pollution	Large	Slight	Low
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	Pervasive	Slight	Low
Overall Calculated Threat Impact: Very High			

Habitat Conservation Actions:

1. Prioritize surveys for this habitat type to determine extent and condition type with a focus on identifying the surrounding landscape context (e.g., residential developments, etc.).
2. Continue to encourage landowners to implement BMPs and adopt Sustainable Forestry Initiative (SFI) standards in the management of this habitat type.

3. Continue to provide cost share funds for landowners to reduce or eliminate costs associated with conducting prescribed burns on their property.
4. Work with forest industry to complete chemical brush control and/or hand clearing of brush in degraded, fire-suppressed bogs, and to apply prescribed fire.

4.6 Freshwater Floating Marsh

Rarity Rank: S2S3/G2G3

Synonyms: Flotant, Peat Marsh, Prairie Tremblant

Ecological Systems: CES203.470 Mississippi Delta Fresh and Oligohaline Tidal Marsh

General Description:

Freshwater Floating Marsh is an emergent marsh that, along with peat (decomposing organic matter), composes a free-floating mat that rises and falls with water levels. The flotant described herein has a 2-3 ft thick mat that typically supports the weight of a person. The grass Maidencane (*Panicum hemitomon*) is the dominant plant in this community and is apparently the best species for forming buoyant floating mats due to its prolific root production. Evidence suggests that this Floating Marsh developed from detachment of a rooted marsh following formation of a peat zone (Swarzenski et al. 1991; Sasser et al. 1995; Sasser et al. 1996). Buoyancy of the floating mat is affected by the capacity of the vegetation to float (internal air spaces, vegetative characteristics), capacity of the substrate to retain metabolic gases, and low bulk density of the substrate (Swarzenski et al. 1991; Sasser et al. 1995; Sasser et al. 1996). The Maidencane dominated floating marshes are buoyant year-round, whereas thick-mat floating marshes dominated by Bulltongue (*Sagittaria lancifolia*) are only seasonally buoyant (Swarzenski et al. 1991). Floating marshes of the type described here are typically rainfall, rather than floodwater-driven (Swarzenski et al. 2005), and the pH is usually acidic (C. Swarzenski, pers. comm). Peat moss (*Sphagnum* spp.) is often conspicuous. This habitat supports a number of plants that otherwise occur in acidic seepage wetlands in interior Louisiana, including several showy orchids. As with interior prairies and pine grasslands, Freshwater Floating Marshes are readily colonized by the shrub Waxmyrtle (*Myrica cerifera*). Fire is required to prevent conversion of emergent herbaceous marsh to floating shrub thicket.

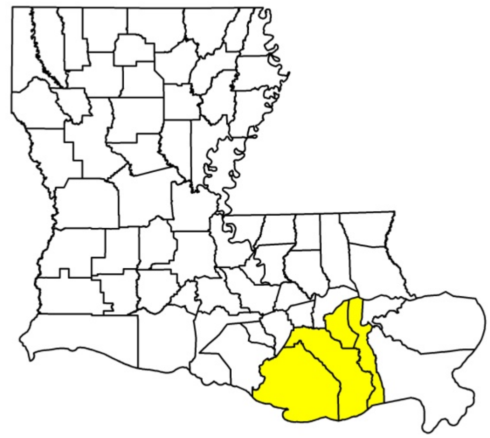
The Maidencane Floating Marshes are strictly of fresh water environments. State transitions can occur with environmental changes, such as introduction of salinity, sediment input, and nutrient input. With increasing salinity, the plant community may transition to a bulltongue-dominated community (Sasser et al. 1996, Swarzenski et al. 1991). Key to the sustainability of the floating marshes is a thick healthy mat. Nutrients and sulfate introduced by seawater can weaken the floating mat by accelerating decomposition of the peat. More than half of the floating marshes in the Terrebonne Basin have converted to thin unstable mats and open water over the past 50 years (Visser et al. 1996). Concurrently the source of freshwater in the Terrebonne Basin has shifted from rain water to river water (Swarzenski et al. 2008). Eutrophication by introduction of Mississippi River water via diversions may destabilize intact floating marshes (Swarzenski et al., 2008). Salinity pulses, if increasing in persistence and duration, could also destabilize thick mat flotant if the mat is affected.

The floating marshes focused on here are thought to have formed by detachment of rooted marsh, rather than infilling of open water. Colonization of stands of free-floating plants by emergent marsh vegetation can happen. For example, the free-floating exotics Water Hyacinth (*Eichhornia crassipies*) and Water Spangles (*Salvinia* spp.) can recruit emergent aquatic and wetland plants, eventually forming a well-developed floating mat (Penfound and Earle 1948). Such floating mats are outside of the concept of the floating marsh discussed here, despite the broad and general application of the term “flotant.”

Freshwater Floating Marsh, Salvador WMA, St. Charles Parish

Freshwater Floating Marsh: Characteristic Plants	
Common Name	**Scientific Name**
Grass Pink	*Calopogon tuberosus*
Swamp Loosestrife	*Decodon verticillatus*
Dwarf Umbrella Sedge	*Fuirena pumila*
Waxmyrtle	*Myrica cerifera*
Royal Fern	*Osmunda regalis*
Rose Pagonia	*Pagonia ophioglossoides*
Maidencane	*Panicum hemitomon*
Snowy Orchid	*Platanthera nivea*
Smallhead Beak Sedge	*Rhynchospora microcephala*
Peat Moss	*Sphagnum* spp.
Southern Marsh Fern	*Thelypteris palustris*
Bog Yellow-eyed-grass	*Xyris difformis* var. *difformis*
Iris-leaf Yellow-eyed-grass	*Xyris laxifolia* var. *iridifolia*

Current Extent and Status:



Floating marsh of all types are estimated to occupy ca. 150,000 ha (375,000 ac) (Evers et al. 1996: Sasser et al. 1996) but the current extent of freshwater Freshwater Floating Marsh treated here is unknown. Accurate assessments are confounded because almost all low-salinity marshes in the Mississippi River Delta Plain are peat-based but only a subset is truly floating. Conservation areas protecting Freshwater Floating Marsh include Salvador and Lake Boeuf WMAs, Jean Lafitte National Historic Park and Preserve, and possibly Mandalay National Wildlife Refuge.

Freshwater Floating Marsh SGCN (22)		
REPTILES	Roseate Spoonbill	Sedge Wren
Alligator Snapping Turtle	Osprey	Marsh Wren
	Bald Eagle	Le Conte's Sparrow
INSECTS	King Rail	Nelson's Sparrow
Dion's Skipper	Gull-billed Tern	
	Caspian Tern	
BIRDS	Forster's Tern	**MAMMALS**
Wood Stork	Loggerhead Shrike	West Indian Manatee
American Bittern		
Least Bittern		**PLANTS**
Little Blue Heron		Bog Moss
Glossy Ibis		Winged Primrose-Willow

Threats Affecting Habitat:

Freshwater Floating Marsh is threatened by input of nutrients and salinity, which is hastened by human activities associated with placement of canals and corridors in the marsh landscape. Inadequate fire is also an issue for some occurrences, which allows shrub dominance. This marsh type is highly buoyant, so has some resilience to subsidence, but increases in salinity associated with subsidence of surrounding rooted marshes poses a serious threat to this habitat.

Freshwater Floating Marsh Threats Assessment:			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	N/A	N/A	N/A
Agriculture/Aquaculture	N/A	N/A	N/A
Energy Production & Mining	Large	Serious	High
Transportation & Service Corridors	Restricted	Serious	Medium
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Small	Slight	Low
Natural System Modification	Large	Serious	High
Invasive & other Problematic Species	Large	Serious	High
Pollution	Large	Serious	High
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	Pervasive	Extreme	Very High
Overall Calculated Threat Impact: Very High			

Habitat Conservation Actions:

1. Accurately assess the amount and condition of Freshwater Floating Marshes (with Maidencane as the dominant).
2. Conduct vegetation and floristic inventories of reference sites including the collection of voucher specimens.
3. Conduct baseline zoological inventories of this habitat.
4. Protect this community from further fragmentation and vigorously prevent further canal development in and around Freshwater Floating Marshes, as canals provide avenues for agents of environmental change (salinity, nutrients).
5. Work with CPRA and other coastal restoration organizations to help them understand the nature and uniqueness of this habitat, and to prevent degradation of this habitat by nutrient and sediment input associated with freshwater diversions.
6. Work within LDWF, and with U.S. Park Service and USFWS to apply appropriate management in this habitat, specifically prescribed burning.
7. Develop outreach materials to increase public awareness of this unique habitat.

4.7 Freshwater Marsh

Rarity Rank: S2/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 enters (e.g., Atchafalaya Bay). Small pools or ponds may be scattered. The floristic composition of these sites is quite heterogeneous and 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 Freshwater Marsh versus only 17 in Salt Marsh. Epiphytic and benthic algae are two other major autotroph groups in Freshwater Marsh. Salinities are usually less than 2 ppt and average about 0.5-1 ppt. A significant portion of Louisiana's Freshwater Marsh is floating marsh (flotant) which occurs in the Deltaic Plain of Louisiana. Freshwater Floating Marshes are treated as a separate habitat due to their uniqueness

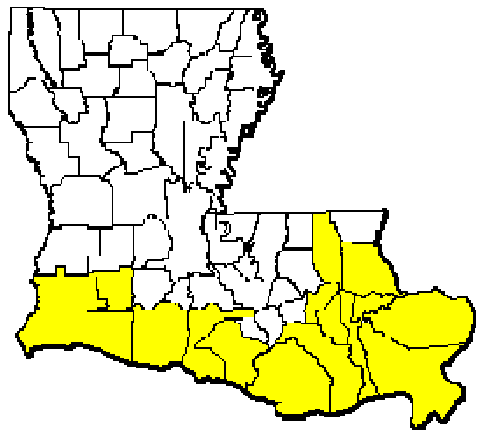
Wildlife populations are generally highest in Freshwater Marsh, and it supports high numbers of wintering waterfowl. As with the other marsh types, Freshwater Marsh acts as important nursery areas for the young of many marine species, such as Atlantic Croaker, Spotted Seatrout, Black Drum, and flounder. This community may change to a more saline marsh type due to salt water intrusion or may become open water with subsidence.

Pool in expansive Freshwater Marsh at White Lake Wetlands Conservation Area, Vermilion Parish

Freshwater Marsh: Characteristic Plants

Common Name	Scientific Name
Maidencane	*Panicum hemitomon*
Bull Tongue	*Sagittaria lancifolia*
Gulf Coast Spike Sedge	*Eleocharis cellulosa*
Square-Stem Spike Sedge	*Eleocharis quadrangulata*
Sawgrass	*Cladium mariscoides*
Southern Cut Grass	*Leersia hexandra*
Broadleaf Cattail	*Typha latifolia*

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. Pre-settlement acreage was estimated at 1 to 2 million acres, but has been reduced by 25 to 50 percent of this original extent (Smith 1993). The largest contiguous tracts of Freshwater Marsh occur in Terrebonne, St. Mary, Vermillion, Cameron, LaFourche and St. Charles Parishes (Hartley et al. 2000). In the Chenier Plain of southwestern Louisiana, federal lands containing Freshwater Marsh habitat include Sabine, Cameron Prairie, and Lacassine NWRs. White Lake Wetlands Conservation Area captures a substantial amount of Freshwater Marsh. In the Deltaic Plain of southeastern Louisiana, LDWF lands with Freshwater Marsh habitat include the Atchafalaya Delta WMA, Salvador WMA, Timken WMA, Pass-a-Loutre WMA, Pearl River WMA, and small amounts of Freshwater Marsh exist on Joyce and Maurepas Swamp WMAs. NWRs with Freshwater Marsh in the Deltaic Plain include the Delta NWR, Bayou Sauvage NWR, Big Branch NWR, and Mandalay NWR.

Freshwater Marsh SGCN (48)		
BIRDS	Sandhill Crane	**INSECTS**
Wood Stork	Whooping Crane	Dion Skipper
American Bittern	Hudsonian Godwit	
Least Bittern	Marbled Godwit	**MARINE FISH**
Glossy Ibis	Dunlin	Diamond Killifish
Roseate Spoonbill	Short-billed Dowitcher	Saltmarsh Topminnow
Mottled Duck	Gull-billed Tern	Bayou Killifish
Northern Pintail	Caspian Tern	Chain Pipefish
Canvasback	Common Tern	
Redhead	Forster's Tern	**MAMMALS**
Lesser Scaup	Short-eared Owl	West Indian Manatee
Osprey	Loggerhead Shrike	
White-tailed Kite	Sedge Wren	**REPTILES**
Bald Eagle	Marsh Wren	Alligator Snapping Turtle
Yellow Rail	Le Conte's Sparrow	Western Chicken Turtle
Black Rail	Nelson's Sparrow	
King Rail		**PLANTS**
		Blue Water-Lily
		Golden Canna
		Grapefruit Primrosewilow
		Hemlock Water-Parsnip
		Narrow-Fruit Horned Beak Sedge
		Rooted Spike Sedge
		Slim Spike Sedge
		Swamp Milkweed

Threats Affecting Habitat:

Threats to this habitat include subsidence, salinty input, and invasive species (especially feral hogs and nutira). Increased storm frequency and intensity associate with climate change would subject Freshwater Marshes to greater disturbance and potentially result in higher incidences of salt water intrusion.

Freshwater Marsh Threats Assessment:			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	N/A	N/A	N/A
Agriculture/Aquaculture	N/A	N/A	N/A
Energy Production & Mining	Restricted	Moderate	Low
Transportation & Service Corridors	Restricted	Moderate	Low
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Restricted	Slight	Low
Natural System Modification	N/A	N/A	N/A
Invasive & other Problematic Species	Pervasive	Serious	High
Pollution	N/A	N/A	N/A
Geological Events	Pervasive	Slight	Low
Climate Change & Severe Weather	Pervasive	Moderate	Medium
Overall Calculated Threat Impact: Low			

Habitat Conservation Actions:

1. Support efforts by the NRCS Plant Materials Center and other growers to produce a greater variety of plant species for the restoration of coastal habitats as well as mitigation.
2. Continue to work with COE to develop better strategies for the placement of dredge materials as a restoration method for this habitat type, particularly in the Mississippi Delta.
3. Work with CPRA to broaden coastal restoration projects to include Freshwater Marsh.
4. Utilize sediment pipeline delivery to create Freshwater Marsh.

4.8 Intermediate Marsh

Rarity Rank: S3/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

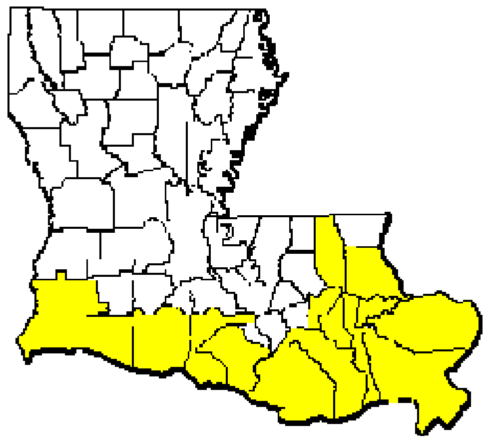
General Description:

Simply stated, Intermediate Marsh is fresh most of the time but is occassionally affected by saltwater inputs associated with tropical strorm surges. This marsh type typically lies between Brackish Marsh and Freshwater Marsh, although it infrequently may be adjacent to the Gulf. Intermediate Marsh has an irregular tidal regime and 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 species in Salt Marsh. It is often dominated by Marshhay Cord Grass. Two other major autotrophic groups in Intermediate Marsh are epiphytic and benthic algae. Intermediate Marsh occupies the smallest acreage of any of the four marsh types. This marsh type is very important to many bird species including large numbers of wintering waterfowl. Intermediate Marsh is also critical nursery habitat for larval marine organisms. Gradual changes in salinity conditions can cause this habitat to shift towards Brackish Marsh.

Intermediate Marsh, St. Tammany Parish.

Intermediate Marsh: Characteristic Plants	
Common Name	**Scientific Name**
Walking Spike Sedge	*Eleocharis rostellata*
Southern Cattail	*Typha domingensis*
Marshhay Cord Grass	*Spartina patens*
Hog Cane	*Spartina cynosuroides*
California Bulrush	*Schoenoplectus californicus*
Leafy Three Square	*Schoenoplectus americanus*
Bull Tongue	*Sagittaria lancifolia*

Current Extent and Status:



Acreage of Intermediate Marsh appears to be decreasing due to salt water intrusion, canal dredging, and commercial, industrial, and residential development. Pre-settlement acreage was estimated at 100,000 to 500,000 acres, but has been reduced by 50 to 75 percent 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, Rockefeller Wildlife Refuge and Sabine NWR contain Intermediate to Brackish Marsh. In the Deltaic Plain, Intermediate Marsh can be found on Pointe-aux-Chenes WMA, Pass-a-Loutre WMA, Pearl River WMA, Biloxi WMA, Manchac WMA, Bayou Sauvage NWR, and Big Branch NWR. Jean Lafitte National Park and Preserve also captures Intermediate Marsh.

Intermediate Marsh SGCN (47)		
BIRDS	Black Rail	Sandwich Tern
Mottled Duck	Clapper Rail	Short-eared Owl
Northern Pintail	King Rail	Loggerhead Shrike
Canvasback	Sandhill Crane	Sedge Wren
Redhead	Whooping Crane	Marsh Wren
Lesser Scaup	American Oystercatcher	Le Conte's Sparrow
Brown Pelican	Marbled Godwit	Nelson's Sparrow
American Bittern	Dunlin	
Least Bittern	Short-billed Dowitcher	**INSECTS**
Little Blue Heron	Coastal Least Tern	Dion Skipper
Reddish Egret	Gull-billed Tern	
Glossy Ibis	Caspian Tern	**MAMMALS**
Roseate Spoonbill	Common Tern	West Indian Manatee
Osprey	Forster's Tern	
White-tailed Kite	Royal Tern	**MARINE FISH**
Bald Eagle		Gold Brotula
		Diamond Killifish
		Saltmarsh Topminnow
		Bayou Killifish
		Opposum Pipefish
		Chain Pipefish
		Emerald Sleeper
		Violet Goby

Threats Affecting Habitat:

Aside from various sources of habitat disturbance, subsidence and salt water intrusion threaten this marsh type by converting it to open water, or Brackish or Salt Marsh.

Intermediate Marsh Threats Assessment:			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	N/A	N/A	N/A
Agriculture/Aquaculture	N/A	N/A	N/A
Energy Production & Mining	Restricted	Moderate	Low
Transportation & Service Corridors	Restricted	Moderate	Low
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Restricted	Slight	Low
Natural System Modification	N/A	N/A	N/A
Invasive & other Problematic Species	Large	Serious	High
Pollution	Restricted	Moderate	Low
Geological Events	Pervasive	Slight	Low
Climate Change & Severe Weather	Pervasive	Moderate	Medium

Habitat Conservation Actions:

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

4.9 Louisiana Beach

***Rarity Ranks**:* S2

Synonyms: none

Ecological System: CES203.469

General Description:

Louisiana's coastal sediments are derived from the Mississippi River. Louisiana Beaches form along the Gulf facing shoreline, and are low in elevation. They are composed of fine sands, and are generally less well-developed than beaches along other parts of the Gulf Coast. A distinctive feature of Louisiana Beaches is the replacement of Sea Oats (*Uniola paniculata*), a grass much more conspicuous of beaches (especially) to the east, by Marshhay Cord Grass (*Spartina patens*) (Barbour et al. 1987). This habitat embraces several ecological associations (NatureServe 2015).

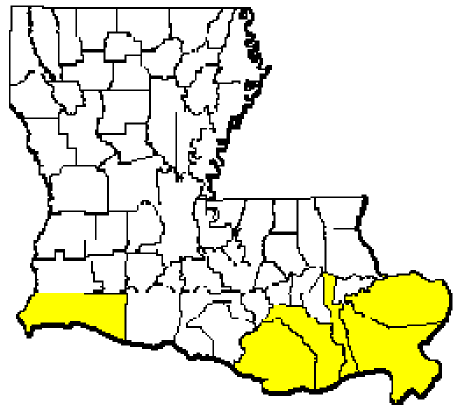
Louisiana Beach, Elmer's Island Refuge, Lafourche Parish

Louisiana Beach, Terrebonne Barrier Islands, Terrebonne Parish

Louisiana Beach: Characteristic Plants	
Common Name	**Scientific Name**
Gregg’s Amaranth	*Amaranthus greggii*
Sea Rockets	*Cakile* spp.
Gulf Croton	*Croton punctatus*
Bitter Panicum	*Panicum amarum*
Railroad Vine	*Ipomoea imperati*
Goat Foot Morning Glory	*Ipomoea pes-capre*
Seashore Paspalum	*Paspalum vaginatum*
Camphor Daisy	*Rayjacksonia phyllocephala*
Sea Purslane	*Sesuvium portulacastrum*
Seaside Goldenrod	*Solidago sempervirens*
Marshhay Cord Grass	*Spartina patens*
Virginia Dropseed	*Sporobolus virginicus*
Amberique Bean	*Strophostyles helvula*
Sea Blites	*Suaeda linearis*

Current Extent and Status:

Well-developed Louisiana Beaches occur on the Chenier Plain from the town of Cameron west nearly to Sabine Pass. On the Deltaic Plain, this habitat is present on barrier islands and portions of the mainland in Lafourche Parish. Several artificial and natural islands at the mouth of the Mississippi River are developing typical Louisiana Beach habitat. Exemplary Louisiana Beach habitat occurs on Trinity and Timbalier Islands in the Terrebonne Barrier Islands, on Grande Terre Island, along the mainland near Port Fourchon, and in the vicinity of Johnson Bayou in Cameron Parish where Louisiana Beach is situated seaward from Coastal Dune Grassland habitat. Louisiana Beach habitat can also be found on Breton NWR and Isle Dernieres Refuge.



LOUISIANA BEACH (42) SGCN		
BIRDS	Caspian Tern	**REPTILES**
Lesser Scaup	Common Tern	Mississippi Diamond-backed
Brown Pelican	Forster’s Tern	Terrapin
Reddish Egret	Royal Tern	Loggerhead Seaturtle
Snowy Plover	Sandwich Tern	Kemp’s Ridley Seaturtle
Wilson’s Plover	Black Skimmer	
Piping Plover	Peregrine Falcon	**PLANTS**
American Oystercatcher		Big Sandbur (shelly substrate)
Long-billed Curlew	**CRUSTACEANS**	Canada Spike Sedge
Marbled Godwit	Ghost Shrimp	Coastal Ground Cherry
Red Knot	Peppermint Shrimp	Dune Sandbur
Dunlin		Gregg's Amaranth
Short-billed Dowitcher	**INSECTS**	Gulf Bluestem
Sooty Tern	Eastern Beach Tiger	Inkberry
Coastal Least Tern	Beetle	Sand Dune Spurge
Gull-billed Tern	Bay Skipper	Sand Rose-gentian
	Louisiana Eyed Silkmoth	Sea Oats
		Southern Hair Grass
		Woolly Honeysweet

Threats Affecting Habitat:

Many Louisiana Beach occurrences are impacted by vehicle traffic and trash accumulation. The maintenance of Louisiana Beaches is dependent upon sand supply, which is lacking in most cases due to leveeing of the Mississippi River, and impediments to longshore sand movement by features such as jetties. Invasive species pose a threat. Potential increased frequency and intensity of tropical storms associated with climate change may also threaten this habitat.

Louisiana Beach Threats Assessment:

First Level Threat	Scope	Severity	Impact
Residential/Commercial Development	Restricted	Moderate	Low
Agriculture/Aquaculture	Restricted	Serious	Medium
Energy Production & Mining	Restricted	Serious	Medium
Transportation & Service Corridors	N/A	N/A	N/A
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Pervasive	Serious	High
Natural System Modification	Pervasive	Serious	High
Invasive & other Problematic Species	Pervasive	Serious	High
Pollution	Pervasive	Slight	Low
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	Pervasive	Moderate	Medium
Overall Calculated Threat Impact: High			

Habitat Conservation Actions:

1. Provide general guidelines for prohibited activities on beaches to be used as a standard by local municipalities. Work with local enforcement groups to enforce rules.
2. Close beaches to vehicle traffic by installing signs and symbolic fencing.
3. Assure designated parking areas are available at all beach access points. Advise local municipalities on where acquire funds to provide such areas and advise on how to install with the least amount of impact to the resource.
4. Where appropriate, install segmented breakwaters and sand fencing to retain sand for development of Louisiana Beach; augment sand supply by depositing sand on or just offshore from beaches.
5. Review literature and conduct original research to determine effects of cattle grazing to Louisiana Beach habitat and associated wildlife.

4.10 Mississippi Terrace Prairie

Rarity Ranks: SX/G2
Synonyms: Macon Ridge prairie
***Ecological Systems*:** CES203.549 Lower Mississippi Alluvial Plain Grand Prairie

General Description:

Mississippi Terrace Prairie was a tall-grass prairie type of northeastern Louisiana on Pleistocene terraces within the Mississippi River alluvial floodplain. These prairies may have been similar to the Grand Prairie of eastern Arkansas. Topographic maps indicate some historical occurrences of Mississippi Terrace Prairies in northeastern Louisiana, such as the Boeuf Prairie in Franklin Parish. This habitat is now extirpated.

Mississippi Terrace Prairie: Characteristic Plants	
Common Name	**Scientific Name**
Big Bluestem	*Andropogon gerardii*
Switch Grass	*Panicum virgatum*
Indian Grass	*Sorghastrum nutans*
Tall Dropseed	*Sporobolus asper*
Eastern Gamma Grass	*Tripsacum dactyloides*

Current Extent and Status:

This habitat was known from Franklin Parish. It may also have been present in other Macon Ridge parishes.

MISSISSIPPI TERRACE PRAIRIE SGCN (23)		
AMPHIBIANS Southern Crawfish Frog **BIRDS** Northern Bobwhite Short-eared Owl Loggerhead Shrike Sedge Wren Spague's Pipit Field Sparrow **INSECTS** American Bumblebee Monarch Brou's Underwing	Lark Sparrow Grasshopper Sparrow Henslow's Sparrow Le Conte's Sparrow Painted Bunting Dickcissel	**MAMMALS** Long-tailed Weasel Louisiana Black Bear Southeastern Shrew **REPTILES** Western Chicken Turtle Western Slender Glass Lizard Eastern Hog-nosed Snake Timber Rattlesnake

Habitat Conservation Actions:

1. Conduct field surveys within and near areas that historically supported Mississippi River Terrace Prairie for grasslands which retain some prairie plants, such as pastures and neglected agricultural land ("go-back" lands).
2. Promote management (e.g. prescribed fire) on prairie-like grasslands in areas where this habitat occurred historically.

4.11 Saline Prairie

Rarity Rank: S1S2/G1G2
Synonyms: Alkali Flats, Barrens, Salt Barrens, Slicks
Ecological Systems: CES203.291 West Gulf Coastal Plain Saline Glade

General Description:

Upland Saline Prairie, De Soto Parish

Saline Prairies are small-scale grasslands, often in complexes of small openings. Saline Prairies range from less than one acre to about 30 acres in size. There are two types of Saline Prairies classified by hydrology and landscape position: Dry-mesic (upland) and wet. Dry-mesic saline Saline Prairies occur on fluvial terraces adjacent to active small stream floodplains, and their soils formed in Pleistocene alluvium. Wet Saline Prairies occur in stream valleys subject to regular flooding. Wet Saline Prairies usually transition upslope into mesic or dry saline prairies.

Upland Saline Prairie soils have high levels of exchangeable sodium and sometimes magnesium in the subsoil and near the surface horizons which create 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 a sodic horizon in the subsoil which acts much like a dense claypan that is very resistant to root penetration. The principal soils supporting the community in the UWGCP and EGCP are the Bonn and Lafe series. Occurrences in the LWGCP are on Brimstone soils. A detailed study of the flora and edaphics of several Upland Saline Prairies by Reid et al. (2010) revealed that the soils of Upland Prairies are not truly saline (containing high levels of dissolved salts as indicated by electrical conductivity), but are sodic (a.k.a. natric, alkali). The flora of upland prairies studied by Reid et al. (2010) had very few typical salt-tolerant plants and supported plants that

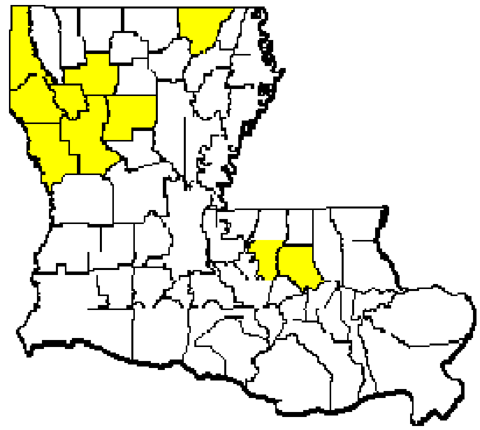
Wet Saline Prairie, Winn Parish

are epehemeral, expressing themselves in the early spring when there is adequate moisture, and plants that are very drought tolerant. The upland Saline Prairie flora has substantial overlap with the flora of sandstone glades/outcrops (MacRoberts et al. 2009; Reid et al. 2010). Wet Saline Prairies occur on lower landscape positions than upland prairies and are seasonally flooded. The flora of wet Saline Prairies is entirely different from that of upland and includes several plants that also occur in coastal saline habitats. Wet Saline Prairies also feature large barren patches, and are in need of more detailed study.

Saline Prairie: Characteristic Plants	
Common Name	**Scientific Name**
Dry-Mesic Saline Prairies (fluvial terraces flanking small stream floodplains)	
Slimspike Threeawn	*Aristida longespica*
Nuttall's Rayless Goldenrod	*Bigelowia nuttallii* (northcentral LA)
Silver Dwarf Morning-Glory	*Evolvulus sericeus*
Earth-fruit	*Geocarpon minimum*
Narrowleaf Sumpweed	*Iva angustifolia*
Drummond's Nailwort	*Minuartia drummondii*
Prickly Pear	*Opuntia nemoralis* (northwest LA)
Texas Sunnybell	*Schoenolirion wrightii*
Poverty Dropseed	*Sporobolus vaginiflorus*
Whorled Dropseed	*Sporobolus pyramidatus*
Small-flowered Flame Flower	*Talinum parviflorum*
Wet Saline Prairies (in stream valleys, seasonally flooded)	
Crested Saltbush	*Atriplex cristata*
Salt Grass	*Distichlis spicata*
Pale Spike Sedge	*Eleocharis macrostachya*
Marsh Fimbry	*Fimbristylis castanea*
Seaside Heliotrope	*Heliotropium curassavicum*
Switch Grass	*Panicum virgatum*
Prairie Cordgrass	*Spartina pectinata*
Seaside Goldenrod	*Solidago sempervirens*

Current Extent and Status:

An effort was made during 2006-2008 to locate Saline Prairies in northwestern Louisiana. This work was very successful, revealing about 10 new records and expanding the range of the Saline Prairie to include three additional parishes (Reid et al. 2010). Saline Prairie is likely extirpated in East Baton Rouge and Livingston Parishes, however, small remnants in these parishes may persist in utility corridors that intersect the Lafe soil series.



SALINE PRAIRIE SGCN (44)

BIRDS
Northern Bobwhite
American Woodcock
Loggerhead Shrike
Sprague’s Pipit
Smith’s Longspur
Field Sparrow
Grasshopper Sparrow
Le Conte’s Sparrow
Henslow’s Sparrow

INSECTS
Saline Prairie Scarab Beetle
Comanche Harvester Ant
American Bumblebee
Monarch

MAMMALS
Eastern Harvest Mouse
Northern Pygmy Mouse
Baird’s Pocket Gopher
Oak Ridge Pocket Gopher
Long-tailed Weasel

REPTILES
Western Slender Glass Lizard
Texas Horned Lizard
Southern Prairie Skink
Eastern Hog-nosed Snake
Western Chicken Turtle

PLANTS
Arkansas Sedge
Evening Rainlily
Wolf Spike Sedge
Upland Swamp Privet
Earth-fruit
Flame Hedgehyssop
Gum Weed
Rosemary Rockrose
San Saba Pinweed
Prairie Trefoil
Drummond's Stitchwort
Dixie Stitchwort
Pale Umbrella-wort
Hall's Panic Grass
Smooth Phacelia
Wand Blackroot
Texas Saxifrage
Tumble Grass
Texas Sunnybell
Prairie Cordgrass
Small-Flowered Flame Flower

Threats Affecting Habitat:

Saline Prairies are threatened by disturbance associated with mineral extraction, roads and service corridors, and aforestation attempts. Feral hogs pose a serious threat to Saline Prairies.

Saline Prairie Threats Assessment:			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	Small	Extreme	Low
Agriculture/Aquaculture	Restricted	Moderate	Low
Energy Production & Mining	Pervasive	Extreme	Very High
Transportation & Service Corridors	Restricted	Moderate	Low
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Large	Moderate	Medium
Natural System Modification	N/A	N/A	N/A
Invasive & other Problematic Species	Pervasive	Moderate	Medium
Pollution	N/A	N/A	N/A
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	N/A	N/A	N/A
Overall Calculated Threat Impact: Medium			

Habitat Conservation Actions:

1. Continue surveys to monitor the current extent and condition of this habitat type.
2. Conduct detailed studies of flora and edaphics of Wet Saline Prairies.
3. Conduct surveys to determine inverterbrate assemblages on Saline Prairies.
4. Provide assistance with feral hog control in this habitat to landowners; disturbance by hogs is a particular threat since this community is very rare and occurs as small openings.
5. Target occurences of Saline Prairie in northwest Louisiana for permanent protection via servitudes or acquisition from willing sellers.

4.12 Salt Marsh

Rarity Rank: S3S4/G5

Synonyms: Smooth Cord Grass 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:

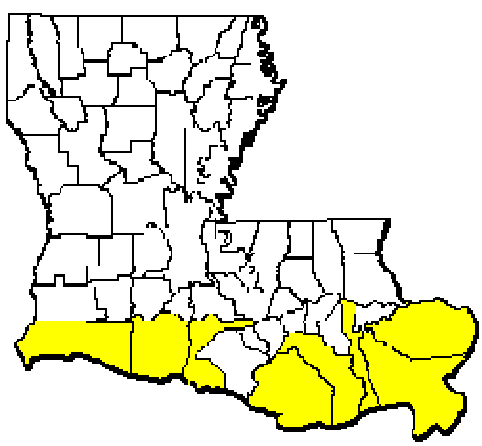
Typically, Salt Marsh is the marsh area closest to the beach rim of the Gulf of Mexico, and in general, varies from 1-15 miles in width. These marshes are regularly tidally flooded, flat, polyhaline areas dominated by salt-tolerant grasses and very few other species. Small pools or ponds may be scattered. Salt Marsh has the lowest plant diversity and soil organic matter content of any marsh type. This community is often totally dominated by Smooth Cord Grass. 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 (5) 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. Although Salt Marsh is known for low species diversity, a few species are wholly dependent on this habitat. For example, Seaside Sparrow (*Ammodramus maritimus*) is endemic to Salt Marsh, one of only five such Salt Marsh-obligate vertebrate species on Earth (Greenberg *et al.* 2006).

Salt Marsh, Lafourche Parish

Salt Marsh: Characteristic Plants	
Common Name	**Scientific Name**
Salt Wort	*Batis maritima*
Sea Ox-Eye	*Borrichia frutescens*
Salt Grass	*Distichlis spicata*
Black Needle Rush	*Juncus roemerianus*
Smooth Cord Grass	*Spartina alterniflora*

Current Extent and Status:

Salt Marsh is estimated to have occupied 500,000 to 1,000,000 acres in pre-settlement times, with an estimated 50 to 75 percent 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 2009). However, coastal erosion and subsidence are threats because they act to convert marsh to open, shallow water.



SALT MARSH SGCN (49)		
BIRDS	American Oystercatcher	**CRUSTACEANS**
Mottled Duck	Marbled Godwit	Ghost Shrimp
Northern Pintail	Dunlin	
Canvasback	Short-billed Dowitcher	**INSECTS**
Redhead	Coastal Least Tern	Bay Skipper
Lesser Scaup	Gull-billed Tern	Obscure Skipper
Brown Pelican	Caspian Tern	Eastern Pygmy-Blue
American Bittern	Common Tern	Western Pygmy-Blue
Least Bittern	Forster's Tern	Louisiana Eyed Silkmoth
Little Blue Heron	Royal Tern	
Reddish Egret	Sandwich Tern	**MARINE FISH**
Glossy Ibis	Black Skimmer	Diamond Killifish
Roseate Spoonbill	Short-eared Owl	Bayou Killifish
Osprey	Sedge Wren	Texas Pipefish
White-tailed Kite	Marsh Wren	
Bald Eagle	Nelson’s Sparrow	**MAMMALS**
Black Rail	Seaside Sparrow	West Indian Manatee
Clapper Rail		
Whooping Crane		**REPTILES**
		Gulf Saltmarsh Snake
		Kemp’s Ridley Seaturtle
		Mississippi Diamond-backed Terrapin
		PLANTS
		Salt Flat Grass

Threats Affecting Habitat:

Salt Marshes are threatened by disturbance from several human sources, invasive animal species, subsidence, and potentially by increased tropical storm frequency and intensity associated with climate change.

Salt Marsh Threats Assessment:			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	N/A	N/A	N/A
Agriculture/Aquaculture	Small	Moderate	Low
Energy Production & Mining	Large	Serious	High
Transportation & Service Corridors	Large	Serious	High
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	N/A	N/A	N/A
Natural System Modification	N/A	N/A	N/A
Invasive & other Problematic Species	Pervasive	Extreme	Very High
Pollution	N/A	N/A	N/A
Geological Events	Pervasive	Slight	Low
Climate Change & Severe Weather	Pervasive	Serious	High
Overall Calculated Threat Impact: High			

Habitat Conservation Actions:

1. Support NRCS and CPRA efforts for shoreline stabilization and habitat restoration.
2. Work with LCA and CPRA to support coastal restoration projects, specifically targeting important nesting areas and SGCN.
3. Work with COE and state agencies to insure water control structures provide the maximum benefit to Salt Marsh.

4.13 Sandbar

Rarity Rank: S2/G4
Synonyms: River Sandbar
Ecological Systems: None

General Description:

A sandbar is a sand/gravel deposit in or adjacent to permanently flowing freshwater contained within a natural channel. Sandbars are composed of course to fine-grained alluvial deposits. The community structure is dependent on the mix and stability of substrate, severity and depth of flooding, and permanence 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 herbaceous plants, with woody plants such as willows (*Salix* spp.) becoming established when sandbars are not scoured and re-worked. Due to the early successional nature of sandbars, they can be invaded by exotic plant species (NatureServe 2015). Sandbars are critical nesting areas for the federally-endangered Interior Least Tern (*Sternulla antillarum athalassos*).

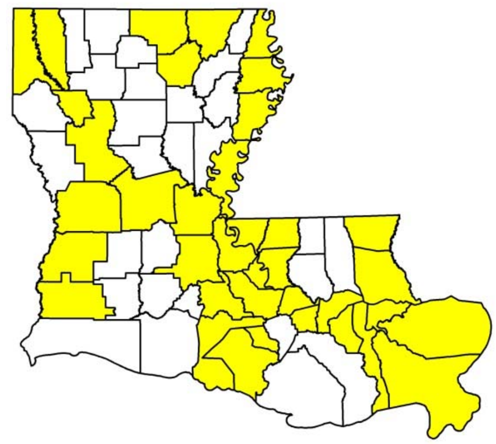
Mississippi River Sandbar, West Feliciana Parish

Expansive dune-like Sand Bar on Red River, Bossier Parish

Sandbar: Characteristic Plants	
Common Name	**Scientific Name**
Roughfruit Amaranth	*Amaranthus tuberculatus*
Valley Redstem	*Ammannia coccinea*
Winged Pigweed	*Cycloloma atriplicifolia*
Chufa	*Cyperus esculentus*
Bearded Flat Sedge	*Cyperus squarrosus*
Tropical Flat Sedge	*Cyperus surinamensis*
Teal Grass	*Eragrostis hypnoides*
Vahl's Fimbry	*Fimbristylis vahlii*
Camphor Daisy	*Heterotheca subaxillaris*
Amazon Sprangletop	*Leptochloa panicoides*
Water Pimpernel	*Lindernia dubia*
Amberique Bean	*Strophostyles helvula*

Current Extent and Status:

Sandbars occur along the following major rivers: Mississippi, Red, Pearl, Sabine, and Ouachita. 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 percent 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 2000). 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 tern nesting colonies, is warranted.



SANDBARS SGCN (20)		
BIRDS	**INSECTS**	Ouachita Map Turtle
Piping Plover	White Sand Tiger Beetle	Sabine Map Turtle
Marbled Godwit	Sandbar Tiger Beetle	Pearl Map Turtle
Dunlin	Comanche Harvester Ant	
Short-billed Dowitcher		**PLANTS**
Gull-billed Tern	**REPTILES**	Downy Prairie-clover
Interior Least Tern	Alligator Snapping Turtle	Phlox Heliotrope
Black Skimmer	Smooth Softshell	Small Flower Hemicarpha
	Ringed Map Turtle	Square-stemmed Monkey-Flower

Threats Affecting Habitat:

Sandbars are subject to frequent human intrusion resulting in disturbance and trampling. Our large rivers are engineered waterways, and operation of locks and dams and levees interrupts the natural development and maintenance of sand bars. Invasive plants and animals threaten this habitat.

Sandbar Threats Assessment:

First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	N/A	N/A	N/A
Agriculture/Aquaculture	Small	Slight	Low
Energy Production & Mining	N/A	N/A	N/A
Transportation & Service Corridors	N/A	N/A	N/A
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Large	Moderate	Medium
Natural System Modification	Pervasive	Extreme	Very High
Invasive & other Problematic Species	Pervasive	Moderate	Medium
Pollution	Pervasive	Slight	Low
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	N/A	N/A	N/A
Overall Calculated Threat Impact: Medium			

Habitat Conservation Actions:

1. Determine ownership/management authority for Sandbars in Louisiana rivers.
2. Work with COE to develop Memorandum Of Understanding (MOU) regarding Sandbar management.
3. Work with landowners to develop limits on recreational vehicle use of this habitat and to protect Sandbars from cattle trampling.
4. Support a study into the need and economic impact of existing dams on Louisiana rivers. Remove low-impact (unnecessary) structures, particularly on the Red and Ouachita Rivers, to restore natural flow of these rivers.
5. Implement control of invasive species on sandbars.

4.14 Sandstone Glade/Barren

Rarity Rank: S1S2/G1G2

Synonyms: Catahoula Barren, Sandstone Outcrop

Ecological Systems: CES203.364 West Gulf Coastal Plain Catahoula Barrens

General Description:

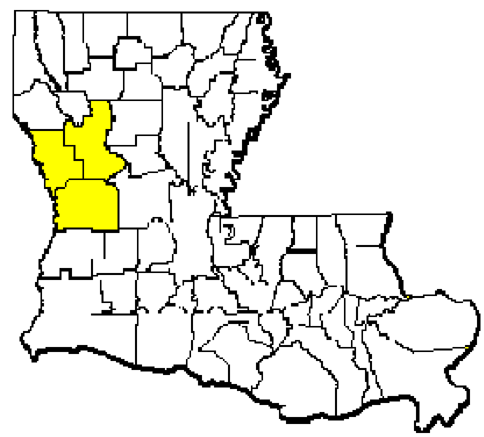
A glade is an open area in an otherwise wooded landscape due to the presence of rock at or near the surface. Sandstone Glades are associated with the Catahoula Formation, which extends as a belt across central Louisiana. Sandstone Glades are embedded in Western Upland Longleaf Pine Woodlands. Soil depth apparently determines development of vegetation. Many glades have portions where rock is at the surface, appearing pavement-like, and areas with very shallow soil. Pavement and shallow soil areas are very resistant to woody encroachment. However, deeper soils support larger grasses and other plants, as well as trees such as Longleaf Pine. Being embedded in Upland Longleaf Pine Woodland, Sandstone Glades would have burned at the same frequency, every one to three years. With deeper-soil glades, fire is essential to maintain open conditions and to prevent establishment of brush thickets. Well-burned glades with relatively deep soil appear prairie-like.

Sandstone Glade, Kisatchie National Forest, Natchitoches Parish

Sandstone Glade/Barren: Characteristic Plants	
Common Name	**Scientific Name**
Nuttall's Rayless Goldenrod	*Bigelowia nuttallii*
Silver Dwarf Morning-Glory	*Evolvulus sericeus*
Slender Bluestem	*Schizachyrium tenerum*
Texas Sunnybell	*Schoenolirion wrightii*
Sand Spikemoss	*Selaginella arenicola*
Rock Pink	*Talinum parviflorum*
Tree Huckleberry	*Vaccinium arboreum*

Current Extent and Status:

Sandstone Glades are thought to have occupied less than 2,000 acres in pre-settlement times with an estimated 50 to 75 percent remaining today (Smith 1993). Most known occurrences are on the Kisatchie District of KNF in southern Natchitoches Parish. There are a number of Sandstone Glades on private lands in Sabine Parish.



SANDSTONE GLADE BARREN SGCN (18)		
AMPHIBIANS Southern Red-backed Salamander **ARACHNIDS** Texas Brown Tarantula **BIRDS** Northern Bobwhite Greater Roadrunner Chuck-Will's-Widow Field Sparrow	**INSECTS** American Bumblebee Cobweb Skipper Monarch **REPTILES** Western Slender Glass Lizard Coal Skink Eastern Hog-nosed Snake Timber Rattlesnake	**PLANTS** Hairy Lipfern Riddell's Spike Moss Small-flowered Flame Flower Texas Sunnybell

Threats Affecting Habitat:

This habitat is threatened by disturbance and resulting soil erosion. Glades with deeper soil are fire-dependent and are degraded by woody encroachment without adequate fire.

<u>Sandstone Glade/Barren Threats Assessment:</u>			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	N/A	N/A	N/A
Agriculture/Aquaculture	Restricted	Serious	Medium
Energy Production & Mining	Small	Slight	Low
Transportation & Service Corridors	N/A	N/A	N/A
Biological Resource Use	Small	Moderate	Low
Human Intrusion/Disturbance	Restricted	Slight	Low
Natural System Modification	Restricted	Moderate	Low
Invasive & other Problematic Species	Restricted	Moderate	Low
Pollution	N/A	N/A	N/A
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	N/A	N/A	N/A
Overall Calculated Threat Impact: Low			

Habitat Conservation Actions:

1. Continue surveys to determine the current extent and condition of this habitat type and support research on the community classification of Sandstone Glades.
2. Encourage and fund the use of prescribed fire and chemical and mechanical brush control as management tools.

4.15 West Gulf Coastal Plain Muck Bog

Rarity Ranks: G1/S1
Synonyms: Stream valley bog
Ecological System: CES203.194 West Gulf Coastal Plain Herbaceous Seep and Bog

General Description:

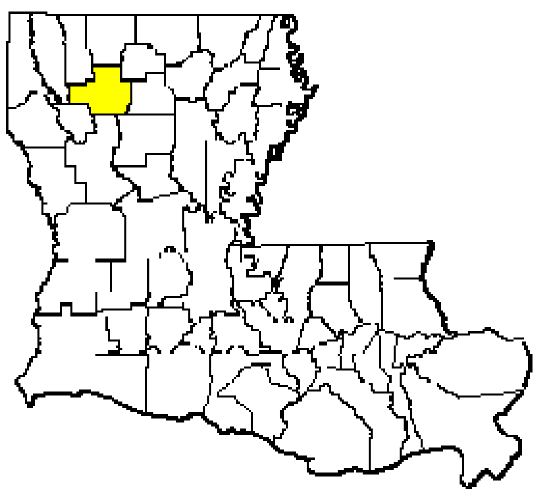
This habitat type is a herbaceous marsh that occupies the valleys of impeded streams embedded within the sandy uplands of the Sparta Formation. Substrates are high in organic matter (peat). In some examples, the vegetation appears to form a mat that floats above or rests on top of a layer of organic slurry, at least seasonally. The vegetation mat is not thick and well developed, and cannot support the weight of a person, as is the case with coastal Freshwater Floating Marsh. The image below shows that stream valley bogs, depending on the season, can look like solid ground from a distance, but an attempt to walk across this area would reward one with a plunge into thigh-deep muck. The vegetation mat apparently floats during summer months, and is submersed during winter and spring.

Some of the muck bogs in Texas are very old, on the order of thousands of years (MacRoberts and MacRoberts 1998) and have several plant species not present in the habitat described here, notably Yellow Trumpet Pitcher Plant (*Sarracenia alata*) and Saw Grass (*Cladium mariscoides*). The formation of WGCP Muck Bogs seems similar in Louisiana as in Texas. Surrounding deep sandy soils efficiently capture and transmit precipitation as ground water, which converges on stream valleys. Small streams become impeded, and constant saturation from seepage leads to peat accumulation. The substrate of WGCP Muck Bogs in Texas is acidic, with a pH of 4.3-4.8 (MacRoberts and MacRoberts 1998), and Louisiana muck bogs are almost certainly acidic as well. Summer fires sweeping off of the adjacent longleaf pine uplands historically controlled woody plant growth and prevented conversion to a wooded habitat. Louisiana's muck bogs are hypothesized to be younger than some of the muck bogs in the Post Oak Savanna of Texas.

West Gulf Coastal Plain Muck Bog, Bienville Parish

West Gulf Coastal Plain Muck Bog: Characteristic Plants	
Common Name	**Scientific Name**
Broomsedge	*Andropogon virginicus*
Snot Plant	*Brasenia schreberi*
Three-way Sedge	*Dulichium arundinaceum*
Yellow Spike Sedge	*Eleocharis flavescens*
Hairy Umbrella Sedge	*Fuirena squarrosa*
Water Spider Orchid	*Habeneria repens*
Virginia-willow	*Itea virginica*
Bog Rush	*Juncus trigonocarpus*
Southern Bog Clubmoss	*Lycopodiella appressa*
Slender Beak Sedge	*Rhynchospora gracilenta*
Long-beak Beak Sedge	*Rhynchospora scirpoides*
Poison Sumac	*Toxicodendron vernix*
Zigzag Bladderwort	*Utricularia subulata*
Bog Yellow-eyed-grass	*Xyris difformis var. difformis*
Iris-leaf Yellow-eyed-grass	*Xyris laxifolia var. iridifolia*

Current Extent and Status:
This community type is only known from the sandy Xeric Upland Longleaf Pine Woodlands on the Sparta Formation in Bienville Parish.



WEST GULF COASTAL PLAIN MUCK BOG SGCN (12)	
BIRDS	**PLANTS**
American Woodcock	Three-way Sedge
Sedge Wren	
Grasshopper Sparrow	
Henslow's Sparrow	
Le Conte's Sparrow	
INSECTS	
Arogos Skipper	
Little Metalmark	
Georgia Saytr	
Pitcher Plant Spiketail	
Texas Emerald	
Monarch	

Threats Affecting Habitat:

At this point little is known about this habitat in Louisiana; this lack of knowledge is itself a threat. Inadequate fire and exotic plants and animals appear to pose the greatest threats.

West Gulf Coastal Plain Muck Bog Threats Assessment:

First Level Threat	Scope	Severity	Impact
Residential/Commercial Development	N/A	N/A	N/A
Agriculture/Aquaculture	N/A	N/A	N/A
Energy Production & Mining	N/A	N/A	N/A
Transportation & Service Corridors	Small	Moderate	Low
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Small	Serious	Low
Natural System Modification	Pervasive	Moderate	Medium
Invasive & other Problematic Species	Large	Moderate	Medium
Pollution	Large	Slight	Low
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	N/A	N/A	N/A
Overall Calculated Threat Impact: Low			

Habitat Conservation Actions:

1. Conduct basic botanical and zoological studies, including analyses of substrate and characterization of the floating mat; address questions regarding development, peat age, and buoyancy of floating mats in this habitat.
2. Document new occurrences of this habitat.
3. Promote fire in this habitat – since the floating mat is submersed during the dormant season, summer or fall burning is necessary.

4.16 Vegetated Pioneer Emerging Delta

Rarity Rank: S2/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 and Mississippi Rivers. Substrates contain a greater percentage of sand and less moisture than do marsh soils. The pioneer ridge vegetation is similar to the sand bars and delta of the Mississippi River, whereas the pioneer marsh vegetation is similar to that of Freshwater Marsh areas. This community can be floristically diverse, containing many species also found on Sandbars. However, rapid invasion by the exotic invasive Torpedo Grass (*Panicum repens*) apparently reduces plant species richness. 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.

Vegetated Pioneer Emerging Delta, Pass-a-Loutre WMA

Vegetated Pioneer Emerging Delta: Characteristic Plants	
Common Name	**Scientific Name**
Sprangletops	*Leptochloa* spp.
Arrow Leaf Duck Potato	*Sagittaria latifolia*
Delta Duck Potato	*Sagittaria platyphylla*
Delta Bulrush	*Schoenoplectus deltarum*

Current Extent and Status:

According to Smith (1993) there was an estimated 2,000 to 10,000 acres of Vegetated Pioneer Emerging Delta in pre-settlement times. An estimated 75 to 100 percent of this figure 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 accreted delta land is incorporated into Atchafalaya Delta WMA. Pass-A-Loutre WMA near the mouth of the Mississippi River, contains natural and constructed crevasses which promote the expansion of this habitat type.

VEGETATED PIONEER EMERGING DELTA SGCN (34)		
BIRDS	Bald Eagle	Gull-billed Tern
Mottled Duck	Clapper Rail	Caspian Tern
Northern Pintail	Whooping Crane	Common Tern
Canvasback	Snowy Plover	Forster's Tern
Redhead	Wilson's Plover	Royal Tern
Lesser Scaup	Piping Plover	Sandwich Tern
Brown Pelican	Red Knot	Black Skimmer
Least Bittern	Long-billed Curlew	Nelson’s Sparrow
Little Blue Heron	Marbled Godwit	Seaside Sparrow
Reddish Egret	Dunlin	
Glossy Ibis	Short-billed Dowitcher	**MAMMALS**
Roseate Spoonbill		West Indian Manatee
		PLANTS
		Small Flower Hemicarpha
		Square-stem Monkey Flower

Threats Affecting Habitat:

The greatest threat to this habitat is invasive species, including plants and animals such as nutria and feral hogs.

Vegetated Pioneer Emerging Delta Threats Assessment:

First Level Threat	Scope	Severity	Impact
Residential/Commercial Development	N/A	N/A	N/A
Agriculture/Aquaculture	N/A	N/A	N/A
Energy Production & Mining	Small	Extreme	Low
Transportation & Service Corridors	Small	Extreme	Low
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Large	Moderate	Medium
Natural System Modification	N/A	N/A	N/A
Invasive & other Problematic Species	Large	Serious	High
Pollution	Pervasive	Slight	Low
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	Pervasive	Slight	Low
Overall Calculated Threat Impact: Low			

Habitat Conservation Actions:

1. Identify and protect sensitive areas from disturbances such as by boats or other motorized vehicles.
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 and general stopover sites and to enhance aquatic species habitat.
3. Work with COE and others to manage water control to create more high quality habitat and benefit existing delta habitat.
4. Work with LCA, CPRA, and NRCS to incorporate management objectives for the protection and restoration of emerging delta habitat.

4.17 Western Hillside Seepage Bog

Rarity Rank: S1/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:

Western Hillside Seepage Bog, Kisatchie National Forest, Vernon Parish

Hillside sSepage Bogs are open, mostly treeless, herb-dominated natural wetlands of hilly, sandy uplands historically dominated by Longleaf Pine (*Pinus palustr*is). This community can be found in 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 lower 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).

Western Hillside Seepage Bog, Fort Polk, Vernon Parish

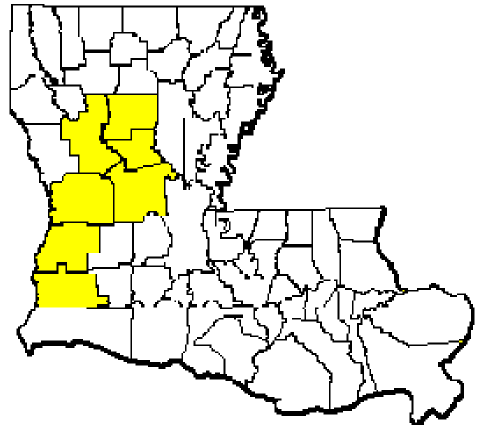
These bogs are generally persistently wet from seepage and are variable in size being most often less than one acre, but rarely exceeding 10 acres. WGCP bogs are underlain by an impervious clay or sandstone layer that, when conditions are right, causes groundwater to constantly seep to the soil surface. The herbaceous ground cover 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. Many species are restricted to this habitat and closely allied Longleaf Pine Flatwood Savannas. 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, which 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.

Western Hillside Seepage Bog: Characteristic Plants	
Common Name	**Scientific Name**
Red Milkweed	*Asclepias rubra*
Grass Pink	*Calopogon tuberosus*
Toothache Grass	*Ctenium aromaticum*
Bog Rush	*Juncus trigonocarpus*
Savanna Meadow Beauty	*Rhexia alifanus*
Fringed Meadow Beauty	*Rhexia petiolata*
Featherbristle Beak Sedge	*Rhynchospora oligantha*
Plumed Beak Sedge	*Rhynchospora plumosa*
White-top Sedge	*Rhynchospora latifolia*
Yellow Trumpets	*Sarracenia alata*
Nut Sedges	*Scleria* spp.
Coastal Plain Yellow-eyed-grass	*Xyris ambigua*
Harper's Yellow-eyed-grass	*Xyris scabrifolia*
Kral's Yellow-eyed grass	*Xyris stricta var. obscura*

Current Extent and Status:

In the WGCP, Hillside Seepage Bogs are found from Calcasieu north to Natchitoches and Winn Parishes. Most known occurrences are in Vernon and Natchitoches Parishes on KNF and Ft. Polk. There are possibly many more unknown bogs in these parishes and Beauregard Parish. Beauregard Parish has received relatively little inventory.



WESTERN HILLSIDE SEEPAGE BOG SGCN (24)		
BIRDS	Georgia Satyr	Staghorn Clubmoss
Yellow Rail	Monarch	Broomrape
Sedge Wren		Large Leaved Grass-of
Grasshopper Sparrow	**MAMMALS**	Parnassus
Henslow's Sparrow	Long-tailed Weasel	White-fringe Orchid
Le Conte's Sparrow		Yellow Fringeless Orchid
	PLANTS	Large Beak Sedge
INSECTS	Red Milkweed	Sabine Coneflower
Pitcher Plant Spiketail	Bearded Grass-pink	Drummond's Yellow-eyed-grass
Texas Emerald	Swamp Thistle	Harper's Yellow-eyed-grass
	Pineland Bog Button	Black Snakeroot

Threats Affecting Habitat:

Fire exclusion or inadequte fire, and invasive species (especially feral hogs) are the main threats to this habitat.

Western Hillside Seepage Bog Threats Assessment:

First Level Threat	Scope	Severity	Impact
Residential/Commercial Development	Small	Serious	Low
Agriculture/Aquaculture	Restricted	Serious	Medium
Energy Production & Mining	Small	Serious	Low
Transportation & Service Corridors	N/A	N/A	N/A
Biological Resource Use	Restricted	Moderate	Low
Human Intrusion/Disturbance	Restricted	Moderate	Low
Natural System Modification	Large	Serious	High
Invasive & other Problematic Species	Pervasive	Serious	High
Pollution	N/A	N/A	N/A
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	Pervasive	Moderate	Medium
Overall Calculated Threat Impact: Medium			

Habitat Conservation Actions:

1. Continue surveys to determine the extent and condition of this habitat type.
2. Expand the number of data exchanges between LNHP and forest products companies to prevent damage of this habitat due lack of awareness of its presence.
3. Work with staff of Kisatchie National Forest and Ft. polk to implement appropriate management, including optimal fire timing and frequency.
4. Encourage landowners to include this community type in prescribed burning plans, and discourage the placement of firebreaks around bogs.
5. Provide additional cost share funds for landowners to reduce or eliminate the costs associated with conducting prescribed burns on their property. Include the presence of embedded Western Hillside Seepage Bogs as a criterion when scoring properties for LDWF Prescribed Burn Initiatives.
6. Support control of feral hogs within and near this habitat type.

5. EPHEMERAL PONDS

Ephemeral ponds are isolated depressions that hold water seasonally. They capture rain water and, in some cases, receive laterally-flowing groundwater, but are not connected to streams or other water bodies. Ephemeral ponds occur in several ecoregions, in forest, savanna, and grassland landscapes, and can be open and herb-dominated or wooded. Each of these ephemeral pond types is in need of basic natural history study. Plant species characteristic of each pond type are listed in the table below the general descriptions. Species of Greatest Conservation Need (SGCN) are listed for all combined ephemeral pond types in a single table at the end of this section.

5.1 Flatwoods Pond (East and West Gulf Coastal Plain)

Rarity Ranks: East Gulf Coastal Plain Flatwoods Pond - S1
West Gulf Coastal Plain Flatwoods Pond - S2

Synonyms: none

Ecological Systems: CES203.547 West Gulf Coastal Plain Flatwoods Pond

General Description:

Flatwoods ponds are embedded in Longleaf Pine flats and are believed to occupy swales and depressions remaining from ancient Pleistocene stream channels. They are often linear in shape, although circular and elliptic ponds do occur. Where surrounding soils are coarser, wind deflation during historical droughts is a potential origin. Flatwoods Ponds may range from just a few inches deep relative to surrounding pine flats, to approximately 5 feet deep in larger ponds. Generally treeless, these ponds are vegetated by a variety of obligate and facultative wetland herbaceous species, mainly tall sedges and grasses. Deep ponds are characterized by a variable mix of herbs. Trees, often appearing stunted, may be present in deeper, more frequently flooded, and therefore less fire-exposed ponds. The hydrologic regime of these ponds is characterized by a seasonally fluctuating water level–dry in summer and fall and flooded to various depths in winter and early spring. 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. Flatwoods Ponds were historically maintained by frequent lightning generated fires that swept the Longleaf Pine flatwoods every few years. Such fires burned into the ponds during the late

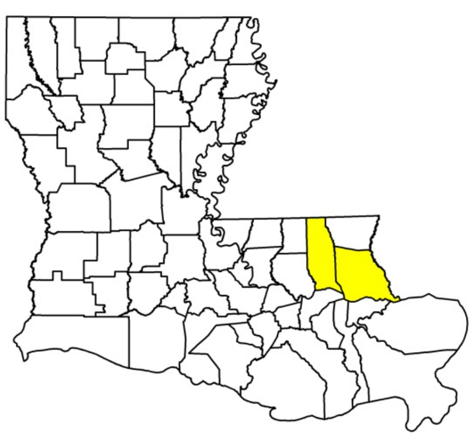
WGCP Flatwoods Pond, Beauregard Parish

spring/summer dry season, killing back encroaching shrubs and trees and rejuvenating the herbaceous ground cover. Flatwoods Ponds are important breeding habitat for many amphibians, including several SGCN.

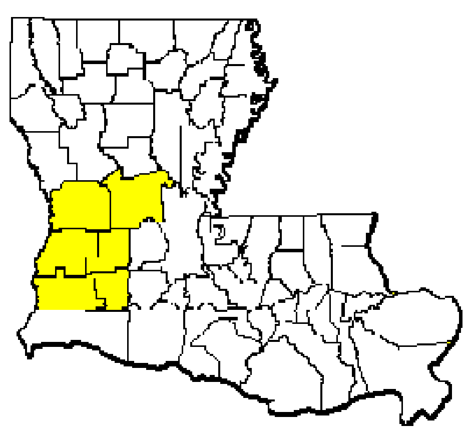
EGCP Flatwoods Pond: Characteristic Plants	
Common Name	**Scientific Name**
Southern Waxy Sedge	*Carex glaucescens*
White Titi	*Cyrilla racemiflora*
Myrtle Holly	*Ilex myrtifolia*
Fetterbush	*Lyonia lucida*
Swamp Blackgum	*Nyssa biflora*

WGCP Flatwoods Pond: Characteristic Plants	
Common Name	**Scientific Name**
Longleaf Three-Awn	*Aristida palustris*
Mayhaw	*Crataegus opaca*
Swamp Blackgum	*Nyssa biflora*
White-top Sedge	*Rhynchospora latifolia*
Baldwin's Nut Sedge	*Scleria baldwinii*
American Snowbell	*Styrax americanus*
Iris-leaf Yellow-eyed-grass	*Xyris laxifolia* var. *iridifolia*
Pineland Yellow-eyed-grass	*Xyris stricta* var. *stricta*

EGCP Current Extent:



WGCP Current Extent:



Threats Affecting Habitat:

Flatwoods Ponds in EGCP and WGCP are threatened by various sources of disturbance. The most impactful threats to both are inadequate fire and invasive plants and animals.

<u>EGCP Flatwoods Pond Threats Assessment:</u>			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	Restricted	Serious	Medium
Agriculture/Aquaculture	Large	Moderate	Medium
Energy Production & Mining	Restricted	Moderate	Low
Transportation & Service Corridors	Small	Moderate	Low
Biological Resource Use	Small	Moderate	Low
Human Intrusion/Disturbance	Restricted	Slight	Low
Natural System Modification	Large	Moderate	Medium
Invasive & other Problematic Species	Pervasive	Serious	High
Pollution	Restricted	Moderate	Low
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	Pervasive	Slight	Low
Overall Calculated Threat Impact: High			

<u>WGCP Flatwoods Pond Threats Assessment:</u>			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	Small	Serious	Low
Agriculture/Aquaculture	Pervasive	Serious	High
Energy Production & Mining	Small	Moderate	Low
Transportation & Service Corridors	Small	Moderate	Low
Biological Resource Use	Restricted	Moderate	Low
Human Intrusion/Disturbance	Small	Slight	Low
Natural System Modification	Large	Moderate	Medium
Invasive & other Problematic Species	Pervasive	Serious	High
Pollution	Restricted	Moderate	Low
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	Pervasive	Slight	Low
Overall Calculated Threat Impact: High			

Habitat Conservation Actions:

1. Continue surveys to determine the extent and condition of this habitat type in both EGCP and WGCP.
2. Conduct research to determine whether EGCP Flatwoods Ponds were historically wooded or open.
3. Support restoration of Flatwoods Ponds that have been converted to Bayhead Swamp by mechanical or hand clearing and restoration of natural fire regimes.
4. Implement a cost-share program to partially offset costs to restore Flatwoods Ponds.
5. Provide education to landowners and managers about Flatwoods Ponds and discourage placement of fire lines around Flatwoods Ponds and modification of pond basins.
6. Include the presence of embedded Flatwoods Ponds as a criterion when scoring properties for the LDWF Prescribed Burn Initiatives.

5.2 Prairie Pothole

Rarity Rank: S1

Synonyms: none

Ecological Systems: none

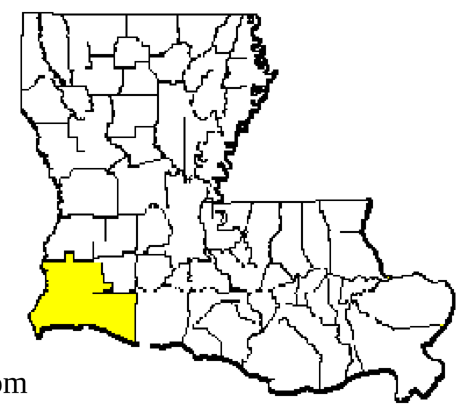
General Description:

This ephemeral pond occurs on the Coastal Prairie landscape in southwest Louisiana. Prairie Potholes are small (often < 1 acre) and circular or elliptic, or sinuous when occupying relict drainage channels winding through a prairie. Prairie Potholes can be well-defined and distinct from the surrounding prairie, or more subtle. Hypotheses for the origin of Prairie Potholes include wind deflation during historical periods of harsh drought, wallowing out by animals such as bison, and fluvial processes. Pothole depth apparently determines vegetation composition, but detailed studies of how vegetation relates to elevation, soils, and hydrology are lacking. Some potholes support freshwater marsh vegetation, with the grass Maidencane (*Panicum hemitomon*) dominating, while others are rich in sedges and rushes.

Prairie Pothole, Calcasieu Parish

Prairie Pothole: Characteristic Plants	
Common Name	**Scientific Name**
Small-Fruited Spike Sedge	*Eleocharis microcarpa*
Square-Stem Spike Sedge	*Eleocharis quadrangulata*
Conecup Spike Sedge	*Eleocharis tuberculosa*
Jointed Rush	*Juncus nodatus*
Cutleaf Watermilfoil	*Myriophyllum pinnatum*
Maidencane	*Panicum hemitomon*
Pickerel Weed	*Pontederia cordata*
Mermaid Weeds	*Proserpinaca palustris* and *P. pectinata*
Clustered Beak Sedge	*Rhynchospora glomerata*
Tall Horned Beak Sedge	*Rhynchospora macrostachya*
Pineland Beak Sedge	*Rhynchospora perplexa*

Current Extent:
Prairie Potholes are very rare on todays landscape, occurring on Coastal Prairie remnants in the rangelands of Calcasieu and Cameron Parishes.



Threats Affecting Habitat:

Prairie Potholes are threatened by disturbance from several human sources, as well as by invasive species, most notably feral hogs.

Prairie Pothole Threats Assessment:			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	N/A	N/A	N/A
Agriculture/Aquaculture	Pervasive	Moderate	Medium
Energy Production & Mining	Restricted	Serious	Medium
Transportation & Service Corridors	Restricted	Moderate	Low
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Restricted	Moderate	Low
Natural System Modification	Small	Slight	Low
Invasive & other Problematic Species	Pervasive	Moderate	Medium
Pollution	Pervasive	Slight	Low
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	Pervasive	Slight	Low
Overall Calculated Threat Impact: Medium			

Habitat Conservation Actions:

1. Conduct studies documenting vegetation composition and structure, relating vegetation to environmental variables.
2. Conduct zoological inventories of this habitat type.
3. Continue working cooperatively with private ranches to implement stewardship on Coastal Prairie rangelands, especially prescribed fire.

5.3 Sparta Sand Pond

Rarity Rank: S1
Synonyms: none
Ecological Systems: none

General Description:

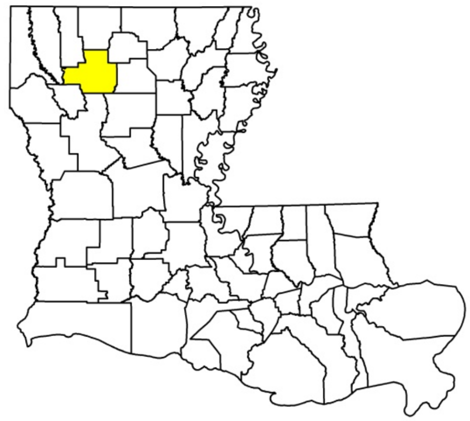
Sand ponds are extremely rare in Louisiana, with only a few known records on the Sparta Formation in Bienville Parish. Sand ponds may be ancient inter-dune depressions which formed in dry shifting sands during historical periods of dry climate. Known examples are wooded, but it is possible this is an artifact of fire exclusion. Black-fruited Spike Sedge is a sand pond specialist, and its presence at one Louisiana sand pond is strong evidence that it is a natural feature.

Sparta Sand Pond, Bienville Parish

Sand Pond: Characteristic Plants	
Common Name	**Scientific Name**
Black-fruited Spike Sedge	*Eleocharis melanocarpa*
Creeping Rush	*Juncus repens*
Swamp Blackgum	*Nyssa biflora*
Warty Panicum	*Panicum verrucosum*
Maryland Meadowbeauty	*Rhexia mariana*
Laurel Oak	*Quercus laurifolia*
Iris-leaf Yellow-eyed-grass	*Xyris laxifolia* var. *iridifolia*

Current Extent and Status:

Sand Ponds are common on sandy formations in Texas, but very rare in Louisiana, where it is restricted to the Sparta Formation. All known occurrences are on forest industry lands.



Threats Affecting Habitat:

Sparta Sand Ponds are apparently naturally rare.
Main threats come from adjacent land uses, and include fire exclusion and woody encroachment on pond margins by planted or volunteering pines. This encroachment likely would have been prevented by frequent fires burning into the edges of Sparta Sand Ponds from adjacent Upland Longleaf Pine Woodland.

Sparta Sand Pond Threats Assessment:

First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	Restricted	Moderate	Low
Agriculture/Aquaculture	Large	Moderate	Medium
Energy Production & Mining	Small	Serious	Low
Transportation & Service Corridors	Small	Moderate	Low
Biological Resource Use	Small	Moderate	Low
Human Intrusion/Disturbance	N/A	N/A	N/A
Natural System Modification	Large	Moderate	Medium
Invasive & other Problematic Species	Pervasive	Serious	High
Pollution	Restricted	Slight	Low
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	Pervasive	Slight	Low
Overall Calculated Threat Impact: Medium			

Habitat Conservation Actions:

1. Continue surveys to determine the extent and condition of this habitat type.
2. Encourage stewardship of sand ponds; beneficial management practices include mechanical or hand removal of woody vegetation on pond margins (especially pines, whose needles acidify the water), and prescribed burning, allowing fires to burn into drawn-down pond edges.

5.4 Macon Ridge Green Ash Pond

Rarity Rank: S1
Synonyms: Spicewood Pond, Spicewood Brake
Ecological Systems: CES203.196 Mississippi River High Floodplain (Bottomland) Forest

General Description:

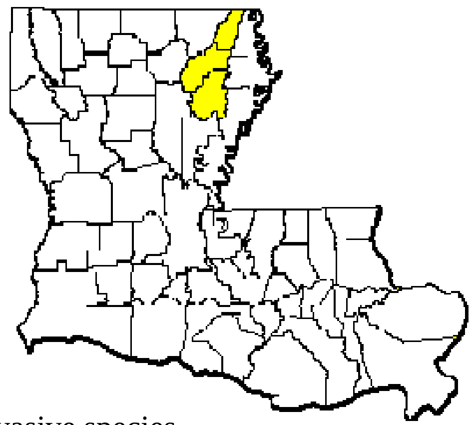
This wooded ephemeral pond type is restricted to Macon Ridge in northeast Louisiana. Macon Ridge Green Ash Ponds are embedded in what was historically Hardwood Flatwoods, and possibly in Mixed Loblolly Pine-Hardwood Forest on higher elevations. On today's landscape, they are often surrounded by agricultural fields. On General Land Office survey records, Macon Ridge Ponds are sometimes referred to as spicewood ponds or spicewood brakes, a possible reference to the aromatic shrub Pondberry (*Lindera melissifolia*), which is federally listed as endangered.

Macon Ridge Green Ash Pond, Franklin Parish

Macon Ridge Pond: Characteristic Plants	
Common Name	**Scientific Name**
Cypress-knee Sedge	*Carex decomposita*
Water Hickory	*Carya aquatica*
Persimmon	*Diospyros virginiana*
Green Ash	*Fraxinus pennsylvanica*
Swamp Cottonwood	*Populus heterophylla*
Overcup Oak	*Quercus lyrata*
Willow Oak	*Quercus phellos*
Black Willow	*Salix nigra*

Current Extent and Status:

Macon Ridge Green Ash Ponds were apparently abundant in pre-settlement times. Many have been lost to agriculture. Faint outlines of ponds in cultivated fields are sometimes evident on aerial imagery. Many ponds were also spared apparently because they were too wet to farm, and are now embedded in agricultural fields.



Threats Affecting Habitat:

Macon Ridge Green Ash Ponds are threatened by invasive species, basin alteration and disturbance, and input of agricultural chemicals from adjacent fields.

Macon Ridge Green Ash Pond Threats Assessment:

First Level Threat	Scope	Severity	Impact
Residential/Commercial Development	Small	Slight	Low
Agriculture/Aquaculture	Restricted	Slight	Low
Energy Production & Mining	Small	Moderate	Low
Transportation & Service Corridors	N/A	N/A	N/A
Biological Resource Use	Restricted	Moderate	Low
Human Intrusion/Disturbance	Restricted	Slight	Low
Natural System Modification	Restricted	Serious	Medium
Invasive & other Problematic Species	Pervasive	Serious	High
Pollution	Large	Slight	Low
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	Pervasive	Slight	Low
Overall Calculated Threat Impact: Medium			

Habitat Conservation Actions:

1. Continue surveys to determine the extent and condition of this habitat type.
2. Conduct zoological inventories for this habitat.
3. Create a set of Best Management Practices (BMPs) for this habitat type, such as use grassland buffers, to filter and reduce agricultural pollutants entering ponds.
4. Work with NRCS to develop conservation initiatives for this ephemeral pond type.

EPHEMERAL POND (ALL TYPES) SGCN (30)		
AMPHIBIANS	Pine Hills Digger	**PLANTS**
Eastern Tiger Salamander	Old Prairie Digger	Black-fruited Spike Sedge
Four-toed Salamander	Flatwoods Digger	Cypress-knee Sedge
Eastern Spadefoot	Sabine Fencing Crawfish	Mrytle Holly
Hurter's Spadefoot	Ouachita Fencing Crawfish	Pineland Yellow-eyed-grass
Ornate Chorus Frog	Caddo Chimney Crawfish	Pondberry
Strecker's Chorus Frog		Sarvis Holly
Southern Crawfish Frog	**INSECTS**	Small's Yellow-eyed-grass
Dusky Gopher Frog	Carolina Spreadwing	
	Creole Pearly Eye	
CRUSTACEANS		
Javelin Crawfish	**REPTILES**	
Flatnose Crawfish	Western Chicken Turtle	
Vernal Crawfish		
Gulf Crawfish		
Twin Crawfish		
Vernal Crawfish		

6. LENTIC WATER BODIES

6.1 Lakes and Reservoirs

Rarity Rank: S3S4
Synonyms: none
Ecological Systems: none

General Description:

Lakes are larger and usually deeper than ponds, but no strict size or depth criteria exist for designating a particular water body as a lake. Natural lakes in Louisiana include oxbows and other floodplain lakes occupying abandoned river channels. Oxbow lakes form when a river meander is cut off and left as free-standing water body; as a result, oxbows are typically U-shaped. Oxbows and other naturally occurring lakes provide valuable fish and wildlife habitat, including multiple SGCN.

Reservoirs are man-made lakes created by impounding streams, and can be relatively small, or up to thousands of acres (e.g. Toledo Bend). The Red River Raft lakes (Lake Bistineau, Caddo Lake, and Cross Lake) were formed by damming of the Red River by the "Great Raft", a massive log jam that persisted for centuries. Following clearing of the Raft in the 19^{th} century, water levels in these lakes fluctuated greatly until control structures were installed. Although reservoirs can and do provide habitat that is utilized by native species, including some SGCN, in some cases it would be desirable to remove impoundments and restore natural hydrology and habitat connectivity. Additionally, the impacts of proposed impoundments should be carefully investigated to avoid damage to natural hydrology and wildlife.

Oxbow Lake associated with Tensas River in Concordia Parish.

Current Extent and Status:

Lakes and reservoirs are common on the landscape. Natural lakes such as oxbows are associated with floodplains of large to moderate-sized rivers. Reservoirs of varying sizes are distributed among all of Louisiana's ecoregions.

LAKE AND RESERVOIR SGCN (16)		
AMPHIBIANS	**CRUSTACEANS**	**PLANTS**
Gulf Coast Waterdog	Teche Painted Crawfish	Cypress-knee Sedge
Red River Mudpuppy		
	REPTILES	
BIRDS	Alligator Snapping Turtle	
Little Blue Heron	Razor-backed Musk Turtle	
Wood Stork	Western Chicken Turtle	
Roseate Spoonbill		
Osprey		
Bald Eagle		
MUSSELS		
Fat Pocketbook		
FISHES		
Gulf Pipefish		
American Eel		
Paddlefish		

Threats Affecting Habitat:

Lakes and Reservoirs area threatened by shoreline residential and commercial development, contamination by agricultural, municipal, and industrial effluents, trash dumping, and Invasive exotic species such as Giant Salvinia (*Salvinia molesta*) and Hydrilla (*Hydrilla verticillata*).

Lakes and Reservoirs Threats Assessment:			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	Large	Serious	High
Agriculture/Aquaculture	N/A	N/A	N/A
Energy Production & Mining	Restricted	Moderate	Low
Transportation & Service Corridors	N/A	N/A	N/A
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Large	Moderate	Medium
Natural System Modification	Restricted	Moderate	Low
Invasive & other Problematic Species	Large	Serious	High
Pollution	Large	Serious	High
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	Small	Slight	Low
Overall Calculated Threat Impact: Medium			

Habitat Conservation Actions:

1. Work with partners to minimize human impacts, such as nutrient loading and other pollution, affecting lakes.
2. Provide education on the limnology, ecology, and wildlife value of all lake types to the public.
3. Provide education regarding the identification and benefits of native aquatic plants and discourage indiscriminant herbicide application and introduction of grass carp.
4. Partner with LDEQ to promote practices such as having updated sewage systems in communities around lakes
5. Promote retention of riparian buffer and submerged woody debris for fish and wildlife species.

6.2 Ponds

Rarity Rank: not ranked
Synonyms: none
Ecological Systems: none

General Description:

Ponds are very frequent on the Louisiana landscape. Most ponds are man-made, created by impounding streams or excavating earth. The typical recreational or farm pond is often relatively “sterile”, being surrounded by anthropogenic habitats such as lawn or pasture. Beaver ponds are small natural ponds that can support open swamp vegetation and recruit freshwater Submersed Aquatic Vegetation (SAV). Such ponds can provide excellent habitat for both fish and wildlife, including SGCN, and may provide refugia during times of drought when associated streambeds are subject to drying. The origins of some ponds on the landscape are not known. An example is Devil’s Lake in Sabine Parish. This lake (pond) is about 1 acre in size and has beaver present. It occupies a depression and the surrounding hills form a natural bottleneck, which possibly contributed to pond formation. Devil’s Lake is fed by a generous amount of seepage from surrounding broad sandy hills. This lake possesses two plants that are very rare west of the Mississippi River, Canby’s Bulrush and Narrow-fruited Horned Beak Sedge. The presence of these two rare plants suggests the lake is possibly on the order of decades old, since recruitment of these species is expected to have taken substantial time given the very small “target” that Devil’s Lake presents. Also, floating mats which support many hillside seepage bog species, including Yellow Trumpet Pitcher Plant, are present. It is possible that there other natural ponds on Louisiana’s landscape that originated by mechanisms other than impoundment by beaver.

Devil’s Lake in Sabine Parish.

Current Extent and Status:

Farm and recreational ponds are scattered across the landscape probably in the thousands. Beaver ponds are generally frequent, though age and degree of development vary greatly. Putatively natural ponds that originated from wind deflation or some other process are apparently rare in Louisiana, but knowledge is greatly lacking.

POND SGCN (11)		
AMPHIBIANS	**INSECTS**	**PLANTS**
Eastern Tiger Salamander	Carolina Spreadwing	Canby's Bulrush
Strecker's Chorus Frog	Creole Pearly Eye	Cypress-knee Sedge
Eastern Spadefoot		Narrow-fruited Horned Beak Sedge
Southern Crawfish Frog		Three-way Sedge
	REPTILES	
	Western Chicken Turtle	

Threats Affecting Habitat:

Most threats affecting ponds operate locally, and include modification of natural ponds (removal of beaver, alteration of basin geometry) and disturbance and pollution from human sources. Invasive exotic species threaten ponds on a larger scale.

<u>**Ponds Threats Assessment:**</u>

First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	N/A	N/A	N/A
Agriculture/Aquaculture	Restricted	Extreme	Medium
Energy Production & Mining	N/A	N/A	N/A
Transportation & Service Corridors	N/A	N/A	N/A
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Restricted	Moderate	Low
Natural System Modification	Restricted	Serious	Medium
Invasive & other Problematic Species	Large	Serious	High
Pollution	Restricted	Extreme	Medium
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	Small	Slight	Low
Overall Calculated Threat Impact: Medium			

Habitat Conservation Actions:

1. Conduct inventories and research to investigate and identify origins of putatively natural isolated ponds.
2. Conduct inventory and research on ponds of all origins to better understand SGCN use, and physical and biological characteristics.
3. Conduct biological inventories and ecological studies of beaver ponds varying in age and degree of development.
4. Provide education on the existence and ecological importance of natural ponds to landowners and the general public.

7. SUBMERSED AQUATIC VEGETATION

Submersed Aquatic Vegetation (SAV) encompasses several associations of submersed aquatic vascular plants. These associations occupy different settings including marine, estuarine, coastal freshwater, and inland freshwater habitats. They are described separately. SGCN for all SAV types combined are presented at the end of this section.

7.1 Marine Seagrass Bed

Rarity Rank: S1

Synonyms: Temperate Grass Flat, Seagrass Bed, Tropical Marine Meadow, Turtlegrass Bed

Ecological Systems: CES203.263 Northern Gulf of Mexico Seagrass Bed

General Description:

This natural community occurs in shallow, relatively clear offshore marine regions with unconsolidated substrate (sand, mud, shell, silt, organic matter). Most benthic "grasses" grow in waters with primarily sand bottoms. Wave action, currents, temperature, salinity, substrate characteristics, and light penetration (turbidity) determine species assemblage. Violent storms may drastically disrupt or alter community structure. Although these grass beds are a relatively small part of the ecosystem in coastal Louisiana, it is believed they play an extremely important role. The actual ecological value of these benthic grass communities is only vaguely understood and may be under-estimated. They are extremely productive communities, often as productive as Salt Marsh. They are known to provide food for a number of animals and act as nursery areas and refugia for the young of many fishes and invertebrates. They support a diverse epiphytic biota, including algae, fungi, bacteria, protozoans, bryozoans, and hydrozoans, thus creating a unique environment that allows for the existence of some indigenous grassbed species. They supply detrital material and nutrients to the water, add oxygen via photosynthesis, and stabilize bottom sediments by increasing sedimentation of suspended particulate matter.

Marine Seagrass Bed: Characteristic Plants	
Common Name	**Scientific Name**
Manatee-grass	*Cymodocea filiformis*
Shoal-grass	*Halodule beaudettei*
Sea-grass	*Halophila englemanii*
Widgeon-grass	*Ruppia maritima*
Turtle-grass	*Thalassia testudinum*

Current Extent and Status:

This habitat is restricted to the Chandeleur Islands, where it is extensive in the clear shallows on the leeward side of the islands.

Threats Affecting Habitat:

While the relatively short-term overall calculated threat impact to Marine SAV is as low, its long-term survival depends on having adequate protection from the Chandeleur Islands, which have degraded in recent decades. Destruction of seagrass by outboard motors is also a threat to this community.

Marine SAV Threats Assessment:

First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	N/A	N/A	N/A
Agriculture/Aquaculture	N/A	N/A	N/A
Energy Production & Mining	Restricted	Extreme	Medium
Transportation & Service Corridors	N/A	N/A	N/A
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Pervasive	Moderate	Medium
Natural System Modification	N/A	N/A	N/A
Invasive & other Problematic Species	N/A	N/A	N/A
Pollution	N/A	N/A	N/A
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	Pervasive	Slight	Low
Overall Calculated Threat Impact: Low			

Habitat Conservation Actions:

1. Determine areal extent of, and map marine SAV at Chandeleur Islands; conduct inventory and monitoring to determine changes in condition and extent over time and to identify emerging threats.
2. Support incorporation of the Chandeleur Islands into the CPRA Master Plan for coastal protection; these islands are biologically valuable and should be a priority for protection.
3. Work with CPRA and other agencies to implement measures to nourish the Chandeleur Islands, such as augmenting sand supply.

7.2 Estuarine Submersed Aquatic Vegetation

Rarity Rank: S1S2; G3G5

Synonyms: none

Ecological Systems Classification: CES203.263 Northern Gulf of Mexico Seagrass Bed
CES203.511 Texas-Louisiana Fresh-Oligohaline Subtidal Aquatic Vegetation

General Description:

These brackish water communities consist of submersed, rooted vascular plants growing in shallow, protected waters with low turbidity. Temperature, salinity (5-10 ppt), substrate, wave action, and light penetration are key factors in determining the composition of the flora and fauna of these beds. Substrate is predominantly sand/mud bottoms. Small scattered beds occur in relative abundance in brackish water ponds throughout coastal Louisiana. More extensive beds are found in the Lake Pontchartrain and Barataria Basins. Although a small component of the larger estuarine ecosystem, these beds play an important ecological role. The beds support a diverse invertebrate and epiphytic population and serve as nursery grounds and shelter for many species of fish and shellfish. Additionally, these beds are extremely productive and release detritus and nutrients to surrounding waters. The beds lack widespread distribution due to the generally turbidity of most of the estuaries in Louisiana. Activities which increase the turbidity in the waters surrounding the sea grass beds are a serious threat to their viability.

Estuarine Submersed Aquatic Vegetation, Lake Pontchartrain

Estuarine Submersed Vascular Vegetation: Characteristic Plants	
Common Name	**Scientific Name**
Eurasian Watermilfoil	*Myriophyllum spicatum* (exotic)
Southern Naiad	*Najas guadalupensis*
Widgeon-Grass	*Ruppia maritima*
Eelgrass	*Vallisneria americana*
Horned Pondweed	*Zannichellia palustris*

Current Extent and Status:

This SAV type occurs in waters subject to occasional salinity pulses in Lake Pontchartrain and several lakes in the Barataria Basin, such as Lake Salvador.

Threats Affecting Habitat:

This habitat faces some threat from various sources of human disturbance, including damage from outboard motors. Alteration in salinity levels due to marsh loss also threatens this habitat.

Estuarine SAV Threats Assessment:

First Level Threat	Scope	Severity	Impact
Residential/Commercial Development	N/A	N/A	N/A
Agriculture/Aquaculture	N/A	N/A	N/A
Energy Production & Mining	Restricted	Extreme	Medium
Transportation & Service Corridors	Restricted	Serious	Medium
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Restricted	Moderate	Low
Natural System Modification	Restricted	Moderate	Low
Invasive & other Problematic Species	N/A	N/A	N/A
Pollution	Large	Slight	Low
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	Pervasive	Slight	Low
Overall Calculated Threat Impact: Low			

Habitat Conservation Actions:

1. Continue surveys to determine the extent and condition of this habitat type; re-visit and evaluate existing occurrences in the LNHP database.
2. Protect this SAV type from damage resulting from boat traffic and development of oil and gas infrastructure.

7.3 River Delta Freshwater Submersed Aquatic Vegetation

Rarity Rank: S3S4
Ecological System: CES203.470 Mississippi Delta Fresh and Oligohaline Tidal Marsh
Synonyms: none

General Description:

Louisiana's two active deltas, the Mississippi River and Atchafalaya Deltas, support extensive SAV beds in shallow water areas. Among the submersed species are also included some floating-leaved species (see table below). As sediments accumulate, this SAV type gives way to the Vegetated Pioneer Emerging Delta habitat. Salinities for this community typically range from 0-5 ppt.

River Delta Submersed Aquatic Vegetation, Atchafalaya Delta WMA

River Delta Freshwater Submersed Vascular Vegetation: Characteristic Plants	
Common Name	**Scientific Name**
Water Star-grass	*Heteranthera dubia*
Eurasian Water Milfoil	*Myriophyllum spicatum* (exotic)
Southern Naiad	*Najas guadalupensis*
Crisped Pondweed	*Potamogeton crispus* (exotic)
Longleaf Pondweed	*Potamogeton nodosus* (floating-leaved aquatic)
Sago Pondweed	*Stuckenia pectinata*

Current Extent and Status:

River Delta SAV beds are associated with the Mississippi and Atchafalaya Deltas. This community can be found on Atchafalaya Delta and Pass-a-Loutre WMAs, as well as Delta NWR.

Threats Affecting Habitat:

This SAV type is threatened by disturbance associated with mineral extraction, canals, and utility corridors including damage from outboard motors. Invasive species pose some threat. Possible increase in frequency and intensity associated with climate change may impair this habitat. Increased salinity due to altered hydrology and marsh loss also threaten this community.

River Delta Freshwater SAV Threats Assessment:			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	N/A	N/A	N/A
Agriculture/Aquaculture	N/A	N/A	N/A
Energy Production & Mining	Large	Slight	Low
Transportation & Service Corridors	Large	Slight	Low
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	N/A	N/A	N/A
Natural System Modification	N/A	N/A	N/A
Invasive & other Problematic Species	Pervasive	Slight	Low
Pollution	N/A	N/A	N/A
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	Pervasive	Moderate	Medium
Overall Calculated Threat Impact: Low			

Habitat Conservation Actions:

1. Conduct studies to determine the areal extent of this SAV type, and address basic ecological questions regarding its development and maintenance.

7.4 Coastal Marsh and Bayou Freshwater Submersed Aquatic Vegetation

Rarity Ranks: S3S4

Synonyms: none

Ecological Systems Classification:

General Description:

Ponds embedded within the Freshwater Marsh, and bayous and canals that traverse Freshwater Marsh areas can all have well-developed SAV beds. There is some species overlap in this type of SAV with estuarine waters, which are fresh or nearly so much of the time (0-5 ppt), and with Interior Freshwater SAV. Floating leaved aquatics such as Water-lilies (*Nymphaea* spp.) are also often conspicuous in Coastal Freshwater SAV.

Current Extent and Status:

This habitat occurs throughout the coastal Freshwater Marshes and interface of Cypress-Tupelo Swamps and Freshwater Marshes. This SAV type develops in natural and man-made water bodies. Exemplary occurrences of this habitat can be found in Lacassine Pool on Lacassine NWR, White Lake Wetlands Conservation Area, and Salvador WMA. Other public lands that support this community include Pass-a-Loutre, Atchafalaya Delta, and Lake Boeuf WMAs as well as Delta NWR.

Coastal Marsh and Bayou Freshwater Submersed Aquatic Vegetation: Characteristic Plants	
Common Name	**Scientific Name**
Snot Plant	*Brasenia schreberi* (floating-leaved aquatic)
Fanwort	*Cabomba caroliniana*
Coontail	*Ceratophyllum demersum*
Hydrilla	*Hydrilla verticillata* (exotic)
Southern Naiad	*Najas guadalupensis*
American Lotus	*Nelumbo lutea*
Water-Lillies	*Nymphaea elegans, mexicana, odorata* (floating-leaved aquatics)
Small Pondweed	*Potamogeton pusillus*
Common Bladderwort	*Utricularia macrorhiza*
Purple Bladderwort	*Utricularia purpurea*
Eelgrass	*Vallisneria americana*

Threats Affecting Habitat:

Several human sources of disturbance, invasive exotic species, and possible effects of climate change, including possible increase in tropical storm frequency and intensity, potentially threaten this habitat.

Coastal Marsh and Bayou SAV Threats Assessment:			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	N/A	N/A	N/A
Agriculture/Aquaculture	N/A	N/A	N/A
Energy Production & Mining	Restricted	Slight	Low
Transportation & Service Corridors	Large	Slight	Low
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Large	Slight	Low
Natural System Modification	Restricted	Moderate	Low
Invasive & other Problematic Species	Large	Moderate	Medium
Pollution	Large	Slight	Low
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	Large	Moderate	Medium
Overall Calculated Threat Impact: Low			

Habitat Conservation Actions:

1. Continue biological inventory and research of this SAV type.
2. In impounded marshes, encourage water management regimes that benefit this SAV type and prevent invasion by emergent plant species and converesion to marsh.
3. Protect this SAV type from threats posed by boat traffic and development of oil and gas infrastructure.

7.5 Interior Freshwater Submersed Aquatic Vegetation

Rarity Ranks: S2S4

Ecological Systems Classification:

Synonyms: none

General Description:

Freshwater SAV in interior Louisiana is highly variable, and can occupy swamp lakes (e.g. oxbows), reservoirs (especially upper ends), sluggish bayous, beaver ponds, and small farm ponds. The benefits of SAV include oxygenation of water, habitat structure for all forms of aquatic life (e.g. shade for fish), and a basis for aquatic food webs that benefits all wildlife associated with a particular SAV occurrence. The details of formal recognition of individual occurrences of this type of SAV have not been determined. For example, a small patch of Coontail in a farm pond does not provide the same quantity and quality of habitat as a floodplain lake supporting abundant SAV consisting of multiple species. Aquatic plants have good dispersal abilities, and can be quickly recruited in a water body lacking aquatic vegetation at some point in time. Older, better developed, and species rich (with natives) SAV beds are of particular interest for conservation and protection.

Interior Freshwater Submersed Aquatic Vegetation: Characteristic Plants	
Common Name	**Scientific Name**
Snot Plant	*Brasenia schreberi* (floating-leaved aquatic)
Fanwort	*Cabomba caroliniana*
Coontail	*Ceratophyllum demersum*
Hydrilla	*Hydrilla verticillata* (exotic)
American Lotus	*Nelumbo lutea* (floating-leaved aquatic)
White Water-Lily	*Nymphaea odorata* (floating-leaved aquatic)
Waterthread Pondweed	*Potamogeton diversifolius* (floating-leaved aquatic)
Inflated bladderwort	*Utricularia inflata*

Current Extent and Status:

This habitat occurs statewide in a variety of water bodies. Areal extent, degree of development, and plant species richness vary widely. Public lands that support this community include Pass-a-Loutre, Atchafalaya Delta, Salvador, and Lake Boeuf WMAs.

Threats Affecting Habitat:

Interior Freshwater SAV is threatened in some cases by habitat instability, and by invasive plants.

Interior Freshwater SAV Threats Assessment:			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	N/A	N/A	N/A
Agriculture/Aquaculture	N/A	N/A	N/A
Energy Production & Mining	N/A	N/A	N/A
Transportation & Service Corridors	N/A	N/A	N/A
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	N/A	N/A	N/A
Natural System Modification	Small	Serious	Low
Invasive & other Problematic Species	Large	Moderate	Medium
Pollution	Restricted	Moderate	Low
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	Pervasive	Slight	Low
Overall Calculated Threat Impact: Low			

Habitat Conservation Actions:

1. Continue surveys to document and describe exemplary occurrences of this SAV type.
2. Produce literature explaining the benefits of SAV and presenting information on the identification of aquatic plants.
3. Produce and distribute a poster series highlighting Interior Freshwater SAV habitat and associated native and exotic submersed aquatic plants.
4. Continue to invest in cleaning stations at boat ramps to limit the spread of invasive exotic aquatic plants.

SUBMERSED AQUATIC VEGETATION (ALL TYPES) SGCN (32)

BIRDS	**MAMMALS**	**PLANTS**
Mottled Duck	West Indian Manatee	**Marine SAV**
Northern Pintail		Gulf Halophila
Canvasback	**MOLLUSKS**	Manatee-grass
Redhead	Bay Scallop	Piedmont Halodule
Lesser Scaup	Sawtooth Pen Shell	Turtle-grass
	Half-Naked Pen Shell	
FISHES	Channeled Whelk	**Estuarine SAV**
Gulf Pipefish	Lightning Whelk	Clasping-leaf Pondweed
Chain Pipefish		
Opossum Pipefish	**REPTILES**	**Freshwater SAV**
Texas Pipefish	Green Sea Turtle	Blue Water Lily
Dwarf Seahorse	Kemp's Ridley Sea Turtle	Loose-flowered Watermilfoil
	Loggerhead Sea Turtle	Nuttall's Pondweed
	Atlantic Hawksbill Sea Turtle	Slim Spike Sedge
	Leatherback Sea Turtle	Yellow water-crowfoot

8. SUBTERRANEAN HABITAT

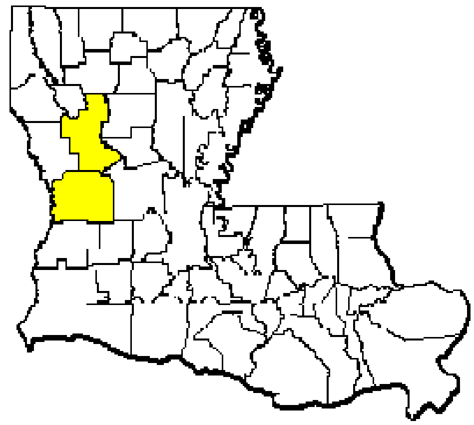
8.1 Cave
Rarity Rank: S1
Synonyms: none
Ecological Systems: none

General Description:
Caves are large air-filled subterranean cavities with openings to the surface. Caves are very rare in west-central Louisiana where they are associated with sandstone strata of the Catahoula Formation. Louisiana's caves are very poorly developed and of limited extent. A few human-created cave systems also exist, which provide the same habitat as do natural caves.

Wolf Cave, Vernon Parish, LA

Current Extent and Status:

There are five known caves in Louisiana, all found on public lands.



CAVE SGCN (2)
MAMMALS
Eastern Pipistrelle
Northern Long-eared Bat

Threats Affecting Habitat:

Caves are threatened by vandalism and by human disturbance.

Caves Threats Assessment:			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	N/A	N/A	N/A
Agriculture/Aquaculture	N/A	N/A	N/A
Energy Production & Mining	N/A	N/A	N/A
Transportation & Service Corridors	N/A	N/A	N/A
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Restricted	Moderate	Low
Natural System Modification	N/A	N/A	N/A
Invasive & other Problematic Species	N/A	N/A	N/A
Pollution	Restricted	Slight	Low
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	N/A	N/A	N/A
Overall Calculated Threat Impact: Low			

Habitat Conservation Actions:

1. Close caves to the public; install gates if warranted
2. Conduct zoological surveys of Louisiana caves, especially for bats and insects.

9. GEOLOGIC FEATURE

9.1 Barrier Island

Rarity Rank: S1/N/A
Synonyms: None
Ecological Systems:
CES203.469 Louisiana Beach
CES203.471 Southeastern Coastal Plain Interdunal Wetland

General Description:

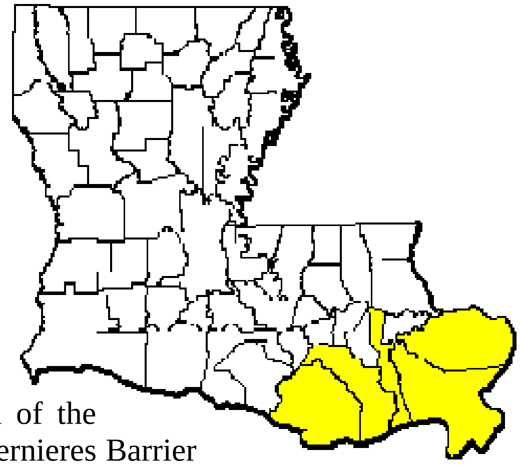
Barrier islands in Louisiana are old shorelines of abandoned, eroding deltas of the Mississippi River. Louisiana's barrier islands are important foraging, loafing, breeding, and nesting habitat for migratory shorebirds and colonial nesting waterbirds. The islands are not classified as a single natural community, because they are comprised of several habitat types including: Coastal Dune Grasslands, Coastal Dune Shrub Thickets, Coastal Mangrove-Marsh Shrubland, and Louisiana Beach. Marine Submergent Aquatic Vegetation also occurs in Chandeleur Sound immediately behind the Chandeleur Islands. 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 Cord Grass on the sheltered bayside areas.

Timbalier Island in the Terrebonne Barrier Islands.

Brown Pelicans nesting among Black Mangrove on Raccoon Island.

__Current Extent and Status:__

Since deltaic processes have been altered due to leveeing of the Mississippi River, no new barrier islands are expected to form. Major efforts are underway to rebuild and preserve remaining islands. These efforts include using breakwaters to buffer wave action, pumping sand on to beaches and dunes, creating back-barrier marsh platforms, and the use of sand fencing and vegetative planting to anchor sand and stabilize the substrate.



The current major barrier islands include the Chandeleur Island chain, Grand Isle, the Grand Terres, Timbalier Islands, and Isle Dernieres. Much of the Chandeleur chain is captured by Breton NWR. Isle Dernieres Barrier Islands Refuge, managed by LDWF, includes Wine, Whiskey, Trinity, and Raccoon Islands. Grand Isle is the only inhabited barrier island, and as a result, much of the natural habitat has been destroyed.

Barrier Island SGCN (60)

BIRDS
Mottled Duck
Redhead
Lesser Scaup
Brown Pelican
Reddish Egret
Little Blue Heron
Glossy Ibis
Roseate Spoonbill
Clapper Rail
Snowy Plover
Wilson's Plover
Piping Plover
American Oystercatcher
Long-billed Curlew
Marbled Godwit
Red Knot
Dunlin
Short-billed Dowitcher
Sooty Tern
Interior Least Tern
Coastal Least Tern
Gull-billed Tern
Caspian Tern
Common Tern
Forster’s Tern
Royal Tern
Sandwich Tern
Black Skimmer
Short-eared Owl
Peregrine Falcon
Marsh Wren
Nelson’s Sparrow
Seaside Sparrow

CRUSTACEANS
Beach Ghost Shrimp
Carolinian Ghost Shrimp

INSECTS
Eastern Beach Tiger Beetle
Obscure Skipper
Eastern Pygmy Blue
Monarch
Louisiana Eyed Silkmoth

MOLLUSKS
Bay Scallop
Sawtooth Pen Shell
Half-Naked Pen Shell
Channeled Whelk
Lightning Whelk

REPTILES
Loggerhead Sea turtle
Atlantic Hawksbill Sea Turtle
Kemp's Ridley Sea turtle
Leatherback Sea turtle
Mississippi Diamond-backed Terrapin
Green Sea Turtle
Eastern Glass Lizard
Gulf Saltmarsh Snake

PLANTS
Canada Spike Sedge
Inkberry
Sand Dune Spurge
Sand Rose-Gentian
Saw Palmetto (relict barrier islands)
Scaevola
Sea Oats
Southern Hairgrass

Threats Affecting Habitat:

Barrier Islands are threatened by habitat destruction and disturbance from human interface, subsidence, inadequate sand supply, and potentially by increased frequency and intensity of tropical storms associated with climate change.

Barrier Island Threats Assessment:			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	Restricted	Slight	Low
Agriculture/Aquaculture	N/A	N/A	N/A
Energy Production & Mining	Restricted	Extreme	Medium
Transportation & Service Corridors	Restricted	Extreme	Medium
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Large	Serious	High
Natural System Modification	Pervasive	Serious	High
Invasive & other Problematic Species	Large	Serious	High
Pollution	Pervasive	Slight	Low
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	Pervasive	Moderate	Medium
Overall Calculated Threat Impact: Very High			

Habitat Conservation Actions:

1. Partner with state and federal agencies, NGOs, private landowners, etc. to implement the Coastal Master Plan and to promote the protection and restoration of barrier islands (including Isle Dernieres Refuge and the Chandeleur Islands) to benefit species of conservation concern.
2. Work with local governing boards to recommend limits on vehicle use on undeveloped portions of barrier islands.
3. Work with NRCS Plant Materials Center to provide native ecotypes for barrier island restoration efforts.

10. ANTHROPOGENIC HABITATS

10.1 Agriculture and Improved Pasture (excluding rice)

Rarity Rank: N/A
Synonyms: None
Ecological Systems: None

General Description:

This is a general category encompassing 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:

Cotton field, Rapides Parish

- Scattered woody and herbaceous vegetation such as orchards (pecan, citrus, etc.), vineyards, experimental plots, plant nurseries, and roadway rights-of-way.
- Row and cover crops consisting of various grain crops, cotton, sweet potatoes, soybeans, 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.
- Pastures dominated by turf grasses such as Bermuda Grass (*Cynodon dactylon*) used both for ungulate grazing, hay fields, or sod farms.
- Rangelands on previously plowed land receiving minimal management inputs and supporting a variable mix of grasses and forbs, usually "low-end" forage grasses such as Old Field Broomsedge (*Andropogon virginicus*) and Smut Grass (*Sporobolus indicus*).

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 with changing agricultural practices (i.e., "clean" agricultural practices), and larger tracts were put in agricultural production, the habitat quality on the landscape declined for many species of wildlife. This is particularly true for resident and breeding edge/grassland species such as Northern Bobwhite, Eastern Bluebirds, Dickcissels, and many species of sparrows. In addition, the value of this habitat for birds migrating across these habitats has diminished. Broad-spectrum pesticides that are systemic in plant tissues (e.g. Neonicotinoids) have been implicated in negatively impacting native insects that utilize agricultural lands, including important pollinators such as bees and butterflies.

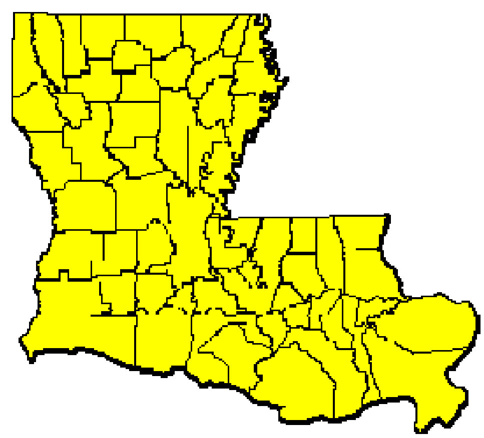
Within this habitat type, there may be patches of “natural” habitat such as vegetated streamsides, embedded wetlands, and small blocks of forest which can serve as important breeding, dispersal, and travel corridors when sufficiently large for various wildlife species. Farm Bill programs such as CRP and WRP have paid landowners to set aside or retire portions of farmland. Lands susceptible to erosion or farmed wetlands, lands on which yields are variable or unreliable, are typically enrolled and are usually planted in native vegetation that was histroically indigenous. Young planted Bottomland Hardwood Forest (early successional) is heavily used by grassland Neotropical migrants and later by American Woodcock. Whereas no SGCN are fully dependent upon these habitats for survival, these systems often support some of the highest concentrations of these resident and migratory species and will likely become increasingly important for these animals as climate change and urbanization claim otherwise suitable habitat.

Grain crops can support the highest populations of Northern Bobwhite and wintering sparrows when appropriate field borders are incorporated into the farming operation. Rain-flooded (harvested or unharvested) grain fields also provide valuable foraging habitat for wintering ducks, coots, and geese. Post-harvested or tilled grain fields, where rain has flooded shallowly, will be used by shorebirds. Dry harvested fields are primary feeding areas for wintering geese.

In fragmented habitats, conservation features on agricultural lands may serve to connect patches of natural habitat. Irrigation ditches are heavily used by wading birds, some marsh birds, and crustaceans. Fencerows serve as breeding sites for some songbirds and impaling stations for loggerhead shrikes. Wooded drainages can serve as travel corridors for migratory birds and mammals, especially Louisiana Black Bear.

Current Extent and Status:

There are approximately 8.1 million acres of farm land in Louisiana (Farmland Information Center 2013). Working agricultural landscapes can be greatly enhanced with proper planning. The 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. Programs such as CRP, WRP, and EQIP provide cost-share, incentive payments, or both to qualified participants. Invasive species such as *Triadica sebifera* (Chinese Tallow Tree) can be a problem on areas where no management is conducted.



Agriculture and Improved Pasture (excluding rice) SGCN (59)

AMPHIBIANS
Strecker's Chorus Frog
Southern Crawfish Frog

BIRDS
Northern Bobwhite
White-tailed Kite
American Woodcock
Short-eared Owl
Crested Caracara
Southeastern American Kestrel
Loggerhead Shrike
Sedge Wren
Sprague's Pipit
Field Sparrow
Lark Sparrow
Grasshopper Sparrow
Le Conte's Sparrow
Nelson's Sparrow
Painted Bunting
Dickcissel
Rusty Blackbird

CRUSTACEANS
Javelin Crawfish
Vernal Crawfish
Twin Crawfish
Gulf Crawfish
Old Prairie Digger
Flatwoods Digger
Sabine Fencing Crawfish
Ouachita Fencing Crawfish
Caddo Chimney Crawfish
Flatnose Crawfish

INSECTS
Texas Brown Tarantula
Comanche Harvester Ant
Florida Harvester Ant
American Bumblebee
Wild Indigo Duskywing
Cobweb Skipper
Dusted Skipper
Yucca Giant Skipper
Monarch
Pineland Noctuid Moth
Falcate Orangetip
Little Metalmark
Creole Pearly Eye

MAMMALS
Southeastern Shrew
Southeastern Myotis
Northern Long-eared Bat
Big Brown Bat
Rafinesque's Big Eared Bat
Eastern Pipistrelle
Bachman's Fox Squirrel
Baird's Pocket Gopher
Oak Ridge Pocket Gopher
Eastern Harvest Mouse
Northern Pygmy Mouse
Golden Mouse
Louisiana Black Bear
Long-tailed Weasel
Eastern Spotted Skunk

REPTILES
Gopher Tortoise
Western Slender Glass Lizard
Western Worm Snake
Common Rainbow Snake
Eastern Hog-nosed Snake
Louisiana Pine Snake

Habitat Conservation Actions:

1. Encourage planting of native species along field borders and filter strips to create habitat and improve connectivity for wildlife species (CRP practice CP33).
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 promote management to maintain these habitats.
3. Encourage management of fallow fields to maintain early successional habitat and to prevent invasion of woody vegetation and invasive species.

4. Target permanently fallowed agricultural fields for habitat stewardship opportunities to maintain grassland habitat and prevent dominance by feral woody vegetation.
5. Encourage management for and/or planting of native grasses and forbs and proper timing of mowing and haying to prevent destruction of burrows and nests in grasslands and rights-of-way. Many utility rights-of-way support the native groundcover which is often absent or weak in adjacent densely stocked, often anthropogenic, forests.
6. Encourage use of more pest-specific pesticides, and pesticides that are not systemic in plant tissues.
7. 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.
8. Provide landowners with information on federal/state incentive programs through LDWF programs, and NRCS, to promote best management practices on working lands
9. Continue to coordinate with NRCS on development of practices via the Farm Bill that are beneficial for SGCN.
10. Continue to participate in NRCS state technical advisory committee (TAC) as well as annual meetings with NRCS.

10.2 Rice Agriculture and Aquaculture

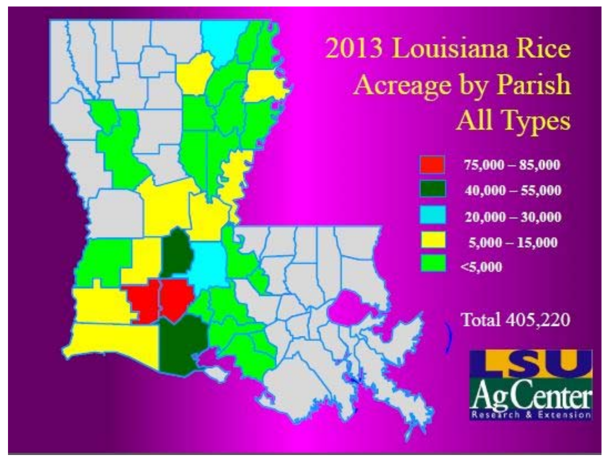
Rarity Rank: N/A
Synonyms: None
Ecological Systems: None

General Description:

This anthropogenic habitat encompasses rice agriculture, crawfish ponds, and catfish and baitfish ponds. Rice fields are fields of annual grasses and forbs, shallowly flooded for substantial portions of the year, and dry during periods of active rice cultivation and harvest. Both before and during spring rice planting, bare fields and mudflats provide foraging grounds for numerous species of wading birds and northbound shorebirds. These birds feed on rice and weed seed, aquatic invertebrates, and green shoots. Fields with growing rice are then flooded where they provide nesting and brood rearing cover for resident waterfowl (Mottled Duck, Black-bellied Whistling Duck and Fulvous Whistling Duck), secretive marshbirds (King and Yellow Rail, Least Bittern, Purple Gallinule, Common Moorhen), and shorebirds (Black-necked Stilt). Vegetated rice levees may be used as nest sites by some of these species. The fields are drained in summer for harvest, at which point they are either left fallow, burned, rolled, or disked and sometimes flooded in late fall to suppress weed growth. These flooded fields are also regularly used for waterfowl hunting. Alternatively, after the first harvest, fields in the southern regions may be again flooded to grow a second “ratoon”, or volunteer crop which is harvested later. Rice is often cultivated in rotation with soybeans or sorghum or left fallow. Rice can also be rotated with crawfish. For crawfish production, a forage crop is grown during the summer (often rice, sorghum, or volunteer wetland vegetation). Rather than a shallow flood, crawfish production requires deeper water (up to 24 in.) during the winter. These fields are used extensively by wading birds, waterfowl, and other water birds such as grebes and coots. Eagles and other raptors are often associated with crawfish and rice aquaculture landscapes due to the abundance of potential prey. Crawfish ponds typically retain water until harvest ends in June, at this point water is drawn down for summer management and planting. The resulting mudflats are used by resident shorebirds, but this drawdown schedule is too late for northbound shorebirds and too early for southbound migrants. However, these summer drawdowns also concentrate aquatic prey into the shallow pools that persist due to elevation differences. Egrets, herons, ibis, spoonbills, and Wood Storks, amongst others, exploit this optimal foraging opportunity. Rice is often grown in crawfish ponds. Flooded rice fields and crawfish ponds are extremely important to shorebirds, wading birds, and waterfowl and are integral components of the Lower Mississippi Valley Joint Venture (LMVJV) and Gulf Coast Joint Venture (GCJV) plans for meeting the present and future nutritional needs of these avian guilds. The expansion of sugarcane into the rice (formerly coastal prairie) region of southwest Louisiana has reduced the value of much agricultural land in the region for wildlife, particularly waterbirds.

Current Extent and Status:

In 2013, Louisiana had 405,220 acres of rice. Louisiana has about 120,000 acres of crawfish ponds.



Rice Agriculture and Aquaculture SGCN (39)	
AMPHIBIANS	Interior Least Tern
Southern Crawfish Frog	Coastal Least Tern
	Gull-billed Tern
BIRDS	Caspian Tern
Mottled Duck	Forster's Tern
Northern Pintail	Short-eared Owl
Canvasback	Crested Caracara
Redhead	Peregrine Falcon
Lesser Scaup	Loggerhead Shrike
Wood Stork	Sedge Wren
American Bittern	Marsh Wren
Least Bittern	Sprague's Pipit
Little Blue Heron	Le Conte's Sparrow
Glossy Ibis	Nelson's Sparrow
Roseate Spoonbill	
Osprey	**REPTILES**
Bald Eagle	Western Chicken Turtle
Yellow Rail	
King Rail	
Sandhill Crane	
Whooping Crane	
Upland Sandpiper	
Hudsonian Godwit	
Dunlin	
Buff-breasted Sandpiper	
Short-billed Dowitcher	

Habitat Conservation Actions:

1. Encourage planting of native prairie species along field borders and filter strips to create habitat and improve connectivity for wildlife species.
2. Encourage management of ditches and canals associated with rice and aquaculture that favors development of emergent aquatic and wetland plants, as opposed to herbiciding ditches and canals to bare mud.
3. Encourage use of more pest-specific pesticides, and pesticides that are not systemic in plant tissues.
4. Pursue acquisition of large areas rice and crawfish ponds from willing sellers within the coastal prairie region for re-establishment native grassland/wetland complexes.
5. Assist rice/crawfish producers in replacement of degrading infrastructure projects (levees/water control structures) to ensure working wetlands persist as opposed to being converted to dry land row crops (e.g., sugarcane).
6. When possible, encourage the provision of mudflat habitat in crawfish ponds for some portion of time in late summer (July-September) for southbound migrating shorebirds. This can be accomplished by either delaying the drawdown of water until later or disking and shallowly flooding dry fields during this time. Similar practices are implemented for the NRCS's

Migratory Bird Habitat Initiative (MBHI). Shallowly flooded mudflat habitat is fairly abundant and reliable on rice fields before and during spring planting but summer-fall habitat is lacking.

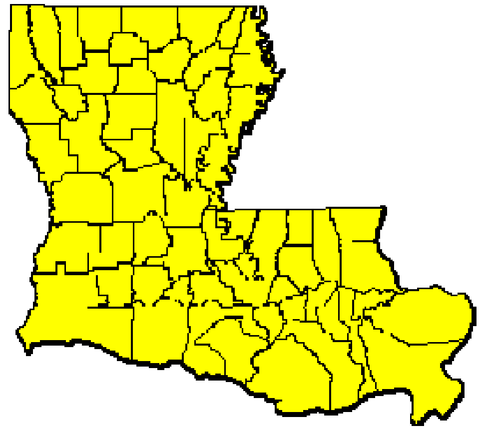
10.3 Pine Plantation
Rarity Rank: N/A
Synonyms: Loblolly Pine Plantation, Slash Pine Plantation
Ecological Systems: None

General Description:

Pine Plantation is a general category encompassing single species or homogenous plantings typically for the purposes of commercial timber production. In Louisiana, both Loblolly Pine (*Pinus taeda*) and Slash Pine (*Pinus elliotii*) plantations are common, depending on geographic location. Loblolly pine is planted most often by industrial and non-industrial private landowners throughout the West and East Gulf Coastal Plains for timber production due to its productivity and adaptability to a wide range of site conditions. Slash Pine is better suited for wetter site conditions and is usually grown in southwest Louisiana. Most pine plantations are managed similarly for production of various wood products. These include many types of paper and packing products, fuel wood pellets, utility poles and piling, structural lumber, and engineered wood products. Demand for these products over the last several decades have driven the expansion of pine plantations to replace many other habitat types on private lands across the state. Pine plantation management generally includes intensive site preparation, high planting densities, one or more herbicide treatments, and multiple thinnings. Stands are usually regenerated by clear-cut harvest and re-planting at a rotation age of 25-30 years.

While some species of wildlife utilize pine plantations, overall this habitat type is not as beneficial as other habitat types in the Gulf Coastal Plain such as more open, grassy longleaf and shortleaf pine savannas and woodlands that historically dominated the landscape. Pine plantations have less plant species diversity in both the forest canopy and understory as a result of single species planting, high stocking (dense shading), more intensive use of herbicides, and exclusion of prescribed fire. Species diversity and diverse habitat structure are important for numerous species of birds and other wildlife. Habitat quality in pine plantations can greatly be improved by a few modifications to management regimes. Implementing site specific herbicide prescriptions for site preparation and mid-rotation treatments can help maintain structure and plant diversity for wildlife while decreasing competition and controlling invasive species. Thinning at regular intervals and implementing prescribed burning programs on many of these sites will provide improved understory conditions for many wildlife species.

Current Extent and Status:



Pine plantations can be found throughout the Gulf Coastal Plain of Louisiana. In addition, some portions of the Macon ridge have been afforested to this habitat type. Over the years, Farm Bill programs such as the Conservation Reserve Program have incentivized the establishment on pine plantations as a soil conservation measure. This habitat type is also preferred by forest industry and non-industrial private landowners as a means to maximize commercial timber production and derive revenue from their lands. There are also numerous programs which cost-share management activities such as site preparation, tree planting, invasive species control, and prescribed burning in these habitat types for private landowners.

Pine Plantation SGCN (79)

AMPHIBIANS
Eastern Tiger Salamander
Ornate Chorus Frog
Strecker's Chorus Frog
Southern Crawfish Frog
Eastern Spadefoot
Hurter’s Spadefoot
Dusky Gopher Frog

CRUSTACEANS
Flatwoods Digger
Pine Hills Digger

REPTILES
Western Slender Glass Lizard
Gopher Tortoise
Western Chicken Turtle
Eastern Diamond-backed Rattlesnake
Eastern Glass Lizard
Coal Skink
Mole Kingsnake
Louisiana Pine Snake
Black Pine Snake
Pine Woods Littersnake

Le Conte's Sparrow
Nelson’s Sparrow
Painted Bunting
Dickcissel
Rusty Blackbird

INSECTS
Texas Brown Tarantula
American Bumblebee
Wild Indigo Duskywing
Cobweb Skipper
Dusted Skipper
Yucca Giant Skipper
Pineland Noctuid Moth
Falcate Orangetip
Little Metalmark
Creole Pearly Eye
Yellow Brachycercus Mayfly
Texas Emerald
Comanche Harvester Ant
Florida Harvester Ant
Frosted Elfin
Little Metalmark
Georgia Satyr
Mottled Duskywing

Southeastern Crowned Snake Harlequin Coralsnake Timber Rattlesnake Eastern Hog-Nosed Snake **BIRDS** Northern Bobwhite White-tailed Kite Bald Eagle American Woodcock Greater Roadrunner Chuck Will's Widow Chimney Swift Red-headed Woodpecker Red-cockaded Woodpecker Southeastern American Kestrel Loggerhead Shrike Brown-headed Nuthatch Sedge Wren Prairie Warbler Bachman's Sparrow Field Sparrow Lark Sparrow Grasshopper Sparrow Henslow's Sparrow	Dusky Roadside Skipper Meske's Skipper Strecker's Giant Skipper Monarch **MAMMALS** Southeastern Shrew Bachman's Fox Squirrel Baird's Pocket Gopher Oak Ridge Pocket Gopher Eastern Harvest Mouse Golden Mouse Louisiana Black Bear Long-tailed Weasel Eastern Spotted Skunk Ringtail

Habitat Conservation Actions:

1. Promote multiple-use management (wildlife and timber) within this habitat type.
2. Provide education/ outreach opportunities to landowners on the benefits and methods of managing these habitat types for wildlife.
3. Promote site specific herbicide prescriptions for site preparation and mid-rotation treatments that can maintain structure and plant diversity for wildlife while decreasing competition and controlling invasive species.
4. Promote thinning at regular intervals followed by application of prescribed burning within these habitat types.
5. Promote federal/state incentive programs such as the Environmental Quality Incentives Program, Conservation Reserve Program, Conservation Stewardship Program, Working Lands for Wildlife Program, Forest Productivity Program, and others that provide cost-share assistance for management activities in pine plantations.

6. Consider targeting areas at high risk to urban development with conservation easements to maintain these areas in working forestlands.

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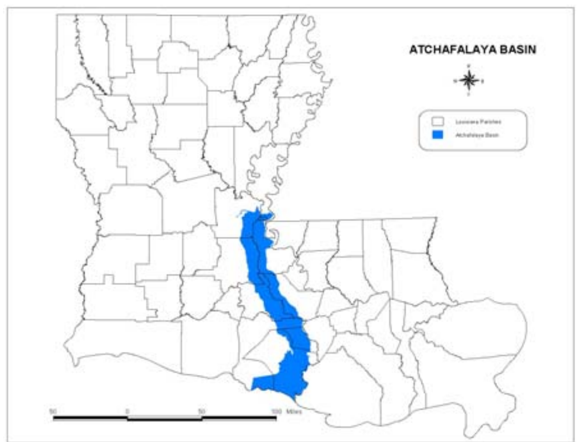
11. River Basins

11.1 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 the combined Red and Mississippi River flow down through the Atchafalaya Basin (LDEQ 1993). A unique feature of the Atchafalaya Basin system is that it supplies sediment for one of the last active river delta systems in the state, with delta formation at the Wax Lake and main Atchafalaya River outlets (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 and extensive oyster reefs which become productive during periods of low river flow.

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 2012 Water Quality Inventory Report (LDEQ 2012) indicated that 50% of the 12 water body subsegments within the basin were fully supporting their designated use for fish and wildlife propagation. The suspected causes for these water quality problems include: fecal coliform bacteria, suspended solids, mercury, turbidity, non-native aquatic invasive plants, and low concentration of dissolved oxygen.

ATCHAFALAYA BASIN SGCN (50)	
AMPHIBIANS	**MARINE FISH**
Red River Mudpuppy	Saltmarsh Topminnow
	Bayou Killifish
CRUSTACEANS	Diamond Killifish
Estuarine Ghost Shrimp	Chain Pipefish
	Opossum Pipefish
	Emerald Sleeper
FRESHWATER FISH	Violet Goby
Pallid Sturgeon	Broad Flounder
Shovelnose Sturgeon	Large-scaled Spinycheek Sleeper
Paddlefish	Tarpon
American Eel	Frillfin Goby
Central Stoneroller	Smalltooth Sawfish
Bluntface Shiner	Southern Puffer
Clear Chub	Lemon Shark
Sturgeon Chub	
Shoal Chub	**MOLLUSKS**
Sicklefin Chub	Southern Hickorynut
Longjaw Minnow	Louisiana Pigtoe
Ironcolor Shiner	Round Pearlshell
Chub Shiner	Fawnsfoot
Bluehead Shiner	
Blue Sucker	**REPTILES**
Gulf Pipefish	Loggerhead Seaturtle
Rainbow Darter	Green Seaturtle
Western Sand Darter	Atlantic Hawksbill Seaturtle
Saddleback Darter	Kemp's Ridley Seaturtle
	Alligator Snapping Turtle
	Leatherback
	Western Chicken Turtle
	Ouachita Map Turtle
	Mississippi Diamond-backed Terrapin
	Razor-backed Musk Turtle
	Gulf Saltmarsh Snake

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.

Atchafalaya Basin Threats Assessment:			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	Small	Moderate	Low
Agriculture/Aquaculture	Restricted	Moderate	Low
Energy Production & Mining	Restricted	Moderate	Low
Transportation & Service Corridors	Small	Moderate	Low
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Small	Moderate	Low
Natural System Modification	Pervasive	Serious	High
Invasive & other Problematic Species	Pervasive	Serious	High
Pollution	Large	Moderate	Medium
Geological Events	Small	Slight	Low
Climate Change & Severe Weather	Restricted	Slight	Low
Overall Calculated Threat Impact: Low			

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. Coordinate with Atchafalaya Basin Program (LDNR) and BTNEP to address threats to this basin.
6. Complete a comprehensive survey of oyster reef/hard bottom habitat acreage within the system.

11.2 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. Freshwater input sources include local precipitation, minor inflow from the Greater Intracoastal Waterway (LaCoast 2005) and freshwater diverted from the Mississippi River, when possible, at sites such as Davis Pond and Naomi. Wetland loss due to coastal erosion is a major environmental issue affecting the basin, although many coastal restoration projects have been planned to address land loss in the area (CPRA 2012).

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. This basin is one of the most productive coastal Louisiana areas for commercial shrimp and oyster harvest. Recreational activities include fishing, hunting, bird watching, swimming, and boating.

Water Quality:

The 2012 Water Quality Inventory Report (LDEQ 2012) indicated that 11% of the 27 water body subsegments within the basin were fully supporting their designated use for fish and wildlife propagation. The suspected causes for these water quality problems include: nitrates and nitrites, non-native aquatic invasive plants, fecal coliform bacteria, 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.

BARATARIA BASIN SGCN (32)	
CRUSTACEANS	**MARINE FISH**
Beach Ghost Shrimp	Saltmarsh Topminnow
Carolinian Ghost Shrimp	Bayou Killifish
Peppermint Shrimp	Diamond Killifish
Estuarine Ghost Shrimp	Chain Pipefish
	Opossum Pipefish
FRESHWATER FISH	Emerald Sleeper
Paddlefish	Violet Goby
Broadstripe Topminnow	Broad Flounder
Gulf Pipefish	Large-scaled Spinycheek Sleeper
American Eel	Tarpon
	Frillfin Goby
	Smalltooth Sawfish
	Southern Puffer
	Dwarf Seahorse
	Lemon Shark
	MOLLUSKS
	Round Pearlshell
	REPTILES
	Loggerhead Seaturtle
	Green Seaturtle
	Atlantic Hawksbill Seaturtle
	Kemp’s Ridley Seaturtle
	Alligator Snapping Turtle
	Leatherback
	Mississippi Diamond-backed Terrapin
	Gulf Saltmarsh Snake

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.

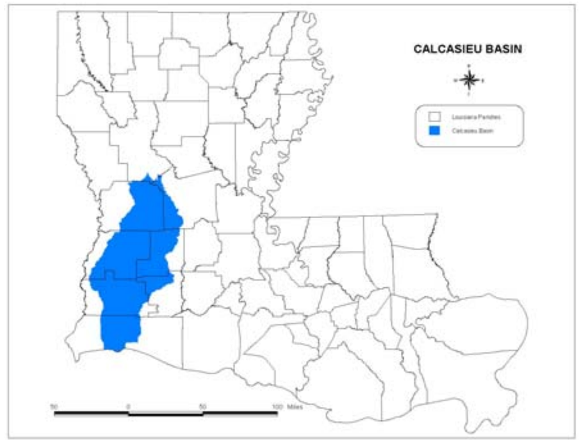
Barataria Basin Threats Assessment:			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	Restricted	Moderate	Low
Agriculture/Aquaculture	Restricted	Moderate	Low
Energy Production & Mining	Restricted	Serious	Medium
Transportation & Service Corridors	Restricted	Moderate	Low
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Small	Moderate	Low
Natural System Modification	Large	Serious	High
Invasive & other Problematic Species	Pervasive	Serious	High
Pollution	Pervasive	Moderate	Medium
Geological Events	Large	Serious	High
Climate Change & Severe Weather	Large	Moderate	Medium
Overall Calculated Threat Impact: Medium			

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.

11.3 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).

Similar to other basins, coastal land loss and saltwater intrusion is a significant threat to the southern portion of this basin, most notably the Brackish Marshes surrounding Calcasieu Lake. The dredging of the Calcasieu Ship Channel is the likely source behind a general increase in salinities in this area over the last half-century, and numerous water control structures have been constructed on bayous that connect Calcasieu Lake with surrounding marshes for salinity control, thereby decreasing ingress and egress opportunities for marine species which spend critical portions of their life history in coastal marshes. A variety of hydrologic restoration projects have been proposed for this area by the coastal restoration community in the attempt to address this threat (CPRA 2012).

There are approximately 90 species of freshwater fishes (Maxwell 2012, LDWF unpublished data), 30 species of mussels (Vidrine 1993), and 16 species of crawfish (J. Walls, personal communication) found within the Calcasieu Basin. At the southern terminus, Calcasieu Lake supports a small but viable commercial fishing industry, which includes the harvest of crabs, shrimp, and oysters. Unlike the estuarine area of most basins, however, oyster harvests occur solely from public oyster areas (Calcasieu Lake) as no state-issued oyster leases exist within the basin.

Water Quality:

The 2012 Water Quality Inventory Report (LDEQ 2012) indicated that 31% of the 39 water body subsegments within the basin were fully supporting their designated use for fish and wildlife propagation. The suspected causes for these water quality problems include: metals, nutrients, fecal coliform bacteria, low concentration of dissolved oxygen, dissolved and suspended solids, turbidity, elevated levels of mercury, elevated water temperatures, and low pH. The suspected sources of the water quality problems include: home sewage systems, agriculture, silviculture, urban storm water runoff, and dredging.

CALCASIEU BASIN SGCN (46)

AMPHIBIANS
Gulf Coast Waterdog

CRUSTACEANS
Calcasieu Painted Crawfish
Teche Painted Crawfish
Old Prairie Digger
Pine Hills Digger
Beach Ghost Shrimp
Carolinian Ghost Shrimp
Peppermint Shrimp
Estuarine Ghost Shrimp

FRESHWATER FISH
Paddlefish
American Eel
Shoal Chub
Gumbo Darter
Bigscale Logperch
Gulf Pipefish
Western Sand Darter

INSECTS
Yellow Brachycercus Mayfly
Pitcher Plant Spiketail

MARINE FISH
Saltmarsh Topminnow
Bayou Killifish
Diamond Killifish
Chain Pipefish
Opossum Pipefish
Violet Goby
Broad Flounder
Large-scaled Spinycheek Sleeper
Frillfin Goby
Southern Puffer

MUSSELS
Sandbank Pocketbook
Southern Hickorynut
Louisiana Pigtoe
Southern Creekmussel
Texas Pigtoe
Round Pearlshell
Fawnsfoot

REPTILES
Loggerhead Seaturtle
Green Seaturtle
Atlantic Hawksbill Seaturtle
Kemp’s Ridley Seaturtle
Alligator Snapping Turtle
Leatherback
Western Chicken Turtle
Sabine Map Turtle
Mississippi Diamond-backed Terrapin
Razor-backed Musk Turtle
Gulf Saltmarsh Snake

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.

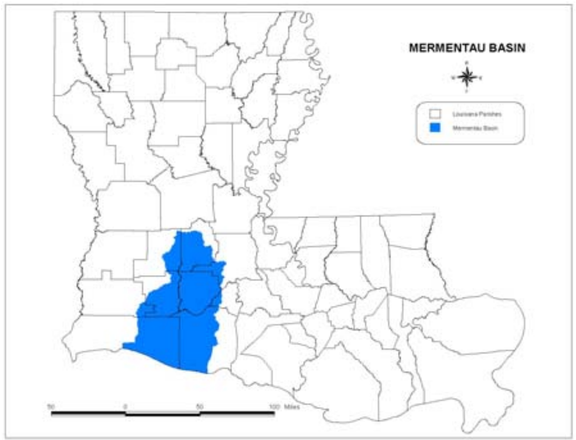
Calcasieu Basin Threats Assessment:			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	Restricted	Serious	Medium
Agriculture/Aquaculture	Large	Serious	High
Energy Production & Mining	Restricted	Serious	Medium
Transportation & Service Corridors	Restricted	Serious	Medium
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Small	Moderate	Low
Natural System Modification	Large	Serious	High
Invasive & other Problematic Species	Pervasive	Serious	High
Pollution	Large	Serious	High
Geological Events	Restricted	Serious	Medium
Climate Change & Severe Weather	Restricted	Moderate	Low
Overall Calculated Threat Impact: High			

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. Support practical initiatives that will help address saltwater intrusion into and erosion of coastal marshes surrounding Calcasieu Lake while also allowing for adequate connectivity of marine fish species between the lake and marsh habitats.

11.4 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 and function to restrict inflow of waters from surrounding estuarine waters and the Gulf of Mexico (USACE 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 Freshwater Marsh, which borders the prairie to the north, then merges into Intermediate and Brackish Marshes and finally terminating with Salt 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 Freshwater 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 approximately 74 species of freshwater fishes (Tulane 2008, LDWF unpublished data), 22 species of mussels (Vidrine 1993), and 13 species of crawfish (J. Walls, personal communication) found within the Mermentau Basin.

Water Quality:

The 2012 Water Quality Inventory Report (LDEQ 2012) indicated that 11% of the 18 water body subsegments within the basin were fully supporting their designated use for fish and wildlife propagation. The suspected causes for these water quality problems include: metals, nutrients, fecal coliform bacteria, low concentration of dissolved oxygen, pesticides, dissolved and suspended solids, sedimentation and siltation, and turbidity. The suspected sources of the water quality problems include: home sewage systems, agriculture, silviculture, urban storm water runoff, and dredging.

MERMENTAU BASIN SGCN (36)

AMPHIBIANS
Gulf Coast Waterdog

CRUSTACEANS
Teche Painted Crawfish
Old Prairie Digger
Carolinian Ghost Shrimp
Peppermint Shrimp
Estuarine Ghost Shrimp

INSECTS
Yellow Brachycercus Mayfly

FRESHWATER FISH
Paddlefish
American Eel
Shoal Chub
Gumbo Darter
Bigscale Logperch
Gulf Pipefish

MARINE FISH
Saltmarsh Topminnow
Bayou Killifish
Diamond Killifish
Chain Pipefish
Opossum Pipefish
Violet Goby
Broad Flounder
Large-scaled Spinycheek Sleeper
Frillfin Goby
Southern Puffer

MOLLUSKS
Sandbank Pocketbook
Round Pearlshell

REPTILES
Loggerhead Seaturtle
Green Seaturtle
Atlantic Hawksbill Seaturtle
Kemp's Ridley Seaturtle
Alligator Snapping Turtle
Leatherback
Western Chicken Turtle
Sabine Map Turtle
Mississippi Diamond-backed Terrapin
Razor-backed Musk Turtle
Gulf Saltmarsh Snake

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.

Mermentau Basin Threats Assessment:

First Level Threat	Scope	Severity	Impact
Residential/Commercial Development	Small	Slight	Low
Agriculture/Aquaculture	Pervasive	Serious	High
Energy Production & Mining	Small	Moderate	Low
Transportation & Service Corridors	Small	Moderate	Low
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Small	Moderate	Low
Natural System Modification	Pervasive	Serious	High
Invasive & other Problematic Species	Pervasive	Serious	High
Pollution	Pervasive	Serious	High
Geological Events	Large	Serious	High
Climate Change & Severe Weather	Restricted	Moderate	Low
Overall Calculated Threat Impact: High			

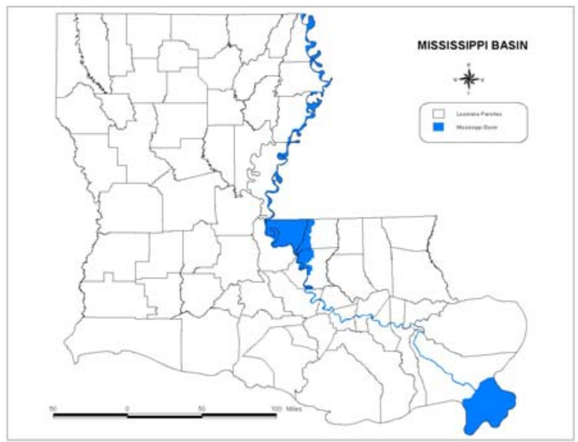
Basin Conservation Strategies:

1. Develop partnerships with regulatory agencies to share data on habitat threats and to ensure compliance of existing regulations.
2. Partners with NRCS to develop an initiative to increase water quality through conservation practices on working lands.
3. Partner with and support the Mississippi River Basin Initiative (http://www.la.nrcs.usda.gov/programs/MRBI/index.html) and the Gulf of Mexico Initiative (http://www.la.nrcs.usda.gov/programs/GOMI/index.html) to address the causes of habitat impairment within the Mermentau River basin.

11.5 Mississippi Basin

General Description:

The portion of the Mississippi River which occurs in Louisiana is part of the Lower Missisippi 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 , 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 Freshwater 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 2012 Water Quality Inventory Report (LDEQ 2012) indicated that 43% of the 17 water body subsegments within the basin were 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 SGCN (56)		
CRUSTACEANS	**MARINE FISH**	**MOLLUSKS**
Old Prairie Digger	Saltmarsh Topminnow	Mucket
Vernal Crawfish	Bayou Killifish	Fat Pocketbook
Beach Ghost Shrimp	Diamond Killifish	Rayed Creekshell
Carolinian Ghost Shrimp	Chain Pipefish	Butterfly
Peppermint Shrimp	Opossum Pipefish	Elephant-Ear
Estuarine Ghost Shrimp	Violet Goby	Ebonyshell
	Broad Flounder	Plain Pocketbook
FRESHWATER FISH	Large-scaled Spinycheek Sleeper	Fatmucket
Gulf Sturgeon		White Heelsplitter
Pallid Sturgeon	Tarpon	Pyramid Pigtoe
Shovelnose Sturgeon	Frillfin Goby	Fat Pocketbook
Paddlefish	Smalltooth Sawfish	Rabbitsfoot
American Eel	Southern Puffer	Southern Creekmussel
Central Stoneroller	Dwarf Seahorse	Round Pearlshell
Clear Chub	Lemon Shark	Fawnsfoot
Gulf Pipefish		
Chub Shiner		**REPTILES**
Bluntface Shiner		Loggerhead Seaturtle
Blue Sucker		Green Seaturtle
Gulf Pipefish		Atlantic Hawksbill Seaturtle
Rainbow Darter		Kemp's Ridley Seaturtle
Bigscale Logperch		Alligator Snapping Turtle
		Smooth Softshell
		Leatherback
		Western Chicken Turtle
		Ouachita Map Turtle
		Mississippi Diamond-backed Terrapin
		Razor-backed Musk Turtle
		Gulf Saltmarsh Snake

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.

Mississippi Basin Threats Assessment:

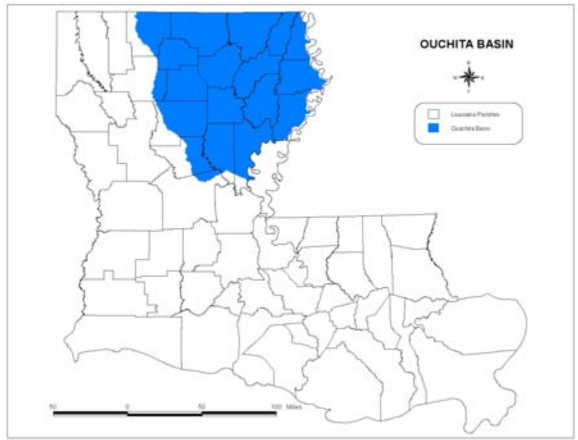
First Level Threat	Scope	Severity	Impact
Residential/Commercial Development	Small	Moderate	Low
Agriculture/Aquaculture	Large	Moderate	Medium
Energy Production & Mining	Small	Moderate	Low
Transportation & Service Corridors	Large	Moderate	Medium
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Small	Moderate	Low
Natural System Modification	Pervasive	Extreme	Very High
Invasive & other Problematic Species	Pervasive	Extreme	Very High
Pollution	Large	Serious	High
Geological Events	Restricted	Moderate	Low
Climate Change & Severe Weather	Small	Serious	Low
Overall Calculated Threat Impact: High			

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. Continue LDWF involvement in the environmental review process of all river related projects. Identify potential impacts and recommend appropriate mitigation.

11.6 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 USACE 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 (USACE 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 2012 Water Quality Inventory Report (LDEQ 2012) indicated that 15% of the 60 water body subsegments within the basin were fully supporting their designated use for fish and wildlife propagation. The suspected causes for these water quality problems include: metals, pesticides, nutrients, fecal coliform bacteria, 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 SGCN (56)

AMPHIBIANS
Red River Mudpuppy

CRUSTACEANS
Vernal Crawfish
Elegant Crawfish
Ouachita Fencing Crawfish
Pine Hills Digger

FRESHWATER FISH
Shovelnose Sturgeon
Paddlefish
American Eel
Central Stoneroller
Bigeye Shiner
Steelcolor Shiner
Shoal Chub
Ironcolor Shiner
Bluehead Shiner
River Redhorse
Blue Sucker
Crystal Darter
Redspot Darter
Channel Darter
Stargazing Darter
Saddleback Darter

INSECTS
Texas Emerald
Texas Forestfly
Louisiana Needlefly
Little Dubiraphian Riffle Beetle
Schoolhouse Springs Net-spinning Caddisfly
Morse's Net-spinning Caddisfly
Holzenthal's Philopotamid Caddisfly
Ceraclean Caddisfly
Schoolhouse Springs Purse Casemaker Caddisfly

MOLLUSKS
Mucket
Western Fanshell
Butterfly
Spike
Ebonyshell
Pink Mucket
Sandbank Pocketbook
Plain Pocketbook
Fatmucket
White Heelsplitter
Black Sandshell
Southern Hickorynut
Hickorynut
Pyramid Pigtoe
Fat Pocketbook
Ouachita Kidneyshell
Rabbitsfoot
Monkeyface
Creeper
Round Pearlshell
Fawnsfoot

REPTILES
Alligator Snapping Turtle
Smooth Softshell
Western Chicken Turtle
Ouachita Map Turtle
Razor-backed Musk Turtle

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.

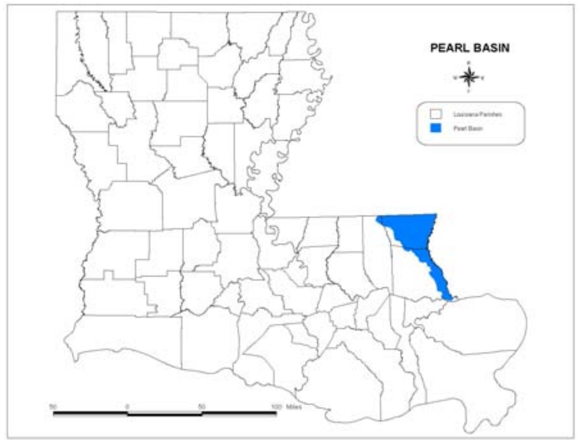
Ouachita Basin Threats Assessment:			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	Small	Moderate	Low
Agriculture/Aquaculture	Large	Moderate	Medium
Energy Production & Mining	Restricted	Serious	Medium
Transportation & Service Corridors	Small	Moderate	Low
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Small	Moderate	Low
Natural System Modification	Large	Serious	High
Invasive & other Problematic Species	Pervasive	Serious	High
Pollution	Pervasive	Serious	High
Geological Events	Small	Slight	Low
Climate Change & Severe Weather	Small	Serious	Low
Overall Calculated Threat Impact: Medium			

Basin Conservation Strategies:

1. Improve partnerships with LDEQ, NRCS, TNC, LSU Co-op 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. Partner with NRCS to reduce impacts from agriculture sediments within the Ouachita Basin, particularly in Bayou Bonne Idee.
6. Address the impacts of adjacent agricultural practices on Bayou Bartholomew SGCN
7. Address the impacts of habitat alteration and development in Bayou DeSiard.

11.7 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 Farrs 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 or expanded reservoirs near Jackson will further compound the interruption of normal flow patterns to that portion of the river below these reservoirs, with unknown impacts to coastal species within the Lake Borgne/Mississippi Sound receiving waters. 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 USACE 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 USACE 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 (USACE 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 2012 Water Quality Inventory Report (LDEQ 2012) indicated that 26% of the 23 water body subsegments within the basin were fully 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, low 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 SGCN (72)

AMPHIBIANS
Gulf Coast Waterdog

CRUSTACEANS
Elegant Crawfish
Flatnose Crawfish
Pearl Blackwater Crawfish
Ponchartrain Painted Crawfish
Ribbon Crawfish
Gulf Crawfish
Flatwoods Digger
Estuarine Ghost Shrimp

FRESHWATER FISH
Gulf Sturgeon
Paddlefish
American Eel
Alabama Shad
Clear Chub
Shoal Chub
Longjaw Minnow
Ironcolor Shiner
Flagfin Shiner
Bluenose Shiner
Southeastern Blue Sucker
River Redhorse
Frecklebelly Madtom
Gulf Pipefish
Crystal Darter
Redspot Darter
Gumbo Darter
Pearl Darter
Channel Darter
Freckled Darter
Gulf Logperch
Stargazing Darter
Saddleback Darter

INSECTS
Southern Snaketail
Molson's Microcaddisfly

MARINE FISH
Saltmarsh Topminnow
Bayou Killifish
Diamond Killifish
Chain Pipefish
Opossum Pipefish
Violet Goby
Broad Flounder
Large-scaled Spinycheek Sleeper
Tarpon
Frillfin Goby
Smalltooth Sawfish
Southern Puffer
Lemon Shark

MOLLUSKS
Rayed Creekshell
Elephant-Ear
Spike
Ebonyshell
Southern Pocketbook
White Heelsplitter
Black Sandshell
Southern Hickorynut
Alabama Hickorynut
Mississippi Pigtoe
Inflated Heelsplitter
Southern Rainbow

REPTILES
Loggerhead Seaturtle
Green Seaturtle
Atlantic Hawksbill Seaturtle
Kemp's Ridley Seaturtle
Alligator Snapping Turtle
Smooth Softshell
Leatherback
Ringed Map Turtle
Pearl Map Turtle
Mississippi Diamond-backed Terrapin
Stripe-necked Musk Turtle
Razor-backed Musk Turtle
Gulf Saltmarsh Snake

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.

Pearl Basin Threats Assessment:

First Level Threat	Scope	Severity	Impact
Residential/Commercial Development	Small	Moderate	Low
Agriculture/Aquaculture	Large	Moderate	Medium
Energy Production & Mining	Restricted	Moderate	Low
Transportation & Service Corridors	Restricted	Moderate	Low
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Small	Moderate	Low
Natural System Modification	Pervasive	Serious	High
Invasive & other Problematic Species	Pervasive	Serious	High
Pollution	Pervasive	Serious	High
Geological Events	Small	Moderate	Low
Climate Change & Severe Weather	Restricted	Moderate	Low
Overall Calculated Threat Impact: Low			

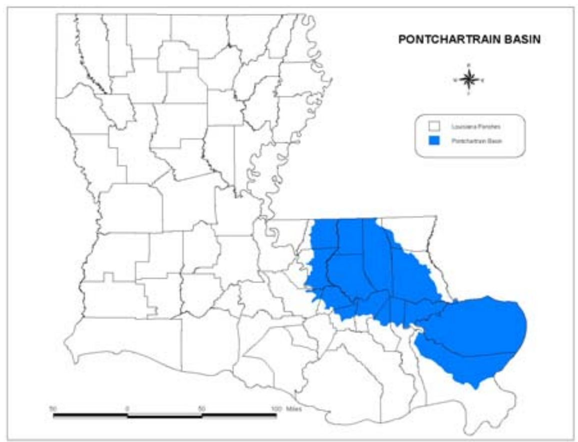
Basin Conservation Strategies:

1. Coordinate with USACE, 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), and 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.

11.8 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.



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. The extreme eastern edge of the basin is bordered by thin ribbons of sand and marsh known as the Chandeleur Islands. These islands are the headland remains of the St. Bernard delta of the Mississippi River, but have undergone extensive erosion through the years, most recently due to strong hurricanes such as Katrina, Gustav, and Isaac.

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. Additionally, numerous coastal restoration projects, including marsh creation and shoreline protection, have been proposed for this basin to address coastal wetland loss (CPRA 2012).

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. Additionally, the Chandeleur Islands are likely the only existing habitat in Louisiana home to certain species of saltwater invertebrates and seagrasses. If erosion continues and the islands are lost, animals such as Bay Scallops and pen shells will be extirpated from Louisiana waters.

Water Quality:

The 2012 Water Quality Inventory Report (LDEQ 2012) indicated that 31% of the 86 water body subsegments within the basin were fully supporting their designated use for fish and wildlife propagation. The suspected causes for these water quality problems include: metals, nutrients, fecal coliform bacteria, non-native aquatic plants, organic enrichment and low concentration of dissolved oxygen, oil and grease, dissolved and suspended solids, pH levels, sedimentation/siltation, elevated water temperatures, 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 SGCN (67)		
AMPHIBIANS	**INSECTS**	Mississippi Pigtoe
Gulf Coast Waterdog	Hodge's Clubtail	Inflated Heelsplitter
	Southern Snaketail	Southern Rainbow
CRUSTACEANS	Molson's	Bay Scallop
Flatnose Crawfish	Microcaddisfly	Sawtooth Pen Shell
Ribbon Crawfish		Half-naked Pen Shell
Gulf Crawfish		Channeled Whelk
Ponchartrain Painted	**MARINE FISH**	Lightning Whelk
Crawfish	Saltmarsh Topminnow	
Flatwoods Digger	Bayou Killifish	
Estuarine Ghost	Diamond Killifish	
Shrimp	Chain Pipefish	**REPTILES**
	Opossum Pipefish	Loggerhead Seaturtle
FRESHWATER	Violet Goby	Green Seaturtle
FISH	Broad Flounder	Atlantic Hawksbill Seaturtle
Gulf Sturgeon	Large-scaled	Kemp's Ridley Seaturtle
Paddlefish	Spinycheek Sleeper	Alligator Snapping Turtle
Flagfin Shiner	Tarpon	Smooth Softshell
Bluenose Shiner	Frillfin Goby	Leatherback
Blue Sucker	Smalltooth Sawfish	Mississippi Diamond-backed
Southeastern Blue	Southern Puffer	Terrapin
Sucker	Dwarf Seahorse	Razor-backed Musk Turtle
River Redhorse	Lemon Shark	Gulf Saltmarsh Snake
Frecklebelly Madtom		
Broadstripe	**MOLLUSKS**	

Topminnow	Rayed Creekshell
Gulf Pipefish	Elephant-Ear
Crystal Darter	Spike
Redspot Darter	Southern Pocketbook
Rainbow Darter	Southern Hickorynut
Pearl Darter	Alabama Hickorynut
Channel Darter	
Freckled Darter	
Gulf Logperch	
Stargazing Darter	
Saddleback Darter	

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.

Ponchartrain Basin Threats Assessment:

First Level Threat	Scope	Severity	Impact
Residential/Commercial Development	Restricted	Serious	Medium
Agriculture/Aquaculture	Large	Moderate	Medium
Energy Production & Mining	Large	Serious	High
Transportation & Service Corridors	Restricted	Serious	Medium
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Small	Moderate	Low
Natural System Modification	Pervasive	Serious	High
Invasive & other Problematic Species	Pervasive	Serious	High
Pollution	Large	Serious	High
Geological Events	Large	Serious	High
Climate Change & Severe Weather	Large	Moderate	Medium
Overall Calculated Threat Impact: Very High			

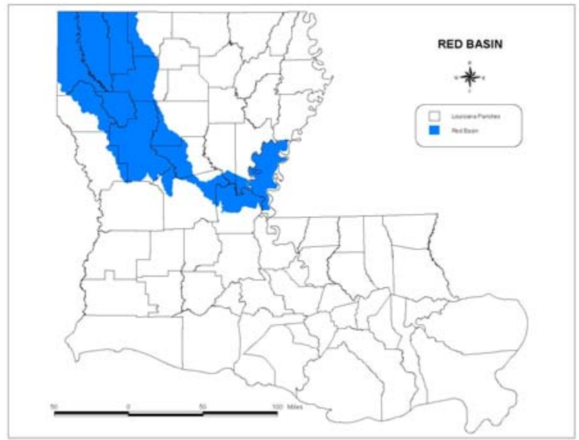
Basin Conservation Strategies:

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.
5. Complete a comprehensive inventory of marine invertebrates at the Chandeleur Islands.

11.9 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 (USACE 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 19th 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 2012 Water Quality Inventory Report (LDEQ 2012) indicated that 23% of the 70 water body subsegments within the basin were fully 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 bacteria, non-native aquatic plants, organic enrichment and low concentration of dissolved oxygen, dissolved and suspended solids, low 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 SGCN (49)

AMPHIBIANS
Gulf Coast Waterdog
Red River Mudpuppy

CRUSTACEANS
Kisatchie Painted Crawfish
Ribbon Crawfish
Javelin Crawfish
Twin Crawfish
Gulf Crawfish
Pine Hills Digger
Flatwoods Digger
Sabine Fencing Crawfish
Caddo Chimney Crawfish

FRESHWATER FISH
Pallid Sturgeon
Shovelnose Sturgeon
Paddlefish
American Eel
Shoal Chub
Ironcolor Shiner
Chub Shiner
Suckermouth Minnow
Bluehead Shiner
Blue Sucker
River Redhorse
Western Sand Darter
Crystal Darter
Redspot Darter
Saddleback Darter

INSECTS
Texas Emerald
Texas Forestfly
Louisiana Needlefly
Little Dubiraphian Riffle Beetle
Schoolhouse Springs Net-spinning Caddisfly
Morse's Net-spinning Caddisfly
Holzenthal's Philopotamid Caddisfly
Ceraclean Caddisfly
Schoolhouse Springs Purse Casemaker Caddisfly

MOLLUSKS
Ebonyshell
Louisiana Pearlshell
Southern Hickorynut
Pyramid Pigtoe
Louisiana Pigtoe
Southern Creekmussel
Creeper
Round Pearlshell
Fawnsfoot

REPTILES
Alligator Snapping Turtle
Smooth Softshell
Western Chicken Turtle
Ouachita Map Turtle
Razor-backed Musk Turtle

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.

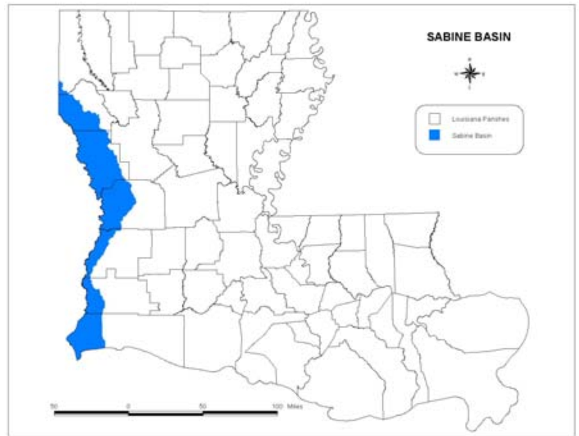
Red River Basin Threats Assessment:			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	Small	Moderate	Low
Agriculture/Aquaculture	Large	Moderate	Medium
Energy Production & Mining	Large	Serious	High
Transportation & Service Corridors	Restricted	Moderate	Low
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Small	Moderate	Low
Natural System Modification	Large	Serious	High
Invasive & other Problematic Species	Pervasive	Serious	High
Pollution	Pervasive	Serious	High
Geological Events	Small	Slight	Low
Climate Change & Severe Weather	Small	Slight	Low
Overall Calculated Threat Impact: Medium			

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.

11.10 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). Within lower Sabine Lake, one of the largest unhnarvested oyster reefs in the world exists, estimated at 10 km^2 (Moore 2008; Nevins et al. 2014). This reef habitat has received extensive interest in recent years as the state of Texas and coastal protection/restoration advocates in Louisiana have pushed strongly for the continuance of a commercial harvest prohibition. To date, the Louisiana Wildlife and Fisheries Commission has resisted oyster industry requests to open the lake to commercial oyster harvest.

There are approximately 99 species of freshwater fishes (Texas State University 2013), 33 species of mussels (Vidrine 1993), and 13 species of crawfish (J. Walls, personal communication) found within the Sabine Basin.

Water Quality:

The 2012 Water Quality Inventory Report (LDEQ 2012) indicated that 63% of the 19 subsegments were supporting their designated use for fish and wildlife propagation. The suspected causes for these water quality problems include: mercury, fecal coliform bacteria, 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.

SABINE BASIN SGCN (53)

AMPHIBIANS
Gulf Coast Waterdog

CRUSTACEANS
Calcasieu Painted Crawfish
Kisatchie Painted Crawfish
Javelin Crawfish
Vernal Crawfish
Twin Crawfish
Southwestern Creek Crawfish
Beach Ghost Shrimp
Carolinian Ghost Shrimp
Peppermint Shrimp
Estuarine Ghost Shrimp

FRESHWATER FISH
Paddlefish
American Eel
Shoal Chub
Ironcolor Shiner
Suckermouth Minnow
Blue Sucker
Gulf Pipefish
Western Sand Darter
Gumbo Darter
Bigscale Logperch

INSECTS
Yellow Brachycercus Mayfly

MARINE FISH
Saltmarsh Topminnow
Bayou Killifish
Diamond Killifish
Chain Pipefish
Opossum Pipefish
Violet Goby
Broad Flounder
Large-scaled Spinycheek Sleeper
Frillfin Goby
Southern Puffer

MOLLUSKS
Sandbank Pocketbook
Southern Hickorynut
Louisiana Pigtoe
Texas Heelsplitter
Southern Creekmussel
Creeper
Texas Pigtoe
Round Pearlshell
Fawnsfoot

REPTILES
Loggerhead Seaturtle
Green Seaturtle
Atlantic Hawksbill Seaturtle
Kemp’s Ridley Seaturtle
Alligator Snapping Turtle
Smooth Softshell
Leatherback
Western Chicken Turtle
Sabine Map Turtle
Mississippi Diamond-backed Terrapin
Razor-backed Musk Turtle
Gulf Saltmarsh Snake

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.

Sabine Basin Threats Assessment:

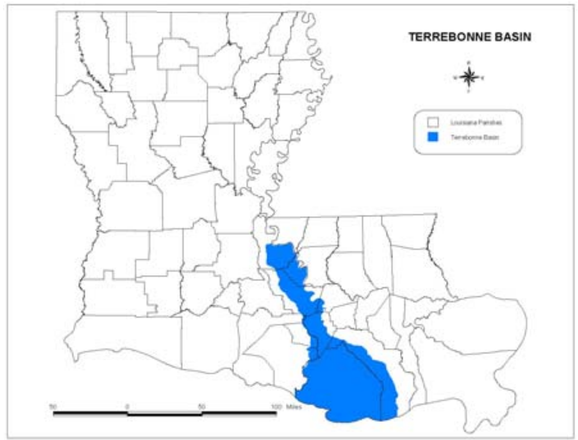
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	Small	Slight	Low
Agriculture/Aquaculture	Large	Moderate	Medium
Energy Production & Mining	Large	Serious	High
Transportation & Service Corridors	Restricted	Moderate	Low
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Small	Moderate	Low
Natural System Modification	Large	Extreme	High
Invasive & other Problematic Species	Pervasive	Serious	High
Pollution	Large	Moderate	Medium
Geological Events	Small	Serious	Low
Climate Change & Severe Weather	Restricted	Moderate	Low
Overall Calculated Threat Impact: Medium			

Basin Conservation Strategies:

1. Support initiatives and programs that help reduce siltation and sedimentation throughout the basin.
2. Continue LDWF participation in Sabine River Aquatic Resource Working Group to provide input to the Sabine River Authority in regards to reducing impacts of power generation on fish and wildlife propagation below Toledo Bend Dam.
3. Develop an internal procedure to distribute information on proposed reservoirs to LDWF district biologists and incorporate their input into official LDWF comments.

11.11 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). As is the case in other basins, however, coastal land loss is a significant threat and numerous projects have been proposed to address the issue (CPRA 2012).). The lower Terrebonne estuary is separated from the open gulf by the Isles Dernieres and Timbalier barrier island chains. Water exchange with the Gulf of Mexico is accomplished through numerous tidal inlets and passes. The barrier islands of the Terrebonne basin are considered some of the most rapidly deteriorating barrier shorelines in the United States. All have received restoration/nourishment through state and federal projects, but will continue to need attention in order to remain emergent and buffer mainland marshes from the tidal processes of the gulf. The southeastern coastal marshes are isolated from any type of riverine input and with high rates of subsidence, show the highest incidence of wetland loss within the basin.

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 2012 Water Quality Inventory Report (LDEQ 2012) indicated that 22% of the 58 water body subsegments within the basin were fully supporting their designated use for fish and wildlife propagation. The suspected causes for these water quality problems include: metals, nutrients, fecal coliform bacteria, non-native aquatic plants, organic enrichment and low concentration of dissolved oxygen, dissolved and suspended solids, low 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 SGCN (35)

CRUSTACEANS
Calcasieu Painted Crawfish
Kisatchie Painted Crawfish
Twin Crawfish
Beach Ghost Shrimp
Carolinian Ghost Shrimp
Peppermint Shrimp
Estuarine Ghost Shrimp

FRESHWATER FISH
American Eel
Paddlefish

MARINE FISH
Saltmarsh Topminnow
Bayou Killifish
Diamond Killifish
Chain Pipefish
Opossum Pipefish
Emerald Sleeper
Violet Goby
Broad Flounder
Large-scaled Spinycheek Sleeper
Tarpon
Frillfin Goby
Smalltooth Sawfish
Southern Puffer
Dwarf Seahorse
Lemon Shark

MOLLUSKS
Round Pearlshell

REPTILES
Loggerhead Seaturtle
Green Seaturtle
Atlantic Hawksbill Seaturtle
Kemp's Ridley Seaturtle
Alligator Snapping Turtle
Smooth Softshell
Leatherback
Sabine Map Turtle
Mississippi Diamond-backed Terrapin
Razor-backed Musk Turtle
Gulf Saltmarsh Snake

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.

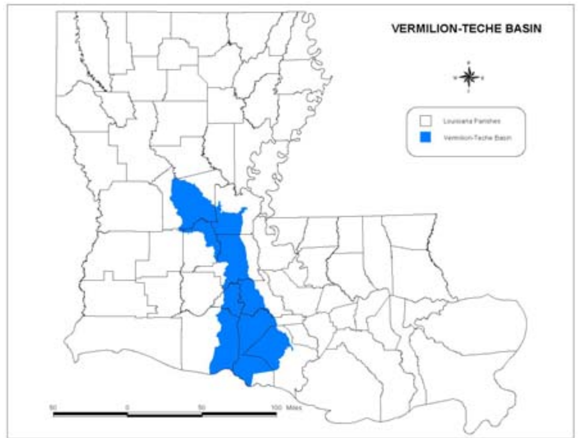
Terrebonne Basin Threats Assessment:			
First Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	Restricted	Moderate	Low
Agriculture/Aquaculture	Large	Moderate	Medium
Energy Production & Mining	Restricted	Serious	Medium
Transportation & Service Corridors	Restricted	Moderate	Low
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Small	Moderate	Low
Natural System Modification	Large	Serious	High
Invasive & other Problematic Species	Pervasive	Serious	High
Pollution	Pervasive	Moderate	Medium
Geological Events	Large	Serious	High
Climate Change & Severe Weather	Large	Moderate	Medium
Overall Calculated Threat Impact: High			

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 barrier island and marsh restoration efforts.
6. Coordinate with the Atchafalaya Basin Program (LDNR) and BTNEP to abate identified threats from invasive flora and fauna to this basin.
7. Promote coastal restoration and protection initiatives to maintain or enhance coastal marsh habitat critical to marine species.

11.12 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 (USACE 1998). Coastal land loss is a significant threat, most notably on Marsh Island and numerous projects have been proposed to address this issue (CPRA 2012).

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. Many marine fisheries species exist within the southern portion of the basin supporting both commercial and recreational fishing industries. Commercial crabbing, shrimping and oystering occur both within the coastal bay system as well as in waters offshore of Marsh Island.

Water Quality:

The 2012 Water Quality Inventory Report (LDEQ 2012) indicated that 11% of the 44 water body subsegments within the basin were fully supporting their designated use for fish and wildlife propagation. The suspected causes for these water quality problems include: metals, pesticides, nutrients, fecal coliform bacteria, 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 SGCN (33)	
CRUSTACEANS	**MOLLUSKS**
Teche Painted Crawfish	Round Pearlshell
Javelin Crawfish	
Old Prairie Digger	**REPTILES**
Peppermint Shrimp	Loggerhead Seaturtle
Estuarine Ghost Shrimp	Green Seaturtle
	Atlantic Hawksbill Seaturtle
FRESHWATER FISH	Kemp's Ridley Seaturtle
Paddlefish	Alligator Snapping Turtle
Ironcolor Shiner	Smooth Softshell
	Leatherback
MARINE FISH	Western Chicken Turtle
Saltmarsh Topminnow	Mississippi Diamond-backed Terrapin
Bayou Killifish	Razor-backed Musk Turtle
Diamond Killifish	Gulf Saltmarsh Snake
Chain Pipefish	
Opossum Pipefish	
Emerald Sleeper	
Violet Goby	
Broad Flounder	
Large-scaled Spinycheek Sleeper	
Tarpon	
Frillfin Goby	
Smalltooth Sawfish	
Southern Puffer	
Lemon Shark	

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.

Vermilion-Teche Basin Threats Assessment:

First Level Threat	Scope	Severity	Impact
Residential/Commercial Development	Restricted	Moderate	Low
Agriculture/Aquaculture	Large	Serious	High
Energy Production & Mining	Restricted	Moderate	Low
Transportation & Service Corridors	Restricted	Moderate	Low
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	Small	Moderate	Low
Natural System Modification	Pervasive	Serious	High
Invasive & other Problematic Species	Pervasive	Serious	High
Pollution	Pervasive	Serious	High
Geological Events	Restricted	Serious	Medium
Climate Change & Severe Weather	Restricted	Moderate	Low
Overall Calculated Threat Impact: Medium			

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. Work with NRCS to develop a watershed initiative to address water quality issues associated with agriculture and water management practices.
4. Promote methods to restore historical flow regimes within the Vermillion-Teche Basin.
5. Develop education material on BMPs for land-use practices within the Vermillion-Teche Basin.
6. Develop partnerships with regulatory and other agencies to share data on habitat threats.
7. Prepare educational material on the potential impacts of invasive species to the Vermillion-Teche Basin.
8. Promote coastal restoration and protection initiatives to maintain or enhance coastal marsh habitat critical to marine fish species.
9. Complete a comprehensive survey of oyster reef/hard bottom habitat acreage within the system.

12. 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. Although listed as "marine" habitats the following substrates, except *State Territorial Open Water*, can be found adjacent to all marsh types and across all salinity regimes; thus, it is the prevailing hydrology above these substrates that will determine the species using these habitats. Due to the dynamic nature of estuarine environments and the many factors that can influence local hydrology, along with the fact that different life stages of marine organisms may require unique conditions and habitats, substrate, salinity gradients, and species life histories all need to be considered when developing threat assessments and conservation actions

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. In lower salinity regimes, these bottoms may be vegetated by *Myriophyllum* spp. (water milfoils), *Utricularia* spp. (bladderworts), *Ruppia maritima* (widgeon 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 autothonous 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.

Eastern Oysters (*Crassotrea virginica*) provide the majority of the shell substrate in Louisiana, and are also a major commercial 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. Extensive Rangia beds are found in Lakes Maurepas and Pontchartrain, as well as in the more northern areas of the Vermilion/East & West Cote Blanche/Atchafalaya bays and in mid to northern Sabine Lake. 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.

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 several Non-Governemental Organizations (NGOs), 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.

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 dominated by mineral materials, and are typically remnants of eroded or submerged shorelinest. Productivity in these areas tends to be derived from terrestrial (marshland) allochthonous sources and phytoplankton.

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. They are also often found in association with marine seagrass beds at the Chandeleur Islands. 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 chenier 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 (*Menticihhrus 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.

MARINE SGCN (36)

CRUSTACEANS
Beach Ghost Shrimp
Carolinian Ghost Shrimp
Peppermint Shrimp
Estaurine Ghost Shrimp

MOLLUSKS
Bay Scallop
Sawtooth Pen Shell
Half-naked Pen Shell
Channelled Whelk
Lightning Whelk

MAMMALS
Bottlenose Dolphin
Sperm Whale
West Indian Manatee

MARINE FISH
Lemon Shark
Smalltooth Sawfish
Tarpon
Gold Brotula
Diamond Killifish
Saltmarsh Topminnow
Bayou Killifish
Dwarf Seahorse
Opposum Pipefish
Chain Pipefish
Texas Pipefish
Goliath Grouper
Large-scaled Spinycheek Sleeper
Emerald Sleeper
Frillfin Goby
Violet Goby
Broad Flounder
Southern Puffer

REPTILES
Loggerhead Seaturtle
Green Seaturtle
Atlantic Hawksbill Seaturtle
Kemp's Ridley Seaturtle
Leatherback Seaturtle
Mississippi Diamond-backed Terrapin

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. Establish marked channels or no wake zones 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.

4. Develop shell budget models to help better manage the volume of shell removed during commercial harvest activities.
5.

B. Timing and Volume of Fresh and Saltwater Releases
1. Through the authority of the Fish and Wildlife Coordination Act the Department will continue to provide recommendations to Federal regulators aimed at preventing loss of and damage to wildlife resources from federally permitted activities that impound, divert or otherwise control or modify waters of any stream or other body of water. Additionally, the Department will continue to work with state coastal zone regulators, as outlined in a 2005 Memorandum of Understanding between the Department of Natural Resources and LDWF, to ensure that proposed water control structures are designed and operated in a manner that provide adequate aquatic organism ingress and egress.
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 USACE 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.
2. Promote upstream BMPs in riparian zones to reduce nutrient loading and sedimentation in coastal waters.

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 USACE 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 USACE permits.

G. Bulkheading

1. LDWF will continue to coordinate with Federal and State regulators (i.e., Army Corps of Engineers and LA Department of Natural Resources) to ensure that authorizations for bulkheads are properly justified. Furthermore, when appropriate, LDWF will recommend alternatives to bulkheads that will not result in the loss of shallow-water spawning, rearing and foraging habitat as well as cover for aquatic species.
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.

B. Barrier Island Deterioration

1. Support the Barrier Island Comprehensive Monitoring program (BICM) with CPRA and promote barrier shoreline restoration projects.

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 recomendations 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. Reduced Sediment Supply to Coastal Marshlands

1. Support appropriate river diversion projects where sediment deposition in coastal marshes can be achieved and/or where there is a high likelihood of increases in coastal marsh biomass.
2. Support research to identify alternative diversion techniques where 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 Aquatic 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 managemnt 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. Basin wide sampling of larval fishes to determine if SGCN are utilizing different habitats during different portions of their life cycle and determine the value of those habitats to those life cycle stages.
6. Estimate recruitment and retention rates of fishes within the estuaries before and after diversion influence.
7. 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.
8. Adequate monitoring is needed of community composition throughout the coastal zone.
9. Evaluate options to optimize the statistical power of current biological and environmental sampling designs.
10. 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.
11. 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. Consider using Barataria Bay as a pilot study area for implementation.
12. Evaluate existing data to possibly identify surrogate species for monitoring cryptic species.
13. Work with university researchers to monitor and verify status of cryptic species by periodically confirming presence, habitat use, life history characteristics, etc.
14. Develop a species ID guide to SGCN within each basin to help researchers and the general public to identify and document those species.

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CHAPTER 6. INVASIVE SPECIES

Invasive species are one of the most widespread and serious threats to SGCN and their habitats in Louisiana. Therefore, during the revision of the WAP, a more comprehensive approach to this issue was taken. This chapter contains a list of invasive species that are known to occur or have the potential to occur in Louisiana within the next 10 years. This chapter also presents information on those invasive species that are considered to pose the greatest threat to SGCN and their habitats.

A. The Invasive Species Problem

Important distinctions must be made between two closely related and oftentimes confusing terms in invasion biology, namely “exotic” and “invasive”. These terms are discussed in detail in Mack et al. (2000) and McGlynn (1999) but will be defined in simple terms here. Exotic species, also known as alien, introduced, or nonnative species are simply those transferred to a new geographic location previously unoccupied by that species. Such transfer might occur through natural means – high winds, flooding, etc. – or through anthropogenic means – movement of nursery stock, intentional stocking, etc. No matter the means, exotics that are introduced have a roughly 10% chance of success in their new range (Mack et al. 2000). A clear dichotomy exists between those exotic flora and fauna intentionally introduced and those accidentally introduced. The vast majority of vertebrates, especially fish, mammals, and birds, have been intentionally introduced, usually for game or aesthetics, and, occasionally, at a great expense to our native organisms (Mack et al. 2000). However, with the exception of biological control agents, very few intentional introductions of invertebrates have occurred.

The term “exotic” alone should not necessarily connote negative impacts to ecosystems. For example, exotic plant and animal species also include a large number of organisms found in zoos, aquariums, arboretums, and botanical gardens, as well as many species sold at pet stores and nurseries. When cared for responsibly, these flora and fauna should not cause any detrimental effects to native species or habitats. The vast majority of problems caused by exotic species involve species that are also invasive.

Invasive exotic species are those that have escaped captivity or have been intentionally or accidentally released and have aggressively spread and become established in an area by outcompeting native species. Once established, these species have the potential to cause significant harm to both native species and natural communities. Invasive exotic species often have life history traits that allow them to outcompete other species, particularly native species. Some such traits may include better-adapted root structures, faster growth rates, more efficient seed dispersal methods, a marked preference for disturbance, and higher fecundity rates. Despite many potential advantages afforded these newcomers, only one-percent of exotic species will reach invasive status (Mack et al. 2000).

Native species can become invasive as well, but such invasions are typically facilitated by humans. In those cases, a native species may undergo rapid or significant expansion into areas where it was not historically found, or it may simply become more common. Therefore, via novelty or abundance, the invasive native species is likely to have negative impacts to other native species. One such invasive native species is the Brown-headed Cowbird (*Molothrus ater*), a blackbird that has become much more abundant in the U.S. as a result of habitat fragmentation and the resulting increase in edge habitat. This species is a brood parasite; female Brown-headed Cowbirds deposit eggs into the nests of other bird species ("hosts"), which then raise the cowbird chicks at the expense of the hosts' own young.

Although invasive species are not exclusively non-native, the vast majority of problematic invasives are, in fact, exotic. Hereafter, for the purposes of this chapter, invasive species will be synonymous with exotic invasive species (with the exception of feral Canada Geese).

Louisiana's humid subtropical climate puts it at high risk for invasive species' introductions and serves to increase the potential for those introductions to lead to established populations. Long, hot summers and short, mild winters, along with high precipitation amounts, allow for a plethora of invasive species to survive year-round in Louisiana. Once established, invasives can cause significant negative impacts to the invaded environment such as decreased food availability and decreased habitat quality for native species, decreased species diversity, increased habitat fragmentation, and weakened ecosystem defenses. Invasive organisms, therefore, represent an additional stressor for native species, particularly SGCN, and natural communities.

Invasive species have far reaching consequences impacting industrial, agricultural, commercial, and private business sectors. The approximately 50,000 exotic invasive species in the United States cause major environmental damage and losses totaling approximately $137 billion per year (Pimental et al 2000). Those species that cause economic losses or that become nuisances to humans are deemed "pests," a term, like "invasive," that may be ascribed to native or exotic organisms. In order to limit the spread of invasive species, federal and state governments have passed laws regulating the transport of exotic species and have created legal consequences for violators. Perhaps the most well-known of these laws is the Lacey Act of 1900. Under the Lacey Act it is unlawful to import, export, sell, purchase, or acquire fish, wildlife or plants that are taken, possessed, transported, or sold: (1) in violation of U.S. or Indian law or (2) in interstate or foreign commerce involving any fish, wildlife, or plants taken, possessed, or sold in violation of State or foreign law. In 2008, the Lacey Act was amended to restrict a wider variety of prohibited plants and plant products, including products made from illegally logged woods. These laws were put in place not only to protect native species and habitats from illegal harvest within the United States, but also to mitigate the astonishing costs of dealing with the consequences of invasive species. Whereas monetary figures of economic damages are hard to comprehend, the greatest damages may come in the unknown value of degradation to our habitats, as well as the decline of our native wildlife, especially SGCN.

Trapping, shooting, and utilization of herbicides and pesticides are the most common methods of control of many invasive species. However, the rate at which invasive species spread is frequently faster than the rate at which these removal techniques can be implemented. This lag time is in part due to insufficient invasive species removal resources for land managers and state agencies. Sam Hamilton, the former director of the U.S. Fish and Wildlife Service, called invasive species "probably the single greatest threat in our country to our native wildlife." Invasive species will remain a major threat to our nation's natural environment if greater action is not taken towards funding aggressive invasive species management projects. Addressing gaps in invasive species legislation, along with properly educating the public about owning and safe-handling of invasive or potentially invasive species, may be the best chance of preventing further introductions of invasive species and may start the process of addressing damage done thus far to our native wildlife and habitats.

B. Additional Sources of Information on Invasive Species

1. Laws and Regulations

- www.fws.gov/invasives/laws.html
- Louisiana regulations (http://www.invasivespeciesinfo.gov/laws/la.shtml)
- Lacey Act Information (www.fws.gov/le/pdffiles/Lacey.pdf)

2. General Invasive Species Information

- Louisiana Invasive species (is.cbr.tulane.edu/index.html)
- Invasive species introduction pathways (www.invasivespeciesinfo.gov/docs/toolkit/pathways.doc)
- Invasive species distribution and mapping (eddmaps.org/
- Invasive species reporting (pest.ceris.purdue.edu/state.php?code=LA)
- Southeast Exotic Pest Plant Council (http://www.se-eppc.org/index.cfm)
- Aquatic Nuisance Species Taskforce (http://www.anstaskforce.gov/default.php)
- USDA APHIS (http://www.aphis.usda.gov/wps/portal/aphis/home/)
- USGS Aquatic Invasives Database (http://nas.er.usgs.gov/)
- BTNEP Invasive Species Website (http://invasive.btnep.org/InvasiveHome.aspx)
- USFWS Aquatic Nuisance Species (http://www.fws.gov/Fisheries/ANS/index.html)

3. Identification and Control of Invasive Species

- A Field Guide for the Identification of Invasive Plants in Southern Forests (http://www.privatelandownernetwork.org/pdfs/IdentificationofInvasivePlantsinSouthernForests.pdf)
- A Management Guide for Invasive Plants in Southern Forests (http://www.privatelandownernetwork.org/pdfs/Management%20Guide%20for%20invasive%20plants%20in%20southern%20forests.pdf)
- Invasive Plant Responses to Silvicultural Practices in the South (http://www.privatelandownernetwork.org/pdfs/silvicsforinvasives.pdf)

C. Louisiana Invasive Species List

Table 6.1 includes all invasive species that are known to occur in Louisiana that have or are likely to have impacts on SGCN or their habitats, as well as species that have the potential to invade in the next 10 years. This list is divided into four Tiers:

- Tier 1 – Currently having severe or widespread negative impacts on wildlife or natural communities in Louisiana. This includes species that have a limited distribution in the state, but that have severe impacts where found.
- Tier 2 – Currently having moderate negative impacts on wildlife or natural communities in Louisiana, but of limited concern and/or extent. This includes species that have severe impacts in other states, but that have not reached Tier 1 status in Louisiana.
- Tier 3 – Currently occurring (or have occurred recently), but that have no known or anticipated impacts on wildlife or natural communities in Louisiana.
- Tier 4 – Species not known to currently occur, or known to have occurred in the recent past, but that have the potential to invade in the near future.

Table 6.1

Common Name	**Scientific Name**
TIER I	
Channeled Apple Snail	*Pomacea canaliculata or Pomacea maculata*
Argentine Ant	*Linepithema humile*
Red Imported Fire Ant	*Solenopsis invicta*
Rio Grande Cichlid	*Herichthys cyanoguttatum*
Grass Carp	*Ctenopharyngodon idella*
Common Carp	*Cyprinus carpio*
Silver Carp	*Hypophthalmichthys molitrix*
Bighead Carp	*Hypophthalmichthys nobilis*
Black Carp	*Mylopharyngodon piceus*
Lionfish	*Pterois volitans*
European Starling	*Sturnus vulgaris*
House Sparrow	*Passer domesticus*
Norway Rat	*Rattus norvegicus*
Black Rat	*Rattus rattus*
Nutria	*Myocastor coypus*
Feral/Domestic Cat	*Felis catus*
Feral Hog	*Sus scrofa*
Hen’s Eyes (Christmas Berry)	*Ardisia crenata*
Camphor Tree	*Cinnamomum camphora*
Bermudagrass	*Cynodon dactylon*
Air Potato	*Dioscorea alata & D. bulbifera*
Japanese Twin-Sorus Fern	*Deparia petersenii*
Chinese Parasol Tree	*Firmiana simplex*
Cogon grass	*Imperata cylindrica*
Chinese Privet	*Ligustrum sinense*

Japanese Climbing Fern	*Lygodium japonicum*
Holmwood Grass	*Paspalum modestum (=P. hydrophyllum)*
Vaseygrass	*Paspalum urvillei*
Trifoliate Orange	*Poncirus trifoliata*
Kudzu	*Pueraria montana*
McCartney Rose	*Rosa bracteata*
Cherokee Rose	*Rosa laevigata*
Chinese Tallow Tree	*Triadica sebifera*
Smutgrass	*Sporobolus indicus*
Tungoil Tree	*Vernicia fordii*
Elephant Ear	*Colocasia esculenta*
Brazilian Waterweed	*Egeria densa*
Water Hyacinth	*Eichhornia crassipes*
Hydrilla or Waterthyme	*Hydrilla verticillata*
Yellow Iris	*Iris pseudacorus*
Torpedograss	*Panicum repens*
Common Salvinia (Water Spangles)	*Salvinia minima*
Giant Salvinia	*Salvinia molesta*
TIER II	
Asian Clam	*Corbicula fluminea*
Zebra Mussel	*Dreissena polymorpha*
Brown Widow	*Latrodectus geometricus*
Water Flea	*Daphnia lumholzi*
Asian Tiger Shrimp	*Penaeus monodon*
Formosan Termite	*Coptotermes formosanus*
Asian Tiger Mosquito	*Aedes albopictus*
Exotic Crazy Ant	*Nylanderia fulva*
European Honeybee	*Apis mellifera*
Cactus Moth	*Cactoblastis cactorum*
Puerto Rican Coqui	*Eleutherodactylus coqui*
Rio Grande Chirping Frog	*Eleutherodactylus cystignathoides*
Greenhouse Frog	*Eleutherodactylus planirostris*
Florida Softshell	*Apalone ferox*
Brown Anole	*Anolis sagrei*
Rock Pigeon	*Columba livia*
Eurasian Collared-Dove	*Streptopelia decaocto*
House Mouse	*Mus musculus*
Tree-of-Heaven	*Ailanthus altissima*
Mimosa	*Albizia julibrissin*
Chaff-Weed	*Alternanthera sessilis*
Giant Reed	*Arundo donax*

Mosquito Fern	*Azolla pinatta*
Australian Bluestem	*Bothriochloa bladhii*
King Ranch Bluestem	*Bothriochloa ischaemum songarica*
Little Quakinggrass	*Briza minor*
Paper Mulberry	*Broussonetia papyrifera*
Balloon Vine	*Cardiospermum halicacabum*
Nodding Thistle	*Carduus nutans*
Japanese Pepper Vine	*Cayratia japonica*
Argentina Fingergrass	*Chloris canterai*
Bull Thistle	*Cirsium vulgare*
Large-Head Horseweed	*Conyza bonariensis*
Slenderleaf Rattlebox	*Crotalaria brevidens var. intermedia*
Lanceleaf Rattlebox	*Crotalaria lanceolata*
Rattleweed	*Crotalaria retusa*
Showy Rattle	*Crotalaria spectabilis*
Deep-rooted Sedge	*Cyperus entrerianus*
Ricefield Flatsedge	*Cyperus iria*
Fuzzy Flatsedge	*Cyperus pilosus*
Purple Nutsedge	*Cyperus rotundus*
Fortunes Net-veined Holly Fern	*Cyrtomium fortunei*
Kleberg Bluestem	*Dichanthium annulatum*
Smooth Crabgrass	*Digitaria ischaemum*
Hairy Crabgrass	*Digitaria sanguinalis*
Junglerice	*Echinochloa colona*
Barnyardgrass	*Echinochloa crus galli*
Thorny Olive	*Elaeagnus pungens*
Autumn Olive	*Elaeagnus umbellata*
Centipedegrass	*Eremochloa ophiuroides*
Reed Fescue	*Festuca arundinacea*
Groundivy	*Glechoma hederacea*
English Ivy	*Hedera helix*
Moon Vine	*Ipomoea alba*
Cypress Vine	*Ipomoea quamoclit*
Tie Vine	*Jacquemontia tamnifolia*
Japanese Lespedeza	*Kummerowia striata*
West India Camara	*Lantana camara*
Weeping Lantana	*Lantana montevidensis*
Shrubby Lespedeza	*Lespedeza bicolor*
Japanese Privet	*Ligustrum japonicum*
Glossy Privet	*Ligustrum lucdium*
Common Privet	*Ligustrum vulgare*

Monkeygrass	*Liriope muscari*
Perennial Ryegrass	*Lolium perenne*
Chinaberry	*Melia azedarach*
Nandina	*Nandina domestica*
Stinkvine	*Paederia foetida*
Dallisgrass	*Paspalum dilatatum*
Japanese Honeysuckle	*Lonicera japonica*
Common Bahiagrass	*Paspalum notatum notatum*
Beefsteak Plant	*Perilla frutescens*
Timothygrass	*Phleum pratense*
Golden Bamboo	*Phyllostachys aurea*
Spider Brake	*Pteris multifida*
Bradford Pear	*Pyrus calleryana*
Sawtooth Oak	*Quercus acutissima*
Castor-Bean	*Ricinus communis*
Multiflora Rose	*Rosa multiflora*
Itch Grass	*Rottboellia cochinchinensis*
Tall Wild Petunia	*Ruellia brittoniana*
Curly Dock	*Rumex crispus*
Indian Cupscale	*Sacciolepis indica*
Crownvetch	*Securigera varia*
Brazilian Rattlebox	*Sesbania punicea*
Thin-Spike Bristlegrass	*Setaria pallide fusca*
Jerusalem Cherry	*Solanum pseudocapsicum*
Tropical Soda Apple	*Solanum viarum*
Johnsongrass	*Sorghum halepense*
African Salt Cedar	*Tamarix africana*
Canary Island Salt Cedar	*Tamarix canariensis*
French Tamarisk	*Tamarix gallica*
Salt Cedar	*Tamarix ramosissima*
Mariana Maiden Fern	*Macrothelypteris torresiana*
Guinea Grass	*Urochloa maxima*
Para Grass	*Urochloa mutica*
Brazilian Vervain	*Verbena brasiliensis*
Vetch	*Vicia villosa*
Chinese Wisteria	*Wisteria sinensis*
Japanese Hawksbeard	*Youngia japonica*
Giant Sensitive Fern	*Aeschynomene fluitans*
Alligatorweed	*Alternanthera philoxeroides*
Water Sprite	*Ceratopteris thalictroides*
Dopatrium	*Dopatrium junceum*

Elodea	*Elodea canadensis*
Mile-a-Minute Vine	*Ipomoea cairica*
Indian Marshweed	*Limnophila indica*
Asian Marshweed	*Limnophila sessiliflora*
Marshweed	*Limnophila x ludoviciana*
Uruguay Seedbox	*Ludwigia hexapetala*
Peruvian Watergrass	*Luziola peruviana*
Purple Loosestrife	*Lythrum salicaria*
Catclaw Vine	*Macfadyena unguis-cati*
Big-foot Water Clover	*Marsilea macropoda*
Parrotfeather	*Myriophyllum aquaticum*
Eurasian Watermilfoil (Spike Milfoil)	*Myriophyllum spicatum*
Brittle Naiad (Brittle Waternymph)	*Najas minor*
Watercress	*Nasturtium officinale*
Sacred Lotus	*Nelumbo nucifera*
White Egyptian Lotus	*Nymphaea lotus*
Crested Floating Hearts	*Nymphoides cristata*
Duck Lettuce	*Ottelia alismoides*
Cuban Bulrush	*Oxycaryum cubense*
Water Lettuce	*Pistia stratiotes*
Japanese Knotweed	*Polygonum cuspidatum*
Curly Pondweed	*Potamogeton crispus*
Indian Toothcup	*Rotala indica*
Guyana Arrowhead	*Sagittaria guyanensis guyanensis*
TIER III	
Chinese Mystery Snail	*Bellamya chinensis*
Japanese Mystery Snail	*Cipangopaludina japonica*
Spotted Jellyfish	*Phyllorhiza punctata*
Red-Rim Melania	*Melanoides tuberculata*
Blue Land Crab	*Cardisoma guanhumi*
Exotic *Pheidole*	*Pheidole sp.*
Spotted Wing Drosophila	*Drosophila suzukii*
Mexican Rice Borer	*Eureuma loftini*
Red-streaked Leafhopper	*Balclutha rubrostriata*
Red-bay Ambrosia Beetle	*Xyleborus glabratus*
Carribean Huntsman Spider	*Heteropoda venatoria*
Southeast Asian Cellar Spider	*Crossopriza lyoni*
Pantropical Jumping Spider	*Plexippus paykulli*
Oscar	*Astronotus ocellatus*
Goldfish	*Carassius auratus*
Convict Cichlid	*Cichlasoma nigrofasciatum*

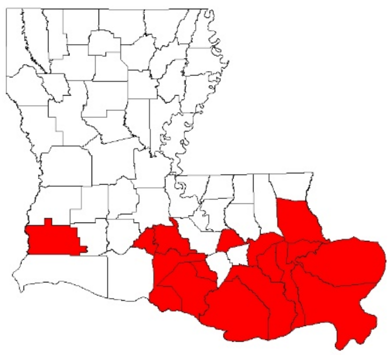
Red-bellied Pacu	*Piaractus brachypomus*
Tessellated Blenny	*Hypsoblennius invemar*
Suckermouth Catfish	*Hypostomus sp.*
Paradisefish	*Macropodus opercularis*
Oriental Weatherfish	*Misgurnus anguillicaudatus*
Tilapia	*Oreochromus, Sarotherodon, Tilapia*
Rudd	*Scardinius erythrophthalmus*
Green Swordtail	*Xiphophorus hellerii*
Southern Platyfish	*Xiphophorus maculatus*
Mediterranean Gecko	*Hemidactylus turcicus*
Flowerpot Snake	*Ramphotyphlops braminus*
Canada Goose (Feral only)	*Branta canadensis*
Mute Swan	*Cygnus olor*
Monk Parakeet	*Myiopsitta monachus*
Eucalyptus	*Eucalyptus* sp.
Asian Spiderwort	*Murdannia keisak*
Brazilian water-hyssop	*Bacopa egensis*
Blyxa	*Blyxa aubertii*
West Indian Marshgrass	*Hymenachne amplexicaulis*
Tier IV	
Freshwater Jellyfish	*Craspedacusta sowerbyi*
Brown (Mexihalo) Mussel	*Perna perna*
(Asian) Green Mussel	*Perna viridis*
Pacific Oyster	*Crassostrea gigas*
Asian Oyster	*Crassostrea ariakensis*
Giant African Land Snail	*Achatina, Archachtina, Limicolaria*
Chinese Mitten Crab	*Eriocheir sinensis*
Green Crab	*Carcinus maenas*
Rusty Crawfish	*Orconectes rusticus*
Virile Crawfish	*Ocronectes virilis*
Papershell Crawfish	*Orconectes immunis*
Emerald Ash Borer	*Agrilus planipennis*
Asian Longhorn Beetle	*Anoplophora glabripennis*
Africanized Honeybee	*Apis mellifera scutellata*
Gypsy Moth	*Lymantria dispar*
Snakehead family	*Channidae*
Walking Catfish family	*Clariidae*
Freshwater Electric Eel	*Electrophorus sp*
Asian Swamp Eel family	*Synbranchidae*
Pencil Catfish family	*Trichomycteridae*
Tench	*Tinca tinca*

Cuban Treefrog	*Osteopilus septentrionalis*
Argentine Giant Tegu	*Tupinambis merianae*
Boa Constrictor	*Boa constrictor*
Burmese Python	*Python molurus*
Pythons	*Python* sp.
Brown Tree Snake	*Boiga irregularis*
Australian Pine	*Casuarina spp.*
Old World Climbing Fern	*Lygodium microphyllum*
Punktree	*Melaleuca quinquenervia*
Brazilian Peppertree	*Schinus terebinthifolius*
"Cylindro" Blue Green Algae	*Cylindrospermopsis raciborskii*
Rooting Water Hyacinth	*Eichhornia azurea*
Indian Swampweed	*Hygrophila polysperma*
Water Spinach	*Ipomoea aquatica*
African Elodea	*Lagarosiphon major & L. muscoides*
Water Clovers	*Marsilea minuta & M. mutica*
False Pickerelweeds	*Monochoria hastata & M. vaginalis*
Marine Naiad	*Najas marina*
Little Floating Hearts	*Nymphoides indica*
Yellow Floating Heart	*Nymphoides pelata*
Roundleaf Toothcup	*Rotala rotundifolia*
Aquatic Soda Apple	*Solanum tampicense*
Water Chestnut	*Trapa natans*

D. Tier I Invasive Accounts

Apple Snail *(Pomacea spp):*
Apple Snails were first reported in the state in Gretna, LA in 2006, and have since spread throughout southeast Louisiana. *Pomacea* species attain much larger sizes than native snails, and can outcompete native species for resources, as well as cause habitat degradation by consuming large quantities of aquatic vegetation. Apple Snails have high fecundity and excellent dispersal capabilities, which further enhances their ability to outcompete native aquatic species. These snails may be introduced either accidentally or on purpose from aquaria, including the improper disposal of aquatic plants infested with eggs or juvenile snails. Apple Snails also serve as hosts for the rat lung worm *(Angiostrongylus cantonensis)* which has been shown to infect humans and other mammals. Louisiana regulations prohibit the possession of live Apple Snails.

Distribution: Primarily southeast Louisiana, but expanding.



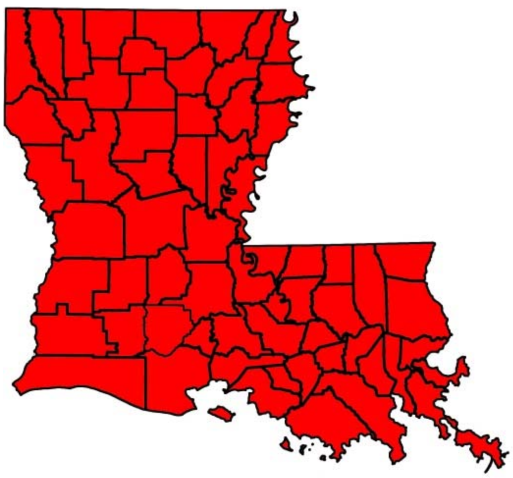
Research Needs & Management Strategies:
- Quantify impacts to native aquatic species and communities due to competition or herbivory, including what plant species the apple snails prefer to consume.
- Investigate parasite prevalence in apple snails and transference to native species to determine potential detrimental impacts.
- Investigate salinity and temperature tolerances to determine potential limiting factors for Apple Snails.
- Develop effective trapping techniques to improve control.
- Develop integrated pest control recommendations for Apple Snails, especially for smaller isolated water bodies where the spread of the animals can potentially be halted.
- Continue efforts to engage local stakeholders in documentation of Apple Snail occurrence and active control of egg masses.

Communities/SGCN Impacted.

All freshwater aquatic systems throughout the state are potentially vulnerable to invasion by Apple Snails. Although exact impacts remain unknown, all native aquatic species are potentially at risk.

Argentine Ant (*Linepithema humile*): Introduced to the U.S. through the Port of New Orleans in the late 1800's, the species now occurs throughout the southern U.S. and areas of the arid west where there is irrigation. Although the species does not sting, like the more recognizable Red Imported Fire Ant, the Argentine Ant overwhelms by sheer number – "supercolonies" may contain millions of workers and thousands of queens. Elimination of colonies is therefore highly unlikely. In most studies, the species' distribution appears tightly linked to presence of available surface water.

Distribution. Statewide, particularly near water bodies. The shoreline of Toledo Bend Reservoir is densely infested.



Research Needs & Management Strategies.

- Quantify impacts to native wildlife and ecosystem function, particularly nesting birds and reptiles
- Baseline study to determine current range, habitat utilization, and microhabitat requirements
- Prioritize control efforts to target areas of highest density or areas of greatest potential impact to native species
- Decrease likelihood of spread to un-infested areas by educating private landowners on basic identification and control measures

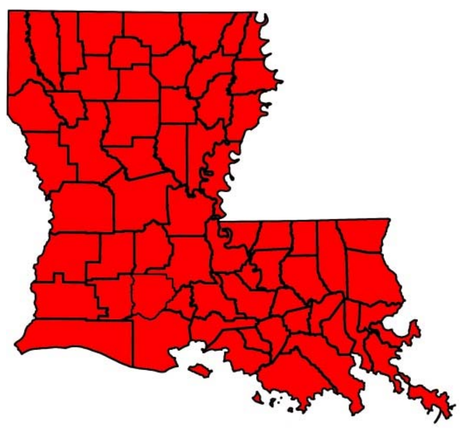
Communities/SGCN Impacted.

All terrestrial communities, with the greatest likelihood of occurrence in open, disturbed habitats near water.

Terrestrial vertebrate and invertebrate species at greatest risk, particularly those near bodies of water (e.g., riparian zones)

Red Imported Fire Ant (*Solenopsis invicta*): The Red Imported Fire Ant is an invasive, exotic, pestiferous species that occurs throughout most of the southeastern U.S. This species outcompetes native ants, causes significant reductions in other ground-dwelling arthropods, attacks and kills eggs and hatchlings of birds and reptiles, and causes shifts in entire communities. Impacts from the Red Imported Fire Ant, a disturbance dependent species, can be difficult to disentangle from effects of the disturbance itself, but the polygynous, or multi-queen form of this species, must be altering ecosystems.

Distribution. Statewide.



Research Needs & Management Strategies.

- Quantify impacts of monogyne (single queen) and polygyne (multi-queen) forms on native wildlife and ecosystem function
- Examine efficacy of broad scale pesticide treatments on suppression or elimination of red imported fire ants on barrier islands or other colonial nesting waterbird sites
- Be cognizant of possible negative impacts to non-target species of ants when utilizing pesticides for management; fire ants may recolonize at greater rates and higher densities than the natives

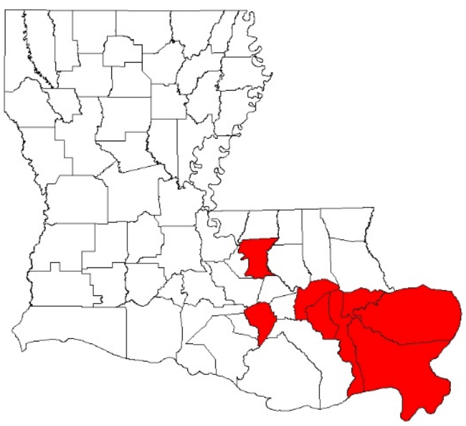
Communities/SGCN Impacted.

All terrestrial communities, including Barrier Islands. with the greatest likelihood of occurrence in open, disturbed habitats, particularly disturbed areas near water, grasslands and open pine systems; rarely found in areas of dense canopy.

Terrestrial vertebrates (including ground nesting birds and turtles) and invertebrate species

Rio Grande Cichlid *(Herichthys cyanoguttatus):*
The Rio Grande Cichlid is native to south Texas and Mexico, but has been spread through the aquarium trade to other parts of the United States. This species is very similar to native sunfishes in habitat and prey preferences, but has been shown to be more aggressive. In its native range, it does co-exist with other sunfish. Characteristics of community structure and composition within the native range may give insight into the interactions we can expect in Louisiana fish communities. Rio Grande Cichlids may impact native species by competing for nesting habitats or prey, as well as by direct predation on smaller native fishes, as well as juveniles of larger species.

Distribution: The first reports of Rio Grande Cichlids in Louisiana were from City Park in New Orleans. Since then specimens have been found in Bayou St. John, and other connecting water ways. An isolated population was reported in 2013 from Destrehan in St. Charles parish.

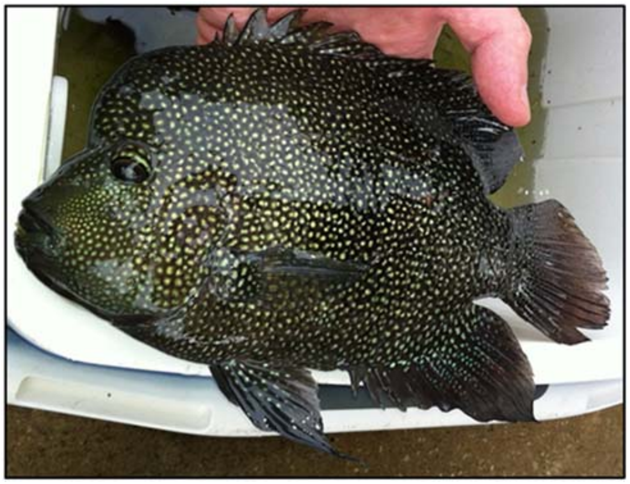


Research Needs & Management Strategies:

- Quantify impacts to native aquatic species, including interactions with native fishes.
- Determine salinity and temperature tolerances of this species to determine the extent of potential range expansion, as well as movement during periods of cold weather.
- Develop effective trapping techniques for passive control of this species.
- Develop integrated pest management strategies for this species, especially in smaller isolated water bodies where elimination could be possible.

Communities/SGCN Impacted.

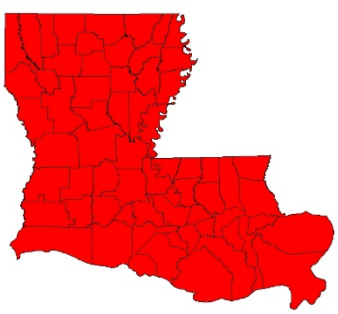
All freshwater aquatic habitats in the southern half of the state are potentially at risk for invasion.



Carp (*Cyprinus carpio, Ctenopharyngodon idella, Hypophthalmichthys molitrix, H. nobilis, and Mylopharyngodon piceus)*: Five species of non-native carp are currently found in LA, having been established through both deliberate and accidental releases. Four species, including Grass Carp, Silver Carp, Bighead Carp and Black Carp are collectively known as Asian Carp. Neither water temperature nor salinity gradients have thus far proved to be effective barriers to non-native carp, leaving the majority of Louisiana waters subject to invasion, with exceptions possibly due to water chemistry.

1. Common Carp (*Cyprinus carpio*):
Common Carp were introduced from Europe into the US in the late 1800s. Deliberate releases as a food fish and accidental releases from fish farms have aided in this species becoming so widespread that it's mistaken as native. Koi are a variety of common carp sometimes kept as ornamental fish in water gardens. Common Carp are omnivores that consume both zooplankton and phytoplankton which may include fish eggs and larvae. Common Carp increase turbidity by disturbing rooted vegetation while searching for food.

Distribution: Statewide.



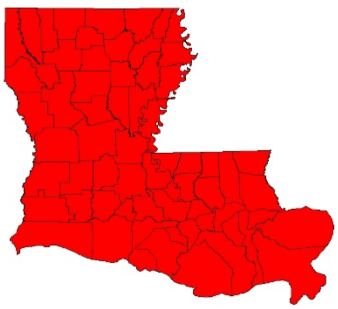
Communities/SGCN Impacted.

Many native aquatic species may be negatively impacted by Common Carp, through direct competition for resources or habitat degradation.

2. Grass Carp (*Ctenopharyngodon idella*):
In 1963, Grass Carp (also called White Amur) were introduced into aquaculture facilities in Alabama and Arkansas to control vegetation. They escaped from the aquaculture ponds and since then have legally and illegally been introduced to many water bodies. Arkansas and Mississippi presently have no restrictions on the stocking and possession of Grass Carp, whereas Louisiana allows triploid Grass Carp to be stocked with a permit. Grass Carp can have a serious effect on aquatic ecosystems by decreasing aquatic vegetation; although used to control targeted aquatic weeds, this species is a generalist herbivore. Removal of submerged aquatic vegetation

can change the phytoplankton community composition which could alter the food web of the water body.

Distribution: Statewide.



Communities/SGCN Impacted.

Many native aquatic species may be negatively impacted by Common Carp, through direct competition for resources or habitat degradation.

3. Silver Carp (*Hypophthalmichthys molitrix*) and Bighead Carp (*Hypophthalmichthys nobilis*): Silver Carp and Bighead Carp were first introduced into the United States for phytoplankton control and to improve water quality in aquaculture ponds around 1973. By the 1980s, both species were found in natural water bodies. These species are primarily planktivorous but are also detritivores.

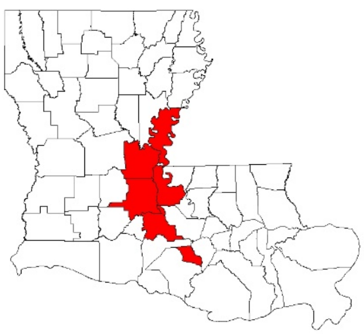
Distribution: Mississippi River and its tributaries and distributaries.

Communities/SGCN Impacted.

Filter-feeding planktivores, such as mussels and paddlefish, may be most impacted by competition for food resources or changes to plankton community.

4. Black Carp (*Mylopharyngodon piceus*):
This species is native to China and parts of eastern Russia. It consumes mollusks as well as crustaceans and insects. The first U.S. introduction was via a shipment of Grass Carp in the early 1970s. Black Carp was introduced to aquaculture facilities as a bio-control of snails in the 1980s. The only known release of this carp to native waters occurred in 1994 when an aquaculture facility was flooded near the Missouri River. At this time it is not known if Black Carp have established reproducing populations.

Distribution: Central Louisiana, in the Mississippi, Red, and Atchafalaya Rivers.



Communities/SGCN Impacted.

Native aquatic species, including mollusk and crustacean SGCN may be directly consumed. Additionally, this species may harbor parasites and diseases that could spread to native fishes, including SGCN.

5. Research needs and management strategies:

- Determine salinity tolerances of all species of non-native carp.
- Increase accuracy of triploid confirmation for Grass Carp and Black Carp used as bio-control agents in aquaculture facilities.
- Conduct research into the necessary conditions for reproduction, including flow rate and water chemistry.
- Investigate community impacts of non-native carp on native species.
- Develop passive trapping methods to aid in reduction of numbers, possibly by using the jumping behavior of some species to assist in low by-catch trapping or by targeting areas of the rivers that they prefer.
- Conduct research into the parasites and diseases carried by non-native carp and the potential impacts on native species.

Top to bottom: Grass Carp, Silver Carp and Bighead Carp.

Lionfish (*Pterois volitans and P. miles*):
Lionfish are predatory marine fish native to the Pacific Ocean that became established through aquarium releases, either accidentally or due to hurricane damage to the Miami Aquarium. These species are associated with reefs and other hard substrates. Lionfish are ambush predators that consume large quantities of prey and may alter reef fish communities by limiting prey availability or via direct predation. Juveniles have been documented offshore in Louisiana, indicating that some level of reproduction is occurring in the Gulf of Mexico. Currently this species has not been shown to occur in nearshore habitats, although there was an unconfirmed report of a Lionfish captured by a shrimp trawler in Terrebonne Bay in 2013.

Distribution: Occur throughout the Gulf of Mexico, usually associated with hard structures such as oil rigs, wrecks, reefs and rock outcroppings.

Research Needs & Management Strategies:

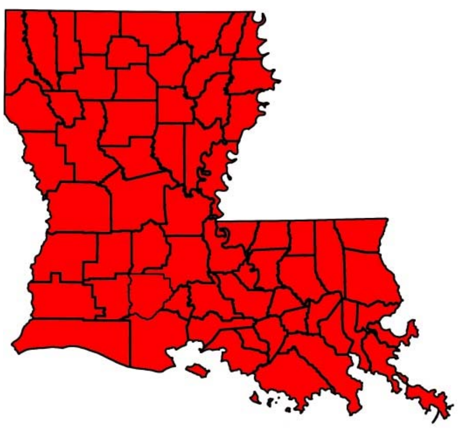
- Quantify the direct and indirect impacts to reef fish communities through resource competition or direct predation of reef fish, as well as the potential for native-species to exert top-down control of Lionfish
- Determine salinity, turbidity and temperature tolerances of Lionfish to determine invasion potential for near-shore habitats.
- Conduct inshore surveys, especially along jetties and reefs, as well as research into nesting, migration patterns, and distribution.
- Develop cost-effective control and removal techniques.
- Promote awareness of the invasive nature of this species, as well as the potential invasive qualities of other closely related species.

Communities/SGCN Impacted.

Native marine species associated with hard structure, including SGCN.

European Starling (*Sturnus vulgaris*): This highly pestiferous species was successfully introduced into the U.S. via New York in the early 1890's. Since that introduction, the species has spread across the country and may now be found on six continents. Although potentially beneficial in some agricultural settings (e.g., removal of insect pests), the species forms extremely large roosts (i.e. millions of individuals in some winter roosts) that cause substantial economic burdens and potential environmental impacts. The degree of impact on native birds has been shown to vary but negative impacts (e.g., nest usurping) have been documented for multiple species, particularly cavity nesters

Distribution. Statewide, particularly near agricultural or urban areas; less commonly encountered in heavily forested regions.



Research Needs & Management Strategies.

- Quantify impacts to native wildlife and ecosystem function, particularly cavity-nesting birds
- Prioritize control efforts to target areas of highest density or areas of greatest potential impact to native species

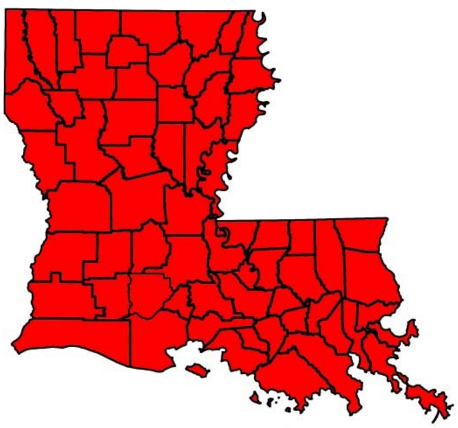
Communities/SGCN Impacted.

Terrestrial communities, particularly agricultural and urban areas. Unlikely to be major threat to any undisturbed, natural community.

Cavity-nesting birds, such as woodpeckers, and secondary cavity-nesting birds, such as bluebirds, are most likely to be negatively affected.

House Sparrow (*Passer domesticus*). Found on six continents, the house sparrow may be the most successful of all invasive bird species. The species was introduced to the U.S. via New York in the mid-1800's and rapidly spread, with multiple introductions, to the west coast by the early 1900's. Within 40 years of its introduction, government agencies were already attempting eradication. House Sparrows are particularly aggressive during nesting and usurp cavity nest sites from native birds, occasionally killing the native birds in the process. Although strongly sexually dimorphic, House Sparrows are readily identifiable to species with only one or two native birds superficially similar in appearance. Easy identification may aid in control measures, but successful eradication is not likely given the species' current geographic extent. The Partners in Flight Science Committee (2013) gives a US population estimate greater than 65,000,000 House Sparrows.

Distribution. Statewide, particularly near agricultural or urban areas; rarely encountered in heavily forested regions.



Research Needs & Management Strategies.

- Quantify impacts to native wildlife and ecosystem function, particularly cavity-nesting birds
- Prioritize control efforts to target areas of highest density or areas of greatest potential impact to native species

Communities & Species Impacted.

Terrestrial communities, particularly agricultural and urban areas. Highly unlikely to be major threat to any undisturbed, natural community.

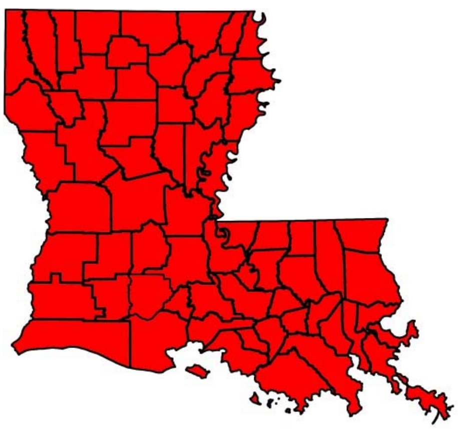
Cavity-nesting birds, such as Red-Headed Woodpecker, and secondary cavity-nesting birds, such as bluebirds, are most likely to be affected by House Sparrows.

Partners in Flight Science Committee 2013. Population Estimates Database, version 2013. Available at http://rmbo.org/pifpopestimates. Accessed on 17 September 2013.

Photo of female ©Wikimedia Commons (check credits)

Black Rat (*Rattus rattus*) and Norway Rat (*Rattus norvegicus*): Originating in Asia, but now cosmopolitan, both of these invasive rodents damage crops, destroy or despoil great quantities of foods and stored grains, harbor diseases to which man is susceptible (Lowery 1974) and have negative impacts on native wildlife. Both species are omnivorous, and have been documented to kill fish, chicks, young rabbits, mice, birds and other animals (Burger 1999). Island ecosystems are especially susceptible to disturbance by rats. Rats are also common disease and parasite vectors, including diseases that may impact native species and humans such as typhus and bubonic plague (Champan and Feldhamer 1982). Both of these species have high reproductive potential, with breeding occurring year round. Females are capable of producing up to 7 litters a year (Jackson 1982), with up to 12 young per litter.

Distribution. Statewide.



Research Needs & Management Strategies.

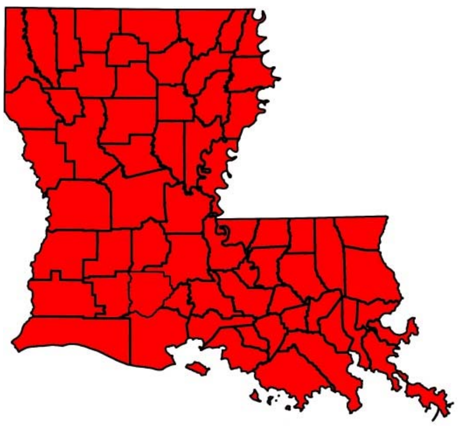
- Quantify impacts of both species on native wildlife, particularly on Barrier Islands.
- Conduct research to determine the role these species play as disease vectors for native species.
- Investigate novel control methods to reduce the negative impacts of these species.
- Conduct trapping or other control methods to eliminate invasive rats from barrier islands where they are reducing productivity of SGCN, especially waterbirds.

Communities/SGCN Impacted.

Barrier Islands are especially vulnerable to invasion by these species. Invertebrates, reptiles, amphibians, mammals and ground nesting bird species, including colonial waterbirds are most at risk of direct predation.

Nutria (*Myocastor coypus*): Nutria are large herbivorous aquatic rodents brought to Louisiana from Argentina in the early 20th century for fur farming. Some animals were deliberately released into Louisiana marshes, and other in cases animals escaped confinement (Bernard 2002). Whether intentionally released or escaped, nutria are now established throughout the state. Nutria typically feed on the roots of semiaquatic and aquatic vegetation (Jones and Leopold 2001). This leads to a loss of vegetative cover, which in turn leaves the denuded substrate subject to erosion. The end result of this process is the conversion of marsh to open water.

Distribution. Statewide, found in fresh, brackish, and salt water.



Research Needs & Management Strategies.

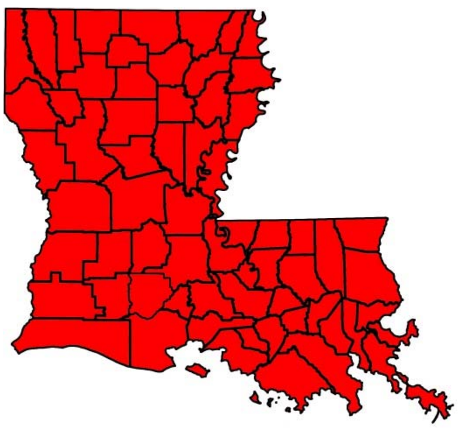
- Study the impacts of grazing Nutria on vegetation in coastal wetlands, including plant responses
- Use models to determine the effects of Nutria on marsh loss
- Determine role of Nutria as predator in colonies of beach-nesting birds
- Continue to support the Coastwide Nutria Control Program.

Communities/SGCN Impacted.

Aquatic communities, particularly Fresh, Intermediate, Brackish Marsh, and Salt Marsh, via herbivory, accelerated land loss, and direct destruction through burrow construction. Potentially all native species, including SGCN, that depend on marsh. Recent observations on a Louisiana Barrier Island implicate nutria as a beach-nesting bird nest predator (Furfey, pers. comm.)

Feral/Domestic Cats (*Felis catus*): Free-ranging, outdoor cats may be the number one anthropogenic-related cause of wildlife mortality in the U.S. Meta-analysis of several cat predation studies suggests that cats may kill more than 3 billion birds, more than 20 billion mammals, and more than 1 billion reptiles and amphibians annually (Loss *et al.* 2013). Cats may also spread infectious diseases and parasites such as rabies, toxoplasmosis and hookworms to native wildlife. Few invasive species have been as thoroughly shown by science to cause significant impacts to native species, yet largely ignored.

Distribution. Statewide, typically with greater concentrations near urban centers.



Research Needs & Management Strategies.

- Quantify impacts to migratory birds and terrestrial wildlife by outdoor cats, particularly at migrant stopover sites
- Promote American Bird Conservancy's Cats Indoors® program
- Educate public on human health impacts created by outdoor cats (e.g., rabies, toxoplasmosis, etc.)
- Provide education on why Trap, Neuter, and Release programs are not effective
- Ensure laws and statutes regarding free-ranging cats are upheld and enforced
- Promote humane removal from Barrier Islands and other migrant stopover sites

Communities & Species Impacted.

All terrestrial communities, including Barrier Islands

Terrestrial and, rarely, aquatic vertebrate and invertebrate species may be affected. Most prey targeted is <100 grams, but items >500 grams may be taken.

The presence of free-ranging cats in wild spaces places tremendous stress on native wildlife during all aspects of their life cycle, which can lead to decreased fitness and fecundity.

Migration is a taxing time for Neotropical migrant songbirds. In spring migration, exhausted birds may arrive otherwise healthy in Grand Isle, La., only to be killed by cats. Note the dead research bird.

Feral Hogs (*Sus scrofa*): Feral hogs, which are also commonly referred to as feral swine, wild hogs, wild boar, Russian boar and "piney-woods rooters", are defined as swine or their offspring which have spent any portion of their life outside of confinement.

Feral hogs are omnivores and commonly reach weights exceeding 250 lbs. This species reaches sexual maturity between 6 and 8 months of age and is capable of producing 2 litters of piglets per year. The average litter size is 6 piglets, but litters of up to 20 piglets have been observed. Adult boars may lead somewhat solitary lives except when pursuing sows to breed. The sows and piglets typically travel in groups known as "sounders". These sounders may contain as many as 40 hogs. The overall population of feral hogs in Louisiana is unknown but surveys indicate that deer hunters alone harvest over 150,000 annually, with no reduction in visible hog damage on the landscape.

These animals compete directly with native wildlife for mast crops, consume untold numbers of reptiles, amphibians and invertebrates and prey opportunistically on deer fawns as well as eggs of ground –nesting birds, turtles and alligators. Additionally, Feral Hogs uproot tree seedlings, consume native plants, initiate erosion problems, and contaminate waterways with coliform bacteria. They harbor a multitude of diseases contagious to other wildlife and humans such as swine brucellosis, pseudorabies, leptospirosis, salmonellosis and *Escherichia colibacillosis*.

Distribution. Statewide.

Research Needs & Management Strategies.

- Numbers can be reduced through shooting, trapping, snaring and pursuit with dogs.
- Research is needed on swine-specific toxicants and immunocontraceptives.
- Educate the public on disease transmission, zoonotic diseases and the detriments of intentional translocation of this species.

Communities/SGCN Impacted.

All terrestrial communities, including marshlands and barrier islands.

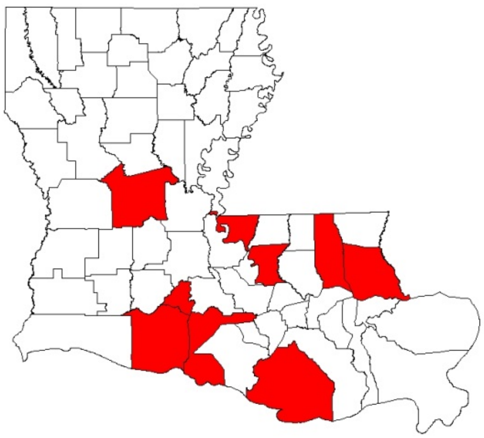
Terrestrial animals, ground-nesting birds, reptiles, amphibians, as well as invertebrate species may be affected. Additionally, plant species and water shed ecology may be significantly impacted.

Typical hog rooting in a pasture in Central LA.

An adult feral hog boar in a SW Louisiana marsh.

Coral Ardisia (*Ardisia crenata*): Coral ardisia is an evergreen shrub native to East Asia that has become naturalized in Florida, Georgia, Louisiana and Texas. It was introduced into the United States as an ornamental and is still used in landscaping. The presence of Coral Ardisia can significantly decrease native plant species richness since densities may reach more than 100 plants/m^2 in infested areas (Langeland and Burks 2007). Such densities are partially due to the poor dispersal typical of this species, as well as high germination rates, which lead to dense stands in the vicinity of parent plants. This species is typically found in areas with moist rich soils

Distribution. Scattered throughout central and southern Louisiana.



Distribution from Thomas and Allen (1998) and observations by LDWF staff.

Research Needs & Management Strategies.

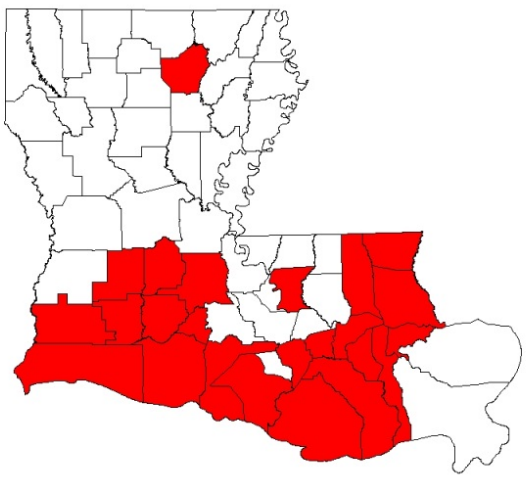
- Establishment of a Coral Ardisia occurrence database; rigorous documentation of newly discovered populations.
- Pursue control of Coral Ardisia on public conservation lands, to include hand-pulling and/or herbicide application.

Communities/SGCN Impacted.

Bottomland Hardwood Forest, Mixed Hardwood-Loblolly Pine Forest, Salt Dome Hardwood Forests, Small Stream Forest, and Southern Mesophytic Forests.

Camphor Tree (*Cinnamomum camphora*): Camphor Tree is a small to medium sized tree that can grow to about 50 feet tall. Crushed leaves emit a strong camphor odor, hence the common name. Camphor Tree is commonly seen in disturbed areas along roads and fence and hedge rows (Godfrey 1988). The fruits are consumed and spread by birds (Langeland et. al. 2008). In southern Louisiana, camphor tree can invade moist forests. It is especially problematic in Salt Dome Hardwood Forests on Cote Blanche and Weeks Islands, where it displaces native species. Despite its invasive nature, camphor tree is still available at nurseries and is planted in yards and urban areas.

Distribution. Moist rich soils mainly in the southern half of the state.



Distribution from Thomas and Allen (1998)

Research Needs & Management Strategies.

- Increase awareness of the threat posed by this species, which is still used as an ornamental.
- Implement aggressive site-level control measures on conservation lands where this species is present.

Communities/SGCN Impacted.

Bottomland Hardwood Forest, Salt Dome Hardwood Forest, and Natural Levee Live Oak Forest are known to be vulnerable to invasion by Camphor Tree.

Photos by Larry Allain

Bermuda Grass (*Cynodon dactylon*): Bermuda Grass is a sod-forming grass native to the tropics of Africa and Asia. It is a short grass that produces both rhizomes and stolons ("runners"). Bermuda grass is used as a forage grass for cattle and is often used for pastures and hay fields. Where it has not been intentionally introduced, Bermuda Grass is mostly encountered as a weed of disturbed areas. Bermuda Grass has some salt tolerance and is one of the only exotics that competes well in saline prairies. This species can also be a weed of Calcareous Prairie and Coastal Prairie as well as dominate Sandbars.

Distribution. Statewide.

Distribution from Thomas and Allen (1993)

Research Needs & Management Strategies.

- Control local infestations in natural areas with either grass-selective or broad spectrum herbicides.
- Provide education and outreach to landowners, producers, and partner agencies regarding impacts of sod-forming grasses on SGCN of native grasslands (e.g. Northern Bobwhite).
- Discourage use of this species where native bunch grasses are a viable alternative.

Communities/SGCN Impacted.

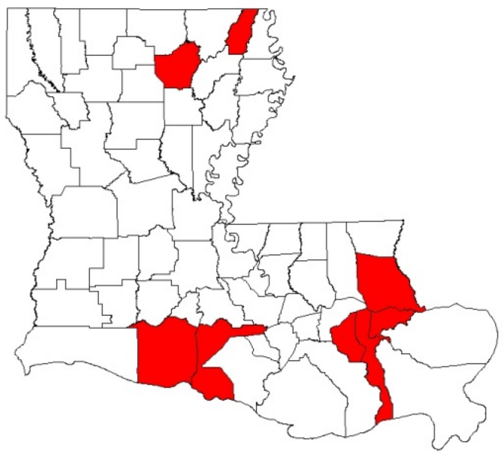
Calcareous Prairie, Coastal Prairie, Saline Prairie, and Sandbars (can be dominant here) are at high risk of invasion by this species.

SGCN that utilize native grasslands, such as Northern Bobwhite, may be most at risk.

Air Yam (*Dioscorea bulbifera*):

Air Yam is an aggressive twining herbaceous vine native to either Asia or Africa, with morphological differences existing between continents. Air yam found in the southeast U.S. is likely to be the African type. Plants die back to the ground line in winter, but dead vines serve as trellises for regrowth in the spring (Miller et al. 2010). In Florida, Air Yam is naturalized (Gucker 2009) and it extends across the Gulf States westward to Texas. This species is extremely fast growing, at a rate of roughly 8 inches per day, and can climb up to 70 feet high. Air Yam spreads primarily through the profuse production of aerial tubers called bulbils (Langeland 2008). This fast reproduction via bulbils has already been documented in Louisiana. In a study of forest regeneration following Hurricane Andrew in Florida, Air Yam was found to impede regeneration of trees following disturbance (Horvitz et al. 1998).

Distribution: Scattered, most frequent in southern Louisiana.



Distribution from USDA, NRCS (2013) and other reports

Research Needs & Management Strategies.

- Conduct outreach to educate the public and land managers on the identification and negative impacts of this species.
- Organize aggressive removal programs on conservation lands.

Communities/SGCN Impacted

Barrier Island Live Oak Forest, Bottomland Hardwood Forest, Natural Levee Live Oak Forest, and Salt Dome Hardwood Forest.

SGCN that depend on the impacted natural communities, including Neotropical migrant birds that may be negatively impacted by decreased quality of stopover habitat associated with heavy infestations.

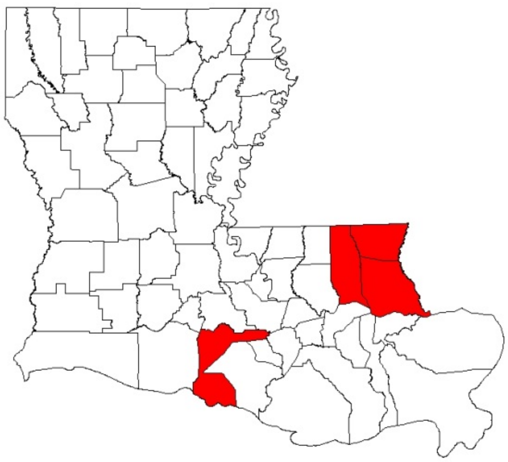
Left: A pile of Air Yams (bulbils) collected from The Nature Conservancy's Grand Isle Preserve by volunteers in just a few hours.

Photo courtesy of Matt Pardue.

Japanese Twin-Sorus Fern (*Deparia petersenii*):

Japanese Twin-Sorus Fern is currently a lesser known invasive, but is spreading in the southeastern U.S. This species is listed as an invasive in southern forests by Miller et al. (2010) but its impacts are apparently not known. Japanese Twin-Sorus Fern can be found growing amongst native ferns in rich woods, ravines, riparian forests, and wooded seeps (Nelson 2000). The distribution of this species in Louisiana certainly under-reported but infestations can be severe where it occurs.

Distribution. Eastern Florida Parishes, Weeks Island and possibly other salt domes.



Distribution based on specimens housed at LSU Herbarium

Research Needs & Management Strategies.

- Conduct field surveys to better determine distribution and abundance in Louisiana.
- Conduct research to determine the ecological impact of this fern on native species in Louisiana.

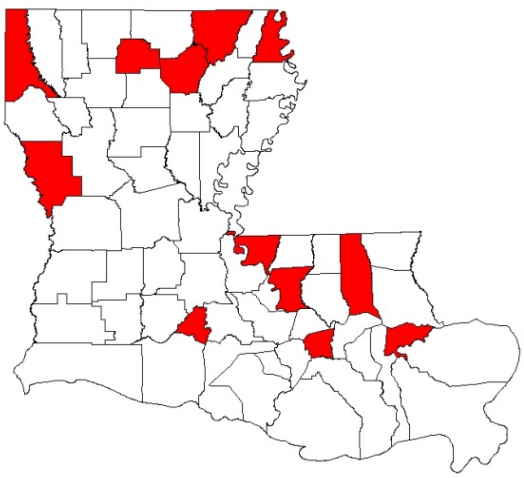
Communities/SGCN Impacted.

Bayhead Swamp, Hardwood Slope Forest, Salt Dome Hardwood Forest, Small Stream Forest, and Southern Mesophytic Forest are known to be invaded by this species.

Chinese Parasol Tree (*Firmiana simplex*):

As the name implies, Chinese Parasol Tree is native to China. This species is extremely fast growing, and in Louisiana has demonstrated the ability to aggressively invade forested areas. Chinese parasol tree is self-fertilizing and produces profuse amounts of seed (Servis 2013). These characteristics coupled with a fast growth rate make it a serious threat, compounded by the fact that Chinese Parasol Tree is still sold in nurseries and planted in gardens and urban areas, increasing the likelihood of continued introductions. As with many exotic plants, this species has the potential to alter the composition of natural communities, reducing habitat quality.

Distribution. Widely scattered. Well established colonies exist in the Tunica Hills in West Feliciana parish.



Distribution from Thomas and Allen

Research Needs & Management Strategies.

- Pursue regulations prohibiting the commercial sale of this species.
- Elevate control of this species to high priority on conservation lands.

Communities/SGCN Impacted.

Hardwood Slope Forest, Southern Mesophytic Forest, and Mixed Hardwood-Loblolly Pine Forests.

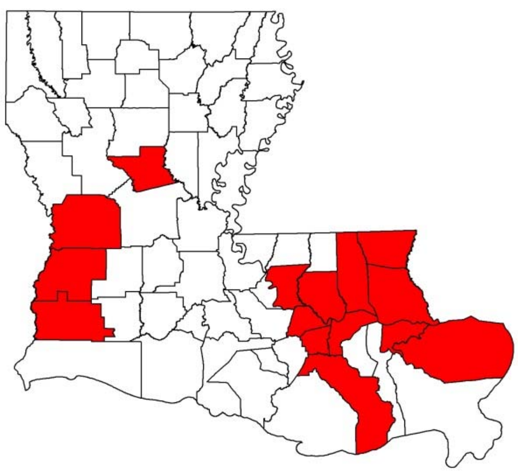
Left: dense stand of Chinese parasol trees (plants with yellow-green leaves) in forest near St. Francisville.

Above Photo courtesy of Larry

Cogon grass (*Imperata cylindrica,* including *I. brasiliensis*):

Cogon Grass has been in the southeastern U.S. for about 100 years. It has been introduced several times, both accidentally in packaging material and intentionally as a potential forage grass. This species is a coarse, robust grass with extensive rhizomes forming dense colonies. The foliage is not palatable to grazing animals and fire benefits this plant. Together, these attributes make Cogon Grass a formidable weed. Cogon grass foliage ranges from over 1 foot to several feet in height. The midrib of the leaf blade is noticeably off-centered as shown in the image below. The leaf blade margins have a scratchy texture. Cogon grass flowers in the spring, producing a white silky contracted panicle that is exerted above the foliage.

Distribution: Mainly Florida Parishes and between Baton Rouge and New Orleans, with several occurrences west of the Mississippi River.



From Kartesz 2014

Research and Management Needs.

- Clean highway mowing equipment after use
- Early detection of new occurrences
- Avoid soil disturbance in pine grassland habitats
- Education and outreach to landowners and the public

Communities/SGCN Impacted.

Eastern Longleaf Pine Savannah, Western Longleaf Pine Savannah, Eastern Upland Longleaf Pine Forest, Western Upland Longleaf Pine Forest, and Sandbars (particularly in the Florida Parishes).

Many SGCN, including Gopher Tortoise, and beach nesting turtles may be negatively impacted due reductions in forage plants and suitable nesting sites, respectively, due to heavy infestations.

Above: Severe infestation of cogon grass on a sand bar on Bogue Chitto River, Washington Parish.

Right: Cogon grass leaf blade showing offset midrib. Photo by Larry Allain.

Chinese Privet (*Ligustrum sinense*). Chinese Privet is one of the most problematic weeds in the southern U.S. Since its introduction in 1852, it has become naturalized throughout the southeast. Once introduced to an area, Chinese Privet can quickly out-compete native shrubs and trees, reducing ground layer species, and altering community structure. Chinese Privet prefers mesic soils, but will also grow on drier sites, and tolerates both heavy shade and direct sunlight. These characteristics allow Chinese Privet to invade a range of habitat types. Chinese Privet creates large seedbanks in infested areas (USDA, NRCS 2013) and also spreads vegetatively by root suckers, making privet difficult to eradicate from an area.

Distribution. Statewide**.**

Research Needs & Management Strategies:

- Promote control measures such as prescribed burning and herbicide use, where applicable.

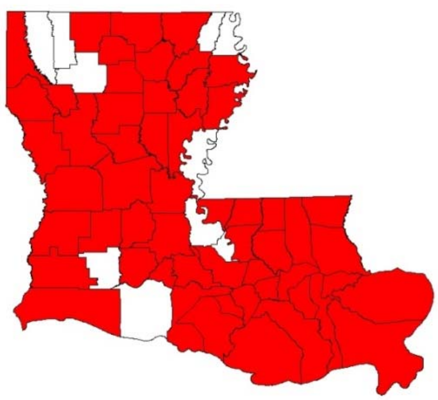
Communities/SGCN Impacted.

Can affect almost all native forested communities, as well as Coastal Prairie and other grassland systems.

Japanese Climbing Fern (*Lygodium japonicum*):

Japanese Climbing Fern is a true fern that climbs by twining fronds. The frond (leaf) is the climbing structure, while the stem (rhizome) is present in the ground. The fronds of Japanese Climbing Fern are light green and, especially when fertile, appear "feathery". Reproduction is by spores and rhizomes. Japanese Climbing Fern is a very frequent, almost ubiquitous invasive. This species climbs on trees and over understory shrubs and herbs, shading them out. Additionally, the climbing fronds are a ladder fuel, enabling fire to reach the forest canopy, which can result in habitat degradation. While this species can invade relatively undisturbed forests, Japanese Climbing Fern is usually much more abundant in disturbed forests, and along forest edges in utility corridors and along roadsides.

Distribution: Essentially Statewide.



Research Needs & Management Strategies.

- Implement prescribed fire followed by targeted herbicide application to kill re-sprouting plants. Use chemical control alone if prescribed fire is not possible (or unsuitable for the community).

Communities/SGCN Impacted.
Bottomland Hardwood Forest, Hardwood Slope Forest, Mixed Hardwood-Loblolly Pine Forest, Salt Dome Hardwood Forest, Small Stream Forest, Southern Mesophytic Forest, Spruce Pine-Hardwood Flatwoods, and Eastern and Western Upland Longleaf Pine Forest.

Holmwood Grass (*Paspalum modestum*; synonym = *P. hydrophilum*):

Holmwood Grass is native to South America (Allen and Hall 2003). This species occupies a relatively small range in Louisiana but is a significant threat where it does occur. Holmwood Grass may have been introduced in contaminated rice seed and is particularly well-established in the area of Holmwood near Lake Charles, hence the common name used here. Holmwood Grass is problematic in Coastal Prairie remnants, where it can form dense stands in wet depressions.

Distribution. Restricted to the Southwest corner of the state, centered around Lake Charles.

Distribution determined from Allen et al. (2004)

Research Needs & Management Strategies.

- Determine the effects of prescribed fire on this species
- Identify herbicides and application times that are effective in controlling Holmwood Grass, while minimizing damage to desirable natives.

Communities/SGCN Impacted

Coastal Prairie and Western Longleaf Pine Savannah are particularly vulnerable to invasion.

Vasey Grass (*Paspalum urvillei*):

Vasey Grass is native to South America and is a frequent invader of disturbed areas in Louisiana. Vasey Grass thrives in open, moist to wet disturbed areas and is commonly seen on roadsides and in agricultural fields where it can be problematic for land managers (Allen et. al. 2004). On grazed lands it is avoided by livestock due to its unpalatability, allowing it to freely proliferate on ranges and pastures. Self-fertilization, a fast growth rate, and the ability to thrive in a wide range of environmental conditions make Vasey Grass a fierce competitor for native flora. Vasey Grass requires soil disturbance to gain a foothold, and will not often invade undisturbed high quality grasslands, with the possible exception of wetter prairies. However, as many remaining native grasslands are disturbed, this species poses a very real threat.

Distribution: Statewide.

Distribution from Thomas and Allen (1993)

Research Needs & Management Strategies.

- Minimize soil disturbance in prairies to deny growing space to Vasey Grass.
- Determine the effects of resting land from grazing and fire on the abundance of Vasey Grass.

Communities/SGCN Impacted.

Communities at highest risk of invasion are grassland communities, including Calcareous and Coastal Prairie and both Eastern and Western Longleaf Pine Savannah, but Vasey Grass can also be found in disturbed areas throughout the state. This species also has the potential to invade and degrade Ephemeral Ponds.

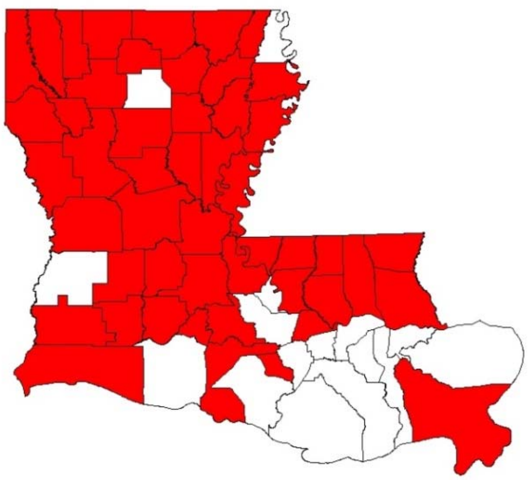
All SGCN that occur in the affected communities are subject to negative impacts, especially those closely tied to native grasses that may be outcompeted.

Photo courtesy of Larry Allain

Trifoliate Orange (*Poncirus trifoliata*):

Trifoliate Orange is native to China, and was introduced as an ornamental and hedge plant. This species is also used as stock on which to graft commercial citrus, which may afford additional opportunities for escape. Trifoliate Orange occurs on mesic soils of Hardwood Flatwoods and Hardwood Slope Forests where it can form extensive thickets, outcompeting native species

Distribution: Nearly statewide.



Research Needs & Management Strategies.

- Pursue aggressive chemical control of this species on conservation lands, particularly in rare community types.

Communities/SGCN Impacted.

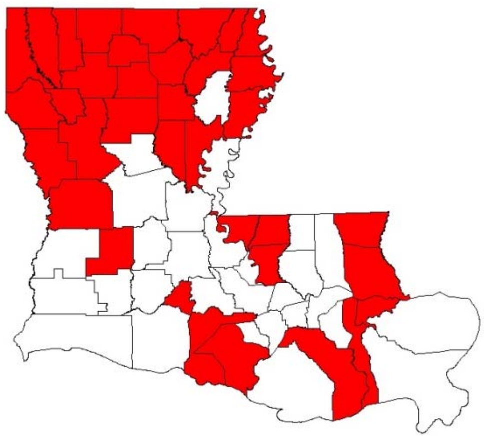
Bottomland Hardwood Forest, Hardwood Flatwoods, Hardwood Slope Forest, and Southern Mesophytic Forest are known to be invaded by this species.

Photo by Jeff McMillian

Kudzu Vine (*Pueraria montana*):

Kudzu is a fast growing deciduous legume that spreads by twining and will completely blanket large expanses if left uncontrolled. These monospecific expanses may suffocate all other vegetation, leading to decreased structural and species diversity. Kudzu thrives in open disturbed areas and is typically seen on forest edges, abandoned fields, and roadsides (Munger 2002). Kudzu is susceptible to Asian Soybean Rust (Benedict 2009) and Tobacco Ringspot Virus (Khankhum et al. 2013) making it a potential conduit for the infection of valuable economic crops or native legumes important to wildlife. In a study by Hickman et. al. (2012), Kudzu was discovered to reduce air quality by increasing nitrogen cycling in soils, causing soils to increase emissions of nitric oxide.

Distribution. Widely distributed throughout the state.



Research Needs &Management Strategies.

- Control this species using a variety of techniques (i.e. herbicide application, mechanical control, prescribed burning, and grazing) as appropriate for the affected habitat.
- Support research to identify more effective control measures for this species, including potential biological controls.

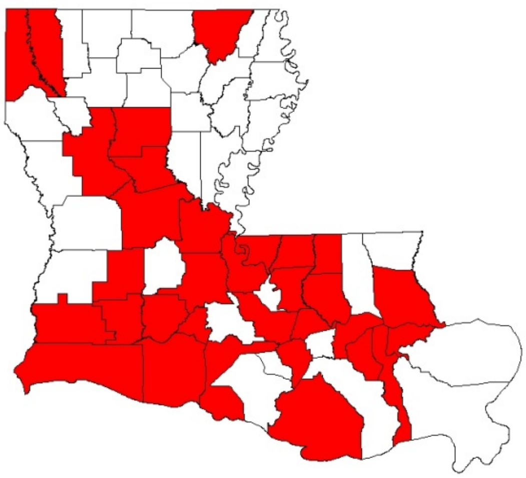
Communities/SGCN Impacted.

Kudzu threatens many native communities, as it has the ability to completely cover native vegetation. Native forests are particularly vulnerable, including Southern Mesophytic Forest, Bottomland Hardwoods, and Batture.

Macartney Rose (*Rosa bracteata*):

Macartney rose is a densely thorny evergreen shrub that grows in clumps, and produces arching and climbing stems, or canes. If left uncontrolled, heights can reach up to 3.5 m (Global Invasive Species Database 2005). Macartney Rose was introduced in the U.S. as an ornamental. Now a problematic weed, it has become nearly impossible to eradicate from the landscape (Enloe et al. 2013). Macartney Rose thrives in open sun in frequently disturbed areas and is drought and fire tolerant. This species is often very conspicuous on heavily grazed rangelands and pastures and is very persistent when cultivated then abandoned. Macartney Rose forms dense thickets that choke out native and desirable vegetation. Wildlife and cattle readily consume the rose hips (fruits) and subsequently spread seeds. McCartney Rose also spreads vegetatively through canes rooting at the nodes (Enloe et.al. 2013).

Distribution in Louisiana. Widely distributed.



Distribution from Thomas and Allen (1998)

Research Needs & Management Strategies.

- Site level control of infestations is the only level of control that is feasible. Implement targeted herbicide application followed by prescribed fire. Use chemical control only if fire is not possible.

Communities/SGCN Impacted.

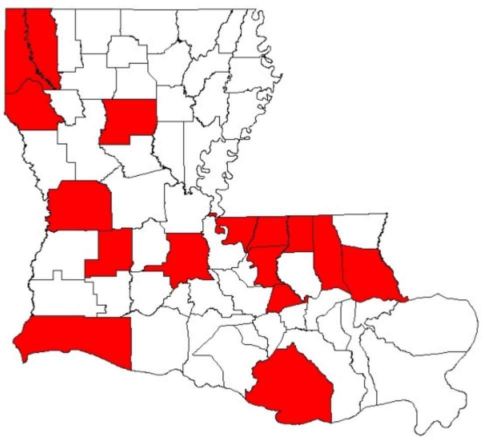
Coastal Prairie, Eastern and Western Longleaf Pine Savannah, and Eastern and Western Upland Longleaf Pine Forest
SGCN that are found in native grasslands and open-pine systems are vulnerable to negative impacts due to reduction in habitat quality.

Photos by Larry Allain

Cherokee Rose (*Rosa laevigata*):

Cherokee Rose is native to China, and like many non-native plants, was brought to the United States as an ornamental. Cherokee Rose is a prickly evergreen sprawling shrub or high climbing vine. This species sometimes grows solitarily, climbing on itself and sprawling outwards. Cherokee Rose can be found in sunny disturbed areas along edges of forests, savannahs, rangelands, pastures, along streams, and in utility rights of way. Since it thrives on edges, it is reasonable to expect Cherokee Rose to colonize canopy gaps in forests and hinder forest regeneration.

Distribution. Widely scattered. Well established and frequent in West Feliciana parish in the Tunica Hills.



Distribution from Thomas and Allen (1998)

Research Needs & Management Strategies.

- Determine the status and impact of this species in the state outside of the Tunica Hills area.
- Control this species where it occurs on conservation lands.

Communities/SGCN Impacted.

Southern Mesophytic Forest, Small Stream Forest, Eastern and Western Longleaf Pine Savannahs and other native grasslands are most vulnerable to infestation by this species.

Photo by Jeff McMillian

Chinese Tallow Tree (*Triadica sebifera*):

Chinese Tallow (a.k.a. Chicken Tree or Popcorn Tree) is one of our most serious invasives in mesic to wet forests and grasslands. Native to East Asia, it has been present in the southeastern United States since the late 1700s, when it was introduced as an ornamental. The persistent seeds account for the common name Popcorn Tree. Chinese Tallow Tree is an invader of disturbed areas but can also appear in undisturbed forests. This species utilizes disturbed areas such as utility corridors to penetrate interior forests. In the historical range of Coastal Prairie, it is a major weed of old fields, pastures, and range land. Neglected fields can come to be dominated by Chinese Tallow Tree, with nearly monospecific stands. Shallow wetlands such as Flatwoods Ponds, especially in the absence of frequent fire, can also become tallow thickets.

Distribution: statewide

Distribution from Thomas and Allen (1996) and additional field observations.

Research Need & Management Strategies:

- At the site level, employ herbicides designed for brush control in rangelands and forests
- Provide funding programs to landowners for broad scale herbicide application
- Maintain a vigorous prescribed burning program in prairies and pine grasslands to prevent infestation
- Educate to prevent further plantings of this species for landscaping

Communities/SGCN Impacted.

Bottomland Hardwood Forest, Coastal Prairie, Cypress-Tupelo-Blackgum Swamp, Ephemeral Ponds, Live Oak Natural Levee Forests, Eastern and Western Longleaf Pine Savannah, and Small Stream Forest are among the natural communities impacted.

Left photo: Chinese Tallow Tree in flower (male catkins).

Right photo: mature popcorn-like fruits.

Photos courtesy of Lowell Urbatsch

Smut Grass (*Sporobolus indicus*):

Godfrey and Wooten (1979) report Smut Grass to be native to tropical Asia although it may be native to tropical regions worldwide (Peterson et al. 2003). Smut Grass grows to about 3 ft. tall and typically occupies disturbed or compacted soils. This species is often infected by *Curvularia ravenelii,* a black fungus which causes False Smut Disease (hence the common name Smut Grass). Smut Grass forms extremely dense clumps, excluding native vegetation and decreasing diversity. The presence of Smut Grass on pasture and rangeland can be an indicator of overgrazing as this exposes bare soil, creating ideal conditions for smut grass seed germination. One individual can produce up to 45,000 seeds per year that easily attach to animals and are carried by wind and water. Smut Grass seeds can also survive in soil for more than 2 years (Davy et. al. 2012). Its prolific seed production as well as seed size and lifespan contribute to its success as an invasive.

Distribution: Statewide. Particularly common in pasture and rangelands.

Distribution determined from Allen et al. (2004)

Research Needs & Management Strategies:

- Work with landowners to establish grazing schemes that avoid overgrazing high quality native grasses, precluding the establishment of vigorous stands of smut grass.

Communities/SGCN Impacted.

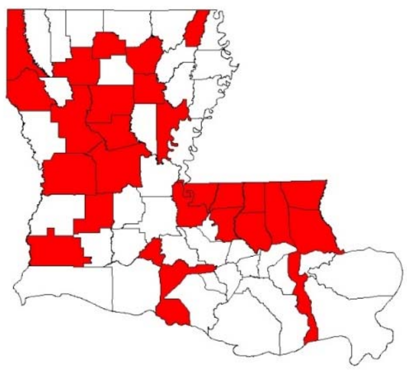
Coastal Prairie may be the community most threatened by this species, although Saline and Calcareous Prairie are also highly vulnerable.

Long narrow seed heads of Smut
Grass. Photo by Larry Allain.

Tung Oil Tree (*Vernicia fordii*):

Tung Oil Tree is a small deciduous tree native to China that has been cultivated for tung oil, a component in lacquers, varnishes, polishes, and other products. Dense Tung Oil Tree stands may represent abandoned plantations. A distinctive feature is the presence of two red glands located on the petiole (leaf stalk) right at the junction with the leaf blade. All parts of the plant are toxic, especially the fruits and seeds.

Distribution. Tung Oil Tree occurs in mesic soils and is most prevalent in the Florida Parishes.



Distribution from Thomas and Allen (1996)

Research Needs & Management Strategies.

- Provide funding to landowners to implement site-level control
- Provide information to the public about why planting this tree is undesirable in landscaping

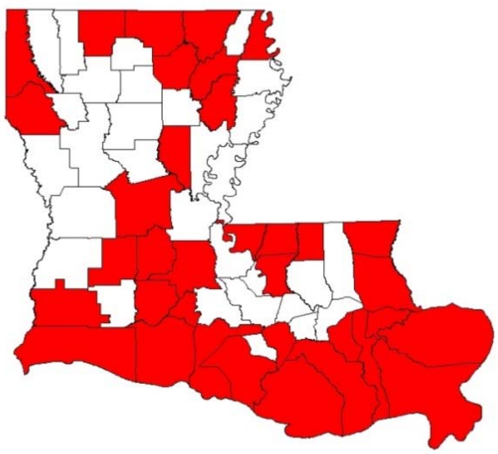
Communities/SGCN Impacted.

Eastern Upland Longleaf Pine Forest, Mixed Hardwood-Loblolly Pine Forest, Shortleaf Pine-Oak-Hickory Forest, Southern Mesophytic Forest, and Small Stream Forest.

Wild Taro (*Colocasia esculenta*):

Wild Taro, also called Elephant Ear, is a Southeast Asian native that is cultivated in many areas for its edible (following cooking) corms. It is very frequent in southern Louisiana where it often forms dense stands along shorelines and in Cypress-Tupelo Swamps, displacing native vegetation. In some areas of southern Louisiana, this species has become so abundant that control is no longer practical.

Distribution: Scattered statewide, but most abundant in the southern half of the state.



Distribution from Thomas and Allen (1993)

Research Needs & Management Strategies:

- Discourage use of this species as an ornamental.
- Control local infestations (especially before it gets out-of-hand) with a combination of digging corms from soil and application of glyphosate plus surfactant (MacDonald et al. 2008).
-

Communities/SGCN Impacted.

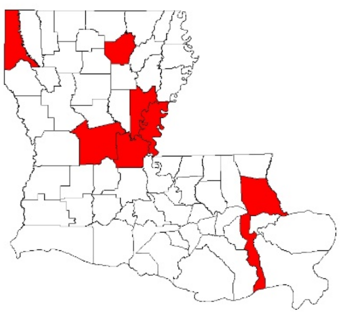
All freshwater communities, including Cypress-Tupelo Swamp, are particularly vulnerable to this species, as well as the shorelines of sluggish waterways throughout the state.

Photo by Larry Allain

Brazilian Waterweed (*Egeria densa*):

This species is also known as Common Waterweed or Brazilian Elodea. Establishment in natural ecosystems is likely due to dumping from aquaria, however this species has also been intentionally introduced, as it was once thought that it could help control mosquito larvae due to its oxygenating properties, Brazilian Waterweed has the ability to spread vegetatively, which can happen via currents, boats, and trailers. This plant forms dense mats near the surface of the water, choking out native vegetation and degrading water quality and fish habitat. Although some states have placed restrictions on the sale and transport of this plant, it remains one of the most widely distributed and utilized aquarium oxygenator plants.

Distribution: Found in scattered areas around the state, *Egeria densa* prefers the slow-moving waters of streams, ponds, and lakes.



Research Needs & Management Strategies:

- Brazilian Waterweed has been successfully controlled with herbicides and through herbivory by triploid Grass Carp.
- Research into cold tolerance and salinity tolerance
- Conduct research to determine more cost effective methods of control, including alternative herbicides and the use of additional bio-controls.
-

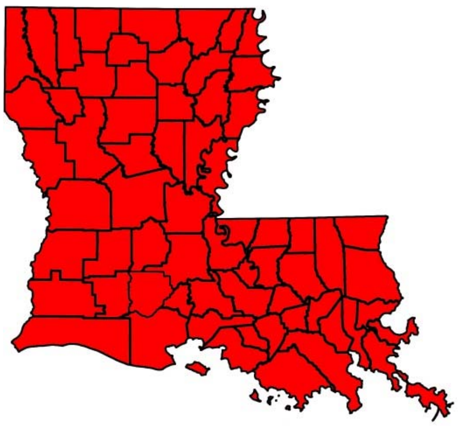
Communities/SGCN Impacted.

Cypress-Tupelo Swamp is particularly vulnerable to this species, as well as the shorelines of sluggish waterways throughout the state.

Water Hyacinth (*Eichhornia crassipes*):

Native to South America, Water Hyacinth was first introduced into the United States as an ornamental plant at the World's Industrial and Cotton Centennial Exposition in New Orleans in 1884-1885. Because of its attractive purple flowers, Water Hyacinth quickly became popular among gardeners and landscapers. Water Hyacinth frequently clogs bayous and canals, impedes boat traffic, slows water currents, and blocks light to native submerged aquatic vegetation (SAV) which degrades water quality and harms wildlife.

Distribution: Statewide.



Research Needs & Management Strategies:

- Water Hyacinth infestations can be controlled with herbicides, as well as drawdowns. Water Hyacinth Weevils (*Neochetina eichhorniae* and *Neochetina bruchi*) are established throughout the state and do reduce the reproductive capacity and growth rate of the plant.
- Fund research to investigate Water Hyacinth as a potential component of biofuels.
- Research is needed into new herbicides which would be more cost effective than current options.
- Conduct research into the long term effectiveness of biocontrol agents, and promote the use of such control when appropriate.
- Continue efforts to educate the public about the threats this species poses, and measures that can be taken to prevent further spread, including proper cleaning of boats and trailers.

Communities/SGCN Impacted.

Can invade native freshwater communities, shading out native vegetation, and leading to lowered dissolved oxygen levels following die-off and decomposition of Water Hyacinth. This negatively impacts native aquatic species, including invertebrates and vertebrates.

Additionally, those species that require a substantial open water habitat component are negatively impacted by the dense mats formed by this species.

Hydrilla (*Hydrilla verticillata*):

A native of Asia, Hydrilla is a rooted aquatic weed found in a variety of aquatic habitats, including both shallow and deep areas. In shallower areas, Hydrilla can form extremely thick mats. Hydrilla can adversely affect water quality by shading out native vegetation and lowering dissolved oxygen concentrations, leading to fish kill. Hydrilla likely was introduced via dumping from aquaria or intentional planting. This species spreads easily between water bodies via boats and trailers.

Distribution: Essentially statewide.

Research Needs & Management Strategies:

- Hydrilla has been controlled using herbicides, drawdowns, and the use of triploid grass carp as a bio-control.
- Conduct research to identify new herbicides which would be more cost effective than those currently used.
- Conduct research into the long term effectiveness of biocontrols.
- Continue efforts to educate the public about the threats this species poses, and measures that can be taken to prevent further spread, including proper cleaning of boats and trailers.

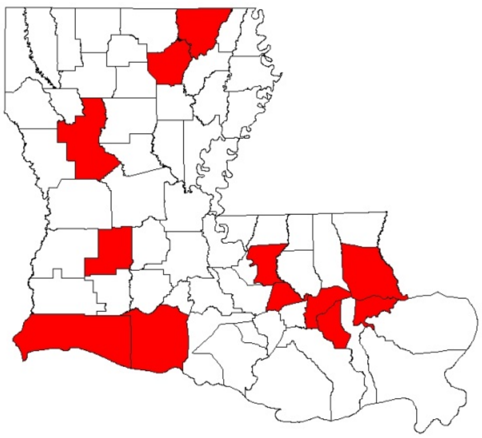
Communities/SGCN Impacted.

Has the potential to invade essentially all freshwater habitats, particularly those with slow-moving water, such as Oxbows and Cypress-Tupelo Swamps. Hydrilla can exclude native aquatic plants, as well as lead to low levels of dissolved oxygen, causing negative impacts to native invertebrates and fishes.

Yellow Flag Iris (*Iris pseudacorus*):

Yellow Flag Iris is an exotic invasive mainly of wetland habitats, typically found growing on edges of lakes, ponds, and streams or in swamps. Drought tolerance and its ability to withstand extended periods of anoxia make it a fierce competitor against native plants. Some possible negative effects of a yellow flag infestation include reduced waterfowl habitat (Stone 2009) and displacement of native irises occurring in the same habitats. Yellow Flag Iris spreads mainly via rhizomes which allow it to quickly form large thickets. Introduction to new areas may occur if pieces of rhizome or seed are carried downstream or by a storm event (Ramey and Peichel 2001).

Distribution: Infrequent and scattered.



Distribution from Thomas and Allen (1993)

Research Needs & Management Strategies:

- Increase awareness of the potential negative effects of this species when used as an ornamental

Communities/SGCN Impacted.

Cypress-Tupelo-Blackgum Swamps and Freshwater Marsh are among the communities most vulnerable to infestation.

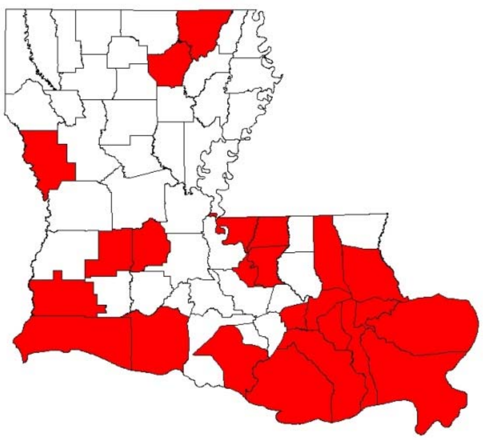
Photo courtesy of Larry Allain

Photo courtesy of Larry Allain

Torpedo Grass (*Panicum repens*):

Torpedo Grass is likely an Old World native that superficially resembles a much larger version of Bermuda Grass (*Cynodon dactlyon*). Torpedo Grass is invasive due to its rapid growth and is spread by its torpedo-like rhizomes. This species can form dense stands in a variety of habitats, from sandy Gulf beaches to riverine shoreline areas. In the latter setting, Torpedo Grass can dominate and actually grow out over the water. Torpedo Grass can rapidly invade and dominate disturbed sandy soils, such as dredge spoil islands.

Distribution. Primarily the southern part of the state, with scattered records elsewhere.



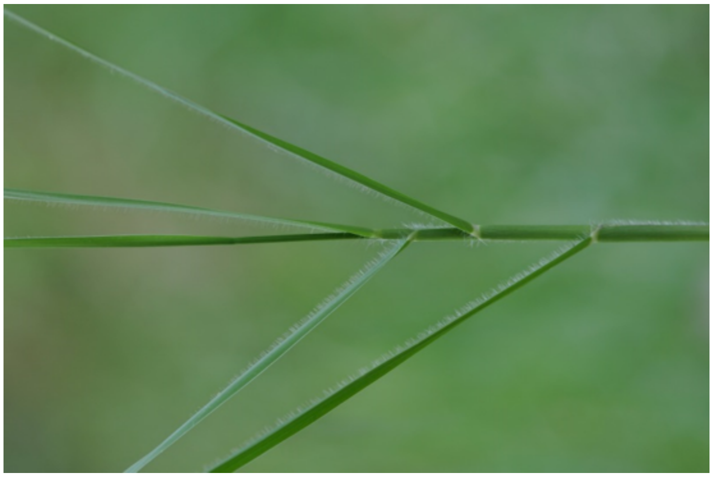
Distribution from Allen et al. (2004) and specimens housed at LSU Herbarium.

Research Needs & Management Strategies.

- Control local infestations using herbicides.
- Conduct research to determine alternative herbicides that may be effective in controlling this species with less impact to non-target species.

Communities/SGCN Impacted

Barrier Island, Coastal Dune Grassland, Vegetated Pioneer Emerging Delta, Sandbars, and Louisiana Beach are among the communities most likely to be negatively impacted.



Torpedo grass shoot showing conspicuously two-ranked leaves.

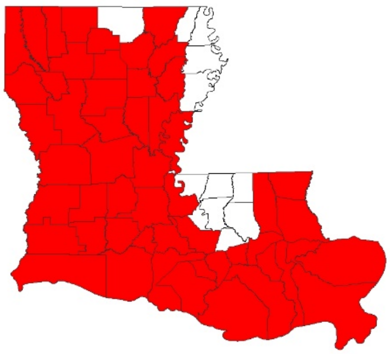
Torpedo Grass inflorescence is an open panicle.

Photos by Larry Allain

Giant Salvinia (*Salvinia molesta*):

Giant Salvinia was likely brought to the United States as an aquarium plant, and subsequently was introduced into the wild via dumping or intentional release. Giant Salvinia is spread via vegetative growth, by wind and currents, and by inadvertent transport by boats and trailer. This is a free-floating species that can double in biomass every three to five days under ideal conditions. Giant Salvinia can quickly take over canals, lakes, and bayous, displacing native vegetation. This species does particularly well in slow-moving water, such as that found in many Louisiana bayous, Cypress-Tupelo Swamps, and marshes. Giant Salvinia was first documented in Louisiana at Toledo Bend Reservoir around 1998, and has since expanded throughout the state.

Distribution. Essentially statewide.



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Research Needs & Management Strategies:

- Continue efforts in conjunction with LSU Agricultural Center, U.S. Army Corps of Engineers Research and Development Center, and other partners to establish the Florida Salvinia Weevil (*Cyrtobagous salviniae*) as a form of biological control.
- Continue research to develop a cold tolerant weevil biotype that may be able to survive in north Louisiana.
- Giant Salvinia is controlled with foliar applications of a mixture of herbicide and surfactants. Water level fluctuation has also proven to be an effective and cost efficient control method for this species.
- Conduct research to identify more cost-effective and sustainable control methods.

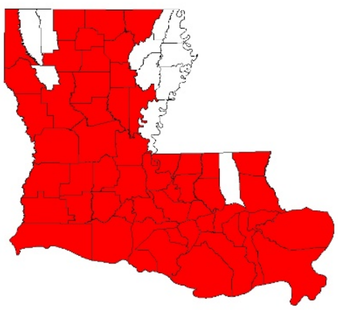
Communities/SGCN Impacted

All aquatic systems, including Cypress-Tupelo-Blackgum Swamps are vulnerable to this species.

Common Salvinia (*Salvinia minima*):

A floating fern, Common Salvinia is also known as Water Spangles or Water Fern. Common Salvinia forms dense mats that exclude native plants, and have negative impacts on wildlife. This Central and South American native has been cultivated in the United States since the 1880s for water gardens, and was likely accidentally introduced into the wild from such a garden. This species is often spread via boats and trailers. Common Salvinia was first documented near Bayou Teche in 1980, and has since become a statewide problem.

Distribution: Essentially statewide.



Research Needs & Management Strategies:

- Continue efforts in conjunction with LSU Agricultural Center, U.S. Army Corps of Engineers Research and Development Center, and other partners to establish the Florida Salvinia Weevil (*Cyrtobagous salviniae*) as a form of biological control.
- Common Salvinia can be controlled with foliar applications of a mixture of herbicide and surfactants. Additionally, water level fluctuation can be an effective control method.
- Conduct research to identify more cost-effective methods of control, including alternative herbicides and additional bio-control agents.

Communities/SGCN Impacted

All aquatic systems, including Oxbows and Cypress-Tupelo-Blackgum Swamp are vulnerable to this species, as are marshes.

E. General Invasive Species Management Strategies

The following management strategies apply to many or all invasive species, and implementation of these strategies will benefit multiple natural communities and SGCN. This list represents strategies that were identified during the 2015 WAP revision, and should not be considered exhaustive.

- Increase awareness about the ecological and economic consequences of escaped invasives planted as ornamentals, and promote the benefits of using native plants for landscaping.
- Establish and maintain an occurrence database for emerging invasives, including rigorous documentation of newly discovered populations of such species.
- Continue and expand efforts to document current range extent and ongoing expansion of invasives to allow for more effective management at the landscape level.
- Promote education about identification and impact of invasive plant and animal species on natural communities and methods to eradicate or control invasives.
- Promote the utilization of federal cost share programs (NRCS) to address invasive species problems.
- Encourage landowners to control invasive species whenever possible to benefit species of concern and natural communities.
- Continue to monitor exotic species (nutria, feral hogs, etc.) and control them as appropriate, particularly when the exotic is documented to have specific negative impacts on SGCN.
- Pursue the creation, implementation, and enforcement of regulations prohibiting the commercial sale of highly invasive exotic plants and animals that are not currently covered by existing regulations.
- Educate public on preventative measures for the spread of invasive plants; Examples include cleaning protocols for equipment, vehicles, and clothing, mowing and/or hand removing invasive plants before seed production, target invasive plants along roadsides to prevent spread down roads, include wash stations at trail heads and parking lots in parks and recreation areas.
- Conduct research into cold and salinity tolerance of Tier I aquatic plants to ensure the application of Best Management Practices for control following storm or freeze events.
- Work with partners, including Plant Conservation Alliance, NRCS and DOTD, to develop native-based seed mixes to replace existing seed mixes that contain exotics.

CHAPTER 7. CLIMATE CHANGE

Climate change has recently moved to the forefront of conservation planning in the U.S., with legislation passed by the U.S. House of Representatives in 2009 which requires the incorporation of a climate change strategy into each state's Wildlife Action Plan (AFWA 2009). Although that legislation was not passed by the U.S. Senate, an Executive Order (Executive Order No. 13653) issued in 2013 increased the responsibility of federal agencies, including the Fish and Wildlife Service, in addressing climate change. Therefore, many states, including Louisiana, are addressing climate change during the WAP revision process, to ensure that these documents remain consistent with future policies and are eligible for any associated funding opportunities to conserve SGCN and their habitats. Our objectives in this chapter are to: (1) present an overview of the current state of climate science, (2) present downscaled climate projections for Louisiana, (3) summarize the results of vulnerability assessments for SGCN, (4) briefly discuss natural communities that could be impacted by climate change, and (5) concisely present Louisiana's adaptation strategy.

A. Climate Science Overview

1. What is Climate Change?

The *National Fish, Wildlife, and Plants Climate Adaptation Strategy* [National Fish, Wildlife, and Plants Climate Adaptation Partnership (NFWPCAP) 2012] defines climate change as "a significant and lasting change in the statistical distribution of weather patterns." This change can refer to average weather conditions or to extreme weather events, and may apply to any geographic scale.

Climate change can be either natural or anthropogenic (human-caused) in origin. Indeed, climatic variability has been a reality throughout the history of Earth, well before humans existed (Inkley et al. 2004). However, recent observed changes in climate have been consistently attributed to increased levels of greenhouse gases due to human combustion of fossil fuels, including carbon dioxide (CO2) (NFWPCAP 2012). The cause of climate change is not as important as the reality that climate change is occurring. Although climate science is a relatively new and evolving discipline, each year science increases our understanding of how and why the climate is changing, and what the implications of those changes are.

Whereas it is true that climate change projections are only likely future scenarios, it is frequently also true that earlier projections have ultimately been confirmed by observed changes in climatic conditions (Melillo et al. 2014), and that these projections are based on fundamental principles of the physical sciences. Although some uncertainty still exists regarding the exact rate of change and effects on regional conditions of future climatic conditions, ignoring climate change is likely to result in an inability to consistently meet wildlife management goals in the future (Inkley et al. 2004).

2. How is climate changing?

The average air temperature in the United States has increased ~1.5-2.0 ° Fahrenheit since 1895 (Melillo et al. 2014), with much of that increase in the last 40 years. Although temperature increase has been less severe in the southeastern United States than elsewhere (Melillo et al. 2014), temperature has, nevertheless, increased. Furthermore, average air temperatures in the United States are predicted to continue to increase by the end of this century (Melillo et al. 2014). Perhaps more important than the change in average annual air temperature are potential decreases in the number of freezing days annually. This may allow for "tropicalization" that could potentially benefit certain invasive species while negatively impacting certain native species.

The amount by which temperatures are expected to increase is dependent on several factors, including the rate of emission of greenhouse gases. Assuming an increase in emissions over current levels (A2 Scenario), the predicted temperature increase may be as much as 10 ° F. However, even the best case emission scenarios (i.e., a reduction from current levels; B1 Scenario) still predict an overall increase in greenhouse gases, and a corresponding increase in global air temperatures of at least 3 ° F (Glick et al. 2011, Melillo et al. 2014). For more information on what these different scenarios describe, see the IPCC Special Report on Emissions Scenarios (IPCC 2000). If emissions could be curtailed, further warming still would be likely, because CO_2 remains in the atmosphere for many years (Wigley 2005). Not only are overall temperatures expected to rise, but the number of days with a maximum temperature of over 95 ° F is predicted to increase, along with a decreased number of days below 32 ° F for the U.S. overall (Melillo et al. 2014). Precipitation has increased approximately 5% over the last 50 years in the U.S., with greater changes being seen in more northern states (Glick et al. 2011). Projections of future temperatures are more consistent than projections of future precipitation patterns (Inkley et al. 2004), but a decrease by as much as 12% in Louisiana by 2100 has been projected (Kunkel et al. 2013). Regardless of how precipitation patterns or amounts may change, current consensus projections suggest that all of the Southeastern U.S. will see a decrease in available annual moisture by mid-century (Kunkel et al. 2013), as rising temperatures will more than offset any increase in precipitation, as evapotranspiration increases along with temperature.

Furthermore, warming temperatures and changes in precipitation are not the only impact of climate change. Other impacts may include increased severity and frequency of extreme weather events, sea level rise (SLR), acidification of the world's oceans, and increased water temperatures in both lentic and lotic systems (NFWPCAP 2012).

In particular, SLR must be considered when discussing climate change impacts in Louisiana. Sea level rise is a product of dynamic interactions, and is influenced by oceanic, atmospheric, and geologic changes including thermal expansion of the oceans and melting of polar ice. Global sea levels have increased by as much as eight inches over the past century (Melillo et al. 2014), and are predicted to continue to rise into the future (Glick et al. 2011). Note that there is a difference between eustatic (global) SLR and relative (local) SLR. Eustatic SLR is a change in global sea level due to alterations in the amount of water in the world's oceans. Relative SLR takes into account local processes such as subsidence and land accretion as well as increases in the volume of sea water due to thermal expansion. Hereafter, “SLR” in this chapter will refer to relative SLR, as that is most relevant for the purposes of the WAP.

Although not as often considered as SLR, increases in water temperature and ocean acidification may also have negative impacts on fish and wildlife, including SGCN. As water temperatures increase, certain marine species may become subject to heat stress or see a reduction or range shift in important prey species, thereby weakening ecological connections between species (Harley et al. 2006) and increasing the risk of extirpation or extinction for affected species. Acidification has been found to have negative impacts for marine species that rely on calcification for growth (Kurihara 2008), including both mollusks and crustaceans, as the availability of calcium carbonate is reduced. This has the potential to impact SGCN directly (marine mollusks and crustaceans), as well as indirectly impact many SGCN that rely on such invertebrates as prey.

3. What are the impacts of climate change to wildlife?

The effects of climate change on wildlife, including changes in distribution patterns, will differ between species, with some species being negatively impacted and other species benefitting (Inkley et al. 2004), but all biodiversity will be impacted in some way (IPCC 2002). Already, changes in the timing of biological phenomena such as spring leaf-out and the onset of migration events have been documented (Melillo et al. 2014). Negative impacts of climate change may be additive to existing stressors, such as habitat destruction and fragmentation, accelerating existing declines (Staudinger et al. 2012). Species of conservation concern have been found to be more vulnerable to climate change impacts than other species, regardless of habitat or taxonomic group (NABCI 2010), because these species are generally already stressed by other factors. A few of the potential negative impacts of climate change are discussed below.

Wetlands are highly susceptible to changes in climate, with even relatively small reductions in precipitation or increases in temperature leading to greatly degraded conditions (NABCI 2010), particularly for seasonal wetlands, such as ephemeral ponds. Streams and rivers may be negatively impacted by decreased precipitation, reduced groundwater recharge, and lowered peak flows (Kunkel et al. 2013). Climate change could result in more frequent or more severe outbreaks of pest species that degrade habitats. It may also provide conditions suitable for the continued spread of invasive species present in Louisiana, as well as potentially allow for invasions of additional exotic species as conditions become more favorable for them. Neotropical migrant landbirds may encounter a lack of available food resources at stopover sites (NABCI 2010), because as birds shift the timing of migration earlier, mismatches between peak migration and peak availability of natural foods such as soft mast and insects are more likely. Further complicating matters is the potential for the phenology of mast-producing plants and insects to change as well, leading to a greater chance of such mismatches. Additionally, emergence times of insect pollinators may shift so that adult insects are not present at the correct time to pollinate some plant species that rely on them. Finally, wildfire frequency could increase as temperatures increase and droughts become more frequent and of longer duration. This could contribute to landscape level changes in the distribution and relative abundance of fire-dependent natural communities (Kunkel et al. 2013). Additionally, there is some speculation that the intensity of wildfires might increase, which could result in negative impacts to even fire-dependent communities.

It is worth noting that, at the time of this revision, additional resources are becoming available that will improve the ability of land managers and conservation practitioners to manage resources in an adaptive manner. One such resource is the Gulf Coast Vulnerability Assessment, which is being coordinated by Amanda Watson of the Northern Gulf Institute and scheduled to be available in summer 2015. The information presented in this assessment will be of great utility to managers across the Gulf Coast.

4. Which species are most at-*risk*?

The IUCN lists 5 traits that serve to make a particular species more vulnerable to the predicted impacts of climate change (Foden et al. 2009):

1) Specialized habitat/microhabitat

2) Narrow environmental tolerances

3) Dependence on specific cues or triggers

4) Dependence on an interaction with another species that may be affected by climate change

5) Poor dispersal ability

Those species that have a preference for a specialized habitat, or highly-specific microhabitat could be vulnerable to climate change as the chances of the species encountering suitable habitat following a climate change induced range shift would be much lower than for species that show greater plasticity. The same would be true for those species with narrow environmental tolerances, because the chances of encountering the precise, required conditions would decrease as environmental tolerance decreases. Dependence on specific cues or triggers, such as air or water temperatures, could also increase vulnerability. For example, a species that relies on such triggers for the initiation of events such as nesting or spawning could initiate such behavior earlier as climate changes, leading to a mismatch between the hatching of young and the peak availability of resources. Dependence on one particular species, whether for food, dispersal, or any other inter-specific interaction could also increase vulnerability, as any negative impacts to that species would necessarily impact the species that relies on it, even if that species is not particularly vulnerable itself. Finally, poor dispersal could serve to increase vulnerability, because it would reduce the ability of the species to track preferred climactic conditions or to escape unfavorable conditions that might arise as a result of climate change.

B. Downscaled Climate Change Projections for Louisiana

1. TACCIMO

The Template for Assessing Climate Change Impacts and Management Options (TACCIMO) is a tool that was developed by the Eastern Forest Threat Assessment Center, the Western Wildland Environmental Threat Assessment Center, and the USDA Forest Service

Regional Forest Planning units. This tool provides a geospatial mapping application that furnishes the user with downscaled historical climate data and climate modeling data to help evaluate the impacts of climate change on forested systems at a given location. These modeling data are intended to inform natural resource managers and planners of potential local impacts of climate change and assist in the development of adaptation strategies.

TACCIMO provides projections for various General Circulation Models (GCM) under the Intergovernmental Panel on Climate Change (IPCC) Special Report on Emission Scenarios (SRES; IPCC 2002). The three emissions scenarios are:

SRES B1 (Low emissions path) – this scenario represents a dramatic reduction in current emissions levels, which will require a strong shift towards sustainable energy sources.

SRES A1B (Middle emissions path) – this scenario represents a more moderate reduction in current emissions levels, which would require an increase in non-fossil fuel energy technology, with fossil fuels remaining an important component of overall energy production.

SRES A2 (Higher emissions path) – This represents the least optimistic future emissions scenario, and is the path that is closest to current emission levels, although recent measured emission levels have been higher than this scenario.

In conjunction with the three emissions scenarios described, TACCIMO also considers three IPCC GCMs, which are summarized in Table 1.

Table 1. General Circulation Models used in TACCIMO analysis for Louisiana.

Source	**Identifier**
U.S. Department of Commerce\NOAA\Geophysical Fluid Dynamics Laboratory	CM2.0
Canadian Centre for Climate Modeling & Analysis	CGCM3.1
Hadley Centre for Climate Prediction and Research\Met Office	HadCM3.1

Table 2 and Figure 1 represent the projected average monthly temperature for Louisiana under each GCM and SRES. Although there is some variation between the different model and scenario combinations, every combination projects an increase over historical levels. Table 3 and Figure 2 represent projected average monthly precipitation totals for the state under each combination of GCM and SRES. Two of the three GCMs project a decrease in precipitation, regardless of the emissions scenario selected, and GCM projects an increase, regardless of emission levels. This reflects the greater uncertainty in precipitation projections compared to temperature projections at the state scale. In summary, these models project an increase in average monthly temperature over the next 85 years of 2.7-4.9 ° F, while precipitation is projected to change by -0.56 to +0.01 inches/month.

Table 2. Projected average monthly temperature (°F) for Louisiana for the period 2009-2099 for each GCM/SRES combination, as well as the average for each GCM, and the historic average from 1970-2000.

	PRISM Historic	CGCM3.1	CM2.0	HadCM3.1
High Emissions (A2)	N/A	70.0	70.2	70.5
Middle Emissions (A1B)	N/A	69.4	70.3	71.1
Low Emissions (B1)	N/A	68.9	68.9	70.0
Average	66.2	69.4	69.8	70.5

Table 3. Projected average monthly precipitation (inches) for Louisiana for the period 2009-2099 for each GCM/SRES combination, as well as the average for each GCM, and the historic average from 1970-2000.

	PRISM Historic	CGCM3.1	CM2.0	HadCM3.1
High Emissions (A2)	N/A	5.1	4.5	4.7
Middle Emissions (A1B)	N/A	5.0	4.5	4.8
Low Emissions (B1)	N/A	5.0	4.7	4.7
Average	5.0	5.0	4.6	4.7

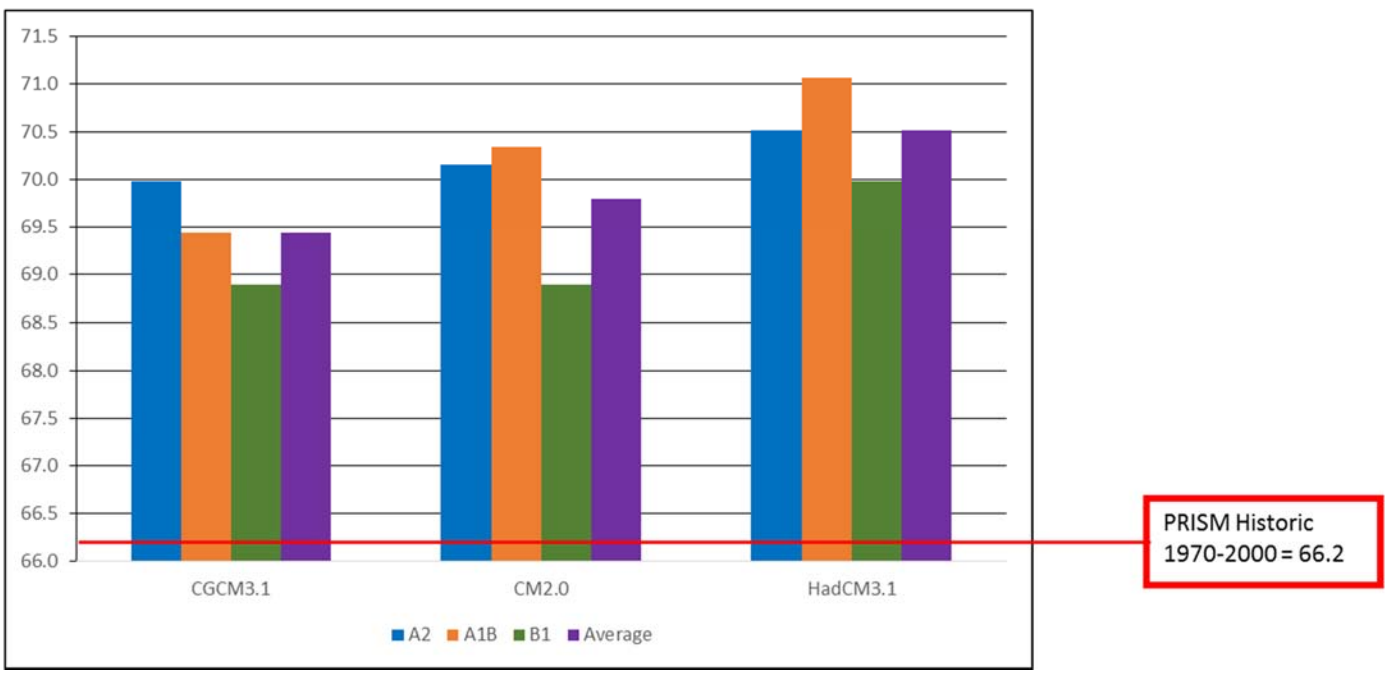


Figure 1. Graphical representation of projected average monthly temperature (°F) for Louisiana for the period 2009-2099, with historic average (PRISM Climate Group 2004) for the period 1970-2000 shown in red.

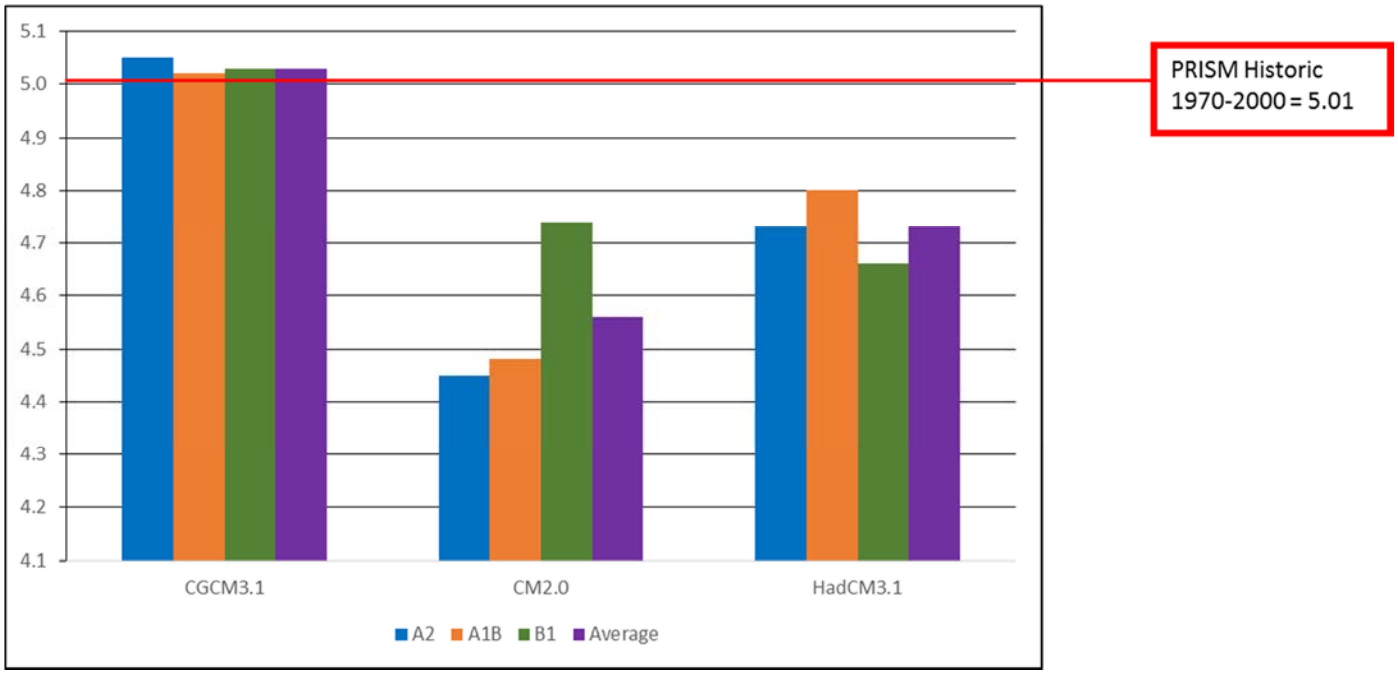


Figure 2. Projected average monthly precipitation (inches) for Louisiana for the period 2009-2099, with historic average for the period 1970-2000 (PRISM Climate Group 2004) shown in red.

2. ClimateWizard

The following figures show projected temperature and precipitation changes for Louisiana, derived from the ClimateWizard website (Girvetz et al. 2009), with all projections for mid-century. Figure 3 shows the projected change in temperature for a 16-general circulation model (GCM) ensemble average under IPCC SRES high emissions scenario (A2), and Figure 4 shows the projected change in temperature for the same ensemble average under the low emissions scenario (B1). Note that both projections indicate overall warming (range = 2.4-4.6 °F) in Louisiana, with temperature increases becoming more pronounced with latitude.

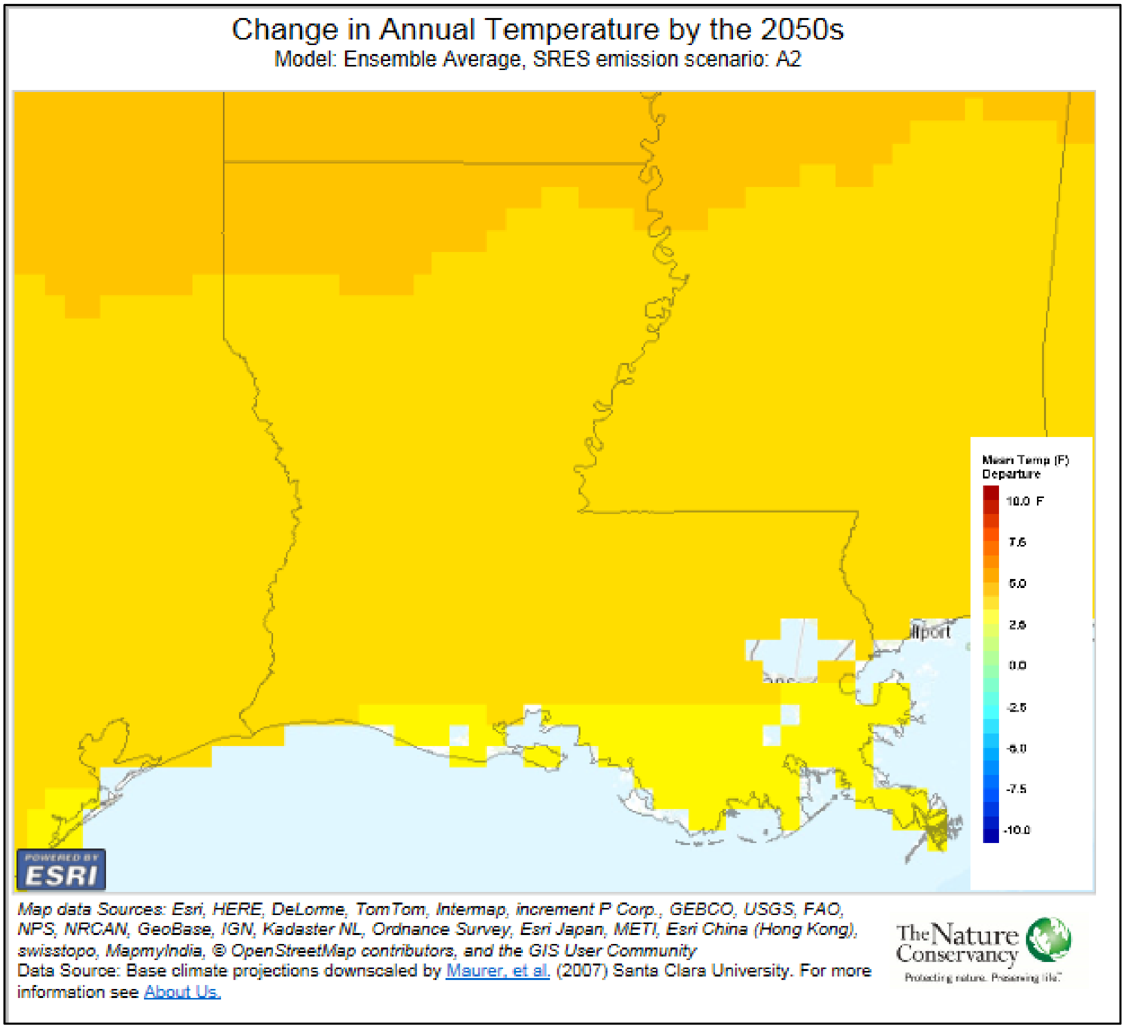


Figure 3. ClimateWizard projected temperature change for mid-century based on the Ensemble Average of 16 GCMs under the high (A2) emissions scenario.

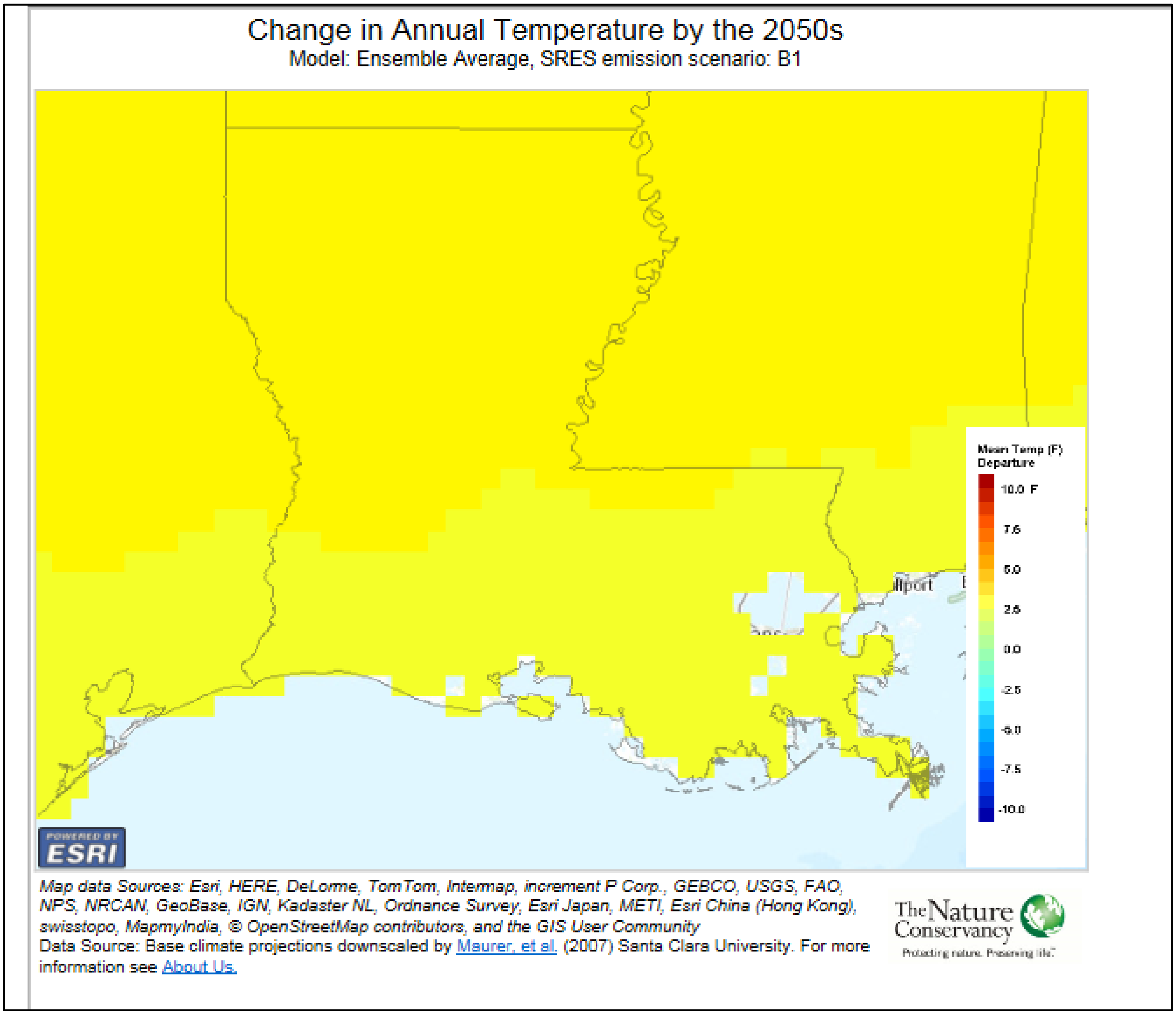


Figure 4. ClimateWizard projected temperature change for mid-century based on the Ensemble Average of 16 GCMs under the low (B1) emissions scenario.

Figures 5, 6, 7, and 8 show ClimateWizard projections of precipitation changes (% change from historical levels) for Louisiana by mid-century. Figures 5 and 6 show the highest and lowest projected precipitation change, respectively, for the high-emissions scenario (A2), and Figures 7 and 8 show the highest and lowest projected precipitation change, respectively, for the low-emissions scenario (B1). As with the TACCIMO projections, note that the different GCMs vary between an increase or decrease in precipitation over historical levels, regardless of which emissions scenario is considered. Again, this reflects uncertainty over how precipitation patterns will respond at the smaller scale of a state, despite the generally agreed upon overall global increase in precipitation (Adam Terando, pers. comm.). It does appear that northwest Louisiana is at risk for the greatest extent of drying, based on the minimum and maximum projected changes in precipitation (e.g. projected change of +4.8 to -17.6% for Shreveport; Table 5).

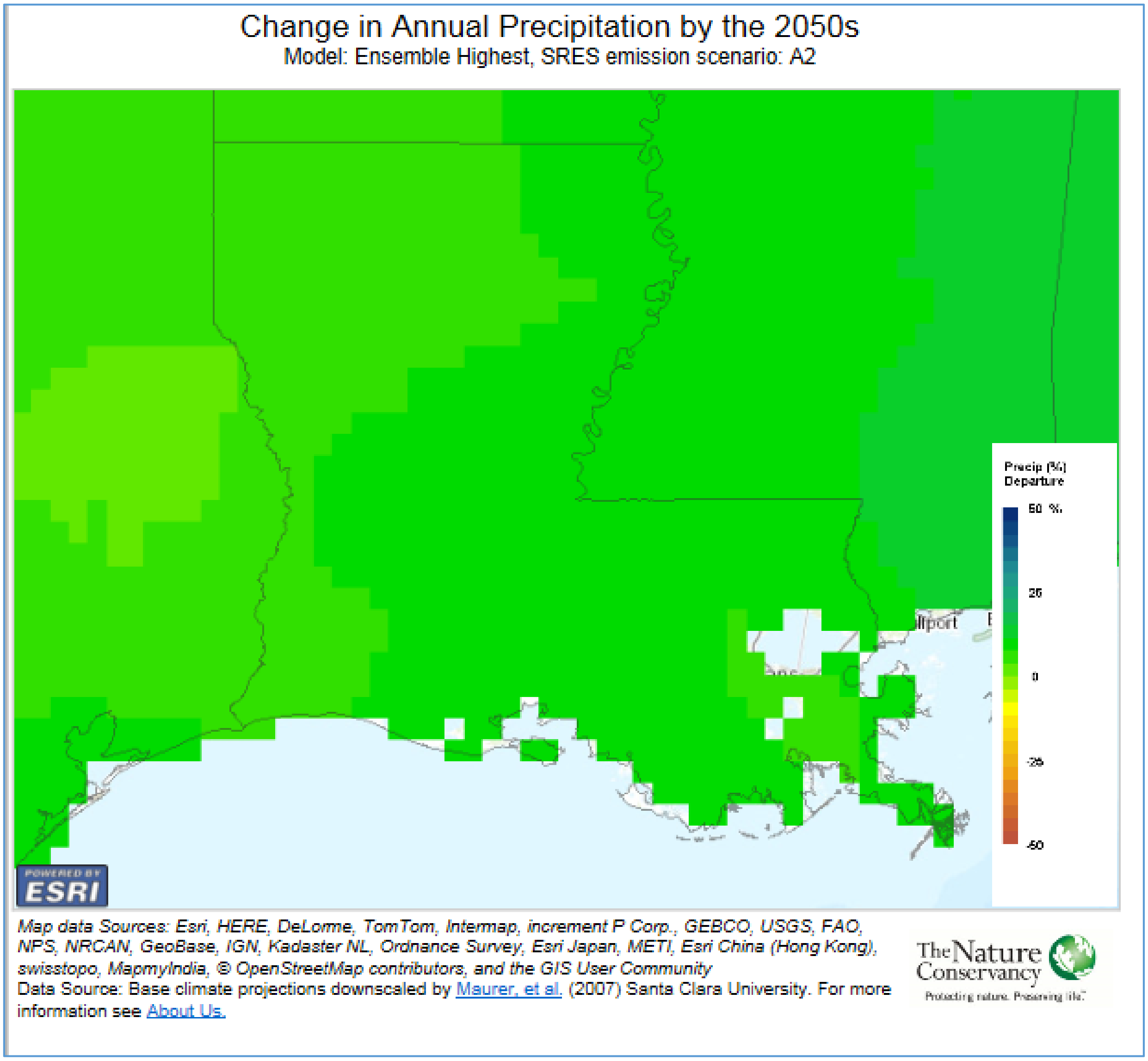


Figure 5. ClimateWizard projected percent precipitation change for mid-century based on the Ensemble Highest of 16 GCMs under the high (A2) emissions scenario.

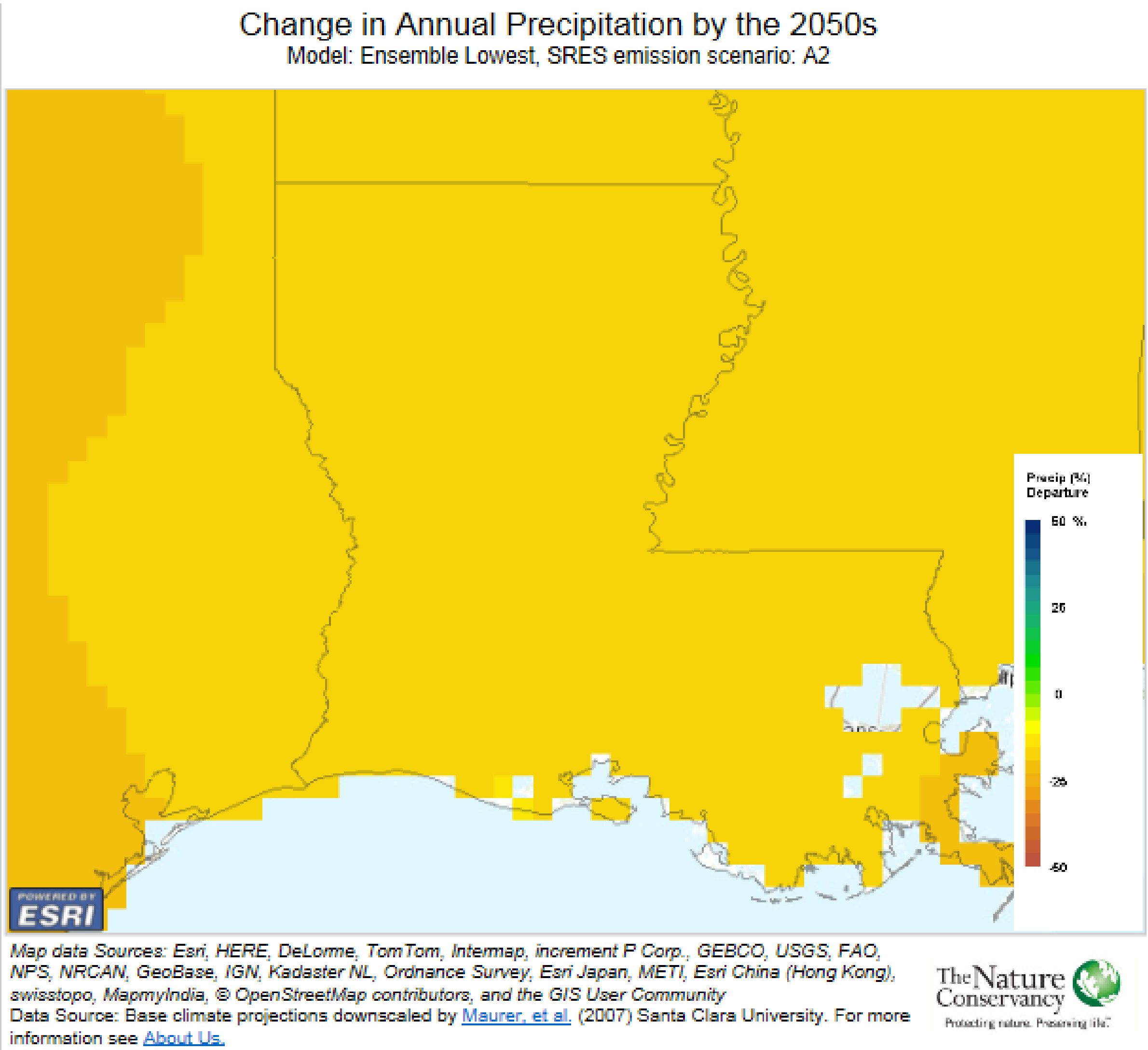


Figure 6. ClimateWizard projected percent precipitation change for mid-century based on the Ensemble Lowest of 16 GCMs under the high (A2) emissions scenario.

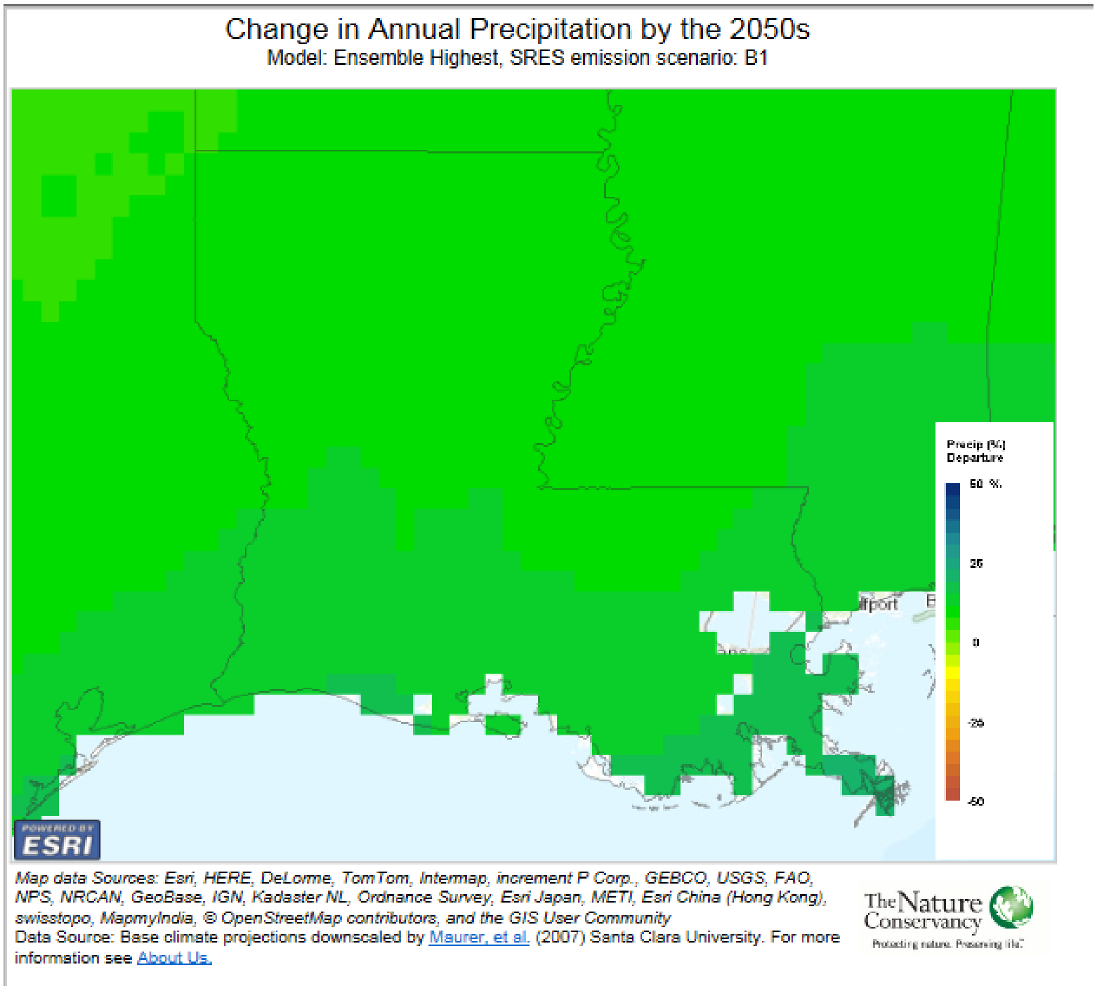


Figure 7. ClimateWizard projected percent precipitation change for mid-century based on the Ensemble Highest of 16 GCMs under the low (B1) emissions scenario.

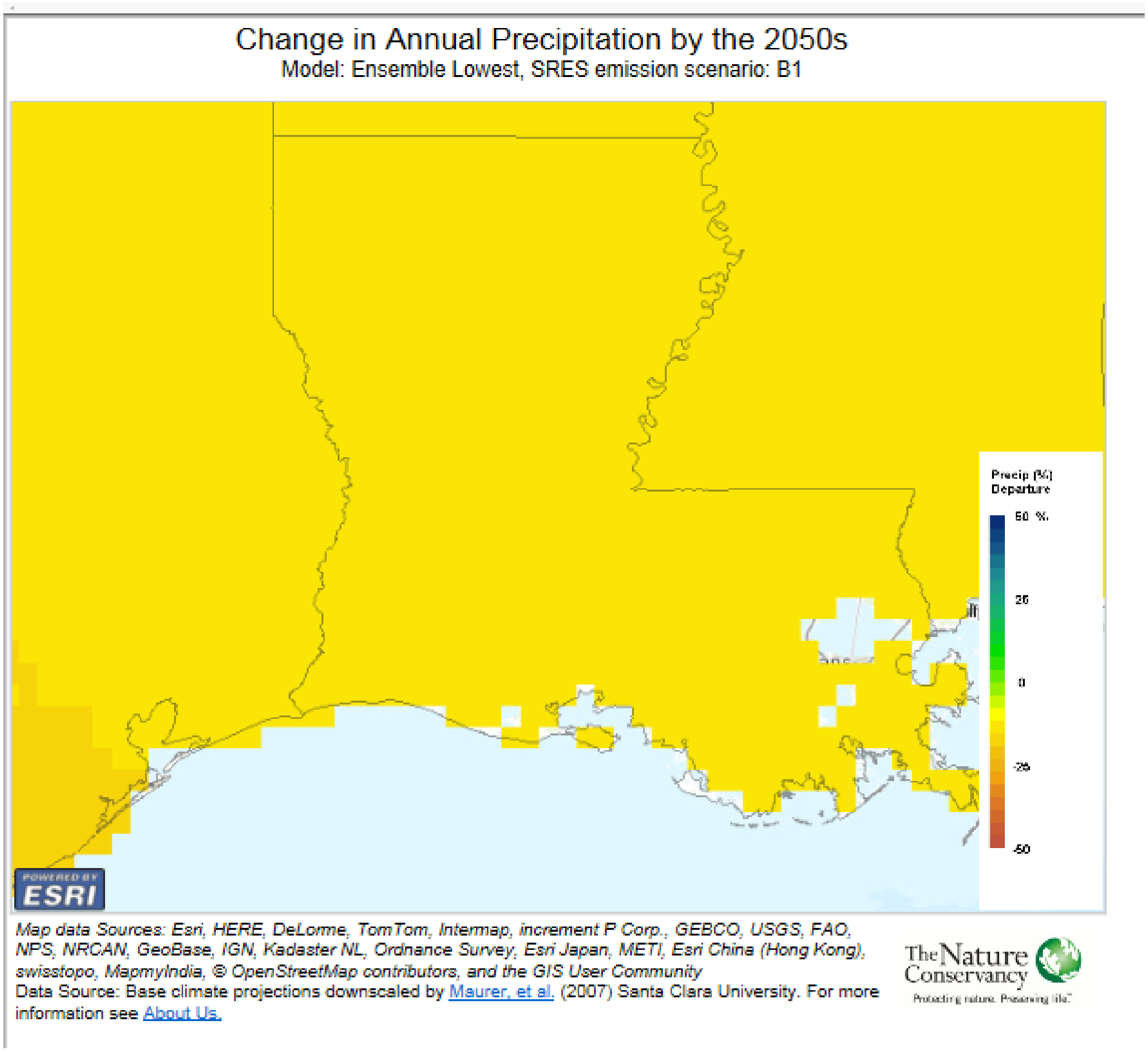


Figure 8. ClimateWizard projected percent precipitation change for mid-century based on the Ensemble Lowest of 16 GCMs under the low (B1) emissions scenario.

Detailed information on ClimateWizard projected temperature and percent precipitation changes for Louisiana's major cities under both emissions scenarios can be found in Tables 4 and 5. Under both emissions scenarios, temperature increases are predicted statewide, both annually and in every season. Temperature increases are generally predicted to be greater in the central and northern areas of Louisiana, compared to the coastal zone, and warming is expected to be most severe in the summer months. For the precipitation projections, once again, a dramatic difference between the projections exists for the two different GCMs, with differences between the emissions scenarios being smaller.

Table 4: ClimateWizard temperature increase projections for mid-century under both High (A2) and Low (B1) Emissions Scenarios, by season and annually for major Louisiana cities (temperature in °F)

	A2 Annual	A2 Winter	A2 Spring	A2 Summer	A2 Fall	B1 Annual	B1 Winter	B1 Spring	B1 Summer	B1 Fall
New Orleans	3.6	3.1	3.6	4.0	3.9	2.7	2.4	2.7	2.9	2.7
Baton Rouge	4.0	3.2	3.8	4.5	4.1	2.9	2.5	2.9	3.2	3.1
Lafayette	3.9	3.3	3.8	4.3	4.1	2.9	2.5	2.8	3.1	3.1
Lake Charles	4.0	3.5	3.9	4.3	4.2	3.0	2.7	2.9	3.2	3.2
Alexandria	4.2	3.5	4.1	4.8	4.3	3.1	2.7	3.0	3.5	3.3
Monroe	4.3	3.3	4.1	5.3	4.5	3.3	2.8	3.1	3.7	3.4
Shreveport	4.4	3.6	4.3	5.1	4.6	3.4	2.9	3.1	3.8	3.6

Table 5: ClimateWizard projections for % change in annual precipitation for mid-century under both High (A2) and Low (B1) Emissions scenarios for the Highest and Lowest of the 16 GCMs considered for major Louisiana cities.

% Change	A2 Ensemble Lowest Annual	A2 Ensemble Highest Annual	B1 Ensemble Lowest Annual	B1 Ensemble Highest Annual
New Orleans	-19.0	7.5	-13.5	15.6
Baton Rouge	-17.4	8.3	-13.9	10.8
Lafayette	-16.7	8.5	-12.8	12.9
Lake Charles	-16.4	6.6	-12.4	12.8
Alexandria	-17.4	8.9	-13.3	10.6
Monroe	-17.0	7.2	-14.8	9.1
Shreveport	-17.6	4.8	-14.3	8.4

3. Sea Level Rise (SLR) Projections for Louisiana

Louisiana is especially vulnerable to SLR due to the unique geology of the Chenier Plain and Deltaic Plain (CPRA 2012b). Inclusion of projected SLR data in the planning and implementation of coastal restoration and conservation efforts is crucial (CPRA 2012b). However, until very recently, consistent SLR modeling data across the coast of Louisiana have been lacking. An effort is underway by four LCCs that include the Gulf Coast to complete a Gulf of Mexico-wide Sea Level Affecting Marshes Model (SLAMM) project, but that project is not yet finalized at the time of this writing. Given the current status of that project, we have elected to follow the recommendations of modeling conducted by the Coastal Protection and Restoration Authority of Louisiana as part of Louisiana's Comprehensive Master Plan for a Sustainable Coast (CPRA 2012a). Sea level rise is predicted to be between 0.16 to 0.65 meters (6.3-25.6 inches) over the next 50 years (Fig. 9). By 2100, CPRA estimates that SLR of 0.5-1.5 meters (19.6-59 inches) will occur in the Gulf of Mexico (CPRA 2012b). In order to fully gauge the impact of relative SLR on the Louisiana coast, subsidence and marsh vertical accretion must also be considered. Subsidence has been the primary historical driver of SLR in Louisiana, and will likely continue to be into the near future (CPRA 2012b). Marsh vertical accretion, on the other hand, may provide some relief from SLR. Projections of land loss in coastal Louisiana must account for all of these factors. CPRA (2012a) considered two scenarios of land loss over the next half-century. The first, more optimistic scenario (Fig. 10) assumes a slower rate of SLR and subsidence, among other factors, and estimates that an additional 770 square miles of land will be lost. The less optimistic scenario (Fig. 11), assuming faster rates of SLR and subsidence predicts that 1,750 square miles of land will be lost by mid-century. Regardless of which, if either scenario proves to be accurate, SLR will result in the loss of vast swaths of coastal wetlands which are some of Louisiana's most productive fish and wildlife habitats. Furthermore, those coastal areas that do not become inundated by SLR may undergo conversion from one habitat type to another, as once inland areas are exposed to coastal processes or as uplands subside into lowlands.

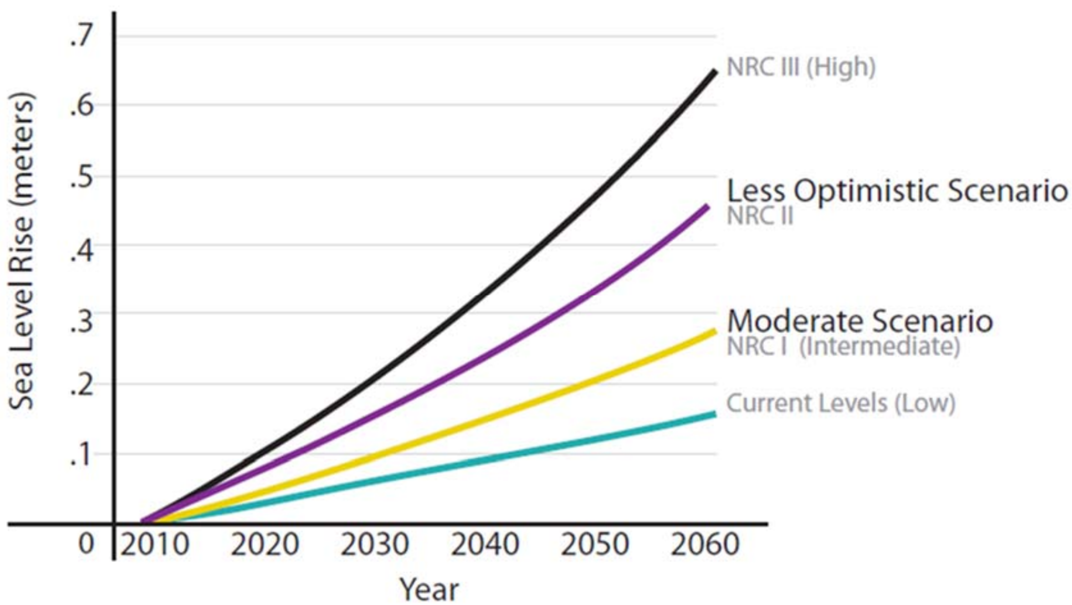


Figure 9: Projected Sea Level Rise by mid-century, based on 3 different scenarios from the National Research Council (NRC). (CPRA 2012a).

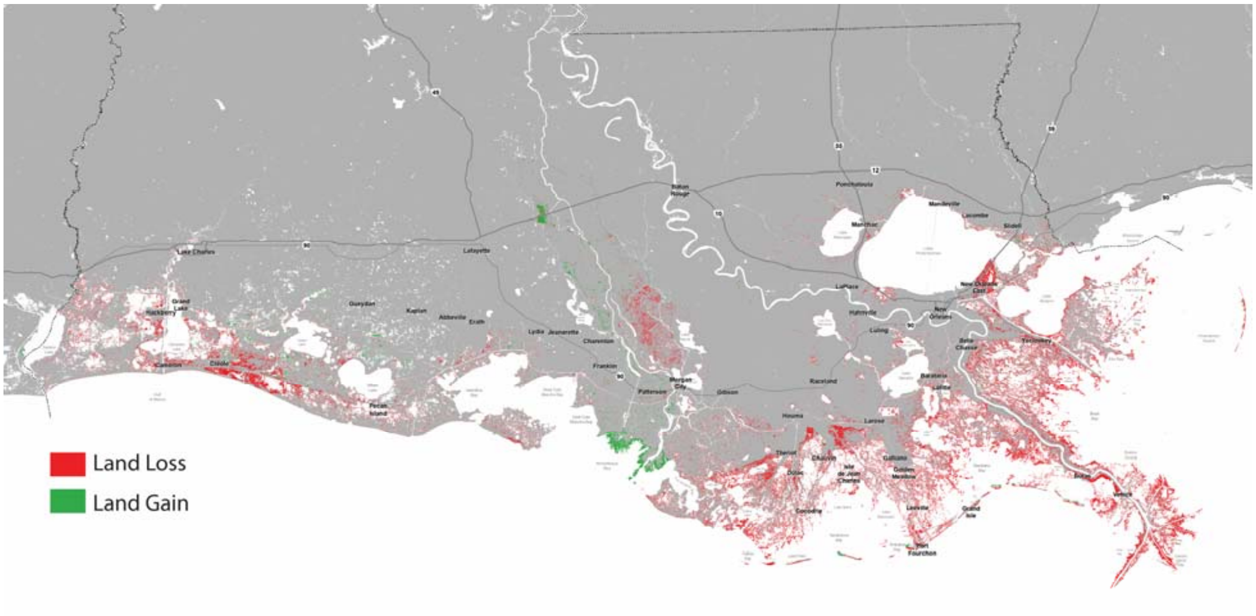


Figure 10: More optimistic land-loss scenario for coastal Louisiana (CPRA 2012a).

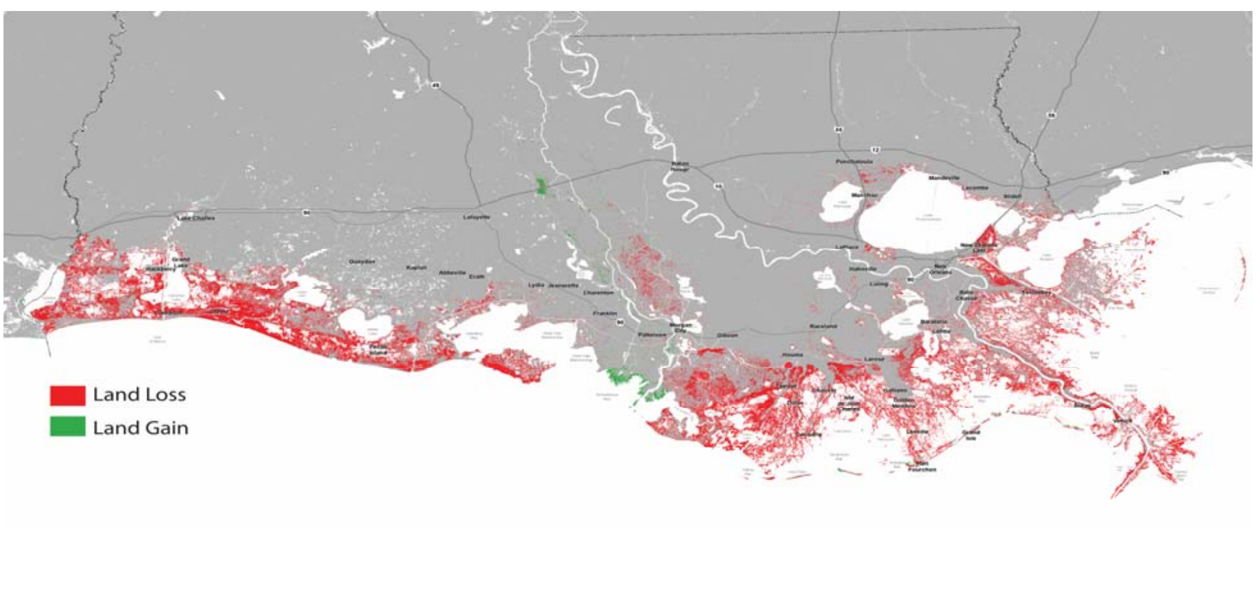


Figure 11: Less optimistic land-loss scenario for coastal Louisiana (CPRA 2012a).

C. Climate Change Vulnerability Assessments

1. What are Vulnerability Assessments?

Climate change vulnerability assessments enable resource managers to identify species and natural communities that are likely to be most strongly affected by projected climate change and understand why those species and habitats are vulnerable. This is vital information that is required for climate change adaptation planning, because it allows for the prioritization of species and communities, and aids in determining which actions will best address the predicted drivers and impacts of climate change.

Vulnerability to climate change has three principle components:

1) Exposure – this component measures the amount of climate change which the target species or community is likely to experience.

2) Sensitivity – this component measures how and to what extent a given community or species is likely to be affected by or responsive to changes in climate.

3) Adaptive capacity – this component measures the ability of a given species or community to adapt or react to climate change in a manner which will reduce the vulnerability of the target to climate change.

Understanding these three components of Climate Change Vulnerability is critical to adaptation planning, as it allows resource managers to identify the specific factors that contribute to the vulnerability of a given species or community and identify adaptation strategies that are appropriate.

Climate Change Vulnerability assessments will not be used in isolation to prioritize conservation actions for Louisiana species of greatest conservation need (SGCN) or natural communities. However, the results of these assessments provide an additional factor that can be taken into consideration when prioritizing SGCN, natural communities, or conservation actions. Climate Change Vulnerability was just one of eight criteria used to prioritize SGCN (see Chapter 3 for more detail), and at most, accounted for ~10% of the overall prioritization score.

Climate Change Vulnerability assessments can be conducted using a variety of tools including vulnerability indices, spatial analysis of distribution shifts, multi-disciplinary models, expert elicitation, and quantitative models. A variety of factors, including management goals, conservation targets (e.g., species, natural communities, etc.), geography, availability of data, technical expertise, monetary constraints, and available time will ultimately dictate the appropriate approach. One approach to Climate Change Vulnerability Assessments that has been widely embraced by the national Wildlife Action Plan community is the NatureServe Climate Change Vulnerability Index (CCVI).

2. Overview of NatureServe Climate Change Vulnerability Index

The NatureServe CCVI (Release 2.1) integrates projected exposure to climate change (Table 6) with three categories of sensitivity factors: (1) indirect exposure to climate change (Table 7), (2) species-specific factors (Table 8), and (3) documented responses to climate change (Table 9). The CCVI is used in conjunction with NatureServe conservation status ranks (e.g., State rarity ranks and Global rarity ranks, aka S-ranks and G-ranks) to generate a climate change vulnerability rank (Table 10).

Table 6. CCVI Direct Exposure Factors		
This category allows for analysis of the percentage of a species' range that is likely to be associated with specific changes in temperature or precipitation/moisture conditions under scenarios of modeled future climate change. Typically, this data is at a relatively coarse scale using data from the tool ClimateWizard.		
Temperature	The percent of a species' range in five categories of increasing temperature based on ClimateWizard projections for 2050. Typically, assessments are based on the results of the Model Ensemble Average for the IPCC SRES A1B emissions scenario.	>5.5° F (3.1° C) warmer (compared to 1961-1990 baseline)
		5.1-5.5° F (2.8-3.1° C) warmer
		4.5-5.0° F (2.5-2.7° C) warmer
		3.9-4.4° F (2.2-2.4° C) warmer
		<3.9° F (2.2° C) warmer
Moisture	The percent of species' range in six categories of changing moisture regime based on ClimateWizard projections for 2050. These figures represent the predicted change in annual moisture based on the Hamon AET:PET Moisture Metric (the ratio of actual evapotranspiration to potential evapotranspiration), rather than changes in precipitation. Negative values indicate net drying: no areas of the contiguous U.S. are predicted to increase in annual moisture.	<-0.119 (a significant change)
		-0.097 - -0.119
		-0.074 - -0.096
		-0.051 - -0.073
		-0.028 - -0.050
		>-0.028 (an insignificant change)

For Louisiana's assessments, the default recommendations in the CCVI guidelines and the GCM Ensemble Average under the SRES Medium A1B emissions scenario were used to generate temperature projections for the year 2050. The predicted net change in moisture by 2050 was based on the Hamon AET:PET Moisture Metric data. These projections, in addition to species-specific information on ecology and life history are used to determine a Vulnerability Score for each species addressed.

Table 7. CCVI Indirect Exposure Factors	
Within the CCVI framework, indirect exposure factors are those changes that are not directly associated with changing climate conditions (e.g., temperature and precipitation) but, rather, those that may result from such direct changes. This category also includes several factors that one might consider elements affecting the adaptive capacity of a particular species (e.g., physical barriers to dispersal). This is also where one might consider any ancillary effects that human response to climate change might create. These may be positive, such as protection of forests or other natural areas to enhance carbon sequestration, or negative, such as developing wind farms in important bird or bat migration corridors or damming rivers for new freshwater reservoirs.	
Exposure to sea-level rise	This factor comes into play only in the case that all or a portion of the range within the assessment area may be subject to the effects of a 0.5-1 m sea level rise and the consequent influence of storm surges.
Distribution relative to natural barriers	This factor assesses the degree to which natural (e.g., topographic, geographic, ecological) barriers limit a species' ability to shift its range in response to climate change. Species for which barriers would inhibit distributional shifts with climate change-caused shifts in climate envelopes likely are more vulnerable to climate change than are species whose movements are not affected by barriers.
Distribution relative to anthropogenic barriers	This factor assesses the degree to which anthropogenic barriers (e.g., roads, urban areas or agricultural areas, seawalls, dams, and culverts) limit a species' ability to shift its range in response to climate change. Species for which barriers would inhibit distributional shifts with climate change-caused shifts in climate envelopes likely are more vulnerable to climate change than are species whose movements are not affected by barriers.
Predicted impacts of land use changes due to human response to climate change	Strategies designed to mitigate or adapt to climate change have the potential to affect very large areas of land, and the species that depend on these areas, in both positive and negative ways. This factor is not intended to capture habitat loss or destruction due to other on-going human activities, which are already considered in existing conservation status ranks.

Table 8. CCVI Sensitivity Factors	
CCVI sensitivity factors refer to characteristics of the particular species being assessed. Some of the factors may, in fact, be considered elements of adaptive capacity as described previously, but here they are relevant to more "intrinsic" elements of adaptive capacity. Extrinsic factors (e.g., anthropogenic or natural barriers to dispersal) are considered in the previous category of assessment variables.	
Dispersal and movements	This pertains to known or predicted dispersal or movement capabilities and characteristics and ability to shift location in the absence of barriers as conditions change over time as a result of climate change. In general, species with poor dispersal ability are likely to be more vulnerable to climate change than those that regularly disperse or move long distances. Specific "barriers" to dispersal (both natural and anthropogenic) are considered as elements of indirect exposure (above).
Sensitivity to changes in temperature	This pertains to the breadth of temperature conditions within which a species is known to be capable of reproducing, feeding, growing, or otherwise existing. Factors evaluated include the historical thermal niche (exposure to past variations in temperature, as approximated by mean annual temperature variation across occupied cells in the assessment area) and the current physiological thermal niche.
Sensitivity to changes in precipitation, hydrology, and moisture regime	This pertains to the breadth of moisture conditions within which a species is known to exist. Factors evaluated include the historical hydrologic niche (exposure to past variations in precipitation) and current hydrologic niche (which pertains to a species' dependence on an narrowly-defined precipitation/hydrologic regime, including strongly seasonal precipitation patterns and/or specific aquatic/wetland habitats or localized moisture conditions that might be vulnerable to loss or reduction with climate change).
Dependence on a specific disturbance regime likely to be affected by climate change	This pertains to a species' response to specific disturbance regimes such as fires, floods, severe winds, pathogen outbreaks, or similar events. It includes disturbances that affect species directly as well as those that affect species via abiotic aspects of habitat quality.
Dependence on ice, ice-edge, or snow-cover habitats	This pertains to a species' dependence on habitats associated with ice or snow throughout the year or seasonally.
Restriction to uncommon geological features or derivatives	This pertains to a species' need for a particular soil/substrate, geology, water chemistry, or specific physical feature (e.g., caves, cliffs) for reproduction, feeding, growth, or otherwise existing for one or more portions of the life cycle. It focuses on the commonness of suitable conditions for the species on the landscape, as indicated by the commonness of the features themselves combined with the degree of the species' restriction to them.

Dependence on other species to generate habitat	Habitat here refers to any habitat (e.g., for reproduction, feeding, hibernation, seedling establishment, etc.) necessary for completion of the life cycle, including those only used on a seasonal basis.
Dietary versatility (animals only)	This pertains to the diversity of food types consumed by animal species. Dietary specialists are more likely to be negatively affected by climate change than species that readily switch among different food types.
Pollinator versatility (plants only)	This pertains to the degree to which plants are dependent on one or multiple species for pollination.
Dependence on other species for propagule dispersal	This can be applied to plants or animals (e.g., fruit dispersal by animals). If the propagule-dispersing species is vulnerable to climate change, the dependent species is likely to be so as well.
Other interspecific interaction factors	This may include factors other than habitat, seedling establishment, diet, pollination, or propagule dispersal, such as mutualism, parasitism, predator-prey relationships, etc.
Measured genetic variation	Species with less standing genetic variation will be less able to adapt because the appearance of beneficial mutations is not expected to keep pace with the rate of 21st century climate change.
Occurrence of bottlenecks in recent evolutionary history	In the absence of rangewide genetic variation information, this factor can be used to infer whether reductions in species-level genetic variation that would potentially impede its adaptation to climate change may have occurred.
Phenological response to changing seasonal temperature or precipitation dynamics	Recent research suggests that some phylogenetic groups are declining due to lack of response to changing annual temperature dynamics (e.g., earlier onset of spring, longer growing season).

Table 9. Documented or Modeled Response to Climate Change	
This category allows for inclusion of information from supplemental studies, if available.	
Documented response to recent climate change	This addresses the degree to which a species is known to have responded to recent climate change based on published accounts in peer-reviewed literature. For example, some species have shifted ranges or shown phenological changes. Species already experiencing change are important sentinels for future impacts.
Modeled future (2050) change in range or population size	Models should be developed based on reasonably accurate locality data using algorithms that are supported by peer-reviewed literature. Relative vulnerability depends on the extent to which species distribution and/or population is projected to change relative to historic or current conditions.
Overlap of modeled future (2050) range with current range	If the range disappears or declines >70% within the assessment area, such that the previous factor is coded as Greatly Increase Vulnerability, this factor should be skipped to avoid double-counting in the scoring.
Occurrence of protected areas in modeled future distribution	"Protected area" refers to existing parks, refuges, wilderness areas, and other designated conservation areas that are relatively invulnerable to outright habitat destruction from human activities and that are likely to provide suitable conditions for the existence of viable populations.

Table 10. The CCVI Scoring System	
Extremely Vulnerable (EV)	Abundance and/or range extent within geographical area assessed extremely likely to substantially decrease or disappear by 2050.
Highly Vulnerable (HV)	Abundance and/or range extent within geographical area assessed likely to decrease significantly by 2050.
Moderately Vulnerable (MV)	Abundance and/or range extent within geographical area assessed likely to decrease by 2050.
Not Vulnerable/Presumed Stable (PS)	Available evidence does not suggest that abundance and/or range extent within the geographical area assessed will change (increase/decrease) substantially by 2050. Actual range boundaries may change.
Not Vulnerable/Increase Likely (IL)	Available evidence suggests that abundance and/or range extent within the geographical area assessed is likely to increase by 2050.
Insufficient Evidence (IE)	Available information about a species' vulnerability is inadequate to calculate an Index score.

D. Results of the NatureServe CCVI for Louisiana SGCN

To assess the vulnerability of Louisiana SGCN, the NatureServe CCVI was applied to a subset of those species. In total, 70 of the 308 non-marine SGCN (CCVI is not designed for use for marine species) were assessed using the CCVI. Species assessed using the CCVI were species selected for their suitability to serve as surrogate or umbrella species for the remainder of Louisiana's SGCN (a list of these 70 SGCN and their CCVI scores can be found in Appendix F). Of the 70 species assessed, the distribution of climate change vulnerability scores can be seen in Table 11. For the purposes of the Louisiana WAP, Not Vulnerable/Presumed Stable and Not Vulnerable/Increase Likely were lumped into the category Not Vulnerable.

Table 11. Distribution of Climate Change Vulnerability ranks for 70 SGCN assessed using NatureServe CCVI.

	Not Vulnerable (NV)	Moderately Vulnerable (MV)	Highly Vulnerable (HV)	Extremely Vulnerable (EV)
# of Species	34	22	12	2
% of Species Assessed	49%	31%	17%	3%

Using the Vulnerability Scores obtained for the 70 representative SGCN, expert opinion was solicited from within LDWF to assign a vulnerability score to the remaining 238 non-marine SGCN. The distribution of vulnerability scores by taxonomic group for all 308 non-marine SGCN can be seen in Figure 12. Overall, amphibians (94%), crustaceans (100%), and fishes (79%) were the groups most vulnerable to climate change in Louisiana, based on the percentage of SGCN that showed at least Moderate Vulnerability. Mammals (16%) and birds (35%) showed the least vulnerability of all taxonomic groups assessed.

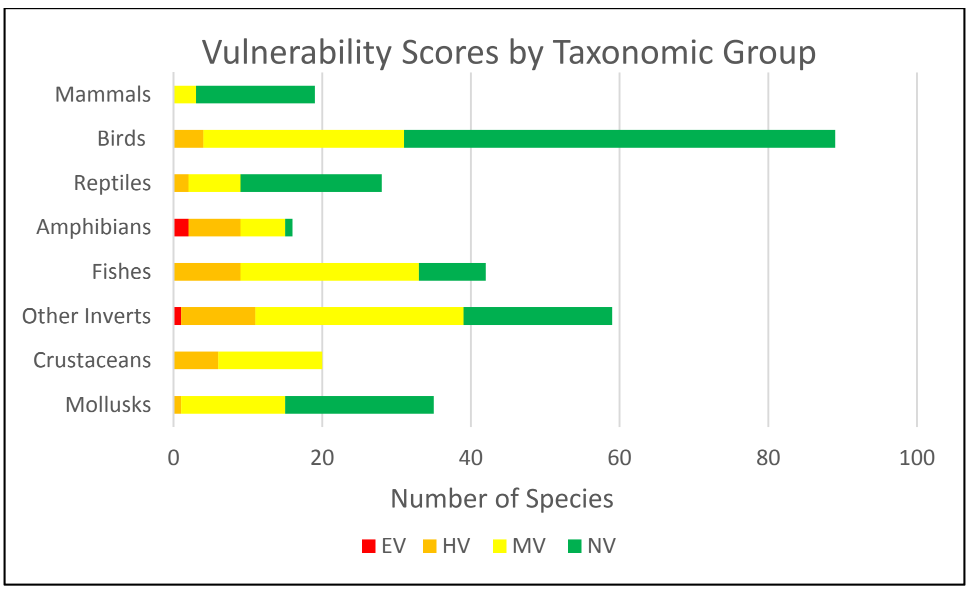


Figure 12. Distribution of Climate Change Vulnerability ranks for Louisiana SGCN, using the results of the 70 CCVI-assessed species to assign ranks to all 308 non-marine SGCN.

1. Vulnerability by Taxonomic Group

a. Amphibians

Overall, 56% of amphibian SGCN ranked as either Extremely Vulnerable or Highly Vulnerable and 94% of amphibian SGCN showed at least Moderate vulnerability to climate change. Reasons for the high vulnerability shown by amphibians (Fig. 13) to climate change included (1) limited ability to overcome both natural and anthropogenic barriers, (2) a general preference for cooler microhabitats that could be lost as temperatures increase, and (3) a general preference for high-moisture microhabitats that could be reduced as temperatures increase and available moisture decreases. Many amphibian SGCN utilize relatively cool and moist refugia, such as found under logs or woody debris in forested areas. Additionally, many amphibians rely on ephemeral wetlands for breeding, and there is a strong possibility that such wetlands could be lost or degraded due to climate change. The primary factor that decreased vulnerability to climate change was the fact that there has been a fair amount of variation in hydrological conditions historically in Louisiana, which provides evidence that these species have survived past variations in precipitation patterns, and could have some resilience to such changes in the future.

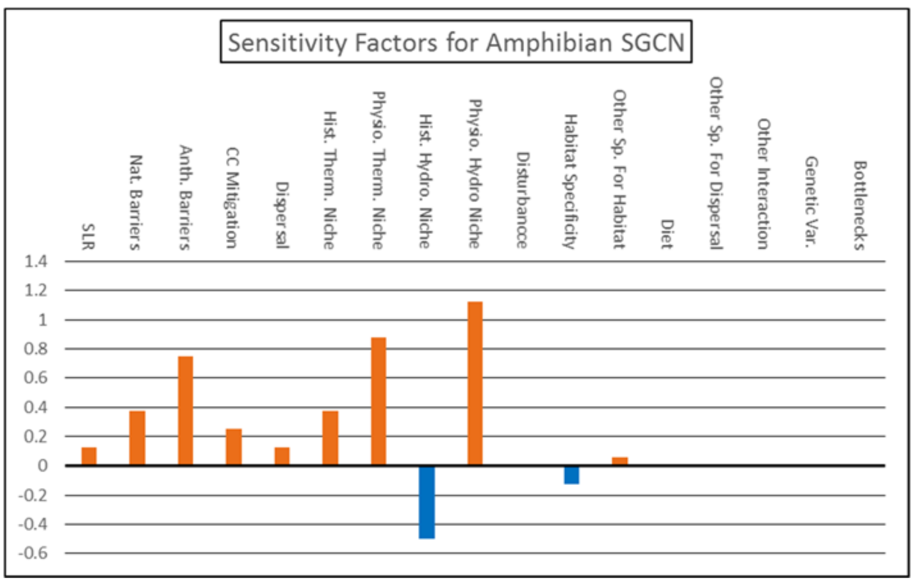


Figure 13: Factors affecting climate change vulnerability for Amphibian SGCN.

b. Crustaceans

Crustaceans showed a high degree of vulnerability to climate change impacts, with 30% of crustacean SGCN being ranked as Highly Vulnerable and 100% of crustacean SGCN ranked as at least Moderately Vulnerable to climate change. A number of sensitivity factors contributed to vulnerability (Fig. 14). Similar to amphibians, the 3 most important factors that contributed to vulnerability were (1) limited ability to overcome anthropogenic barriers, (2) a general preference for cooler microhabitats that could be lost as temperatures increase, and (3) a general preference for high-moisture microhabitats that could be reduced as temperatures increase and available moisture decreases. Most of Louisiana's crustacean SGCN are found in either ephemeral water bodies or in smaller order streams, both of which are at risk of degradation as precipitation patterns change and temperatures increase. As with amphibian SGCN, the past variation in precipitation in Louisiana provides some predicted resiliency to future changes. The other primary factor that served to mitigate vulnerability was the fact that crawfishes have a generalized diet, as highly specific diets tend to increase vulnerability.

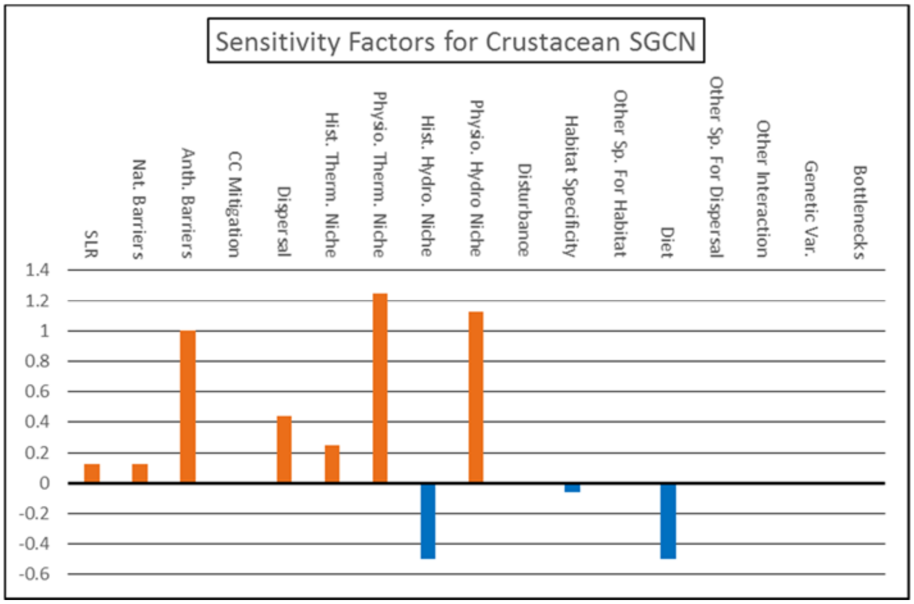


Figure 14: Factors affecting climate change vulnerability for crustacean SGCN.

c. Mollusks

Mollusks showed a moderate amount of climate change vulnerability (43% at least Moderately Vulnerable), which might seem somewhat low, given the fact that most mollusk SGCN are aquatic and highly sedentary. However, there are several factors that helped to ameliorate climate change vulnerability for this group (Fig 15). First, many of these species have fairly wide habitat tolerances (in terms of water depth, flow, and substrate particle size) as well as a highly generalized detritus based diet. Additionally, the wide range of past hydrological conditions found in Louisiana, as with other taxonomic groups, served to counteract those factors that were contributing to climate change vulnerability for these animals. Those factors included (1) restricted ability to pass through natural or anthropogenic barriers, as even the glochidial stage would often be blocked by dams when attached to a fish host, (2) the fact that some species require fast flowing areas that could be reduced as a result of changing precipitation patterns, and (3) the fact that mussels are dependent upon other species for propagule dispersal, which means that any negative impacts to their host fishes would have a trickle-down effect on them as well. Additionally, those species that are found in smaller streams (e.g. Louisiana Pearlshell) were predicted to have higher vulnerability, as such streams are, presumably, more susceptible to drying. Due to potential negative impacts of SLR, species in the Florida Parishes are potentially more at risk, and species in the northwestern part of Louisiana are at higher risk than species in other areas of the state, due to projected greater increases in temperature and decreases in precipitation in that region relative to the rest of the state.

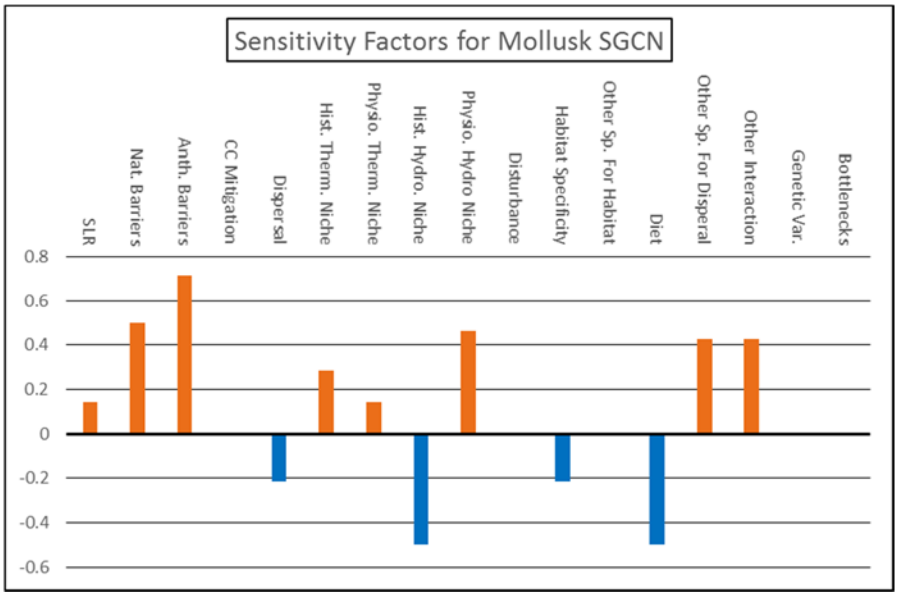


Figure 15: Factors affecting climate change vulnerability for mollusk SGCN.

d. Insects and Arachnids

A number of different sensitivity factors contributed to high vulnerability to climate change in insects and arachnids (66% of SGCN at least moderately vulnerable). The two factors that weighed most heavily were historical thermal niche and physiological hydrological niche (Fig. 16). Historical thermal niche reflects the relatively stable historical temperature patterns found in Louisiana, and physiological hydrological niche reflects the fact that many of our insect SGCN are either found in wetland communities, or have at least one life stage that is aquatic (e.g., mayflies, stoneflies, caddisflies, and dragonflies). The specialized diet of many insect SGCN also served to increase climate change vulnerability; as such specialization could be a detriment under changing climatic conditions, if the host plant becomes reduced due to such changes. Serving to mitigate climate change vulnerability for this group is the relatively good dispersal capability of most insects, as well as the past variation in precipitation patterns that has been historically found in Louisiana, which should provide at least some level of resiliency to such changes in the future.

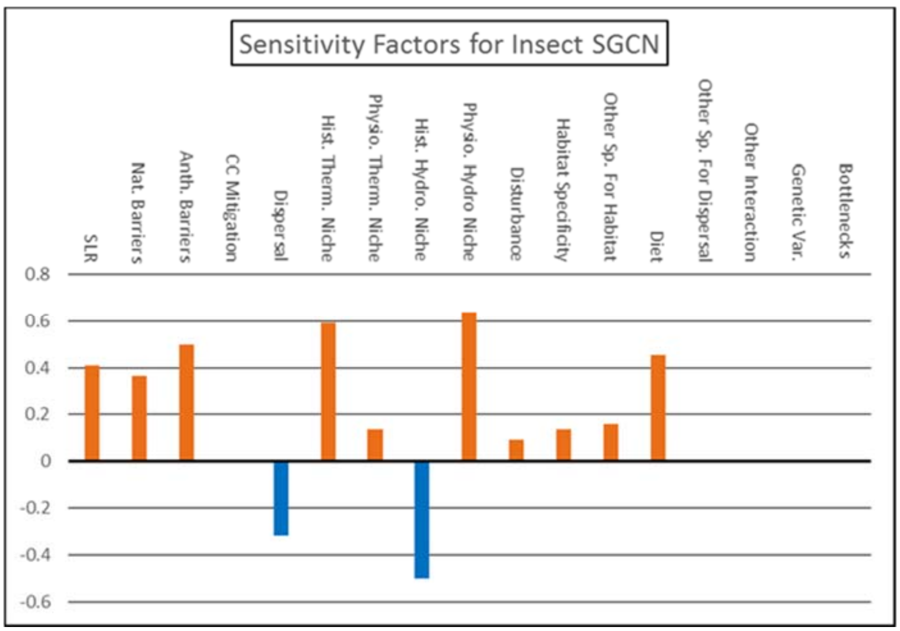


Figure 16: Factors affecting climate change vulnerability for insect SGCN

e. Fishes

Fishes were determined to be among the most vulnerable taxonomic groups to climate change, 79% of fish SGCN were determined to be at least Moderately Vulnerable to climate change, although a relatively small percentage (21%) were considered Highly Vulnerable or Extremely Vulnerable. As with other aquatic taxa, a number of factors contributed heavily to predicted vulnerability (Fig. 17). The presence of dams, sills, and other man-made barriers to movement within stream systems was one important factor. The relatively small range of past temperature variation in Louisiana also contributed to climate change vulnerability, as did the fact that many of our fish SGCN are found in smaller streams or shallow areas within larger streams that are subject to a reduction in habitat quality with the drier conditions that are expected. Helping to counteract those factors are the facts that, in the absence of man-made barriers, many fishes have good dispersal capability within stream systems, and that there has been significant variation in precipitation patterns historically in Louisiana.

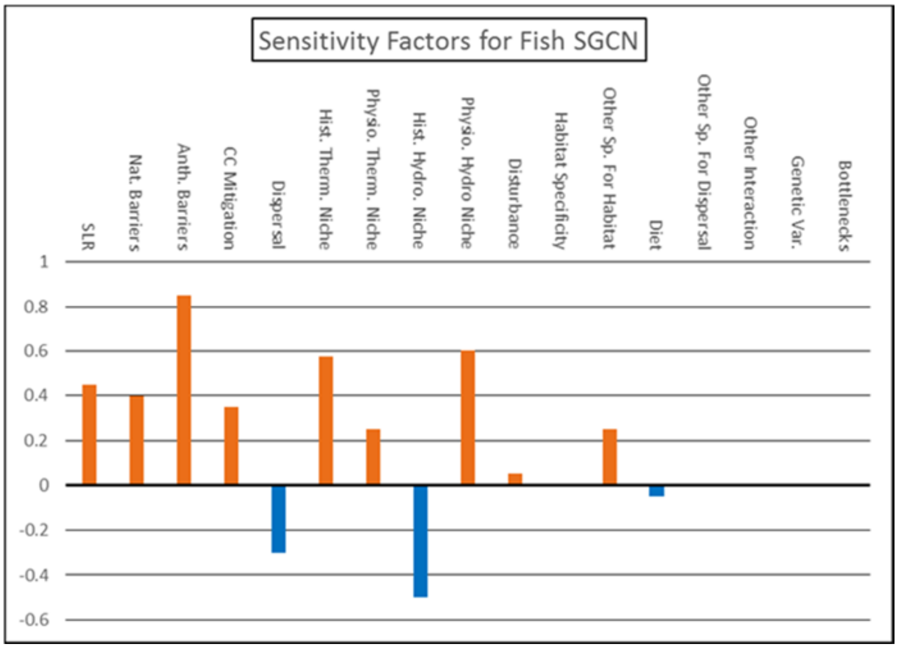


Figure 17: Factors affecting climate change vulnerability for fish SGCN.

f. Birds

It is not surprising that birds were among the least sensitive groups examined, with only 35% showing some level of vulnerability, and less than 5% being ranked as Highly Vulnerable or Extremely Vulnerable. The primary factor for the low vulnerability shown by birds (Fig. 18) is dispersal ability. As birds are highly mobile as a group, it is predicted that many species will be able to shift breeding and non-breeding ranges to track preferred climatic conditions. Among the birds examined, the most sensitive were those that rely on wetland habitats, particularly coastal marshes, and those that breed on barrier islands. There are a number of bird SGCN that rely on such habitats, and as those habitats are very likely to be negatively impacted by SLR and associated increased storm surge. SLR was found to be 1 of the 2 factors that contributed the most to climate change vulnerability among bird SGCN. As with several other taxa, the limited amount of past variation in temperatures within Louisiana was also predicted to be a major contributor to the observed vulnerability, as life history strategies of these species that have developed under relatively stable climatic conditions may not be as successful during a period of more rapid change.

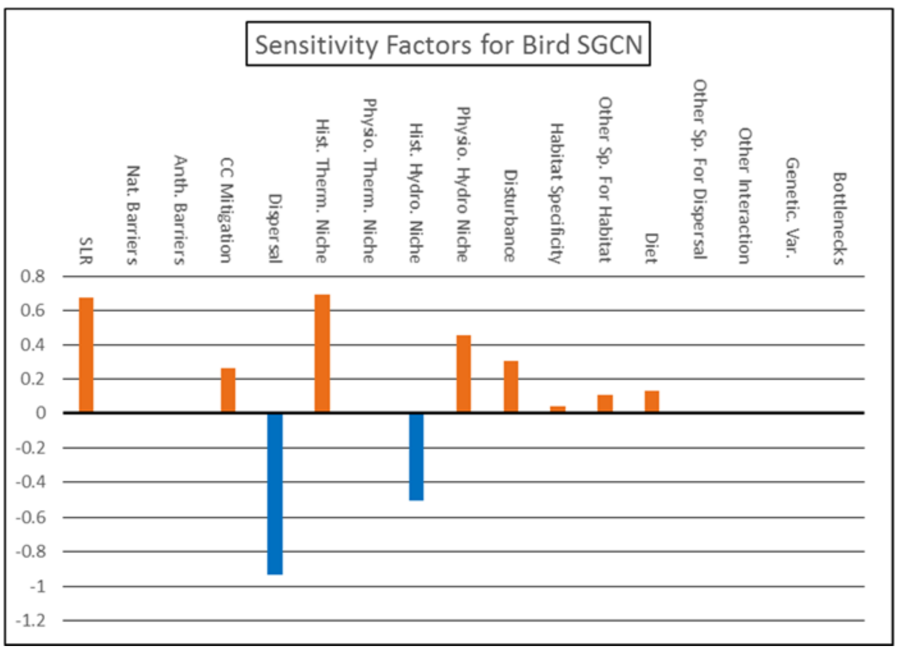


Figure 18. Factors affecting climate change vulnerability for bird SGCN.

g. Mammals

This taxonomic group showed the least climate change vulnerability among Louisiana SGCN. Only 16% of mammal SGCN showed any level of climate change vulnerability, and no species were found to be Highly Vulnerable or Extremely Vulnerable. As with birds, an overall high level of dispersal capability (Fig. 19) was one of the primary factors that contributed to the observed low level of vulnerability. Additionally, many of Louisiana's mammal SGCN do not show high habitat or dietary specificity, and several species that are more habitat specific are found in habitats that are not likely to contract as a result of projected climate change. As with most taxa, the relatively narrow historical thermal niche typical of Louisiana was the primary contributing factor to the vulnerability that was predicted for mammalian SGCN.

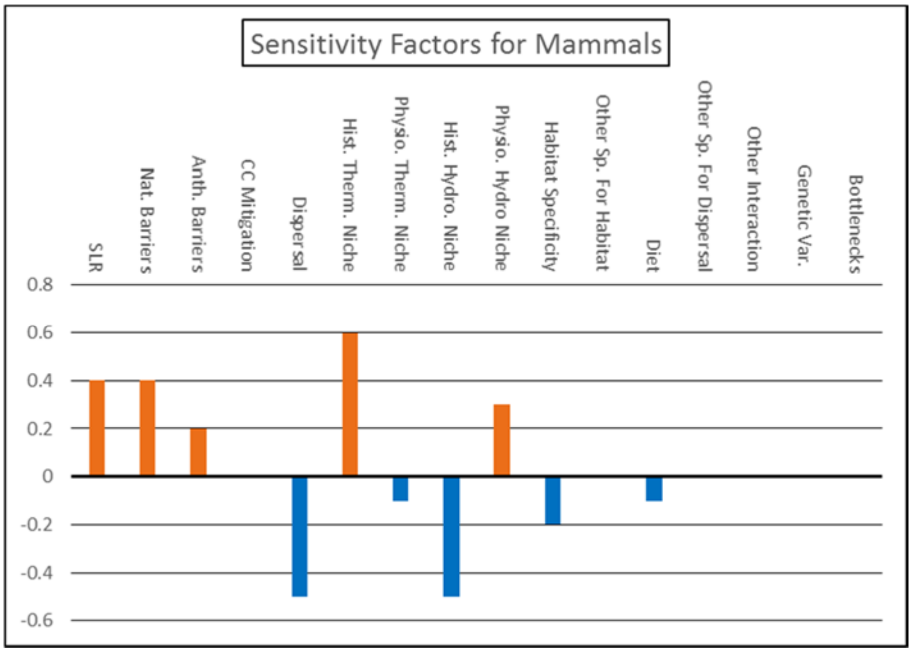


Figure 19. Factors affecting climate change vulnerability for mammal SGCN.

h. Reptiles

Lagging behind only mammals in terms of Low Vulnerability to climate change, only 32% of reptile SGCN were projected to be vulnerable at some level, and only 7% were predicted to be Highly Vulnerable or Extremely Vulnerable. Although the dispersal ability of reptiles is generally greatly reduced compared to birds, and to a lesser extent mammals, the dispersal capability of many reptile SGCN served to reduce predicted vulnerability. As with several other taxa, the relatively large variation in past hydrological conditions in Louisiana also reduced sensitivity. Anthropogenic barriers (i.e. roads) were predicted to be one of the two main factors contributing to the level of vulnerability that was observed. Many species of reptiles suffer very elevated levels of mortality during road crossings, which could prevent some reptile SGCN from utilizing their ability to disperse to track preferred climatic conditions.

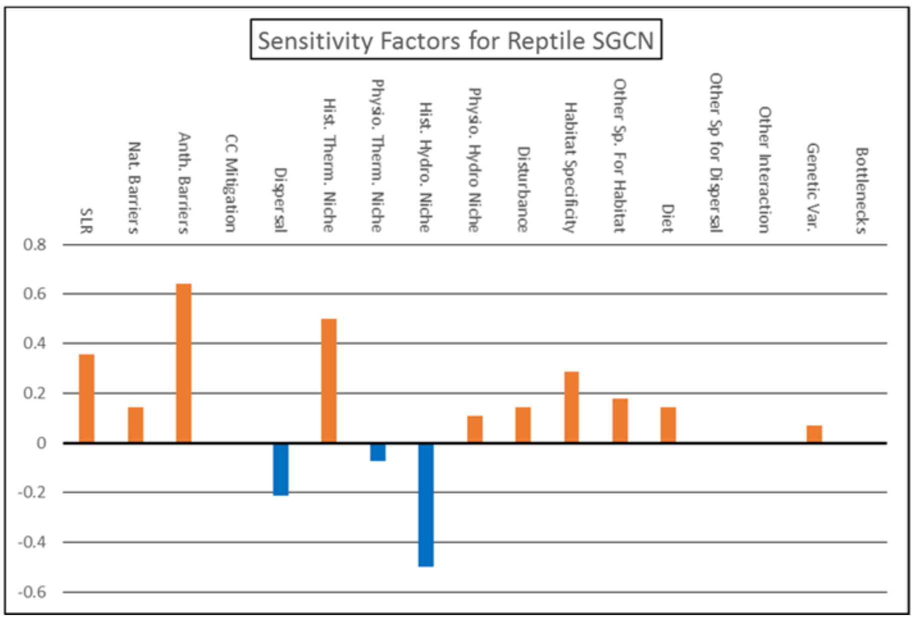


Figure 20. Factors affecting climate change vulnerability for reptile SGCN.

i. Coastal SGCN

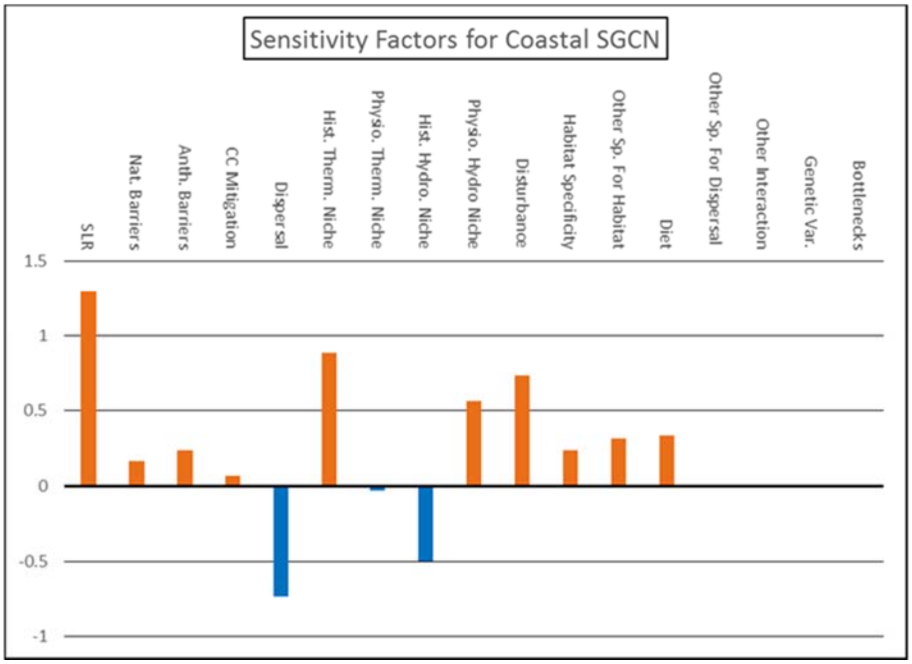


Figure 21. Factors affecting climate change vulnerability for coastal SGCN.

In addition to the individual taxonomic groups, species that are primarily coastal in distribution were also assessed. This category included birds, mammals, fishes, reptiles, and insects. For this subset of SGCN, 47% were ranked as Highly Vulnerable or Extremely Vulnerable, and 73% were at least Moderately Vulnerable. The primary sensitivity factor contributing to this high level of climate change vulnerability is SLR. Species that rely on low-elevation islands, such as Louisiana's barrier islands, for nesting are among those SGCN most vulnerable to negative impacts of climate change (NABCI 2010). The Gulf of Mexico has experienced the greatest rate of relative sea level rise in the U.S. and continued sea-level rise will fragment or inundate additional coastal habitats (NABCI 2010). These impacts will only further exacerbate the existing issue of coastal-land loss in Louisiana, with almost 1,900 square miles having been lost in the last 80 years, and up to an additional 1,750 square miles at risk of being lost in the next five decades (CPRA 2012a). Serving to mitigate the climate change vulnerability of coastal SGCN is good dispersal ability, as about half of these species are birds. However, that dispersal ability might not be as valuable for some coastal birds, as there may be no suitable nesting habitat to disperse to.

E. Community Vulnerability

Although LDWF has not yet completed an assessment of the impacts of projected climate change on natural communities in the state, some predictions can be made based on other studies. As already discussed, coastal habitats such as barrier islands and marshes are likely to undergo a decrease in both extent and quality (NABCI 2010). Coastal forests, including both Coastal Live Oak Hackberry Forest and Barrier Island Live Oak Forest are also predicted to be highly vulnerable to projected sea level rise, with potentially severe consequences for the migratory birds that currently utilize these areas for stopover sites.

As temperatures increase across the southeastern United States, there is predicted to be an increase in the intensity and frequency of wildfires (Melillo et al. 2014), which could result in an increase in fire-dependent communities, with a concurrent decrease in those communities that are intolerant of fire. Even those communities that are fire-dependent could be negatively impacted if the frequency or intensity of natural fires exceeds historical levels. Forested wetlands, including Bottomland Hardwood Forest and Cypress-Tupelo Swamps have the potential to become degraded as a result of increasing temperatures and altered hydrologic patterns (Brandt et al. 2014) that may result in longer periods of drying, or extended periods between inundations. Forest types that are predicted to have the lowest vulnerability to climate change include Eastern and Western Longleaf Pine Savanna and other open pine systems (Brandt et al. 2014). More closed forest types may shift towards savanna-like conditions as a result of drier, hotter conditions (McNulty et al. 2013) that lead to reduced tree density. Although drier conditions might favor native prairies and other grasslands, it has also been suggested that increased atmospheric CO_2 could lead to invasion of woody plants into such systems (NABCI 2010).

As discussed above, despite wide variation in precipitation projections, it is generally agreed that increased evapotranspiration will decrease available water regardless of how precipitation totals change, which could negatively impact both in-stream flow and groundwater recharge (Sun et al. 2013). Reductions in in-stream flow could lead to more frequent and longer periods of stream drying, potentially affecting intermittent and perennial streams (Hopkinson et al. 2014). Additionally, Ephemeral Ponds of all types are potentially at risk of reduction in extent and quality. Another concern related to reduced freshwater input is increased saltwater intrusion into coastal rivers, as well as associated habitats such as Cypress-Tupelo Swamps. Such intrusion can lead to significant mortality of freshwater adapted vegetation, and greatly reduce the value of such habitats to fish and wildlife.

F. Louisiana's Climate Change Adaptation Strategy for SGCN and associated Habitats

As climate change continues, or potentially intensifies, it may not be sufficient to base future management decisions on either current or historical conditions. Failing to account for potential changes in natural communities, SLR, and impacts from human response to climate change could reduce the effectiveness of traditional conservation actions. However, the value of continuing traditional approaches to conservation should not be underestimated, as many of the best strategies for improving resilience to climate change are activities that LDWF and partners are currently engaged in. A philosophy and practice of adaptive management based on appropriate monitoring of our natural resources will provide heightened awareness to managers and society of ongoing changes that may otherwise go unnoticed during the gradual process of change.

The National Fish, Wildlife, and Plants Climate Adaptation Strategy (National Fish, Wildlife, and Plants Climate Adaptation Partnership 2012, (hereafter referred to as the *Strategy*) presents seven (7) major goals for climate change adaptation (Table 12), which will provide a framework for Louisiana's adaptation strategy. Each of these 7 goals is consistent with the overall goals and objectives of the Louisiana WAP. Below is a brief discussion of each of the 7 goals from the *Strategy*, including how each goal fits into the overall purpose of the WAP. It should be noted that each of the 7 goals includes actions that would be conducted by LDWF and partners independent of climate change adaptation, and can therefore be expected to have value to fish and wildlife, regardless of whether or not climate change proceeds as projected.

Table 12. Crosswalk between the 7 goals of the National Fish, Wildlife, and Plants Climate Adaptation Strategy (2012) and the goals and objectives of the Louisiana WAP

Climate Change Adaptation Goal	LA WAP Goal(s)	LA WAP Objective(S)
Conserve and Connect Habitat	Goal 2: Habitat Conservation	2.1, 2.2, 2.3, 2.4., 2.5, 2.6
Manage Species and Habitats	Goal 1: Species Conservation	1.1,.1.2, 1.3
	Goal 2: Habitat Conservation	2.1, 2.2, 2.3, 2.4, 2.5, 2.6
Enhance Management Capactity	Goal 1: Species Conservation	1.3
	Goal 2: Habitat Conservation	2.1, 2.2, 2.5
	Goal 4: Partnerships	4.1, 4.2, 4.3
Support Adaptative Management	Goal 1: Species Conservation	1.3
	Goal 4: Partnerships	4.1, 4.2 .4.3
Increase Knowledge	Goal 1: Species Conservation	1.1
	Goal 2: Habitat Conservation	2.1, 2.2, 2.3
	Goal 4: Partnerships	4.2, 4.3
Increase Awareness and Motivate Action	Goal 3: Public Outreach/Education	3.1, 3.2
Reduce Non-Climate Stressors	Goal 1: Species Conservation	1.2, 1.3
	Goal 2: Habitat Conservation	2.1, 2.2, 2.3, 2.4, 2.5, 2.6

<u>1. Conserve habitat to support healthy, fish, wildlife, and plant populations and ecosystem functions in a changing climate:</u>

In order to maintain populations of all fish and wildlife, including SGCN, it will become more important than ever before to conserve a variety of habitats, and to improve connectivity between protected areas to enhance the ability of wildlife to move in response to changing conditions. Continuing current efforts towards habitat protection, restoration, and the establishment of corridors will be crucial to achieving this goal. Such efforts may not be enough however, as future conditions should also be considered when planning and implementing habitat conservation. For example, it might be beneficial to proactively protect forested lands inland of current migration stopover sites, to ensure the continued availability of such habitat when current stopover habitat is lost. Additionally, the identification of Conservation Opportunity Areas (COAs, see Chapter 8) will allow LDWF and partners to prioritize both land acquisition and the establishment of corridors under changing conditions.

<u>2. Manage species and habitats to protect ecosystem functions and provide sustainable cultural, subsistence, recreational, and commercial use in a changing climate.</u>

Continuing the efforts of LDWF and partners to responsibly manage both wildlife and wildlife habitat will continue to be important, and such management may become even more vital, if changing conditions lead to decreased habitat quality. Programs such as the Prescribed Burn Initiative that seek to restore ecosystem function should be continued, or even expanded to improve resilience of wildlife and natural communities to climate change. Climate change considerations should also be taken into account when updating management plans, as is being done for the WAP, as this will improve the ability of resource managers to effectively manage SGCN and their habitats.

3. Enhance capacity for effective management in a changing climate.

To effectively continue and expand upon current management activities under changing conditions could require novel approaches to data collection and analysis, developing or modifying management techniques, and continuing and expanding collaboration. The first step towards this goal is increasing the awareness of resource managers to the potential challenges ahead, which this chapter is addressing. Additionally, expanding upon current partnerships and emphasizing conservation efforts that cross jurisdictional and political boundaries will enhance the capacity of all partners to address current and future conservation issues. Changes in climate will require a more landscape-scale oriented approach to wildlife conservation (Staudinger et al. 2012), leading to an increased need for conservation that crosses state and national borders (NABCI 2010). For Louisiana, this means that continuing and expanding current partnerships with neighboring states is crucial, as efforts within the borders of Louisiana may not be sufficient to ensure the future of Louisiana's SGCN. For that reason, participation in landscape level conservation planning and delivery via membership in LCCs and JVs is likely to become increasingly important, for both game species and SGCN. Additionally, cooperation with other states in the southeast will be more critical to the mission of LDWF in the years to come. Mechanisms of such cooperation, including the Southeastern Association of Fish and Wildlife Agencies (SEAFWA) Wildlife Diversity Committee, as well as Southeastern Partners in Amphibian and Reptile Conservation (SEPARC) and Southeastern Partners in Flight (SEPIF) should be maintained or even expanded upon.

4. Support adaptive management in changing climate through integrated observation and monitoring and use of decision support tools.

Improving existing efforts to coordinate and integrate data collection, data management, and decision support tools will help with developing adaptive management strategies to adjust to changing conditions. The continuation and expansion of current wildlife monitoring programs (e.g., USGS Breeding Bird Surveys, Louisiana Amphibian Monitoring Program, etc.) will be valuable in detecting any changes that may occur due to climate change. The development and use of decision support tools, such as the EGCP JV Open Pine Decision Support Tool, and the GCP LCC Mottled Duck Decision Support Tool will also be a valuable tool for resource managers and policy makers. As new downscaled climate data become available, those data should be incorporated into support tools and other decision making processes. Finally, the success or failure of all conservation actions and planning efforts should be used to inform future actions.

5. Increase knowledge and information on impacts and responses of fish, wildlife, and plants to a changing climate.

Targeted research to fill data gaps for SGCN will continue to be a high priority, as the ability to predict responses to changing climatic conditions will be much improved with a better understanding of the current status, distribution, and limiting factors for SGCN. Increased coordination with partners will allow for time and funding to be better focused on shared priorities, maximizing the impact of research. Efforts to improve regional or sub-regional climate models could also be valuable, as better downscaled climate data could help inform conservation priorities at the state or regional level. Cooperation with other conservation stakeholders, specifically those that have expertise in regard to climate science, such as the USGS Southeast Science Climate Center, will be a necessity for meeting this goal.

6. Increase awareness and motivate action to safeguard fish, wildlife, and plants in a changing climate.

Climate change adaptation efforts will be most successful with buy-in from conservation partners, landowners, and the general public. Therefore, it could prove advantageous to incorporate information about the potential impacts of climate change into current outreach efforts, or to develop entirely new outreach products or methods. Coordination across jurisdictions could also be valuable, and could include such existing mechanisms as Landscape Conservation Cooperatives and Joint Ventures.

7. Reduce non-climate stressors to help fish, wildlife, plants, and ecosystems adapt to a changing climate.

In particular, the reduction of non-climate stressors is an important part of our approach to addressing the potential impacts of climate change, as this includes the conservation actions that LDWF and other conservation partners are currently undertaking in Louisiana to benefit SGCN and their habitats (see Chapters 4 and 5 for detailed lists of those actions). By continuing efforts to address conservation issues such as habitat fragmentation, invasive species, and natural system modification, the resiliency of SGCN and associated habitats can be increased, which will in turn decrease the potential negative impacts associated with changing climatic conditions. Among the most important strategies for improving the resilience of natural systems to climate change are restoring natural hydrological and fire regimes, as well as connecting existing and future conservation lands through the use of corridors (NABCI 2010). Carbon sequestration is another major strategy to mitigate the impacts of climate change by offsetting carbon emissions, so programs such as those administered by NRCS that retire agricultural lands from active production will be even more important, as doing so will increase carbon storage (NABCI 2010), potentially slowing the rate of climate change.

In the *Strategy*, there are multiple conservation actions listed for each of the 7 goals that can help resource managers attain those goals. As many of those actions are consistent with the habitat conservation strategies and species conservation strategies presented earlier in the WAP, similar detail will not be presented here. However, within Chapters 4 and 5, conservation strategies that are taken from or consistent with those from the *Strategy* are identified. It should be noted that all of these conservation actions go hand in hand with the overall goals of the Louisiana WAP. Similarly, it should be noted that addressing the goals and actions identified as consistent with the *Strategy* will be of great benefit to Louisiana SGCN and their habitats, even if climate change does not happen in the ways or at the rate currently projected.

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CHAPTER 9. RESEARCH AND MONITORING

This chapter describes both the research and monitoring components of the WAP. Research is an integral part of WAP implementation, as filling data gaps will allow for LDWF and conservation partners to refine conservation priorities and better target conservation action. Monitoring is critical to ensure that the goals of the WAP are being met and to demonstrate the success of both the WAP and the SWG Program in addressing the needs of SGCN. Required Element #5 for State Wildlife Action Plans directs the states to provide a three-tiered monitoring plan:

- Tier 1 – Species and Habitat Monitoring
- Tier 2 – Monitoring Effectiveness of Conservation Actions
- Tier 3 – Adaptive Management of Monitoring

Tier 1 Monitoring is described in Section B below and includes information on monitoring all SGCN taxa, as well as habitats. Tier 2 Monitoring is described in Section C below and includes information on Monitoring Effectiveness of the Wildlife Action Plan. Tier 3 Monitoring is described in Section D below.

A. Research

The WAP is divided into 58 habitat types across 6 ecoregions, 12 aquatic basins, and 5 marine habitat types. Research needs are often provided within each basin/habitat type description (Chapter 5). As such, the WAP will drive most of the research and monitoring activities funded through Louisiana's share of the SWG program. However, this is certainly not intended to be a complete list, and the research needs are fluid. Conceptually, LDWF views allocation of SWG funds for research and monitoring as a two-tiered program:

- LDWF-developed research and monitoring projects based on SGCN and/or habitat needs specified in the WAP
- Partnerships with outside contractors (universities, NGO's, industry, etc.) to develop projects based on SGCN and/or habitat needs specified in the WAP

1. Research Priorities

Priorities for SWG projects are determined through a combination of factors including: relevance to SGCN and/or habitat priorities identified in the WAP, project design, feasibility and cost, and the amount of currently available funding. A list of all past and current SWG projects in the state can be found in Appendix A, and abstracts and final reports for all completed projects can be located on the LDWF website.

However, other research activities will continue to provide vital data to inform the conservation of fish and wildlife resources in the state. During the development and revision of the WAP, many academic, state, and federal partners were able to provide input into research needs for Louisiana's SGCN. The SWG program will only be able to fund a fraction of the work that will be needed to ultimately accomplish the goals of the WAP, thereby advancing conservation in the state. It is recognized that each individual institution will have its own research and monitoring interests and specialties. Nonetheless, we believe that the WAP will serve to focus everyone on the conservation needs of Louisiana SGCN, while allowing institutions and other partners to continue to maximize the use of their expertise.

2. Database Needs

Currently there is no single data management system in Louisiana. Although numerous habitat and species oriented studies are being conducted in the state at any given time, data are not stored in the same data management systems, collected with the same protocols, or easily retrievable by all interested stakeholders. Developing a central data storage/retrieval system is of paramount importance for accurate assessments (baseline and long-term) to be made. 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 cannot occur. As data sharing is becoming more and more common to meet regional, national, and international conservation needs, resources such as the LNHP Environmental Review Tool will become more important due to its ability to (1) protect LDWF data from inappropriate and fraudulent use; (2) provide clients with expeditious turnaround on requests; and (3) decrease the burden on data manager(s) for providing data in a myriad of formats for various, specific projects. Utilization of national databases (e.g., e-Bird, Eastern Avian Knowledge Network, Butterflies and Moths of North America, etc.) should be encouraged, particularly for those data not deemed sensitive (e.g., locations of birds away from nest sites).

As important as establishing a data clearinghouse may be, 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. In Section B, below, recommended survey and monitoring protocols are discussed. Although this treatment is not intended to be exhaustive, it does provide resource managers and researchers with a solid starting point for developing and implementing monitoring programs.

B. 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. Biological monitoring in this plan is divided into 2 major categories: terrestrial and aquatic. Where standardized protocols or established monitoring programs exist that can be used to monitor SGCN, those protocols and programs are detailed. In the absence of such protocols, standard techniques are described, and suggestions for standardizing data collection are given. All-species monitoring is, and should be, the ultimate goal for effective SGCN conservation, but the establishment and maintenance of long-term monitoring programs is often limited by both time and capacity.

1. Terrestrial Habitats and Species

Identification of changes in habitat is critical to the assessment of the effectiveness of the WAP for wildlife species. Currently, the location and size of many of the LNHP habitat types are not explicitly identified spatially or quantitatively. From some faunal perspectives, the habitat type may be less important than the structural composition of that habitat. Sources of habitat data include the LNHP Biotics database, USFS Inventory and Analysis (FIA), and the NRCS National Resources Inventory (NRI), among others. 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, USDA, USFWS, CPRA, 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 WAP, because the primary threat facing many species of wildlife, including SGCN, is habitat loss and degradation. That being said, managers and restoration ecologists should recognize that recruitment into newly restored or altered areas takes time, and natural ecological processes do not develop at these sites immediately.

a. Habitat Inventory and Monitoring

Knowledge of the amount, condition, and viability of each habitat type is important to conservation planning and decision making. How much total acreage is there of a particular habitat? How much acreage is high-quality, and how much is degraded? Is the habitat improving, stable, or declining on the landscape? Are certain management actions having the desired effect? These are questions that can be best answered through inventory and monitoring. Habitat inventory entails investigating and documenting occurrences of a particular habitat to determine areal extent and condition. Monitoring involves detecting a change in some aspect of a habitat over time, and can be accomplished using qualitative or quantitative approaches at both coarse and fine spatial scales.

The LDWF Louisiana Natural Heritage Program (LNHP) is the primary organization conducting habitat inventory in Louisiana and has been operating for about 30 years. The Natural Heritage habitat inventory procedure includes analyzing evidence such as topographic maps, soils maps, and aerial imagery to locate potential occurrences of target habitats, followed by visiting sites to confirm the presence of the target habitat and to collect detailed data on the occurrence. This approach has been especially effective in locating habitats that have distinctive signatures on aerial photography, characteristic soil types, or that occur on specific landscape positions. Examples of habitats that can be efficiently identified using one or more of these sources of evidence include (but are not limited to) Calcareous Prairie, Saline Prairie, Hillside Seepage Bog, Longleaf Pine Flatwoods Savanna, and Upland Longleaf Pine Woodlands. Aerial imagery also enables detection of remnant blocks of forested habitat and Coastal Prairie embedded in agricultural landscapes. Light Detection and Ranging (LiDAR) is a remote sensing technology that allows visualization of small elevation changes, and is useful in differentiating areas that still retain natural surface topography, such as Coastal Prairie remnants with pimple mounds and potholes, from land-leveled agricultural land and pasture. Remote sensing technology is an indispensable tool for habitat inventory. Depending on the objective, remote sensing alone can be used for habitat inventory. For example, if the objective was to quantify the current acreage of identifiable (and presumably recoverable) Longleaf Pine Flatwoods Savanna, which has a distinctive signature on aerial imagery, remote sensing alone could accomplish this. Field studies would be required if more detailed information is desired.

The objective of monitoring is to determine trends over time. Monitoring methods and intensity are dictated by the specific habitat, site, and project. Habitat monitoring is usually conducted at a specific site with the aim of detecting changes in habitat over time, and often is employed to determine the effects of management and stewardship actions. Remote sensing technology can be used to monitor change in structural habitat attributes, such as woody cover in various prairie types, by comparing aerial imagery taken in different years. Site-specific monitoring in the field can be either qualitative or quantitative. In the case of qualitative monitoring, a competent biologist (usually a botanist or plant ecologist) will inspect the site prior to and during the course of management implementation. This biologist can ascertain from site visits the treatment effects and whether or not the habitat is responding in the desired direction. An example might be a Calcareous Prairie that is degraded by encroachment of woody vegetation and lack of fire. A qualified biologist can determine by visual inspection whether or not the prairie is progressing toward the desired condition following mechanical brush removal and implementation of fire at an appropriate season and return interval. More intense monitoring for hypothesis-driven research can involve quantitative sampling. Since habitats are defined by vegetation, such intensive monitoring usually involves measuring attributes of vegetation. Important vegetation attributes include measures of frequency and dominance (e.g. percent cover for herbs, basal area/dbh for trees and shrubs) for each species falling within the sampling area. There are many vegetation sampling protocols available, and many potential modifications that can be made based on the specific site and questions being addressed. Many methods applicable to grasslands are detailed by the Interagency Technical Reference (1999). In addition to sampling vegetation, it is prudent to also collect and test soil samples, and in some cases, to measure elevation and other abiotic factors such as slope percent and aspect. These site factors may explain more variation in the vegetation sampling than do the experimental treatment, and without these data, one could arrive at spurious conclusions.

b. Bird Monitoring

A number of different approaches for monitoring avian abundance, trends and densities for breeding and nonbreeding birds were evaluated for the WAP, and several are presented here separated by species, species groups, or guilds. Many of these approaches provide means of evaluating change at the landscape level, but may also be scalable for other needs. Additionally, we believe that several presented methods provide mechanisms to confirm apparent trends suggested by USGS North American Breeding Bird Survey

(BBS) data and fit well into population goal assessments developed by programs such as Partners in Flight (PIF) and various JVs. Although all bird monitoring, or, at least, as close to all bird monitoring as is feasible such as BBS and National Audubon Society's Christmas Bird Counts, may be relatively simple and inexpensive, many bird species or guilds are frequently underrepresented by such sampling. In cases where such groups are apparently neglected, species or guild specific monitoring protocols may be advisable; accepted protocols for previously under-surveyed birds are discussed below in addition to more holistic approaches. Note that the list of summaries below is by no means exhaustive, and, in many cases, existing monitoring programs are evolving or may be replaced altogether; one should not assume that a project is acceptably designed simply because an approach below is chosen for his/her project. When selecting a monitoring regime, one should commit to the project for a minimum of several years of data collection.

1. United States Geological Survey (USGS) North American Breeding Bird Surveys

The current USGS BBS design has approximately 4 routes per degree block in Louisiana for a total of 67 currently active routes. These data, along with data collected throughout the United States, Canada, and Mexico, are used to make inferences relative to the status and trends of North American bird species that are readily detected by this scheme. One drawback with (but also a very strong asset of) BBS routes is the expertise required to survey the routes. As a consequence, limitations in personnel and volunteers frequently result in some routes not being run from year to year. Thanks in part to SWG funds and in part to diligent State coordinators and surveyors, participation in the BBS in recent years in Louisiana has been exemplary. In addition, a continued, concerted effort will be made to recruit enough birders with sufficient proficiency in bird identification to survey all BBS routes in Louisiana every year. Possible future modifications to the BBS protocol may include utilization of distance annuli and time intervals as suggested by Somershoe and colleagues (2006).

Web address: https://www.pwrc.usgs.gov/bbs/

2. Christmas Bird Count

Both National Audubon Society and private Christmas Bird Counts (CBCs) may be utilized for monitoring resident and wintering landbirds, as well as most other bird guilds. Because CBCs are rarely restricted to roadsides, biases related to increased detection of edge species (as in BBSs) are less likely to affect results. With almost 30 active, 15 mile diameter count circles, the data from CBCs have great utility for calculating population indices, a relative measure of abundance and trend. Like the BBSs, CBCs cannot be considered complete censuses, but whereas BBS point counts may be modified with distance sampling, CBCs are not so easily altered in this way. This difference is important when biologists desire to calculate detection probabilities. Also, because CBCs are frequently surveyed by parties of varying sizes and experience levels, data should be carefully analyzed and vetted. Despite noted shortcomings, the CBC has been called the longest running, citizen science endeavor in the Western Hemisphere and will, clearly, continue to be the most utilized sampling method for wintering species. Future modifications and standardizations of the CBC protocols would only enhance its value to bird conservation.

Web addresses: National Audubon Society CBCs: http://birds.audubon.org/christmas-bird-count
Other CBCs: http://losbird.org/

3. The Institute for Bird Populations (IBP) Monitoring Avian Productivity and Survivorship

Developed in 1989, IBP's Monitoring Avian Productivity and Survivorship (MAPS) program has become the standard for the collection of demographic data utilizing constant-effort mist netting. MAPS provides data that are not readily produced by many of the other more recognizable efforts such as CBCs and BBSs; MAPS collects data that may be used to calculate vital rates, which may be crucial in determining causation of declines. In addition, MAPS is unique in that it links birds with habitat and has been used to measure bird response to various habitat treatments. One should be mindful, however, that as valuable as mist net data may be, like other methods, mist netting has issues. Particularly, land managers and biologists should recognize that setting up mist nests in extremely different forest types or treatment types, frequently, do not provide results that may be comparable across types and will likely bias relative abundance calculations. That is, unless nets are stacked from the ground to the canopy, mist nets will, obviously, be biased towards species occurring in lower strata. Clustering of water or food features in study sites may also impact the "catchability" of birds. Despite these possible short-comings or caveats of mist netting, the MAPS program has proven to be invaluable in collecting demographic data and should be utilized and promoted wherever and whenever possible.

The LDWF began a MAPS project in the Atchafalaya Basin in 2004 and extended the project to the Pearl River Basin in 2007. Phase I of the project was completed in 2014 when eight stations were in operation. More than 25,000 bird captures have been logged since initiation, Neotropical migratory songbirds being a very large proportion of that number. Data analysis is currently underway, but results may not be available by publication date of this document.

Web address: http://www.birdpop.org/maps.htm

4. Surrogates

This approach would use surrogates to determine by proxy the status of other species or, more appropriately, the quality of their shared habitat. Surrogates may be keystone, umbrella, or indicator species; but regardless of the subtype chosen, the surrogate must be appropriate based on the objective or outcome being monitored. For example, Prothonotary Warbler may be a suitable species for monitoring Bottomland Hardwood Forest sites that have been altered as a result of "wildlife-forestry." This surrogate species may be useful in determining whether or not desired forest conditions are met, which would benefit multiple SGCN. The main advantage of utilization of surrogates is that it does not require birders with the expertise to identify all birds by sight, song, or call. As such, LDWF staff or volunteers could more easily be trained and may prove useful in limited-species point counts or other less technical surveys. An in-depth treatment of surrogate species and their ties to habitat conservation may be found on the USFWS website below.

Web address: USFWS Strategic Habitat Conservation and surrogates: http://www.fws.gov/Landscape-Conservation/index.html

5. Point Counts

Like all other "all" bird monitoring, critical to successful point counts is the expertise of the observers. Casual birders would not be qualified for such extensive surveys unless the project objective only includes a small number of readily identifiable species (e.g., Prothonotary Warbler, Yellow-breasted Chat, etc.). Instead, experts in bird identification through auditory and visual cues are imperative to help ensure that the highest quality data are collected. Variable or fixed distances and time interval point counts are most frequently employed and may be utilized to investigate effects of habitat management regimes. Time intervals chosen often mirror other national protocols such as three minute BBS counts for comparison purposes. Distance annuli frequently chosen include 25 m, 50 m and >50 m and are important in calculating detection probability and species density. Without detectability estimates, bird counts may be very skewed toward the easily detected. Degree of openness of habitats also influences detectability, because vegetation may mask aural and visual cues. Line transects are also commonly used for bird monitoring, and due to similarity to point counts will not be further discussed in this treatise except to note that limitations in point counts versus line transects and vice versa should be considered prior to initiating a field project with either technique. Also, these methods will vary in efficacy based on season and habitat (Wilson *et al.* 2000).

Standardization of point count protocols and sample data sheets are provided in the excellent *A Land Manager's Guide to Point Counts of Birds in the Southeast* (Hamel *et al.* 1996).

Web address: http://www.pwrc.usgs.gov/point/index.cfm?fa=pointcount.whatIsAPointCount

6. Strip Transects

Unlike point or line transects which may require the observer to measure distances of birds from a center point or center line, strip transects are, instead, of fixed width. Surveyors of strip transects must be experienced birders as with the abovementioned surveys. Despite their linear nature, strip transects, which act as long, narrow plots, are very different from line transects. Whereas line transects do not assume the observer has detected all birds, the strip transect does; this means counts obtained utilizing strip transects are considered a census of birds present. An in depth treatment of this and other distance sampling approaches may be found in Buckland *et al.* (1993); a free, on-line book version is available.

Web address: http://www.colostate.edu/Dept/coopunit/download.html

7. Species or Guild Specific Surveys

<u>Waterbird Nesting Colonies</u>- Perhaps no group of birds better represents Louisiana than waterbirds. To be sure, for a few species, a high proportion of those species' North American or global populations occur in Louisiana, which suggests a great responsibility for monitoring those species within our state (Fontenot *et al. 2012)*.

Whereas it is strongly advisable to monitor these and other birds utilizing a statistically defensible framework such as that discussed in Green *et al.* (2010), to date, list frame sampling has been utilized by LDWF to determine activity of known waterbird colonies in the state. This list frame sampling, or surveys of known colonies flown point-to-point, is favored by LDWF over more rigorous techniques, because (1) the goal of these surveys is not for a population census, but for gauging activity of known colonies and their distribution on the landscape; (2) these data assist the Louisiana Natural Heritage Program during permit reviews, whereas a different framework may not detect known or new colonies; and (3) population indices are acceptable to determine trend, which may trigger conservation action.

In Louisiana, waterbird colonies have been surveyed by both air and water routes; although aerial surveys are now the most often used method. LNHP's database of waterbird colonies extends from 1976 to 2014. Surveys of Louisiana's colonies is an arduous task; the historical and current number of colony locations in Louisiana – both active and inactive – is a staggering 800+. Realistically, only a subset of active colonies can be expected to be surveyed. Data collection has been a truly collaborative effort; federal and state agencies (particularly Barataria-Terrebonne National Estuary Program), academia, nonprofit groups, private citizens and others have provided an invaluable service in assisting the Department in keeping these records current. More recent efforts by the Department have included double observers, who independently record estimates of nests or pairs of waterbirds at each colony, perhaps the only significant deviation from protocols set in the late 1980's by Martin and Lester (1990). Briefly:

1) Surveys of colonial nesting waterbirds are performed utilizing an aerial platform – typically helicopter, most frequently Bell Jet Rangers instrumented with emergency, inflatable pontoons for unscheduled water landings.
2) Both observers (i.e., wildlife surveyors) are seated on the left side of the helicopter.
3) One observer is seated beside the pilot, assists in navigation, and acts as Secondary Observer.

4) Auxiliary navigation is provided by an aviation GPS unit preloaded with coordinates of known waterbird nesting colonies. Colonies are filtered to include colonies known to be active at least once during the last three surveys.
5) Prior to the survey, the pilot and observers discuss safety and flight plans, including expected outcomes for the day and possible refueling locations. In addition, the pilot is informed of any possible hazards faced (e.g., low flying vultures, soaring Anhingas, etc.).
6) Flights begin as early as possible each morning and routes are flown point-to-point with observers noting GPS coordinates and number of nesters at each new colony detected.
7) At each colony, the pilot decreases altitude to approximately 300 feet while maintaining a buffer at least as large. Airspeed is decreased to slowest speed deemed safe by the pilot.
8) Colonies are speciated and enumerated in as few passes (circles) as possible to prevent or minimize disturbance to nesters. Should birds show signs of disturbance, the pilot is instructed to back away from the colony, and the survey recommences at a greater buffer distance.
9) When both observers have recorded all required data, the pilot is instructed to fly to the next closest colony.
10) At the end of surveys, the Biotics database is updated with all new data, and all colonies marked “NEW” are confirmed as such – occasionally, “NEW” colonies may simply be existing colonies that have moved. A new colony must be at least 0.5 km away from all other colonies before it is given a new unique identifier in Biotics.

Swallow-tailed Kite Surveys – Sometimes animal behavior allows researchers a commonsense approach at censusing. During the second half of July in the southeastern United States, Swallow-tailed Kites form pre-migration roosts where a few birds to several hundred birds gather to communally rest. In October 2007, the Swallow-tailed Kite Conservation Alliance, a working group composed of state and federal agencies, nonprofit groups, academia, and timber industry partners, met to discuss a range-wide survey methodology based on that utilized in Florida (Meyer 1996).

The Wildlife and Sport Fish Restoration Program, the Orleans Audubon Society, and the Department provided funds for roost surveys from 2008 to 2012. Surveys were concentrated in three major river basins – the Pearl, the Atchafalaya, and the Sabine – and survey dates coincided with those in Florida, where the largest roosts gather, to avoid double counting. Fixed wing aircraft were used to fly river systems from sunrise until roosts began to disperse (around 9:00am?). Larger roosts were photographed to assist enumeration.

Another round of pre-migration roost surveys for Swallow-tailed Kites is advisable and should allow an estimate of population trend.

Bald Eagle Surveys – Removed from the federal list of threatened and endangered species in 2007 due to population recovery, Louisiana's Bald Eagle population continues to rise. Surveys for Louisiana's nesting eagles were started in 1984 by Rockefeller Wildlife Refuge biologist Tom Hess and continued through 2008. In 2015, approximately 650 nests were surveyed, and approximately 350 were active with chicks, eggs, or incubating adults.

Like colonial waterbirds, LDWF nesting Bald Eagle surveys are based on a list frame; nests are flown point-to-point, with possible new nests discovered while flying between points. In 2015, an effort was made to search nearby, suitable habitat as well even if off the flight track. Brief protocol from 2015:

1) Surveys of nesting Bald Eagles are performed by helicopter and, typically, include two rounds of flights – one to gauge activity and one to gauge productivity. Because eagles are winter nesters in Louisiana, surveys can occur December through March. Round one typically occurs in February, whereas round two occurs in March. Round two should be adjusted based on the age of chicks targeted (typically, 8-10 weeks old).
2) Both observers (i.e., wildlife surveyors) are seated on the left side of the helicopter.
3) One observer is seated beside the pilot, assists in navigation, and acts as Secondary Observer.
4) Auxiliary navigation is provided by an aviation GPS unit preloaded with coordinates of known Bald Eagle nests. In 2015, due to the last flight occurring several years prior, LDWF filtered nests to include those known to be active at least once during the last decade.
5) Prior to the survey, the pilot and observers discuss safety and flight plans, including expected outcomes for the day and possible refueling locations. In addition, the pilot is informed of any possible hazards faced (e.g., low flying vultures, territorial eagles, etc.).
6) Flights begin as early as possible each morning and routes are flown point-to-point with observers noting GPS coordinates and presence of adults, eggs, and chicks at each nest detected.
7) At each nest, the pilot decreases altitude to approximately 300 feet while maintaining a buffer at least as large. Airspeed is decreased to slowest speed deemed safe by the pilot.
8) Eggs and chicks are counted by both observers. If chicks are present, the observers confer and record age of chicks to the nearest two week period (e.g., 1-2 weeks old, 3-4 weeks old, etc.) based on photographs of known-aged chicks. Should birds show signs of disturbance, the pilot is instructed to back away from the nest, and the survey recommences at a greater buffer distance.
9) When the main observer has recorded all required data, the pilot is instructed to fly to the next closest nest.
10) At the end of surveys, the Biotics database is updated with all new data.
11) Round Two surveys as many nests found to be active in Round One as is feasible. The timing of Round Two is based on when the maximum number of nests with

chicks detected in Round One would be approximately ten weeks old, the age at which we may assume the nest will, ultimately, be successful.

Secretive Marsh Bird Callback Surveys– Marsh birds pose particular challenges to bird scientists. Often secretive in nature, several species of marsh birds prefer to remain hidden from view in dense vegetation, frequently only detectable by their songs or calls. In 1998, bird scientists met at Patuxent Wildlife Research Center to discuss the need of marsh bird monitoring (Ribic *et al.* 1999). Refinement of standardized protocols for surveys, ultimately, resulted in the Standardized North American marsh bird monitoring protocol (commonly known as the "Conway protocol") (Conway 2011). Briefly, the protocol involves point count surveys with periods of passive (*i.e.*, no callback allowed) survey and callback survey, and counts are usually situated along a route (water, road, etc.). Surveyors are strongly encouraged to enter data into the National Marsh Bird Monitoring Database. [As of June 2015, the database is currently being transitioned to the Avian Knowledge Network, but it should become available for data transfer again soon.]

In Louisiana, despite excellent work by academia and others, marsh birds continue to be under surveyed and knowledge gaps, even the most basic in nature, remain. Marsh birds have only recently been subject to intensive surveys in coastal Louisiana. In 2010, USGS, LDWF, and other federal and academic partners began coastwide, marsh bird callback surveys. More than 30 routes, each with approximately eight point counts, were established in *Spartina* and *Phragmites* coastal wetlands.

Due to reductions in available staff, from 2011 through 2015, approximately 130 points were surveyed utilizing the Conway protocol (Conway 2011) three times each year – once each in April, May, and June. Louisiana's callback sequence was based on that utilized in coastal Mississippi (Mark Woodrey, pers. comm.) – Black Rail, Least Bittern, King Rail, Clapper Rail, Common Gallinule, Purple Gallinule, American Coot, and Pied-billed Grebe. Other focal birds for this work include Seaside Sparrows, Marsh Wrens, and Mottled Ducks.

Future marsh bird surveys should include additional, stratified survey points, which utilize the Conway protocol (Conway 2011), and projects that elucidate vital rates of these birds should be encouraged.

Web address: http://ag.arizona.edu/research/azfwru/NationalMarshBird/index.htm

Nightjars – The USGS Breeding Bird Survey has collected and made available invaluable data on many species of birds. Some birds, however, are not well-surveyed by the BBS; wading birds, seabirds, nocturnal species and others. The Center for Conservation Biology's Nightjar Survey Network was established to address the monitoring needs of this underrepresented group. Surveys are restricted to nights with bright moons, because these are times of peak detection. Many existing routes coincide with well-established BBS routes, but only ten point counts are distributed along that track rather than 50.

Web address: http://www.nightjars.org/

Finally, when initiating any new monitoring program or even for critiquing existing ones, consultation with Southeast Partners in Flight's *Field Guide to Southeast Bird Monitoring Programs and Protocols* (Laurent *et al.* 2012) is strongly advised.

Web address: http://SEmonitoringguide.sepif.org

In addition, an emerging panel of bird scientists, the Gulf of Mexico Bird Monitoring Working Group, is (as of June 2015) becoming a major driving force in bird work in the Gulf region. This group is poised to make significant expansions and positive changes to existing monitoring programs and will likely guide a large portion of future bird science and monitoring. The Department's continued commitment to this working group and others like Southeast Partners in Flight will, undoubtedly, serve to promote sound monitoring decisions in this state and beyond.

C. Amphibian and Reptile Monitoring

Amphibian and reptile species are declining worldwide at an accelerated rate. Monitoring is critical to document changes in local populations and to assist in identification of the causes of population changes. Herpetofauna can be more problematic to monitor than other faunal groups due to their cryptic nature, relatively small population sizes of some species, and non-random or limited distribution of others.

Several national and regional systems exist for monitoring amphibians and reptiles: the North American Amphibian Monitoring Program (NAAMP, including the Louisiana Amphibian Monitoring Program - LAMP), Partners in Amphibian and Reptile Conservation (PARC, including Southeast Partners in Amphibian and Reptile Conservation - SEPARC), and the U.S. Geological Survey Amphibian and Reptile Monitoring Initiative (USGS-ARMI). LDWF continues to recruit volunteers to implement LAMP, and agency staff conduct routine surveys for amphibians and reptiles. State Wildlife Grant (SWG) projects as well as other sources provide presence/absence data and/or estimates of abundance for amphibians and reptiles in numerous habitat types in Louisiana. Research projects directed towards specific species, either funded through SWG or other sources, will continue to provide valuable data at a local scale for each.

The methods listed below are recommended and standardized for monitoring amphibian and reptile populations.

- Visual Encounter Surveys (VES) are used to detect species richness and/or abundance by observer(s) walking a pre-determined area in a time-constrained manner and recording all amphibians and reptiles seen. VES may consist of randomized-walk, quadrat, or transect methods, and coverboards may be used also to increase detection.

- Artificial cover of various materials including plywood, carpet sections and sheet metal, placed in systematic arrays within selected sites, are used to attract and shelter various reptile and amphibian species, which can then be sampled

- Funnel Traps with/without drift fence arrays are commonly used to capture amphibians and reptiles in terrestrial and aquatic habitats. Drift fences may significantly increase capture of amphibians and reptiles when combined with funnel traps. Various funnel trap types include plywood and hardware cloth box trap, steel minnow trap, plastic minnow trap, and collapsible nylon trap.

- Automated recording devices (ARUs) may be used to record calling amphibians to detect presence/absence.

- Hoop nets and Fyke nets are used to trap turtles. Fyke nets use net wings to guide turtles into an escape-proof enclosure, whereas hoop nets are baited to attract turtles. Replicate surveys should use nets of similar size and mesh and use the same bait.

- Basking turtle traps are used for mark-resight techniques to assess population estimates of basking turtles. Basking structures (e.g., logs, branches) are selected for the placement of open-topped, crawfish wire basking traps that are attached to logs with twine and nails. A boat is used to frequently monitor the traps for turtles. Captured turtles are identified, weighed, measured and permanently marked by scute drilling, and temporarily marked on the 2nd and 3rd vertebral scutes with fluorescent orange, waterproof spray paint for mark-resight surveys.

- Basking surveys use spotting scopes and binoculars to monitor basking turtle populations on riverine transects. Data recorded include species, sex and age class.

- Line Transect Distance Sampling (LTDS) is used as the standardized method of surveying and monitoring gopher tortoise populations.

- Box traps with drift fence arrays are used to capture snake species for presence/absence and for mark-recapture of specific species, such as the Louisiana Pine Snake, to obtain population data.

- PVC pipe traps can be placed vertically within selected microhabitats, either in the ground or attached to standing structures, to create refugia for amphibians within wetland and surrounding upland habitat.

- Leaf litter bags are a commonly used method to capture and detect presence of aquatic amphibians, such as stream-dwelling salamanders and their larvae.

- Calling surveys are used to quantify nocturnal breeding activity of amphibians. For each species, chorus sizes are assigned values of 1, 2, or 3 based on intensity.

D. Mammal Monitoring

Mammal monitoring faces many of the same challenges as amphibians and reptile monitoring in the sense that the majority of the species are often not readily observed through sight or sound. Standard methods for monitoring mammals typically involve some sort of catch-per-unit-effort (CPUE) or mark-recapture technique. Volant mammals are one exception to this; whereas they are routinely sampled using mist nets or harp traps, they can also be sampled using ultrasonic recording devices and are sometimes observed while roosting or as they emerge. There are numerous trapping methods available for capturing terrestrial mammals; however, lethal techniques are not recommended for monitoring mammal SCGN. The majority of the mammal research and survey needs are listed in Chapter 4 of this plan.

Examples of recommended standardized survey techniques are listed below:

- Pitfalls are very effective at capturing the smallest of our terrestrial mammals such as shrews. Their effectiveness can be greatly enhanced when used in combination with drift fences.

- Small to medium sized mammals can be sampled effectively using appropriately sized box traps. Arranging traps in a grid or web design allows the researcher to obtain density estimates.

- Mist nets or harp nets placed in flyways or emergence points can be used to capture bats.

- Ultrasonic recording devices are gaining popularity due to their relative ease of use. Distinguishing between similar species can be problematic with the current software packages available; nonetheless, this method can be useful for detecting certain species.

- When a day roost or hibernaculum is known, roost or emergence counts are routinely used to monitor bat populations over time.

- Track plates can be used to sample small to medium sized mammals. This technique requires that the target (1) traverses an ink pad and (2) deposit a print on a hard medium.

- Placed in soft substrate, which can record track imprints, scent stations with centrally placed attractants can be used to detect the presence of carnivores.

- Various methods for acquiring mammalian hair such as barbed wire or sticky paper are available. Mammals can often be identified through the hairs collected, and densities of mammals can be determined through genetic techniques.

- Motion activated or time lapse cameras can be very effective for detecting the presence of appropriately sized mammals. Widespread use of these cameras by the hunting community provides an excellent opportunity for a statewide citizen science project.

- Scat surveys are often employed to detect presence, and in some cases, may be utilized to estimate densities of certain mammals especially carnivores.

When applicable, LDWF will require the use of standard survey techniques by researchers conducting surveys and monitoring for SWG funded projects. In addition, CPUE data from projects outside of the SWG program can be captured by requesting that researchers include a measure of effort on their Louisiana Scientific Collecting Permit annual report. Acquiring these data will allow us to utilize the efforts of our partners in order to more effectively make comparisons of mammal populations over time.

E. Terrestrial Arthropod Monitoring

The techniques for sampling terrestrial arthropods (e.g., insects, arachnids, etc.) are as diverse as the groups themselves and, as such, the techniques utilized are dependent upon the target organism(s) and cannot be addressed at length here. Active techniques include sweep netting, aerial netting, and employing traps that use pheromones or ultraviolet light, whereas more passive techniques such as pitfalls, flight intercept, and malaise traps are commonly used as well. Although proper setting and collection of traps, and even active sampling and collection, may be readily taught to seasonal technicians, identification of most arthropods, especially to family, genus, or species, is time consuming and requires special expertise. In fact, for these reasons, arthropods are often not identified to species level during projects, a lack of specificity that hamstrings efforts of conservation of SGCN in Louisiana. Because of the paucity of these data, even baseline information like arthropod distribution is lacking. In order to address this knowledge gap, LDWF plans to collect data on arthropod SCGN both through in-house efforts as well as partnering with local experts. Surveys of current at-risk species are vital to elucidate the distribution and abundance of the species so that management or conservation actions can be applied if necessary. Due to their high fecundity and short generation times, arthropods often respond rapidly to habitat manipulation and can be excellent early indicators of successful habitat management.

2. <u>Aquatic Habitats and Species</u>

A. Freshwater

Due to the diverse nature of the freshwater ecosystems and the lack of recent fish population data on many SGCN listed in this strategy, monitoring efforts should focus on documenting new occurrences of fish SGCN and maintaining or establishing long-term monitoring programs.

Information needed beyond species occurrence within all river basins include species trends and abundance with emphasis on SGCN. For those species for which we have adequate occurrence data, monitoring efforts should focus on population trends and changes in habitat availability.

An established monitoring framework has been devised for some species, such as the Gulf Sturgeon, and partnerships with MDWFP and USFWS have been established and will continue to aid in monitoring the recovery of this species. For other aquatic SGCN or suites of SGCN, similar monitoring plans should be developed and implemented. 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.

Periodic monitoring should be conducted every 5 to 10 years, with reevaluation of goals and objectives after 5 years. Monitoring efforts will be conducted using standard LDWF protocols or other fish sampling methods recognized by the American Fisheries Society (Murphy and Willis 1996, Bonar et al. 2009). During the revision of the WAP, monitoring strategies were written to address freshwater aquatic SGCN found in each river basin and are listed in Table 8.1.

Large river systems serve as major conduits for the inflow of invasive fish and mussel species into the waters of Louisiana. Therefore, additional monitoring efforts are needed for identifying trends in the current range and abundance of these species, particularly the Asian Carp and Zebra Mussel, and for determining to what degree of impact the exotics have on native species.

Due to the locks and dams on the Red River and the impoundment of the Sabine River at Toledo Bend, 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 Sabine River Authority (SRA) and USACE to monitor their effect on SGCN.

Coastal basins offer unique and ever changing habitats. Coastal restoration projects such as Davis Pond and the Caernarvon Diversion 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. Impacts on freshwater habitat and species from saltwater-barrier placements in steams and river channels to prevent saltwater intrusion must be monitored.

Habitat degradation in river basins has led to a reduction in aquatic species richness and abundance. Land use practices in these basins have impacted water quality. Partnering with state and federal partners such as LDEQ and NRCS to monitor and improve water quality is a long term need.

Intensive inventories are needed to better understand the distribution and status of aquatic mollusks and crustaceans. To date, the technique most commonly used to sample freshwater mussels in Louisiana has been time-constrained, hand searches. Future inventories using this method will allow comparisons to be made over time. Additional information on this and other standard methods for sampling mussels can be found in Strayer and Smith (2003). Alternative techniques may be warranted for species specific surveys, especially for mussels like the Louisiana Pearlshell which occurs in headwater streams, often in dense aggregations. A standardized monitoring protocol for this species is now available and could serve as a template for the development of other such protocols.

Techniques for sampling crustaceans vary widely with habitat type. Various trap designs, electroshocking, seines, dip nets, and hand capture have all been used to study the distribution of these organisms in Louisiana. Much work remains to be done with crustacean and mollusk SGCN, including the development of standardized population monitoring protocols as well as basic life history studies.

B. Marine

The status of marine SGCN is 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. Habitat threats are at a critical level in the coastal zone, and LDWF Office of Fisheries prioritizes these habitat threats rather than having a species-oriented focus. Data developed through this process provides 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 protocols.

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 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.

Many conservation efforts are 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., CPRA).

Table 8.1 Monitoring needs for individual aquatic basins in Louisiana.

Atchafalaya Basin
Monitor population trends of SGCN
Develop long-term water quality monitoring sites
Develop long-term monitoring sites for SGCN
Monitor trends of invasive species catch in commercial fisheries landings

Barataria Basin
Monitor population trends of SGCN
Monitor the effects of freshwater diversions in the basin
Monitor the effects of severe land loss in the basin.

Calcasieu Basin
Monitor annual salinity wedge in the river above the salt water barrier
Monitor population trends of SGCN

Mermentau Basin
Monitor population trends of SGCN
Develop long-term water quality monitoring sites
Develop long-term monitoring sites for SGCN
Sampling is needed to identify trends in range and abundance of invasive species

Mississippi Basin
Monitor population trends of SGCN
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
Monitor population trends of SGCN
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 SGCN
Develop protocol for gear-type to ensure sampling is repeatable
Partner with academia to monitor populations of SGCN

Pontchartrain Basin
Monitor the effects of freshwater diversions in the basin
Develop protocol for gear-type to ensure sampling is repeatable. Develop long-term monitoring sites for species of concern.
Conduct sampling to identify trends in range and abundance of invasive species
Monitor population trends of SGCN

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 SGCN
Monitor population trends of SGCN

Sabine Basin
Evaluate the impacts of dam operations on fish populations post new SRA hydropower license implementation
Monitor the effectiveness of mitigation features
Monitor population trends of SGCN
Conduct sampling to identify trends in range and abundance of invasive species

Terrebonne Basin
Monitor population trends of SGCN
Develop long-term water quality monitoring sites
Develop monitoring protocols to determine population trends of SGCN
Develop long-term monitoring sites for SGCN
Sampling is needed to identify trends in range and abundance of invasive species

Vermilion-Teche Basin
Monitor population trends of SGCN
Sampling is needed to identify trends in range and abundance of invasive species
Develop long-term water quality monitoring sites

C. Measuring Effectiveness of Conservation Actions

Success of the Louisiana WAP will rest on implementation of the various conservation actions developed during the revision process. These actions present explicit and concise approaches to addressing the identified threats to Louisiana's SGCN and their associated habitats. Since the completion of the 2005 WAP, there have been several major developments that directly impact this aspect of the WAP. The first was the completion of a report on measuring the effectiveness of State Wildlife Grants (AFWA 2011). This document provides a framework for evaluating and adaptively managing the actions taken towards conservation of SGCN. That document should be referenced for more information on the framework and how it will be implemented.

Additionally, there is a new system for reporting on SWG projects developed by USFWS. This program is known as Wildlife TRACS (Tracking and Reporting on Actions for the Conservation of Species). Wildlife TRACS was developed to incorporate the Effectiveness Measures developed by AFWA, as well as the standard lexicon set forth by Salafsky *et al.* (2008). As recommended by AFWA, Wildlife TRACS will be used to monitor the effectiveness of WAP implementation (AFWA 2012).

When reporting on a conservation action in Wildlife TRACS, the user must select from a set of Conservation Actions, which have three levels (Appendix J). The first level conservation actions are comprehensive, and fall into several categories including:

- Direct Management of Natural Resources
- Data Collection and Analysis Education and Outreach
- Land Acquisition and Protection
- Planning

- Species Reintroduction
- Technical Assistance

Second level Conservation Actions are also comprehensive, but for the third level Actions, only examples are provided, as a comprehensive list would be prohibitively lengthy.

Wildlife TRACS also provides standard output measures for each conservation action, and these measures will allow LDWF to monitor our success in implementing the WAP and the effectiveness of our conservation actions. In order to facilitate monitoring of WAP implementation, and to maximize the utility of Wildlife TRACS outputs in reporting on SWG effectiveness, SMART (Specific, Measurable, Achievable, Realistic, and Time Bound) objectives will be developed for all future SWG projects.

In addition to replacing the overly complicated monitoring protocol detailed in the 2005 WAP, adoption of Wildlife TRACS actions and outputs will allow for data from Louisiana to be rolled-up with data from other states, providing a better picture of the effectiveness of WAPs across the nation.

D. Adaptive Management

An important aspect of monitoring is to ensure that conservation actions and management approaches that are proven to be beneficial to SGCN are incorporated into LDWF's management practices and promoted among all state and federal natural resource agencies and private land managers and that those actions that are most effective are identified. It is critical that mechanisms are in place to measure the effectiveness of conservation actions taken by LDWF and other partners, as discussed above. This will enable LDWF to adapt conservation actions as needed to achieve the desired result. Additionally, it will be important to periodically evaluate the effectiveness of our monitoring, if the monitoring protocols in place are not adequately documenting the success of conservation actions.

Adaptive management is a four-phase cycle, in which each phase leads into the next, and is a continual process (Stankey *et al.* 2005). The four phases are as follows, adapted from Stankey *et al.* (2005):

Phase 1 – planning (either at the project of WAP level)
Phase 2 – on-the ground conservation action
Phase 3 – the results of the conservation actions are monitored
Phase 4 – the results are evaluated, leading back to Phase 1

This is a continually evolving process, with lessons learned from each project and action feeding back into the loop, and improving the outcomes of future conservation actions.

LDWF will complete the next comprehensive revision of the WAP by 2025 and will continue to utilize the Emerging Issues process to address high priority conservation issues outside the scope of the 2015 WAP that may arise within the next decade. The use of SMART objectives, effectiveness measures (AFWA 2011), and Wildlife TRACS will enable LDWF to continually monitor and evaluate the success of WAP implementation and adjust goals and actions as needed to ensure that benefits to SGCN are maximized.

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LIST OF ACRONYMS

AET	Actual evapotranspiration
AFB	Air Force Base
AFWA	Association of Fish and Wildlife Agencies
APHIS	Animal and Plant Health Inspection Service
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
CCVI	Climate Change Vulnerability Index
CLEAR	Coastal Louisiana Ecosystem Assessment and Restoration
CNR	Coastal and Nongame Resources
COAs	Conservation Opportunity Areas
COE	U.S. Army Corps of Engineers
CP33	NRCS program, habitat buffers for upland birds
CPRA	Coastal Protection and Restoration Authority
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
DEQ	Department of Environmental Quality
DFC	Desired Forest Conditions
DMAP	Deer Management Assistance Program
DNR	Department of Natural Resources
DOD	Department of Defense
DOI	Department of Interior
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
GCM	General Circulation Models
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
HV	Highly Vulnerable
IBA	Important Bird Area
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
JV	Joint Venture
KNF	Kisatchie National Forest
LAMP	Louisiana Amphibian Monitoring Program
LANSTF	Louisiana Aquatic Nuisance Species Task Force
LCA	Louisiana Coastal Area
LCC	Landscape Conservation Cooperative
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
LNSRA	Louisiana Natural and Scenic River Act
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
MAV	Mississippi Alluvial Valley
MDEQ	Mississippi Department of Environmental Quality
MDWFP	Mississippi Department of Wildlife, Fisheries, and Parks
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MRAP	Mississippi River Alluvial Plain
MRGO	Mississippi River Gulf Outlet
NAAMP	North American Amphibian Monitoring Program
NABCI	North American Bird Conservation Initiative
NACD	National Association of Conservation Districts
NAS	National Audubon Society
NAWMP	North American Waterfowl Management Plan
NBCI	Northern Bobwhite Conservation Initiative
NBII	National Biological Information Infrastructure
NFWPCAP	National Fish, Wildlife, and Plants Climate Adaptation Partnership
NGO	Non Governmental Organization
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRC	National Research Council
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)
ORV	Off-road Vehicle
OSP	Louisiana Office of State Parks
PAH	polycyclic aromatic hydrocarbon
PARC	Partners for Amphibian and Reptile Conservation
PCB	polychlorinated biphenyl
PET	Potential evapotranspiration
PIF	Partners-in-Flight
PRISM	Program for Regional and International Shorebird Monitoring
RCW	Red-cockaded Woodpecker

RFRI	Recreational Fishing Research Institute
RIFA	Red Imported Fire Ants
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
SGCN	Species of Greatest Conservation Need
SLAMM	Sea Level Affecting Marshes Model
SLPOH	Shortleaf Pine-Oak-Hickory
SLR	Sea Level Rise
SMZ	Streamside Management Zone
SPC	Spill Prevention Control
SRES	Special Report on Emission Scenarios
SWAP	State Wildlife Action Plan
SWG	State Wildlife Grants
TAC	Technical Advisory Committee (NRCS)
TACCIMO	Template for Assessing Climate Change Impacts and Management Options
TED	Turtle Exclusion Device
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
USACE	U.S. Army Corps of Engineers
USCB	U.S. Census Bureau
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
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
VHF	Very High Frequency
WAP	Wildlife Action Plan
WCRP	Wildlife Conservation and Restoration Program
WGCP	West Gulf Coastal Plain
WMA	Wildlife Management Area
WRDA	Water Resources Development Act
WRP	Wetland Reserve Program

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APPENDIX B. WILDLIFE ACTION PLAN COMMITTEES

2015 Wildlife Action Plan Revision

Core Committee

Amity Bass	Office of Wildlife - CNR
Beau Gregory	Office of Wildlife - CNR
Brian Alford	Office of Fisheries
Chris Reid	Office of Wildlife - CNR
Cody Cedotal	Office of Wildlife – Wildlife Division
Jeff Duguay	Office of Wildlife – Wildlife Division
Kyle Balkum	Office of Wildlife
Michael Seymour	Office of Wildlife - CNR
Rob Bourgeois	Office of Fisheries
Sam Holcomb	Office of Wildlife - CNR
Todd Baker	Office of Wildlife - CNR

Technical Committee – Birds

Amity Bass	Office of Wildlife - CNR
Beau Gregory	Office of Wildlife - CNR
Jason Olszak	Office of Wildlife – Wildlife Division
Jeff Duguay	Office of Wildlife – Wildlife Division
Michael Seymour	Office of Wildlife - CNR
Sam Holcomb	Office of Wildlife - CNR

Technical Committee – Climate Change

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Michael Seymour	Office of Wildlife - CNR
Nicole Lorenz	Office of Wildlife - CNR
Rob Bourgeois	Office of Fisheries
Sairah Javed	Office of Wildlife - CNR
Sam Holcomb	Office of Wildlife - CNR
Todd Baker	Office of Wildlife - CNR

Technical Committee – Conservation Opportunity Areas

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Chris Reid	Office of Wildlife - CNR
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Jeff Duguay	Office of Wildlife – Wildlife Division
Kyle Balkum	Office of Wildlife
Michael Seymour	Office of Wildlife - CNR
Nicole Lorenz	Office of Wildlife - CNR
Sam Holcomb	Office of Wildlife - CNR
Steven Beck	Office of Fisheries
Sam Holcomb	Office of Wildlife - CNR
Todd Baker	Office of Wildlife - CNR

Technical Committee – Crustaceans

Amity Bass	Office of Wildlife - CNR
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Brian Alford	Office of Fisheries
Mark Schexnayder	Office of Fisheries
Sam Holcomb	Office of Wildlife - CNR

Technical Committee - Habitat

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Sairah Javed	Office of Wildlife - CNR
Sam Holcomb	Office of Wildlife - CNR
Scott Durham	Office of Wildlife – Wildlife Division
Tommy Tuma	Office of Wildlife – Wildlife Division

Technical Committee - Herps

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Beau Gregory	Office of Wildlife - CNR
Jeff Boundy	Office of Wildlife - CNR
Keri Landry	Office of Wildlife - CNR
Sam Holcomb	Office of Wildlife - CNR

Technical Committee – Inland Fishes

Amity Bass	Office of Wildlife - CNR
Beau Gregory	Office of Wildlife - CNR
Bobby Reed	Office of Fisheries
Brian Alford	Office of Fisheries
Glenn Thomas	Office of Fisheries
Robby Maxwell	Office of Fisheries
Sam Holcomb	Office of Wildlife - CNR

Technical Committee – Insects

Amity Bass	Office of Wildlife - CNR
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Keri Landry	Office of Wildlife - CNR
Michael Seymour	Office of Wildlife - CNR
Sam Holcomb	Office of Wildlife - CNR

Technical Committee – Invasive Species

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Amity Bass	Office of Wildlife - CNR
Beau Gregory	Office of Wildlife - CNR
Brac Salyers	Office of Fisheries
Cody Cedotal	Office of Wildlife – Wildlife Division
Jeff Duguay	Office of Wildlife – Wildlife Division
Jim Lacour	Office of Wildlife – Wildlife Division
Michael Seymour	Office of Wildlife - CNR
Rob Bourgeois	Office of Fisheries
Sairah Javed	Office of Wildlife - CNR
Sam Holcomb	Office of Wildlife - CNR

Technical Committee – Mammals

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Ed Mouton	Office of Wildlife - CNR
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Mandy Tumlin	Office of Fisheries
Sam Holcomb	Office of Wildlife - CNR
Scott Durham	Office of Wildlife – Wildlife Division

Technical Committee – Marine Fishes

Amity Bass	Office of Wildlife - CNR
Beau Gregory	Office of Wildlife - CNR
Bill Hano	Office of Fisheries
Glenn Thomas	Office of Fisheries
Jason Adriance	Office of Fisheries
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Sean Jackson	Office of Fisheries

Technical Committee - Mollusks

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Brian Alford	Office of Fisheries
Keri Landry	Office of Wildlife - CNR
Patrick Banks	Office of Fisheries
Sam Holcomb	Office of Wildlife - CNR

2005 Wildlife Action Plan

Core Committee

Name	Division
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

Technical Committee--Birds

Name		Organization
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

Technical Committee--Crustaceans

Name		**Organization**
Bauer	Raymond	ULL
Maxit	Inés	LDWF
Martin	Richard	TNC
Shively	Steve	USFS
Vermillion	Bill	USFW
Walls	Jerry	Louisiana Fauna Project

Technical Committee--Fish

Name		**Organization**
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

Technical Committee--Herps

Name		**Organization**
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
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

Technical Committee--Insects

Name		**Organization**
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

Technical Committee--Mammals

Name		**Organization**
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

Technical Committee--Mussels

Name		**Organization**
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

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APPENDIX C. WAP GOVERNMENT PARTNERS and NGO PARTNERS

GOVERNMENT

2015 WAP Revision

Arkansas Game and Fish Commission
Arkansas Natural Heritage Commission
Barataria-Terrebonne National Estuary Program
BREC
Coastal Protection and Restoration Authority
East Baton Rouge Parish Planning Commission
Louisiana Cooperative Extension Service
Louisiana Department of Agriculture and Forestry
Louisiana Department of Culture, Recreation, and Tourism, Office of State Parks
Louisiana Department of Environmental Quality
Louisiana Department of Natural Resources
Louisiana Department of Transportation and Development
Louisiana Division of Administration Office of State Lands
Mississippi Department of Marine Resources
Mississippi Department of Wildlife, Fisheries, and Parks
National Oceanic and Atmospheric Administration
National Park Service - JLNHP
Southeastern Climate Science Center, USGS
Texas Parks and Wildlife Department
USACE New Orleans
US Army Corps of Engineers Vicksburg
US Department of Agriculture NRCS
US Department of Army, Fort Polk
US Fish and Wildlife Service, ES Lafayette
US Forest Service, Kisatchie National Forest
US Geological Survey, National Wetlands Research Center

2005 WAP

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)

NGOs

2015 WAP Revision

Gulf of Mexico Research Initiative
Gulf Restoration Network
Hancock Forest Management
Houma Tribe
Hunt Forest Products
International Paper
Jena Band of Choctaw Indians
LA/MS Conservation Delivery Network
LA/TX Longleaf Taskforce
Land Trust for Louisiana
Longleaf Alliance
Louisiana Academy of Sciences
Louisiana Alligator Farmers & Ranchers Association
Louisiana Aquaculture Association
Louisiana Association of Professional Biologists
Louisiana Bayoukeeper
Louisiana Cattleman's Association
Louisiana Crawfish Farmers Association
Louisiana Environmental Action Network

Louisiana Forestry Association
Louisiana Landowners Association
Louisiana Master Naturalist
Louisiana Native Plant Society
Louisiana Ornithological Society
Louisiana Outdoor Writers Association
Louisiana Purchase Cypress Legacy
Louisiana Shrimp Association
Louisiana Society of American Foresters
Louisiana Urban Forestry Council
Louisiana Water Resources Research Institute
Louisiana Wildlife Federation
Lower Mississippi Riverkeeper
Lower Mississippi Valley Joint Venture
Mississippi River Basin Alliance
Molpus Timberlands Mgt
National Audubon Society
National Fish and Wildlife Foundation
National Wild Turkey Federation (Louisiana Chapter)
NBCI
Northlake Nature Center
Orleans Audubon Society
Ouachita River Foundation
Ouachita Riverkeeper
Plum Creek
Resource Management Service (RMS)
Roy O. Martin
Shortleaf Initiative
Sierra Club, Delta Chapter
Society for Ecological Restoration Southeast
Southeast Partners in Flight
Southeastern Partners for Amphibian and Reptile Conservation
Templin Forestry, Inc
The Conservation Fund (Louisiana)
The Nature Conservancy (Louisiana Chapter)
Tunica-Biloxi Indian Tribe of Louisiana
Turtle Survival Alliance
United Commercial Fishermen's Association
Water Institute of the Gulf
Weyerhaeuser

Woodlands Trail Conservancy
Xerces Society

2005 WAP

- 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

APPENDIX D. Explanation of Rankings

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 D. Explanation of Rankings cont.

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)

<u>STATE ELEMENT RANKS:</u>

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. 1st and 2nd LEVEL THREATS

Residential & commercial development
Housing & urban areas
Commercial & industrial areas
Tourism & recreation areas
Agriculture & aquaculture
Annual & perennial non-timber crops
Conversion/modification of habitat for crop production
Routine agricultural operations
Crop protection (against pests, pathogens)
Other
Wood & pulp plantations
Conversion/modification of habitat for plantations
Routine plantation operations
Crop protection (against pests, pathogens)
Other
Livestock farming & ranching
Animal feed lots
Livestock ranching
Dairy farming
Poultry farming
Other livestock farming
Other
Marine & freshwater aquaculture
Energy production & mining
Oil & gas drilling
Mining & quarrying
Renewable energy
Transportation & service corridors
Roads & railroads
Utility & service lines
Shipping lanes
Flight paths
Biological resource use
Hunting & collecting terrestrial animals
Gathering terrestrial plants
Logging & wood harvesting
Fishing & harvesting aquatic resources
Human intrusions & disturbance
Recreational activities
War, civil unrest & military exercises
Work & other activities
Natural system modifications
Fire & fire suppression
Dams & water management/use

Agriculture
Dam/levee/dike construction
Dam/levee/dike operations
Irrigation
Wetland drainage
Groundwater modification
Stream channelization
Other
Hydropower
Flood control
Drinking water
Recreation
Other
Other ecosystem modifications
Invasive & other problematic species & genes
Invasive non-native/alien species
Problematic native species
Introduced genetic material
Pollution
Household sewage & urban waste water
Industrial & military effluents
Agricultural & forestry effluents
Fertilizers, herbicides, or other agrochemicals
Sediments
Salts, metals, and other inorganic substances
Nutrients from animal concentration areas
Other
Garbage & solid waste
Air-borne pollutants
Industrial/urban sources
Agricultural sources
Other human-related sources
Excess energy
Geological events
Volcanoes
Earthquakes/tsunamis
Avalanches/landslides
Climate change & severe weather
Habitat shifting & alteration
Droughts
Temperature extremes
Storms & flooding

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APPENDIX G. 2015 SGCN LIST

Mollusks			
Common Name	**Scientific Name**	**G-Rank**	**S-Rank**
Mucket	*Actinonaias ligamentina*	G5	SH
Rayed Creekshell	*Anodontoides radiatus*	G3	S2
Western Fanshell	*Cyprogenia aberti*	G2G3Q	SH
Butterfly	*Ellipsaria lineolata*	G4G5	S1
Elephant-Ear	*Elliptio crassidens*	G5	S3
Spike	*Elliptio dilatata*	G5	S2S3
Ebonyshell	*Fusconaia ebena*	G4G5	S3
Pink Mucket	*Lampsilis abrupta*	G2	S1
Southern Pocketbook	*Lampsilis ornata*	G5	S3
Sandbank Pocketbook	*Lampsilis satura*	G2	S2
Plain Pocketbook	*Lampsilis cardium*	G5	S1
Fatmucket	*Lampsilis siliquoidea*	G5	S2
White Heelsplitter	*Lasmigona complanata*	G5	S1
Black Sandshell	*Ligumia recta*	G4G5	S1
Louisiana Pearlshell	*Margaritifera hembeli*	G1	S1
Southern Hickorynut	*Obovaria jacksoniana*	G2	S1S2
Hickorynut	*Obovaria olivaria*	G4	S1
Alabama Hickorynut	*Obovaria unicolor*	G3	S1
Mississippi Pigtoe	*Pleurobema beadleianum*	G3	S2
Pyramid Pigtoe	*Pleurobema rubrum*	G2G3	S2
Louisiana Pigtoe	*Pleurobema riddellii*	G1G2	S1S2
Texas Heelsplitter	*Potamilus amphichaenus*	G1G2	SH
Fat Pocketbook	*Potamilus capax*	G2	S1
Inflated Heelsplitter	*Potamilus inflatus*	G1G2Q	S1
Ouachita Kidneyshell	*Ptychobranchus occidentalis*	G3G4	S1
Rabbitsfoot	*Quadrula cylindrica*	G3G4	S1
Monkeyface	*Quadrula metanevra*	G4	S1
Southern Creekmussel	*Strophitus subvexus*	G3	S1
Creeper	*Strophitus undulatus*	G5	S2
Southern Rainbow	*Villosa vibex*	G5Q	S2
Texas Pigtoe	*Fusconaia askewi*	G2G3	S3
Round Pearlshell	*Glebula rotundata*	G4G5	S4
Fawnsfoot	*Truncilla donaciformis*	G5	S3
Silty Hornsnail	*Pleurocera canaliculata*	G5	S2
Flamed Tigersnail	*Anguispira alternata*	G5	S1
Bay Scallop	*Argopecten irradians*	G5	S1

Sawtooth Pen Shell	*Atrina serrata*	G5	S1
Half-Naked Pen Shell	*Atrina seminuda*	GNR	S1
Channeled Whelk	*Busycotypus canaliculatus*	GNR	S1
Lightning Whelk	*Busycon contrarium*	GNR	S1
Crustaceans			
Common Name	**Scientific Name**	**G-Rank**	**S-Rank**
Teche Painted Crawfish	*Orconectes hathawayi*	G3	S3
Calcasieu Painted Crawfish	*Orconectes blacki*	G2	S1
Pontchartrain Painted Crawfish	*Orconectes hobbsi*	G4Q	S3
Kisatchie Painted Crawfish	*Orconectes maletae*	G2	S2
Sabine Fencing Crawfish	*Faxonella beyeri*	G4	S2
Ouachita Fencing Crawfish	*Faxonella creaseri*	G2	S2
Caddo Chimney Crawfish	*Procambarus machardyi*	G1G2	S1
Plain Brown (Gulf) Crawfish	*Procambarus shermani*	G4	S2
Ribbon Crawfish	*Procambarus bivittatus*	G5	S2
Twin Crawfish	*Procambarus geminus*	G3G4	S2
Javelin Crawfish	*Procambarus jaculus*	G4	S1
Flatnose Crawfish	*Procamabarus planirostris*	G4	S3
Vernal Crawfish	*Procambarus viaeviridis*	G5	S1
Southwestern Creek Crawfish	*Procambarus dupratzi*	G5 (should be G2/G3)	S2
Elegant Crawfish	*Procambarus elegans*	G4	S2
Pearl Blackwater Crawfish	*Procambarus penni*	G3	S3
Calcasieu Creek Crawfish	*Procambarus pentastylus*	G3	S3
Flatwoods Digger	*Fallicambarus oryktes*	G4	S2
Pine Hills Digger	*Fallicambarus dissitus*	G4	S2
Old Prairie Digger	*Fallicambarus macneesei*	G3	S2
Beach Ghost Shrimp	*Callichirus islagrande*	GNR	SU
Carolinian Ghost Shrimp	*Callichirus major*	GNR	SU
Peppermint Shrimp	*Lysmata wurdemanni*	GNR	SU
Estuarine Ghost Shrimp	*Lepidophthalmus louisianensis*	GNR	SU
Inverts			
Common Name	**Scientific Name**	**G-Rank**	**S-Rank**
Texas Brown Tarantula	*Aphonopelma hentzi*	GNR	S3
Southern Unstriped Scorpion	*Vaejovis carolinianus*	G5	S1
Yellow Brachycercus Mayfly	*Brachycercus flavus*	G4Q	S2
Carolina Spreadwing	*Lestes vidua*	G5	SH
Hodges Clubtail	*Gomphus hodgesi*	G3	S1
Southern Snaketail	*Ophiogomphus australis*	G1G2	S1
Pitcher Plant Spiketail	*Cordulegaster sarracenia*	G1	S1
Texas Emerald	*Somatochlora margarita*	G2	S2

Texas Forestfly	*Amphinemura texana*	G3	S3
Masked Springfly	*Helopicus bogaloosa*	G3	S2
Louisiana Needlefly	*Leuctra szczytkoi*	G2	S1
Eastern Beach Tiger Beetle	*Cicindela dorsalis venusta*	G4T3T4	S2
White Sand Tiger Beetle	*Cicindela wapleri*	G3G4	S2S3
Sandbar Tiger Beetle	*Cicindela blanda*	G3G4	S3
Cajun Tiger Beetle	*Cicindela pilatei*	G4	S3
Saline Prairie Scarab Beetle	*Ataenius robustus*	GNR	S1
Little Dubiraphian Riffle Beetle	*Dubiraphia parva*	G1G3	S1
Six-banded Longhorn Beetle	*Dryobius sexnotatus*	GNR	S1
Florida Harvester Ant	*Pogonomyrmex badius*	G5	S1
Comanche Harvester Ant	*Pogonomyrmex comanche*	G2	S2
American Bumblebee	*Bombus pensylvanicus*	G3G4	S3S4
Schoolhouse Springs Net-spinning Caddisfly	*Diplectrona rossi*	G1	S1
Morse's Net-spinning Caddisfly	*Cheumatopsyche morsei*	G1G3	S1
Holzenthal's Philopotamid Caddisfly	*Chimarra holzenthali*	G1G2	S1
Ceraclean Caddisfly	*Ceraclea spongillovorax*	G3G4	S2
Spring-loving Psiloneuran Caddisfly	*Agarodes libalis*	G3	S1
Molson's Microcaddisfly	*Hydroptila molsonae*	G2G3	S1
Schoolhouse Springs Purse Casemaker Caddisfly	*Hydroptila ouachita*	G1G2	S1
Hydroptilad Caddisfly	*Hydroptila poirrieri*	G2	S2
Frosted Elfin	*Callophrys irus*	G3	S2S3
Little Metalmark	*Calephelis virginiensis*	G4	S4
Creole Pearly Eye	*Enodia creola*	G3G4	S3
Georgia Satyr	*Neonympha areolata*	G3G4	S3
Mottled Duskywing	*Erynnis martialis*	G3	S3
Wild Indigo Duskywing	*Erynnis baptisiae*	G5	S2S3
Lace Winged Roadside Skipper	*Amblyscirtes aesculapius*	G3G4	S3
Dusky Roadside Skipper	*Amblyscirtes alternata*	G2G3	S2S3
Celia's Roadside Skipper	*Amblyscirtes celia*	G4	SU
Pepper and Salt Skipper	*Amblyscirtes hegon*	G5	SU
Arogos Skipper	*Atrytone arogos*	G3	S1
Dusted Skipper	*Atrytonopsis hianna*	G4G5	S3
Bay Skipper	*Euphyes bayensis*	G2	S1
Palatka Skipper	*Euphyes pilatka*	G3G4	S1
Dion Skipper	*Euphyes dion*	G4	SU
Cobweb Skipper	*Hesperia metea*	G4G5	SU
Obscure Skipper	*Panoquina panoquinoides*	G5	S1
Meske's Skipper	*Hesperia meskei*	G3G4	S1

Yucca Giant Skipper	*Megathymus yuccae*	G5	S1
Strecker's Giant Skipper	*Megathymus streckeri*	G5	S1
Falcate Orangetip	*Anthocharis midea*	G4G5	S4?
Monarch	*Danaus plexippus*	G5	S4
Western Pygmy Blue	*Brephidium exile*	G5	S1S2
Eastern Pygmy Blue	*Brephidium pseudofea*	G5	S1S2
Seminole Texan Crescent	*Phyciodes texana seminole*	G5	S3
King's Hairstreak	*Satyrium kingi*	G3G4	SU
Appalachian Brown	*Satyrodes appalachia*	G4	SU
Gulf Pine Sphinx	*Lapara phaeobrachycerous*	G3G4	S3
Louisiana Eyed Silkmoth	*Automeris louisiana*	G1G3	S1
A Noctuid Moth	*Bagisara brouana*	G3	S3
Brou's Underwing	*Catocala atocala*	G3G4	S1S2
Inland Fishes			
Common Name	**Scientific Name**	**G-Rank**	**S-Rank**
Gulf Sturgeon	*Acipenser oxyrinchus desotoi*	G3T2	S1
Pallid Sturgeon	*Scaphirhynchus albus*	G2	S1
Shovelnose Sturgeon	*Scaphirhynchus platorynchus*	G4	S4
Paddlefish	*Polyodon spathula*	G4	S4
American Eel	*Anguilla rostrata*	G4	S4
Alabama Shad	*Alosa alabamae*	G2G3	S1
Central Stoneroller	*Campostoma anomalum*	G5	S2
Bluntface Shiner	*Cyprinella camura*	G5	S2
Steelcolor Shiner	*Cyprinella whipplei*	G5	S2
Clear Chub	*Hybopsis winchelli*	G5	S3
Sturgeon Chub	*Macrhybopsis gelida*	G3	SU
Shoal Chub	*Macrhybopsis hyostoma*	G5	S3
Sicklefin Chub	*Macrhybopsis meeki*	G3	SU
Longjaw Minnow	*Notropis amplamala*	G5	S3
Bigeye Shiner	*Notropis boops*	G5	S3
Ironcolor Shiner	*Notropis chalybaeus*	G4	S3
Chub Shiner	*Notropis potteri*	G4	S3
Suckermouth Minnow	*Phenacobius mirabilis*	G5	S1
Bluehead Shiner	*Pteronotropis hubbsi*	G3	S2
Flagfin Shiner	*Pteronotropis signipinnis*	G5	S2
Bluenose Shiner	*Pteronotropis welaka*	G3G4	S2
Blue Sucker	*Cycleptus elongatus*	G3G4	S3
Southeastern Blue Sucker	*Cycleptus meridionalis*	G3G4	S1
River Redhorse	*Moxostoma carinatum*	G4	S1
Frecklebelly Madtom	*Noturus munitus*	G3	S1

Broadstripe Topminnow	*Fundulus euryzonus*	G3	S2
Gulf Pipefish	*Syngnathus scovelli*	G5	S4
Western Sand Darter	*Ammocrypta clara*	G3	S2
Crystal Darter	*Crystallaria asprella*	G3	S2
Redspot Darter	*Etheostoma artesiae*	G5	S3
Rainbow Darter	*Etheostoma caeruleum*	G5	S2
Gumbo Darter	*Etheostoma thompsoni*	GNR	S2
Pearl Darter	*Percina aurora*	G1	SH
Channel Darter	*Percina copelandi*	G4	S2
Freckled Darter	*Percina lenticula*	G3	S1
Bigscale Logperch	*Percina macrolepida*	G5	S2
Gulf Logperch	*Percina suttkusi*	G5	S2
Stargazing Darter	*Percina uranidea*	G3	SU
Saddleback Darter	*Percina vigil*	G5	S3
Marine Fishes			
Common Name	**Scientific Name**	**G-Rank**	**S-Rank**
Lemon Shark	*Negaprion brevirostris*	GNR	S3
Smalltooth Sawfish	*Pristis pectinata*	G1G3	SH
Tarpon	*Megalops atlanticus*	G5	S3
Gold Brotula	*Gunterichthys lonigpenis*	GQ	SU
Diamond Killifish	*Adinia xenica*	G5	S4
Saltmarsh Topminnow	*Fundulus jenkinsi*	G3	S3
Bayou Killifish	*Fundulus pulvereus*	G5	S4
Dwarf Seahorse	*Hippocampus zosterae*	GNR	SNR
Opossum Pipefish	*Microphis brachyurus*	G4G5	SU
Chain Pipefish	*Syngnathus louisianae*	GNR	S4
Texas Pipefish	*Syngnathus texanus*	G1	SU
Goliath Grouper	*Epinephelus itajara*	G2	SH
Large-scaled Spinycheek Sleeper	*Eleotris amblyopsis*	G5	S4
Emerald Sleeper	*Erotelis smaragdus*	GNR	SU
Frillfin Goby	*Bathygobius soporator*	GNR	S4
Violet Goby	*Gobioides broussonnetii*	G5	S4
Broad Flounder	*Paralichthys squamilentus*	GNR	SU
Southern Puffer	*Sphoeroides nephelus*	G5	S5
Reptiles and Amphibians			
Common Name	**Scientific Name**	**G-Rank**	**S-Rank**
Eastern Tiger Salamander	*Ambystoma tigrinum tigrinum*	G5	S1
Four-toed Salamander	*Hemidactylium scutatum*	G5	S1
Southern Dusky Salamander	*Desmognathus auriculatus*	G5	S1
Southern Red-backed Salamander	*Plethodon serratus*	G5	S1

Webster's Salamander	*Plethodon websteri*	G3G4	S1
Louisiana Slimy Salamander	*Plethodon kisatchie*	G3G4	S1
Gulf Coast Mud Salamander	*Pseudotriton montanus flavissimus*	G5	S1
Southern Red Salamander	*Pseudotriton ruber vioscai*	G5	S2
Gulf Coast Waterdog	*Necturus beyeri*	G4	S3
Red River Mudpuppy	*Necturus maculosus louisianensis*	G5	S3
Ornate Chorus Frog	*Pseudacris ornata*	G5	SH
Strecker's Chorus Frog	*Pseudacris streckeri*	G5	S1
Eastern Spadefoot	*Scaphiopus holbrookii*	G5	S3
Hurter's Spadefoot	*Scaphiopus hurterii*	G5	SU
Dusky Gopher Frog	*Lithobates sevosus*	G1	SH
Southern Crawfish Frog	*Lithobates areolatus areolatus*	G4	S1
Loggerhead Seaturtle	*Caretta caretta*	G3	S1B, S3N
Green Seaturtle	*Chelonia mydas mydas*	G3T3	S1N
Atlantic Hawksbill Seaturtle	*Eretmochelys imbricata imbricata*	G3T3Q	SZ
Kemp's Ridley Seaturtle	*Lepidochelys kempii*	G1	S1B, S3N
Alligator Snapping Turtle	*Macrochelys temminckii*	G3G4	S3
Smooth Softshell	*Apalone mutica*	G5	S3
Leatherback Seaturtle	*Dermochelys coriacea*	G2	SZ
Ringed Map Turtle	*Graptemys oculifera*	G2	S2
Ouachita Map Turtle	*Graptemys ouachitensis ouachitensis*	G5	S3
Sabine Map Turtle	*Graptemys sabinensis*	G5T5	S3
Pearl Map Turtle	*Graptemys pearlensis*	G2G3	S3
Western Chicken Turtle	*Deirochelys reticularia miaria*	G5	S2
Mississippi Diamond-backed Terrapin	*Malaclemys terrapin pileata*	G4T3Q	S3
Ornate Box Turtle	*Terrapene ornata ornata*	G5T5	S1
Stripe-necked Musk Turtle	*Sternotherus minor peltifer*	G5	S1
Razor-backed Musk Turtle	*Sternotherus carinatus*	G5	S4
Gopher Tortoise	*Gopherus polyphemus*	G3	S1
Western Slender Glass Lizard	*Ophisaurus attenuatus attenuatus*	G5T5	S3
Eastern Glass Lizard	*Ophisaurus ventralis*	G5	S3
Southern Prairie Skink	*Plestiodon septentrionalis obtusirostris*	G5T5	S1
Coal Skink	*Plestiodon anthracinus*	G5	S3
Texas Horned Lizard	*Phrynosoma cornutum*	G4G5	SX
Western Worm Snake	*Carphophis vermis*	G5	S1
Common Rainbow Snake	*Farancia erytrogramma erytrogramma*	G4	S2
Eastern Hog-Nosed Snake	*Heterodon platirhinos*	G5	S3
Mole Kingsnake	*Lampropeltis calligaster rhombomaculata*	G5T5	S1S2

Gulf Saltmarsh Snake	*Nerodia clarkii clarkii*	G4	S3S4
Black Pine Snake	*Pituophis melanoleucus lodingi*	G4T2T3	S1
Louisiana Pine Snake	*Pituophis ruthveni*	G2	S2
Pine Woods Littersnake	*Rhadinaea flavilata*	G4	S1
Southeastern Crowned Snake	*Tantilla coronata*	G5	S1
Harlequin Coralsnake	*Micrurus fulvius*	G5	S2
Eastern Diamond-backed Rattlesnake	*Crotalus adamanteus*	G4	S1
Timber Rattlesnake	*Crotalus horridus*	G4	S3S4
Birds			
Common Name	**Scientific Name**	**G-Rank**	**S-Rank**
Mottled Duck	*Anas fulvigula*	G4	S4
Northern Pintail	*Anas acuta*	G5	S5N
Canvasback	*Aythya valisineria*	G5	S4N
Redhead	*Aythya americana*	G5	S4N
Lesser Scaup	*Aythya affinis*	G5	S5N
Northern Bobwhite	*Colinus virginianus*	G5	S3
Wood Stork	*Mycteria americana*	G4	S3N
Brown Pelican	*Pelecanus occidentalis*	G4	S3
American Bittern	*Botaurus lentiginosus*	G4	S4N
Least Bittern	*Ixobrychus exilis*	G5	S5B
Little Blue Heron	*Egretta caerulea*	G5	S3N, S4B
Reddish Egret	*Egretta rufescens*	G4	S1
Glossy Ibis	*Plegadis falcinellus*	G5	S2
Roseate Spoonbill	*Platalea ajaja*	G5	S3
Osprey	*Pandion haliaetus*	G5	S3
Swallow-tailed Kite	*Elanoides forficatus*	G5	S1S2B
White-tailed Kite	*Elanus leucurus*	G5	S1B, S1S2N
Bald Eagle	*Haliaeetus leucocephalus*	G5	S3
Yellow Rail	*Coturnicops noveboracensis*	G4	S3S4N
Black Rail	*Laterallus jamaicensis*	G4	S2N, S1B
Clapper Rail	*Rallus crepitans*	G5	S5
King Rail	*Rallus elegans*	G4	S3B, S4N
Sandhill Crane	*Grus canadensis*	G5	S2N
Whooping Crane	*Grus americana*	G1	SH
Snowy Plover	*Charadrius nivosus*	G3	S1B,S2N
Wilson's Plover	*Charadrius wilsonia*	G5	S2B, S1N
Piping Plover	*Charadrius melodus*	G3	S2N
American Oystercatcher	*Haematopus palliatus*	G5	S1
Upland Sandpiper	*Bartramia longicauda*	G5	S4N
Long-billed Curlew	*Numenius americanus*	G5	S5N

Hudsonian Godwit	*Limosa haemastica*	G4	S3N
Marbled Godwit	*Limosa fedoa*	G5	S4N
Red Knot	*Calidris canutus*	G4	S2N
Dunlin	*Calidris alpina*	G5	S5N
Buff-breasted Sandpiper	*Calidris subruficollis*	G4	S3N
Short-billed Dowitcher	*Limnodromus griseus*	G5	S5N
American Woodcock	*Scolopax minor*	G5	S1B, S5N
Sooty Tern	*Onychoprion fuscatus*	G5	S1B
Interior Least Tern	*Sternula antillarum athalassos*	G4T2Q	S1B
Coastal Least Tern	*Sternula antillarum*	G4	S4B
Gull-billed Tern	*Gelochelidon nilotica*	G5	S2
Caspian Tern	*Hydroprogne caspia*	G5	S1S2B,S3N
Common Tern	*Sterna hirundo*	G5	S1B,S3N
Forster's Tern	*Sterna forsteri*	G5	S5
Royal Tern	*Thalasseus maximus*	G5	S5
Sandwich Tern	*Thalasseus sandvicensis*	G5	S4B
Black Skimmer	*Rynchops niger*	G5	S3
Common Ground-Dove	*Columbina passerina*	G5	S1B,S2N
Greater Roadrunner	*Geococcyx californianus*	G5	S3
Short-eared Owl	*Asio flammeus*	G5	S3N
Chuck-Will's-Widow	*Antrostomus carolinensis*	G5	S4B
Chimney Swift	*Chaetura pelagica*	G5	S5B
Red-headed Woodpecker	*Melanerpes erythrocephalus*	G5	S4
Red-cockaded Woodpecker	*Picoides borealis*	G3	S2
Crested Caracara	*Caracara cheriway*	G5	S1
Southeastern American Kestrel	*Falco sparverius paulus*	G5T4	S2
Peregrine Falcon	*Falco peregrinus*	G4	S3N
Loggerhead Shrike	*Lanius ludovicianus*	G4	S4
Bell's Vireo	*Vireo bellii*	G5	S1B
Yellow-throated Vireo	*Vireo flavifrons*	G5	S4B
Warbling Vireo	*Vireo gilvus*	G5	S1B
White-breasted Nuthatch	*Sitta carolinensis*	G5	S3
Brown-headed Nuthatch	*Sitta pusilla*	G5	S5
Sedge Wren	*Cistothorus platensis*	G5	S4N
Marsh Wren	*Cistothorus palustris*	G5	S4
Wood Thrush	*Hylocichla mustelina*	G5	S4B
Sprague's Pipit	*Anthus spragueii*	G4	S2N
Smith's Longspur	*Calcarius pictus*	G5	S1N
Worm-eating Warbler	*Helmitheros vermivorum*	G5	S3B
Louisiana Waterthrush	*Parkesia motacilla*	G5	S3B

Golden-winged Warbler	*Vermivora chrysoptera*	G4	S2N
Prothonotary Warbler	*Protonotaria citrea*	G5	S5B
Swainson's Warbler	*Limnothlypis swainsonii*	G4	S4B
Kentucky Warbler	*Geothlypis formosa*	G5	S4B
Hooded Warbler	*Setophaga citrina*	G5	S5B
Cerulean Warbler	*Setophaga cerulea*	G4	S2N
Prairie Warbler	*Setophaga discolor*	G5	S4B
Yellow-throated Warbler	*Setophaga dominica*	G5	S4B
Bachman's Sparrow	*Peucaea aestivalis*	G3	S3
Field Sparrow	*Spizella pusilla*	G5	S4BS5N
Lark Sparrow	*Chondestes grammacus*	G5	S3
Grasshopper Sparrow	*Ammodramus savannarum*	G5	S1B,S3N
Henslow's Sparrow	*Ammodramus henslowii*	G4	S3N
Le Conte's Sparrow	*Ammodramus leconteii*	G4	S4N
Nelson's Sparrow	*Ammodramus nelsoni*	G5	S5N
Seaside Sparrow	*Ammodramus maritimus*	G4	S4
Painted Bunting	*Passerina ciris*	G5	S5B
Dickcissel	*Spiza americana*	G5	S4B
Rusty Blackbird	*Euphagus carolinus*	G4	S3N
Mammals			
Common Name	**Scientific Name**	**G-Rank**	**S-Rank**
West Indian Manatee	*Trichechus manatus*	G2	S1N
Bachman’s Fox Squirrel	*Sciurus niger bachmanii*	G5 (subspecies not listed)	S5T3
Eastern Chipmunk	*Tamias striatus*	G5	S3
Northern Pygmy Mouse	*Baiomys taylori*	G4G5	SU
Hispid Pocket Mouse	*Chaetodipus hispidus*	G5	S2
Oak Ridge Pocket Gopher	*Geomys breviceps breviceps*	G5	S4T1
Baird's Pocket Gopher	*Geomys breviceps sagittatus*	G5	S4
Prairie Vole	*Microtus ochrogaster ludovicianus*	G5TX	SH
Golden Mouse	*Ochrotomys nuttalli*	G5	S4
Eastern Harvest Mouse	*Reithrodontomys humulis*	G5	S3
Southeastern Shrew	*Sorex longirostris*	G5	S2
Big Brown Bat	*Eptesicus fuscus*	G5	S2
Eastern Pipistrelle	*Perimyotis subflavus*	G5	S4
Rafinesque’s Big Eared Bat	*Corynorhinus rafinesquii*	G3G4	S4
Silver-haired Bat	*Lasionycteris noctivagans*	G5	SZ
Southeastern Myotis	*Myotis austroriparius*	G3G4	S4
Northern Long-eared Bat	*Myotis septentrionalis*	G1G3	S1
Louisiana Black Bear	*Ursus americanus luteolus*	G5T2	S3
Long-tailed Weasel	*Mustela frenata*	G5	S3

Eastern Spotted Skunk	*Spilogale putorius*	G5	S1
Ringtail	*Bassariscus astutus*	G5	S1
Bottlenose Dolphin	*Tursiops truncatus*	G5	S5
Sperm Whale	*Physeter macrocephalus*	G3G4	SZ

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APPENDIX I. CCVI SCORES FOR REPRESENTATIVE SGCN

Common Name	Score
Louisiana Slimy Salamander	EV
Louisiana Eyed Silkmoth	EV
Calc. Painted Crawfish	HV
Clapper Rail	HV
Crawfish Frog	HV
Seaside Sparrow	HV
Saltmarsh Topminnow	HV
Arogos Skipper	HV
Caddo Chimney Crawfish	HV
Louisiana Pearlshell	HV
Bluenose Shiner	HV
Palatka Skipper	HV
Diamond-backed Terrapin	HV
Mud Salamander	HV
Black Skimmer	MV
Brown Pelican	MV
Inflated Heelsplitter	MV
Louisiana Pine Snake	MV
Royal Tern	MV
Wilson's Plover	MV
King Rail	MV
Frecklebelly Madtom	MV
Pitcher Plant Spiketail	MV
Flatwoods Digger	MV
Creole Pearly-Eye	MV
Vernal Crawfish	MV
Crystal Darter	MV
Gulf Logperch	MV
Bluehead Shiner	MV
River Redhorse	MV
Suckermouth Minnow	MV
Baird's Pocket Gopher	MV
Louisiana Needlefly	MV
Molson's Microcaddisfly	MV
Rabbitsfoot	MV
Southern Hickorynut	MV
Northern Bobwhite	NV/IL

Dickcissel	NV/IL
Buff-breasted Sandpiper	NV/IL
Red-headed Woodpecker	NV/IL
American Bumble Bee	NV/IL
Chimney Swift	NV/PS
Chuck-Will's-Widow	NV/PS
Glossy Ibis	NV/PS
Gopher Tortoise	NV/PS
Golden-Winged Warbler	NV/PS
Smooth Softshell	NV/PS
Swainson's Warbler	NV/PS
Alligator Snapping Turtle	NV/PS
Rafinesque's Big-eared Bat	NV/PS
Gulf Sturgeon	NV/PS
Louisiana Black Bear	NV/PS
Redhead	NV/PS
Dunlin	NV/PS
Short-eared Owl	NV/PS
Henslow's Sparrow	NV/PS
Rusty Blackbird	NV/PS
Nutmeg Underwing	NV/PS
Western Sand Darter	NV/PS
Cajun Tiger Beetle	NV/PS
Louisiana Waterthrush	NV/PS
Southern Pocketbook	NV/PS
West Indian Manatee	NV/PS
Eastern Chipmunk	NV/PS
Dusted Skipper	NV/PS
Red River Mudpuppy	NV/PS
Eastern Hog-nosed Snake	NV/PS
Southeastern Crowned Snake	NV/PS
Squawfoot	NV/PS
Hickorynut	NV/PS

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APPENDIX J – WILDLIFE TRACS CONSERVATION ACTIONS AND OUTPUTS

Project Level	Action Level 1	Action Level 2	Action Level 3	Level 2 and Level 3 Output Measures	Description/Examples/Notes
Project Catagories	**Category**	**Strategy**	**Activity**	**Units**	
Administration and/or Conservation / Management and/or Recreation	Coordination and Administration	Coordination and Administration		Number	Coordination and administration necessary for effective agency operations and program/project management
			Program/project administrative support	Number	Administration necessary for effective program/project management (e.g., staff support and training, monitoring progress of grant proposal and reporting processes)
		Incentives	Incentives	Number	Development and delivery of economic incentives to private landowners to influence responsible stewardship of land/water and specific species
	Direct Management of Natural Resources	Create new habitat or natural processes		Acres	Creation of new habitat or natural processes for the benefit of fish and wildlife and recreational users
			Habitat conversion	Acres	Conversion of one type of habitat into another (e.g., creating bottomland forest from agricultural land, wetland creation) Note: Forest and wetland would be the appropriate broad habitat types to code for these two examples
			impoundment creation	Acres	Creation of shallow water impoundments for the primary benefit of waterfowl

		Dam and barrier removal		Structures	Removal of barriers to maintain aquatic species populations and restore ecological functions in streams (e.g., dam or dike removal, notching of dams)
			Culvert work	Structures	Replacement or repair of road culverts (e.g., installing larger culvert, eliminating perching)
			Dam notching	Structures	Removal of portions of dams for increased flow
			Dam removal	Structures	Removal of entire dams
			Road crossing removal	Structures	Removal of other obstructions (e.g., beaver dams)
		Fire Management		Acres	Use of fire to benefit fish and wildlife and their habitats
			Fuel reduction	Acres	Application of treatments to reduce the risk of high-severity wildfires and to manage changes in the ecological functions of forests (e.g., mechanical thinning)
			Prescribed burning	Acres	Application of fire in a knowledgeable manner to forest fuels on a specific land under selected weather conditions to accomplish predetermined, well-defined management objectives (e.g., burning an established native grass community to reduce or eliminate invading brush or exotic species)
		Fish and wildlife habitat structures		Structures	Installation of structures to benefit fish and wildlife and their habitats
			Artificial reef development	Structures	Development of artificial reeds in freshwater or marine environments for aquatic species spawning, foraging and refugia
			Hibernacula	Structures	Creation or improvement of overwintering sites
			Nesting habitat improvements	Structures	Installation of nesting structures (e.g., wood duck boxes, osprey platforms)

			Wildlife escape structures	Structures	Installation of structures that allow wildlife to escape from man-made devices placed in the environment (e.g., ramps that allow sage grouse to escape from livestock watering troughs)
		Grazing/farm management		Acres	Improvements to agricultural practices to benefit fish and wildlife and their habitats
			Alley cropping/silvopasture	Acres	Methods of planting in which perennial, preferably leguminous trees or shrubs, are grown simultaneously with an arable crop
			Farming residue management	Acres	Use of vegetative crop material left on a field after harvesting, pruning or processing to benefit wildlife and soil quality
			Forage use management	Acres	Management of timing and duration of grazing to maintain adequate cover for range health and nesting success (e.g., establishment of rotational grazing system to improve grassland nesting bird habitat)
			Livestock heavy use area establishment	Acres	Provision of stable, non-eroding surfaces for areas intensively used by livestock to protect and improve water quality
			Livestock stream crossing	Acres	Installation of structures that allow livestock to cross a stream in a safe and environmentally sound manner (e.g., fords, culverts, bridges)
			Nutrient or runoff management system	Acres	Application of techniques to minimize nutrient runoff from agricultural operations
			Riparian fence installation	Acres	Installation of fences along riparian areas to keep out livestock
			Waste storage/treatment	Acres	Management of on-farm generated wastes in an environmentally responsible manner (e.g., liquid retention and storage ponds, anerobic waste treatment lagoons)
		Hazard or infrastructure removal		Acres	Removal of hazards or infrastructure to benefit fish and wildlife and their habitats

			Degraded land reconstruction	Acres	Reconstruction of degraded land to benefit wildlife (e.g., abandoned mine area recovery, deleveling)
			Derelict gear (net/pot) removal	Acres	Removal of derelict fishing gear from waters to prevent continued capture of aquatic species (e.g., fishing nets, fish/crab pots)
			Shoreline armoring removal	Acres	Removal of shoreline armoring to improve aquatic habitats (e.g., jetties, riprap)
			Solid waste removal	Acres	Removal of solid waste to improve habitat for wildlife (e.g., derelict vehicles, rubbish)
		Instream modification		Miles	Stream improvements to benefit fish and wildlife and their habitats
			Channel reconfiguration	Miles	Restoration of natural stream channels (e.g., returning meanders and sustainable profiles to straightened streams, sandbar improvement)
			Channel structure placement	Miles	Placement of structures within streams to restore natural characteristics (e.g., cross vanes, boulders)
			Nutrient improvement	Miles	Application of nutrients to improve water quality of fish and wildlife (e.g., liming of streams, carcass placement)
			Spawning by-pass channels	Miles	Construction of side channel fish spawning and rearing habitat
			Spawning gravel placement	Miles	Addition of gravel to streams to improve spawning areas
			Streambank stabilization	Miles	Stabilization of streambanks (e.g., bank armoring, bank bioengineering
		Invasive species control		Acres	Control of invasive
			Animal - chemical	Acres	Control of invasive animal species by chemical means (e.g., piscicide treatment of sea lamprey in inland waters)
			Animal - mechanical	Acres	Control of invasive animal species by mechanical means (e.g., constructing a barrier in a stream to prevent entry of invasive fish species)

			Plant - biological	Acres	Control of invasive plant species by biological means (e.g., using beetles to control purple loosestrife)
			Plant - chemical	Acres	Control of invasive plant species by chemical means (e.g., herbicide treatment of invasive plant species)
			Plant - mechanical	Acres	Control of invasive plant species by mechanical means (e.g., hand pulling of invasive plant species)
		Living shorelines		Acres	Physical manipulation in shoreline areas to maintain fish and wildlife habitats and/or restore ecological functions
			Beach renourishment	Acres	Placement of sand onto beaches and employing other techniques for their renourishment
			Erosion control structures	Acres	Installation of hard structures (e.g., seawall bulkhead) or living structures (e.g., greenwall systems) to control erosion
			Sand Dune restoration	Acres	Application of techniques to restore sand dunes (e.g., fencing off sea-grass areas)
		Planting/seeding		Acres	Planting or seeding to maintain fish and wildlife habitats and/or restore ecological functions
			Field border/hedgerow	Acres	Maintenance or establishment of edge between two vegetation types
			Herbaceous vegetation	Acres	Planting/seeding of grasslands
			Plant propagation/nursery	Acres	Use of nurseries to raise plants for habitat improvement
			Submerged aquatic vegetation	Acres	Restoration of vegetation that lives at or below the water surface
			Trees/shrubs	Acres	Planting trees or shrubs
			Vegetation buffer	Acres	Maintenance or establishment of strips of land with permanent vegetation to intercept stormwater runoff and minimize soil erosion
			Woody debris	Acres	Placement of limbs, bush, trees and stumps to improve habitat

		Vegetation management		Acres	Physical manipulation of vegetation to maintain fish and wildlife habitats and/or restore ecological functions
			Chaining	Acres	Dragging heavy chains to remove unwanted vegetation
			Clearing and snagging	Acres	Use of varied techniques to clear vegetation (e.g., brush shearing to set back early successional plant communities)
			Dixie harrow/Lawson aerator	Acres	Removal of vegetation and treating soil by pulling devices behind a tractor (e.g., removing sagebrush for improved herbaceous cover for sage grouse)
			Forest stand improvement	Acres	Removal of trees to improve forest habitat for wildlife (e.g., forest management that promotes a particular serial stage)
			Mowing	Acres	Cutting down grass or grain to maintain habitat for wildlife
			Plowing/Discing	Acres	Plowing or other mechanical means of disturbing existing vegetation and exposing soil
		Water management		Number	Management of water to benefit fish and wildlife and their habitats
			Ditch plugs	Number	Installation of earthen plugs into drainage ditches to restore wetlands
			Diversion/headgate	Number	Installation or maintenance of structures to divert water
			Drainage	Number	Removal of tile drains or drainage ditches to restore wetland hydrology
			Spring development	Number	Application of techniques to improve the flow, quantity and yield of water from a natural spring
			Tide gate	Number	Installation or maintenance of structures to increase the hydroperiod and water depth of a wetland
			Impoundment maintenance	Number	Maintenance of impoundments for waterfowl habitat (e.g., renovation of impoundment dikes)

			Water control structure	Number	Installation or maintenance of structures to simulate natural hydrological processes
		Wildlife damage management		Intervention s	Assessment and management of damage from nuisance native fish and wildlife. Includes control of predators by biological, chemical or mechanical means to maintain populations of species at risk and restore ecological functions (e.g., gull or cormorant control, nest exclusion devices, cave gating) Note: Limited eligibility for funding through WSFR grant programs
		Wildlife disease management		Intervention s	Assessment and management of wildlife disease situations. Includes control or treatment of diseased animals to maintain populations of species at risk and restore ecological functions (e.g., chronic wasting disease, brucellosis, tuberculosis, plague management activities)
	Data Collection and Analysis	Database development and management		Databases	Information technology development and maintenance to support project objectives (e.g., statewide database development) Note: This is different from other Data Collection and Analysis activities in that it refers to the hardware, software, and supporting infrastructure that support multiple data collection efforts
			Database development	Databases	Information technology development to support project objectives (e.g., statewide database development) Note: This is different from other Data Collection and Analysis activities in that it refers to the hardware, software, and supporting infrastructure that support multiple data collection efforts

			Information systems operations and maintenance	Databases	Information technology maintenance to support project objectives (e.g., GIS analyses) Note: This is different from other Data Collection and Analysis activities in that it refers to the hardware, software, and supporting infrastructure that support multiple data collection efforts
		Research, survey or monitoring - fish and wildlife populations		Projects	Collection and analysis of data as part of research, survey or monitoring primarily focused on fish and wildlife populations Note: includes compilation, management, synthesis, analysis and reporting of spatial and non-spatial data Note: Code work on fish and wildlife diseases to Wildlife Disease Management within Direct Management of Natural Resources
			Abundance determination	Projects	Determination of relative abundance or estimation of size of fish and wildlife populations (e.g., adult population estimate, juvenile relative abundance)
			Age, size and sex structure	Projects	Determination of age, size or sex structure of fish and wildlife populations (e.g., age and growth, length frequency, sex ratio)
			Baseline inventory	Projects	Baseline survey and inventory to understand distribution of fish and wildlife population
			Food habits	Projects	Studies on food habits of fish and wildlife species or their utilization as prey
			Genetics	Projects	Genetics studies of fish and wildlife populations (e.g., population connectivity, hybridization)
			Movement	Projects	Studies of fish and wildlife movements (e.g., tagging, telemetry)

			Population assessment	Projects	Assessments of biological information to determine status of fish and wildlife populations (e.g., population viability analysis, fisheries stock assessment)
			Reproduction	Projects	Studies of reproduction of fish and wildlife populations (e.g., fecundity, nesting success)
		Research, survey or monitoring - habitat		Projects	Collection and analysis of data as part of research, survey or monitoring primarily focused on fish and wildlife habitats Note: includes compilation, management, synthesis, analysis and reporting of spatial and non-spatial data
			Baseline inventory	Projects	Baseline survey and inventory to understand distribution of fish and wildlife habitat quality and quantity (e.g., wetland mapping)
			Monitoring	Projects	On-going monitoring of fish and wildlife habitat quality and quantity (e.g., annual early successional habitat survey, artificial reef condition)
		Research, survey or monitoring - utilization		Projects	Collection and analysis of data as part of research, survey or monitoring primarily focused on utilization of fish or wildlife resources and demographics of users Note: includes compilation, management, synthesis, analysis and reporting of data
			Harvest	Projects	Collection and analysis of data as part of research, survey or monitoring primarily focused on utilization of fish or wildlife resources (e.g., lake creel surveys; deer statistics)

			Human dimensions	Projects	Collection and analysis of data as part of research, survey or monitoring primarily focused on human dimensions (e.g., demographic surveys; resource economics analyses)
		Techniques development		Studies	Research and development of techniques important for the conservation and management of fish and wildlife
			Artificial propagation studies	Studies	Research on artificial propagation of fish and wildlife (e.g., nutrition studies, culture methods)
			Habitat restoration methods	Studies	Development or improvement of methods to restore habitats and natural processes (e.g., evaluations of water level fluctuations)
			Fish and wildlife research, survey and management techniques	Studies	Development or improvement of research techniques or management tools (e.g., tag retention studies, sampling device improvements, testing of animal control devices)
	Education	Student Training		Students	Training of educators/instructors on aquatic resources, firearm safety, and archery-related activities
			Wildlife education	Students	Instruction of students on wildlife species and their habitats in an educational setting Note: This activity has a limited eligibility for reimbursement through WSFR grant programs
	Facilities and Areas (Major Renovation)	Boat pump out and dump stations	Pump out stations (*)	Number	Pump out stations
			Dump stations (*)	Number	Dump stations
			Floating restrooms (*)	Number	Floating restrooms

			Pump out boats (*)	Number	Pump out boats
		Fish passage facilities		Number	Major renovation of facilities designed to allow fish to move past instream barriers (e.g., fish ladders; counting stations) Note: Not related to removal of dams and other barriers coded elsewhere
			Counting traps/stations	Number	Counting traps/stations
			Downstream bypass facilities	Number	Facilities designed specifically for downstream movement of fish
			Fish ladders	Number	Fish ladders
			Fish lifts	Number	Fish lifts
			Nature-like fishways	Number	Fishways whose designs are based on simulating natural stream characteristics and are constructed of natural materials
		Fish screening and related facilities		Sites	Major renovation of screening systems that prevent fish from passing into areas that do not support their survival (e.g., into irrigation diversion channels) Note: Primarily funded by FRIMA grant program in Region 1
		Hatcheries (restoration)		Sites	Major renovation of facilities to propagate fish or wildlife species for restoration purposes
		Wildlife Management Areas	Dikes/levees	Number	Dikes/levees
			Observation Structures	Number	Wildlife blinds, towers, platforms, etc.
	Facilities and Areas (New Construction)	Boat pump out and dump stations		Number	Construction of new facilities for pumping sewage from boats Note: Typically funded through the Clean Vessel Act program
			Dump stations (*)	Number	Dump stations
			Floating restrooms (*)	Number	Floating restrooms
			Pump out boats (*)	Number	Pump out boats

			Pump out stations (*)	Number	Pump out stations
		Fish passage facilities		Number	Construction of new facilities designed to allow fish to move past instream barriers (e.g., fish ladders; counting stations) Note: Not related to removal of dams and other barriers coded elsewhere
			Counting traps/stations	Number	Counting traps/stations
			Downstream bypass facilities	Number	Facilities designed specifically for downstream movement of fish
			Fish ladders	Number	Fish ladders
			Fish lifts	Number	Fish lifts
			Nature-like fishways	Number	Fishways whose designs are based on simulating natural
		Fish screening and related facilities		Sites	Construction of new screening systems that prevent fish from passing into areas that do not support their survival (e.g., into irrigation diversion channels) Note: Primarily funded by FRIMA grant program into Region 1
		Hatcheries (restoration purposes)		Sites	Construction of new facilities to propagate fish or wildlife species for restoration purposes
		Wildlife Management Areas		Number	Major renovation of facilities at Wildlife Management Areas
			Dikes/levees	Number	Dikes/levees
			Observation Structures	Number	Wildlife blinds, towers, platforms, etc.
	Facilities and Areas (Operations and Maintenance)	Boat pump out and dump stations		Number	Routine operations and maintenance of facilities for pumping sewage from boats Note: Typically funded through the Clean Vessel Act Program
			Dump stations	Number	Dump stations
			Floating restrooms	Number	Floating restrooms

			Gallons of sewage pumped	Number	Gallons of sewage pumped. Note: Likely to be a required data element in the future when CVA regulations are revised
			Pump out boats	Number	Pump out boats
			Pump out stations	Number	Pump out stations
		Fish passage facilities		Number	Routine operations and maintenance of facilities designed to allow fish to move past instream barriers (e.g., fish ladders; counting stations) Note: Not related to removal of dams and other barriers coded elsewhere
			Counting traps/stations	Number	Counting traps/stations
			Downstream bypass facilities	Number	Facilities designed specifically for downstream movement of fish
			Fish ladders	Number	Fish ladders
			Fish lifts	Number	Fish lifts
			Nature-like fishways	Number	Fishways whose designs are based on simulating natural stream characteristics and are constructed of natural materials
		Fish screening and related facilities		Sites	Routine operations and maintenance of screening systems that prevent fish from passing into areas that do not support their survival (e.g., into irrigation diversion channels) Note: Primarily funded by FRIMA grant program in Region 1
		Hatcheries (restoration)		Sites	Routine operations and maintenance of facilities to propagate fish or wildlife species for restoration purposes
		Wildlife Management Areas		Number	Routine operations and maintenance of Wildlife Management Areas Note: Activities primarily for restoration and management of species and habitats

					should be coded to Create, Restore or Enhance Habitat and Natural Processes
			Dikes/levees	Number	Dikes/levees
			Observation Structures	Number	Wildlife blinds, towers, platforms, etc.
			Trails	Number	
	Land and Water Rights Acquisition and Protection (Potential High Level Purposes: Conservation/ Management, Recreation, Administration)	Land acquisition	Fee title	Acres	Acquisition of lands through fee title acquisition
			Non-fee title	Acres	Acquisition of lands through leases, permanent easement, cooperative agreements, contracts or other non-fee title arrangements
		Water rights acquisition	Fee title	Acres feet	Purchase of water rights through fee title acquisition (e.g., purchase of water rights to maintain adequate flows for endangered stream fishes)
			Non-fee title	Acres feet	Acquisition of water rights through leases, permanent easements, cooperative agreements, contracts or other non-fee title arrangements (e.g., purchase of water rights to maintain adequate flows for endangered stream fishes)
		Conservation area designation		Acres	Designation of a site or landscape as having unique and important value to fish and wildlife with or without legal protections (e.g., waterfowl breeding area, Marine Protected Area)

		Private lands agreements		Acres	Number of acres that are protected by agreement with private landowners, but which do not involve active habitat improvement Note: Used extensively within the Landowner Incentive Program
	Outreach	Partner/stakeholder engagement		Number	Engagement of partners to achieve shared objectives and broader coordination across overlapping areas
			Government agency	Number	Engagement of federal, state and local agencies and tribal entities to achieve shared objectives and broader coordination across overlapping areas (e.g., outreach with tribal governments for habitat restoration)
			Non-governmental organization	Number	Engagement of the NGO community to achieve shared objectives and broader coordination across overlapping areas (e.g., coordinate with an NGO on a fish and wildlife GIS analysis)
			Others	Number	Engagement of other partners to achieve shared objectives and broader coordination across overlapping areas (e.g., convene an advisory committee from academia to assist with management planning for a species)
		Recruitment and retention activities		Number	Participation in programs intended to recruit and retain anglers, boater, hunters or wildlife watchers
			For wildlife watching	Number	Participation in programs intended to recruit and retain wildlife watchers Note: this activity has limited eligibility for funding through WSFR grant programs

	Planning	Land use planning		Plans	Leading or participating in land use planning for rural, urban or agricultural lands (e.g., assist in developing county-wide zoning plans, participate in workgroup regarding low impact development siting)
		Organizational strategic and CMS planning		Plans	Development of agency strategic and operational plans and fish and wildlife comprehensive management systems Note: Does not include actions to implement plans
			Organizational strategic and CMS planning	Plans	Development of agency strategic and operational plans Note: Does not include actions to implement plans
		Species and habitat management planning		Plans	Development of management plans for fish and wildlife species and habitats
			Species management planning	Plans	Development of management plans for fish and wildlife species (e.g., interjurisdictional fisheries management planning)
			Listed species recovery planning	Plans	Development of recovery plans for federal or state listed species
			Habitat management planning	Plans	Development of management plans for habitats and natural processes (e.g., management planning for longleaf pine habitat; Habitat Conservation Plan development)
			Habitat Conservation Plan (HCP) Development	Plans	

		State Wildlife Action planning		SWAPs	Conduct activities to develop and revise State Wildlife Action Plans (e.g., convene interagency work groups to revise portions of a SWAP, hold public hearings to help set priorities for SWAP conservation actions)
	Species Re-introduction and Stocking	Native Species restoration		Animals	Re-introduction, rehabilitation and relocation of native animals or plants in their historic habitats
			Propagation and stocking	Animals	Re-introduction of propagated native animals or plants to their historic habitats (e.g., restore American shad to rivers within their historic range, head-starting rare turtles
			Rehabilitation	Animals	Rehabilitation of injured fish and wildlife
			Translocation	Animals	Relocation of native species (including plants) to suitable habitats (e.g., translocate/breed in captivity black-footed ferrets to establish new populations in suitable habitat)
	Technical Assistance	Environmental Review		Reviews	Review of agency and private sector policies, projects and plans (primarily related to development and adverse impacts to natural resources) to help ensure potential impacts to fish and wildlife are avoided, minimized and/or compensated/mitigated (e.g., review of municipal pier development, review of transmission corridor siting)
			Review of proposed projects	Reviews	Review of proposed development projects to help ensure that impacts to fish and wildlife are minimized and resource benefits are maximized

			Review of proposed policies and plans	Reviews	Review of non-conservation oriented policies and plans to help ensure that impacts to fish and wildlife are minimized and resource benefits are maximized (e.g., review of harbor dredging plan, review of state highway plans)
		Technical assistance		Assists	Provision of professional training and technical assistance to others on fish and wildlife assessment and management
			With individuals and groups involved in resource management decision making	Assists	Provision of professional training and technical assistance on fish and wildlife assessment and management to individuals and groups involve in resource management decision-making (e.g., provide agency-collected data to other governmental officials, train non-governmental organizations on new trapping methods, review of conservation-oriented policies and plans)
			With private landowners	Assists	Provision of technical assistance on fish and wildlife management practices to private landowners Note: Could include development and delivery of economic incentives to private landowners to influence responsible stewardship of land/water and specific species